# [CV-03-029] Design and Aesthetics

## Abstract

Design and aesthetics are fundamental to cartographic practice. Developing students' skills in design and aesthetics is a critical part of cartography education, yet design is also one of the most difficult part of the cartographic process. The cartographic design process of planning, creating, critiquing, and revising maps provides a method for making maps with intentional design decisions, utilizing an understanding of aesthetics to promote clarity and cohesion to attract the user and facilitate an emotional response. In this entry, cartographic design and the cartographic design process are reviewed, and the concepts of aesthetics, style, and taste are explained in the context of cartographic design.

*Keywords*: aesthetics, design, process, style

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## Explanation

1. Definitions
2. Introduction
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### 1. Definitions

**design:** (verb) planning a map, (verb): constructing a map ; (noun): the "look and feel" of the map product; (noun): the internal organization of a map

**design requirements:** qualities the map must include

**design constraints:** limitations on the appearance of the map

**sketch mapping:** creating a rough outline of the map

**specification sheet:** a document outlining the design choices for the map; also known as style sheets or style guides

**cartographic design process:** the multi-part nonlinear process of planning, creating, critiquing, and revising maps

**default design:** a design reflecting software default choices, rather than conscious decisions by the map creator

**map aesthetics**: (noun) the “beauty” of a map; (noun) the overall clarity or cohesion of a map; (noun) the overall attraction of a map

**style:** (noun) an individual choice affecting a map’s appearance; (noun) the set of choices made on a map resulting in a map’s appearance; (verb) the act of changing the appearance of a map

**form:** variation in the linework generalization and symbolization

**texture:** embellishments that give the appearance of a particular type of surface, such as smooth, bumpy or reflective

**design cohesion:** the complementariness of design and stylistic choices on a map

**pastiche:** cartographic styles that imitate other styles by including characteristic appearance choices of that style

**taste:** (noun) the subjectivity of a design; (noun) the styles preferred by a given audience

## 2. Introduction

Cartographic design describes map making as a process and the map as a product. Through the cartographic design process, the map maker develops the map’s aesthetic, which describes the beauty of a map, the overall clarity of cohesion of a map, and the overall attraction of a map. Thinking through design choices results in a stronger aesthetic, which in turn makes a map more memorable to an audience. This entry explains design concepts and their relationship with aesthetics, style, and taste.

## 3. Design Concepts

The modern meaning of design did not enter the cartographic lexicon until the 1950s, following a broader change in the understanding of the word design through the 20th century (Oxford Art Encyclopedia 2018). Cartographers writing before World War II, such as Debenhem (1937) and Raisz (1948), use design interchangeably with other words like style and appearance. During the war, the need to create precise and readily understandable maps lead Arthur H. Robinson toward a reified understanding design as providing functional principles for map creation (1952, 1953). Design is now so fundamental to cartography that it often is included within the definition of both cartography and map (e.g., ICA 2018, “[a map is] designed for use when spatial relationships are of primary relevance”). Further, the majority of cartography textbook authors over the past 10 years have included the word design in the title of the work (e.g., Dent et al 2009, Peterson 2009, Tyner 2010, Muehlenhaus 2014).

Modern academic cartography considers design a process and a product. A cartographer **designs** maps through planning a map (definition #1: verb) then designs through constructing a map (definition #2: verb). The finished map shows design through identifiable map elements, forming the “look and feel” of the map product (definition #3:

noun), with internal organization (definition #4: noun; see Figure 1).

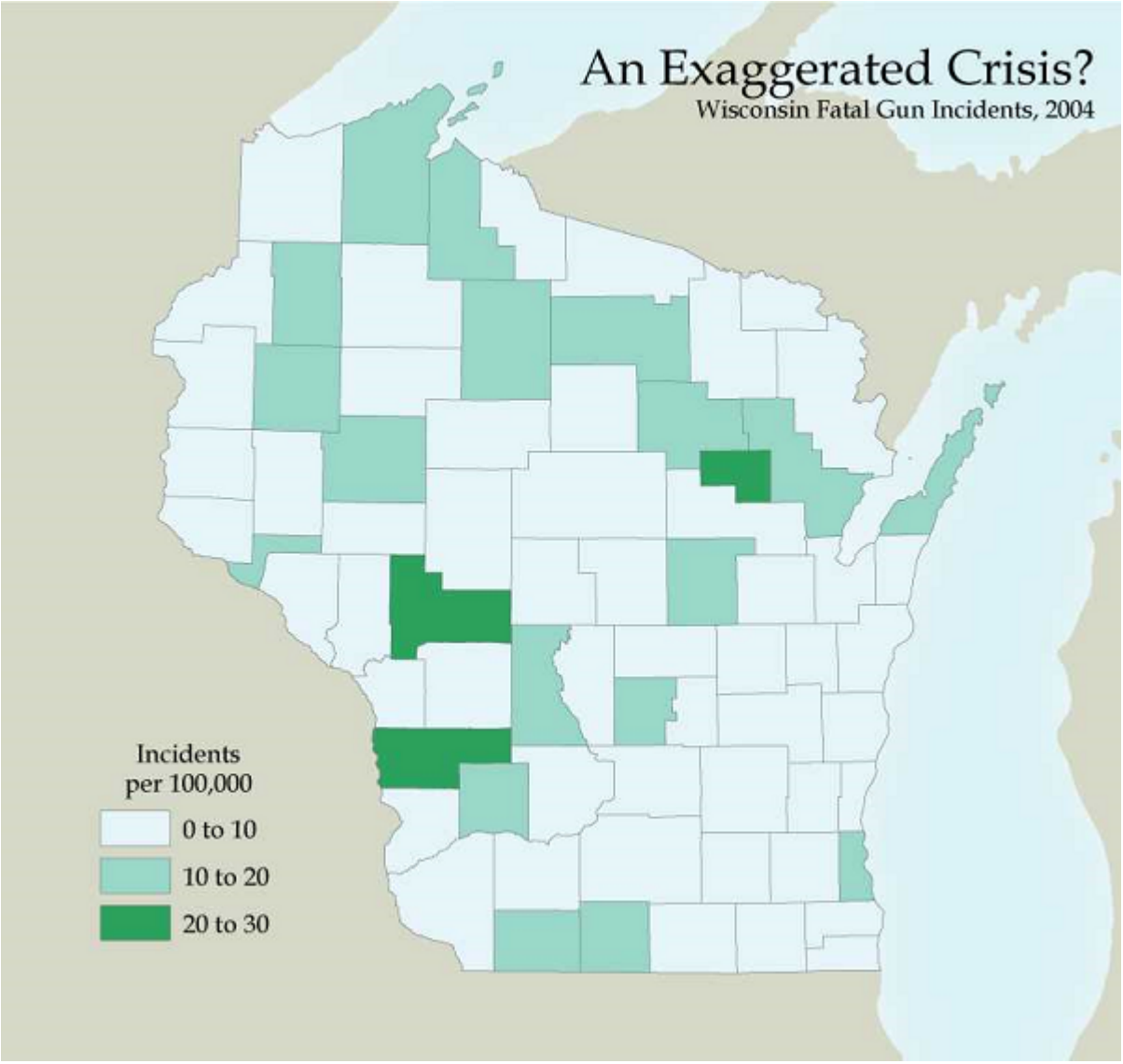



Figure 1. Wisconsin Fatal Gun Incidents. Map courtesy of Daniel Huffman. Four aspects of design can be identified: 1) Design as planning a map: finding the data for the map, answering design questions about the map, etc.; 2) Design as constructing the map: putting together the data in a GIS, choosing the color scheme, etc.; 3) Design as the look and feel of the final map: the appearance of the completed map; above is an example of design referring to a completed map; and 4) Design as organization: the internal logic of the map; for example, the classification system used relates to the design architecture of the example map.

These definitions share in common decision making, conventions, and recommendations from map design research (see **Cartography & Science**). Cartographic design has been impacted by developments in science and the broader field of design, such as functionalism (Robinson 1952, 1953; Bertin 1967), gestalt theory (MacEachren 1995; Robinson et al 1995, Slocum et al 2009), and minimalism (Tufte 1986, 1989; treated as a style below) (see **Visual Hierarchy & Layout**).

### 3.1 Design as Planning and Building

Cartographic design first requires identifying the map's purpose when planning the map, which includes understanding the map subject, the data, and the map audience, as well as identifying any **design requirements**, such as qualities the map must include, or **design constraints**, which are limitations on the appearance of the map (e.g., fixed extent, grayscale only.) Common design planning questions include but are not limited to the following (e.g., Krygier and Wood 2011, Muehlenhaus 2014, Tyner 2014):

- What is the phenomena of interest?
- Who is the audience for my map?
- What data do I need to create the map?
- What will the map show, and what will the map leave out?
- Is a map the appropriate representation for this phenomena?
- Should some phenomena be mapped?
- What technology will be used to make the map?
- How will the map be reproduced?

**Sketch mapping**, or creating a rough outline of the map, is recommended at the planning stage by most cartography textbooks. When planning a complex map, or a series of maps, cartographers create a **specification sheet**, a document outlining the design choices on the map (see **Map Production and Management**).

Compiling the map comprises the cartographic design process (Dent et al 2009, Slocum et al 2009, Kraak and Ormeling 2011). This includes manipulation of data through digital creation, the process of making the map using analog or digital methods (or both), evaluating map drafts, and revision. While building a map, cartographers decide how closely to follow cartographic conventions, or standards used by other maps over the course of many decades. Conventions function as a cartographic shorthand and improve map comprehension through viewer familiarity (Robinson 1952). Cartographers also follow design recommendations from map design research, such as color recommendations (Brewer 2015; see **Color Theory**) and perception research (see **Symbolization and the Visual Variables**). Some maps consciously depart with convention and with existing design recommendations, favoring alternate designs (Krygier and Wood 2011), though that choice is not made lightly.

### 3.2 Design as the Final Map Product

The final map product, a designed map, is the end result of the design process. Nevertheless, maps are never truly finished as there are always opportunities for further refinement. Instead, the map's design can be evaluated to determine how well it works for its purpose (Kraak and Ormeling 2011; Slocum et al 2009, Tyner 2010) as well as through user testing (see **Usability Engineering & Evaluation**).

### 3.3 Design as the Organization of a Map

Design can describe the organization of a map. The organization can be that belonging to the database or coding structure of a webmap or the information design on the map, such as the classification scheme used or the inclusion of information. Design as organization

can also refer to the inner working of figure / ground relationships and contrast or visual differences on a map (Krygier and Wood 2011), as well as a map's intellectual and visual hierarchies (Dent et al 2009).

### 3.4 Design Subsets

In addition to the three broad categories of design outlined above, there are many identifiable subsets of design. Subsets include global design decisions such as media type (e.g., web map design) or map type (e.g., choropleth design); local design decisions such as the design of a map element (i.e., legend design) or the design of type placement and appearance (i.e., typographic design); or a category of map users (design for color vision variation) (Roth 2013). Though similar design challenges may occur across design subsets (Kraak and Ormeling 2011), distinctions are made to reflect the different design decisions, conventions, and recommendations each design subset entails.

## 4. Cartographic Design Process

Multiple design processes are outlined in the cartographic literature, though generally follow the model planning →creating → critiquing → revising (Dent et al 2009, Slocum et al 2009, Tyner 2010, Kraak and Ormeling 2011, etc.). This model is not linear, and may appear something like a design squiggle (Newman 2009) in which a line begins a squiggle, and then a tangle, before finally straightening out near the end of the design. The "design squiggle" shows the cartographic design process as an experimentation as the cartographer finds patterns and insights, reconceptualizing the map many times before achieving a clarity of vision that allows the production of the final product.  Thus, the cartographic design process is iterative, and each stage may repeat itself multiple times before producing the final output.

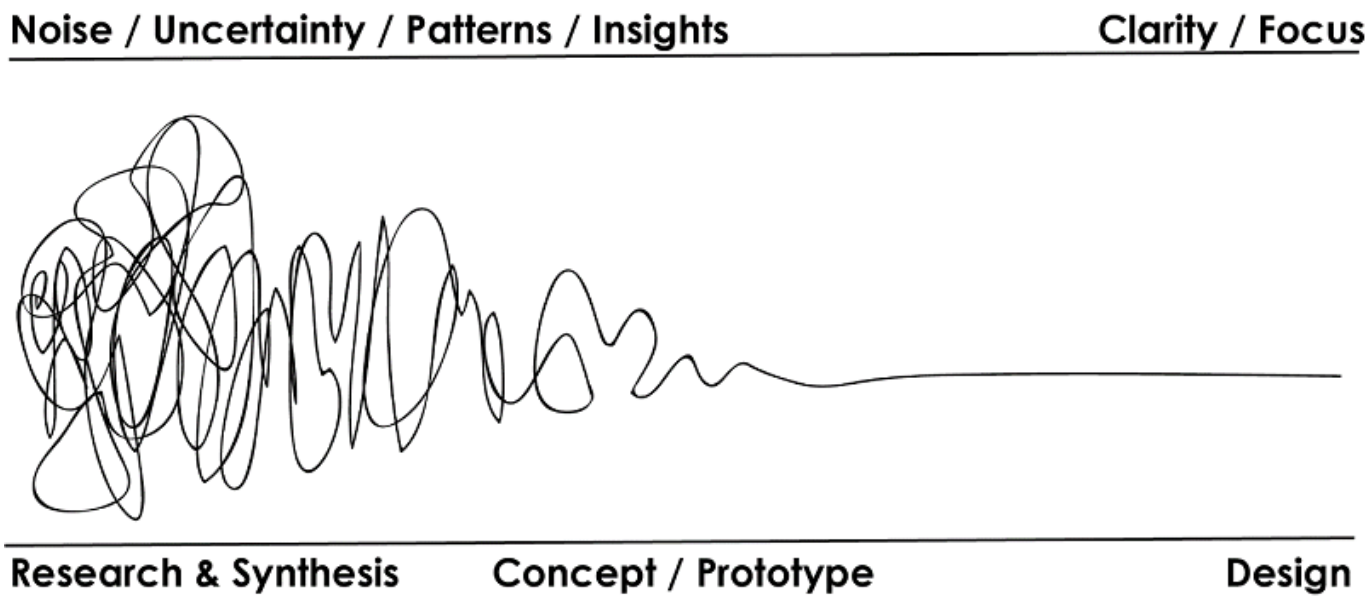



Figure 2:  The Design Squiggle (adapted from Damien Newman, 2009,

thedesignsquiggle.com). The process of design is often frustrating because it is not linear, but mastery means navigating and even embracing the squiggle, which helps move to design faster.

Nevertheless, design begins through planning and continues through every stage of the map creation process. The importance of decision making to the design process cannot be understated (Kraak and Ormeling 2010), for at each step the cartographer makes decisions about what to include or exclude from the map, stylistic choices, etc. Most digital cartography utilizes software programs like ArcGIS and Adobe Illustrator to speed up the design process over traditional cartography. The technological changes have resulted in identifiably **default design**, a design reflecting software default choices, rather than conscious decisions by the map creator. A map showing default design suggests the absence of decision-making; as the design decisions were made by the software rather than the user. For this reason, decision-making is inseparable from design.

Creating maps is time-consuming and difficult (Krygier and Wood 2011). Because the potential representations of a phenomena are limitless, there are any number of designs possible for a map, rather than a single correct design (MacEachren 2005).

5. Aesthetic Concepts

Aesthetics is a branch of philosophy that studies the nature of beauty. Traditionally, cartographic aesthetics refers to the intangible quality of a map's beauty or artistic qualities (Raisz 1948, Robinson 1952, Tyner 2010; philosophically, Kant 1790) and its functional qualities (Kent 2005). More recently, cartographers have observed that when cartographers speak about map aesthetics they are actually referring to the overall clarity or cohesion of a map (Imus and Loftin 2012). Clarity and beauty go hand-in-hand, as humans show a blanket preference for consistency and symmetry (Evans et al 2012). Thus, functionalism and beauty are not mutually exclusive.  Important to note is that aesthetics are value neutral or "disinterested". One can be attracted to a highly negative or highly positive sight (Kant 1790; see also modern psychological theories of arousal and attention). Aesthetics can be thought of as both art and science, because many cartographic operations which promote clarity are also scientific. Generalization is one such scientific operation (Robinson 1952), finding expression in scientific concepts like Ockham's Razor, the notion that the simplest explanation for a phenomena is the most likely to be correct. Such ideas are an expression of scientific elegance, the way that complexity is collapsed into a solution. An aesthetically clear map shows scientific elegance. Therefore, in cartography, **map aesthetics** refers to the "beauty" of a map, the overall clarity or cohesion of a map, and the overall attraction of a map.

### 5.1 Difference from Design

Cartographers develop a map's aesthetics through careful consideration of how the map works as a whole. This is often done using graphic design software, which allows easier and more sophisticated manipulation of the map's style than a GIS program (Kraak and

Ormeling 2011). Continued refinement of map style for clarity and consistency results in an aesthetically pleasing map.

Aesthetics should not be conflated with design, style or taste. Aesthetics describes an overall quality of a map: a map's aesthetic is not determined by one single design choice, but by the sum of design choices made by the cartographer. Thus, aesthetics comprises design and stylistic decisions.

### 5.2 Style

Not to be confused with aesthetics, **style** refers to an individual choice affecting a map's appearance, the set of choices made on a map resulting in a map's appearance (Kent 2008), and the act of changing the appearance of a map. In contrast, aesthetics refers to the clarity or cohesion of the map itself. An aesthetic style is a set of style choices resulting in design cohesion, or the overall similarity or complementariness of stylistic choices on a map. An aesthetic style can have an emotional impact (Section 4.5). For ease of discussion, style can be broken down into the components of form, type, color, and texture (Roth 2019).

### 5.3 Form, Type, Color, and Texture

A method for understanding the variations possible in visual style is the four part framework of form, type, color, and texture. **Form** refers to differences in linework generalization (see **Scale & Generalization**) and symbolization (see **Symbolization & the Visual Variables**). **Type** refers to typefaces chosen, placement, appearance, and microaesthetics (see **Typography**; note that in typography, microaesthetics has a different meaning from aesthetics as defined in this entry). Finally, **color** refers to the color choices and their relationships to the map and broader cultural connotations (see **Color Theory**), and **texture** describes embellishments that give the appearance of a particular type of surface, such as smooth, bumpy or reflective. Utilizing the framework provided by Roth (2020) helps develop new styles as well as analyze existing styles.

### 5.4 Pastiche

**Pastiche** refers to cartographic styles that imitate other styles by including characteristic appearance choices of that style. For example, a map with a pop-art pastiche may use a comic typeface and Ben-Day dots (Christophe and Hoarau 2012; Figure 3) to imitate the appearance of comic books, which were printed using dots to create shading and color effects inexpensively. We can also contrast the realism of Eduard Imhof with the minimalism of Edward Tufte as two additional styles.




Figure 3. Pastiche styles. Pop-art pastiche map “Lichtenstein” by Katie Kowalsky (left), realism of Eduard Imhof (center; Walensee), minimalism of Daniel Huffman in the style of Edward Tufte (right).

### 5.5 Emotional Impact

Much in the way that text can be read in various emotions, stylistic choices set the emotional tone of the map (Griffin and McQuoid 2012). Persuasive maps combine stylistic map marks, texture, color, and text choices to impact a map viewer’s emotions (Muelenhaus 2011).

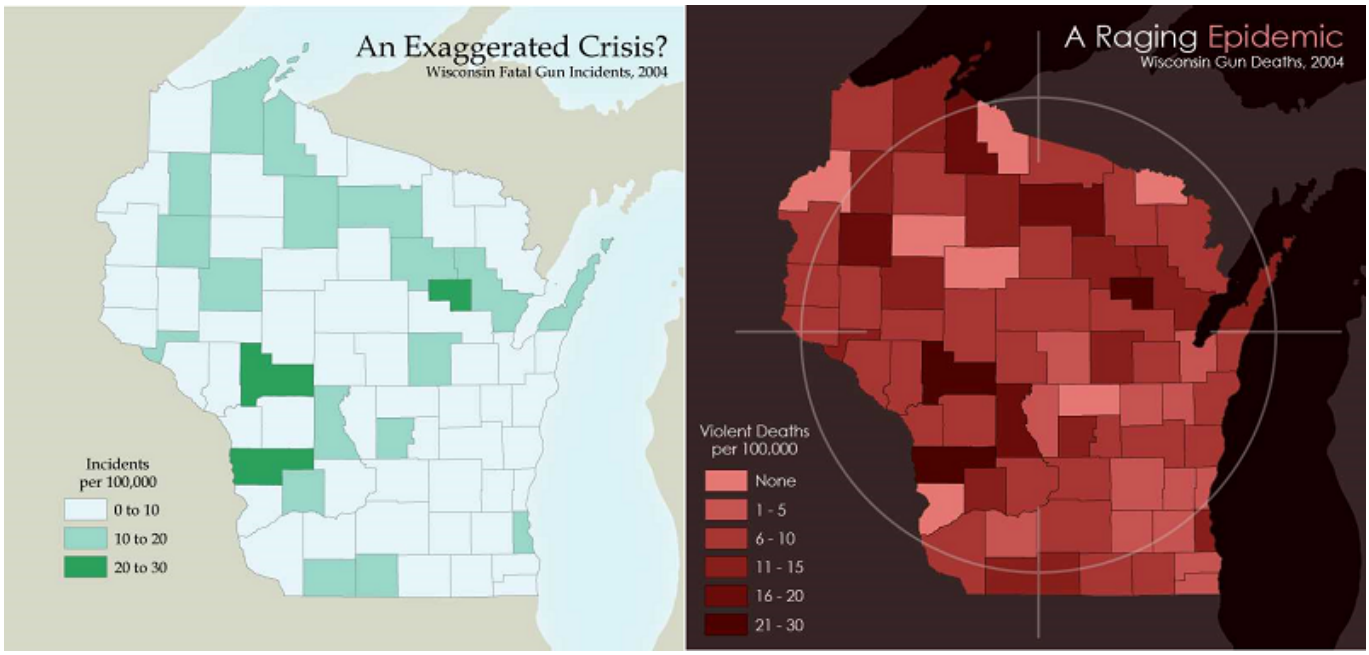



Figure 4 Two different representations of the same dataset to manipulate a viewer’s emotions (Source: Daniel Huffman).

### 5.6 Taste

**Taste** refers to the subjectivity of a design or the styles preferred by a given audience. Cartographic thinking regarding taste comes from the philosophy of subjectivism, in which the qualities of the world are relative to the individual percipient. Under subjectivism, there is no “good” or “bad” except in the eye of the beholder (Rosen et al 2015). Under a

subjectivist view the judgment of taste is individual, however, taste is often shared across people and groups in a normative sense (Kant 1790). Since taste can be normative, a wholly subjectivist vision of taste is not strictly correct, because most people judge “good” or “bad” taste, even if they do not openly admit it (Zangwill 2014).

Cartographic ideas about the semi-subjectivity of design relate to taste. Preferences change over time, referred to as changing fashions, as some styles lose popularity or regain popularity later. Understanding taste and style is important to understand the multiplicity of responses to a map.

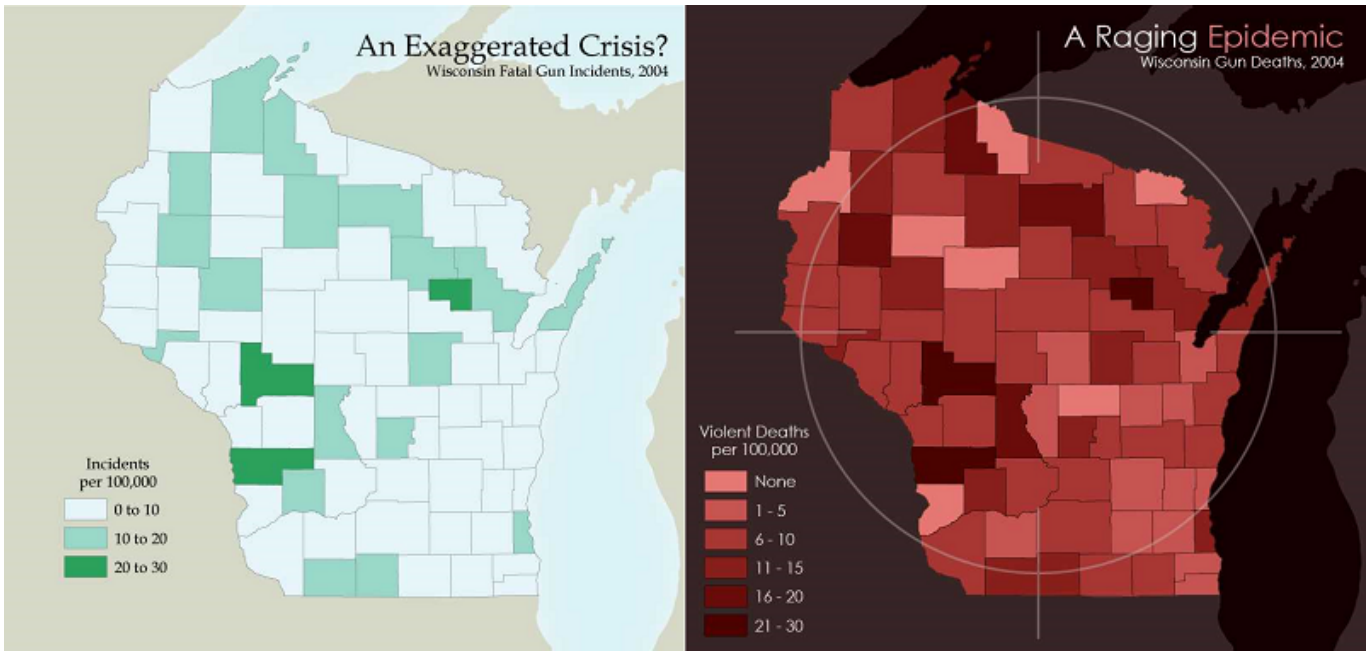



Figure 5: Map Evaluation (Putting it all together). In the discussion below, Map 1 is on the left and Map 2 is on the right.

- **Aesthetics:** Both maps have a developed aesthetic through the consistency of design choices and the clarity of information on the map. Map 2’s aesthetic is stronger than map 1 because the stylistic choices are more cohesive.
- **Style:** Both maps show styling changed from GIS software defaults, enhancing their appeal.
    - Form: Map 1 and Map 2 have thin linework with the same level of generalization.
    - Type: Map 1 uses a serif, which looks more naturalistic. Map 2 uses a thin sans.
    - Color: Map 1 uses pastels and variations on green. Green is associated with “go” on a traffic light, and connects to the theme of safety “an exaggerated crisis.” Map 2 uses variations in dark red and black.  Red has an association with blood and danger, connecting to the theme of violence and a “raging epidemic.” Map 1 also uses highlighting to emphasize the word “epidemic” in the title.
    - Texture: Map 1 has a soft glow around Lake Michigan. Map 2 does not use texture.
- **Emotional Impact:** Map 2 has a stronger emotional impact than map 1, because the map’s aesthetics are more strongly developed from more stylistic elements that contribute to the map’s theme. Map 2 is more memorable, as the stylistic choices emphasize danger and may motivate behavior in response to the perceived danger.

- **Taste:** Map 1 and Map 2 touch on a current political debate. The viewer's opinion on the tastefulness of the map may be impacted by their position in that debate.

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