Chapter 16

Maps and Diagrams

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- Introduction
- Approaches to Map Making and Use
- Elements in Map Design
- The Power of Maps

Keywords

Cartogram
Cartography
Digital elevation model
Equal area map projection
Generalization
Geographic visualization
Map
Map projection
Map scale
Symbolization

Introduction

Maps and spatial diagrams are powerful tools used to visualize, explore, store, and communicate geographic information. Thus, the skills of making and using these visual representations of the worlds around us are very important within the discipline of geography. Traditionally, we learn these skills within the subdiscipline of **cartography**, but they are also integral to the related fields of Geographic Information Science and **GeoVisualization**. In addition, we produce maps, like the places, identities, landscapes, and spaces they represent, within particular social and cultural contexts. Thus, they at least reflect – and many would argue help reproduce – dominant cultural values and power relations present in the society within which the maps are made and used.

Maps and spatial diagrams come in a variety of forms and are produced and consumed through a variety of media. Whether printed on the two-dimensional pages of an atlas, molded out of plaster or plastic to make a three-dimensional model, or animated on a computer screen, all maps and diagrams are composed of more or less abstract symbols that represent different aspects of our cultural and physical environment – what most people consider to be the "real" world. For example, we may use  on road maps and highway signs to stand for a library. Making and using maps successfully involves the creation and interpretation of these symbols.

The International Cartographic Association (ICA) (2008) defines a map as "a symbolized image of geographical reality, representing selected features or characteristics, resulting from the creative effort of its author's execution of choices, and is designed for use when spatial relationships are of primary relevance" (See Box 16.1). This very broad definition encompasses the examples found in Figure 16.1. It also includes maps produced through a variety of media ranging from the traditional paper map to the whole world of digital maps and terrain simulations. Such spatial representations are traditionally grouped into two categories. *General purpose maps* are designed for a variety of uses while *thematic maps* focus on more specific topics (Dent 1999). While these categories can be useful, they are problematic as well. After all, a map's purpose or use is not solely defined by its creator. Any map could be used for purposes not even imagined by the cartographer. For this reason, general purpose maps are better described as multivariate maps.

Traditionally, the term "map" is reserved for graphics that use an absolute coordinate system, such as latitude and longitude, to "realistically" locate and represent attributes of specific places and spaces. More recently, however, many geographers have argued that we do not experience and know the places and spaces around us as mere sets of coordinates. **Cartograms** and other spatial diagrams can be employed to capture these other, often subjective and culturally specific, ways of knowing the world. For the remainder of this chapter, therefore, I will use the word "map" to refer to any spatial representation.

Most people assume that the "author" referenced in the ICA definition is a professional cartographer who makes maps for public consumption. Yet, more and more people are creating their own maps for their own private and public purposes using desktop mapping

Box 16.1 Defining Maps

The ICA's definition of a map is only one of many. Most textbooks devoted to cartography or map use and analysis offer their own definition. For example, in the Preface to Volume One of *The History of Cartography*, J. B. Harley and David Woodward provide the following definition:

> Maps are graphic representations that facilitate a spatial understanding of things, concepts, conditions, processes, or events in the human world.

Is this definition more or less restrictive than the ICA's definition? Why might authors focusing on the history of cartography need a different definition?

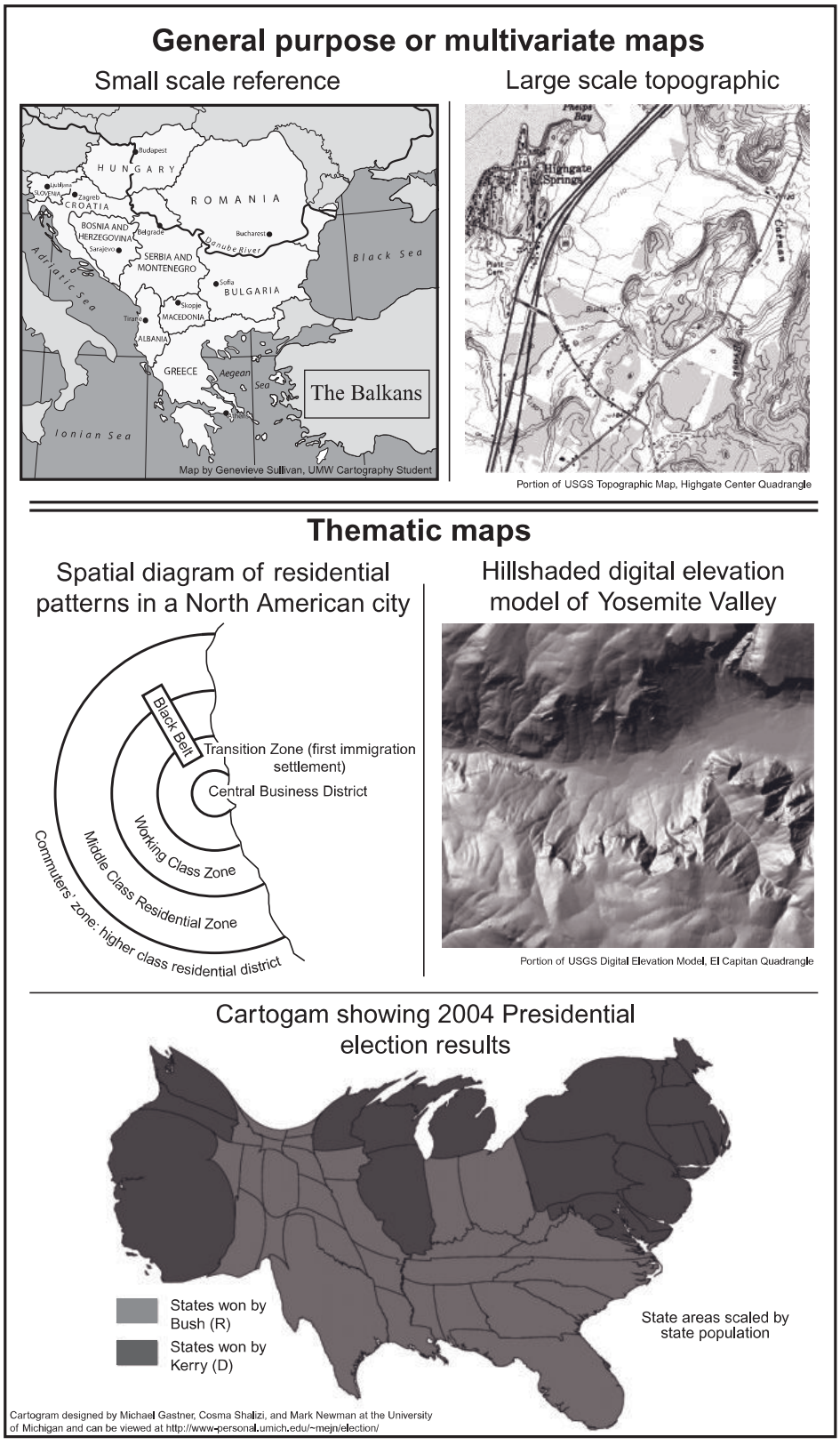


Figure 16.1 Samples from the world of maps

software or interactive websites (MacEachren 1995). While this challenges cartographers' traditional understandings of the mapping process and the map itself, it only underscores the importance of learning some key cartographic concepts that can help any map maker or user harness the power of maps. Thus, this chapter begins with an overview of the major Western theoretical perspectives used by geographers to understand maps and mapping and concludes with guidelines on how to use projection, **scale** and **generalization**, and **symbolization** to improve your ability to work with maps.

Approaches to Map Making and Use

Over the past 500 years, Western Cartography has been dominated by explorers, surveyors, and academic geographers/cartographers. Often working with the state, these individuals strove to create increasingly accurate and scientific maps for purposes including navigation, the conquest and control of territory, and the assessment of property for tax purposes (see Box 16.2). After World War II, cartographers sought to increase the perceived objectivity and predictability of map creation by developing general rules or laws governing all aspects of map creation (MacEachren 1995). To use the example from the introduction, if  is proven through empirical testing of map users to be interpreted always as meaning "library," then it should always be used by cartographers to symbolize "library." One approach to achieving this goal is standardization. Using the same map symbols to represent the same earth objects should result in all users being able to grasp the meanings

Box 16.2 The Art and Science of Cartography

Map making is often defined as both an art and science. As a form of graphic expression and communication, it is easy to recognize different aspects of mapping that seem to fall within the province of art or the realm of science. As some cartographers have argued that maps should be made more scientifically, others respond that the art in cartography needs to be respected. Below are keywords often associated with art and with science.

The Art in Cartography Stresses

- creativity
- subjectivity
- intuitive-holistic approach
- emotional input and response
- assessment of quality based on aesthetics

The Science in Cartography Stresses

- repeatability
- objectivity
- standardized-technical approach
- functionality
- assessment of quality based on best practices sestablished through empirical testing

Are these lists mutually exclusive?

contained in any map more easily. Single map-making institutions, such as the National Geographic Society or the United States Geologic Survey (USGS) have created "house" standards for type styles and sizes, symbols, **map projections**, and uses of color. Because of the difficulty of standardizing methods and symbols across institutional and cultural contexts, however, most cartographers have pursued another path based on theories and methods developed by behavioral psychologists.

Prior to the late 1960s, behavioral psychologists attempted to define laws concerning how people respond to external stimuli apprehended through vision, hearing, and the other senses. In this method of explaining human behavior, there is no attempt to understand how people process the sights, sounds, and smells to which they are exposed. Instead, researchers seek to predict that a particular stimulus will provoke a particular response. Cartographers have adopted this approach and many researchers focus on how map readers react to various symbols, colors, and lettering sizes and styles.

Most cartographers who borrow from behavioral psychology conceive of **cartography** as a communication science (Figure 16.2). In this model, the cartographer's role is to communicate some geographic information objectively and accurately to an audience of map readers. The cartographer conceives of the map's purpose, gathers and processes the necessary data, and transforms it into a map that meets that purpose. The map, therefore, both stores the data until it is used and serves as a medium for communication. The map reader, most likely removed from the cartographer in both time and space, is responsible for transforming the map's symbols back into the geographic information they represent in order to understand the cartographer's intended purpose.

In order for this communication to be effective, the cartographer must know that the map she/he designs will stimulate the correct response in the map reader. A great deal of cartographic research in the 1960s and 1970s consisted of exposing study groups to particular symbols, type styles and sizes, and other map elements and then measuring their

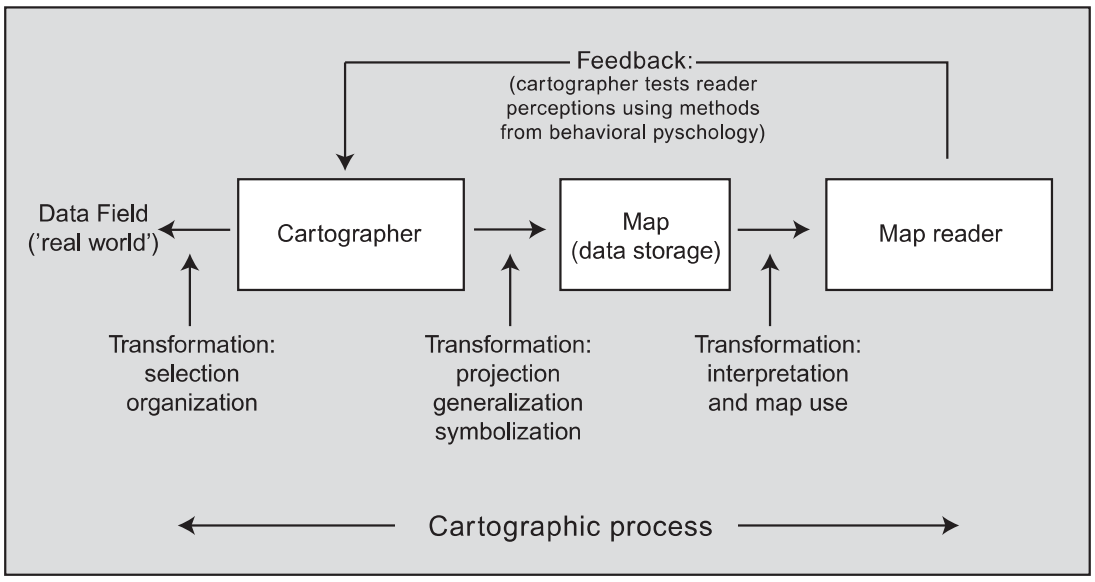


Figure 16.2 Cartography as Communication Science (adapted from Dent, B. 1996. *Cartography: Thematic Map Design*. Boston: WCB McGraw-Hill)

responses (MacEachren 1995). A key goal was to determine the "least discernable difference." If a map designer knows the smallest difference between two type sizes, symbol shapes, or colors that a reader can discern, then she or he can employ that knowledge to ensure that the map reader will be able to perceive differences and similarities among the symbols that make up the map. Within this model of cartography, such feedback is intended to ensure that a map can be predictably interpreted into an accurate and objective representation of some place and/or aspect of the world.

Since the 1980s, critics within and beyond cartography have noted the limitations of the communication model of cartography. Some theorize that cartography and maps need to be understood within their broader social and cultural contexts and argue that since cartographers operate within such contexts, their maps cannot be viewed as merely objective communication devices (Harley 2001, Wood 1992). Others, noting that psychologists have largely abandoned their own behavioral models in favor of a cognitive approach, argue that simply noting map readers' responses to visual stimuli does not actually explain human perception and interpretation of map symbols (MacEachren 1995). There is no recognition of the variations in knowledge, interest, and purpose map readers bring to a map in the behavioral approach. Finally, since the communication model focuses on the means of communicating the map's content, and not on the content itself, little attention is paid to the actual meanings of the maps themselves. These critiques have lead to two major developments in our understanding of how maps work.

One approach was pioneered by J. B. Harley (2001) and Denis Wood (1992), among others. In their calls for more critical understandings of cartography, they argue that map makers, maps, and map users have always operated within particular social and institutional contexts. These ensure that all maps, both thematic and general purpose, are made to serve particular interests, usually those of a society's elites. Individual maps and the entire discipline of cartography, therefore, can be studied to reveal how they both represent and reproduce the social and spatial status quo.

Cartographic historians and other scholars have made use of this critical approach in a variety of contexts. For example, the development of Western cartography from the 1500s to the 1800s accompanied European exploration and colonization of the Americas, much of Asia, and Africa. Maps made these parts of the world known to Europeans and, therefore, controllable by Europeans. Later historical atlases published by these colonial powers often erased all evidence of indigenous civilizations (Black 1997). In the North American context, the map shown in Figure 16.3 does not demarcate the territories and settlements of Native Americans and, thereby, contributes to the myth that the continent was an empty wilderness waiting to be settled and civilized by Europeans.

Critical cartographers also examine map use or interpretation. While a map may be intended to serve the interests of a government claiming a particular territory or a beach resort company hoping to attract tourists, there is no guarantee that those will be the only interests served when the map is used. Map users make sense of their maps in their own social and spatial contexts and rely on previous knowledge of places and subjects to interpret map symbols. American Civil War buffs, for example will focus on the tourism map shown in Box 16.3 to find the battlefields and war monuments they already know and, perhaps, will celebrate Virginia as home to the capital of the Confederacy. Others hoping to learn about the history of African American slavery and resistance will be disappointed that this map hides any evidence of their struggles for freedom and equal rights. Thus maps

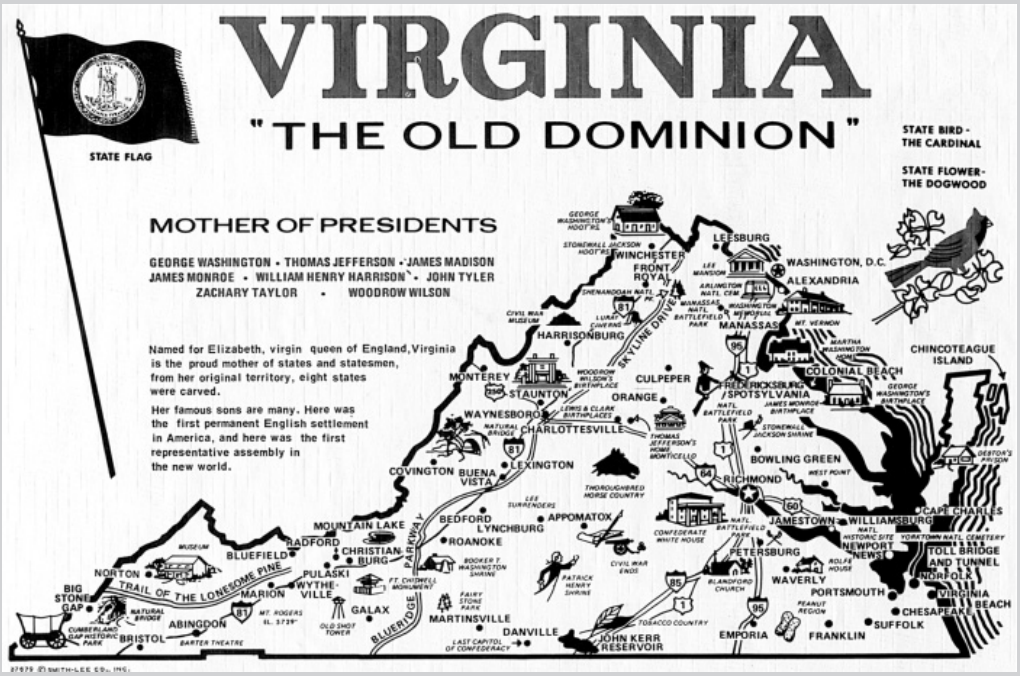
Figure 16.3 "North America 1650" from Hart (1891). *Epoch Maps Illustrating American History.* New York

are *intertextual*; for any user they refer, both explicitly and implicitly, to books, photographs, web pages, and other texts and experiences concerning that place and/or topic (Del Casino and Hanna 2000). These texts lend their own meanings to the places, peoples, and/or events represented on the map.

Cartographers more interested in how to improve maps' functionality suggest that these critical approaches do not help anyone make better maps. Responding to computer and internet mapping technologies that have exponentially increased people's access to both maps and mapmaking, Alan MacEachren (1995) and others have reconceived the relationships among map makers, the map, and map users (Figure 16.4). Recognizing that not all maps are made to communicate a cartographer's message to a public audience, MacEachren's model of cartography leaves space for maps that help us visualize previously unknown

Box 16.3 A Critical Approach to Map Interpretation

This placemat can be found in restaurants throughout Virginia. An example of popular cartography, it was created to entertain its readers and advertize tourism places to consumers.



A critical analysis of this or any map involves research into the sites referenced on the map. For both the mapmaker and all map users, the symbols refer not just to places, but to social meanings people attach to these sites. Therefore, it is important to investigate the social and historical contexts in which a map is produced and consumed. While a map's meanings change through time and vary according to a map users' background, some meanings dominate others. They are reinforced by what we learn in school, in other texts, and simply by living within a society.

On this map, Thomas Jefferson's home, Monticello, may have many different meanings, but the dominant ones focus on his contributions to an American nationalism that celebrates freedom and individualism as well as its European heritage. Furthermore, most tourism marketers try to attach positive meanings to the places they sell to tourists. Thus, Monticello's presence on this map more than likely reproduces this patriotic national identity rather than drawing attention to Jefferson as a slaveholder.

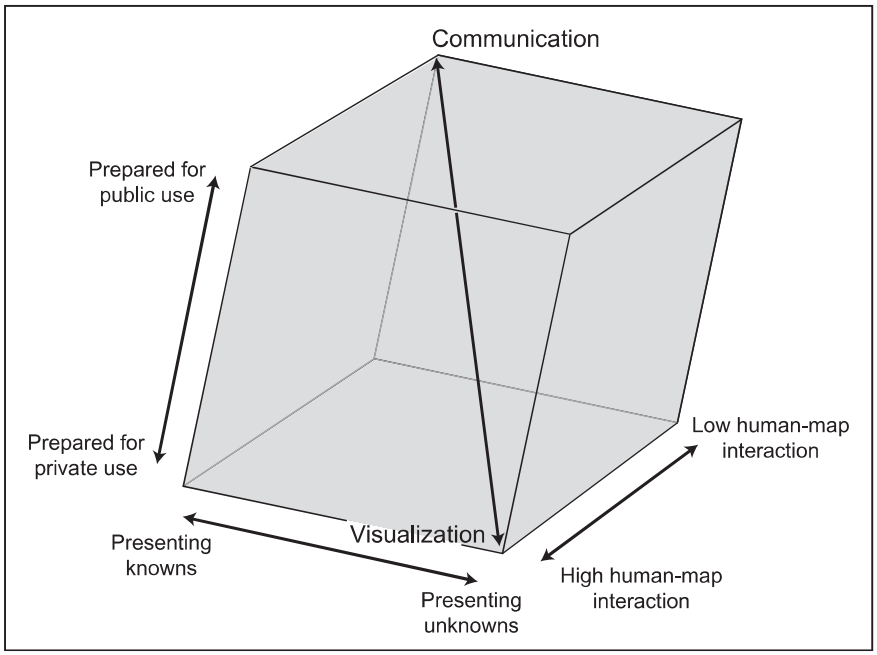


Figure 16.4 MacEachren's model of cartography

spatial patterns in private. It also captures the possibility that, as map users, we do not simply and passively receive the meanings encoded on a map by cartographers. Rather, we interact with maps actively by bringing our own knowledge and perspectives on the places and themes represented on a map. We may also alter a map to make it suit their purpose or actually make the map ourselves.

Understanding how maps are made and used is necessary to improve how maps help us visualize, explore, and communicate about the world around us. To do this, MacEachren argues, we need to understand the biological, psychological, and social factors that explain how people perceive and interpret the symbols comprising all maps and diagrams. This means knowing: (1) how an individual's vision and cognition work to make sense of visual stimuli; (2) how cartographers create and choose symbols; and (3) how symbols acquire multiple levels of meaning as maps are made and used in particular social contexts. While all three sets of factors are needed to gain a full understanding of how maps work, I would argue that we can *begin* to make and use maps more effectively if we focus on the last two.

Elements in Map Design

In order to make and use maps to visualize, explore, and communicate any aspect of our cultural or physical environment, we need to unpack how the geographic information we collect is transformed into symbols that can be positioned on a map. This involves the processes of selection and organization, projection, scale and generalization, and symbolization (Dent 1999, Monmonier 1996). Each of these operations involves transforming our richly detailed, three dimensional, ever-changing, and contested world into a simplified, time-specific representation with a limited perspective. It is vitally important for both map

users and mapmakers to remember that a single map is always only one of a potentially infinite number of maps that could be made to represent the same information.

Selection and organization

The first steps in creating a map are the selection of the information to be represented and the organization of this information. Whether intended as a general purpose or thematic map, no map can represent the entirety of any place or topic. To make the map useful, we begin by selecting the geographic information most pertinent to the map's purpose. By definition, this means that we also select what will *not* appear on the map. Remembering that the maps we make and use contain absences helps us approach these representations more critically. For example, we should ask why a general purpose or multivariate map – perhaps a topographic map such as the one shown in Figure 16.1 – represents churches, but does not note that a particular factory is a source of toxic emissions.

When organizing the selected information, it is useful to categorize it into layers or themes (Figure 16.5). For a thematic map, we might think of the map's subject, perhaps population, layered on top of a base map comprised of the locations for which we have collected data. A general purpose map may be composed of several thematic layers, perhaps topography, drainage, and buildings. This is an exercise in abstraction and reductionism. We tend to use only one or two measurable attributes of complex entities, such as forest regions or ethnic enclaves, to represent these spaces on our maps. Variations within regions and other aspects of the spaces we map are intentionally and necessarily disregarded. Once organized into thematic layers, we usually attach each attribute to specific locations using the map's coordinate system.

Map projections

To describe locations on the surface of the earth we use a spherical coordinate system in which latitude measures distance north or south of the Equator and longitude determines distance east or west of the Prime Meridian. A map projection is a systematic method of transforming this spherical coordinate system, and the locations on the Earth's surface it describes, into a flat or planar coordinate system suitable for use on a piece of paper or a computer screen. This process inevitably produces distortions in shape, area, distance, and/or direction (Figure 16.6). These distortions are especially noticeable in small-scale maps – maps that show large portions of the Earth's surface, but with few details.

Over the past 500 years, cartographers have developed hundreds of map projections designed to control these distortions and/or to serve specific purposes. When choosing a projection, we must decide whether it is more important to measure distances accurately or to preserve the angular relationships that make up the shapes of the territories and water bodies shown on the map. For small-scale thematic maps, most cartographers agree that areas should be preserved accurately. This is in part because most people associate an increase in size with an increase in importance. Imagine using the Mercator projection in Figure 16.6 to make a map of percent of population living in poverty by country. Then imagine making the same map using the Molleweide **equal area projection**. Given that most of the world's wealthiest countries are clustered in the northern hemisphere while

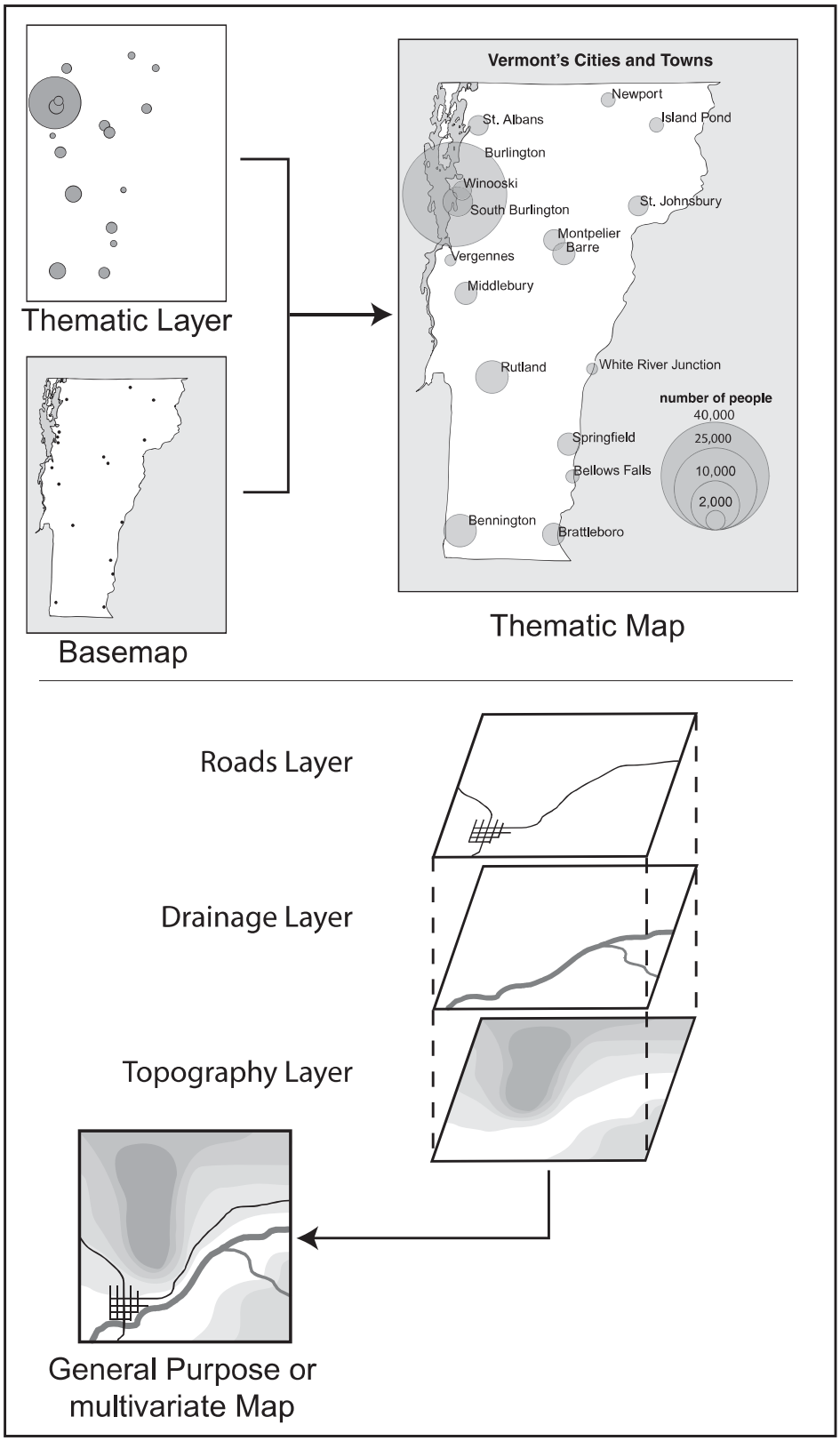


Figure 16.5 Organizing information on thematic and general purpose maps

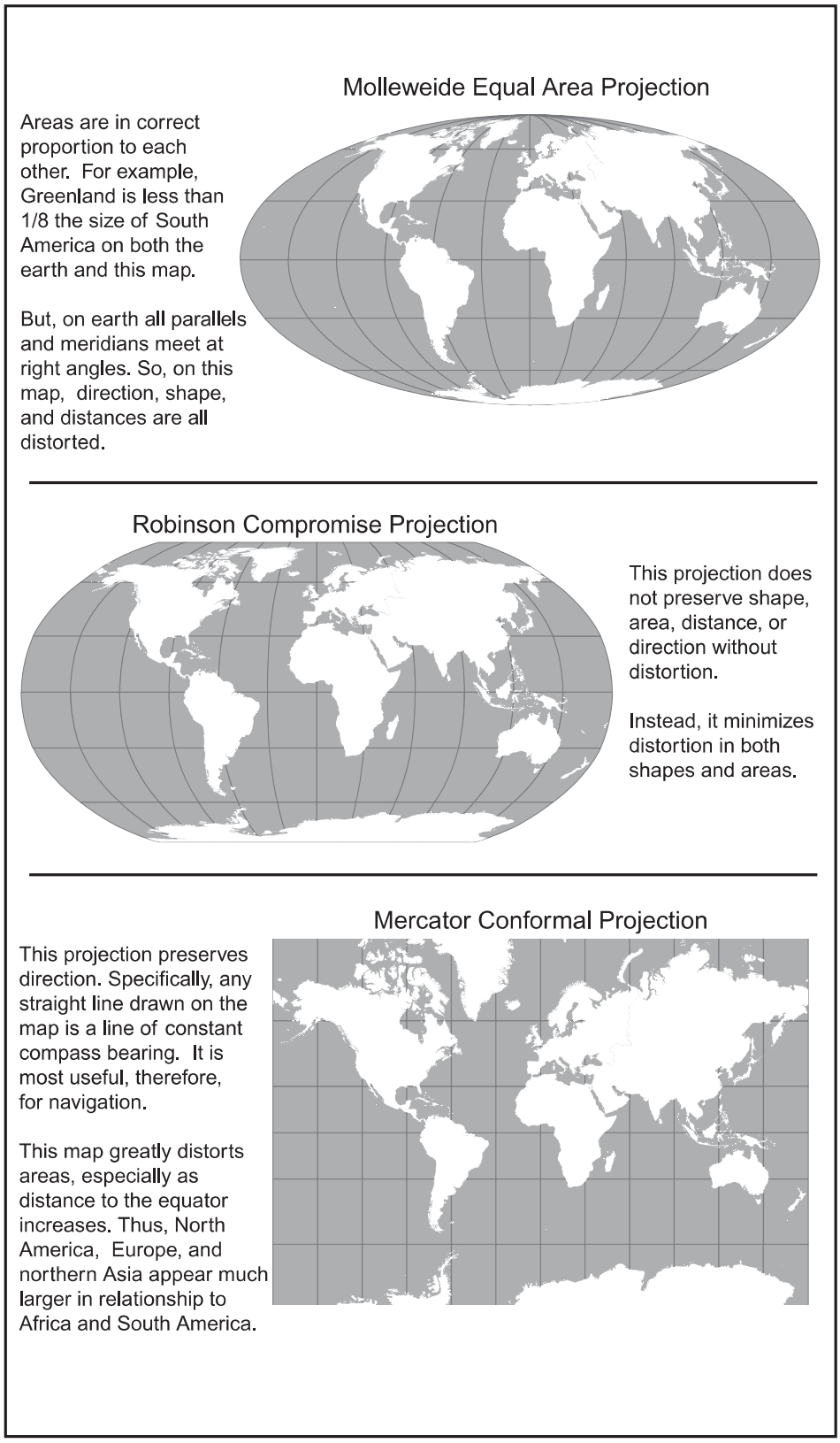


Figure 16.6 Map projections

Figure 16.7 Polar projection

the world's poorer countries are concentrated nearer the equator, you can imagine how the two projections represent the same economic geography very differently.

This is just one example of how projections used to map whole hemispheres or the entire globe can influence people's knowledge and understanding of our world. For example, the widespread use of the Mercator projection for wall maps in US classrooms has been criticized for helping to creating both isolationist and Eurocentric world views. On this projection, the United States appears separated from Europe and Asia by wide expanses of ocean. During World War II and in the early days of the Cold War, polar projections (Figure 16.7) were used to combat isolationism by showing how close Europe and the Soviet Union "really" were. And, as hinted at above, the tendency for people to associate size with importance means that the Mercator projection reinforces world views that rank the countries in Europe and North America as somehow "better" than those in Africa, Latin America, and Asia.

Scale and generalization

The transformation of our three-dimensional complex and contested world into a flat map does not only involve projection. In almost all cases, we map the world at a much smaller

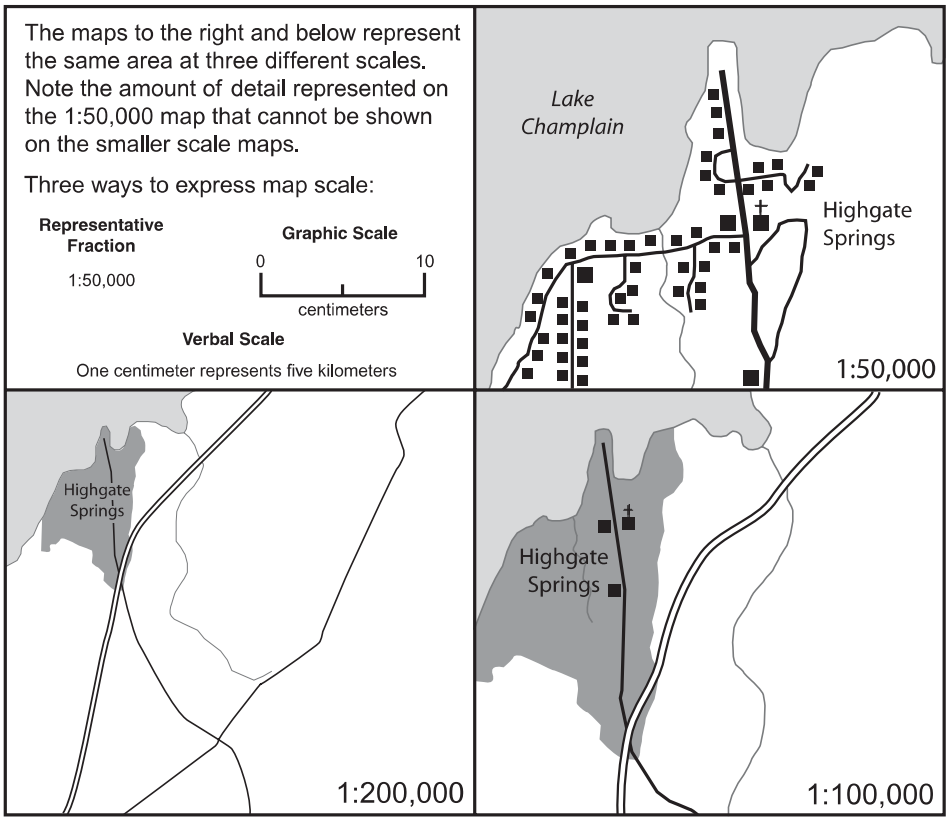


Figure 16.8 Scale and generalization

scale than "reality." In other words, earth distances we typically measure in kilometers or miles are represented in centimeters or inches on our maps. A map's *scale* is a mathematical measurement of how much smaller the map is than the portion of the world it represents (Figure 16.8). A scale of 1:50,000 means that a unit of distance on our map represents 50,000 of same units of distance on the Earth's surface. In other words, the linear distances shown on our map are one 50,000th the size of the distances they represent on earth.

This reduction in scale inevitably involves generalization – the process of selecting and organizing the geographic information to be represented on the map and transforming that data into map form (Dent 1999). Selection and organization of geographic information has been covered above, but generalization also involves the simplification and classification of the already selected information to suit the map's scale and purpose. Most obviously, the smaller our map's scale (the more reduction that occurs), the less detail can be shown (see Figure 16.8). As scale is reduced, coastlines and rivers are simplified and individual buildings may be agglomerated into urban regions. But generalization is not only regulated by scale; the map's purpose also plays a role. A map feature that is more central to our purpose can be shown in more detail than elements that are less important.

Another form of generalization is classification. On most thematic maps, symbols representing the same or similar phenomena located in different places are made to appear the same. For example, on a **digital elevation model**, all locations with an elevation between 200 and 210 meters are given the same color despite the actual variations in value

within that range. This classification of geographic information can help us to see patterns more clearly by suppressing details that may "clutter-up" the map.

Symbolization

A final aspect of generalization that is often treated separately in cartography is symbolization – the transformation of the selected geographic information into map symbols. Every point, line, area, icon, letter and word on a map is a relatively simple symbol or sign that represents some aspect of the more complex world we wish to visualize, explore, or communicate to others. In a very real way, these symbols make places that are distant in time and space present whenever we work with maps.

Choosing, creating, and interpreting map symbols can be approached from the scientific, artistic, and/or critical cartographic perspectives. Despite the limits of the behavioral approach, decades of testing groups of map readers has yielded useful guidelines on how people perceive and react to different symbol colors, shapes, and sizes. At the same time, map symbols continue to be evaluated on aesthetic grounds as well. Cartography textbooks continue to quote the map critic John K. Wright who, in 1944, wrote, "The quality of a map is also in part an aesthetic matter … An ugly map, with crude colors, careless line work, and … poorly arranged lettering may be intrinsically as accurate as a beautiful map, but it is less likely to inspire confidence." Finally, map symbols acquire social and cultural meanings and these can be reinforced or challenged when a map is made and used. The widespread use of green to symbolize low elevations on reference maps, for example, may lead us to believe that California's Central Valley is a naturally humid and verdant environment. Of course, while this semi-arid valley is a rich agricultural area, this is only due to massive, publicly-funded irrigation projects.

The concept of visual variables provides a very practical starting point for understanding how we create, choose, and make sense of symbols (MacEachren 1995, Monmonier 1996). In two-dimensional mapping, Earth objects are represented as points (buildings, individual trees, a city on a smaller scale map), lines (rivers, roads, railroads), or areas (countries, water bodies, parcels or properties on a larger scale map). Because not all roads carry the same volume of traffic and different city parcels are characterized by different land uses, we need to be able to vary symbol appearance to represent different attribute values. Figure 16.9 contains the visual variables we can employ to represent similarities and differences among our map symbols.

Of course, we measure differences among the places on our maps in a variety of ways. A highway's traffic volume is a quantitative attribute, while a parcel's dominant land use is a qualitative characteristic. Size and color value (the lightness or darkness of a color) are best suited to show quantitative differences and similarities on a map. Map readers tend to associate the size of a circle or the thickness of a line with absolute amounts. For example, a larger circle might represent a city with a larger population than a city symbolized as a smaller circle. Giving area symbols a range of color values suggests a difference in percents or rates. A darker area is usually associated with having a higher value than a lighter area. Shape, color hue, and patterns are best used to symbolize qualitative difference or difference in kind. Geologic maps often use different hues to symbolize different rock or soil types.

We can also think of map symbols existing on a continuum from the most pictorial to the most abstract. Pictorial symbols look more like the earth objects they represent. They attract a map reader's attention due to their visual complexity and also make the link between a symbol and what it is supposed to represent much clearer. The map used in Box 16.2 employs very pictorial symbols. Abstract symbols have little in common visually with the earth objects they represent. A dot (•) may represent a city on a small scale map or a monument on a city plan. It certainly has nothing in common visually with either a city or a monument.

Of course, such graphic map symbols seldom stand alone. They are labeled with place names and explained in map legends. Placing the name "London" next to a dot on a map ensures that almost all map users will know that the dot represents a particular city. In order to make our maps legible, however, we usually cannot label every attribute represented by every symbol on our map. Therefore, we rely on map legends and explanatory notes to help us attach meanings to, and discern differences between, map symbols. The methods of symbolizing qualitative and quantitative differences shown in Figure 16.9 are organized in typical map legend formats. You can imagine, for example, a map where each European country is shaded one of the three gray values shown in the "percent in poverty" legend. If the map title reads, "Children in Poverty", then the legend would provide map users with the information needed to attach the map's symbols to the attribute values they represent.

The Power of Maps

Maps are deployed for an ever increasing number of purposes. We find them in our newspapers and on our newscasts. Governments use them to assign values to properties for tax purposes, to define their territories, and to inspire nationalism among their citizens. Maps make us aware of events, help us understand their contexts, and determine how such events will affect our futures. As Hurricane Katrina approached the Gulf Coast of the United States in late August, 2005, we watched animated representations of swirling clouds churn across the Gulf of Mexico. In the immediate aftermath, Jonathan Mendez and Greg Stoll (two Austin, Texas, residents with limited programming experience) created an online form that allowed people to report where family members, friends, and pets in need of help were located. The resulting locations were mapped online using a Google map mashup (see http://googlemapsmania.blogspot.com for more examples of mashups). Later maps produced by professionals placed the images of destroyed buildings and displaced people and helped us know where aid was most needed. Now, new government maps delineating flood-prone areas are determining which neighborhoods can be rebuilt and which may be transformed back into swamp land.

We use maps – both those we make and those made by others – to navigate, explore, and see more of our worlds than we can ever experience firsthand. Desktop mapping and GIS software, as well as a large number of interactive mapping sites on the World Wide Web, such as the map mashups mentioned above, permit rapid entry into the world of map making (see Box 16.4). These technologies, and the expanding digital geo-databases upon which they are based, are also making maps that are increasingly ephemeral – the data on which our maps are based change more rapidly then ever before. Such changes

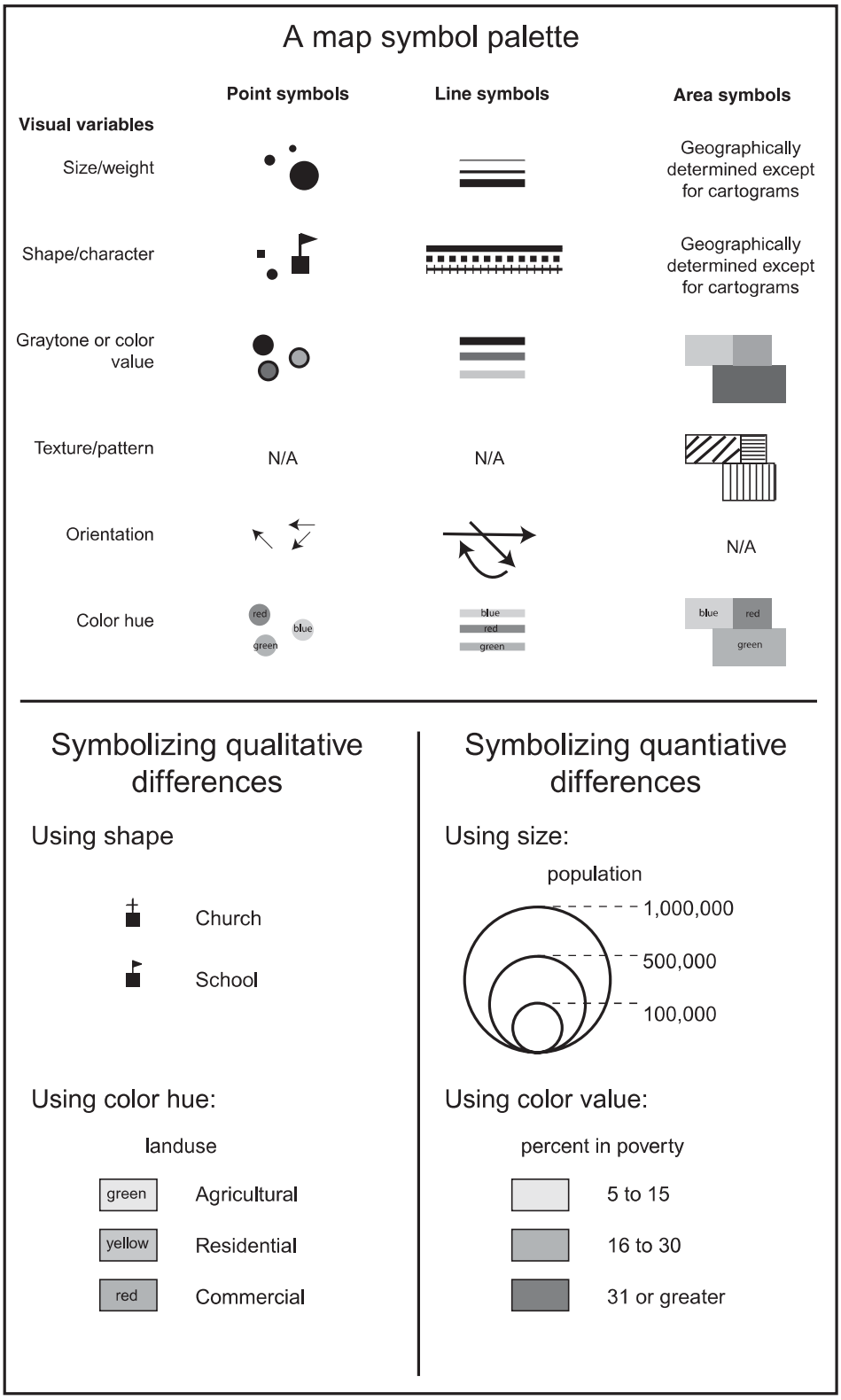


Figure 16.9 Visual variables of cartographic symbols (adapted from Monmonier 1996. *How to Lie with Maps* Chicago: University of Chicago Press)

Box 16.4 Sample Desktop Mapping Software and Internet Mapping Sites

Mapping and GIS Programs

Public Domain /Freeware

AGIS: http://www.agismap.com
ArcExplorer: http://www.esri.com
FlowMap: http://flowmap.geog.uu.nl
GRASS: http://grass.itc.it

Licensed Software

ArcView and ArcGIS: http://www.esri.com
Idrisi: http://www.clarklabs.org
MapInfo: http://www.mapinfo.com
Maptitude: http://www.caliper.com

Internet Mapping Sites

The Geography Network: http://www.geographynetwork.com/
UN Environmental Programme GEO Data Portal: http://geodata.grid.unep.ch/
TerraServer.com: http://www.terraserver.com/
Google Maps Mania: http://googlemapsmania.blogspot.com/

may increase our confidence in map currency and our ability to create our maps to serve our own interests.

Yet, there are still constraints. Desktop mapping software and internet mapping sites are based on geographic information that has already been collected, organized, and generalized into geo-databases. While we may be able to augment these with our own data, the structure of the database will limit how we can represent our worlds. In addition, to make mapping programs more accessible, most producers of such software provide symbol palettes and default design options. These may or may not be based on the suggestions and guidelines summarized in this chapter, but limit our options either way. When making maps using these tools and using maps created with such programs, we must pay attention to how they enable and constrain our ability to visualize, explore, and communicate geographically. Also, we must remember that any map we use and make is but one of many simplified, time-specific, perspective-limiting representations of our complex, ever-changing and contested worlds. Finally, it is critically important to consider the implications our maps may have for the people and places we represent.

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Additional Resources

Crampton, J. (2010) *Mapping: A Critical Introduction to Cartography and GIS*. New York: Wiley-Blackwell. A much needed introductory text that summarizes post-1990 developments in cartographic theory and technology and presents case studies that help readers understand how to use maps and GIS critically.

Harmon, K. (2004) *You Are Here: Personal Geographies and Other Maps of the Imagination*. New York: Princeton Architectural Press. A book that invites readers to explore how people past and present see and map their bodies, worlds, imaginations, and values. Very useful in broadening anyone's geographic imagination.

Monmonier, M. (2002) *Spying with Maps: Surveillance Technologies and the Future of Privacy*. Chicago: The University of Chicago Press. In a world of handheld GPS devices, high resolution satellite imagery, geo-coded public and private databases, and surveillance cameras, this book introduces the concept of locational privacy and asks if these mapping technologies constitute a significant threat to the right of privacy.

Pickles, J. (2004) *A History of Spaces: Cartographic Reason, Mapping, and the Geo-coded World*. London: Routledge. A valuable history of the development of Western cartography and analysis of how the cartographic gaze shapes our world.

Thongchai, W. (1994) *Siam Mapped: A History of the Geo-body of a Nation*. Honolulu: University of Hawai`i Press. An excellent and often-cited work detailing how a society's understanding of its geography, as mapped, changes through time and with interactions of other societies.

Exercise 16.1 Analyzing Maps

Find a published map to analyze. It can be historic or contemporary, in print or electronic form, and have any thematic basis (e.g., political, socio-demographic, biogeographic, climatic). Based on the material presented in this chapter, write a short essay on the selected map that answers the following questions:

1 Where did you find the map, and why did you select it for analysis? What is the larger context (e.g., planning/administration, profit, public persuasion) that led to its production?

2 What is the map's stated or presumed purpose?
3 How does the map use projection, scale, generalization, and symbolization to convey geographic information in support of its purpose?
4 Whose interests (political, economic, cultural, administrative, etc.) are served by the way the map represents its geography?
5 What prior knowledge might a reader bring to this map? In other words, how is this map intertextual? To answer this question, think about: the style and content of this map in relation to other maps; the histories of the places shown on the map; important demographic, economic, or political information; other representations of the places in popular culture (film or television, for example); and/or how nature is represented in the map. How might these aspects affect how the map is interpreted?