True Maps, False Impressions: Making, Manipulating, and Interpreting Maps

► INTRODUCTION

Human geography studies the distribution of humans and their activities on the surface of the earth and the processes that generate these distributions. People use geographic space and interact with the environment when they grow crops, build homes, drive cars, do jobs, raise children, practice religions, cast votes, and spend leisure time. Geographers help us understand the evolving character and organization of human life on the earth's surface.

Geographers subscribe first and foremost to the view that location matters. It is significant that 290 million persons live in the United States. More significant, however, is where these 290 million persons live. Are they urban or rural? Are they spreading out or becoming increasingly concentrated? What kinds of places are attracting people and what kinds are losing them? These are geographic questions. Similarly, the world is capable of producing plenty of food to feed its current population of 6.2 billion. Relevant questions about world hunger are geographic ones. How are the supply of and demand for food distributed spatially? What environmental, economic, and political factors account for these distributions? How are demand and supply reconciled in the international marketplace for food?

Many of the topics that you will find in this workbook are common to other sciences. Geographers have no monopoly on the study of baseball franchises, migration, AIDS, the population explosion, civil war, and air pollution. Geographers bring to the table their unique spatial perspective and interest in human-environmental relations by asking "where?" and "why there?" questions about the same pressing human problems that engage other social and environmental scientists.

The "where" question leads to five overarching themes in human geography that run through the various chapters of this book (Table 1.1). The first theme, **location**, refers not only to the exact coordinates of a point in space but also to where it is relative to other factors. **Place**, the second theme, involves the human and physical characteristics that uniquely define a place and impart meaning to its inhabitants. The third theme, **region**, defines areas that are bound together by common characteristics: Similar places and locations form common regions. In the fourth

geographical theme, **movements** of information, goods, and people connect locations and regions to one another. The final theme is **human-environmental interactions**. Humans and their environment interact in both directions: environmental resources constrain and benefit human societies while human activities refashion and degrade their environments. Notice in Table 1.1 that some of the case studies in the book involve several themes (i.e., the themes are not mutually exclusive).

Geography's spatial perspective—and all five themes—lead to the heavy use of maps. In the broadest sense, a **map** is a two-dimensional graphical representation of the surface of the earth. No map can perfectly represent reality. People tend to think of maps as unalterable facts, as if produced by an all-seeing overhead camera. In practice, however, mapmakers (or cartographers, as they are known in the field) exercise considerable discretion in the spatial information they display and the way they display it. You must always keep in mind that any map you look at could have been made in countless different ways, sometimes drastically altering your perception of what you see.

Cartographers (mapmakers) make five critical decisions about map construction that greatly influence the message conveyed by the map. First, they choose a particular **map projection**, which is a systematic method of transferring the spherical surface of the earth to a flat map. There is an old saying that "all maps lie flat, and all flat maps lie." It is utterly impossible to represent the three-dimensional world on a flat, two-dimensional piece of paper or video screen without stretching or compressing it in some way. Every projection is therefore distorted in one way or another, and this distortion influences the impression in the viewer's mind about the size and proximity of different regions of the world (Figure 1.1).

Second, to avoid muddling its message in a sea of minutia, a map necessarily offers a simplified and sometimes distorted view of reality. **Simplification** can take many forms, such as omission, straightening, exaggeration, and distortion, depending upon the map's ultimate use. Maps of Canada for educational purposes frequently omit small, uninhabited islands and straighten jagged coastlines in the Canadian Arctic, whereas maps for navigation try to show the same features with great accuracy as well as water depth and currents. Highly simplified subway maps emphasize information of potential use to a subway rider and ignore features of the human and natural environment that are unimportant to navigating the subway network (Figure 1.2). Stations five or six blocks apart in the central city appear on the map as far apart as suburban stations separated by several miles because for most subway travelers, distance is unimportant. What matters is whether they are on the right line, how many stops until they need to get off, and whether they need to change trains. To make road lines readable on the map, they are drawn thicker than if they were drawn proportional to their width in the real world. Some buildings are considered important enough to include, but most are not. No two cartographers make these ultimately subjective decisions in the same way.

A third way to manipulate the way a map looks is by choosing a different map scale. **Map scale** refers to the degree to which a map "zooms in" on an area. Map scale can be defined as the ratio of map distance (distance between two points on a map) to earth distance (distance between those two points on the surface of the earth), measured in the same units. Every map has a scale, and the degree of generalization of information depends on that scale. A large-scale map depicts a small area (such as downtown Phoenix) with great detail. A small-scale map depicts a large area (such as the state of Arizona) but with less detail. You can remember this by

TABLE 1.1   Five Themes in Human Geography

| Theme	Definition	Selected Examples in Chapters
Location	The absolute position of something on the surface of the earth and its relative proximity to other related things	Chapter 1: Where do African-Americans live, and why? Chapter 6: Where are different kinds of jobs concentrated, and why? Chapter 7: What is the spatial pattern of development, and why? Chapter 8: Where are different crops and livestock grown, and why? Chapter 9: Where are major league baseball teams located, and where should new ones be put, and why? Chapter 11: Where should new housing be built in the urban area, and why? Chapter 12: Are the locations of Catholics and Protestants in Northern Ireland growing more mixed or more segregated over time?
Place	The local human and physical characteristics that uniquely define a place and impart meaning to its inhabitants	Chapter 2: What characteristics of the place where you live are portrayed on postcards, and why? Chapter 10: What can you tell about a neighborhood by observing it, and how does it compare to Census data? Chapter 13: Why are people of the former Yugoslavia and Kurdistan so attached to their places of birth?
Region	An area characterized by similarity or by cohesiveness that sets it apart from other areas	Chapter 2: What are the boundaries of the Middle East or American Southwest culture regions? Chapter 6: Which regions specialize in which industries, and why? Chapter 9: How and why would a new baseball team affect the market areas of existing teams? Chapter 10: What kinds of subregions exist within a city, and why? Chapter 11: How and why have urban regions expanded over time? Chapter 13: How did mismatches between political and ethnic regions lead to war in Yugoslavia and Iraq?
Movement	The flow of people, goods, money, ideas, or materials between locations near and far	Chapter 3: How and why has AIDS spread throughout the United States? Chapter 4: From where do people move to your state, and why? Chapter 8: What kinds of food are imported from other countries, and why? Chapter 11: How will different urban growth strategies affect traffic congestion? Chapter 13: When did Islam spread to Bosnia, and why? Chapter 14: How does the movement of water or beef lead to environmental problems?
Human/ Environmental Interaction	The ways in which human society and the natural environment affect each other	Chapter 2: How have humans adapted to arid climates in the Middle East and the American Southwest? Chapter 5: How does population growth in India affect the environment? Chapter 8: Which crops grow best in which climates? Chapter 11: How does urban sprawl affect the environment? Chapter 14: What are the causes and effects of environmental problems, and what are the positions of the various stakeholders?
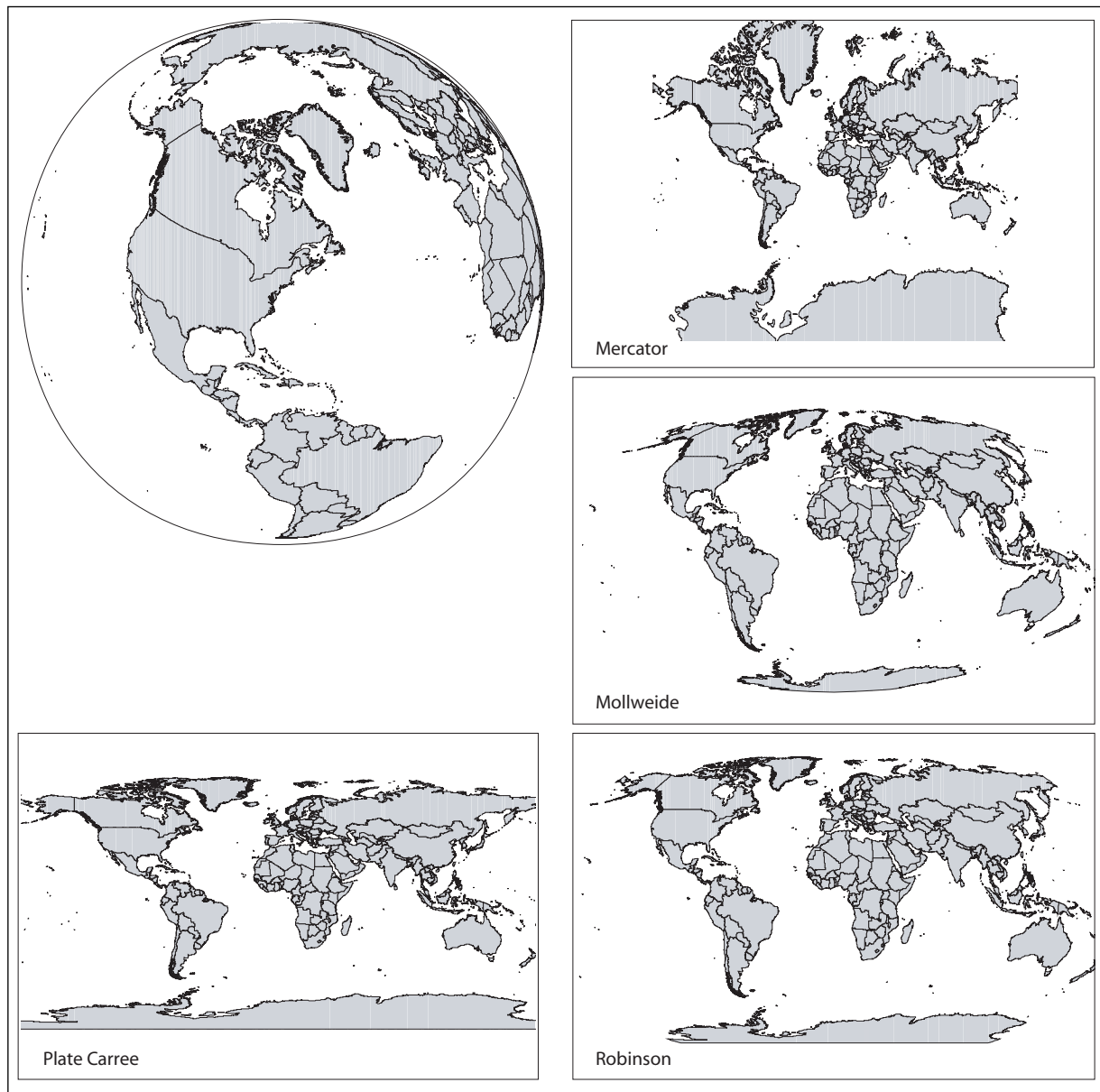
Figure 1.1   The projection chosen to draw the global earth on flat paper affects the shape of the map. The Mercator projection, for instance, is directionally correct and therefore good for ocean navigation, but it exaggerates the area near the poles while minimizing the size of tropical regions. For this reason, many international agencies prefer the Robinson or other "equal area" projections. Because the four examples shown all split the Pacific Ocean in two, Hawaii appears near to the United States and far from Asia, a false impression that may have contributed to the "surprise" Japanese attack on Pearl Harbor during World War II.

considering the size of a particular feature on a map. For example, the larger your dwelling appears on a map, the larger the map scale. Another way to remember it is by the fraction that defines the ratio of map distance to earth distance. On a large-scale map of downtown Phoenix, the scale might be 1/10,000, which is a larger number than 1/1,000,000 for a typical small-scale map of Arizona. A large fraction means large scale; a small fraction means small scale.
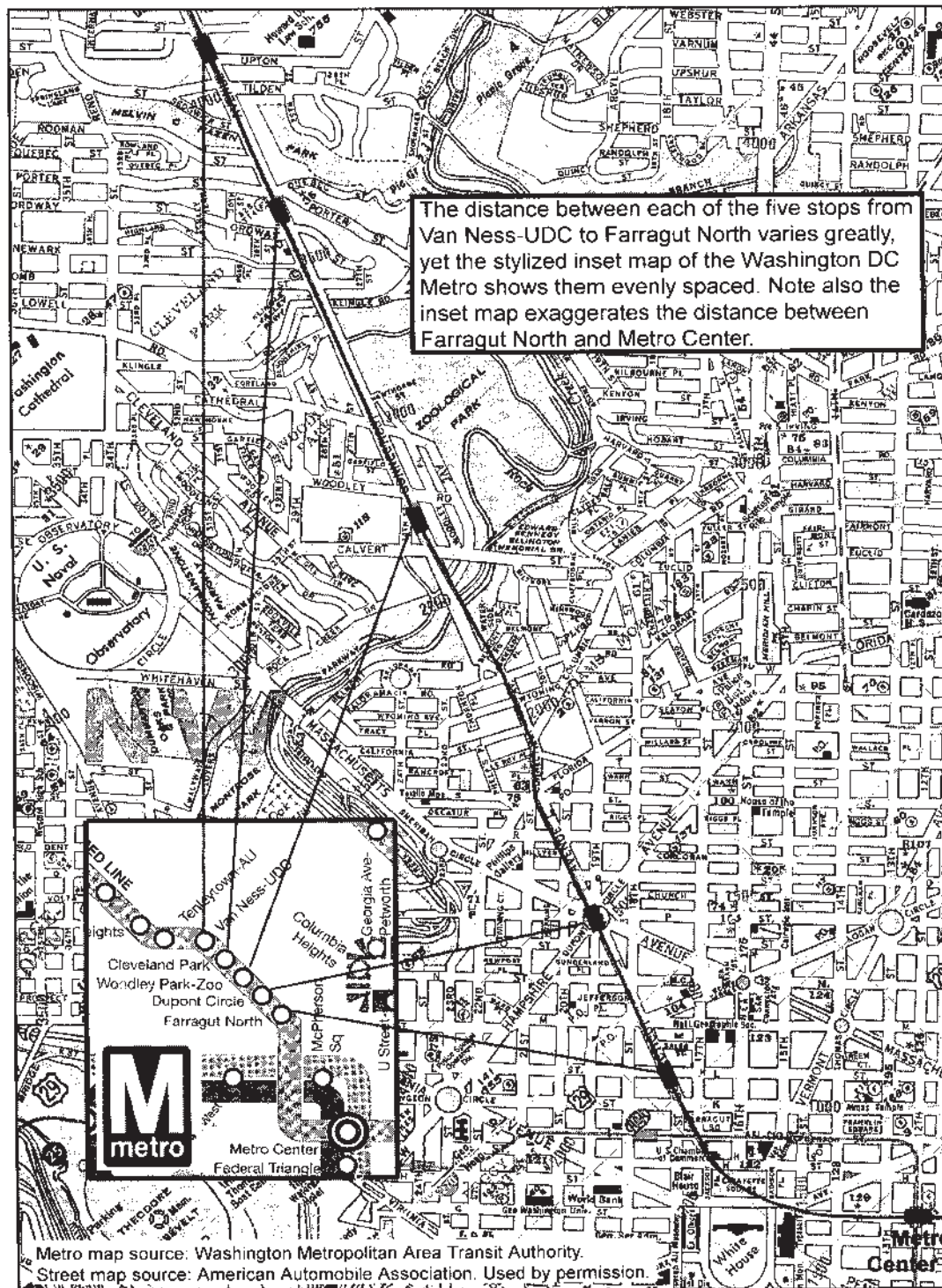
The distance between each of the five stops from Van Ness-UDC to Farragut North varies greatly, yet the stylized inset map of the Washington DC Metro shows them evenly spaced. Note also the inset map exaggerates the distance between Farragut North and Metro Center.

Metro map source: Washington Metropolitan Area Transit Authority.
Street map source: American Automobile Association. Used by permission.

Figure 1.2 The DC Metro inset map is highly selective in that it shows only the sequential relationship beween subway stops. All underlying detail is suppressed so that even distance is distorted.

The case studies in this book explore human geography at a variety of scales. Activities at the global scale (i.e., small-scale maps) include Chapter 7 on international development levels, Activity 1 of Chapter 8 on global agriculture, and Activity

1 of Chapter 14 on global carbon dioxide emissions. At the national or regional scale are Chapter 2 on the Middle East and American Southwest culture regions, Chapter 3 on AIDS diffusion, Chapter 4 on migration to your state or province, Chapter 5 on India's population, Chapter 6 on economic specialization, Chapter 9 on baseball market areas, Chapter 12 on segregation in Northern Ireland, Chapter 13 on the wars in the former Yugoslavia and Iraq, and Chapter 14 on environmental case studies. Finally, the activities at the local scale (large-scale maps) include Activity 3 of Chapter 8 on local agricultural change in Latin America, Activity 1 of Chapter 9 on pizza restaurants in your state, Chapter 10 on your local urban landscape, and Chapter 11 on urban sprawl in Colorado Springs.

Related to map scale is the fourth cartographic issue of data **aggregation**. The level of data aggregation influences the spatial patterns we see. By level of aggregation, we are referring to the size of the geographic units under investigation (i.e., cities, counties, states, regions, countries, or groupings of countries, such as Central America, Western Europe, or Eastern Africa). A particular pattern that is revealed at one level of aggregation does not necessarily appear at another. For example, the spatial pattern of college graduates depends on whether you consider counties or states as your unit of analysis. If asked by a high-tech employer: "Where are the highest percentages of people with a college degree?" a good geographer would answer that it depends on the level of geographic resolution you have in mind. At the state level of aggregation, Massachusetts has the highest percentage of people with a bachelor's degree or higher at 27.2 percent and West Virginia has the lowest at 12.3 percent (Figure 1.3). Maps at the county level, however, show that some urban counties and counties with universities in West Virginia have higher percentages of college graduates than some rural counties in Massachusetts (Figure 1.4).

Finally, the fifth way to influence the way a map looks is through the type of map you choose. General-purpose maps with a variety of common features such as
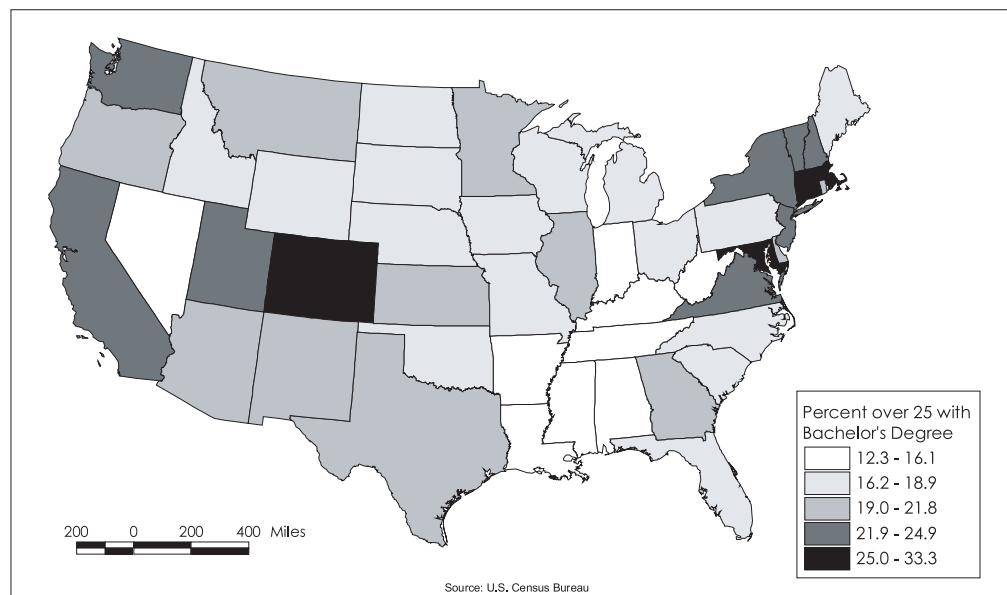

Figure 1.3   Percent of the population over 25 years old with a bachelor's degree, 1990.
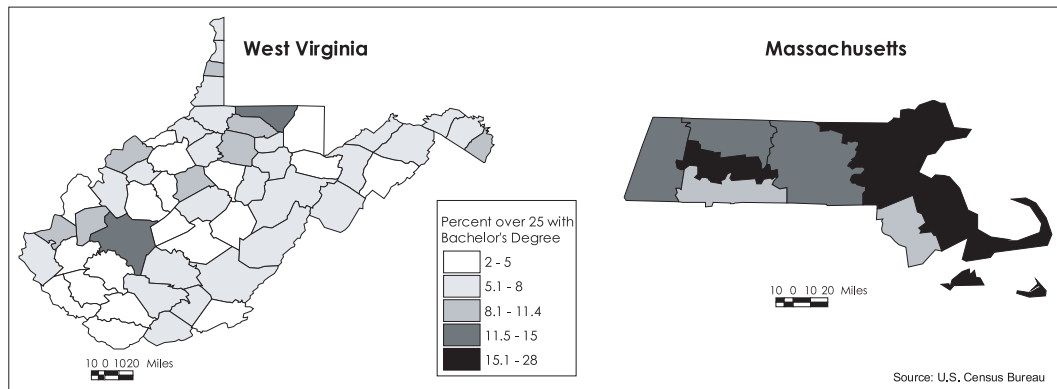
Figure 1.4   Percent over 25 with bachelor's degree for West Virginia and Massachusetts counties, 1990.

cities, boundaries, mountains, or roads are known as **reference maps**. Maps that highlight a particular feature or a single variable such as temperature, city size, or acreage in potatoes are called *thematic maps*. There are several types of **thematic maps** (Figure 1.5). **Isoline maps** show lines that connect points of equal value (*iso* means equal in Greek). Crossing an isoline amounts to going up or down that surface (increasing or decreasing the value of the variable being mapped). A **choropleth map** shows the level of some variable within predefined regions, such as counties, states, or countries. It categorizes a variable into classes and depicts each class with different shading patterns or colors. A **proportional symbol map** uses a symbol such as a circle to show intensity or frequency; the size of the symbol varies with the frequency or size of the variable being mapped. Finally, **dot maps** use a dot to represent the occurrence of some phenomenon in order to depict variation in density in a given area.

The project you will work on in this chapter asks you to use **spatial data**, which have a geographic or locational component. You can place them on the surface of the earth, and therefore you can map them. Geographers commonly use two types of geographic data: primary data and secondary data. **Primary data** are measured or obtained directly by the researchers or their equipment without any intermediary. For instance, survey research involves asking people about their shopping behavior, travel patterns, or migration history. Traffic counts can be measured by video cameras, sensor plates or wires, or human observers. Geographers obtain **secondary data** from another source that previously collected, processed, and catalogued the data. Agencies of international, national, state, and local governments collect and disseminate a veritable treasure trove of geographic information. Examples are agencies of the United Nations (www.un.org/), the U.S. Census Bureau (www.census.gov), National Oceanographic and Atmospheric Administration (www.nesdis.noaa.gov), state governments, and local planning agencies. Using secondary data can be efficient (imagine conducting your own census!) and can enable you to greatly extend the scope of your research by including a wide array of factors. In this book, most of the data you will use were obtained from secondary sources, but you will have a chance to collect primary data in Chapter 2 (postcards), Chapter 8 on agriculture (foods available in your local supermarket), Chapter 9 (pizza restaurants in your state), and Chapter 10 (field observations of landscapes).
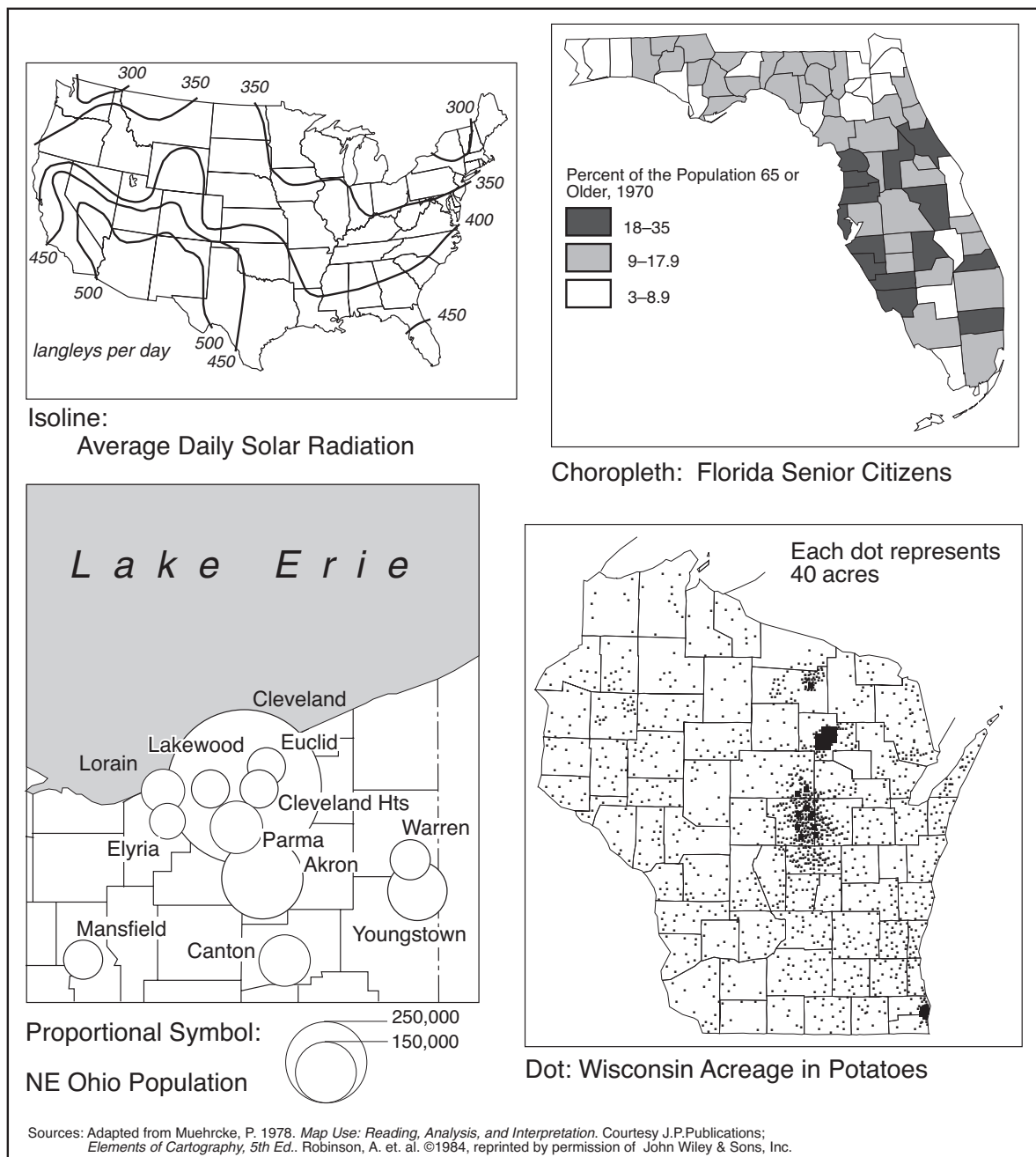
Figure 1.5 Four types of thematic maps.

One of the most important recent trends in geography is the development of the **geographic information system (GIS)**. A GIS is, in short, a spatial database linked to a graphic display. Geographers and scientists in related fields use a GIS to store, access, analyze, and display geographic information in electronic form with user-friendly software. Addresses and locations can be given x,y earth coodinates (geocoded) within a GIS, enabling the user to pinpoint and interrelate a variety of phenomena in geographic space. The volume and variety of geographic data that can be linked using space as the reference grid literally have no limit. Different

geographic information is stored in different layers that can be viewed in any combination, and their relations to each other can be analyzed.

A GIS has many useful applications in planning, environmental management, market research, and demographic analysis. You will use GIS in the following mapping exercise and observe its power to enrich geographic analysis.

▶ *CASE STUDY*

TRUE MAPS, FALSE IMPRESSIONS

GOAL

To interpret and critically evaluate maps, to understand how scale influences data representation on maps, and to recognize three types of map scale: representative fraction, verbal, and graphic. You will also learn how to represent data with different types of **thematic maps**—the **dot map**, the **isoline map**, the **choropleth map**, and the **proportional symbol map**—and see that your choice of map type profoundly influences the resulting spatial pattern.

LEARNING OUTCOMES

After completing the chapter, you will be able to:

- Convert map scale to real-world distances.
- Recognize choropleth, proportional symbol, isoline, and dot maps.
- Recognize that changing the scale and type of a map changes its message.
- Understand the difference between changing scale and changing level of aggregation.
- Use GIS to change the class limits on a choropleth map.
- Describe the geographic distribution of African-Americans in the United States.

SPECIAL MATERIALS NEEDED

- Calculator
- Computer with CD drive and Internet Explorer 5.0 and above. See *Read Me*.

BACKGROUND

Africans were first brought to what is now the United States between 1619 and 1808 as slaves to work on tobacco, rice, sugar, and cotton plantations, mostly in the South. Although the practice of bringing slaves into the country was made illegal in 1808, some smuggling of slaves continued into the nineteenth century. Importation was replaced by programs of slave breeding and trade within the South. Although concentrated in the South, a small number of slaves escaped to the North and other parts of the country where they were represented across many walks of life. A free black man living in Baltimore was commissioned by Thomas Jefferson to survey the District of Columbia. Black cowboys, based in Texas, were well known on cattle drives throughout the West.

Many people are surprised to learn that African-Americans represented a sizable share of the U.S. population during the seventeenth and eighteenth centuries. At the time of the first Census in 1790, one of every five residents of the new country was African-American. Concentrations were highest in southern states: 54 per-cent of South Carolina's population was African-American, 40 percent of Virginia's, 37 percent of Georgia's, 34 percent of North Carolina's, and 33 percent of Maryland's.

After emancipation in 1863, most African-Americans remained in the South, working as sharecroppers or tenants on white-owned cotton farms, barely getting by. Although the reasons to leave the South were compelling, including crushing poverty, antiblack terrorism, and a lack of civil rights, few actually left the region. Many black farmers were illiterate and, therefore, unaware of economic opportunities in other parts of the country. White landowners, desperate to preserve their favored way of life sustained by cheap black labor, promulgated an economic system that put sharecroppers in a position of permanent indebtedness, making departure illegal. In the late 19th century, Northern labor unions lobbied against the importation of African-Americans from the South, fearing it would depress their wages. They preferred European immigrants to meet the demand for new industrial workers in America's burgeoning manufacturing sector.

All of that changed after the end of World War I, and thus began one of the most dramatic migration streams in U.S. history. At the turn of the twentieth century, 90 percent of the nation's African-American population lived in the South, mostly in the rural South. By 1970, barely 50 percent lived in the South (Figure 1.6) after millions sought a better life in northern cities. Reasons for leaving were many and complicated. The supply of cheap immigrant labor was cut off by World War I, and recruiters went south, bringing literally trainloads of African-American workers to the steel mills, automobile factories, and meat-packing plants of Pittsburgh, Detroit, Chicago, and other northern cities (Figure 1.7). Once these connections had been established, thousands of migrants followed and established themselves in predominantly black neighborhoods such as the South Side of Chicago and Harlem in northern Manhattan (Figure 1.8). The mechanization of cotton harvesting after 1945 further spurred the African-American exodus from the South. The mechanical cotton picker rendered sharecroppers obsolete by drastically reducing the need for their labor. Early models of the cotton picker reduced the costs of picking cotton from $40 to $5 per bale. Each machine did the work of 50 pickers. As the mainstay for southern African-American employment evaporated, many left the rural South in search of northern jobs.

The story does not end here, as migration flows between the South and North were reversed after 1970. Fewer African-Americans left the South, and many more moved from the North to the South. Race riots and deteriorating economic conditions in northern cities served as push factors, and the favorable economic opportunities and improved social conditions of the "New South" attracted

Figure 1.6 Farmer and son in Daphne, Alabama.

Figure 1.7 Many of today's African-Americans continue to work in blue-collar industries such as this construction worker at Newark Airport.

Figure 1.8 African-American culture, featuring jazz and blues music, flourished in their neighborhoods in northern cities. Olympic great Jesse Owens and his wife danced at the opening of the Cotton Club in Harlem, September 25, 1936.

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migrants from the North. Whereas the earlier migration streams connected the *rural* South to the *urban* North, today's streams primarily link the *urban* North with the *urban* South (Figure 1.9).

This exercise, involving mapping the distribution of African-Americans, relies heavily on information about race from the U.S. Census. Census race data are used to enforce antidiscrimination laws on voting rights, equal job and housing opportunity, and access to credit, as well as in studies of migration, residential segregation, health, education, and poverty. Until recently, the U.S. Census Bureau had established five racial categories—American Indian or Alaskan Native, Asian or Pacific Islander, Black, White, and "Some Other Race"—and asked respondents to self-identify into one of the five groups. In 2000, for the first time, the Census allowed Americans to select more than one racial category, reflecting the growing rates of racial intermarriage and the increasing racial and ethnic diversity of the nation's population. In addition, the number of racial categories was increased to six, and they have been renamed as: "American Indian or Alaskan Native," "Asian," "Black or African-American," "Native Hawaiian or Other Pacific Islander," "White," and "Some Other Race." Also, the census category "Hispanic or Latino" is independent of these racial categories; Hispanics can be of any race.

The way racial categories are constructed has a social dimension. Some geographers go so far as to argue that emphasis on racial distinctions is a means of privileging whites above those of color—or vice versa. At the very least, we must recognize that racial categories are not perfectly objective ways of organizing people who, after all, self-identify themselves into categories with increasingly fuzzy boundaries. Although Census 2000 recognizes

Figure 1.9 As previously closed opportunities in workplace and universities have opened up, many African-Americans, such as this businessman in Fort Lauderdale, have moved up the socioeconomic ladder and moved to upscale urban and suburban neighborhoods.

greater racial diversity and intermixing with 63 possible racial combinations, questions of what race means in our society and why we continue to collect data by race remain important social and political issues.

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True Maps, False Impressions: Making, Manipulating, and Interpreting Maps

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▶ ACTIVITY 1: SCALE

Map scale is the ratio of the distance on the map to the distance on the ground, where both are measured in the same units. Scale can be represented in three different ways:

Representative Fraction. The map distance to ground distance ratio is written as a simple fraction (e.g., 1/50,000) or ratio (1:50,000). In this example, it simply means that one unit (inches, centimeters, etc.) on the map represents 50,000 of the same units on the ground.

Verbal Scale. Words instead of numbers are used to express the scale. The verbal scale can thus be thought of as a "translation" of the representative fraction into words. For example, the scale of 1:63,360 can also be expressed as "one inch to one mile," or "one inch represents one mile." This is because there are 12 inches in 1 foot, and 5,280 feet in 1 mile, and:

$$5280 \, \frac{\text{feet}}{\text{mile}} \times 12 \, \frac{\text{inches}}{\text{feet}} = 63{,}360 \, \frac{\text{inches}}{\text{mile}}$$

Therefore, one inch on the map represents 63,360 inches, or one mile, on the ground.

Graphic Scale. This normally appears as a line or bar divided into conveniently numbered segments. You can think of this as a picture of the words in the verbal scale. In the following example, 1 inch represents 1 mile (use a ruler to test it out!).

```
  0       1/2      1               2             3             4
  |__.__.__|__.__|_____|_____|_____|
                            Miles
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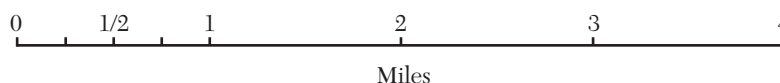
1.1. Suppose you have a map with a scale of 1/31,680 and that City A is four inches away from City B on the map. How many *inches* apart are they on the surface of the earth?

1.2. For the same two cities in Question 1.1, how many *miles* apart are they on the surface of the earth? (*Hint:* Take your answer to Question 1.1, which is in inches, and divide by 12 to measure it in feet and divide again by 5,280 to measure it in miles.)

1.3. A bakery needs to supply bread to every store within a 20-mile radius. How many inches will this radius be when drawn on the map?

1.4. Which is the largest-scale map (circle it)?
    a. 1/24,000   b. 1/62,500   c. 1/100,000   d. 1/250,000

1.5. Which of the following maps is larger scale?

1.6. Would your college campus appear larger on a map at a scale of 1:500 or 1:5,000?

Scale is more than just a way of zooming in or out for a closer look or a broader perspective. When you change scales, you can actually see a different spatial process at work. The process you will investigate in Questions 1.7 to 1.9 involves whether the U.S. population became more concentrated or more spread out during the twentieth century.

Figure 1.10 shows each county's percent of the total U.S. population for 1900 (top) and 1997 (bottom) at a relatively small scale, 1:12,000,000. At this scale you can see the whole northeastern section of the United States, and each county is fairly small. We could call this a "regional-scale" map.

1.7. On the regional-scale maps (Figure 1.10), did the population become more spread out or more concentrated from 1900 to 1997? Explain how you interpreted the map pattern to reach this conclusion.

Percent of Population 1900
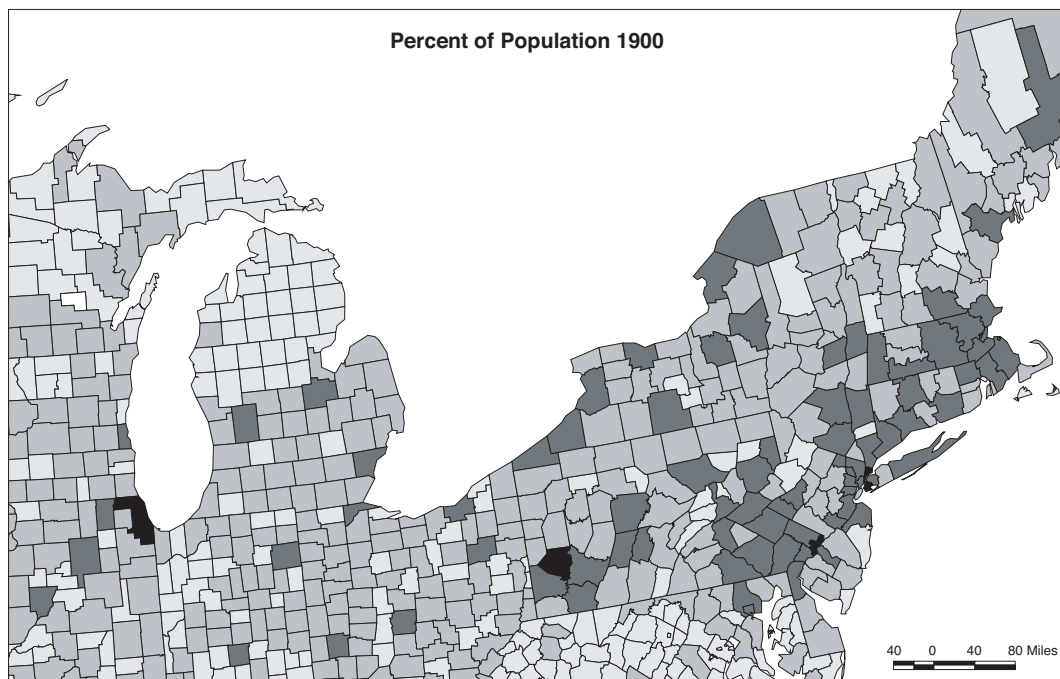
Note: We chose to map the northeast U.S. rather than the whole U.S. because many countries in the South and West did not exist in 1900, which leaves confusing gaps in the 1900 map. Also, the Northeast makes a better example of the process at work than the other regions because it was more fully settled. You can focus more on redistribution of the population than on in-migration.

Percent of National Population

- 0 – 0.03
- 0.031 – 0.1
- 0.11 – 1.0
- 1.01 – 3.56
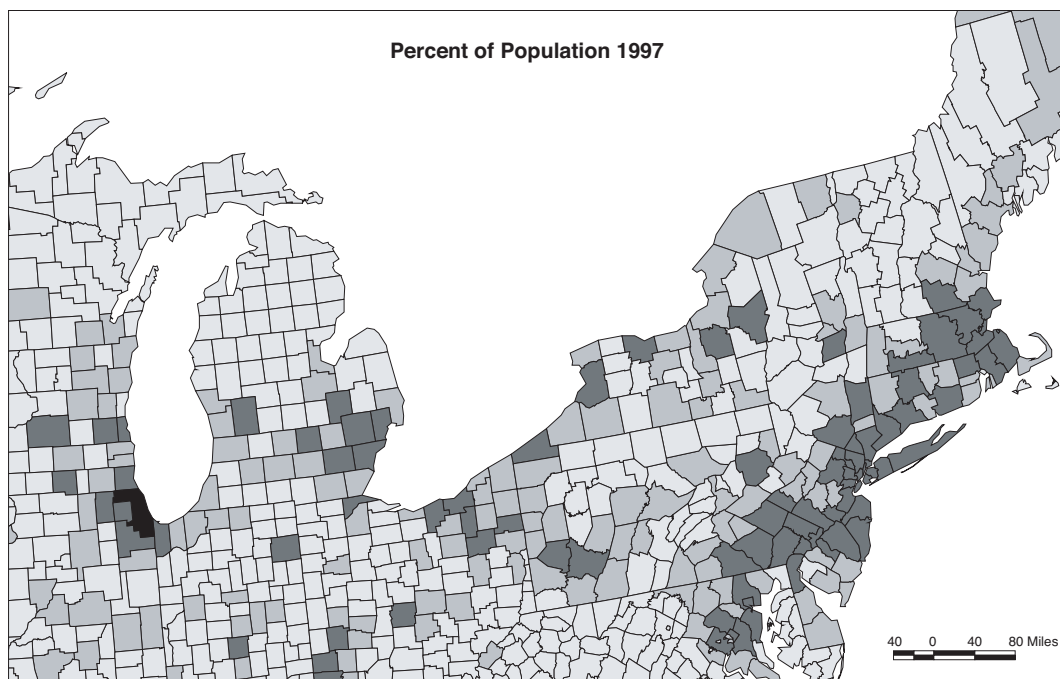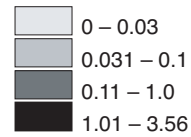
Percent of Population 1997

Figure 1.10 Regional-scale map of population by county in the northeastern United States, 1900 and 1997.
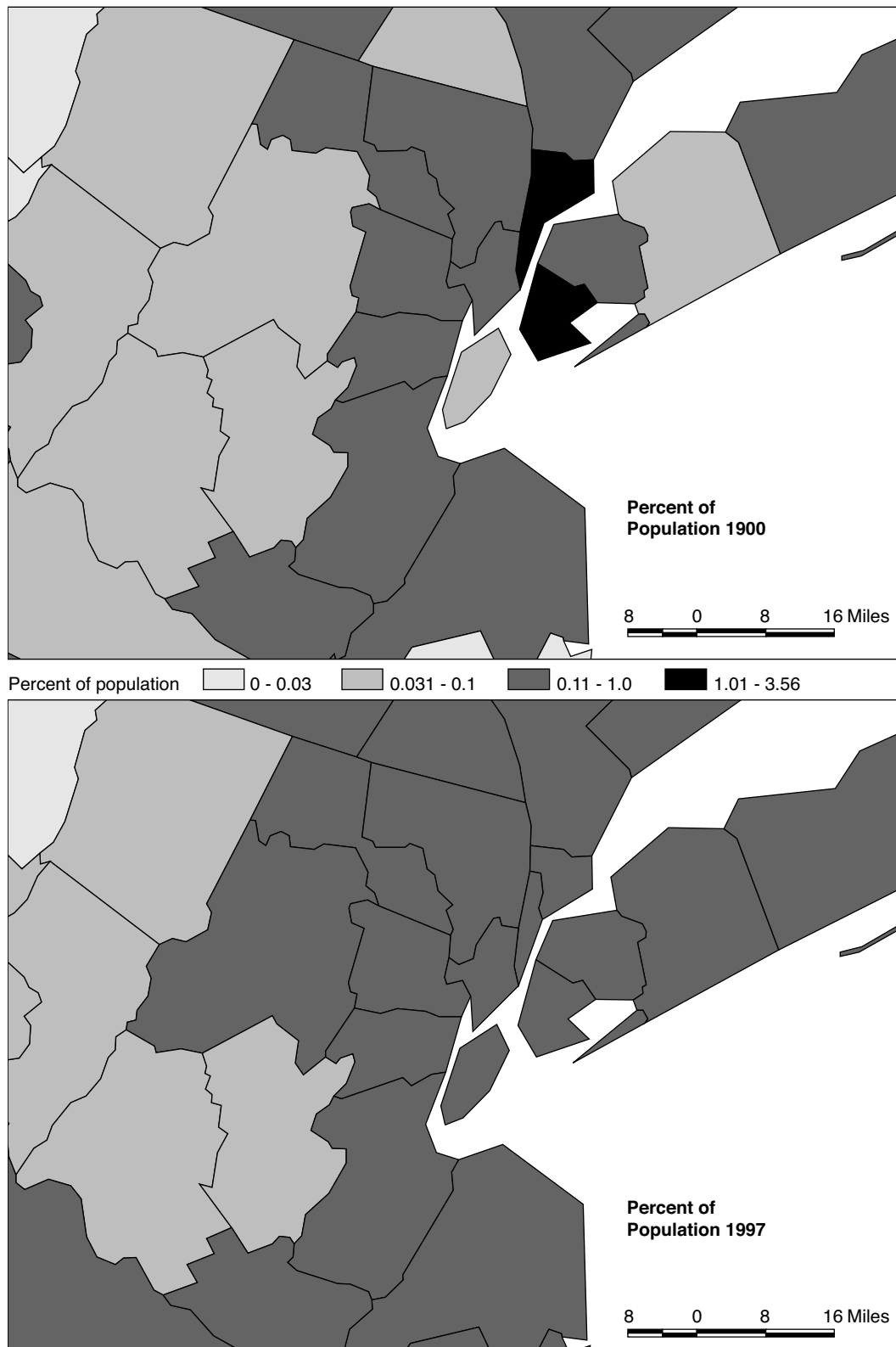
Figure 1.11 Populations in New York City region, 1900 and 1997.

Now look at Figure 1.11, which zooms in on the New York region. This is a larger-scale map at 1:1,200,000. In fact, it is exactly 10 times larger. This is a more "local-scale" map. Notice that the level of aggregation has stayed the same as in Figure 1.10: It still shows the percent of national population by county.

1.8. On the local-scale maps (Figure 1.11), did the population of the New York region become more spread out or more concentrated from 1900 to 1997? Explain how you interpreted the map pattern to reach this conclusion.

1.9. Geographers are fascinated by the links between processes at different scales. The patterns of change you see in the regional-scale maps (Figure 1.10) are a function of Americans moving from the countryside to cities. How is this related to the patterns of change you see at the local scale (Figure 1.11)?

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▶ ACTIVITY 2: THEMATIC MAPS

This activity involves looking at the distribution of African-Americans in the United States (or Aboriginals in Canada) using different types of thematic maps. You will use some of the functions of a geographic information system (GIS) to look at the various maps and choose the most useful ones. A GIS is a software package that makes maps and allows the user to analyze spatial data. A GIS is a powerful tool used by utility companies, city planners, engineers, cartographers, environmental scientists, and many others. You will be using the mapping capabilities of a GIS to interactively change the maps on your computer screen.

A. Insert the CD into your computer. A window will automatically appear (if this doesn't work, see the *readme.txt* file or the instruction sheet that came with the CD).

B. If *Human Geography in Action* has already been installed on your computer, click on *Run from HD.* If not, click either *Install* (for faster performance on your home computer) or *Run from CD* (on school lab computers).

C. Click on the large *Human Geography in Action* logo to start.

D. Click on *Chapter Menu.*

E. Click on *Chapter 1—True Maps,False Impressions.*

F. Click on *Activity 2: Thematic maps (USA)* or *(Canada),* according to your instructor's directions.

G. Read the activity description and then click *Continue.*

H. Students who chose the United States should proceed to Step I. Students who chose Canada should first read the short background on the geography of the Aboriginal population in the window that appears. Following the background, Canadian students will find the computer instructions and questions to answer and hand in for the Canadian case study. To print the background, instructions, and questions, go to the *File* menu and select *Print.* (Alternatively, you could select the entire Canadian text for Chapter 1 by pressing *Ctrl-A* on your keyboard, and then *copy* and *paste* it into a word processing program.) Afterward, click on *Activity 2: Thematic Maps (Canada),* which you can find either at the end of the Canadian Background section or at the very end of the file or on the *Chapter Menu.* The window will change to a map of the Aboriginal population of Canada. Proceed with Instruction I of the Canadian version.

I. You will see the first of four types of thematic maps you will use to evaluate the distribution of African-Americans in the United States. In the right margin are the names for all of the maps. The map displayed is

County Choropleth, which classifies each county into one of four classes and assigns a pattern as shown in the map **legend**. Notice that this map shows the *percentage* of African-Americans per county, not the actual number. Choropleth maps are usually used to show intensity, such as percentages, rather than magnitude, such as total numbers. You will later see maps that show magnitude, such as the total number of African-Americans.

If you wish, you can zoom in on portions of the map to get a better view of a smaller area (you would then be looking at a larger-scale map). Simply move the "slider" in the upper right toward the plus sign. To zoom back out, slide it toward the minus sign. The percentage enlargement is shown in the box below. Next to the percentage is a menu for choosing low, medium, or high resolution.You can move the map around on the screen if you click and hold the mouse button on the red square in the small map in the upper right and move the square around. You also have a layer of boundaries of *States* and another of *City Names* that you can click on or off for reference.

2.1. According to the *County Choropleth*, where would you say most African-Americans live in the United States?

Based on the map, approximately what percentage of African-Americans would you guess live in the dominant region? No need to write an answer; just think about it. Would you say the overwhelming majority? Maybe two-thirds? Less than one-half?

In fact, only about one-half of all African-Americans live in the South. About the same number live outside the South in large urban areas of the Northeast, Midwest, and West.

J. Click on the icon entitled *County Circle* in the right margin. Now do you believe the previous statement? This map is called a *graduated circle map*. A graduated circle is a type of proportional symbol whose size varies with the value for each county. This graduated circle map shows magnitude with each circle a different size, depending on the total number of African-Americans per county.

2.2. Based on this map, name four cities with the largest number of African-American residents. (Don't forget, you can zoom in and also turn on *City Names*.)

_____ _____

_____ _____

2.3. Now you see that the way in which data are presented on maps can greatly alter your perception of the distribution of the information being mapped. By using a different type of thematic map and by presenting the data in absolute rather than percentage terms, the latter map's message changes even though both maps are based

on exactly the same data. What are the false impressions created by the *County Choropleth* and *County Circle* maps?

2.4. Zoom in on the New York City area. What graphic or visual problems do you see with the way the graduated circle map represents the African-American population of the counties adjacent to New York City?

K. Click on the icon entitled *County Dot*. Now you see another way to present the distribution of African-Americans using a dot map. According to the legend, each dot represents 15,000 people. Any county with fewer than 15,000 African-Americans has no dots, those with 15,000 to 29,999 get one dot, those with 30,000 to 44,999 get two dots, and so on.

2.5. What is the drawback of using this kind of map to compare the number of African-Americans in different counties?

L. Change the threshold that sets the number of people per dot to 50,000 and then to 5,000 by clicking on the buttons with these resolutions. Toggle between the three dot resolutions to see the different impressions they portray.

2.6. Which map emphasizes urban areas while deemphasizing the rural South? Why?

M. The level of aggregation (i.e., the size of the spatial unit of analysis) is also important to the pattern depicted on the map. Click on the *County Choropleth* map again to get a fresh image of it in your mind, and then click on *State Choropleth*. This shows the same data but by state rather than by county. Note that as you move your mouse over each state, you see the state name and the percent African-American of the state's total population.

2.7. What different impression of spatial pattern do you get from the state map compared to the county map?

N. Experiment with the different *Color Scheme* options seen at the bottom of the window. Think about how the colors relate to the percent African-American.

2.8. Which color scheme, if any, does a poor job of portraying the percent African-American? Why?

O. Reinstate the original color scheme. Next you will interactively define your own class limits using the graphic array to the left of the map. This graph shows the distribution of data on the *x*-axis, in this case the percent African-American for each state, from low to high. The *y*-axis, which ranges from 0 to 50 states, shows the states in rank order from highest to lowest percent African-American. As you move your mouse over the dots in the graph, the state name and percent African-American appear. Starting at the upper left, you can see that the lowest 20 states are all 4 percent or under, the next 10 states are between 4 percent and 9 percent, and so on. Cartographers use graphic arrays to help in setting class break points that divide the data into "natural classes" or groupings. Look for vertical groupings that indicate a group of states with similar percentages of African-Americans, and set your class limits in the empty horizontal gaps.

The vertical red bars show your class limits in this distribution. You can select a bar by clicking on the top triangle with your mouse. Holding the mouse button down on the triangle, move it left or right to set new class limits. The shading patterns between the bars match those of the map. When you move the bars, the break points in the boxes below change to reflect the new position. These boxes can also be edited: Click in a break-point box, edit the value, and hit return. You will use this interactive graphic array and/or the editable boxes to make your final map, but we aren't quite there yet. You will experiment with several other options first.

P. As you just discovered, changing break points between classes can alter the impression the map gives. Buttons in the lower left use standard cartographic rules for establishing break points, known as *equal frequency* and *equal interval*:

Equal frequency Divides the data distribution into classes with equal numbers of states (this is the default you first looked at). Click this button and look at the histogram (bar graph) below the map to see the number of states in each class.

Equal interval Divides the data distribution into classes (intervals) of equal size between the smallest and largest numbers. Click this button and look at the break points on the graphic array (the red vertical lines) to see that they are equally spaced. The boxes below the graphic array also list the break-point values, and they too will be evenly spaced between the minimum and maximum values.

The default map uses the equal frequency settings. Click back and forth between the *Equal Frequency* and *Equal Interval* buttons to see their effects on the maps.

Q. Another way to customize a choropleth map is to change the *number* of classes. The initial map has only four classes. You can change the number of classes to 5 or 6 using the small window in the lower left. Set the map to 5 *classes* and click *Equal Interval* and then *Equal Frequency*. Finally, set 6 *classes* and click *Equal Interval* and *Equal Frequency*. From these six distinct maps (*Equal Frequency* with 4, 5, or 6 classes, and the same for *Equal Interval*), choose the map you consider to be the most misleading (i.e., it creates the most inaccurate impression of where African-Americans live). You could consult the actual data values for each state in Table 1.2 to compare actual values to perceived values from the map. You also could refer to the graphic array to look for natural groupings that are broken by break points.

R. Using the window above the map, change the map title to the "Most Misleading Map." Click on the *Print* button in the lower-right corner. Hand in the map with this assignment.

TABLE 1.2   Number and Percent African-American by State, 2000 (ranked by %)

State	Total pop	African American	Percent African American	State	Total pop	African American	Percent African American
District of Columbia	572,059	343312	60.0	Nevada	1,998,257	135,477	6.8
				California	33,871,648	2,263,882	6.7
Mississippi	2,844,658	1,033,809	36.3	Kansas	2,688,418	154,198	5.7
Louisiana	4,468,976	1,451,944	32.5	Wisconsin	5,363,675	304,460	5.7
South Carolina	4,012,012	1,185,216	29.5	Massachusetts	6,349,097	343,454	5.4
Georgia	8,186,453	2,349,542	28.7	Rhode Island	1,048,319	46,908	4.5
Maryland	5,296,486	1,477,411	27.9	Nebraska	1,711,263	68,541	4.0
Alabama	4,447,100	1,155,930	26.0	Colorado	4,301,261	165,063	3.8
North Carolina	8,049,313	1,737,545	21.6	Minnesota	4,919,479	171,731	3.5
Virginia	7,078,515	1,390,293	19.6	Alaska	626,932	21,787	3.5
Delaware	783,600	150,666	19.2	Washington	5,894,121	190,267	3.2
Tennessee	5,689,283	932,809	16.4	West Virginia	1,808,344	57,232	3.2
New York	18,976,457	3,014,385	15.9	Arizona	5,130,632	158,873	3.1
Arkansas	2,673,400	418,950	15.7	Iowa	2,926,324	61,853	2.1
Illinois	12,419,293	1,876,875	15.1	New Mexico	1,819,046	34,343	1.9
Florida	15,982,378	2,335,505	14.6	Hawaii	1,211,537	22,003	1.8
Michigan	9,938,444	1,412,742	14.2	Oregon	3,421,399	55,662	1.6
New Jersey	8,414,350	1,141,821	13.6	Utah	2,233,169	17,657	0.8
Texas	20,851,820	2,404,566	11.5	Wyoming	493,782	3,722	0.8
Ohio	11,353,140	1,301,307	11.5	New Hampshire	1,235,786	9,035	0.7
Missouri	5,595,211	629,391	11.2	South Dakota	754,844	4,685	0.6
Pennsylvania	12,281,054	1,224,612	10.0	North Dakota	642,200	3,916	0.6
Connecticut	3,405,565	309,843	9.1	Maine	1,274,923	6,760	0.5
Indiana	6,080,485	510,034	8.4	Vermont	608,827	3,063	0.5
Oklahoma	3,450,654	260,968	7.6	Idaho	1,293,153	5,456	0.4
Kentucky	4,041,769	295,994	7.3	Montana	90,2195	2,692	0.3

Washington, D.C., has been omitted from the maps on the CD.

2.9. How many classes did your most misleading map have (4, 5, or 6) _____ Which rule for establishing class break points did you choose? (Equal Frequency or Equal Interval)_____ Why is the map you chose misleading?

S. It is clear that many African-Americans live in the South. So far, however, many of your maps have probably lumped all southern states into one "high-percentage" category. Suppose you want a map to differentiate *among* the southern states. Look at the data for each state in Table 1.2 and choose class categories that show differences in the percent of

African-Americans within the South. Set the map to *4 classes*. Using either the graphic array or the editable boxes, set the break points to highlight the differences within the South. Study your map, and repeat the process if necessary. When finished, label the map "Differentiation among Southern States." Go to the *File* menu and *Print*. Hand in this map with your exercise.

2.10. What happens to the West when you choose classes that differentiate among southern states? Would this map be useful to show differences in the percentage of African-Americans in California and Oregon?

T.   Finally, using the interactive graphics array and thinking about the various options you have already seen, set the number of classes and the break points to produce the "best" map. *Print* and hand in this map, clearly labeled "Best Map."

2.11. Why did you select this classification scheme?

U. Click on *State Isoline*. Isolines connect points of equal value, in this case, equal percentages of African-Americans. Therefore, as you cross an isoline, you are going into an area with either higher or lower percentages of African-Americans. Interpretation of the spacing and configuration allows one to "read" a third dimension portrayed on the map, an African-American "surface" with peaks of high percentage and valleys of low percentage (Figure 1.12).

The legend says the isoline interval is 3 percent. Therefore, the map has isolines at 3 percent, 6 percent, 9 percent, and on up to 33 percent. Try to picture the surface that the map represents. As you move from very low percentages in South Dakota toward the "peak" in Mississippi, each time you cross an isoline, you are going up by 3 percent. The surface peaks at higher than 33 percent in the ring centered over Mississippi and then starts back down as you head toward Florida, which is below 15 percent. Elsewhere in the map, you can really see the gradient decline sharply from New York to New England as the percentage of African-Americans drops rapidly. You can also see the West Virginia "gap."[1]

2.12. a. Is the change more rapid between South Carolina and Kentucky or between South Carolina and Alabama?

    b. Is the change more rapid between New Mexico and Louisiana or between New Mexico and California?

    c. Look at the range within which most of Oklahoma falls. Based on this, what impression does the map give for the average percentage of African-Americans in Oklahoma?

[1] The isoline maps are based on state data in Table 1.2. The surface is defined by 50 data points (excluding Washington, D.C.), not by thousands of county data points. Therefore, the map cannot be used for studying variations within states.

The following six rules help you read an isoline map:

1. Evenly spaced isolines represent comparatively steady or constant slopes.
2. Closely spaced isolines represent steep slopes.
3. Widely spaced isolines represent slight slopes.
4. Isolines that form the "peaks" of your variable become closed circles.
5. Isolines either start and end at the edges of the map **or** form closed circles. There are no other possibilities.
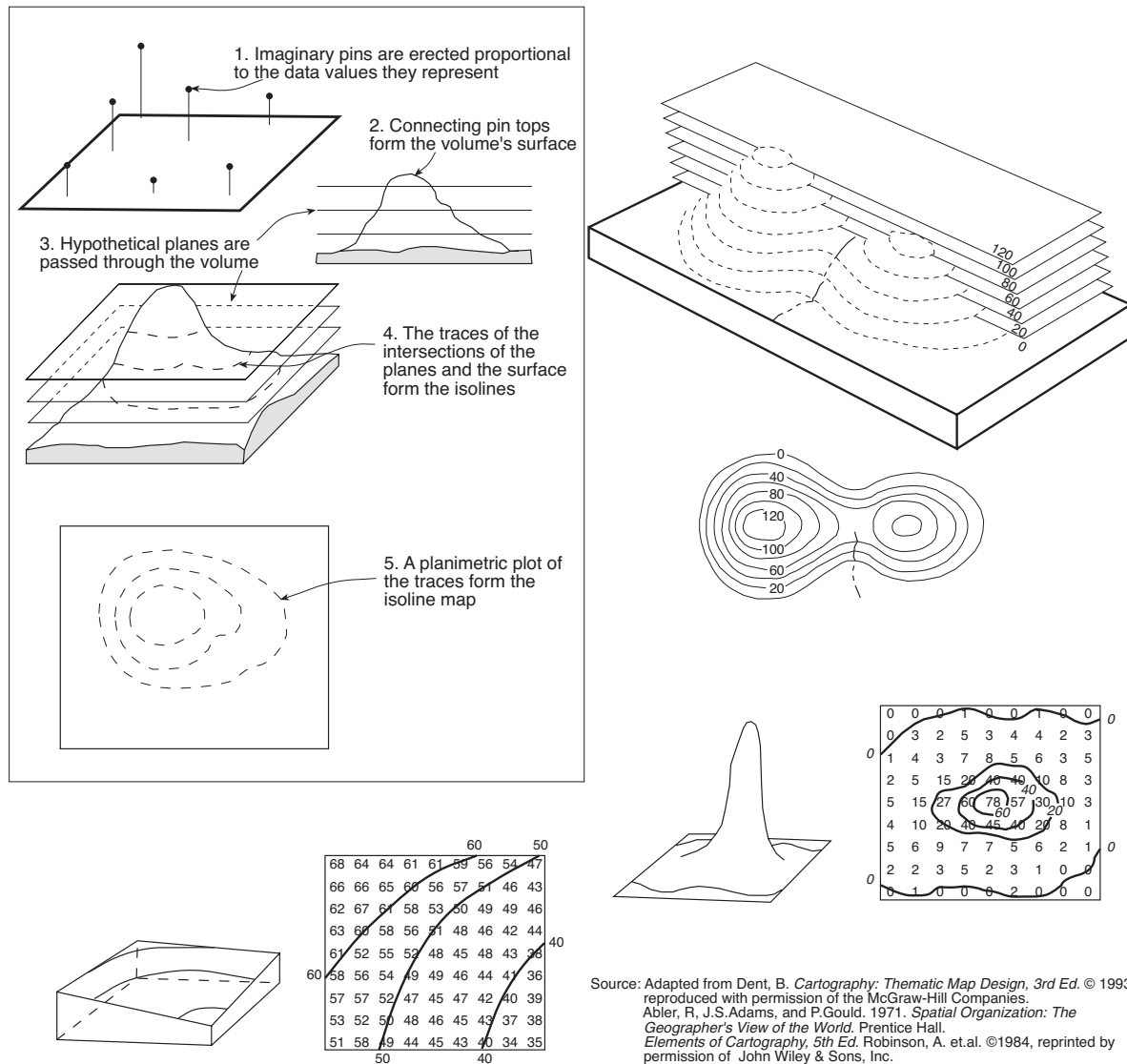6. Isolines **never split, intersect, or cross each other.**

1. Imaginary pins are erected proportional to the data values they represent

2. Connecting pin tops form the volume's surface

3. Hypothetical planes are passed through the volume

4. The traces of the intersections of the planes and the surface form the isolines

5. A planimetric plot of the traces form the isoline map

Source: Adapted from Dent, B. *Cartography: Thematic Map Design, 3rd Ed.* © 1993 reproduced with permission of the McGraw-Hill Companies.
Abler, R, J.S.Adams, and P.Gould. 1971. *Spatial Organization: The Geographer's View of the World.* Prentice Hall.
Elements of Cartography, 5th Ed. Robinson, A. et.al. ©1984, reprinted by permission of John Wiley & Sons, Inc.

Figure 1.12 Rules and visual aids for isoline maps.

2.13. Does the isoline surface accurately depict where African-Americans are concentrated? Look at the state and county choropleth maps to get a feel for the concentration of African-Americans, and then compare your isoline "peaks" and "valleys" to see whether this concentration is accurately shown. Point out some noticeable similarities or dissimilarities between the two maps.

2.14. Think about TV shows and movies you have seen that prominently feature African-Americans. Based on the maps you have seen of the distribution of African-Americans, does Hollywood accurately represent where African-Americans live? What stereotypes are embodied in these media images?

Census 2000 asked Americans to list their race and Hispanic origin separately because *race* and *ethnicity* are two entirely different concepts. Of those who identify with a single race, 211.46 million (75.1 percent) consider themselves White; 34.66 million (12.3 percent) consider themselves to be Black or African-American; 2.48 million (0.9 percent) are American Indian or Alaskan Native; 10.24 million (3.6 percent) are Asian; and another 15.66 million (5.6 percent) belong to other races. Reflecting increasing intermarriage and growing racial diversity, some 6.83 million (2.4 percent) regard themselves as belonging to more than one racial group.

Separate from racial status is Hispanic or Latino origin. As of the 2000 Census, 35.31 million (12.5 percent) of the U.S. population identifies as Hispanic. The vast majority of Hispanics consider themselves to be White (16.91 million) although some 710,000 individuals are both Black and Hispanic, many of them immigrants from Cuba and other parts of the Caribbean.

V.   In the right margin, click on *Other Ethnic Groups*.

W.   In the right margin, click on the *Choropleth* and *Circle* maps for these other groups (all maps based on county-level data).

2.15. Many atlases show ethnic population distribution via county choropleth maps rather than circle maps. In the following table, briefly summarize, in a few words, the overall impression you get from each map for each ethnic group. If the circle map gives the same impression, write "same."

X.   When you have finished, close the *Activity 2* browser window, and click the *exit* button at the top right of the *Chapter Contents* page. If you are on a campus network, log off your machine. Don't forget your CD.

Note:With the experience you now have in map making and map reading, you might want to think about taking a GIS or cartography class next semester. You are also ready to make your own ethnic maps on the U.S. Census Bureau Web site. Keep in mind, however, that you can make only choropleth maps, which, as you know, will create a certain impression of the data. The Census site lets you make choropleth maps at either the state or national scale with either the state or county level of aggregation. You can select from varieties of ethnicities and other socioeconomic characteristics.

The following instructions were valid at the time this book went into production. Go to www.census.gov/. Click on *American FactFinder*. Click on the *Maps* button, choose a census variable (the *Show me* menu) and a scale and a level of aggregation (the *For* menu), and click *Go*. Once the map is displayed, you can print it or download it using the buttons displayed.

This exercise has demonsrated that maps can be manipulated in a variety of ways to produce different impressions of spatial data. We hope it has opened your eyes regarding the careful use of symbols for representing data on maps. Choose the wrong symbol, and your readers could get a false impression. We also hope it has corrected any false impressions you may have had about the historical and contemporary geography of the African-American population of the United States.

	County Choropleth Map	County Circle Map
White		
Hispanic or Latino (of any race)		
Asian		
American Indian and Native Alaskan		