

Name: _____ Instructor: _____

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

► 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 $1:100,000$ can also be expressed as “one centimeter to one kilometer,” or “one centimeter represents one kilometer.” This is because there are 100 centimeters in 1 meter, and 1,000 meters in 1 kilometer.

$$100 \frac{cm}{m} \times 1,000 \frac{m}{km} = 100,000 \frac{cm}{km}$$

Multiply 100 by 1,000 and cancel the m 's on top and bottom and you get 100,000 centimeters in a kilometer. Therefore, in a map with a scale of $1:100,000$, one centimeter on the map represents 100,000 centimeters, or one kilometer, on the ground. Likewise, a verbal scale of “one inch to one mile” translates to a representative fraction of $1:63,360$ because there are 63,360 inches in a mile:

$$12 \frac{inches}{foot} \times 5,280 \frac{feet}{mile} = 63,360 \frac{inches}{mile}$$

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 example below, two centimeters represents one kilometer (use a ruler to test it out!).



16 ► Chapter 1. True Maps, False Impressions: Making, Manipulating, and Interpreting Maps

Questions 1.1 to 1.3 assume a scale of 1:25,000. Note that this scale is different from those in either of the examples just given.

1.1. Suppose that City A is four centimeters away from City B on the map. How many *centimeters* apart are they on the surface of the earth?

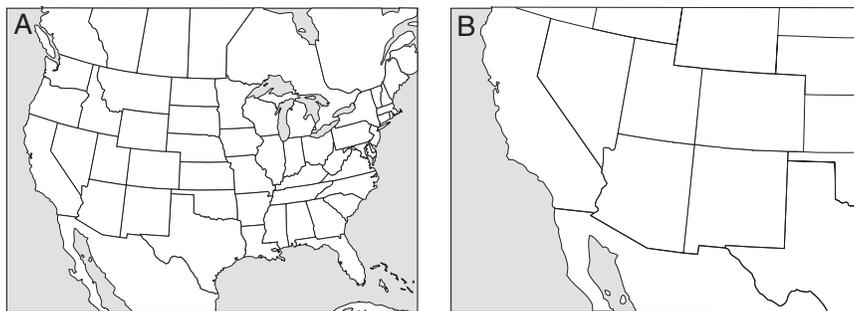
1.2. How many *kilometers* apart are Cities A and B on the surface of the earth?

1.3. A bakery needs to supply bread to every store within a six-kilometer radius. How many centimeters will this radius be when drawn on the map? *Hint*: First convert 6 km to cm, and then multiply by the representative fraction: 1/25,000.

1.4. Which is the largest-scale map?

- 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 northeastern U.S. population became more concentrated or more spread out during the twentieth century.

Figure 1.11 shows each county's percentage of the northeast regional population for 1900 (top) and 2000 (bottom) at a relatively small scale of 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.

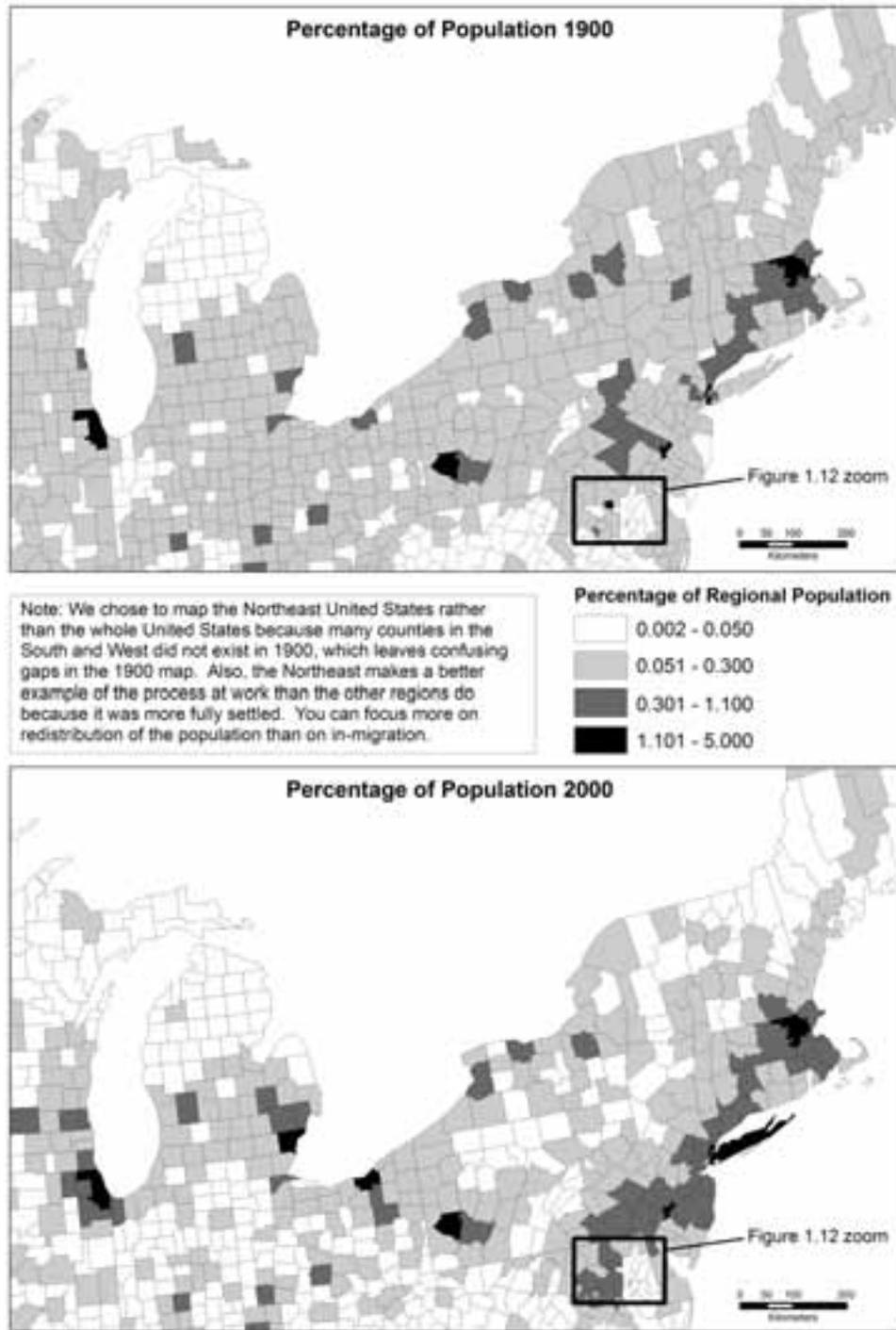


Figure 1.11 Regional-scale map of population by county in the northeastern United States, 1900 and 2000.

18 ► Chapter 1. True Maps, False Impressions: Making, Manipulating, and Interpreting Maps

1.7. On the regional-scale maps (Figure 1.11), did the population become more spread out (people distributed more uniformly and evenly across counties) or more concentrated (more people living in a few places) from 1900 to 2000? Explain how you interpreted the map pattern to reach this conclusion.

Now look at Figure 1.12, which zooms in on the Baltimore-Washington 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 1.11: It still shows the percentage of regional population by county.

1.8. On the local-scale maps (Figure 1.12), did the population of the Baltimore-Washington region become more spread out or more concentrated from 1900 to 2000? Explain how you interpreted the map pattern to reach this conclusion.

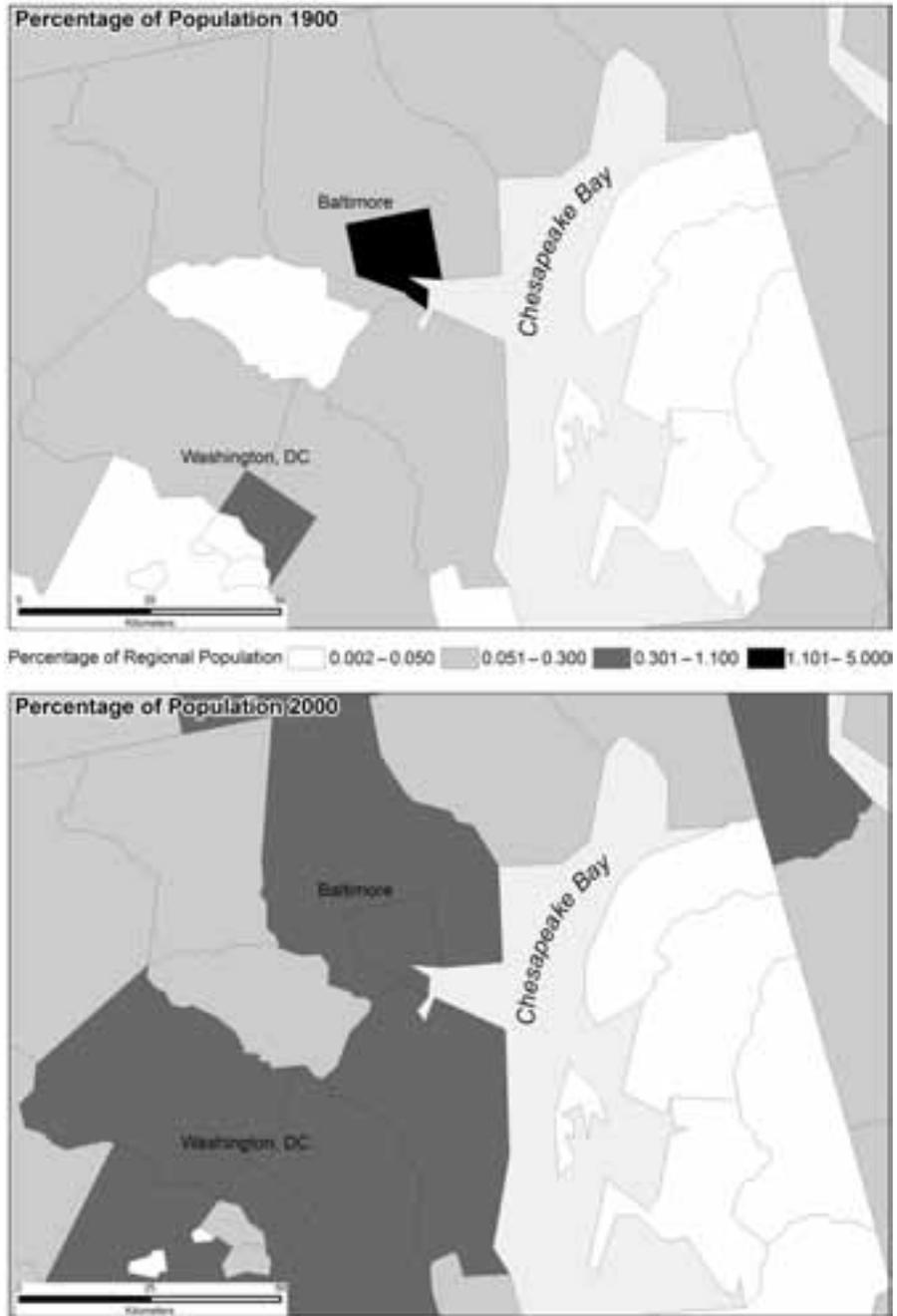
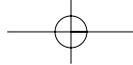
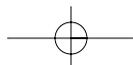
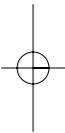
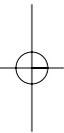


Figure 1.12 Populations in Baltimore-Washington region, 1900 and 2000.



20 ► Chapter 1. True Maps, False Impressions: Making, Manipulating, and Interpreting Maps

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 1.11) 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 1.12)?



Name: _____ Instructor: _____

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

► ACTIVITY 2: THEMATIC MAPS

This activity involves looking at the distribution of African-Americans in the United States (or Aborigines 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. To start your activity, log onto the *Human Geography in Action* Web site or insert your CD into your computer.
- B. Select this chapter from the drop-down list, and then click on *Computerized Chapter Activities*.
- C. Click on *Activity 2: Thematic maps (USA)* or *(Canada)*, according to your instructor's directions.
- D. Students who chose Canada should first read the short background article on the geography of the Aboriginal population in the window that appears. Following the background article, Canadian students will find the computer instructions and questions to answer and hand in for the Canadian case study. You can print these if you like. Proceed with the digital instructions for the Canadian version.
- E. 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" at 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

22 ► Chapter 1. True Maps, False Impressions: Making, Manipulating, and Interpreting Maps

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.

F. Click on the *County Circle* icon 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?

- G. Click on the icon entitled *County Dot*. Dot maps are another way to present the distribution of African-Americans. 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 a drawback of using this kind of map to compare the number of African-Americans in different counties?

- H. 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?

- I. 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 percentage of African-Americans included in the state's total population.

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

24 ► Chapter 1. True Maps, False Impressions: Making, Manipulating, and Interpreting Maps

- J. Experiment with the different *Color Scheme* options seen at the bottom of the window. Think about how the colors relate to the percentage of African-Americans.

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

- K. Restore 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 percentage of African-Americans 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 percentage of African-Americans. As you move your mouse over the dots in the graph, the state name and percentage of African-Americans appear. Starting at the upper left, you can see that the lowest 13 states are between 0 and 2.2 percent, the next 13 states are between 2.2 and 6.8 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 the Enter key. 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.

- L. As you just discovered, changing break points between classes can alter the impression the map gives. Buttons at 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.

- M. 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 at 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 may consult the actual data values for each state in Table 1.2 to compare actual values to perceived values from the map. You

TABLE 1.2 Number and Percentage of African-Americans by State, 2000 (ranked by %)

State	Total population	African-American	Percent African-American	State	Total population	African-American	Percent African-American
District of Columbia	572,059	343,312	60.0	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	902,195	2,692	0.3
Nevada	1,998,257	135,477	6.8				

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

26 ► Chapter 1. True Maps, False Impressions: Making, Manipulating, and Interpreting Maps

also may refer to the graphic array to look for natural groupings that you can separate with break points.

- N. 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.

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) _____ In what way is the map you chose misleading?

- O. 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 percentage 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.” Click on the *Print* button in the lower-right corner. 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?

- P. 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?

Q. 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. By interpreting the spacing and configuration, you can “read” a third dimension portrayed on the map: an African-American “surface” with peaks of high percentage and valleys of low percentage (Figure 1.13).

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?

¹The 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.

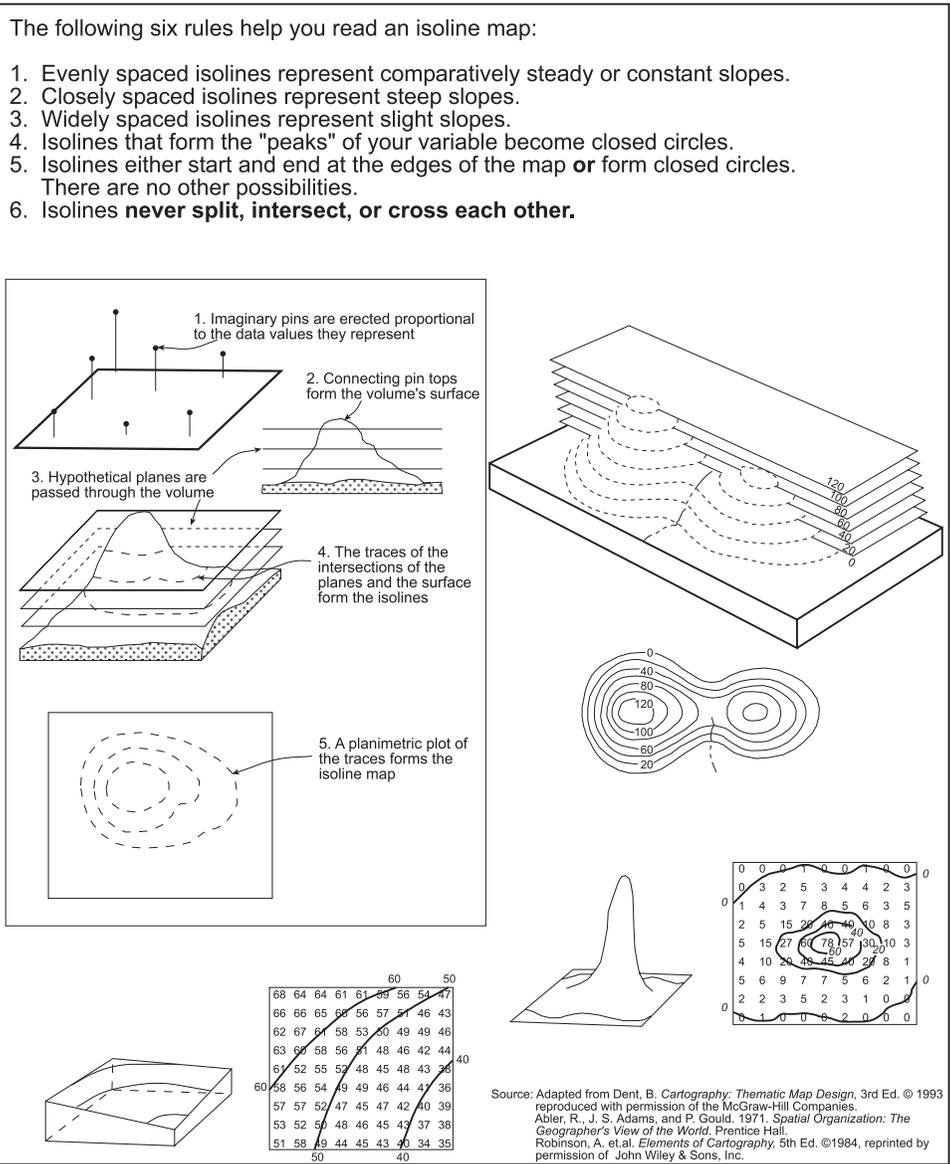


Figure 1.13 Rules and visual aids for isoline maps.

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. Robinson, A. et al. *Elements of Cartography*, 5th Ed. © 1984, reprinted by permission of John Wiley & Sons, Inc.

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?

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?

30 ► Chapter 1. True Maps, False Impressions: Making, Manipulating, and Interpreting Maps

Census 2000 asked Americans to list their race and Hispanic origin separately because *race* and *ethnicity* are two entirely different concepts. Of those who identified with a single race, 211.46 million (75.1 percent) considered themselves White; 34.66 million (12.3 percent) considered themselves to be Black or African-American; 2.48 million (0.9 percent) were American Indian or Alaskan Native; 10.24 million (3.6 percent) were Asian; and another 15.66 million (5.6 percent) belonged to other races. Reflecting increasing intermarriage and growing racial diversity, some 6.83 million (2.4 percent) regarded 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 identified as Hispanic. The vast majority of Hispanics considered themselves to be White (16.91 million) although some 710,000 individuals were both Black and Hispanic, many of them immigrants from Cuba and other parts of the Caribbean.

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

S. 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.”

T. When you have finished the activity, *exit* from the CD or *log out* from the Web page. Don't forget your CD if you are using one.

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 Bureau 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 *Data Sets* button and then select a data set you want to use. Click *Thematic Maps*. You next select a *geographic type* and *geographic area* (these are your units of analysis and the location). Hit the *Map It* button for a reference map of the location you chose, or go to *Next*. You then pick a theme, which is the thematic variable you want mapped, and click *Show Results*. Once the map is displayed, you can change the zoom or elements visible on the map and then print it or download it to a file.

This exercise has demonstrated 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. 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.