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

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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. To start your activity, click on the *Student Companion Site* at [www.wiley.com/college/kuby](http://www.wiley.com/college/kuby). (For students using Wileyplus, log on to your class Web site, select the *Assignment* tab, locate and click on this assignment, and follow all instructions.)
- 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 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*.)

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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?

- 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 ranked 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. The  $x$ -axis is labeled in percentages, and when you move the bars, the breakpoints in the boxes below change to reflect the new position. These boxes are also directly editable: click on a breakpoint box, type in a value, and hit return. You will use this interactive graphic array and/or the editable boxes to make your final map. Before then, experiment with some other options.

- 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 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.

**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 in the animated activity.

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 for showing 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. Describe the classification scheme you chose and explain why you thought it was best.

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 1.14).

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.

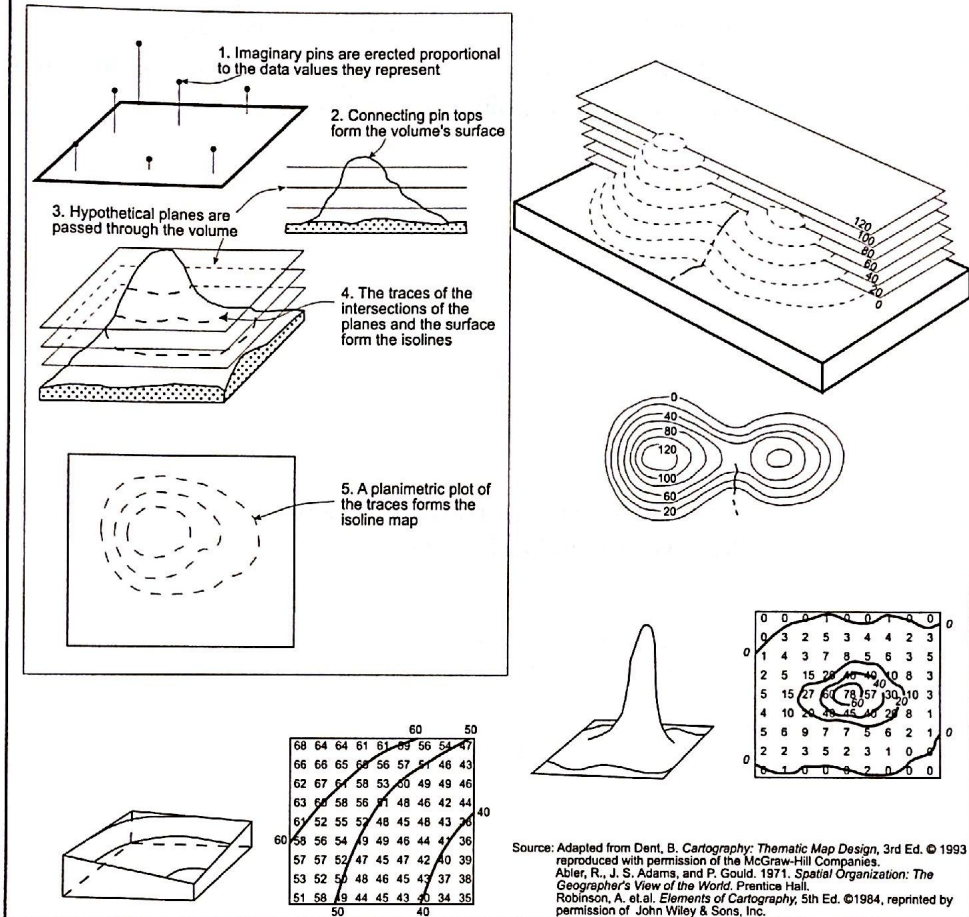


Figure 1.14 Rules and visual aids for isoline maps.

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."<sup>1</sup>

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?

<sup>1</sup>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.



2.13. Look again at the *State Isoline* map to “read” the African-American “surface” with peaks of high percentage and valleys of low percentage. Compare these peaks and valleys with the *State Choropleth* map. Set the *State Choropleth* map to 4 classes with the Equal Frequency breakpoint setting (this should be the default) and toggle between this map and the *State Isoline* map.

Describe one difference between the State Isoline map and the State Choropleth map.

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 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, close all browser windows.

*Note:* With the experience you now have in mapmaking 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 [factfinder.census.gov](http://factfinder.census.gov). Under the *Decennial Census* heading, click on *get data*. Select a data set you want to use, then click *Thematic Maps*. You next select a *geographic type* and *geographic area* (these are your units of analysis and the location). Hit the *Next* button. 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 to the importance of 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.

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

## ► DEFINITIONS OF KEY TERMS

**Aggregation** The level of detail for dividing a thematic map into geographic units, ranging from a coarse division (e.g., countries) to a fine division (e.g., zip codes).

**Choropleth Map** A thematic map in which ranked classes of some variable are depicted with shading patterns or colors for predefined zones.

**Dot Map** A thematic map in which a dot represents some frequency of the mapped variable.

**Geographic Information Systems** A computer hardware and software system that handles geographically referenced data. A GIS uses and produces maps and has the ability to perform many types of spatial analysis.

**Human-Environmental Interaction** The ways in which human society and the natural environment affect each other (the fifth theme of geography).

**Human Geography** The study of the distribution of humans and their activities on the surface of the earth and of the processes that generate these distributions.

**Isoline Map** A thematic map with lines that connect points of equal value.

**Legend** Explanatory list of symbols in a map. Usually appears in a box in a lower corner.

**Location** The absolute position of something on the surface of the earth and its relative proximity to other related things (the first theme of geography).

**Map** A two-dimensional graphical representation of the surface of the earth (or of events that occur on the earth).

**Map Projection** A systematic method of transferring a spherical surface to a flat map.

**Map Scale** The ratio of map distance to earth distance, measured in the same units.

**Movement** The flow of people, goods, money, ideas, or materials between locations near or far (the fourth theme of geography).

**Place** The local human and physical characteristics that uniquely define a place and give it meaning to its inhabitants (the second theme of geography).

**Primary Data** Information collected directly by the researchers or their equipment without any intermediary. This can include surveys, interviews, observations, or measurements obtained in the field.

**Proportional Symbol Map** A thematic map in which the size of a symbol varies in proportion to the frequency or intensity of the mapped variable.

**Reference Map** A general-purpose map that shows recognizable landmarks, roads, and political units.

**Region** An area characterized by similarity or by cohesiveness that sets it apart from other areas (the third theme of geography).

**Secondary Data** Information obtained indirectly from another source that was previously collected, processed, and made available to a larger audience.

**Simplification** Elimination of unimportant detail on maps and retention and possibly exaggeration and distortion of important information, depending on the purpose of the map.

**Spatial Data** Information that has a geographical or locational component.

**Thematic Map** A map that demonstrates a particular feature or a single variable. Four types of thematic maps are (1) dot maps, (2) choropleth maps, (3) proportional symbol maps, and (4) isoline maps.

## ► FURTHER READINGS

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