

Mills College SOC128

Fall 1999 -- Dan Ryan

Lying With Maps I – Thematic Maps

Readings:

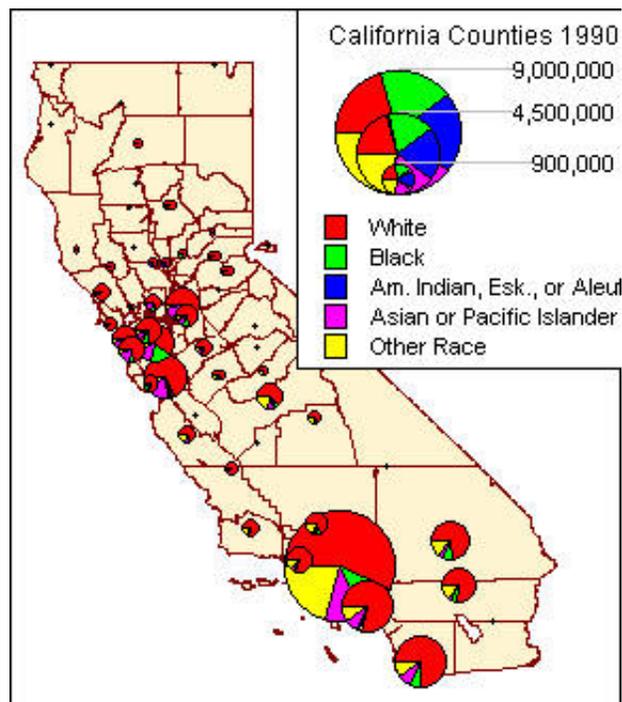
Monmonier, Chapter 10 "Data Maps"

Johnson, Chapter 8 "Thematic Mapping"

Kraak, Chapter 7, "Statistical Mapping"

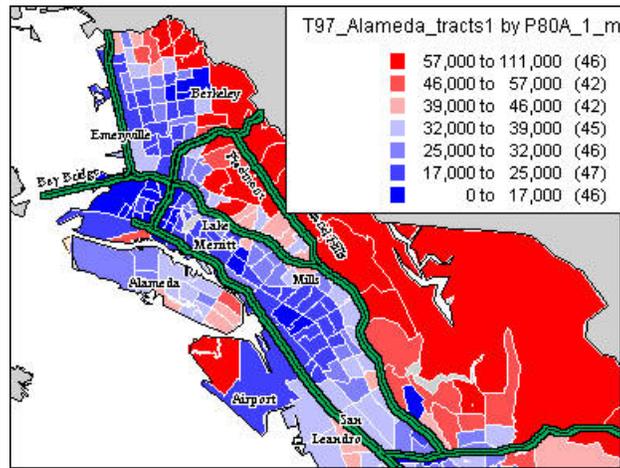
Definition: A thematic map represents the spatial distribution of some observable phenomenon rather than only showing standard features such as boundaries and place names. Thematic maps use the standard visual variables (size, shape, hue, value, texture, orientation) to modify the appearance of point, line, and area objects to represent the values of data elements associated with those objects.

Suppose, for example, we have census data giving 1990 race and population numbers for each of California's counties. To compare the relative proportions of each race between counties as well as the total populations of counties, we can create a "pie chart" thematic map. Each county has a pie chart whose diameter is proportional to the county's total population.



The sectors of the pie are color coded and their size is proportional to the size of each race category in that county.

The previous example placed an object (pie chart) at the "centroid" of each region and used data associated with the region to draw the object (using shape, size and hue). We can also use the visual variables to modify the appearance of the region itself as shown in the map of Oakland area census tracts at right.



The median household income of a census tract is a number such that half the households in the tract have higher incomes and half have lower incomes. Because of the effects of very high and very low incomes on averages, median is the preferred way to characterize the overall patterns of variables like income.

Instructions

MapInfo creates a thematic map "on" a specified layer in a Map view. To create a thematic layer you need to tell Mapinfo

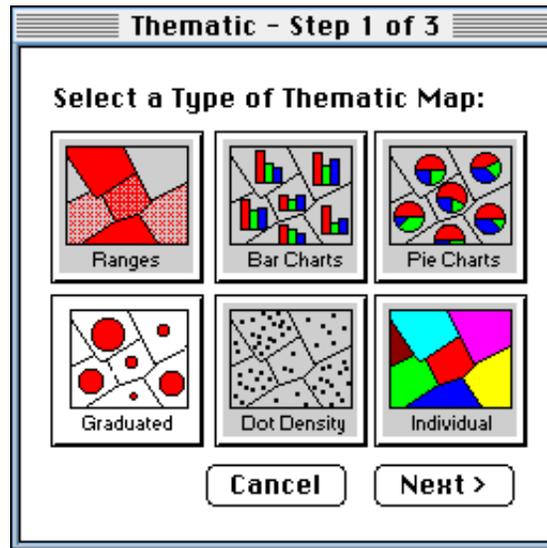
1. what kind of thematic map you want to make
2. what layer (table) you will make the new layer on
3. what data should be used to make the map

4. Connect to **CLASSES** and retrieve the folder **EXERCISE04** from the SOC128 folder.

5. Open the table **CA_counties** and zoom in/out so that you see the entire state of California.

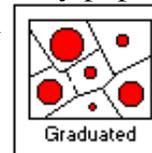
6. Open the table in a browser (**Window > New Browser Window**) so you can see what kinds of data are included in the table. These data items are derived from the 1990 [US Census of Population and Housing](#).

7. Close the browser and click on **Map > Create Thematic Map....** As mentioned above, creating a thematic map is a three step process. The first dialog box looks like this:

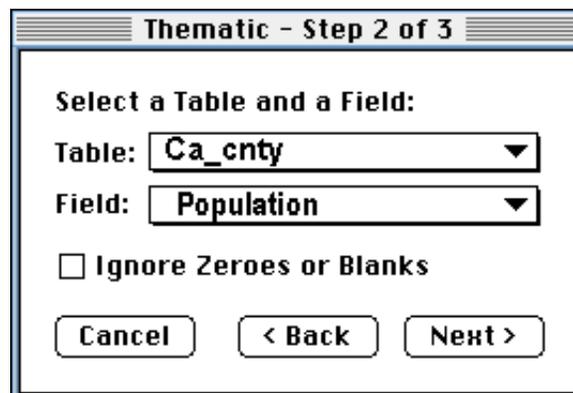


8. As you read in Monmonier, different thematic styles are used for different kinds of data. Ranges, graduated, dots, and individual are used to show single variables while bars and pies are used to show multiple variables. Ranges and dot density are used when we want to show density distributions (as in what proportion of land area is "green space"), graduated is used when we want to represent absolute numbers (homicides per district, for example), and individual coloring is used when we have either a small number of discrete values or a nominal variables (states with Democrat senators, Republican senators, or one of each).

9. We will begin by making a map comparing California counties by population. Let's use the graduated symbol (aka "blob map") thematic style. Click on

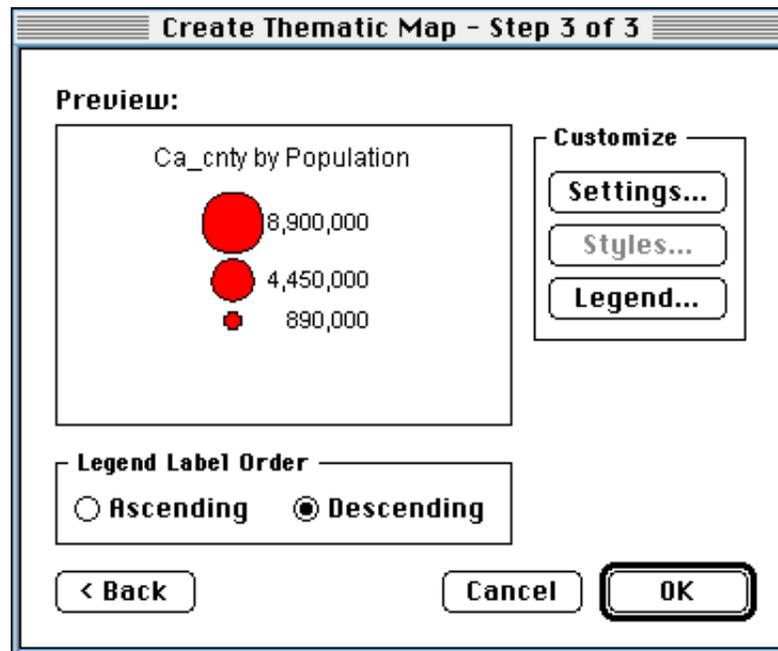


10. Next we tell Mapinfo what table we will make the thematic layer on AND what data field we will base it on. The next dialog box features pull down lists that permit us to choose from any open layers and then from all the fields in the selected layer. Select the county layer and the population field. Click on **Next**.

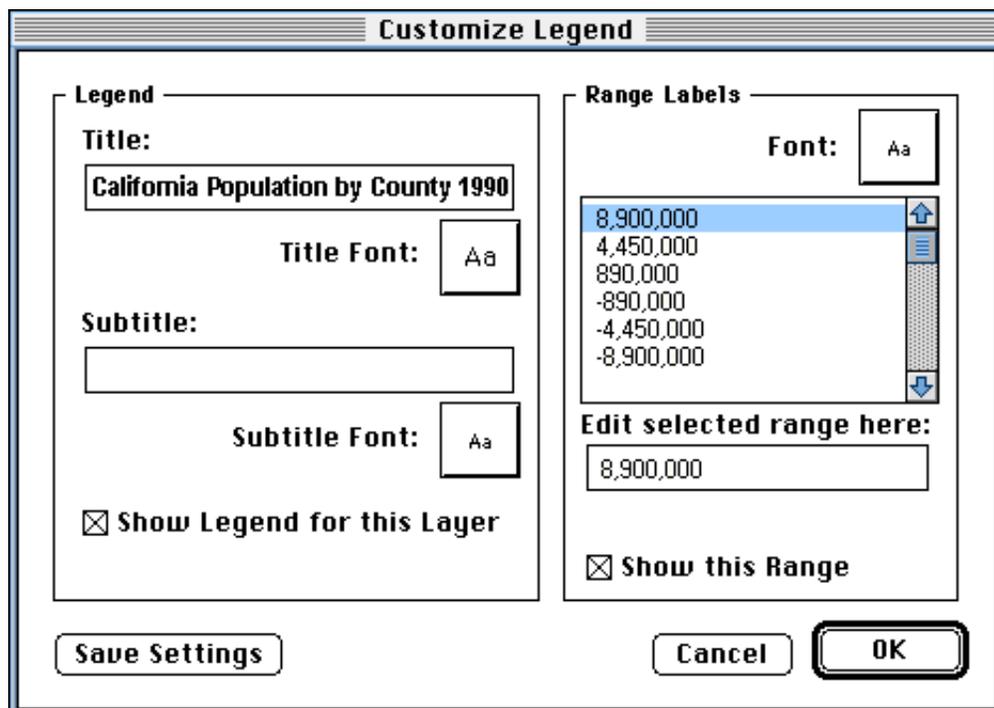


11. Finally, we need to tell Mapinfo some statistical and cosmetic details. This includes specifying what size symbols should correspond to what data values, what colors to use, and what the map LEGEND should look like. Click on both the **Settings...** and the **Legend...** buttons just to see what lies behind them, but don't worry about changing anything right now. When you've had a look, come

back to this dialog box and click on **OK**.



12. Mapinfo will draw the California map with circles in each county. The diameter of the circles will be proportional to the 1990 population of the county. Notice how Mapinfo put together a default legend in a separate **legend window**. There are several ways to access the Customize Legend dialog box. The easiest is simply to double click on the legend in the legend window to bring up the step three thematic map dialog (aka "Customize Thematic Map"). Try it. Then click on **Legend....**



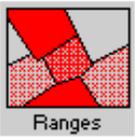
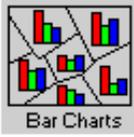
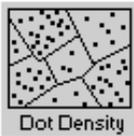
13. In the Customize Legend dialog you can change the wording of the legend, change the fonts, and indicate what information should or should not appear there. Try to make the legend look like this:



14. When you are satisfied with your legend, open a new layout window. When the dialog comes up choose **One frame for window:** and Mapinfo will open a frame for your map window AND a frame for your legend.
15. Arrange these frames on the sheet, remove neatlines if you wish (select the frame and click on Options > Region Style and then set border to None to remove), add a Map Title and your name, and print.

Expanding Our Repertoire

As mentioned above, Mapinfo offers six kinds of thematic maps. To complete this exercise, we'll learn how to do "ranges" and "pie charts."

<p>Ranges. Displays your data according to ranges you set. The ranges are shaded with colors or patterns. These can be shaded lines, points or regions.</p>	 <p>Ranges</p>	<p>Bar Charts. Displays a bar chart of your thematic variables for each record in your table. Use bar charts to analyze multiple variables per record on the map.</p>	 <p>Bar Charts</p>	<p>Pie Charts. Displays a pie chart of your thematic variables for each record in your table. Pie charts are multi-variable: use pie charts on the map to analyze more than one variable at a time.</p>	 <p>Pie Charts</p>
<p>Graduated. Displays a symbol for each record in your table, the size of which is directly proportional to your data values. It is useful for illustrating quantitative information, such as high-to-low rankings.</p>	 <p>Graduated</p>	<p>Dot Density. Displays the data values as dots on your map, where each dot is represents a number, and the total number of dots in a region is proportional to the data value for that region. A dot density map allows you to examine raw counts of data (e.g. population).</p>	 <p>Dot Density</p>	<p>Individual. Shades records according to individual data values. Useful when you want to emphasize categorical differences in the data rather than show quantitative information (e.g. types of stores, zoning classifications, etc.).</p>	 <p>Individual</p>

Range Themes

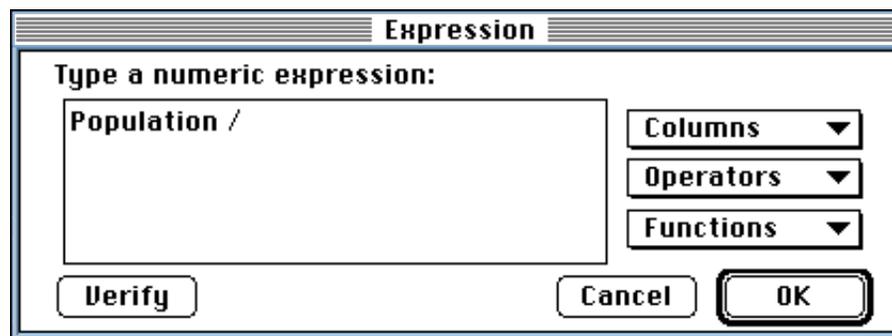
For this example we will create a thematic map showing population density (persons per square mile) by county.

1. **Maps > Create Thematic Map...**
2. Select **Ranges**.

3. Select the counties table and for field to base theme on select **Expression...** which is at the very bottom of the list. The "expression builder window" will come up. We want to shade counties by population density where

$$\text{density} = \frac{\text{population}}{\text{area of county}}$$

4. Use the expression builder to create this expression from the columns "POP90" and "AREA_SqMi" and the division operator "/" and then click OK to return to the thematic dialog step 2. What you have done is essentially create a new column (aka field aka variable) which is a mathematical formula based on two other columns. This new data won't be stored in the table on disk, but is available for our use during this session.

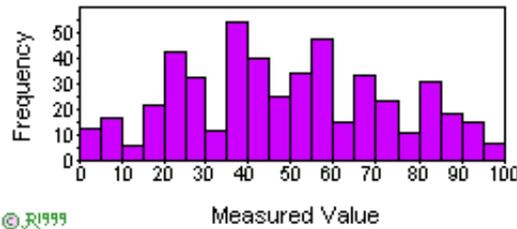


5. The Step 3 dialog is different for ranges than for graduated symbols. This time we can specify what the ranges should be, what styles (again, our visual variables) should be used to represent each range, and what the legend should say. First time through, just click on the **ranges** button and the **styles** button to see what's there and then say OK. Click on OK in the Step 3 dialog when you get back to it and have a look at the resulting thematic map.
6. Now let's play around with customizing this map. First, we'll look at ranges. Double click on the legend window or use **Map > Modify Thematic Map...** to bring up the Customize Thematic dialog (same as the Step 3 dialog above) and click on **Ranges**.

Excursus on Ranges

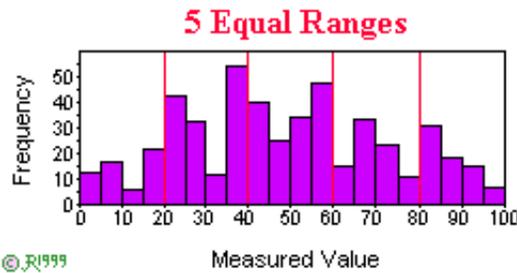
The **Ranges...** options correspond to what are sometimes called "cutpoints" between range categories. We can set the number of cutpoints and the method for determining what they should be. Any set of data values (such as county populations) has a "distribution" -- that is, different numbers of cases exhibit each possible value. Some are large, some small, some inbetween.

Imagine we have about 500 objects (say neighborhoods) and for each one we've measured the fraction of households living below poverty level. This measurement can vary from 0% to 100%. We start out by making a frequency histogram of our data as shown at right.

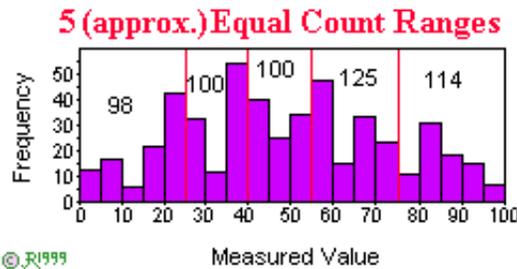


We can insert the cutpoints in a number of ways. Here we'll just look at "equal ranges," "equal numbers," and "natural break."

Equal ranges means taking the total range of the data (highest value minus lowest value) and dividing it up into a particular number of equal sized ranges.

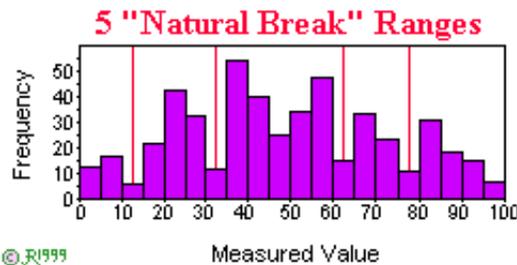


Equal count means taking the data and separating it into groups of equal size. Thus, for five ranges, we would divide a set of 500 objects into groups of about 100 each. Sometimes the groupings aren't perfectly even because we "have to draw the line somewhere" and can't put objects with equal values into different ranges.



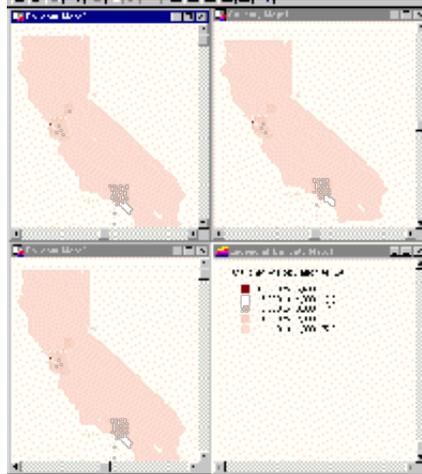
1.

A mode in a data set is a value that occurs more frequently than its neighbors. A dataset is said to be unimodal if it has one peak, bimodal if it has two, trimodal if three, and so on. Mapinfo's "natural break" range method can be thought of as splitting the dataset at its valleys. Of course, to use this most effectively (that is, to know how many peaks and valleys your data has and so decide on how many ranges) you would need to look at its distribution. We'll learn how to do that later.

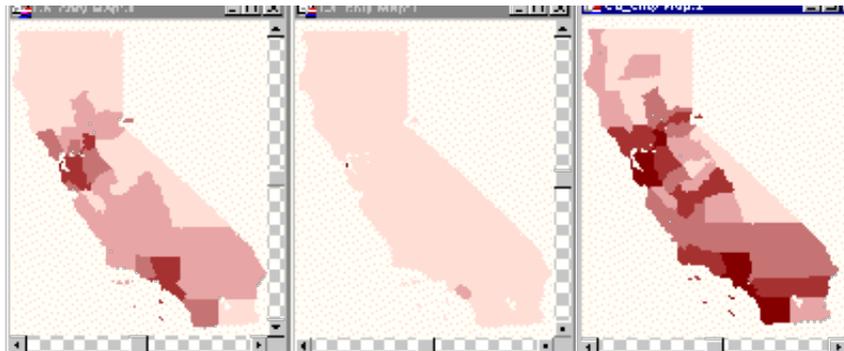


Back to Our Thematic Map Using Ranges

1. To compare the effects of different range methods, let's "clone" our map window so we can see the thematic maps side by side. After you've made the "default" range map, click on **Map > Clone View** twice and tile your windows. You will probably be looking at something like this



2. Select the second map and click on **Maps > Modify Thematic Map...** Click on Ranges and set it to **Equal Count** instead of **Equal Ranges** and click on the **Recalc** button. Click OK to return to the modify thematic dialog. From here, you might want to modify the legend so it says what the range method is (that is, when we later print out we'll remember how we did it -- like what we did with projection names) and then click OK to see the results. Go to the third map and repeat but for Natural Break. The result should be something like this:



Pie and Bar Charts

1. Close all your map windows (not your tables!!!). Open the table **CA_counties**. Open a new browser and have a look at the data fields included for each county. Field names are explained below.

Fieldname	Description
County	County Name (County table)
POP90	(1990) TOTAL POPULATION
FAM90	(1990) FAMILIES
HH90	(1990) HOUSEHOLDS
MALEPOP90	(1990) TOTAL MALE POPULATION
FEMPOP90	(1990) TOTAL FEMALE POPULATION
WHTPOP90	(1990) WHITE POPULATION

BLKPOP90	(1990) BLACK POPULATION
INDPOP90	(1990) AMERICAN INDIAN/ESKIMO/ALEUT POPULATION
ASNPOP90	(1990) ASIAN/PACIFIC ISLANDER POPULATION
OTHPOP90	(1990) OTHER POPULATION
GroupQ90	(1990) GROUP QUARTERS POPULATION
Dorms90	(1990) COLLEGE DORMITORIES POPULATION
MilitaryQ90	(1990) MILITARY QUARTERS POPULATION
Institutional90	(1990) INSTITUTIONAL POPULATION
SheltersEtc90	(1990) SHELTER/STREET/NONINST POPULATION

2. Pie and bar charts are used to display more than one value at a time. Usually these are several categories of a given variable, as for example, male and female or the categories of the so-called "five value race variable."
3. **Decide** which group of values you want to portray. Note that if you do the "type of living situation" group (the last group in the table) you'll have to construct a "everyone else" value with the expression $POP90 - (GroupQ90 + Dorms90 + MilitaryQ90 + Institutional90 + SheltersEtc90)$.
4. **Map > Create Thematic Map...**
5. Select bar or pie, as you like. Click **Next...**
6. The table we will create the thematic layer on is CA_counties.
7. For bar and pie charts we need to specify a number of fields. Select all the fields in the group of values you want to show on the map. Click **Next...**
8. Note that you can specify styles and other specifics for how your bars and pies should look. For now, though, just click **OK**.
9. After you've had a look at the results, double click on the legend window or select Map > Modify Thematic Map to bring up the Modify Thematic Map dialog. From here, play with bar or pie size, styles, etc. and specify a meaningful legend. Put your name in the subtitle section of the legend.
10. Create a layout for map and legend and print.

