SPSS Maps™ 10.0

SPSS

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Marketing Department
SPSS Inc.
233 South Wacker Drive, 11th Floor
Chicago, IL 60606-6307
Tel: (312) 651-3000
Fax: (312) 651-3668

Preface

If your data have a geographical component, SPSS Maps™ 10.0 can display it in the most natural and effective way—in a map. You can create range, graduated symbol, and dot density maps to show where problems or opportunities are concentrated. You can place bar or pie charts to compare variables or show a breakdown, such as how agricultural, manufacturing, and service components contribute to the economics of each area. And you can combine these themes into maps that pack a wealth of information into one easily interpreted page. After you have created your map, you can modify it to emphasize the most important information and customize it for presentation.

SPSS Maps uses map-drawing software from industry-leading MapInfo that ensures quality of presentation and availability of map data (geosets) for almost any area of the world. The software comes with a number of these geosets, and you can obtain additional geosets directly from SPSS or from other suppliers who have adopted the MapInfo format. These geosets are flexibly configured as sets of layers that allow you to show and hide features as you zoom in and out of the map. You can combine these layers into different sets for special purposes, and you can create custom layers that show, for example, the location of every hotel in a particular chain.

Because SPSS Maps is an option to the SPSS Base software, you have available all of the data analysis and manipulation power of the SPSS system to prepare your data for display. As long as the data contain some information to identify location—a country, state, or postal code—you can map it. And you can quickly create ratios between variables or more complex calculations—perhaps the outliers from a statistical analysis—to obtain exactly the right information to display. See the *SPSS Base User's Guide* for information on these capabilities.

This manual contains instructions for creating maps and editing them. It also contains a complete reference to the command language used to create maps both in online sessions and in production jobs. The software includes a tutorial that provides a quick introduction to the way SPSS Maps works with your data and geoset information to produce a map. It also offers an extensive Help system that makes most of the information in this manual available online.

Installation

To install SPSS Maps, follow the instructions for adding and removing features in the installation instructions supplied with the SPSS Base. (To start, double-click on the SPSS Setup icon.)

Compatibility

The SPSS system is designed to operate on many computer systems. See the materials that came with your system for specific information on minimum and recommended requirements.

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Your comments are important. Please send us a letter and let us know about your experiences with SPSS products. We especially like to hear about new and interesting applications using the SPSS system. Write to SPSS Inc. Marketing Department, Attn: Director of Product Planning, 233 South Wacker Drive, 11th Floor, Chicago, IL 60606-6307.

About This Manual

This manual is divided into two sections. The first section documents the graphical user interface. Illustrations of dialog boxes are taken from SPSS for Windows. Dialog boxes in other operating systems are similar. The second part of the manual is a Syntax Reference section that contains a complete reference to the command language used to create maps both in online sessions and in production jobs. The Maps command syntax is also available online with the CD-ROM version of SPSS. This manual also contains two indexes: a subject index and a syntax index.

Contacting SPSS

If you would like to be on our mailing list, contact one of our offices, listed on page vii, or visit our WWW site at *http://www.spss.com*. We will send you a copy of our newsletter and let you know about SPSS Inc. activities in your area.

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1

Introduction to Thematic Mapping

Thematic maps show you how data are distributed over a geographical area. They illustrate relationships and patterns in your data and help you make projections for your business. SPSS Maps turns your geographically distributed data into high-quality maps with symbols, colors, bar charts, pie charts, and combinations of themes.

This chapter provides an introduction to thematic mapping. It includes important mapping concepts and terminology that will help you to create meaningful maps in SPSS. Specific issues, such as geosets and data binding, will be covered in Chapter 2. The step-by-step process of creating thematic maps begins in Chapter 3. Each type of map is discussed in subsequent chapters. Modification of existing maps is described in Chapter 11.

What Is Thematic Mapping?

Thematic mapping is the display of data on a map. Maps can be color-coded, shaded, or used to display symbols and/or charts. For example, you can use thematic mapping to illustrate the relationship between United States region and incidence of strokes. Such a map would show you that the stroke rate in the southeastern U.S. is nearly twice as high as in other areas.

Figure 1-1
Thematic map showing stroke fatality rate in the stroke belt
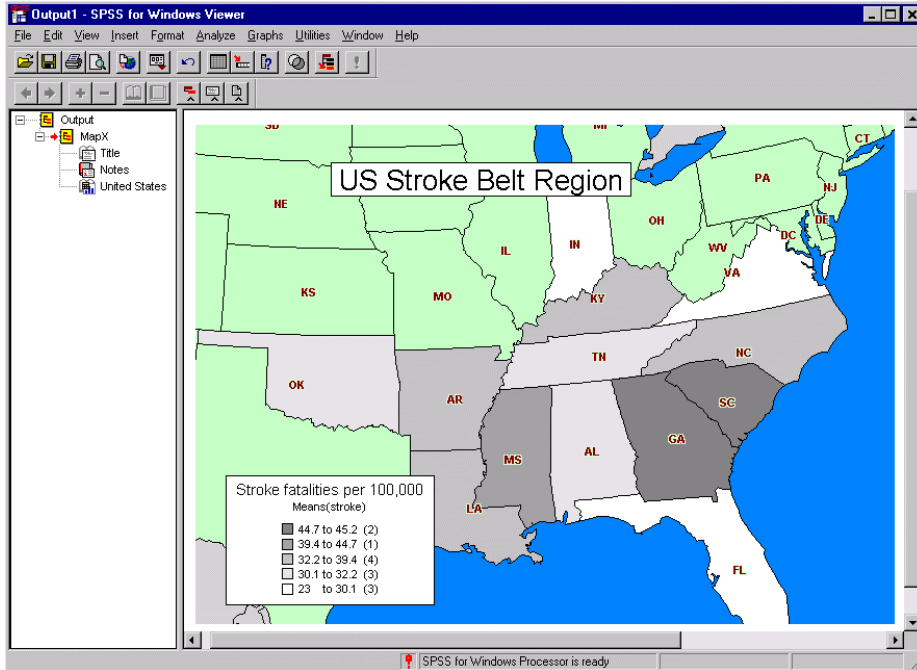
Before you start making thematic maps, there are several concepts you should understand.

Geosets and Layers

Computer maps are made up of **layers**. Each layer, like an overhead transparency, is stacked upon the other to create a detailed map. A typical map, for example, contains different layers for country, ocean, highways, and major cities. These layers overlap to create a map with varying degrees of detail.

Each layer contains a different set of geographical information and is therefore a separate file. These layer files are bundled together according to geographic area in a set of files called a **geoset**.

Figure 1-2
Geoset layers displayed in the Geoset Manager
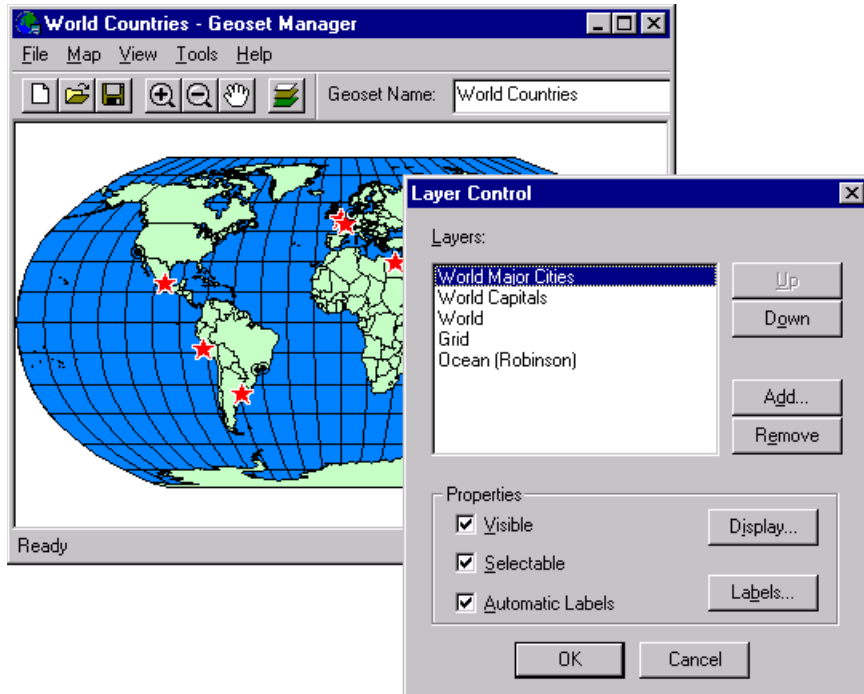
A typical geoset contains separate data files for states, capitals, rivers, and highways that are layered to create a detailed map. Layers in a geoset can be reordered, added, or deleted using the Geoset Manager. You can also create new geosets from geographic data in MapInfo format.

For more information about geosets and layers, see Chapter 2.

Data Binding

In order to make thematic maps, your data need to have a geographic component. A typical data file used for mapping might contain data for states, countries, or zip code. When you create a thematic map, data are aggregated for each geographic region and matched to a location on the map.

The process of matching data to a map is known as **data binding**. For example, data binding occurs when the name "Washington, D.C." is matched with a geoset that knows to position the U.S. capital near Maryland and Virginia.

Geographic Variables

The most common way to conduct data binding is to use geographic variables, such as *state* and *county*, from your data file. A geographic variable should have values that match a similar set of values in a geoset layer (*.tab* file). For example, you could map property tax rates based on a geographic variable, such as *US county*. The values of the county variable in your data (for example, Door County, WI) would match the values of the county layer in the geoset. If there is a mismatch between values, data will not be displayed for that region.

Figure 1-3

Geographic variable in the creation dialog box
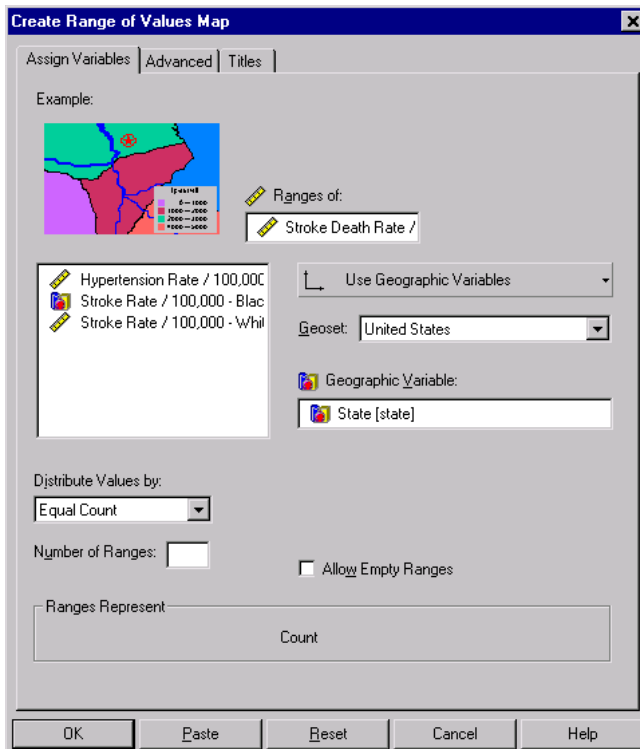
In some cases, the data file may not contain a geographic variable. Instead, you may have *x* and *y* variables that contain latitude and longitude coordinates for points on the map. This type of data binding is called **X/Y binding**. X/Y binding is frequently used to create custom maps showing sales by store location or inventory type by distribution center.

In other cases, your data may contain a geographic variable, such as *zip code*, that is not part of a geoset. In order to link this variable to points on a map, you need to use a table file called a **point reference file**. This table contains both the values of the geographic variable and *x/y* coordinates for each data value. Using these *x/y* coordinates, the location of each zip code can be projected on the map.

For more information about these three types of data binding, see Chapter 3.

Available Summary Functions in Maps

The following statistics are supported in the SPSS Maps option. Only summary functions appropriate for each chart type are available.

First Values. The value found in the first case for each category in the data file at the time the summary function was assigned.

Last Values. The value found in the last case for each category in the data file that created it.

Maximum Values. The largest value for each category.

Means. The arithmetic average for each category.

Medians. The value below which half of the cases fall in each category. If there is an even number of cases, the median is the average of the two middle cases when they are sorted in ascending or descending order.

Minimum Values. The smallest value within the category.

Modes. The most frequently occurring value within each category. If multiple modes exist, the smallest value is used.

Number of Cases Above (N of Cases >). The number of cases having values above the specified value.

Number of Cases Between (N Between). The number of cases between two specified values.

Number of Cases Equal to (N of Cases =). The number of cases equal to the specified value.

Number of Cases Greater Than or Equal to (N of Cases >=). The number of cases having values above or equal to the specified value.

Number of Cases Less Than (N of Cases <). The number of cases below the specified value.

Number of Cases Less Than or Equal to (N of Cases <=). The number of cases below or equal to the specified value.

Standard Deviations (SD). A measure of dispersion around the mean, expressed in the same unit of measurement as the observations, equal to the square root of the variance. In a normal distribution, 68% of cases fall within one standard deviation of the mean and 95% of cases fall within two standard deviations.

Sums. The sums of the values within each category.

Variances. A measure of how much observations vary from the mean, expressed in squared units.

Working with Geosets

Geosets contain the information needed to draw a map. The SPSS Maps option comes with a variety of basic geosets. Each geoset comprises a group of table files (*.tab*) from the same geographic region. The World geoset, for example, contains different tables for oceans, countries, and major world cities. Each of these tables has display properties that you can specify and save in the geoset file (*.gst*). The *.gst* file itself does not contain map data; it is simply a workspace, or view, of map tables and their properties.

You can create new geosets and open or edit existing ones using the Geoset Manager. Layers in a geoset can be registered and modified in the Geodictionary Manager. The Maps option uses geosets in MapInfo format. To purchase new geosets, you should contact SPSS at *www.spss.com*.

This chapter discusses how to work with geosets using both the Geoset Manager and the Geodictionary Manager.

Geoset Tables and Layers

In a map, geoset tables are displayed as layers. These layers are like a stack of transparencies. In a map of the world, for example, the *.tab* file for world capitals becomes a layer with symbols at the location of each country's capital city. This layer is stacked on the world countries layer and the oceans layer to become a detailed map. The visibility and options for each layer can be modified in the Geoset Manager.

Figure 2-1
Maps as a collection of layers
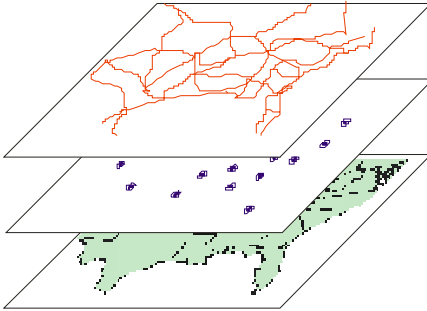
Behind the scenes, each geoset layer is made up of several file types. Every layer has a *.tab* file that contains crucial geographic data. Other file types found in a layer are *.ind*, *.dat*, *.map*, and *.id*.

Using the Geoset Manager

The Geoset Manager is a utility that ships with the SPSS Maps option. You can access it from the SPSS for Windows software group on your Start menu.

Figure 2-2
Selecting the Geoset Manager
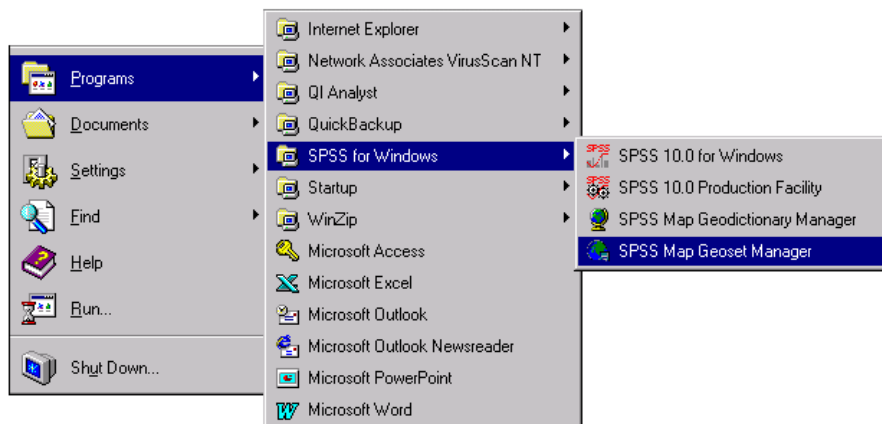
Use the Geoset Manager to create new geosets and organize map layers in existing geosets. The Geoset Manager acts as a library for your geosets, where you can customize, reorder, add, or delete layers. Any changes that you make to your geoset, or workspace, are stored in the *.gst* file.

Creating New Geosets

You can create new geosets through the Geoset Manager. For example, you can create a new geoset that includes airport and casino locations throughout the world. First, you need to import airport and casino data into your SPSS Maps folder. Then, using the Geoset Manager, you can create a new geoset by adding layers such as world countries, oceans, and highways. Next, add layers for world airports and casino locations. After you name and save this new geoset, you are ready to make thematic maps.

Note: Map data must be in MapInfo format to create maps in SPSS. To purchase MapInfo geosets, you should contact SPSS at *www.spss.com*.

Figure 2-3
World.gst as displayed in the Geoset Manager
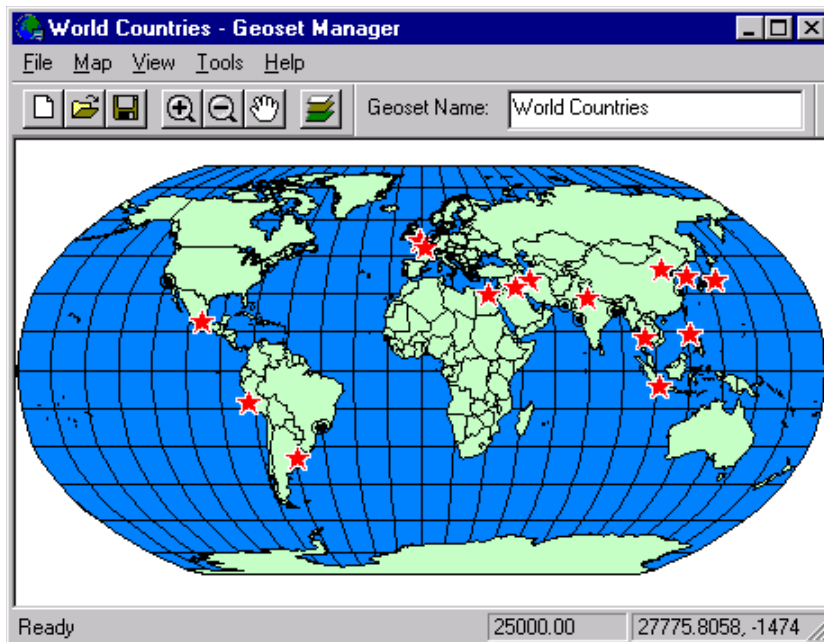
To Create a New Geoset

▶ From the Geoset Manager menus choose:

   File
     New Geoset

▶ Click Add.

▶ Select the desired layers (*.tab* files). Use the Ctrl-click method to select multiple files.

▶ Click Open.

▶ Use the Layer Control dialog box to reorder layers and select properties.

▶ Click OK to display the new geoset.

▶ From the menus choose:

   File
     Save Geoset

Modifying a Geoset

You can modify existing geosets in the Geoset Manager. Using the Layer Control dialog box, you can add, remove, or reorder layers in a geoset. You can also select properties such as color, line style, fonts, and zoom for each layer. These changes will be saved with the geoset and specified in the *.gst* file.

Figure 2-4
Layer Control dialog box
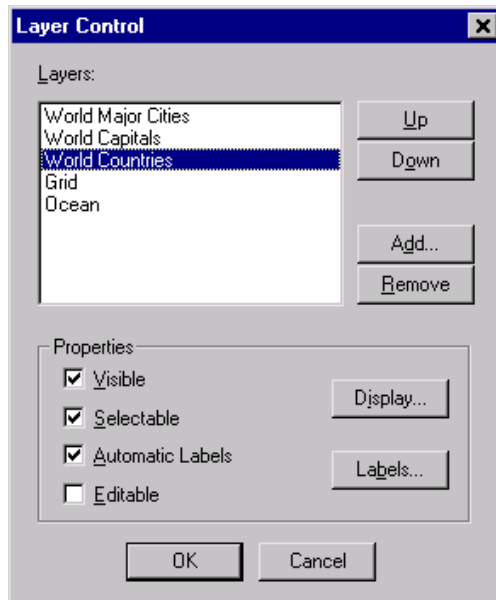
To Add or Remove Layers in a Geoset

▶ Click the Layer Control tool in the Geoset Manager.

To Remove Layers

▶ Select a layer from the list.

▶ Click Remove.

Note: You cannot undo this action.

To Add Layers

▶ Click Add in the Layer Control dialog box.

▶ Select a file and click Open.

To Reorder Layers in a Geoset

▶ Click the Up or Down button to change the order of the layers.

Layers commonly at the top of the list include highways and cities. Oceans and countries work best at the bottom.

To Modify Layer Properties

▶ Select the desired Properties check boxes to make each layer visible, selectable, editable, and labeled.

▶ Click Display or Labels for more options.

You must repeat this process for each layer by selecting one from the list.

Geosets and Data Binding

To make thematic maps in SPSS, you need to create a link between the data file and a particular geoset. This link is called **data binding**. Data binding is the process of matching a geographical variable from your data file to a particular geoset layer. This layer has *x/y* coordinates that point to locations on the map.

For example, if you want to create a bar chart map of deforestation rate by country, your geographic variable would be *country*. Each value of this variable—such as Brazil, France, or United States—must exactly match the values in the geoset for correct data binding. If the geoset refers to USA instead of United States, you will not get a chart for that country.

You can check the values in your geoset files by opening the *.dat* file for each layer. For example, to check the value for United States in the World layer, you would open *world.dat*, located in the SPSS Maps directory. You can either make changes in the *.dat* file or in the SPSS *.sav* file.

Figure 2-5
Comparing values for data binding

Using the Geodictionary Manager

The Geodictionary Manager is a utility that ships with the SPSS Maps option. You can access it from the SPSS for Windows software group on your Start menu.

Figure 2-6
Selecting the Geodictionary Manager
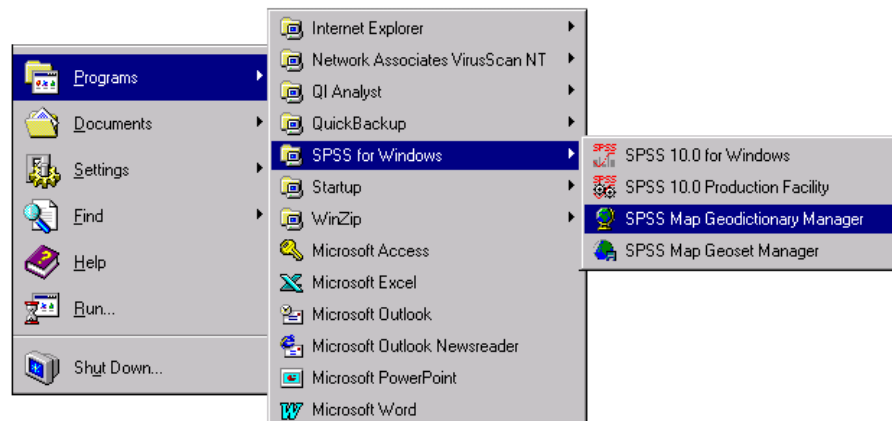
The Geodictionary Manager keeps track of layers for data binding. You can register, unregister, and modify layer properties. Changes you make through the Geodictionary Manager are saved in a text file called the Geodictionary.

For example, if you import a new boundary file showing U.S. national park locations, you will first need to add the National Parks layer to a geoset and then register it in the Geodictionary. This allows SPSS to know that the National Parks layer is available for data binding.

In order to register layers in the Geodictionary, all geosets need to be located in the same directory as the *geodict.dct* file. You can change the location of the geodictionary and reference multiple geodictionaries by clicking the ... button at the top right of the dialog box.

Registering Geoset Layers

There are two ways to register layers. You can open a geoset in the Geoset Manager and register the current layers, or you can use the Geodictionary Manager. The Geodictionary recognizes all layers (*.tab* files) in the SPSS Maps directory. If you register a layer that is not located in the same directory, it will store a copy locally.

Note: Geosets that shipped with the SPSS Maps option have already been registered.

Figure 2-7
Registered geoset layers used to create maps
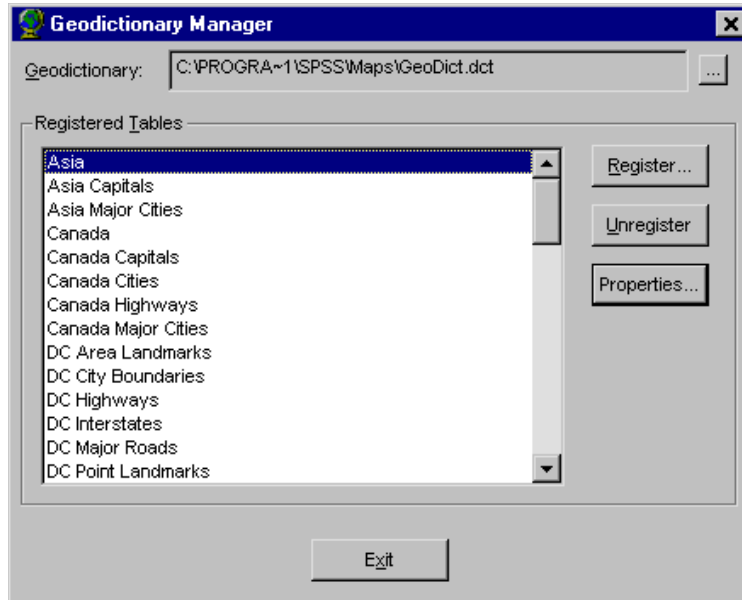
To Register Layers from the Geodictionary Manager

▶ Click Register.

▶ Select a MapInfo table from the list and click Open.

▶ In the Table Properties dialog box, type a name in the Description text box.

Optionally, you can:

▶ Select the Search check box for each layer field to be searched during data binding.

▶ Click the Add button to select geosets that will be loaded when the layer is matched.

To Register Layers from the Geoset Manager

▶ From the Geoset Manager menus choose:

   Tools
     Register Layers in GeoDictionary...

▶ Select the layers you would like to register.

Creating Thematic Maps

Thematic mapping is the display of data on a map. Maps can be color coded, shaded, or used to display symbols and/or charts. These visual displays are called **map themes**. For example, you could create a map theme illustrating the relationship between stroke incidence and race for different geographic regions. Such a map might reveal that African-Americans have a higher number of strokes in the southeastern United States than Caucasians.

You can create seven types of thematic maps:

- Range of values
- Dot density
- Graduated symbol
- Individual values
- Bar charts
- Pie charts
- Multiple theme maps combining any of the above themes

Depending on your data, certain types of maps will display statistics more appropriately. For example, if your aggregated data have negative values, you should use a range of values, individual values, or bar chart map.

Figure 3-1
Thematic maps

Urban population by country
Sums(urbanpop)

300,000,000
150,000,000
30,000,000
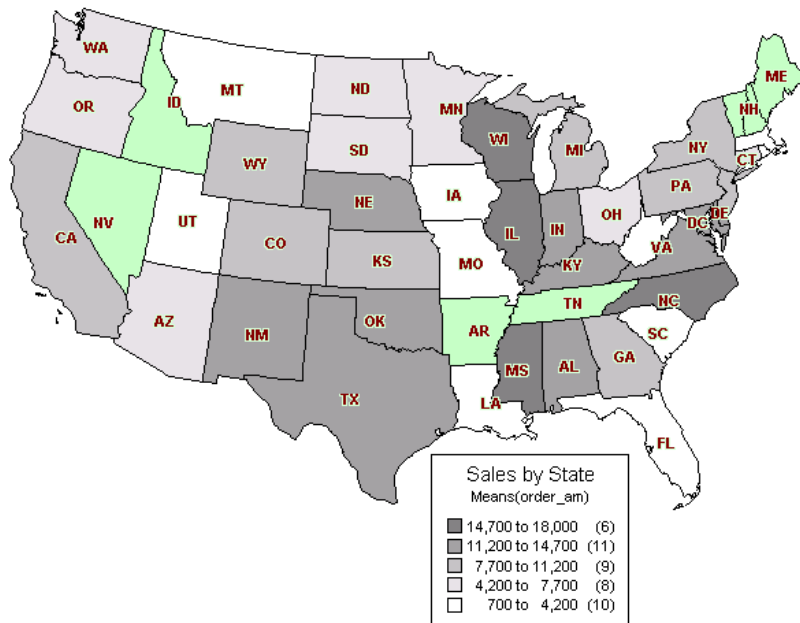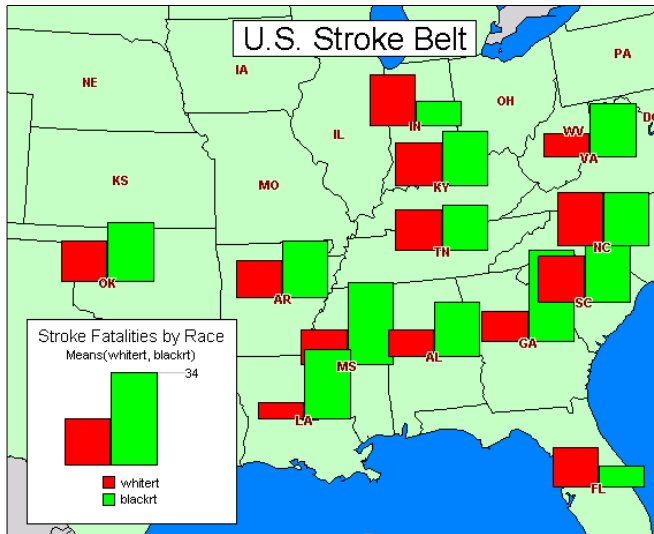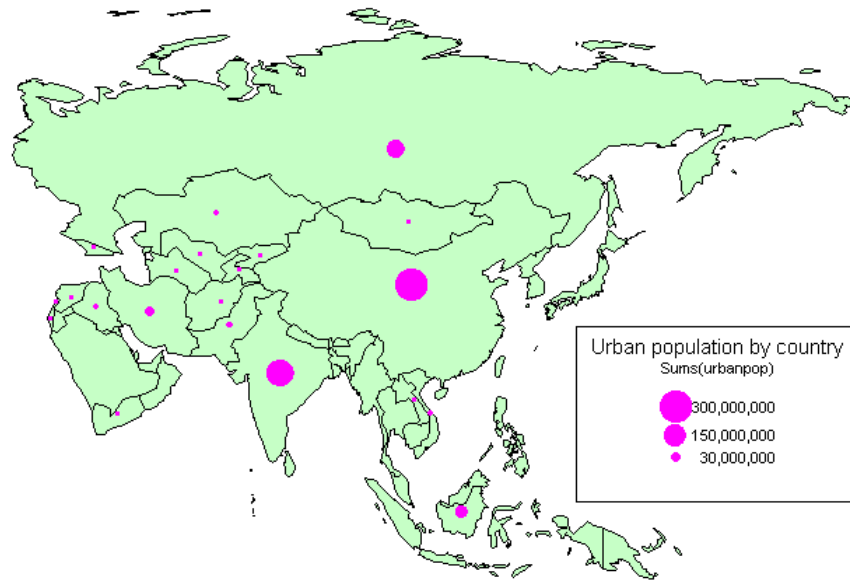
Selecting Geosets and Data Binding Options

To create thematic maps, you need to link the SPSS data file to map boundary files. This process is called **data binding**. Data binding occurs when a geographic variable, such as *state* or *country*, is linked to the appropriate layer in a geoset file. This allows SPSS to display shading, symbols, or charts based on data aggregated for each region.

There are three data binding methods:

- Geographic variables
- X/Y binding
- Point reference tables

For general information about data binding, see Chapter 2.

Figure 3-2
Creation dialog box showing geoset and data binding options
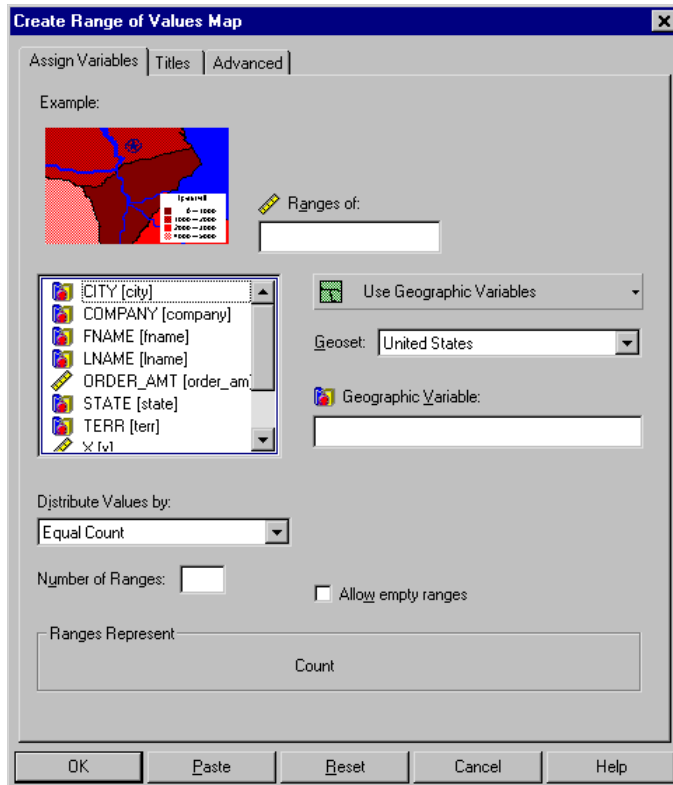
Geographic Variable. Matches a geographic variable, such as *country* or *region*, to a layer in the map geoset. If no layer matches this variable, you will get a blank map. To select a layer other than the default, click the Advanced tab.

X/Y Binding. Links your data to points on a map using longitude and latitude variables, typically called *x* and *y*. This type of binding could be used to show government incentive amounts at specific building sites around the country.

Point Reference Table. Refers to a file containing *x/y* coordinates for a lookup variable, such as *cities* or *zip code*. You can specify any table file in the SPSS Maps directory.

Geoset. The geoset determines the map that will be displayed and the information that will be used for data binding. All geosets in the SPSS Maps directory are listed here.

To Select a Geoset

▶ From the menus choose:

Graphs
 Map

▶ Choose a map type.

▶ Select a geoset from the Geoset drop-down list that matches the geographic variable. For example, if your geographic variable is *customer location by US county*, you would choose the United States geoset.

▶ Click the Advanced tab to select options, such as geoset layer, a variable to refine the geographic match, and mismatch handling.

To Select Geographic Variables

▶ From the data binding drop-down list, select Use Geographic Variables.

▶ Drag a variable, such as *country*, *state*, or *zip code*, to Geographic Variable.

X/Y Binding

Instead of using geographic variables to bind data to a map, you can use a method called X/Y binding. This type of data binding uses two variables in your data file that represent longitude (*x*) and latitude (*y*). These variables place data at specific points on the map and are frequently used to show the exact location of stores and other facilities. In the output map, the *x/y* points become a separate layer that can be modified in addition to the theme.

Note: Dot density maps do not support X/Y binding. For range of values and individual values maps, a symbol is placed on the *x/y* intersection and shaded accordingly.

In some cases, you may need to adjust the coordinate projection system of the selected geoset to match the projection of the *x* and *y* variables.

■ Projections are methods used to translate the three-dimensional world onto a two-dimensional map.

■ You can pick a projection that matches your *x* and *y* variables using the Geoset Manager.

Example. You could show mean revenue by store location using X/Y binding in a graduated symbols map. Data would be aggregated for a unique key variable, such as *store number*.

Figure 3-3
Map creation using X/Y binding
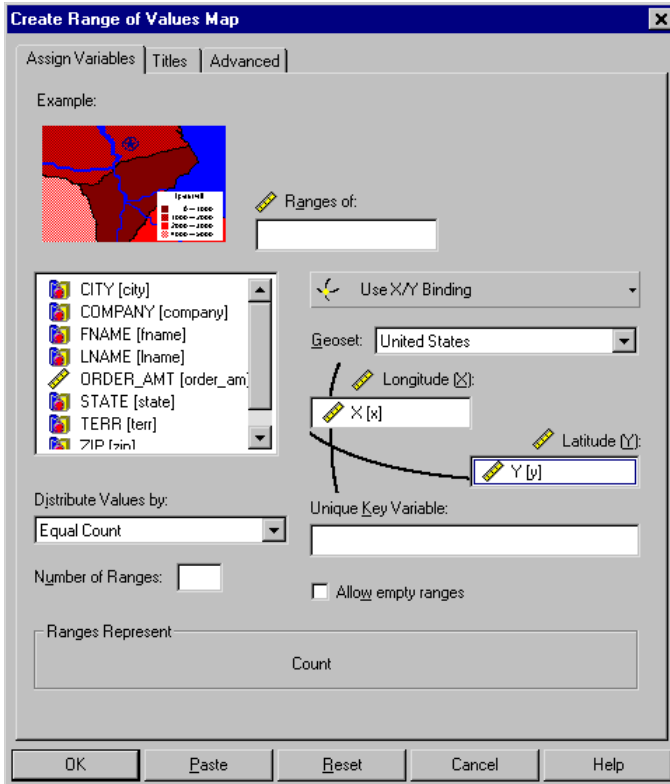
Longitude (X variable). Creates points corresponding to longitude. This variable is commonly named *x*.

Latitude (Y variable). Creates points corresponding to latitude. This variable is commonly named *y*.

Unique Key Variable. Aggregates data for a variable, such as *store number*. Every value in this variable must be unique in the sense that all instances of the same value must refer to the same entity. For example, if there are multiple records for one store number, those records are aggregated into a single record for that store.

To Use X/Y Binding

▶ From the data binding drop-down list, select Use X/Y Binding.

▶ Drag a longitude variable (frequently called *x*) to Longitude.

▶ Drag a latitude variable (frequently called *y*) to Latitude.

▶ Drag a variable to Unique Key Variable. The values of this variable must uniquely identify each record you want in the aggregated data used to draw the map.

▶ Select a geoset from the Geoset drop-down list.

To Set a Coordinate Projection System

When using X/Y binding, you may need to change the coordinate projection system of the selected geoset to match the projection used by the *x* and *y* variables in your data. You can change the projection using the Geoset Manager utility.

▶ From the Windows Start menu choose:

Programs
  SPSS for Windows
    SPSS Maps Geoset Manager

▶ Open the geoset you want to use for X/Y binding.

▶ From the Map menu choose:

Projection…

▶ From the Category drop-down list, select a projection category, such as Universal Transverse Mercator.

▶ From the Category Members drop-down list, select a specific projection type.

▶ Click OK to apply the projection to the current geoset.

▶ Save the geoset before returning to SPSS.

Point Reference Tables

To place charts or symbols at specific points on the map without *x* and *y* variables, you can use a point reference table. A **point reference table** is a file containing values for a lookup variable as well as longitude and latitude (*x/y*) coordinates for each value. Coordinates place each value of the lookup variable at a particular location on the map. These points become a new map layer that can be modified in addition to the theme.

Example. You could show customer sales and location by city using a point reference table in a graduated symbol map. Only cities with data will be displayed on the map.

Figure 3-4

Map creation using a point reference table
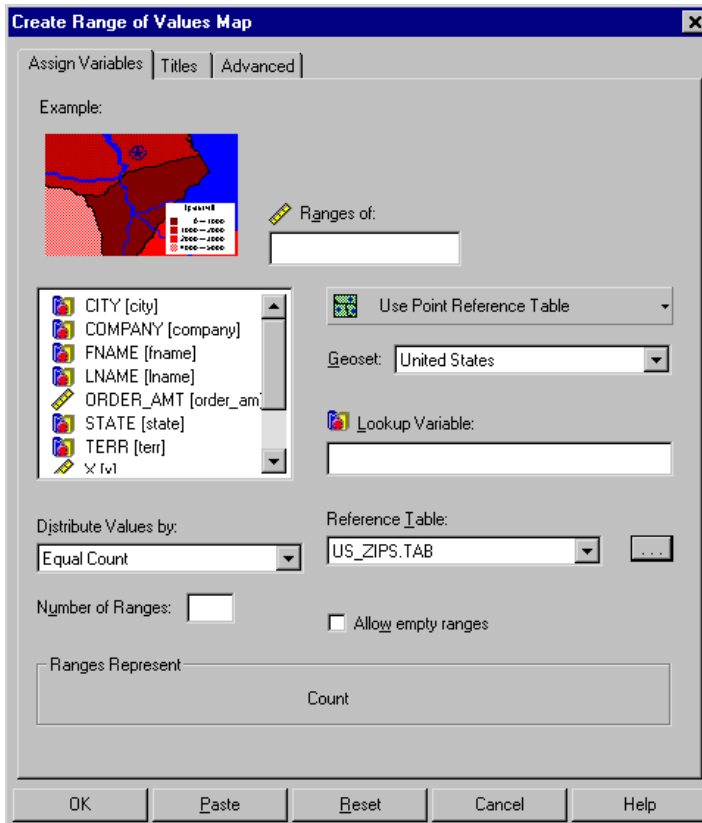
Lookup Variable. A variable whose values specify geographic locations. The point reference table must contain the values of this variable.

Reference Table. Contains *x*/*y* coordinates for values of the lookup variable. All tables in the SPSS Maps directory are listed in the drop-down list. Point reference files frequently have a *.tab* extension; however, you can use any table file containing *x*/*y* coordinates for the lookup variable. Click ... to select tables outside the SPSS Maps directory.

Note: To use a point reference table, you must register it in the geodictionary.

To Use a Point Reference Table

▶ From the data binding drop-down list, select Use Point Reference Table.

▶ Drag a lookup variable to Lookup Variable.

▶ Select a reference table from the drop-down list. Click ... to browse for tables outside the SPSS directory.

All reference tables used in data binding must be registered in the geodictionary. Open the Geodictionary Manager and click Register to add the desired reference table.

Advanced Options in Thematic Maps

Figure 3-5
Advanced options
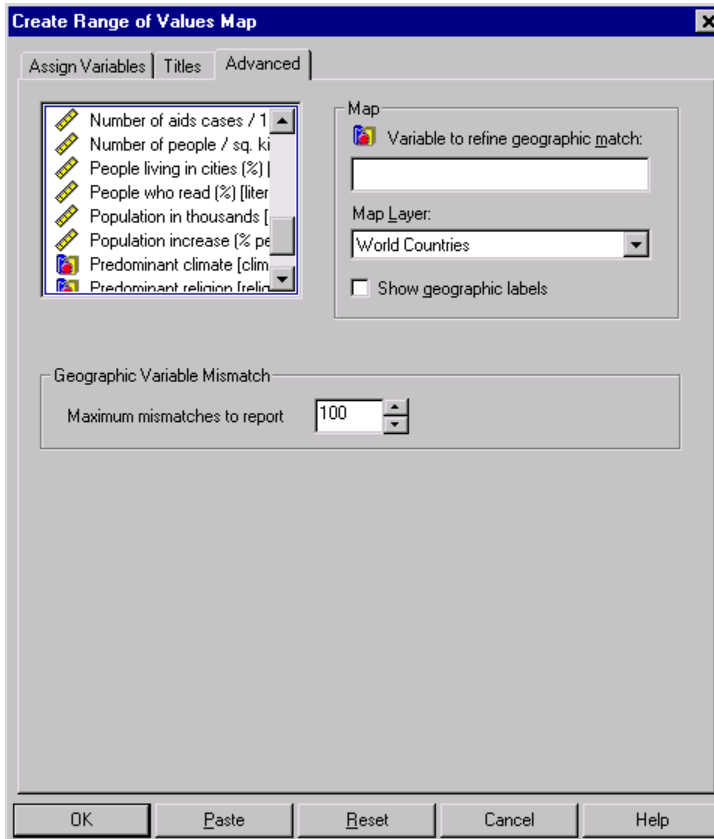
Variable to refine geographic match. In some cases, you need to select a variable to refine the geographic match. For example, if your geographic variable is *US county*, you need a refining variable, such as *state*, to distinguish between identical county names.

Map Layer. All registered layers for the geoset selected on the Assign Variables tab are listed here. Choose a layer that matches your geographic variable. When showing Internet commerce by city, for example, choose the Cities layer in the United States geoset.

Note: For X/Y binding and point reference binding, the layer list is disabled.

You can also choose to show labels for a layer by selecting Show geographic labels.

Geographic Variable Mismatch. Sets options in case of a mismatch between the data file and geoset. For example, if the geographic variable *world countries* uses the country name Great Britain and the layer file uses United Kingdom, a mismatch will occur. All mismatches are reported in a warnings table in the Viewer. You can specify the maximum number of reports in the table.

To Select Advanced Options

▶ Click the Advanced tab.

▶ If needed, select a variable to refine the geographic match to distinguish between identical values in a geographic variable, such as *county*.

▶ Select a geoset layer, such as US Capitals, from the drop-down list.

▶ To avoid excessive warnings, enter a maximum number of mismatches to report.

Title Options in Thematic Maps

Figure 3-6
Titles options
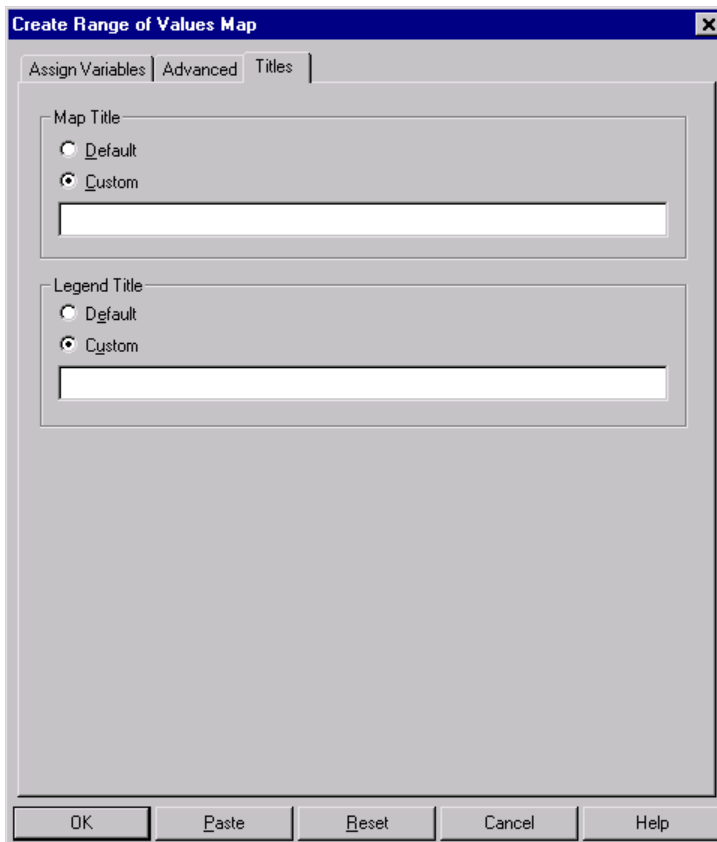
Map Title. Choose Custom to create your own map title. The default title is the name of the geoset used to create the map.

Legend Title. Choose Custom to create your own legend title. The default title is the variable label of the summary variable used to create the map.

To Select Title Options

▶ Click the Titles tab.

▶ For both Map Title and Legend Title, select Custom and enter an appropriate title.

Measurement System Used in Thematic Maps

Units of measurement for maps are specified in the General Options dialog box for SPSS.

Measurement System. Selections made in General Options affect theme and map measurement units as follows:

If you select Points or Inches:

- Theme measurement units (used for pie diameter, bar height, etc.) will be points or inches.
- Measurement units for maps will be miles.

If you select Centimeters:

- Theme measurement units (used for pie diameter, bar height, etc.) will be centimeters.
- Map measurement units will be kilometers.

To Select a Measurement System

▶ From the menus choose:
 Edit
  Options...

▶ Choose a map type.

▶ Click the General tab.

▶ Select the measurement system you want to use.

▶ Click OK or Apply.

Range of Values Maps

Range of values maps divide a range of summary statistic values into categories and indicate the range category (for example, 0–100, 101–200, 201–300, etc.) for each geographic unit. Each range uses a separate color or pattern to show which range each geographic region falls into. Experimenting with numbers of ranges and different methods of forming ranges can help you examine your data more closely.

Example. To determine placement of medical assistance programs, you could create a range of values map showing AIDS rate by country. Countries with the highest AIDS rates appear in the darkest shade.

Figure 4-1
Create Range of Values Map: Assign Variables tab
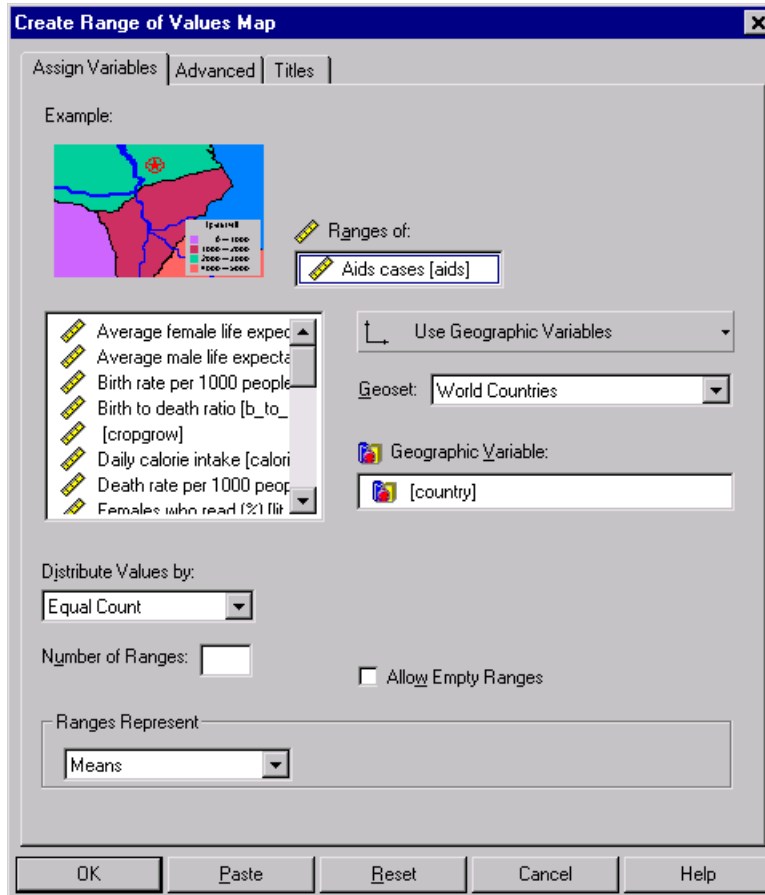
Ranges of. Creates ranges for the values of a scale variable. Data are aggregated according to the summary function you choose from the Ranges Represent drop-down list. Leave the target blank to get the count of cases within each region.

Distribute Values by. You can distribute data values into ranges using one of the following methods:

- **Equal Count.** Each range contains the same number of cases (records).
- **Equal Size.** Creates ranges of equal size (for example 0–10, 11–20, 21–30, etc.).

- ■ **Natural Break.** Uses an algorithm that attempts to find natural breaks in the data and keep clusters of values together.

- ■ **Standard Deviation.** Each range represents approximately one standard deviation. The mean falls approximately at the boundary between the middle two ranges.

Number of Ranges. Specify a number of ranges up to 16.

Allow Empty Ranges. This selection allows empty ranges to be created. For example, if you choose a number of ranges and method of distribution that forces some ranges to be empty, and you do not select Allow Empty Ranges, SPSS Maps will override your specifications.

Sample Output

Figure 4-2
Range of values maps
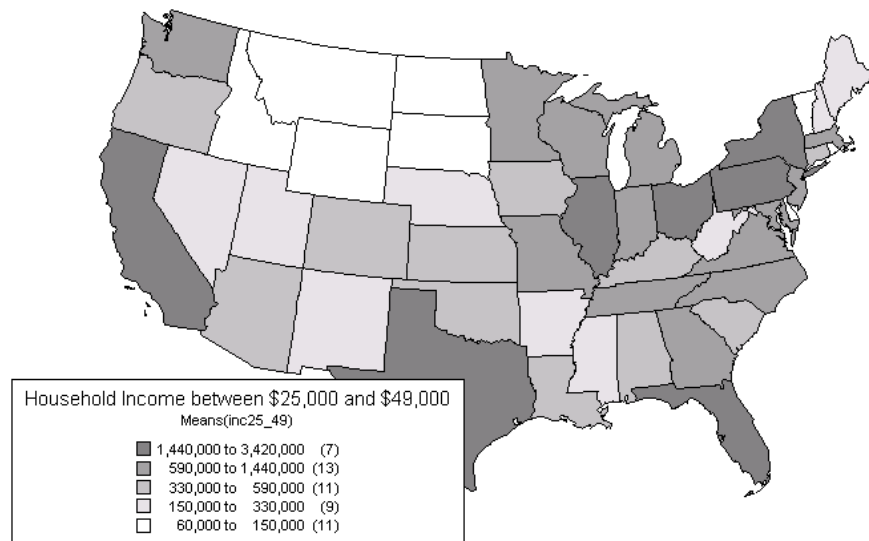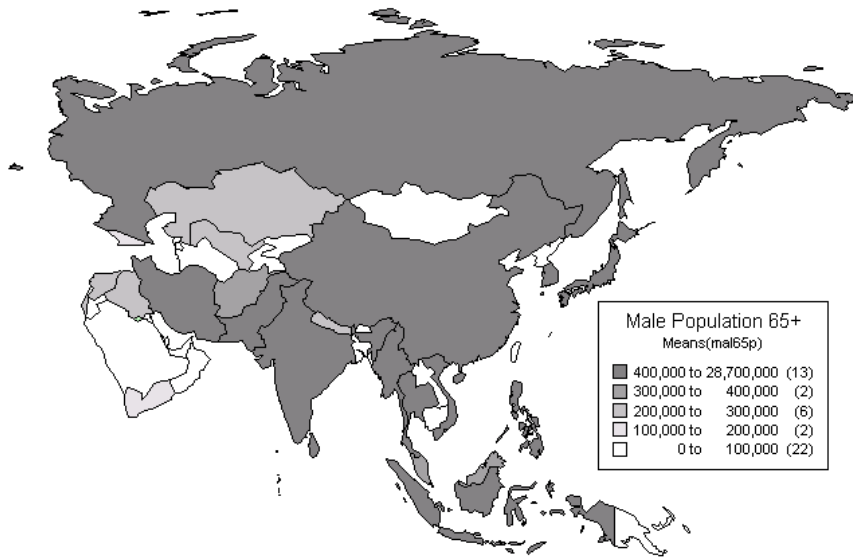
To Create a Range of Values Map

▶ From the menus choose:

Graphs
 Map
   Range of Values…

▶ Drag a scale variable to Ranges of. Or leave this field blank to get the count of cases in each region.

▶ Select a distribution method from Distribute Values by.

▶ Select a summary statistic from the Ranges Represent drop-down list.

▶ Drag a geographic variable to Geographic Variable. Or you can select an alternative data binding method: Use X/Y Binding or Use Point Reference Table.

▶ Select a geoset from the Geoset drop-down list.

▶ Click the Advanced tab to select options, such as geoset layer, mismatch handling, and a variable to refine the geographic match.

Graduated Symbol Maps

Graduated symbol maps use symbols to represent values in a scale variable by geographic region. The size of each symbol is proportional to the value for that region. The total number of hospitals per state, for example, can be illustrated with a medical icon that varies in size. Scale variables work best in graduated symbol maps.

Example. You could create a graduated symbol map displaying the total amount of federal funding spent on veterans' hospitals per region.

Figure 5-1
Create Graduated Symbol Map: Assign Variables tab
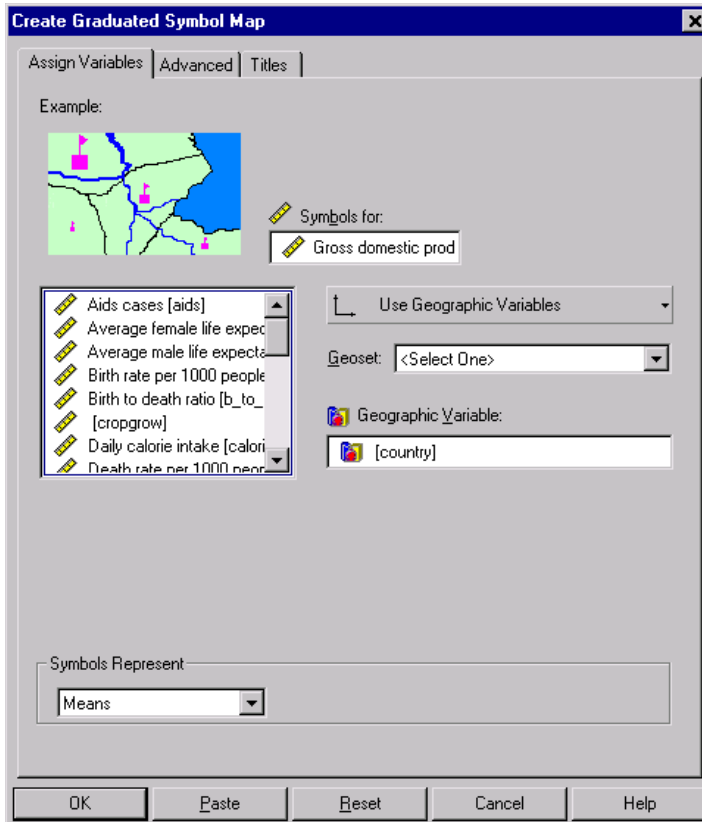
Symbols for. Graduates symbols according to scale variable values aggregated for each geographic region. You can select a summary function from the Symbols Represent drop-down list.

Sample Output

Figure 5-2
Graduated symbol maps
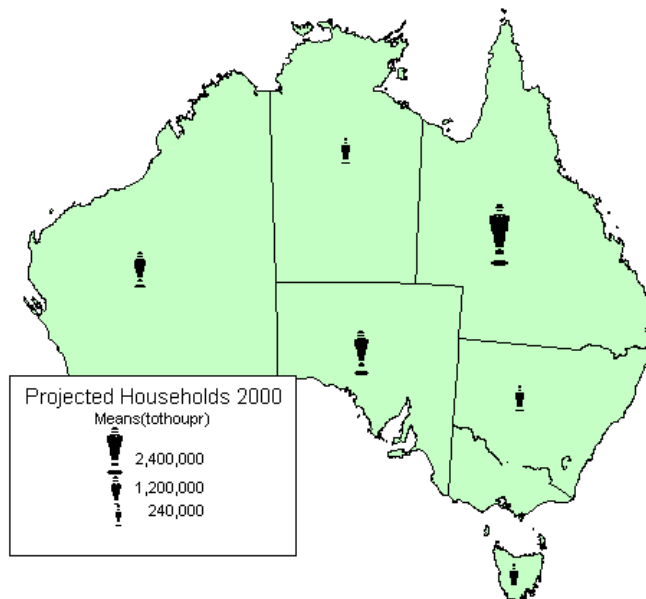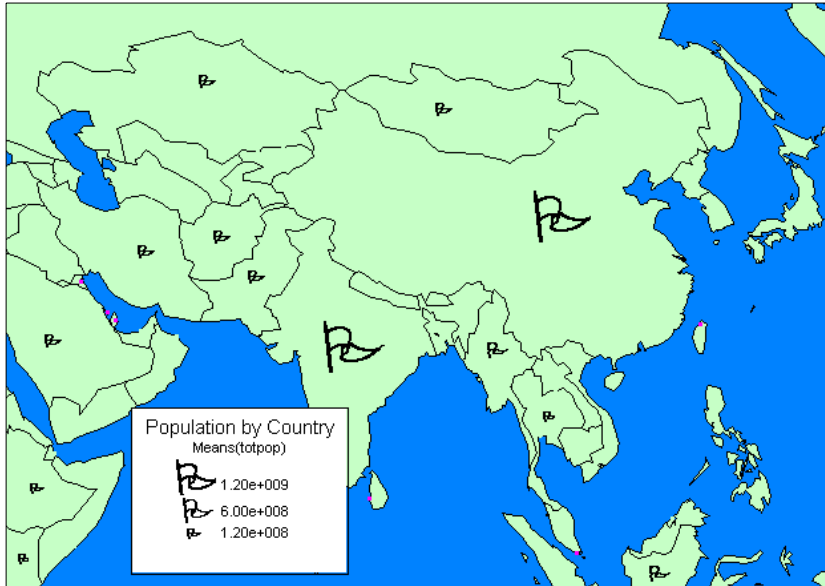
To Create a Graduated Symbol Map

▶ From the menus choose:

Graphs
 Map
  Graduated Symbol…

▶ Drag a scale variable to Symbols for. Or leave this field blank to show counts.

▶ Select a summary statistic from the Symbols Represent drop-down list.

▶ Drag a geographic variable to Geographic Variable. Or you can select an alternative data binding method: Use X/Y Binding or Use Point Reference Table.

▶ Select a geoset from the Geoset drop-down list.

▶ Click the Advanced tab to select options, such as geoset layer, mismatch handling, and a variable to refine the geographic match.

Dot Density Maps

Dot density maps use dots to represent a data value within a geographic region or boundary. The sum of dots in a region is proportional to the data value for that region. For example, if you have 1000 stores in Illinois and each dot represents 10 stores, there would be 100 dots within the state boundary. Notice that dots are distributed randomly within a boundary. In this example, dots would not represent the exact location of potential customers. Instead, dots indicate the total number of customers within each geographic region.

Example. To gage prospective store competition, you could create a dot density map showing the total number of existing retailers by region.

Figure 6-1
Create Dot Density Map: Assign Variables tab
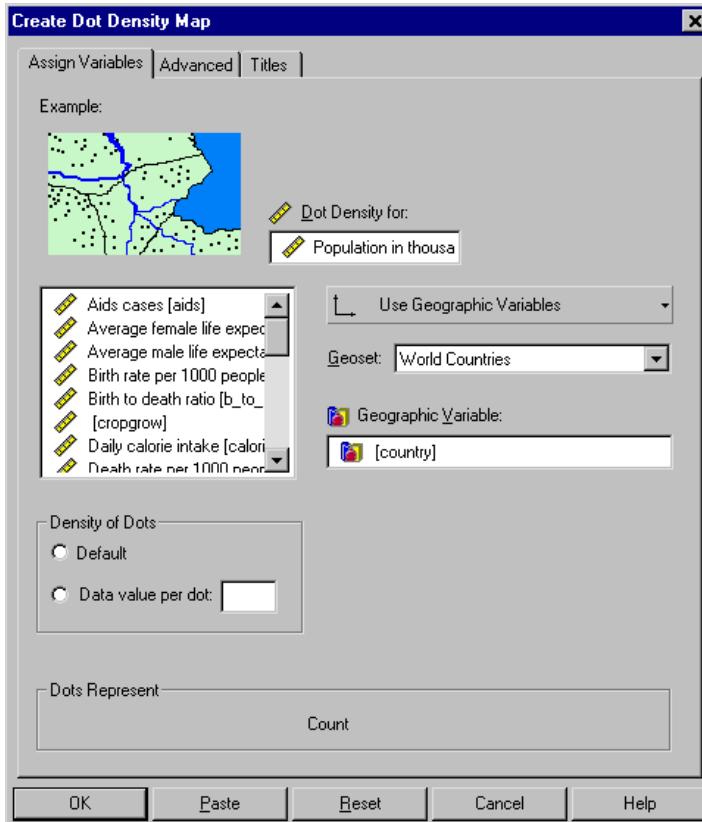
Dot Density for. Displays dots in proportion to the data values in a single scale variable. You can select a summary function from the Dots Represent drop-down list.

Density of Dots. Sets the data value that one dot represents.

Sample Output

Figure 6-2
Dot density map
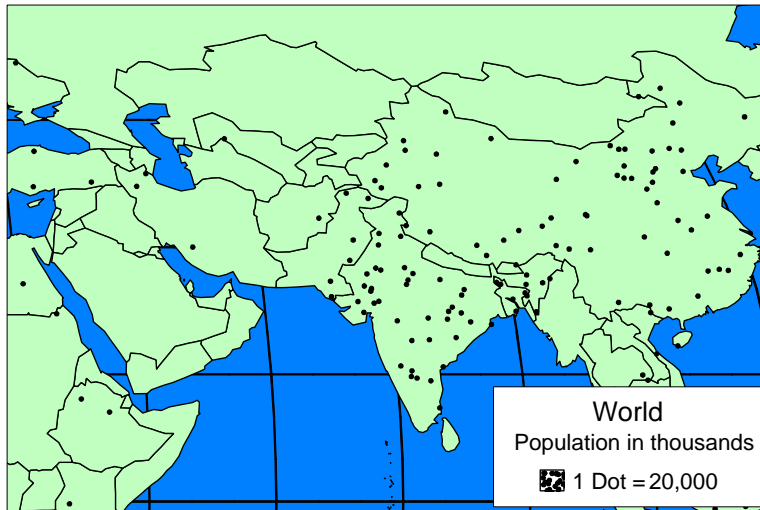
To Create a Dot Density Map

▶ From the menus choose:

Graphs
  Map
    Dot Density…

▶ Drag a single scale variable to Dot Density for.

▶ Select a summary statistic from the Dots Represent drop-down list.

▶ Drag a geographic variable to Geographic Variable. Or you can select an alternative data binding method: Use X/Y Binding or Use Point Reference Table.

▶ Select a geoset from the Geoset drop-down list.

▶ Click the Advanced tab to select options, such as geoset layer, mismatch handling, and a variable to refine the geographic match.

Individual Values Maps

Individual values maps are useful for data files in which each case represents a single geographic region, such as a different country. For example, you might have a table that shows major export commodities by country. You could simply enter the values from this table in the Data Editor (one variable for the country and one variable for the commodity), and then create a map of the data. Individual values can be displayed for the following geographic features:

■ Regions (such as countries) are shaded with a color or pattern.

■ Points (such as cities or locations specified by x/y coordinates) are shaded by changing symbol properties displayed on each point.

■ Lines (such as highways or rivers) are shaded by varying line properties.

Example. You can create an individual values map showing major export commodity by country.

Figure 7-1

Create Individual Values Map: Assign Variables tab
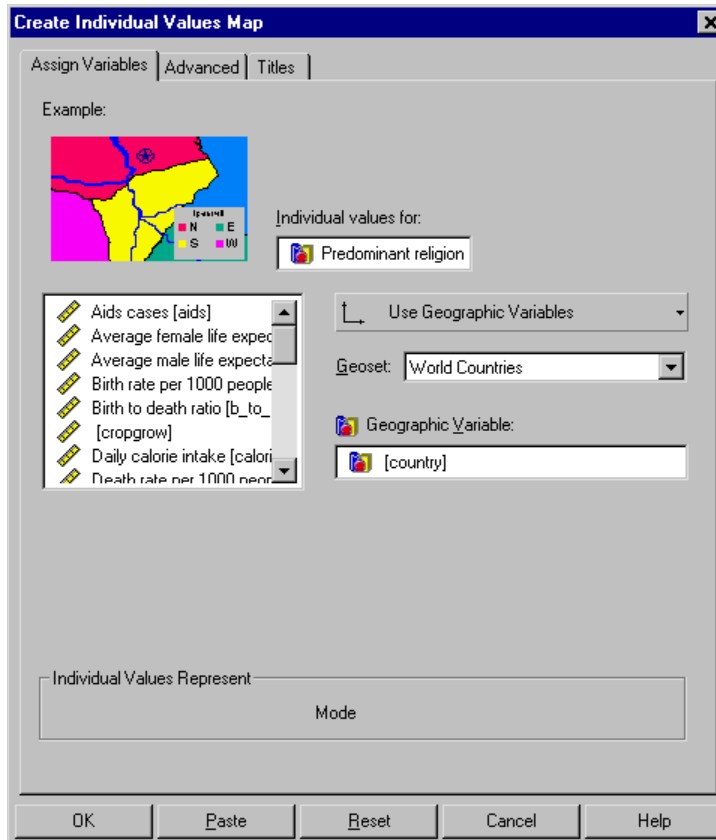
Individual values for. Shades points, lines, or regions according to data values in a variable (usually categorical).

Sample Output

Figure 7-2
Individual values map
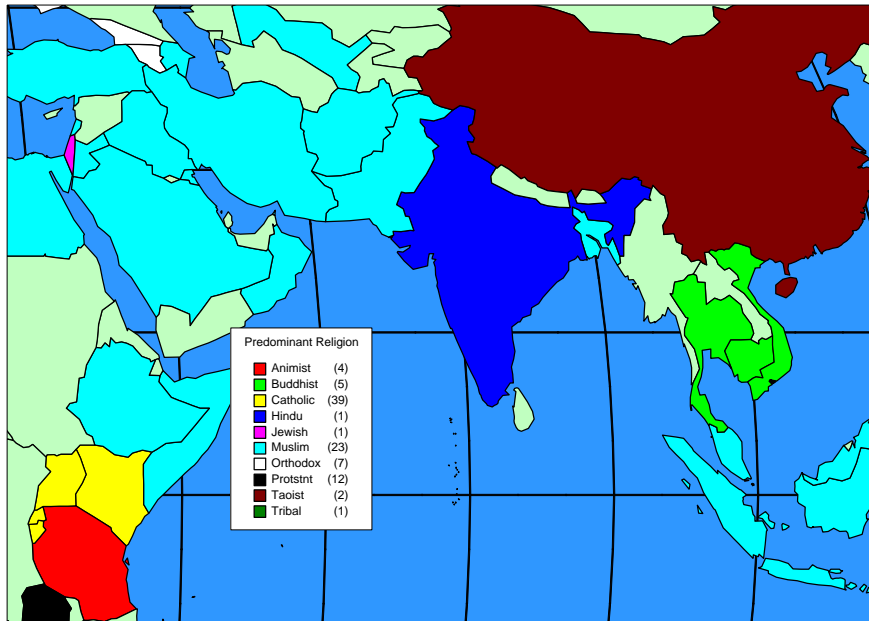
To Create an Individual Values Map

▶ From the menus choose:

Graphs
 Map
  Individual Values…

▶ Drag a variable (usually categorical) to Individual values for.

▶ Drag a geographic variable to Geographic Variable. Or you can select an alternative data binding method: Use X/Y Binding or Use Point Reference Table.

▶ Select a geoset from the Geoset drop-down list.

▶ Click the Advanced tab to select options, such as geoset layer, mismatch handling, and a variable to refine the geographic match.

Bar Chart Maps

Bar chart maps are useful when you want to compare more than one variable or category across a geographic area. Each variable or category is represented by a bar plotted against a background map. Bars are located at the center of each map object and are identified in a legend.

There are three types of bar chart maps:

- Bars that display counts within categories of a single categorical variable, such as number of males and females.

- Bars that display summary statistics for two or more scale variables, such as urban and rural population rates.

- Bars that display summary statistics for a scale variable within categories defined by a categorical variable. This type of bar chart could be used to show total sales to three different customer types within each country.

Example. You could create a bar chart map showing male and female literacy rates by country.

Figure 8-1

Create Bar Chart Map: Assign Variables tab
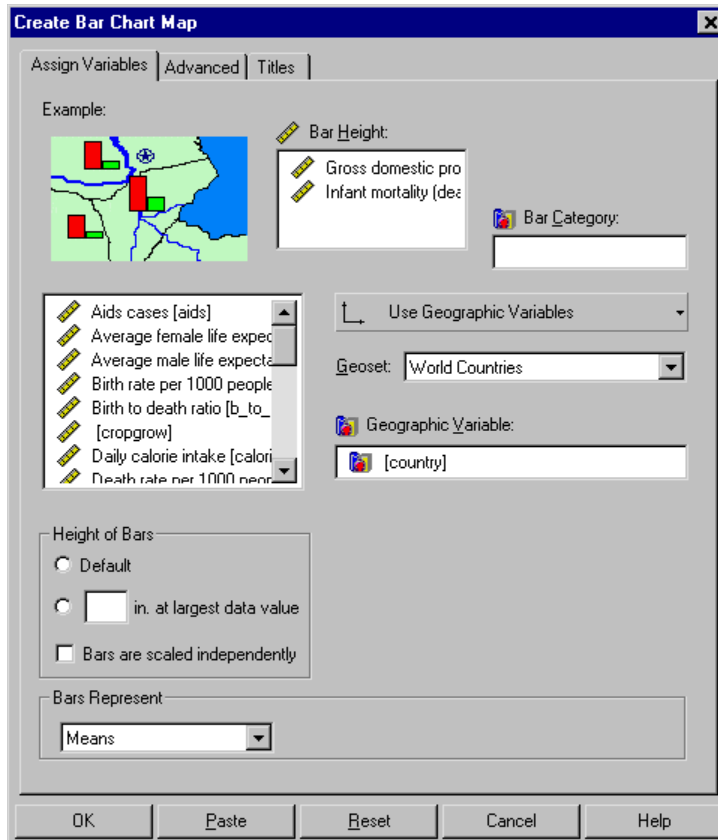
Bar Height. Creates bars of summary statistics for one or more scale variables. Leave this target blank to get the count of cases in each geographic region. You can select a summary function from the Bars Represent drop-down list.

Bar Category. Creates a bar for each category of a categorical variable. Variables with a small number of categories, such as gender, work best. If you select a bar category variable, you can select only one bar height variable.

Height of Bars. Sets the height of the bar that represents the largest data value.

Sample Output

Figure 8-2
Bar chart map
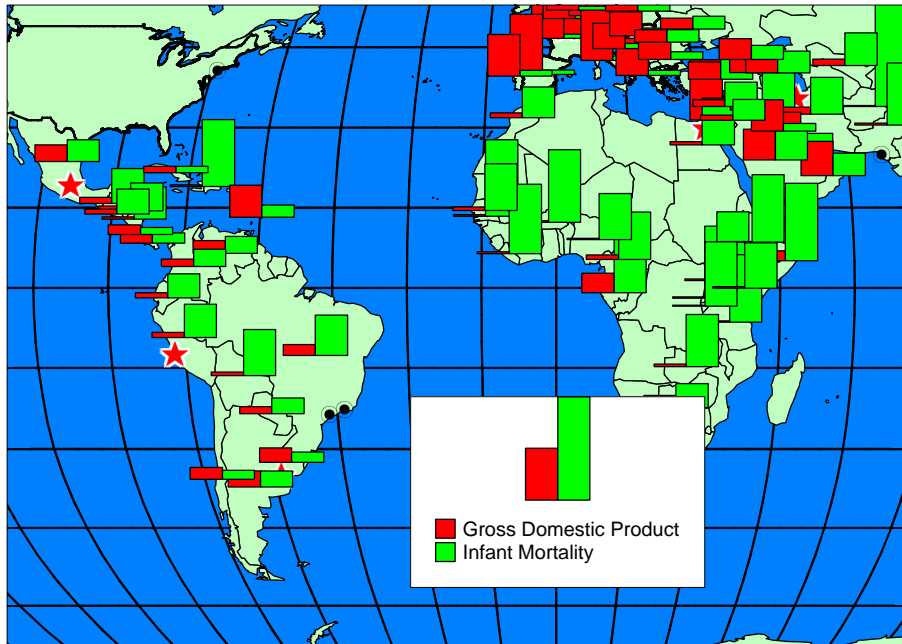
To Create Bars for Counts of a Categorical Variable

▶ From the menus choose:

Graphs
  Map
    Bar…

▶ Drag a categorical variable to Bar Category.

▶ Drag a geographic variable to Geographic Variable. Or you can select an alternative data binding method: Use X/Y Binding or Use Point Reference Table.

▶ Select a geoset from the Geoset drop-down list.

▶ Click the Advanced tab to select options, such as geoset layer, mismatch handling, and a variable to refine the geographic match.

To Create Bars of Summary Statistics for One or More Scale Variables

▶ Drag one or more scale variables to Bar Height.

▶ Select a summary statistic from the Bars Represent drop-down list.

▶ Select a data binding method (such as Use Geographic Variables), a geoset, and other optional settings as appropriate.

To Create Bars of Summary Statistics for a Scale Variable within Categories

▶ Drag a single scale variable to Bar Height.

▶ Drag a categorical variable to Bar Category.

▶ Select a summary statistic from the Bars Represent drop-down list.

▶ Select a data binding method (such as Use Geographic Variables), a geoset, and other optional settings as appropriate.

Pie Chart Maps

Pie charts show the contribution of parts to a whole. Putting pies on a map enables you to see how the distribution of categories differs by geographic region. A pie chart map summarizes categories defined by a single variable, such as the political party of registered voters. The size of each slice represents either counts of a categorical variable or the summary function of a scale variable within categories of a categorical variable.

Example. You could use pie charts to display the types of computer operating systems your customers are using in each region.

Figure 9-1
Create Pie Chart Map: Assign Variables tab
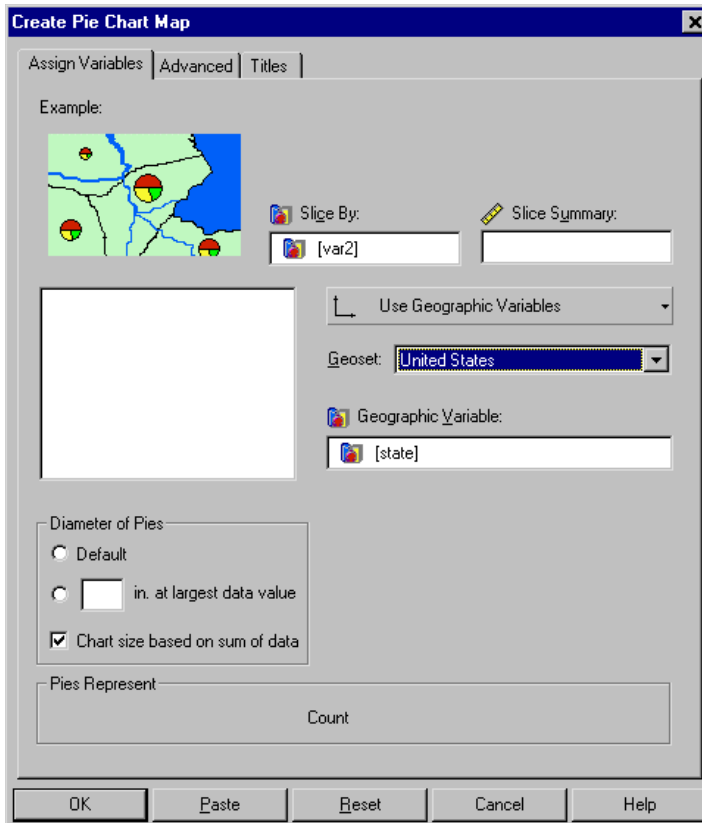
Slice By. Creates pie slices for each category of a categorical variable.

Slice Summary. Determines the size of each slice by the summary function of a scale variable. You can select a summary function from the Pies Represent drop-down list. Leave this target empty to display counts for a categorical variable.

Diameter of Pies. Sets the diameter of pies relative to the largest data value. Select Chart size based on sum of data to graduate pies, indicating the sum of the values represented for each pie. Pies are sized in proportion to the total value of their slices so that you can compare the distribution of values across regions as well as within a region.

Sample Output

Figure 9-2
Pie chart map
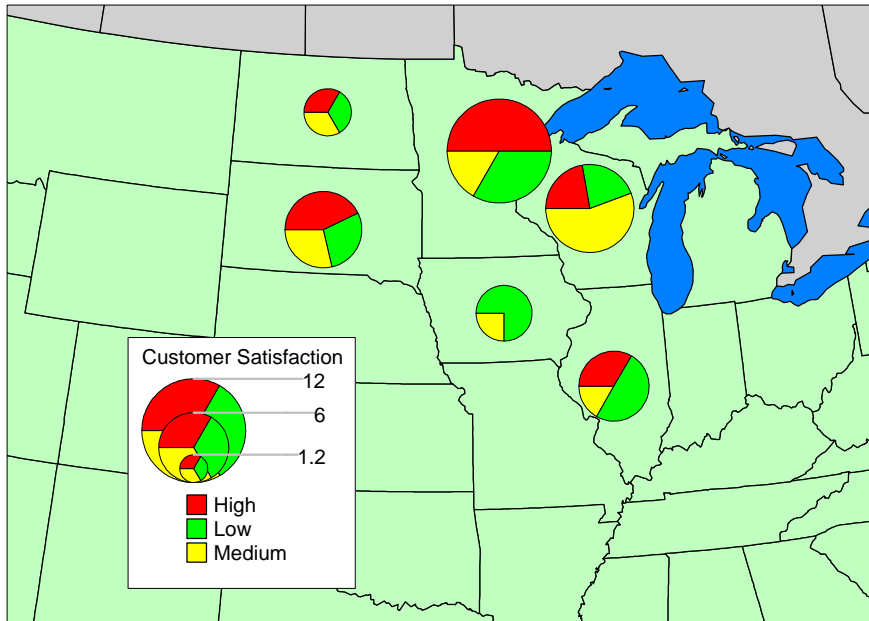
To Create a Pie Chart Map

▶ From the menus choose:

Graphs
  Map
    Pie...

▶ Drag a categorical variable to Slice By.

▶ Optionally, you can drag a scale variable to Slice Summary to create a pie in which each slice represents the value of a summary function for the scale variable for that category.

▶ Drag a geographic variable to Geographic Variable. Or you can select an alternative data binding method: Use X/Y Binding or Use Point Reference Table.

▶ Select a geoset from the Geoset drop-down list.

▶ Click the Advanced tab to select options, such as geoset layer, mismatch handling, and a variable to refine the geographic match.

Multiple Theme Maps

You can create a map with multiple chart types, or "themes." For example, if you want to show sales revenue and distribution cost per customer region, you could use ranges of values to show revenue and bar charts to show distribution costs. The bar charts would be displayed on top of the shaded ranges, but each theme would have a separate legend.

To create a map with multiple themes, you need to select a geographic variable and geoset. These selections will apply to all themes.

Note: Map themes can be added only during creation. You should create all themes you would like to explore in the output map.

- Click the tab for each theme type to assign variables.

- Select Invisible to aggregate data for a theme you might want to show during editing.

- Click the Advanced tab to select a geoset layer, a variable to refine the geographic search, and mismatch options.

- You can add, delete, or change both invisible and visible themes during editing.

Figure 10-1
Create Multiple Theme Map dialog box
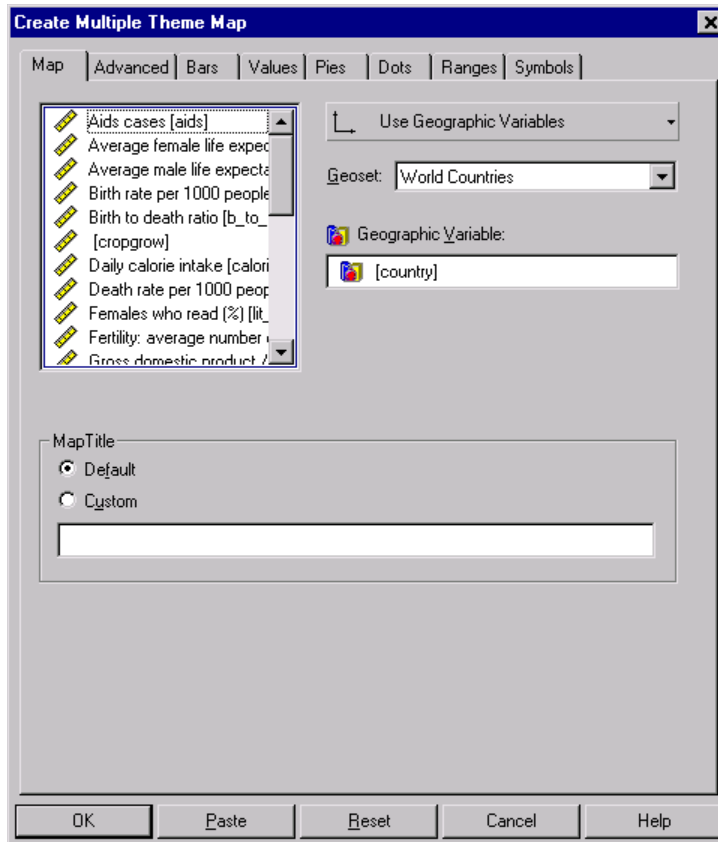
Geographic Variable. A geographic variable, such as country or region, that matches your data to a key column in the geoset.

Geoset. A geoset determines the background map and is crucial for data binding. All geosets in the SPSS Maps directory are listed here. All theme types will use the selected geoset.

Map Title. Select Custom to create your own map title.

Sample Output

Figure 10-2
Multiple theme map
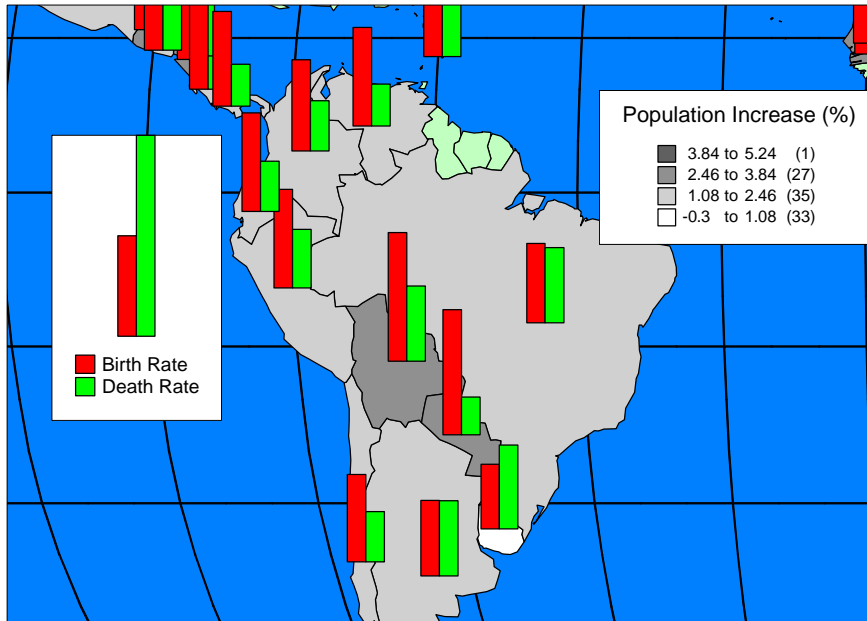
To Select Common Controls for a Multiple Theme Map

▶ From the menus choose:

Graph
 Map
  Multiple Themes…

▶ Click the Map tab.

▶ Drag a geographic variable to Geographic Variable. Or you can select an alternative data binding method: Use X/Y Binding or Use Point Reference Table.

▶ Select a geoset from the Geoset drop-down list.

▶ Click the appropriate tab to create each theme type.

▶ Click the Advanced tab to select options, such as geoset layer, differentiating variable, and mismatch handling.

Adding Themes to a Multiple Theme Map

In multiple theme maps, each theme type has a tab on which you can select variables, summary functions, and other options. You can either select Add this theme to the map to get started or drag a variable to the target box. You can also choose to create an invisible theme that can be displayed during editing.

After selecting geographic variables and a geoset on the Maps tab, you can add themes to the map. For example, you could click the Dots tab to add a dot density theme.

Figure 10-3
Create Multiple Theme Map: Dots tab
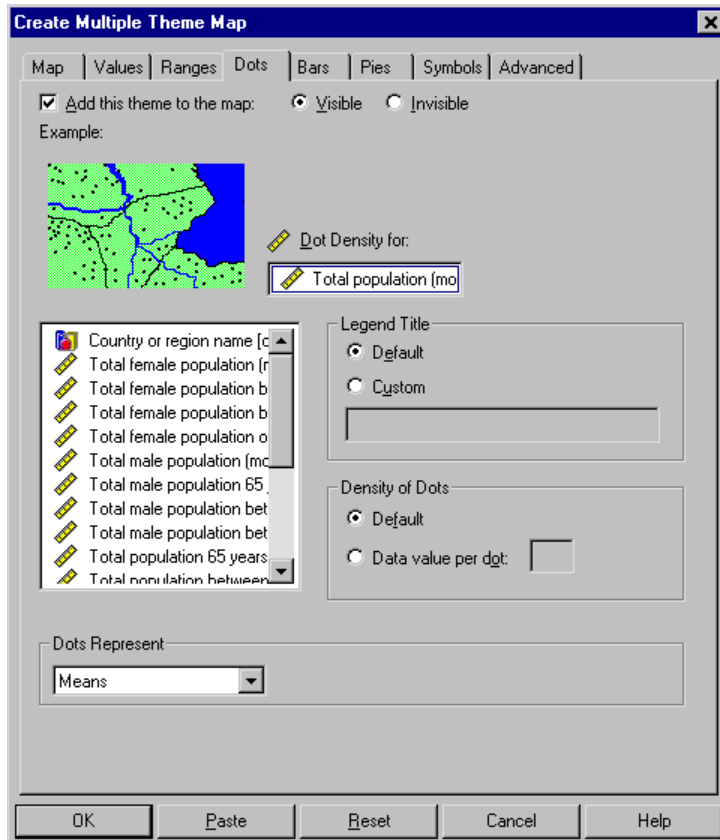
Add this theme to the map. Select Visible to include the theme in the output map. Select Invisible to aggregate data for this theme but hide it in the output map. You can show, hide, modify, or delete invisible and visible themes during editing.

Dot Density for. Displays dots in proportion to the data values in a single scale variable.

Legend Title. Creates a custom legend title for each theme type.

Density of Dots. Sets the data value that one dot represents.

For detailed information about creating other themes, see the chapter about each theme type.

To Add Themes to a Multiple Theme Map

▶ From the menus choose:

Graphs
 Map
  Multiple Themes…

▶ Click the appropriate tab to add a theme type.

▶ Drag a variable (or variables) to the appropriate targets.

▶ Select a summary statistic from the drop-down list.

▶ To suppress the initial display of the theme, select Invisible. This option is useful when you are unsure which themes will work best but still want to aggregate data for later use during editing.

▶ Click the Advanced tab to select options, such as geoset layer, differentiating variable, and mismatch handling.

Modifying Thematic Maps

Thematic maps have two components: theme layers and map layers.

■ Theme layers include bar charts, pie charts, ranges of values, individual values, graduated symbols, and dots. Theme layers can be modified using the Theme Control.

■ Map layers include geoset components, such as oceans, cities, and highways. Map layers can be modified using the Layer Control.

X/Y and point reference binding create both map layers and theme layers. The layer of points (showing location of stores, facilities, etc.) created from *x* and *y* coordinates can be modified using the Layer Control. Themes bound to this layer (for example, bar charts showing sales by store location) can be modified using the Theme Control.

When you activate a thematic map, the editing toolbar appears. The editing tools allow you to zoom, center, pan, and open the Theme and Layer Controls.

Pointer	
Hand Pan	
Center Map	
Zoom In	
Zoom Out	
Display Entire Map	
Themes	
Map Layers	
Map Title	

Modifying Themes Using the Theme Control

You can change theme properties for each theme type in a map. Each theme has unique properties, such as symbol color, bar height, and dot size, that can be changed using the properties dialog box for each theme.

Note: Thematic layers cannot be added during editing. Using multiple theme maps, you can create additional themes and choose to display or hide them in the final map.

Figure 11-1
Theme Control dialog box
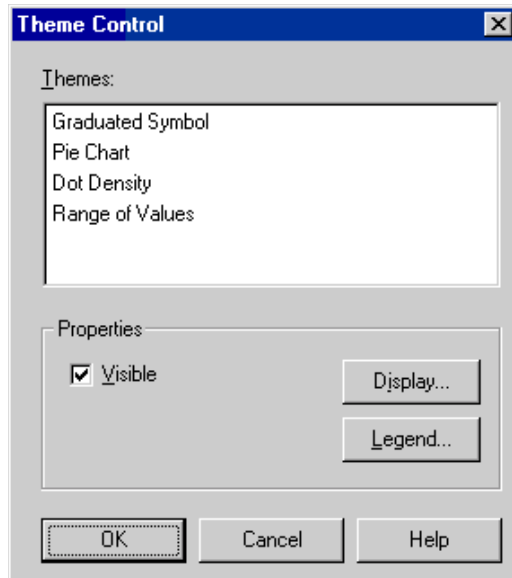
Themes. All themes in the activated map are listed here.

Properties. Properties for the selected theme can be changed by clicking Display or Legend. Deselect Visible to hide a theme in the map.

To Modify Themes

▶ Activate the map (double-click it).

▶ Click the Themes tool on the toolbar.

▶ Select a theme in the list.

▶ Click Display to edit theme properties.

▶ Click Legend to edit legend options for each theme.

▶ Optionally, you can hide or show theme layers by clicking the Visible check box.

Range of Values Properties

In a range of values map, you can change range properties and distribution as well as the range of fill colors. For each type of range of values map, there are two color values available that represent the minimum and maximum data value.

Figure 11-2
Ranged Theme Options dialog box
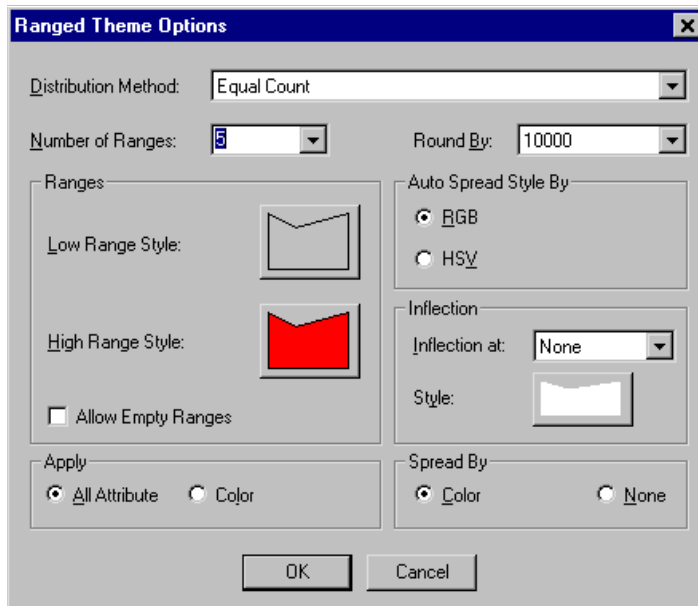
Distribution Method. Changes the method of distributing data values into ranges.

See Chapter 4 for more information about distribution methods.

Number of Ranges. Breaks data values into a specified number of ranges. Enter a number of ranges or select one from the drop-down list.

Round By. Rounds range values to the decimal of your choice.

Ranges. Low and high range colors for fill progression. To apply all style attributes, such as fill color and pattern, select All Attribute. Selecting Color will apply only color choices and ignore pattern choices.

Allow Empty Ranges. Allows empty ranges to be created.

Auto Spread Style By. Sets a color model used to spread color between the low and high ranges. Choose RGB (red, green, blue) or HSV (hue, saturation, value).

Inflection. An inflection point separates the ranges into two sections. The colors in the ranged theme will spread from the top range color to the inflection color, and then from the inflection color to the bottom range color.

Spread By. Controls how autospreading is done for ranged thematic maps. You can spread ranges by color (when binding to a region layer) or size (when binding to a point layer).

To Modify Range of Values Themes

▶ Select Range of Values in the theme list.

▶ Click Display to edit theme properties.

▶ Select the settings you want to change, such as style properties, range distribution, and inflection.

▶ Click Legend to edit legend options for each theme.

Individual Values Properties

In an individual values map, you can change fill, symbol, and line properties, depending on the type of individual values map. For example, for a map showing political dominance by city, the individual values might appear as shaded points on a map. You can edit the symbol style, size, fill, and rotation at these points. For a map showing types of major roadways in Europe, each highway might have different line properties that you could adjust.

Figure 11-3
Individual Value Theme Options dialog box
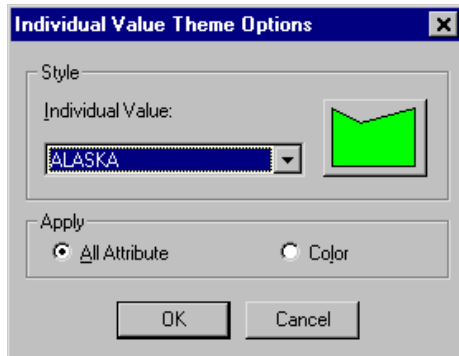
Style. In maps bound to a region layer, such as category by country, you can change fill color and border styles. Click the style button for each category to specify options.

Apply. To apply all style attributes, such as fill color and pattern, select All Attribute. Selecting Color will apply only color choices and ignore pattern choices.

To Modify Individual Values Themes

▶ Select Individual Values in the theme list.

▶ Click Legend to edit legend options for each theme.

▶ Click Display to edit theme properties.

To select style options for each category:

▶ Select a category from the drop-down list.

▶ Click the style button to change style options for the region, point, or line layers.

Line Style Properties

For individual value themes bound to a line layer, such as highways, you can edit line style properties for each category.

Figure 11-4
Line Style dialog box
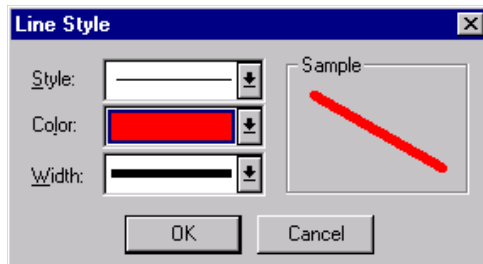
Style. Applies a style from the list to all lines.

Color. Sets line color.

Width. Sets the width (weight) of lines.

To Change Line Style Properties

▶ Click the line style button.

▶ Select the settings you want to change, such as line style, color, and width.

Graduated Symbol Properties

In a graduated symbol map, you can change the look and size of symbols displayed in each region.

Note: Changes apply to all symbols on the theme layer.

Figure 11-5
Graduated Symbols Theme Options dialog box
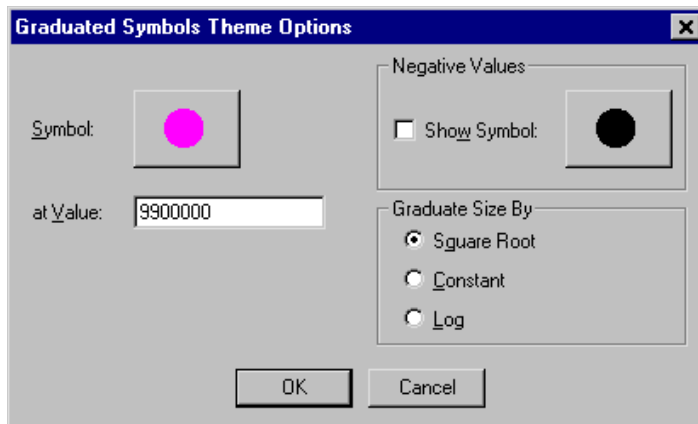
Symbol. Click the symbol style button to change symbol options, such as:

- Font, size, and color of the chosen symbol
- Rotation angle for all symbols
- Background color and effects

At Value. Sets a data value for the symbol size defined in the Symbol Style dialog box. For example, you could set the size of the largest symbol at 36 and the data value for the largest symbol at 100000. Choosing a data value lower than the largest value in the data will cause the largest symbol to be larger than specified.

Negative Values. Sets a symbol to display at negative data values. Click the symbol button to select a symbol.

Graduate Size By. Graduates bar size according to a square roots scale, a constant (linear) scale, or a logarithmic scale.

To Modify Graduated Symbol Themes

▶ Activate the map (double-click it).

▶ Click the Themes tool on the toolbar.

▶ Select Graduated Symbol in the theme list.

▶ Click Legend to edit legend options for each theme.

▶ Click Display to edit theme properties, such as data value of the largest symbol.

▶ Click the symbol style button to change font, size, color, rotation, background, and effects.

▶ If desired, select a symbol to display for negative values.

▶ Optionally, you can choose a scale to graduate symbol size.

Symbol Style Properties

For graduated symbol themes, you can edit symbol properties for display in the current map.

Figure 11-6
Symbol Style dialog box
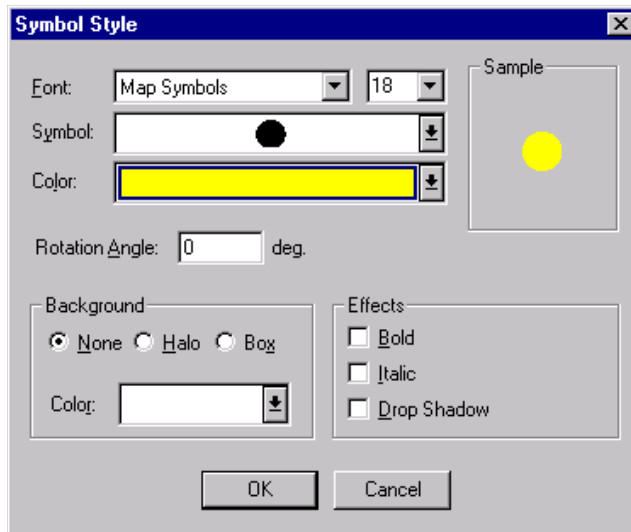
Style. Sets font, size, symbol, and color options.

Rotation Angle. Rotates all symbols according to the degree you specify.

Background. Creates a halo or box in the color of your choice for all symbols.

Effects. Adds effects, such as bold, italic, and drop shadow.

To Change Symbol Style Properties

▶ Click the symbol style button.

▶ Select the settings you want to change, such as font style, symbol, background, and rotation.

Dot Density Properties

In a dot density map, you can change data value per dot. You can also specify the size of dots.

Figure 11-7
Dot Density Theme Options dialog box
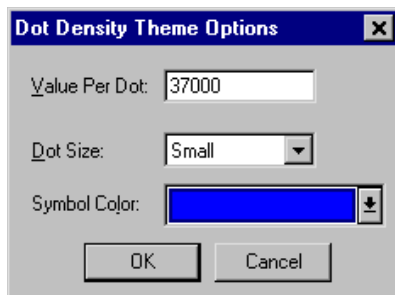
Value Per Dot. Sets the value of each dot. For example, each dot could represent 1000.

Dot Size. Displays small or large dots. Using small dots can reduce clutter if you have a high dot density.

Symbol Color. Sets a color for dots.

To Modify Dot Density Themes

▶ Select Dot Density in the theme list.

▶ Click Legend to edit legend options for each theme.

▶ Click Display to edit theme properties.

▶ Select the settings you want to change, such as dot size, color, and data value.

Bar Chart Properties

In a bar chart map, you can modify bar size, fill progression, style, and border. You can also set the size of bars relative to values in the data.

Figure 11-8
Bar Chart Theme Options dialog box
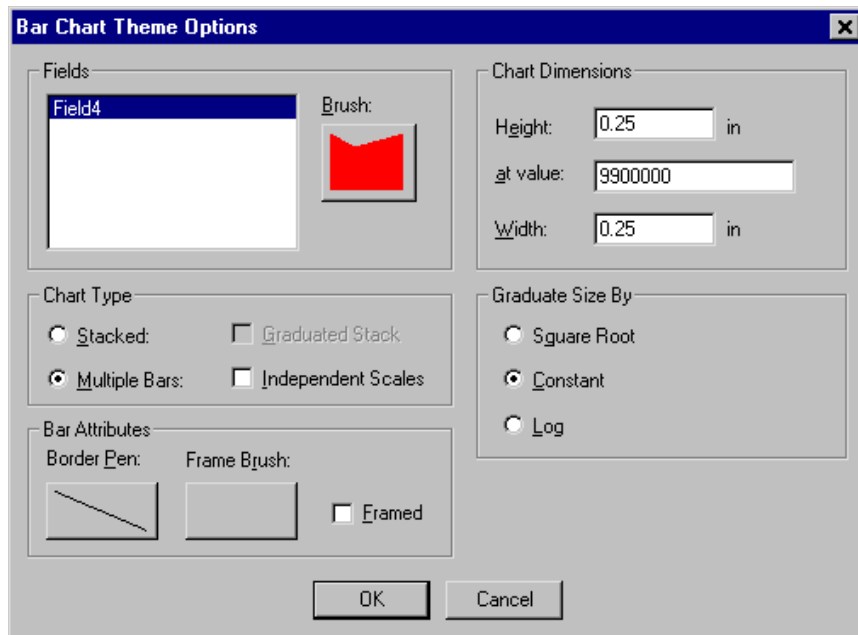
Fields. You can change properties for each bar in a chart by selecting a field from the list. Click the brush style button to change fill options for each bar.

Chart Type. Creates stacked bars or multiple bars. You can specify whether stacked bars will be graduated and select independent scales for multiple bars. Scaling independently is appropriate when you are displaying two or more scale variables with different scales, such as grain output per acre and annual rainfall.

Bar Attributes. Creates a border and frame around bars. Click the border pen or frame brush buttons to specify properties.

Chart Dimensions. Sets the height for the bar chart at a particular data value. For example, with a setting of 1000, a bar representing a value of 500 would be half the size specified in Chart Dimensions: Height. You can also specify chart width.

Graduate Size By. Graduates bar size according to a square roots scale, a constant (linear) scale, or a logarithmic scale.

To Modify Bar Chart Themes

▶ Select Bar Chart in the theme list.

▶ Click Legend to edit legend options for each theme.

▶ Click Display to edit theme properties.

▶ Select the settings you want to change, such as the value of the largest bar, chart width, and bar attributes.

To select style options for each category:

▶ Select a bar field from the list.

▶ Click the brush style button to change fill and border options.

Fill Style Properties

You can set fill pattern and foreground and background colors. Choose styles from the drop-down lists. For patterned fills, you can also select a background fill.

For bar themes, you can edit fill style properties for each bar.

Figure 11-9
Fill Style dialog box
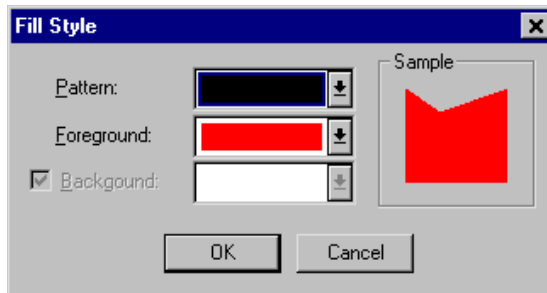
To Change Fill Style Properties

▶ Click the region style button.

▶ Select the settings you want to change, such as fill pattern and color.

Pie Chart Properties

In a pie chart map, you can modify pie size, slice style, and fill progression. You can also set the diameter of pies relative to data values.

Figure 11-10
Pie Chart Theme Options dialog box
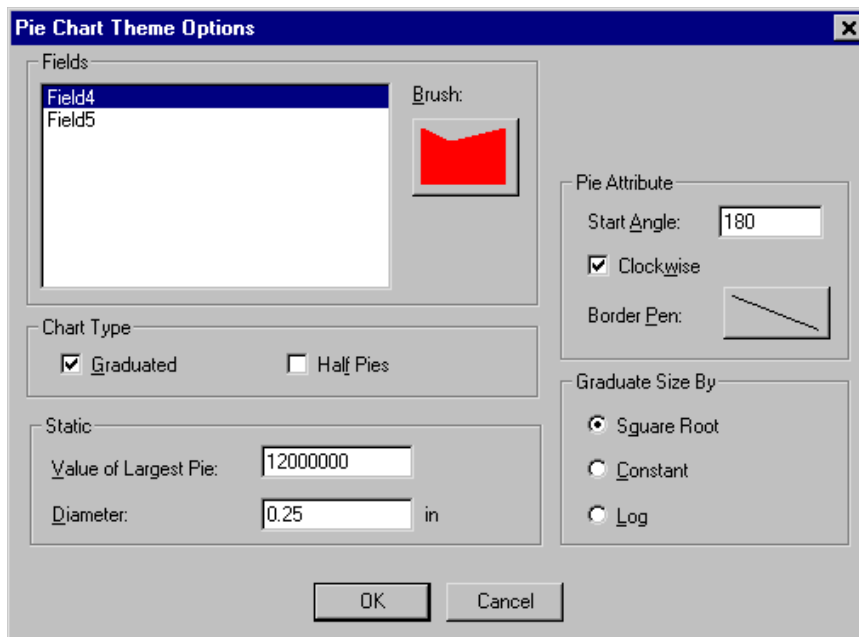
Fields. You can change properties for pie slices in a chart by selecting a field from the list. Click the brush style button to change fill options for each slice.

Chart Type. Creates pie chart variations, such as graduated pies and half pies. Pies are graduated according to data values specified in Value of Largest Pie, indicating the sum of the values represented in each pie. You can also create half pies, which compress the data displayed into 180 degrees.

Static. Sets a data value, such as 1000, for the largest pie. You can set the diameter of the largest pie. In this example, a pie representing a total value of 500 would be half the size of the pie specified for Diameter.

Diameter. Sets the diameter of the pie whose value is specified for Value of Largest Pie.

Pie Attribute. Sets a start angle (such as 90 degrees) and rotation for pie slices. You can set border options for pies and slices by clicking the border pen style button.

Graduate Size By. Graduates pie size according to a square roots scale, a constant (linear) scale, or a logarithmic scale.

To Modify Pie Chart Themes

▶ Select Pie Chart in the theme list.

▶ Click Legend to edit legend options for each theme.

▶ Click Display to edit theme properties.

▶ Select the settings you want to change, such as the value and diameter of the largest pie, chart type, and pie attributes.

   To select style options for each pie slice (or section):

▶ Select a field from the list.

▶ Click the brush style button to change fill options.

Modifying Map Titles

You can show, hide, or modify map titles. The default map title is the name of the geoset used to make the map.

Figure 11-11
Edit Map Title dialog box
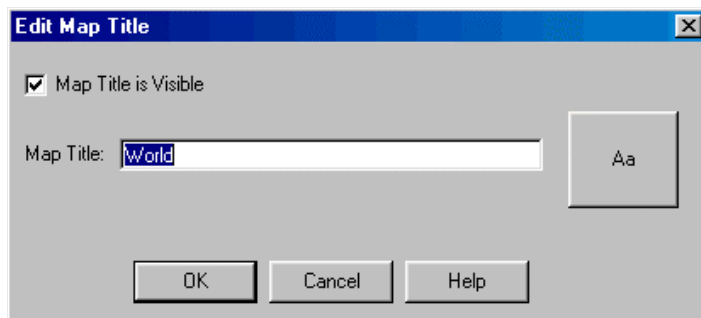
Map Title is Visible. Displays the title in the current map.

Map Title. You can create a new title or edit the current one. Click the text style box to change options, such as text font, style, and size.

To Modify Map Titles

▶ Activate the map (double-click it).

▶ Click the Map Title tool on the toolbar.

▶ Select the settings you want to change, such as title visibility and title text.

Legend Properties

For all theme layers, you can modify legend type, options, and contents.

Figure 11-12
Legend Style dialog box
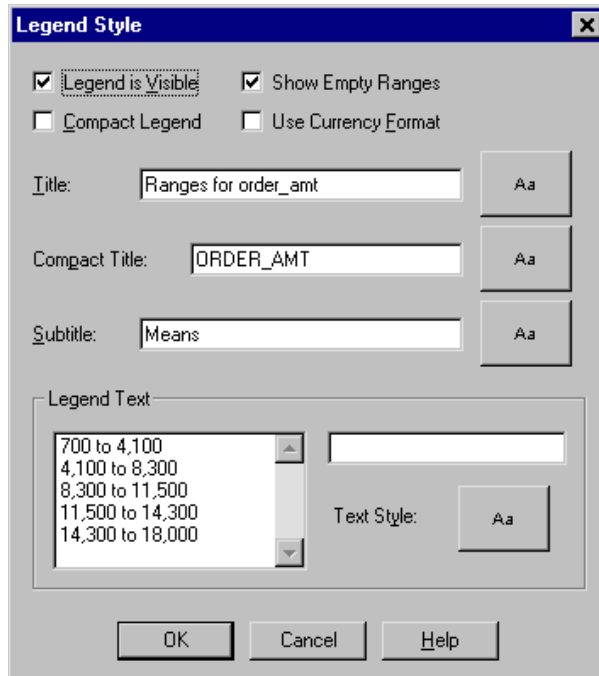
Legend is Visible. Displays the legend in the current map.

Compact Legend. Displays a compact legend. A full legend is displayed by default.

Show Empty Ranges. Includes empty ranges in the legend.

Use Currency Format. Displays numbers as currency for maps showing sales figures, income, etc.

Title. You can edit title text for titles and subtitles. You can also edit text for a compact legend. Click the text style button to edit font style, color, and effects.

Legend Text. Select an entry to edit the text. Click the text style button to edit font style, color, and effects.

To Change Legend Properties

▶ Click Legend to edit the legend for each theme.

▶ Select the settings you want to change, such as title, subtitle, and legend text.

Modifying Map Layers Using the Layer Control

Map layers are files, such as oceans, countries, and cities, that make up a map. For each map layer, you can use the Layer Control to add, remove, and reorder layers. You can also select properties, such as color, line style, fonts, labels and zoom. To make permanent changes to geoset layers, use the Geoset Manager.

For more information on using the Geoset Manager, see Chapter 2.

Figure 11-13
Layer Control dialog box
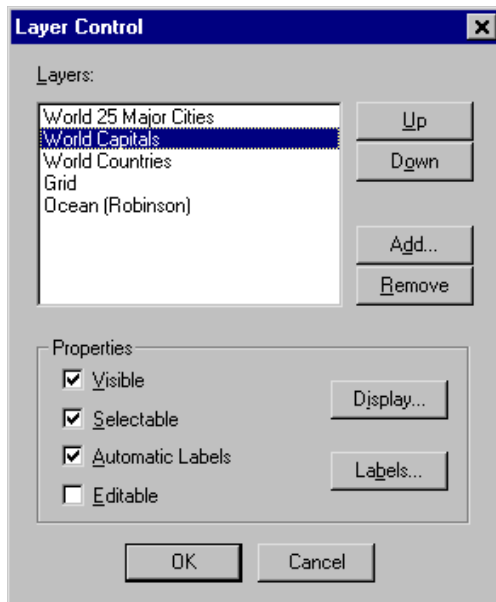
Layers. Displays all layers in the current map, including geoset layers and layers created during X/Y binding. You can reorder, add, and remove layers, such as grid or ocean, from the current map.

Properties. For each layer, you can choose to make it visible, selectable, and editable. You can also choose to show labels, such as country names. For cosmetic edits, click the Display button. You can also change label options by clicking Labels.

To Use the Layer Control

▶ Activate the map (double-click it).

▶ Click the Map Layers tool.

▶ Select a layer from the list.

▶ Click Up or Down to reorder layers.

▶ Click Display to change the zoom level and region, line, or point properties.

▶ Click Labels to change label style, visibility, and location options.

Adding Layers to a Map

Click Add in the Layer Control to bring up a dialog box listing all layers, or *.tab* files, in the SPSS Maps directory. After adding map layers, you can reorder them and adjust their zoom level using the Layer Control.

Figure 11-14
Adding map layers
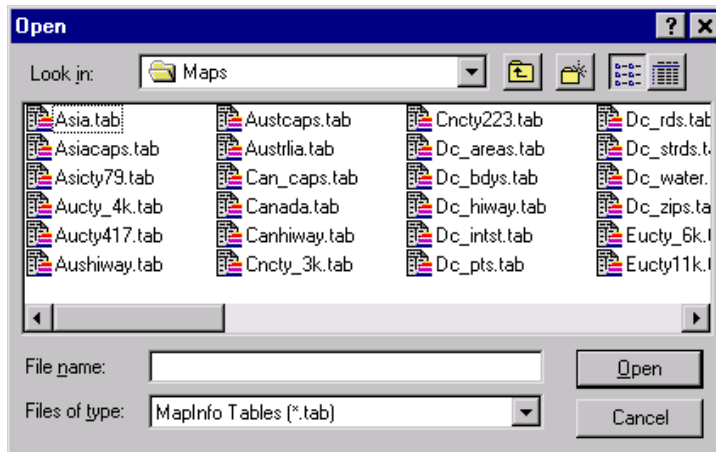
To Add Map Layers

▶ Activate the map (double-click it).

▶ Click the Map Layers tool.

▶ Click Add.

▶ Select a layer from the list and click Open to add the layer.

Note: This action adds a layer to the current map. To add a permanent layer to the geoset, use the Geoset Manager.

Display Properties

Using the Layer Control, you can specify display properties for all types of map layers, including region, point, and line layers. You can choose to display certain map layers, such as power plant location, at a detailed zoom level. This reduces clutter in your map by making certain layers invisible at high or low zoom levels. You can set zoom levels manually by entering a value in map units. Additional display properties include:

■ Show line direction for line layers such as highways.

■ Show nodes.

■ Show centroids of each geographic region.

Figure 11-15
Display Properties dialog box
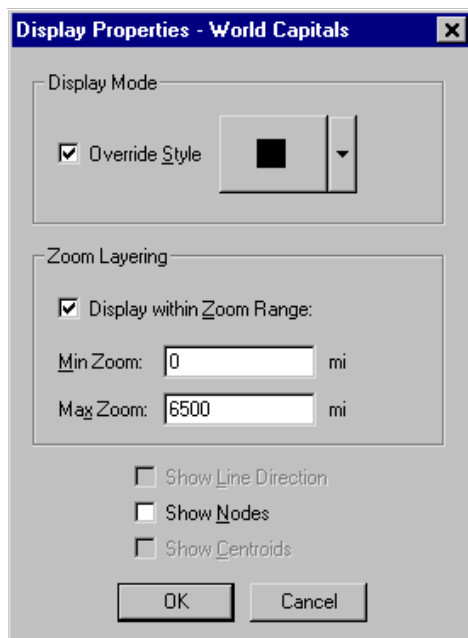
Display Mode. First, select Override Style to activate the style button. Click the style button to change options for region fill, point symbols, and line style. For example, if the selected layer is World Capitals, the style button will open a dialog box for symbol options.

Zoom Layering. Select Display within Zoom Range to specify zoom levels for a layer. For example, you could display a layer of nuclear power plants at all zoom levels between 1256 miles and 314 miles. When you zoom to a level, such as 800 miles, you will then see the location of nuclear power plants in each region.

To Change Display Properties

▶ Select a layer in the Layer Control and click Display.

▶ Set zoom level visibility for the selected layer.

▶ Click the style button to change options for region, point, and line layers.

Label Properties

For each map layer, you can change the appearance, visibility, and location of labels.

Figure 11-16
Label Properties dialog box
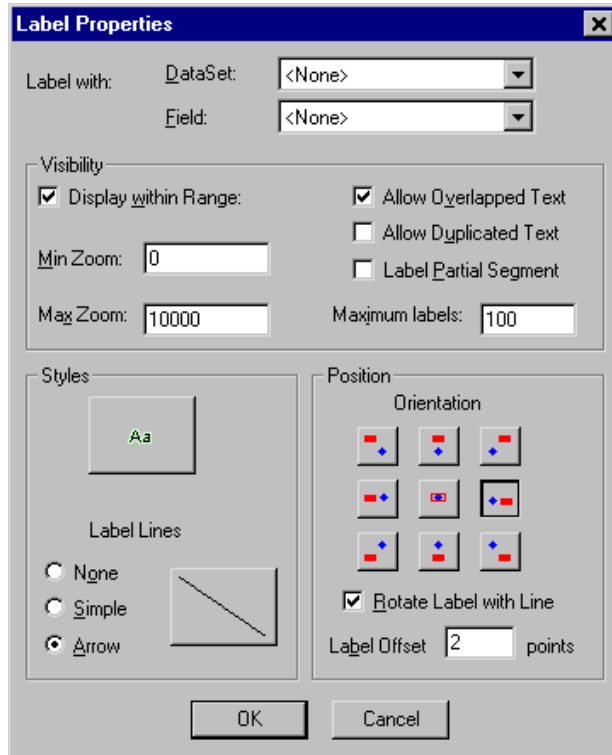
Label with. Displays labels using either a data set value, such as sales amount, or a field name, such as country name.

Visibility. Sets a zoom range in which the labels will be visible for each layer. Labels are visible only when a layer is visible. You can also control the way labels are displayed. Choose to allow overlap and duplicate labels. Select Label Partial Segment for more specific labeling of geographic features, such as merged highways. You can also set a maximum number of labels per layer to limit clutter.

Styles. Sets options for a line connecting labels with the center of a feature. Click the text style button to edit font style, color, and effects.

Position. Sets the location of the label relative to the center of the geographic feature. You can specify a specific distance from the center. For line layers, keep labels parallel with lines by selecting Rotate Label with Line.

To Change Label Properties

▶ Select a map layer from the list.

▶ Select or deselect Automatic Labels to show or hide labels.

▶ Click the Labels button for more options.

▶ Select the settings you want to change, such as label visibility, styles, and position.

Geographic Variable Mismatches

Sometimes you will get a mismatch warning table in the Viewer window. This table lists discrepancies between values in the geoset layer and values in the *.sav* file. For example, if the geoset layer uses the name United States while the *.sav* file uses the abbreviation USA, you will see a mismatch for USA in the warnings table. To avoid mismatches, you can change values in your *.sav* file to correspond to values in the geoset layer.

Figure 11-17
Mismatch between the geoset and .sav file

Mismatches

	Unrecognized
1	Gibraltar
2	Great Britain
3	St. Vincent & Grenadine
4	The fmr Yug Rep Macedonia
5	USA
6	Western Sahara

To Correct Mismatches

To turn on labels for the geographic feature with a mismatch (for example, state or country):

▶ Activate the map (double-click it).

▶ Click the Map Layers tool.

▶ Select the map layer with a mismatch from the list.

▶ Select Automatic Labels to display labels (geographic values from the geoset).

To determine data values in the geoset:

▶ Zoom in to the mismatched geographic feature (such as USA).

▶ Determine the value displayed for that feature (such as United States, USA, or US).

To resolve mismatches in the *.sav* file:

▶ In the Data Editor, find the field with a mismatch.

▶ Change the value to match that in the geoset layer.

▶ Save changes and recreate the thematic map.

Syntax Reference

MAPS

```
MAPS

{/GVAR = VAR(varname)[VAR(varname)]          }
{/XY(varname)(varname)(varname) }
{/LOOKUP(varname)(filename)}

/GSET = "filename" [LAYER = "layer name"]

[/SHOWLABEL = AS_IS │ NO │ YES]

[/TITLE = {(DEFAULT)       }
          {"string value"}]

[/GVMISMATCH MAX = {100}
                   { n }

 /ROVMAP = Var(varname)
   SUM = (function name)
  [DISTRIBUTION = EQSIZE ]
                  EQCOUNT
                  NATBREAK
                  SD
                  CUSTOM
  [ALLOWEMPTY = YES │ NO ]
  [NUMRANGES = n]
  [XRANGE = (n,n) ["string value"]]
  [LEGENDTITLE = {(DEFAULT)       }
                 {"string value"}
  [VISIBLE = YES │ NO]

 /SYMBOLMAP = Var(varname)
   SUM = (function name)
  [LEGENDTITLE = {(DEFAULT)       } ]
                 {"string value"}
  [VISIBLE = YES │ NO]

 /DOTMAP = Var(varname)
   SUM = (function name)
  [VALUE1DOT = n]
  [LEGENDTITLE = {(DEFAULT)       } ]
                 {"string value"}
  [VISIBLE = YES │ NO]

 /IVMAP = Var(varname)

   SUM = (function name)
  [LEGENDTITLE = {(DEFAULT)       }
                 {"string value"}
  [VISIBLE = YES │ NO]

/BARMAP = {VAR(varname) VAR(varname)...}
          {VAR(varname) BY VAR(varname)}
   SUM = (function name)
  [HEIGHT = {0.25}]
            {n   }
  [INDSCALE = YES │ NO]
  [LEGENDTITLE = {(DEFAULT)       } ]
                 {"string value"}
  [VISIBLE = YES │ NO]

/PIEMAP = VAR(varname) BY VAR(varname)
   SUM = (function name)
  [DIAMETER = {0.25}]
              {n   }
  [GRADUATED = YES │ NO]
  [LEGENDTITLE = {(DEFAULT)       }
                 {"string value"}
  [VISIBLE = YES │ NO]
```

Example
```
MAPS  /GVAR = VAR(country)
 /GSET = 'World Countries' LAYER ='World'
 /TITLE = ""
 /ROVMAP=VAR(populatn)
  SUM=(SUM)  DISTRIBUTION = EQCOUNT .
```

Overview

Each occurrence of the MAPS command produces a single map displaying from one to six **themes** (bars, pies, dot densities, symbols, and shadings for ranges or individual values) that illustrate the distribution of data across the geographic regions displayed on the map. The map boundaries and geographic features, such as highways and city locations, come from a set of tables known as a **geoset**. The values of a geographic variable in the SPSS data must match values of a key field in a geoset in order to place the thematic elements in the right geographic regions.

Note: *Region* is used throughout this document to refer to any geographic unit. In fact, most themes can be applied to points, such as cities or office locations, and to lines, such as highways, as well as to areas with boundaries, such as countries.

Basic Specification

The basic specification has three required parts:

- The name of a geoset.
- The name of the geographic variable whose values correspond to those of a table in the geoset. (See the XY subcommand for an alternative.)
- A theme subcommand that includes the variable on which descriptive statistics are to be calculated for each region.

Syntax Rules

- One and only one of the GVAR, XY, or LOOKUP subcommands is required to specify the SPSS variable to be matched with a table in the geoset. XY and LOOKUP also provide information to create a new layer.
- The GSET subcommand is required.
- At least one of the theme subcommands (ROVMAP, SYMBOLMAP, DOTMAP, IVMAP, BARMAP, or PIEMAP) is required. Each of these can be entered once and only once.
- The GVAR (or XY or LOOKUP), GSET, LAYER, LOOK, SHOWLABEL, TITLE, and GVMISMATCH subcommands can be entered in any order but must precede the theme subcommands.

Operations

- Each MAPS command creates a single map.
- Data are aggregated to the level of the values of the geographic variable.
- After aggregation, data values are matched by the values of the geographic variable to the values of a layer in a specified geoset. This is known as **data binding**. By default, the software looks for a layer whose values match the values of the geographic variable specified on the MAPS command.
- If multiple themes are requested, they are drawn in this order: individual values, range of values, dot density, pie, bar, and symbol.

Limitations

- A maximum of ten bars or pie slices can be shown. For bars corresponding to separate variables, the limit is six.
- A maximum of 99 values is allowed in an individual values map.
- Each theme can be applied only once to each map.
- All themes on a map must be bound to the same layer. For example, it is not possible to have a range of values based on countries and graduated symbols based on cities.

GVAR Subcommand

The GVAR subcommand requires the name of an SPSS variable that identifies the geographic regions, such as *COUNTRY* or *COUNTY*. The values of this variable must match the values in a table of the geoset. Occasionally, the values of a single variable do not fully identify regions, as in the case of United States counties, which can occur with the same name in more than one state. In this case, a second variable is required to refine the match.

Example

```
MAPS
  /GVAR = VAR(county) VAR(state)
  /GSET = 'United States'
  /DOTMAP= VAR(sales) SUM=(sum).
```

- Because the same county name can occur within different states, the variable *STATE* is required to ensure that *COUNTY* is unique.

XY Subcommand

The XY subcommand is useful when the SPSS data contain the coordinates of points to be shown on a map. By naming these coordinates, you can create a new layer in the geoset that contains the points and displays themes at those points. This subcommand requires three variables, giving in order the *x* (longitude) and *y* (latitude) coordinates and a key variable that identifies the points. The data are aggregated on the key variable; if there is more than

one instance of each value of the key variable in the file, the *x/y* coordinates are taken from the first occurrence of that value in the data. (The assumption is that all occurrences of the same key value, such as the identity of an office at a particular location, will have the same *x/y* coordinates.)

Example

```
MAPS
  /XY = VAR(x) VAR(y) VAR(company)
  /GSET = 'United States'
  /SYMBOLMAP= VAR(sales) SUM=(SUM).
```

- Each company in the data file has unique coordinates, designated *x* and *y*. (If some companies had more than one location, it would be necessary to have a variable that designated each location so that all locations would be shown.)
- A new layer named Company (XY) is created in the geoset.
- The total (sum) of sales to each company will be represented in the size of a symbol at each of the *x/y* points.

LOOKUP Subcommand

The LOOKUP subcommand extends the capability of the XY subcommand. It allows you to use coordinates from an existing table to create a new layer in your geoset. For example, if you have zip codes in your data but no *x/y* coordinates to represent zip codes on your map, and your geoset does not contain a zip code layer, you can instruct SPSS Maps to look up the coordinates in a table and create a new layer, just as in XY binding. In this case, you provide the name of the variable that you want to match to geographic coordinates and the name of the file that contains those coordinates. The data are aggregated on that variable and then matched to values in the lookup table (exactly as geographic variables are matched), and the resulting layer is included in the geoset.

The lookup file can be any table in the MapInfo format to which data could be bound. The layer constructed by LOOKUP contains points only for points present in the data, not for all points that might be present in the lookup file. Therefore, the LOOKUP subcommand can be useful whenever you want to create a layer containing just the points of interest to you—a selection of cities, perhaps, instead of all of the cities in a geoset layer.

Example

```
MAPS
  /LOOKUP = VAR(zip) 'C:\\Program Files\spss10\Maps\ZIPCODE.TAB'
  /GSET = 'United States'
  /SYMBOLMAP= VAR(sales) SUM=(SUM).
```

- The SPSS data file contains the zip codes in the variable *ZIP*.
- The file *ZIPCODE.TAB* contains zip codes and the *x/y* coordinates of their centroids.
- A new layer containing the coordinates of each zip code in the SPSS data file is added to the geoset.

- The total (sum) of sales to each zip code will be represented in the size of a symbol at each of the *x/y* points. If multiple cases have the same zip code, they will be summed to give the total sales per zip code.

GSET Subcommand

The required GSET subcommand names the geoset that supplies the boundaries, points, and other geographic features for the map. The filename refers to a file with a *.GST* extension that includes references to the various tables that make up the geoset.

LAYER Keyword

By default, the Maps procedure searches all of the registered tables in the geoset to find one whose values match the values of your geographic variable. It is possible for more than one table in the geoset to contain matching values. You might, for example, have a layer of major cities and another layer of capital cities, with a good deal of duplication between them. The optional LAYER keyword on the GSET subcommand allows you to specify a particular layer in the geoset to which you want your geographic variable to be bound. To find the names of all the layers in a geoset, run the Geoset Manager, which is available from the SPSS for Windows software group on the Start menu.

SHOWLABEL Subcommand

The SHOWLABEL subcommand allows you to specify whether labels are displayed on your map for the layer that matches your geographic variable.

AS_IS *Displays or hides the labels depending on the setting within the geoset.* This is the default.

NO *Hides the labels.*

YES *Displays the labels.*

TITLE Subcommand

The TITLE subcommand specifies a title for the map. The default title is the name of the geoset.

- The title is limited to a single line.
- Enter the title enclosed in quotation marks or apostrophes.
- Title attributes (font, size, color) can be changed through editing in the Viewer but cannot be set through command syntax.

GVMISMATCH Subcommand

When a data value in your geographic variable does not match a value in the layer to which it is being bound, a mismatch occurs and a warning is written to a mismatch table in the Viewer. GVMISMATCH allows you to specify the maximum number of mismatches that will be reported. The existence of a value in the geoset that is not in the SPSS data does not constitute a mismatch. If, for example, you do not have data for one of the countries shown on your map, that country will simply appear without a theme in the color and pattern established for it in the geoset.

Example

```
MAPS
  /GVAR = VAR(city)
  /GSET = 'United States' LAYER = 'US Cities'
  /GVMISMATCH MAX = 50
  /IVMAP= VAR(SALESREP) SUM=(MODE).
```

- This map identifies each city with the sales representative who appears most often on the records for that city.
- The GVMISMATCH subcommand allows up to 50 mismatches to be reported in a warning table.
- Sales to cities not included in the U.S. Cities layer of the geoset will not be shown on the map.

ROVMAP Subcommand

A range of values map divides the values of a variable into a set of ranges and assigns each geographic unit to one of the ranges. On the map, the ranges are represented as gradations between a color representing the lowest range and another color representing the highest range. Data are first aggregated so that each geographic unit is represented by one case, and then ranges are determined and cases are assigned to ranges.

VAR(varname)	*The variable whose ranges are shown on the map.* $COUNT can be used instead of VAR(varname) to produce ranges based on the count of cases within each geographic unit. This specification is required.
(SUM=function)	*The aggregation to be performed on the specified variable before ranges are determined.* Not required if the variable is $COUNT.
DISTRIBUTION	*The method used to distribute cases into ranges.* Five methods are available: EQSIZE divides cases into ranges of approximately equal size. EQCOUNT puts approximately the same number of cases in each range. NATBREAK uses an algorithm to distribute data evenly among ranges based on the average of each range. Values in each range are close to the average for that range. SD uses the standard deviation. The middle range breaks at the mean of the data values. The ranges above and below the middle are one

standard deviation above or below the mean.

CUSTOM allows you to specify your own ranges with the XRANGE keyword.

XRANGE=(n,n)   *For custom ranges, specify XRANGE once for each range.* Ranges may not overlap. Optionally, you can specify a name for each range, as in XRANGE=(13,19) 'Teenagers'.

ALLOWEMPTY   *Whether empty ranges should be allowed.* The specifications are YES and NO, with NO being the default for all distribution methods except CUSTOM. With custom ranges, this specification is ignored.

NUMRANGES=n   *The number of ranges to create.* Ignored if the distribution method is SD or CUSTOM, or if the number and distribution of cases is too small to produce the requested number of ranges.

LEGENDTITLE   *The title for the legend.* (DEFAULT) explicitly requests the default, which is the label of the variable whose ranges are shown, or blank if counts are shown.

VISIBLE   *Determines whether the theme is visible when the map is initially drawn.* The default is YES. The alternative, NO, is useful on multiple-theme maps where you intend to experiment with which themes to show.

Example

```
MAPS
  /GVAR = VAR(country)
  /GSET = 'World Countries' LAYER='World'
  /TITLE = 'Population Increase'
  /ROVMAP = VAR(pop_incr) SUM=(MEAN)
   DISTRIBUTION = SD LEGENDTITLE = ''.
```

- This command generates a map showing the various ranges of population increase in the countries of the world.

- The SPSS data file contains only one record per country, so no real aggregation takes place. MEAN simply yields the one value per value of *COUNTRY*.

- The distribution method is SD, so that ranges of population growth will be one standard deviation wide, with the middle range breaking at the mean.

SYMBOLMAP Subcommand

A graduated symbol map places a symbol on or within each region. The size of the symbol is proportional to the value of a summary function calculated on a single variable within each region.

VAR(varname)   *The variable whose values determine the symbol size for each region.* $COUNT can be used instead of VAR(varname) to produce symbols based on the count of cases within each geographic unit. This specification is required.

(SUM=function)	*The aggregation to be performed on the specified variable to produce the values represented by the symbol sizes.* Not required if the variable is $COUNT.
LEGENDTITLE	*The title for the legend.* (DEFAULT) explicitly requests the default, which is the label of the variable represented by the symbols, or blank if counts are shown.
VISIBLE	*Determines whether the theme is visible when the map is initially drawn.* The default is YES. The alternative, NO, is useful on multiple-theme maps where you intend to experiment with which themes to show.

Example

```
MAPS
  /GVAR = VAR(country)
  /GSET = 'World Countries' LAYER='World'
  /SYMBOLMAP= VAR(gdp_cap)
   SUM=(MEAN).
```

- This command produces a map in which a symbol within each country is proportional to that country's gross domestic product.
- Because the data contain only one record per country, the MEAN summary function simply yields the value for each country.

DOTMAP Subcommand

A dot density map places within each region a number of dots proportional to the value of a summary function calculated on a single variable within each region. Because the dots must be spread across a region, the geographic variable used in a dot density map must correspond to a layer that contains area boundaries. Dots are distributed randomly within each region.

VAR(varname)	*The variable whose values determine the density of dots for each region.* $COUNT can be used instead of VAR(varname) to produce dot densities based on the count of cases within each geographic unit. This specification is required.
(SUM=function)	*The aggregation to be performed on the specified variable to produce the values represented by the dot density.* Not required if the variable is $COUNT.
VALUE1DOT=n	*The data value represented by one dot.* The specification can be any positive number, including decimal values less than 1.
LEGENDTITLE	*The title for the legend.* (DEFAULT) explicitly requests the default, which is the label of the variable represented by the dots, or blank if counts are shown.
VISIBLE	*Determines whether the theme is visible when the map is initially drawn.* The default is YES. The alternative, NO, is useful on multiple-theme maps where you intend to experiment with which themes to show.

Example

```
MAPS
  /GVAR = VAR(fromctry)
  /GSET = 'World Countries' LAYER='World'
  /TITLE = 'Total Messages Per Country'
  /DOTMAP= $COUNT.
```

- This command creates a map that uses dot densities within the borders of each country to show the number of e-mail messages received from that country.

- The data for this example are records of individual e-mail messages.

- The geographic variable is the country from which each message originated.

- The $COUNT stand-in variable requests that the messages be counted for each country.

IVMAP Subcommand

An individual values map uses color and/or pattern differences to indicate the value each region has on a single variable.

VAR(varname)	*The variable whose values determine the color and/or pattern for each region.* This specification is required.
(SUM=function)	*The aggregation to be performed on the specified variable to produce the values represented by the individual colors.* Required even if the data contain only one record per region (in which case you can use any of the functions that return the single value, such as MEAN or MODE). From the dialog boxes, only MODE is available. Not required if the variable is $COUNT.
LEGENDTITLE	*The title for the legend.* (DEFAULT) explicitly requests the default, which is the label of the variable whose values are shown.
VISIBLE	*Determines whether the theme is visible when the map is initially drawn.* The default is YES. The alternative, NO, is useful on multiple-theme maps where you intend to experiment with which themes to show.

Example

```
MAPS
  /GVAR = VAR(country)
  /GSET = 'World Countries' LAYER='World'
  /IVMAP= VAR(climate) SUM=(MODE).
```

- This command produces a map in which each country is colored to indicate its predominant climate.

- The legend contains the value labels for *CLIMATE*.

- The MODE function produces the most frequently occurring value for each country. Because this data file contains only one record for each country, that value is obtained and shown.

BARMAP Subcommand

A bar chart map can display bars for multiple variables or for categories determined by a BY variable.

VAR(v1) VAR(v2) ...	*Variables for individual bars.* You can list up to six scale variables in the form VAR(varname) VAR(varname) .... The data are aggregated within the values of the geographic variable; each bar represents all of the cases within each region. See VAR(v1) BY VAR(v2) for the alternative. You can also use $COUNT, but that must be the only variable.
VAR(v1) BY VAR(v2)	*V1 is the variable to be summarized within the bars; you can use $COUNT instead of VAR(v1). V1 must be numeric. The values of v2* divide the data into separate bars. *V2* can be numeric or string and should have no more than 10 distinct values.
(SUM=function)	*The aggregation to be performed on the specified variable to produce the values represented by the bars.* Not required if the variable is $COUNT.
HEIGHT	*The height for the bar that represents the largest value encountered in the data.* The default is 0.25 inches (0.64 cm.).
INDSCALE	*When set to YES, each bar is scaled independent of the other bars so that bar heights can be compared between regions but not between bars in a single chart.* This is useful for showing variables measured on different scales, such as population and revenue. The default is NO so that all bars on the map use the same scale.
LEGENDTITLE	*The title for the legend.* (DEFAULT) explicitly requests the default, which is blank if more than one variable is represented in the bars or if counts are shown and otherwise is the name of the variable whose values determine the heights of the bars.
VISIBLE	*Determines whether the theme is visible when the map is initially drawn.* The default is YES. The alternative, NO, is useful on multiple-theme maps where you intend to experiment with which themes to show.

Example

```
MAPS
  /GVAR = VAR(state)
  /GSET = 'United States'
  /TITLE = 'Sales by Size of Customer'
  /BARMAP= $COUNT BY VAR(cosize3).
```

- This command produces a map of the United States with a bar chart in each state indicating the number (count) of individual sales made to small, medium, and large customers within each state.
- The data are records of individual sales.

Example

```
MAPS
  /GVAR = VAR(country)
  /GSET = 'World Countries' LAYER='World'
  /TITLE = 'World Literacy Rates'
  /BARMAP= VAR(lit_fema) VAR(lit_male)
   SUM=(MEAN) INDSCALE=NO.
```

- This command creates a world map and places a bar chart on each country showing the female and male literacy rates.

- Because the data contain only one record per country, the MEAN summary function yields that value for each country.

- INDSCALE=NO is the default, included here for illustration. Because the same scale is used for both variables, the bar heights allow you to compare relative female and male literacy rates within each country. If it were YES, then both female and male literacy rates would be relative to that in other countries but independent of each other.

PIEMAP Subcommand

VAR(v1) BY VAR(v2)	*V1 is the variable to be summarized within each pie; you can use $COUNT instead of VAR(v1). V1* must be numeric. The values of *v2* divide the pie into slices. *V2* can be numeric or string and should have no more than 10 distinct values. Both variables are required.
(SUM=function)	*The aggregation to be performed on* V1 *to produce the values represented by the slices in each pie.* Not required if the variable is $COUNT.
DIAMETER	*The diameter of each pie.* If GRADUATED=ON, this is the diameter of the largest pie. The default is 0.25 inches (0.64 cm.).
GRADUATED	*When GRADUATED=YES, the diameters of pies within the map are scaled according to the total value represented by the whole pie, enabling comparisons between regions.* The default is YES.
LEGENDTITLE	*The title for the legend.* (DEFAULT) explicitly requests the default, which is the label of the variable that determines the size of the slices (*V1* in the description), or blank if counts are shown.
VISIBLE	*Determines whether the theme is visible when the map is initially drawn.* The default is YES. The alternative, NO, is useful on multiple-theme maps where you intend to experiment with which themes to show.

MAPS

Example

```
MAPS
  /GVAR = VAR(state)
  /GSET = 'United States'
  /TITLE = 'Sales by Customer Type'
  /PIEMAP= VAR(sale_prd) BY VAR(industry)
   SUM=(SUM)
   GRADUATED = YES
   LEGENDTITLE = ''.
```

- This command produces a map of the United States with a pie chart in each state indicating the sum of product sales by customer type (industry).

- Because GRADUATED=YES, the pies are scaled so that their diameters are proportional to the total sales for each state relative to that of the other states.

- The null legend title prevents the variable label for *INDUSTRY* from being printed there, since the title is used to give that information.

Summary Functions

The following functions are available for any map theme. Some may be inappropriate, such as means and standard deviations in pie charts or individual values charts, and are not available through the graphical user interface, but you are not prevented from using them in the command language. To obtain counts, use $COUNT in place of VAR(varname) as indicated in the sections on theme subcommands.

First Values. The value found in the first case for each category in the data file at the time the summary function was assigned.

Last Values. The value found in the last case for each category in the data file that created it.

Maximum Values. The largest value within each category.

Means. The arithmetic average for each category.

Medians. The value below which half of the cases fall in each category. If there is an even number of cases, the median is the average of the two middle cases when they are sorted in ascending or descending order.

Minimum Values. The smallest value within each category.

Modes. The most frequently occurring value within each category. If multiple modes exist, the smallest value is used.

Number of Cases Above (N of Cases >). The number of cases having values above the specified value.

Number of Cases Between (N Between). The number of cases between two specified values.

Number of Cases Equal to (N of Cases =). The number of cases equal to the specified value.

Number of Cases Greater Than or Equal to (N of Cases >=). The number of cases having values above or equal to the specified value.

Number of Cases Less Than (N of Cases <). The number of cases below the specified value.

Number of Cases Less Than or Equal to (N of Cases <=). The number of cases below or equal to the specified value.

Standard Deviations (SD). A measure of dispersion around the mean, expressed in the same unit of measurement as the observations, equal to the square root of the variance. In a normal distribution, 68% of cases fall within one standard deviation of the mean and 95% of cases fall within two standard deviations.

Sums. The sums of the values within each category.

Variances. A measure of how much observations vary from the mean, expressed in squared units.

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