

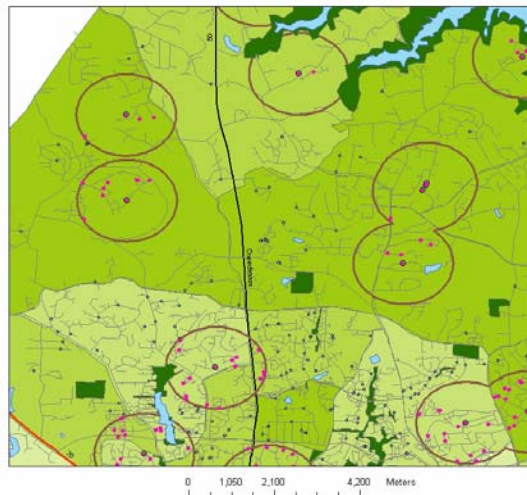
SAS Mapping: Technologies, Techniques, Tips and Tricks

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Every organization has location based data. The difficulty is in choosing the right technology and tool to effectively transform that data into useful information or intelligence. The Business Intelligence component of the SAS Intelligence Value Chain contains 3 powerful mapping technologies that can be used to transform your data: SAS Bridge for ESRI, SAS/GIS and SAS/GRAPH mapping. This handout should make you aware of these technologies and provide you with the resources to help you further understand and explore them.

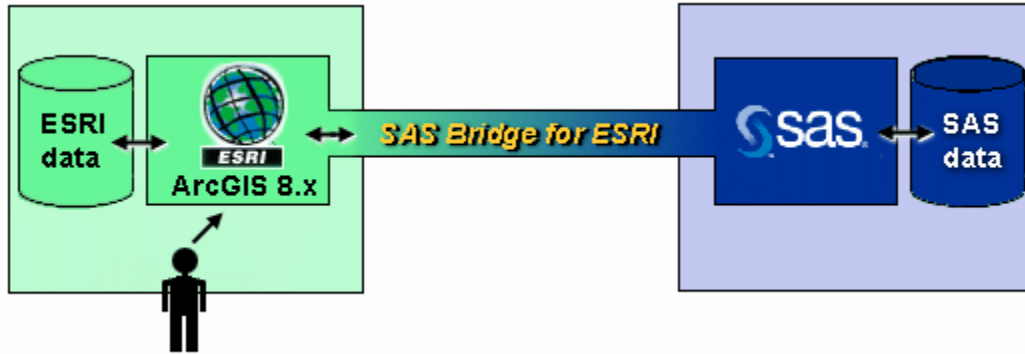
SAS Bridge for ESRI

The SAS Bridge for ESRI adds the powerful analytic and business intelligence capabilities of SAS to the ESRI ArcGIS geographic information system.



This product allows users to combine the full power of ArcGIS with the power of SAS by providing the following functionality:

- Read SAS Datasets
- Export SAS Datasets
- View Metadata for SAS Datasets
- Run SAS Programs (Stored Processes).



Resources for further information:

Product information and help files:

<http://www.sas.com/products/bridgeforesri/index.html>

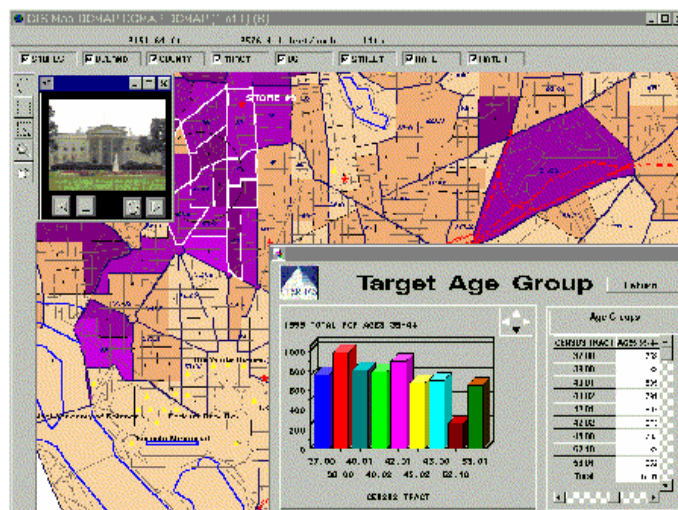
<http://support.sas.com/rnd/datavisualization/BridgeForESRI/V1/>

Conference resources:

Demo area.

SAS/GIS

SAS/GIS software provides an interactive Geographic Information System (GIS) within the SAS System.



SAS/GIS software provides a variety of tools, features, and capabilities that are specific to the business geographics market and can be used to build powerful decision support systems, including:

- direct link to the full breadth of SAS System software
- thematic mapping (color-coding) tools
- multi-layer maps to display streets, ZIP code boundaries, census boundaries, landmarks, or any other point, line or area layer
- geocoding (address matching) down to street level locations
- map customization tools, including labels, legends, symbols and more
- map importing tools supporting a variety of data sources
- map printing tools and support for a wide variety of graphical output formats

Much of the functionality available interactively through the graphical user interface can also be accessed in batch with the GIS Procedure. PROC GIS also uses the SAS Output Delivery System (ODS) to generate html pages containing clickable gif images of maps created with SAS/GIS.

Resources for further information:

Product Information, web examples, FAQs:

<http://www.sas.com/products/gis/index.html>

<http://support.sas.com/download>

<http://support.sas.com>

Look for SAS/GIS in the SAS Online Help.

Conference resources:

Demo Area.

SAS/GRAPH Mapping

The SAS/Graph mapping functionality allows you to create choropleth, prism, block and surface maps. This includes the GMAP, GREMOVE, GREDUCE, GPROJECT and MAPIMPORT procedures. Three key techniques are highlighted to deliver powerful SAS/GRAPH maps: Map Data, Annotate and the Output Delivery System (ODS).

Twelve map examples will be examined that uses these techniques.

Map Data

As you will see in the examples, having the right map data is the key to transforming your data into useful information. The following items will aid you in creating and manipulating your map data.

- Proc Mapimport.

This proc allows you to import ESRI Shapefile data into a SAS Map dataset.

Syntax:

```
PROC MAPIMPORT OUT= traditional-map-data-set
                DATAFILE= 'path-to-shapefile'
                <CONTENTS>
                <CREATE_ID_>;
                <SELECT <'>field-identifier-1<'><...<'>field-identifier-n<'>>>;
                <EXCLUDE <'>field-identifier-1<'><...<'>field-identifier-n<'>>>;
                <RENAME <'>field-identifier-1<'>=SAS-variable-name-1<...
                <'>field-identifier-n<'>=SAS-variable-name-n>>;
```

```
PROC MAPIMPORT OUT=sasuser.newmap DATAFILE='e:\nc.shp'; run;
```

See the SAS 9.0 Online Help for additional information.

- Maps OnLine website

SAS Maps Online shows maps for various regions throughout the world. These maps make it easy to locate and identify world regions by each of the following categories: world maps, continents, countries, and maps of political groups.

This site continues to evolve and grow, so check it periodically for changes.

See <http://www.sas.com/maponline>

- Procs GREduce, GREmove, and GPROJECT.

These PROCs are for reducing the number of points, removing shared line segments and projecting spherical coordinates into Cartesian coordinates for your map data.

See SAS Online Help for additional information.

Annotate

The Annotate facility enables you to generate a special dataset of graphics commands from which you can create graphics output. The annotate output can be combined with PROC GMAP output to create custom maps that reflect your needs.

The annotate facility is documented in the SAS/Graph documentation. You can either create your data manually or use the annotate macros to aid in the creation and manipulation of your data.

Two new macros were added in SAS 9.0 and are available for users to download with earlier versions:

CENTROID – For a map, it creates a new dataset with the centroid of each polygon.
`%CENTROID (input-data-set, output-data-set, list-of-id-variables);`

- input-data-set* - specifies a map data set.
- output-data-set* - contains the id variables and the X and Y variables.
- list-of-id-variables* - specifies the variables each of which is to be assigned the centroid coordinates of each observation in the input-data-set. There will be one observation for each unique set of ID values

MAPLABEL – Creates a new annotate dataset with a label at the centroid.

`%MAPLABEL(map-dataset, attr-dataset, output-dataset, label-var, id-list, font=font_name, color=n, size=n, hsys=n);`

- map-dataset* - the name of the map to be annotated.
- attr-dataset* - the name of the dataset containing the text to be shown on each ID value.
- output-dataset* - the name of the annotate data set created by the macro.
- label-var* - the name of the label variable to place on the map (the text for annotate).
- id-list* - the list of ID vars that you would issue in PROC GMAP to create the map. These values need to be on both the map and the attribute data sets. If you also supply the SEGMENT variable, then every polygon will get a value. Without the SEGMENT variable, only one label per ID set will be shown over the collection of polygons. For instance, Hawaii with SEGMENT gets a label on each island, whereas without SEGMENT, there is only one label centered on the entire set of islands.
- font* - specifies a font name for the [STYLE Variable \(Fonts\)](#) variable.
- color* - specifies a value for the [COLOR Variable](#) variable.
- size* - specifies a value for the [SIZE Variable](#) variable. Defaults to 2.
- hsys* - specifies a value for the [HSYS Variable](#) variable. Defaults to 3.

These are available for download at:

<http://ftp.sas.com/techsup/download/public/graph>

See SAS Online Help for additional information on Annotate.

Output Delivery System (ODS)

The Output Delivery System gives you greater flexibility in generating SAS/GRAPH output with a wide range of formatting options. This handout will focus on some very basic features to give you a feel for what is possible with ODS. We will focus on basic ODS HTML statements, graphics styles and graphics output devices.

- Basic ODS Syntax:

Statements used in the examples:

```

GOPTIONS DEVICE=gif;           /*specify the device to use*/
ODS LISTING CLOSE;            /*Close in case of back to back programs*/
ODS HTML PATH="c:\mydir"      /*Directory path for the output file*/
    BODY="graph.html"         /*HTML file being created */
    STYLE=banker;             /*Use the BANKER graph style*/
... PROC GMAP statements...
ODS HTML CLOSE;              /*Close the output files*/
ODS LISTING;

```

See the SAS Online Help for complete details on ODS.

- Devices

Different devices can impact the look of your maps. We will focus on 6 devices: GIF, METAJAVA, JAVA, JAVAIMG, ACTIVEX, ACTXIMG.

GIF and Metajava produce output that looks like the default output in SAS. The remaining devices produce newer style output and have some newer features available. Styles are an example of a feature that is only available on the client devices. JAVA and ACTIVEX create interactive graphs that run the Java applet or ActiveX control to view the graph. JAVAIMG and ACTXIMG create a static image of the graph through JAVA or ACTIVEX and can also be used with ODS RTF and ODS PDF output.

- Styles

Graphics styles are only available on the newer devices. A style combines map colors, background colors, images and fonts into a package along a particular theme and provides a consistent look for your entire ODS output. There are currently 16 styles:

Analysis	Astronomy	Banker	Blockprint
Curve	Education	Electronics	Gears
Magnify	Money	RSVP	Science
Sketch	Statistical	Torn	Watercolor

Resources for additional information:

<http://www.sas.com/technologies/bi/visualization/index.html> - product information

<http://support.sas.com/usergroups/sugi/proceedings/index.html> - SUGI Proceedings.

<http://support.sas.com/download> - download examples

<http://www.sas.com/mapsonline> – MapsOnLine website.

<http://support.sas.com> - Support web site (FAQs, Examples, more)

<http://support.sas.com/techsup/ftp/download.html>

<http://ftp.sas.com/techsup/download/public/graph> - New annotate Macros.

<http://support.sas.com/techsup/ftp/download.html> - Tech Support examples.

See SAS Online Help.

Download Examples in this presentation:

ftp://ftp.sas.com/pub/sugi28/sasmapping_src.zip

Conference Resources:

Demo area.

Example maps

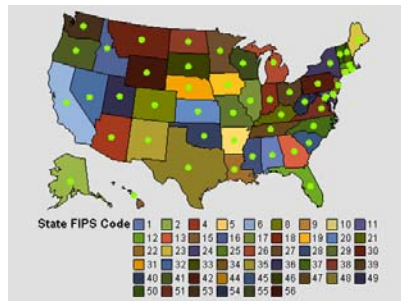
We will examine 2 sets of example maps. The first group will demonstrate new ways to think about and develop standard geographic maps and will demonstrate the features previously covered. The second group will help you think about location based data in a new way and will demonstrate some 'non-geographic' maps.

The programs are available for download from:

ftp://ftp.sas.com/pub/sugi28/sasmapping_src.zip

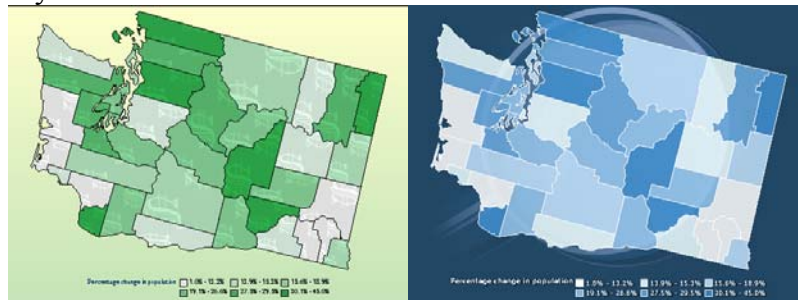
Geographic maps.

- Macro



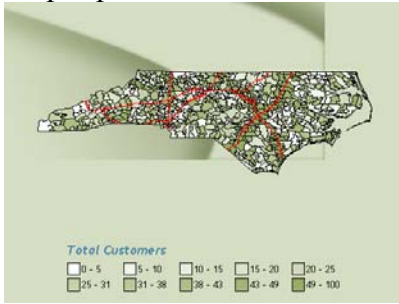
Demonstrates how to use the new centroid and maplabel macros.

- Styles



Illustrates the use of several different ODS Graph styles.

- Mapimport

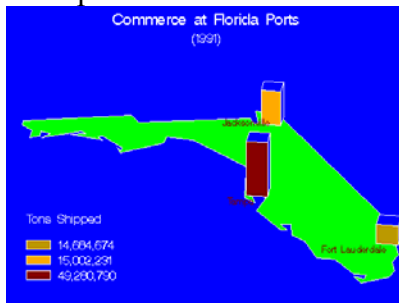


Demonstrates the use of Proc MAPIMPORT to read 2 shapefile datasets and create a map dataset and annotate dataset.

This program:

- 1) Imports 2 shapefiles and creates 2 datasets: NC zipcode dataset and NC highways dataset.
- 2) Processes the Highway dataset into an annotate dataset with only Interstates.
- 3) Reduces the density of the map data with GREduce.
- 4) Displays a map with Customers per zipcode area and Interstates annotated on the map.

- Multiplebar



Demonstrates how to create multiple bars on a state and label the bars.

This program:

- 1) Reads the uscities database and extracts the 3 Florida cities that we are interested in. It then creates a tiny triangle at the location of each city.
- 2) Extracts Florida from the US map. The map of triangles is then merged in. This makes each city a tiny 'state' within the state.
- 3) Gets the response data (Tons Shipped) for the cities.
- 4) Creates an annotate dataset for the labels using coordinate system 3. Note that the label location will vary between different devices with this coordinate system.
- 5) Displays the block map of Florida and annotated labels.

- US Divisions

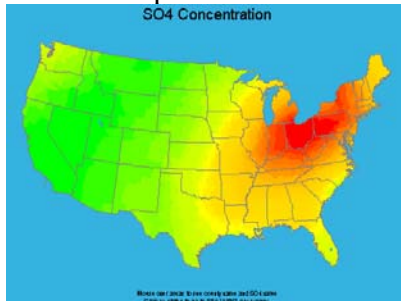


Demonstrates how to modify the map data to divide the map into regions.

This Program:

- 1) Creates a new map dataset that assigns states to divisions and divisions to regions.
- 2) Modifies the map data by creating a gap between regions by offsetting the data and moving Alaska and Hawaii.
- 3) Creates Mouse over/drill down.
- 4) Creates Annotate data for labeling states, divisions and regions.
- 5) Creates annotate data for legend.
- 6) Creates annotate data for darker division lines.
- 7) Combines all annotate data.
- 8) Displays map.
- 9) Creates Drill down tables.

- Weathermap

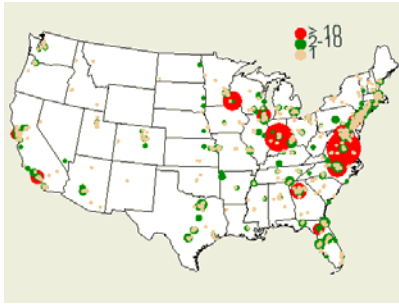


Demonstrates how to create a 'weathermap' looking map.

This program:

- 1) Reads county response data and adds chart tips and drill down.
- 2) Reads the US Counties map and
 - a) Removes all county boundaries and
 - b) Creates an annotate dataset with the State boundaries.
- 3) Displays the map and adds the annotated state boundaries.

- Sizeddots

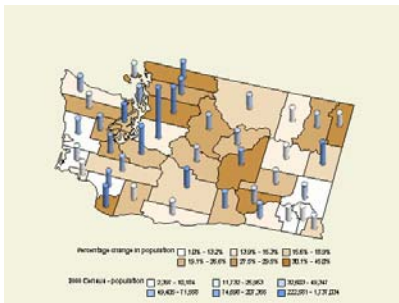


Demonstrates how to use annotate to create multiple size and color markers to represent your data.

This program:

- 1) Extracts the zipcode data from your response data.
- 2) Creates a dataset of unique zipcodes with a count people at that zipcode.
- 3) Adds the X/Y coordinates of each City in the zipcode (using sashelp.zipcode).
- 4) Creates an annotate dataset of dots of different sizes and colors based on count.
- 5) Sorts smaller dots on top.
- 6) Reduces the map size with GREduce.
- 7) Removes Alaska and Hawaii.
- 8) Creates a 'fake' legend.
- 9) Displays the map and annotated dots.

- TwoValues



Illustrates how to represent 2 values on a map with the choro color and markers. This program will only work with Java, javaimg, activex and actximg devices.

This program:

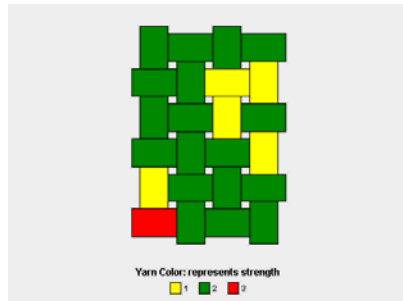
- 1) Reads the response data (Census data).
- 2) Merges county names into the response data.
- 3) Displays a block map using block= and area=.

```
Proc gmap ...;
...
block pop00 / shape=cylinder
area=pctchg ... ;
```

Non-Geographic maps: Thinking outside the ‘country’.

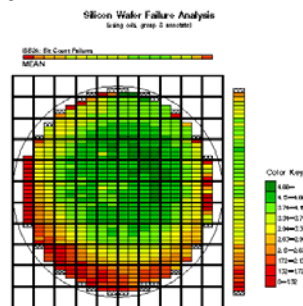
Not all location data is located in a state or country map. You could be dealing with the location inside a building, the location of a part on a piece of equipment, or other similar locations.

- Weave



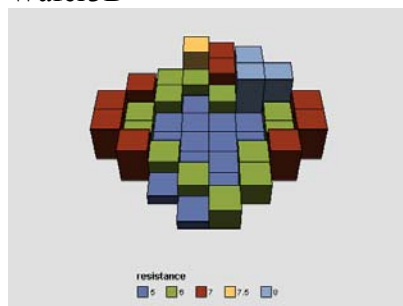
This illustrates how the location might be the location of yarn in a weave in a piece of fabric. You might be concerned with quality control issues such as the thickness of the yarn. You don't want it too thick or too thin.

- Wafer



The location of failure rates on a semiconductor wafer is another example of non-geographic location data.

- Wafer3D



You may also want to examine your Wafer failure rates interactively and in 3D by using java or ActiveX.

- Calendar



In this example, your location data is the placement in the calendar.

Summary of Resources:

Presentation handout:

ftp://ftp.sas.com/pub/sugi28/sasmapping_notes.zip

SAS Bridge for ESRI

Product information and help files:

<http://www.sas.com/products/bridgeforesri/index.html>

<http://support.sas.com/rnd/datavisualization/BridgeForESRI/V1/>

Conference resources:

Demo Area.

SAS/GIS

Product Information, web examples, FAQs:

<http://www.sas.com/products/gis/index.html>

<http://support.sas.com/download>

<http://support.sas.com>

Look for SAS/GIS in the SAS Online Help.

Conference resources:

Demo Area.

SAS/GRAPH Mapping

Product information, downloads, FAQs:

- <http://www.sas.com/technologies/bi/visualization/index.html> - product information
- <http://support.sas.com/usergroups/sugi/proceedings/index.html> - SUGI Proceedings.
- <http://support.sas.com/download> - download examples
- <http://www.sas.com/maponline> – MapsOnLine website.
- <http://support.sas.com> - Support web site (FAQs, Examples, more)
- <http://support.sas.com/techsup/ftp/download.html>
- <http://ftp.sas.com/techsup/download/public/graph> - New annotate Macros.
- <http://support.sas.com/techsup/ftp/download.html> - Tech Support examples.

See SAS Online Help.

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ftp://ftp.sas.com/pub/sugi28/sasmapping_src.zip

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Demo area.

Suggestions and comments to: mapping@sas.com

Tech Support suggestions to: Suggestion@sas.com