

Mapping without GMAP

An Innovative Use of the SAS/Graph Annotate Facility

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When You Hear “Annotate Dataset”...

- ...do you think of things like
 - adding symbols to plots
 - adding a median line to a bar chart
 - adding labels to maps
- All are great uses of annotate datasets, but they can also be used “all by themselves”



The SAS/Graph Annotate Facility

- An “annotate” dataset contains commands that produce graphical output
- The dataset contains...
 - One observation for each command, i.e.,
 - move - draw - symbol
 - label - bar - image
 - Specific variables describing the command, i.e.,
 - x and y - Text - Position
 - Color - Style - Rotate

Annotate Macros

- Drawing a shape may take more than one command – for example,
 - Drawing a bar requires a “move” to one corner of the bar and a “bar” to draw to the other corner
- There are a number of SAS-supplied macros that simplify the process – for example,
 - %BAR will produce two observations, one for each command required
- To make the annotate macros accessible, you must execute the following
%ANNOMAC

Viewing Annotate Output

The GSLIDE Procedure

- Very often annotate datasets are used with SAS/Graph procedures that produce output - for example,
 - Adding labels to points in GPLOT
- The GSLIDE procedure produces no output of its own, but will display the output defined in an annotate dataset

```
proc gslide anno=AnnoData;  
run;  
quit;
```



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The WebTB Project

- A project funded by the CDC to provide web-based tracking and reporting of tuberculosis cases in the South Pacific islands
 - American Samoa
 - Commonwealth of the Northern Marinas Islands
 - Federated States of Micronesia
 - Guam
 - Republic of the Marshall Islands
 - Republic of Palau
- Some of these territories have additional geographies – for example,
 - Micronesia: Yap, Chuuk, Pohnpei, Kosrae



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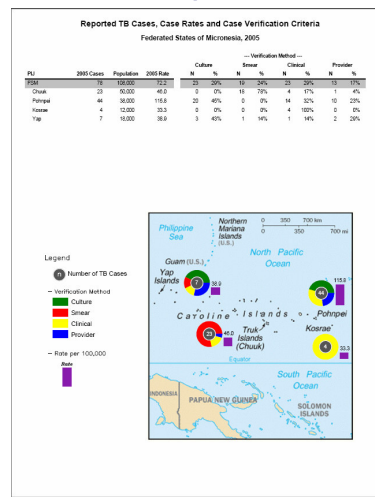
The WebTB Website

- The project web site allows users to enter data on TB cases
- It also allows for reporting on those cases
 - Demographic reports
 - Case verification reports
 - Maps!
- On the web site, the map reports allow the user to select parameters for the report
 - Geography
 - Year of reporting
 - Analysis variable, including
 - Case verification method
 - Race
 - Gender

Case Verification Method Map Report

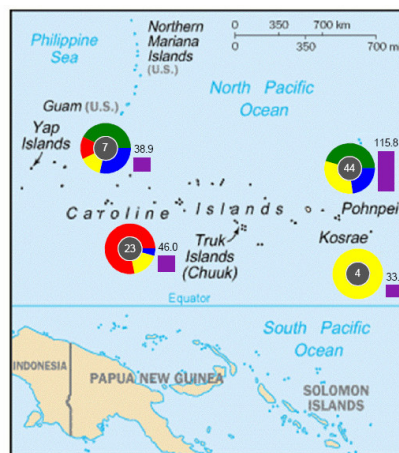
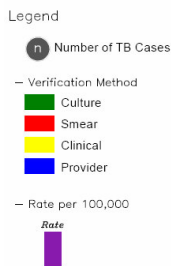
- A report that contains a table and a map
- Our sample shows verification method for cases in Micronesia
- The background map is a “user-friendly” map, with common features labeled
- Set of graphics for each region
 - Donut chart
 - slices for each method
 - donut center contains number of cases
 - Bar chart
 - rate per 100,000

– Legend



Creating the Map

- All the graphics on the page are created with annotate datasets
 - Map
 - Pie chart
 - Donut center
 - Bar chart
 - Legend
- All are created with annotate macros
 - Except for placing the map image
- Placed on the page with PROC GSLIDE
 - No other SAS/Graph procedures used



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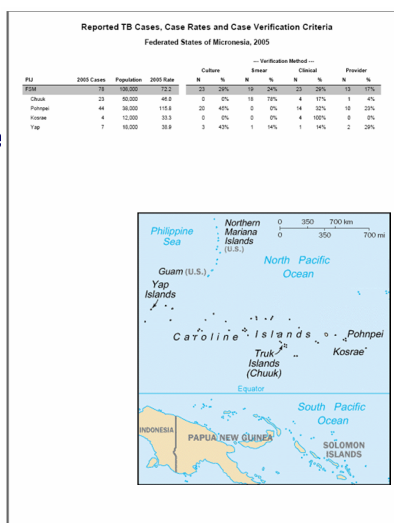
Placing the Map on the Page

- The map image is the only graphic item on the page for which annotate macros were not used
- It takes two commands to place the map
 - MOVE sets the x,y of the lower left corner
 - IMAGE sets the x,y of the upper right and gives the name of the image file

```
x=10; y=0; function='move'; output;
```

```
x=60; y=45; imgpath="c:\images\fsm.gif";  
style='fit'; function='image'; output;
```

- We'll see later the GOPTIONS needed to place the map where it is



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The Analysis Dataset

- The analysis dataset contains annual data which is summarized to one observation per region (CityDetail) per verification method (VerCrit)
 - Here, the Yap Islands are city "14"
 - There were cases for 4 verification methods
 - There were 7 total cases
 - The percentages add to 1 for each region

	CityDetail	vercrit	Cases	Pct
32	11	2	18	0.7826086957
33	11	3	4	0.1739130435
34	11	4	1	0.0434782609
35	12	1	20	0.4545454545
36	12	3	14	0.3181818182
37	12	4	10	0.2272727273
38	13	3	4	1
39	14	1	3	0.4285714286
40	14	2	1	0.1428571429
41	14	3	1	0.1428571429
42	14	4	2	0.2857142857



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Creating the Pie Chart

An Annotate Macro Example - %SLICE

- The %SLICE macro draws a pie slice, using the following parameters:
 - x,y coordinates of the center of the pie
 - starting position of the arc, in degrees (0 is at 3:00)
 - sweep of the arc, in degrees
 - radius of the circle
 - other parameters indicating color, fill and line style



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Creating the Pie Chart Using the %SLICE Macro

- We create a pie for each region (remember the percentages add to 1)
 - Start position begins at 0 for each region
 - Each verification method is assigned a color (for example, method 1 is green)
 - The arc is 360*percent of cases
 - For Yap, method 1: $360 \times .4285 = 154.3$

```
%slice(22,31, 0, 154.3, 2.5, green, s, 3)
      x  y start sweep radius color fill line
```



Note: a %Slice call creates four observations in the dataset



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%Slice after %Slice Building the Whole Pie

- We've drawn the first slice...
 - `%slice(22,31,0,154.3,2.5,green,s,3)`
- The next will start where that one stopped
 - The start is the same as the previous sweep
- The same method is used for the next two slices

```
%slice(22,31,154.3,51.4,2.5,red,s,3)
```



```
%slice(22,31,205.7,51.4,2.5,yellow,s,3)
```



```
%slice(22,31,257.1,102.9,2.5,blue,s,3)
```



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Building the Pie from Code

- In the real program, all the pie building is based on values in the dataset – here's the code...

```

if first.CityDetail then StartPos = 0; ← Start at 0 for each city/region

Sweep = 360 * Pct; ← The sweep is based on the Pct of the current obs
Color = put(VerCrit,$PieColor.); ← Get the color of the current method

if Color eq 'green' then do;
  %slice(x,y,StartPos,Sweep,2.5,green,s,3); end;
if Color eq 'red' then do;
  %slice(x,y,StartPos,Sweep,2.5,red,s,3); end;
if Color eq 'yellow' then do;
  %slice(x,y,StartPos,Sweep,2.5,yellow,s,3); end;
if Color eq 'blue' then do;
  %slice(x,y,StartPos,Sweep,2.5,blue,s,3); end;

StartPos = StartPos + Sweep; ← Increment the StartPos by the Sweep
  
```

There is an x and y value attached to each observation (same value for all obs of the region)

The color parameter must be a constant - so there is a %SLICE call for each color



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Making a Pie into a Donut

- To make the pie chart into a donut, we just add another couple %SLICES
 - use a solid gray, 360 degree arc
 - same x,y center as the pie, half the radius

```
%slice(x,y,0,360,1.2,gray55,s);
```

- an empty white, 360 degree arc sets it off

```
%slice(x,y,0,360,1.2,white);
```

- Use the %LABEL macro to add the number of cases

```
%label(x,y,TotalCases,white,0,0,1,'Arial',5);
```



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Adding the Donut Code

- The code to prepare the pie slices executes for each observation
 - There is one observation per verification method
- The donut code only needs to be executed once per city/region

```
if last.CityDetail then
do;
  %slice(x,y,0,360,1.2,gray55,s);
  %slice(x,y,0,360,1.2,white);
  %label(x,y2>TotalCases,white,0,0,1,'Arial',5);
end;
```



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More Information on the Map

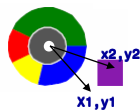
- We want to add a bar next to the donut chart that indicates the TB rate per 100,000 population
- The height of the bar is relative to the highest rate shown on the map
 - A macro variable has been created (&MaxRate) containing the maximum rate value
 - The highest bar will be 4 units tall



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Adding the Bar Chart

- The bar code is contained in the same block of code that creates the donut center, executed once per city/region



```
x1 = x + 3.5;  
x2 = x + 5.5;  
y1 = y - 2.5;
```

The corners of the bar are based on the same x,y as the donut. That way the position of both can be made by changing a single value

The top of the bar is based on the highest rate that will be displayed on the map. The tallest bar will be 4 units high.

```
y2 = round(4 * (Rate / &MaxRate),.01) + (y - 2.5);
```

```
%bar(x1,y1,x2,y2,Purple,1,s);
```

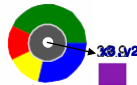
The %BAR macro will draw a solid purple bar



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Labeling the Bar Chart

- Like the bar itself, the label for the bar is based on the x,y of the donut



```
x3 = x + 4.5;
```

```
%label(x3,y2,RateText,black,0,0,1,'Arial',2);
```

Remember:

- the bar x1 and x2 were 3.5 and 5.5
- the y2 value is sets the height of the bar

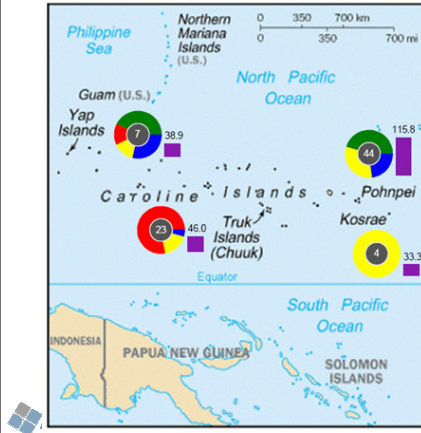
So, the label will be centered over the top of the bar



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Putting the Map Together

- The donut and the bar are created for each city/region on the map



```
data MapAnno;
set AnalysisBreakdown;
by CityDetail;

if _n_ eq 1 then
do;
  <put map on page>
end;

<build pie slices>

if last.CityDetail then
do;
  <add donut center>
  <build bar chart>
end;

run;
```

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Building the Legend

- The commands to build the legend for the map are in a separate annotate dataset
- The map report can be run for any number of analysis variables, so the portion that defines the pie slices is dynamic, built from a dataset
- There are also a number of “static” components to the legend, like the section headers and rate bar

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Creating the Legend

The Dynamic Portion

- The verification method labels are contained in a dataset used to create a format used in the report table

```
set AV_Format end=done;
```

```
if _n_ eq 1 then do;
  %bar(6,66,15,71,green,1,s);
  %label(17,69,Label,black,0,0,4,'Arial',6); end;
if _n_ eq 2 then do;
  %bar(6,59,15,64,red,1,s);
  %label(17,62,Label,black,0,0,4,'Arial',6); end;
if _n_ eq 3 then do;
  %bar(6,52,15,57,yellow,1,s);
  %label(17,55,Label,black,0,0,4,'Arial',6); end;
if _n_ eq 4 then do;
  %bar(6,45,15,50,blue,1,s);
  %label(17,48,Label,black,0,0,4,'Arial',6); end;
```

Legend

 Number of TB Cases

— Verification Method

 Culture

— Rate per 100,000

Rate



VIEWTABLE: Work.Av_format				
	FMTNAME	START	END	LABEL
1	VERMETHOD	1	1	Culture
2	VERMETHOD	2	2	Smear
3	VERMETHOD	3	3	Clinical
4	VERMETHOD	4	4	Provider

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Creating the Legend

A Dynamic Portion

- The verification method labels are contained in a dataset used to create a format used in the report table

```
set AV_Format end=done;
```

```
if _n_ eq 1 then do;
  %bar(6,66,15,71,green,1,s);
  %label(17,69,Label,black,0,0,4,'Arial',6); end;
if _n_ eq 2 then do;
  %bar(6,59,15,64,red,1,s);
  %label(17,62,Label,black,0,0,4,'Arial',6); end;
if _n_ eq 3 then do;
  %bar(6,52,15,57,yellow,1,s);
  %label(17,55,Label,black,0,0,4,'Arial',6); end;
if _n_ eq 4 then do;
  %bar(6,45,15,50,blue,1,s);
  %label(17,48,Label,black,0,0,4,'Arial',6); end;
```

Legend

 Number of TB Cases

— Verification Method

 Culture

 Smear

— Rate per 100,000

Rate



VIEWTABLE: Work.Av_format				
	FMTNAME	START	END	LABEL
1	VERMETHOD	1	1	Culture
2	VERMETHOD	2	2	Smear
3	VERMETHOD	3	3	Clinical
4	VERMETHOD	4	4	Provider

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Creating the Legend A Dynamic Portion

- The verification method labels are contained in a dataset used to create a format used in the report table

```
set AV_Format end=done;
```

```
if _n_ eq 1 then do;
  %bar(6,66,15,71,green,1,s);
  %label(17,69,Label,black,0,0,4,'Arial',6); end;
if _n_ eq 2 then do;
  %bar(6,59,15,64,red,1,s);
  %label(17,62,Label,black,0,0,4,'Arial',6); end;
if _n_ eq 3 then do;
  %bar(6,52,15,57,yellow,1,s);
  %label(17,55,Label,black,0,0,4,'Arial',6); end;
if _n_ eq 4 then do;
  %bar(6,45,15,50,blue,1,s);
  %label(17,48,Label,black,0,0,4,'Arial',6); end;
```

Legend

 Number of TB Cases

— Verification Method

 Culture
 Smear
 Clinical

— Rate per 100,000

 Rate

VIEWTABLE: Work.Av_format

	FMTNAME	START	END	LABEL
1	VERMETHOD	1	1	Culture
2	VERMETHOD	2	2	Smear
3	VERMETHOD	3	3	Clinical
4	VERMETHOD	4	4	Provider

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Creating the Legend A Dynamic Portion

- The verification method labels are contained in a dataset used to create a format used in the report table

```
set AV_Format end=done;
```

```
if _n_ eq 1 then do;
  %bar(6,66,15,71,green,1,s);
  %label(17,69,Label,black,0,0,4,'Arial',6); end;
if _n_ eq 2 then do;
  %bar(6,59,15,64,red,1,s);
  %label(17,62,Label,black,0,0,4,'Arial',6); end;
if _n_ eq 3 then do;
  %bar(6,52,15,57,yellow,1,s);
  %label(17,55,Label,black,0,0,4,'Arial',6); end;
if _n_ eq 4 then do;
  %bar(6,45,15,50,blue,1,s);
  %label(17,48,Label,black,0,0,4,'Arial',6); end;
```

Legend

 Number of TB Cases

— Verification Method

 Culture
 Smear
 Clinical
 Provider

— Rate per 100,000

 Rate

VIEWTABLE: Work.Av_format

	FMTNAME	START	END	LABEL
1	VERMETHOD	1	1	Culture
2	VERMETHOD	2	2	Smear
3	VERMETHOD	3	3	Clinical
4	VERMETHOD	4	4	Provider

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Creating the Legend A Static Portion

- The static portion of the legend is built after all the data has been read

```

if done then
do;
  %label(1,98,'Legend',black,0,0,5,'Arial/bold',6);
  %slice(10,86,0,360,5,gray55,s);
  %label(10,87.5,'n',white,0,0,5,'Arial/bold',5);
  %label(15,87.3,'Number of TB Cases',black,0,0,4,'Arial',6);
  %label(3,76,'- &AV_Name',black,0,0,4,'Arial',6);
  %label(3,y1,'- Rate per 100,000',black,0,0,4,'Arial',6);
  %label(14.5,y2,'Rate',black,0,0,3,italic,2);
  %bar(12,y3,17,y2,Purple,1,s);
end;

```

Note: the &AV_Name variable contains the label for the analysis variable (Verification Method, in this case)

Putting the Legend Together

- The legend is created for each value of the analysis variable (e.g., verification method)

Legend

Number of TB Cases

— Verification Method

Culture

Smear

Clinical

Provider

— Rate per 100,000

Rate

```

data LegendAnno;
  set AV_Format end=done;

  <build value-specific bars>;

  if done then
  do;
    <legend label>;
    <section labels>;
    <donut center>;
    <bar chart>;
  end;
run;

```

Putting it All Together

```
data MapAnno;
  <map commands>;
run;
```

```
data LegendAnno;
  <legend commands>;
run;
```

The two datasets are each placed on the page with separate PROC GSLIDES, in separate graphic regions.

```
goptions vorigin=1.0in vsize=6.0in
         horigin=2.0in hsize=6.0in;
```

```
proc gslide anno=MapAnno;
run; quit;
```

```
goptions vorigin=1.7in vsize=3.5in
         horigin=0.5in hsize=2.7in;
```

```
proc gslide anno=LegendAnno;
run; quit;
```

Reported TB Cases, Case Rates and Case Verification Criteria
Federated States of Micronesia, 2005

PU	2005 Cases	Population	2005 Rate	Verification Method						Provider	
				Culture		Smear		Clinical			
	N	%	N	%	N	%	N	%	N	%	
Total	5	100.00	252	2	25%	2	25%	1	11%		
Chuuk	23	92.00	45.2	0	0%	16	70%	4	17%	1	4%
Marshall	44	88.00	115.3	20	45%	0	0%	14	32%	10	23%
Yap	4	16.00	33.3	0	0%	0	0%	4	100%	0	0%
Yap	7	10.00	38.9	3	43%	1	14%	1	14%	2	29%

Conclusion

- Maps can be used to present more than just points or shaded areas
- Annotate datasets are a powerful tool that can be used to create charts, plots, graphs, etc.
- The annotate facility can be used for more than just enhancing other SAS/Graph output

Contact Information

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