

# Introduction to ODS Graphics for the Non-Statistician

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## ODS Graphics for the Non-Statistician

1.1 What is ODS Graphics?
1.2 Producing Non-Statistical Graphs Using Base SAS Procedures
1.3 SAS/GRAPH "SG" Procedures
1.4 Using PROC SGPLOT to Produce Non-Statistical Charts and Plots
1.5 Controlling Graph Appearance with SGPLOT
1.6 Using PROC SGPANEL to Display Multiple Cells Per Page
1.7 Using PROC SGSCATTER to Produce Multiple Plots Per Page
1.8 The ODS Graphics Designer
1.9 Editing Graphs Produced by SG Procedures
1.10 Upcoming Features and Conclusions

## Assumptions

- You need to create non-statistical graphics
  - Bar charts
  - Scatter plots
  - Line plots
- You may or may not have used SAS/GRAPH in the past to create these graphs
- You are afraid of statistics
- You are not here to learn detailed syntax. You are here to learn what you can do with the SG procedures

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## Section 1: ODS Graphics for the Non-Statistician

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# What is ODS Graphics?

The screenshot shows a SAS session with two windows. The top window displays a table titled 'Back Orders by Region' with the following data:

Region	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Beaumont	4	9.33	4	9.33
Boston	12	27.00	16	36.33
Cheyenne	9	20.00	25	56.33
Pottland	8	18.00	33	74.33
Raleigh	7	15.56	40	89.89
Rockford	7	15.56	47	100.00

The bottom window shows a bar chart titled 'Cumulative Distribution of Region' with the following data:

Region	Cumulative Frequency
Beaumont	4
Boston	16
Cheyenne	25
Pottland	33
Raleigh	40
Rockford	47

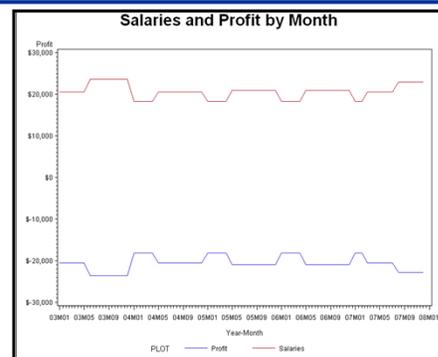
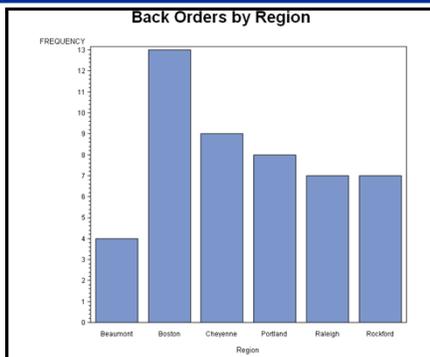
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# In the Beginning. . .

All SAS graphics were done with "classic" SAS/GRAPH procedures such as PROC GCHART and PROC GPLOT

```
proc gchart data=orders;
  vbar region;
  title 'Back Orders by Region';
run;
```

```
proc plot data=profit;
  plot amount*date=type;
  title 'Salaries and Profit by Month';
run;
```



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## Classic SAS/GRAPH Procedures

- The Good
  - Very flexible and customizable
- The Bad
  - Not so easy to use
  - Statistical graphs required running a STAT procedure to create an output data set and using a SAS/GRAPH procedure to graph the output data

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## Example: Creating LOESS Plots

```

proc loess data=Melanoma;
  model Incidences=Year;
ods output OutputStatistics=Results;
run;

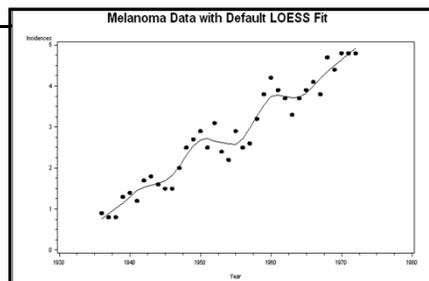
symbol1 color=black value=dot;
symbol2 color=black interpol=join value=none;

proc gplot data=Results;
title1 'Melanoma Data with Default LOESS Fit';
plot DepVar*Year Pred*Year/
      hminor=3 vminor=3 overlay;
run;

```

**Step 1:**  
Create output  
data set from  
PROC LOESS.

**Step 2:**  
Plot data from  
output data set  
with PROC  
GPLOT.

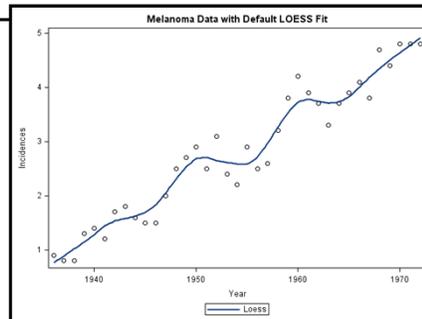


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## ODS Graphics: Why?

Designed to make it easier for statistical users to develop commonly-used statistical graphics. For example:

```
proc sgplot data=Melanoma;
title1 'Melanoma Data with Default LOESS Fit';
loess x=year y=incidences;
run;
```



Only one step  
is required.

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## ODS Graphics: What is It?

1. Graphics capabilities added to statistical procedures
2. Graphics capabilities added to some Base SAS procedures
3. New features added to SAS/GRAPH:
  - "SG" procedures
  - Graphics Template Language
  - ODS Graphics Designer

This collection of features is **ODS Graphics**.

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## Some Terminology

The following terms are interchangeable:

- Classic SAS/GRAPH
- Device-based Graphics
- SAS/GRAPH "G" Procedures
  
- The following terms are interchangeable:
- ODS Graphics
- Statistical Graphics

SAS/GRAPH "SG" Procedures are a component of ODS/GRAPHICS

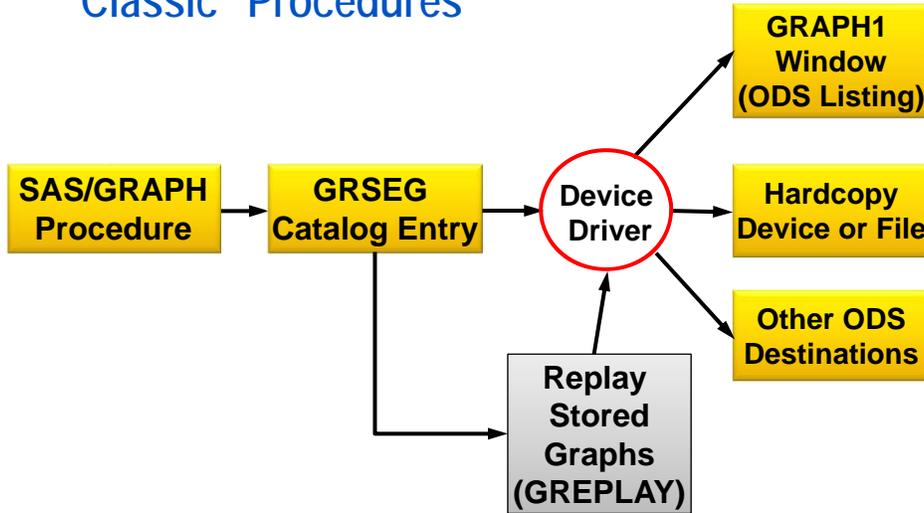
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## SAS/GRAPH "Classic" vs. ODS Graphics: Major Differences

- Internal architecture and how graphs are produced
- Support for replaying graphs
- Specification of graphics options
- Support for annotation

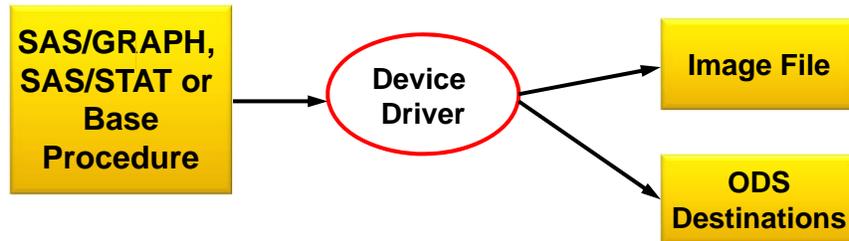
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## How Graphs Are Produced by "Classic" Procedures



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## How Graphs Are Produced by ODS Graphics



- No catalog entry is created
- No output to GRAPH1 window (ODS Listing)

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## Architectural Differences

SAS/GRAPH "Classic Procedures" and ODS Graphics use different underlying subsystems to create their graphs. Because of this:

- You can't combine graphs produced by the two systems
- PROC GREPLAY cannot be used to replay multiple or individual ODS graphs

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## Specifying Graphics Options

- For "classic" SAS/GRAPH, many options can be specified in a GOPTIONS statement.

```
goptions hsize=3 inches htext=12pt;
```

- For ODS Graphics, there is no GOPTIONS statement. A limited number of options can be specified on the ODS GRAPHICS statement. Many others are specified in the procedure

```
ods graphics/height=200px imagefmt=jpeg;
```

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## Annotating Graphs

For "classic" SAS/GRAPH, the Annotate facility can be used to add data-based annotation to graphics created by SAS/GRAPH procedures (such as labeling points on a graph).

ODS Graphics currently do not support the Annotate facility. Annotate support is expected to be available in SAS 9.3.

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## Not Just for Statisticians!

Although the original purpose of ODS Graphics was to make producing statistical graphics easier, it's also a convenient way for producing general purpose plots and charts.



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## ODS Graphics: How to Use It

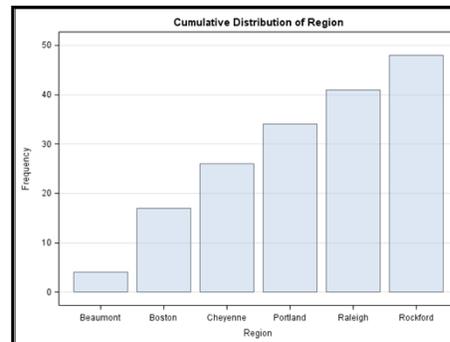
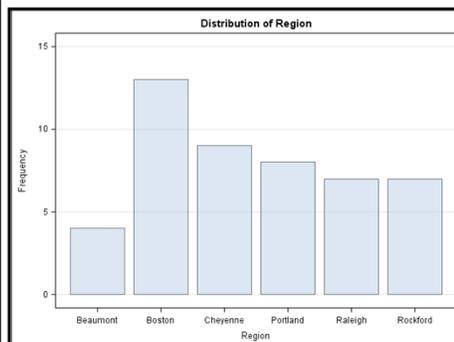
For statistical and Base SAS procedures

- Use ODS GRAPHICS statement to activate graphics
- Add options to procedure code to generate graphs
- Use ODS GRAPHICS OFF statement to deactivate graphics

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## ODS Graphics Example: Base/Stat Procedures

```
ods graphics on;  
proc freq data=orion.back_orders;  
  tables region/plots=freqplot;  
run;  
ods graphics off;
```



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## ODS Graphics: How to Use It

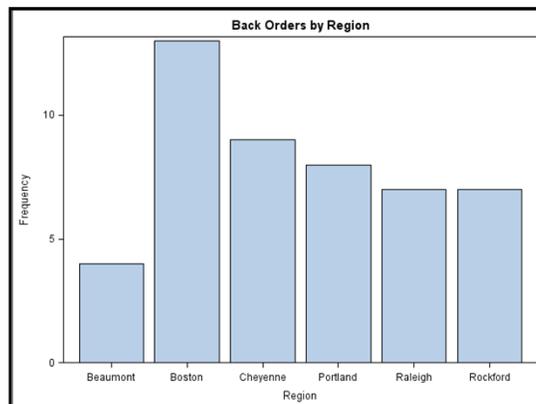
For SAS/GRAPH "SG" Procedures

- Use SG procedure statements
- No ODS GRAPHICS statement required

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## ODS Graphics Example: "SG" Procedure

```
proc sgplot data=orion.back_orders;  
  vbar region;  
  title 'Back Orders by Region';  
run;
```



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## ODS Graphics: Output

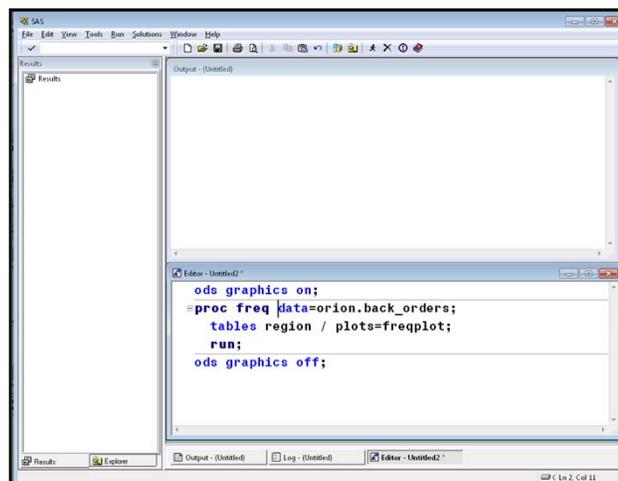
Output from ODS Graphics can go to either:

- An image file (default)
  - ODS LISTING destination used
  - Image file accessed from Results window
  - Output displayed in host image viewer
- An ODS destination
  - HTML, PDF, RTF
  - Graph is output as either a separate image (HTML) or an embedded image (RTF, PDF) in the ODS result file
  - Specify destination on ODS statement
  - Output document can be viewed in Results Viewer

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## Output to an Image File

Step 1: Submit Code



```
ods graphics on;
proc freq data=orion.back_orders;
  tables region / plots=freqplot;
run;
ods graphics off;
```

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## Output to an Image File

Step 2: Expand entry in Results Panel—results include text tables and graphs

Text table

Graphs (as image files)

The screenshot shows the SAS Results Panel with the following table:

Region	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Beaumont	24	8.33	24	8.33
Boston	78	27.08	102	35.42
Cheyenne	54	18.75	156	54.17
Portland	48	16.67	204	70.83
Raleigh	42	14.58	246	85.42
Rockford	42	14.58	288	100.00

Below the table, the SAS code editor shows the following code:

```
ods graphics on;
proc freq data=orion.orders;
  tables region/plots=freqplot;
run;
ods graphics off;
```

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## Output to an Image File

Step 3: Double click on graph entry in results. Graph opens in separate viewing application.

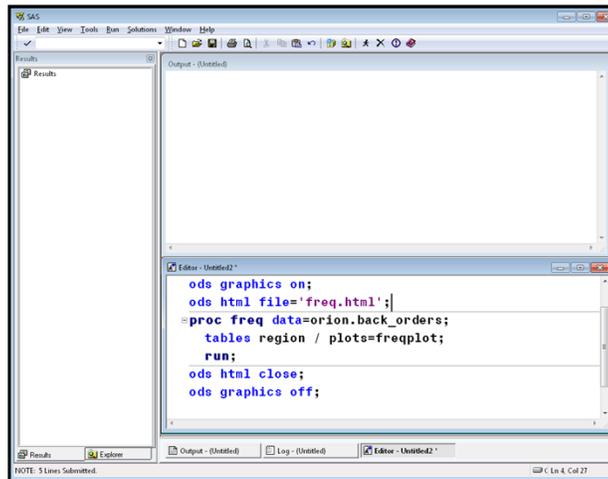
Graphs are created and stored as .png files by default

The screenshot shows the SAS Results Panel with a histogram titled "Distribution of Region". The x-axis is labeled "Region" and the y-axis is labeled "Frequency". The bars represent the frequency for each region: Beaumont (24), Boston (78), Cheyenne (54), Portland (48), Raleigh (42), and Rockford (42).

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## Output to a HTML File

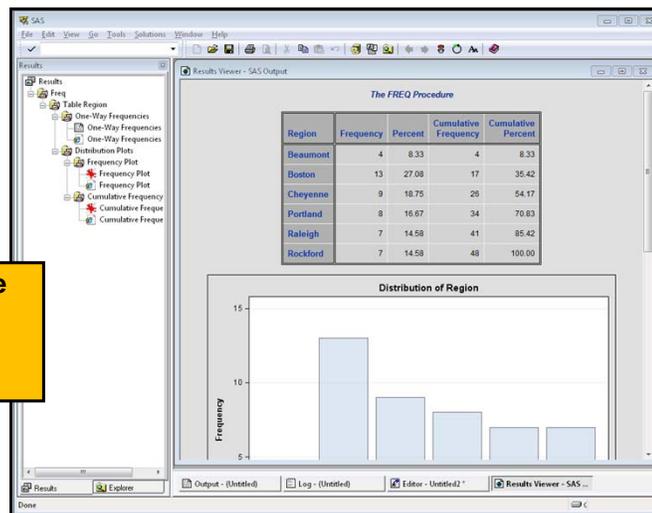
Step 1: Submit Code



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## Output to a HTML File

Step 2: HTML page is created and automatically opened in SAS Results Viewer window



HTML page contains tables and graphs

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## SAS/GRAPH "Classic" vs. ODS Graphics

Output from "Classic" SAS/GRAPH procedures cannot be combined in SAS with output from ODS Graphics.

SAS/GRAPH Classic Procedures	ODS Graphics
Output goes to GRAPH1 window or other destinations (including ODS)	Output to image file or ODS document only
Graph created as a GRSEG entry in a SAS catalog	No catalog entries created
GREPLAY procedure replays graphs stored in catalogs	No GREPLAY procedure
Annotate facility available to add elements to existing graphs	No Annotate facility (coming in SAS 9.3)
GOPTIONS statement sets general graphics options	GOPTIONS statement not used.

## Some Destinations Supported by ODS Graphics

Destination	Viewer	Graphics File Types
HTML	Web browser	PNG (default), GIF, JPEG, ...
RTF	Word processor, such as Microsoft Word	Embedded in RTF file
PS	PostScript viewer, such as GSview	Embedded in PostScript file
PDF	PDF viewer, such as Adobe Reader	Embedded in PDF file
LATEX	PostScript or PDF viewer after compiling LaTeX file	PostScript (default), EPSI, GIF, JPEG, PDF, PNG
LISTING	Default viewer in your system for file type	PNG (default), GIF, BMP, DIB, EMF, EPSI, JFIF, JPEG, ...

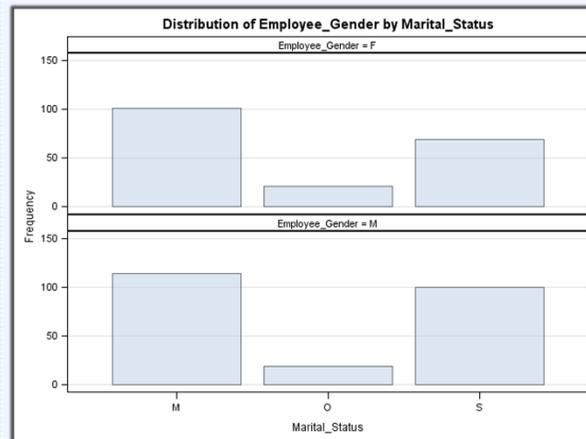
## Some Recommended Styles

Style	Description
DEFAULT	Color style intended for general-purpose work. This is the default for the HTML destination.
STATISTICAL	Color style recommended for output in Web pages or color print media. This is the style used in SAS/STAT 9.2 documentation.
ANALYSIS	Color style with a somewhat different appearance from STATISTICAL.
JOURNAL and JOURNAL2	Gray-scale and pure black-and-white styles, respectively. Recommended for graphs in black-and-white publications.
RTF	Used to produce graphs to insert into a Microsoft Word document or a Microsoft PowerPoint slide.

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## Producing Non-Statistical Graphs Using Base SAS Procedures



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## Base SAS Procedures that Produce Graphics

ODS Graphics can be used with the following Base SAS procedures:

- CORR
- FREQ
- UNIVARIATE

These procedures produce both statistical and non-statistical graphics. This presentation will focus on the non-statistical charts and plots that PROC FREQ and PROC UNIVARIATE can produce.

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## Producing Graphics with Base Procedures

For statistical and Base SAS procedures

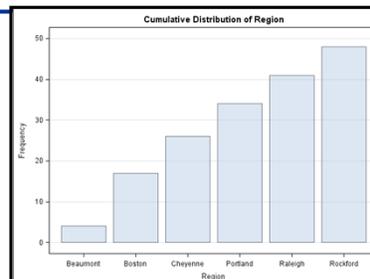
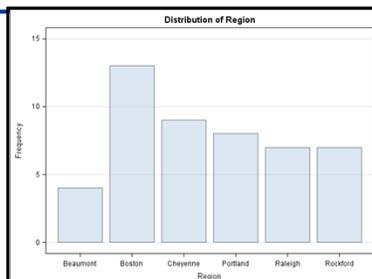
1. Use ODS GRAPHICS ON statement to activate graphics
2. Add options or statements to procedure code to generate specific graphs
3. Use ODS GRAPHICS OFF statement to deactivate graphics

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## PROC FREQ Graphics with One-Way Tables

If you activate graphics, but do not specify a specific plot with a one-way frequency table request, both frequency and cumulative frequency plots are generated:

```
ods graphics on;
proc freq data=orion.back_orders;
  tables region;
run;
ods graphics off;
```

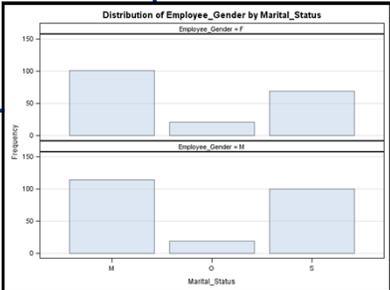


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## PROC FREQ Graphics with Two-Way Tables

If you activate graphics, but do not specify a specific plot with a two-way frequency table request, a single graph is generated containing a frequency plot for each variable. No cumulative frequency plot is produced.

```
ods graphics on;
proc freq
  data=orion.employee_payroll;
  tables employee_gender*
         marital_status;
run;
ods graphics off;
```

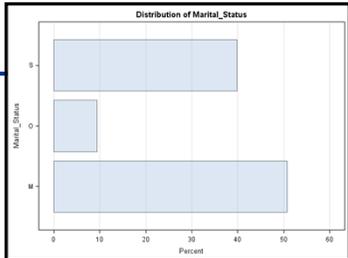


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## Using the PLOTS= Option with PROC FREQ

You can use the PLOTS= option to request specific types of plots, including various statistical plots. By using the PLOTS= option, you can specify some appearance options.

```
ods graphics on;
proc freq data=orion.employee_payroll;
  tables marital_status/plots=freqplot
         (orient=horizontal
          scale=percent);
run;
ods graphics off;
```

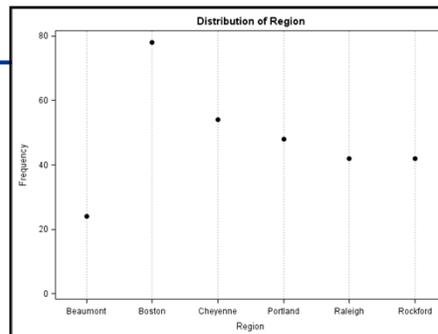


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## Creating a Dot Plot with PROC FREQ

The example below requests a dot plot for the frequency plot only.

```
ods graphics on;
proc freq data=orion.orders;
  tables region/plots(only)=freqplot
  (type=dotplot orient=vertical);
run;
ods graphics off;
```

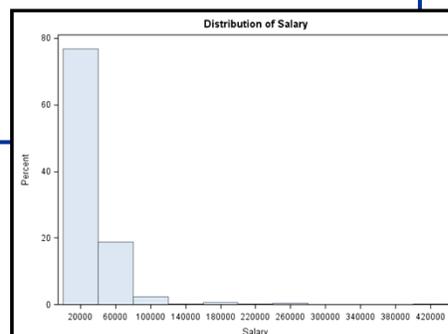


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## Graphics with PROC UNIVARIATE

To produce graphics with PROC UNIVARIATE, you must explicitly supply a statement requesting a graph. The HISTOGRAM statement produces histograms.

```
ods graphics on;
proc univariate
data=orion.employee_payroll;
  var salary;
  histogram salary;
run;
ods graphics off;
```



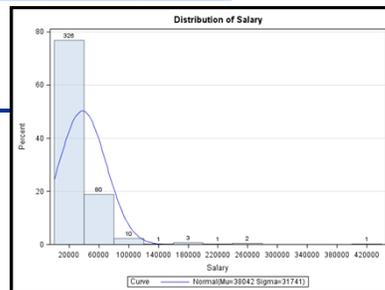
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## Graphics with PROC UNIVARIATE

Various options can be used on the HISTOGRAM statement to control the appearance of the plot.

```
ods graphics on;
proc univariate
data=orion.employee_payroll;
  var salary;
  histogram salary/barlabel=count
  normal(color=blue)
  grid;

run;
ods graphics off;
```



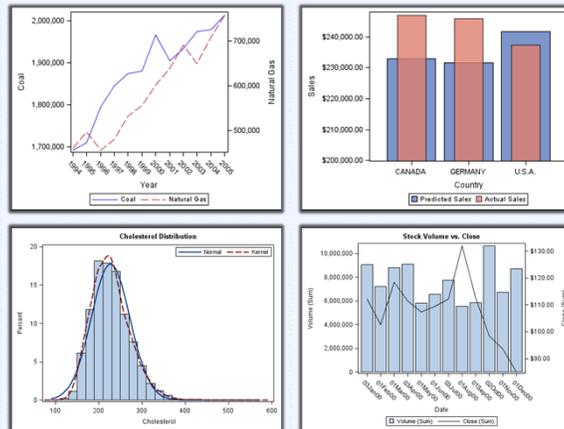
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## Overview of SAS/GRAPH "SG" Procedures



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## ODS GRAPHICS with SAS/GRAPH

Several new procedures and features that implement ODS Graphics have been added to SAS/GRAPH.

They are:

- PROC SGPLOT
- PROC SGPANEL
- PROC SGSCATTER
- PROC SGRENDER
- Graphics Template Language (GTL)

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## The "SG" Procedures

- SGPLOT, SGPANEL, and SGSCATTER Procedures
  - designed to create commonly used graphs quickly.
  - produce many of the same types of graphs as the original SAS/GRAPH procedures such as GPLOT and GCHART, but use the ODS architecture
- SGRENDER and the Graphics Template Language
  - used to produce more complex, customized graphs
  - steeper learning curve

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## SGPLOT vs. Graph Template Language

### SGPLOT

```
proc sgplot data=orion.back_orders;
  vbar region;
  title "Frequency Count by Region";
run;
```

### GTL and PROC SGRENDER

```
proc template;
define statgraph sgdesign;
dynamic _ORDER_MONTH;
begingraph;
layout lattice _id='lattice' /
  columndatarange=data rowdatarange=data;
  layout overlay _id='overlay' /;
  barchart _id='bar' x=_ORDER_MONTH / name='bar' stat=freq;
endlayout;
endgraph;
end;
run;
proc sgrender data=ORION.ORDER_SUMMARY template=sgdesign;
dynamic _ORDER_MONTH="'ORDER_MONTH'n";
run;
```

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## Using the New SG Procedures

- ODS GRAPHICS statement is not required, but can be used to specify some options
- No GOPTIONS statement
- Symbols and patterns are specified in the procedure—no SYMBOL or PATTERN statements
- Statements available to control axis and legend appearance, but differ from those in "classic" SAS/GRAPH
- Titles and footnotes work as in "classic" SAS/GRAPH

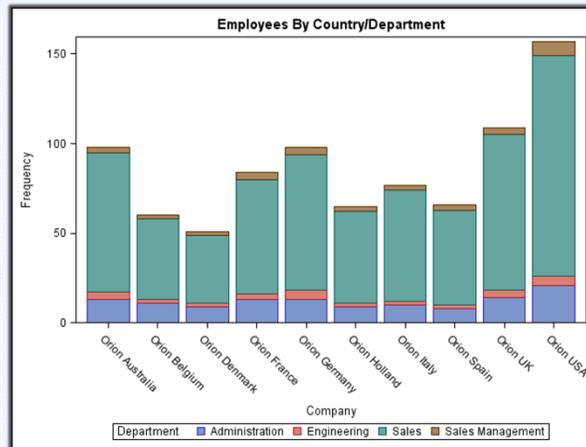
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## Using PROC SGPLOT to Produce Non-Statistical Charts and Plots



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## The SGPLOT Procedure

PROC SGPLOT can be used to produce the following basic plots and charts:

- Simple bar charts
- Stacked bar charts
- Histograms
- Scatter plots
- Series plots
- Overlaid graphs including bar/line charts

 Although the procedure is named *SGPLOT*, it produces both plots and charts.

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## PROC SGPLOT: Statistical Graphs

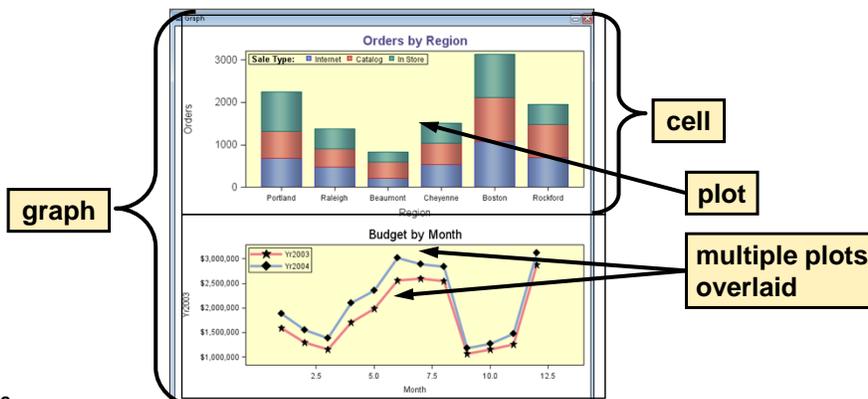
In addition, PROC SGPLOT can be used to produce the following types of plots and charts:

- Density plots
- Dot plots
- Ellipse plots
- Horizontal and vertical box plots
- Loess plots
- Spline curves
- Regression plots

 For this presentation, we will focus on the non-statistical plots listed on the previous slide.

## Terminology for ODS Graphics

Term	Meaning
plot	any type of plot or chart, such as a scatter plot, bar chart, etc.
cell	area containing one plot, or multiple overlaid plots
graph	a collection of one or more cells



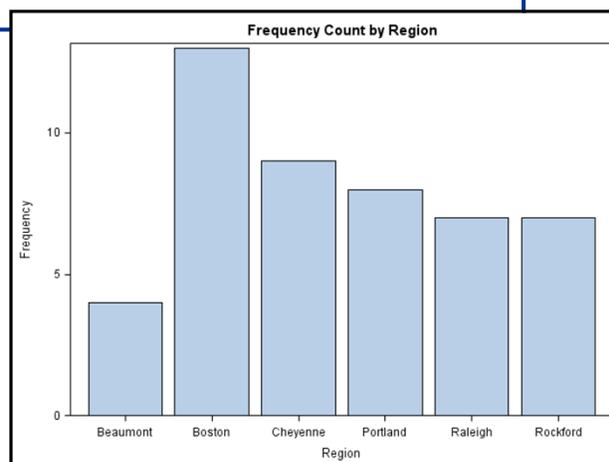
## General SGPLOT Syntax

- PROC SGPLOT statement – invokes the procedure and specifies input data set
- Plot statement – specifies type of graph, variables, and options.
- Axis statements – control appearance of axes (optional)
- KEYLEGEND statement – controls appearance of legend (optional)
- Multiple plot statements can be used to overlay multiple plots on the same axes.

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## Vertical Bar Chart

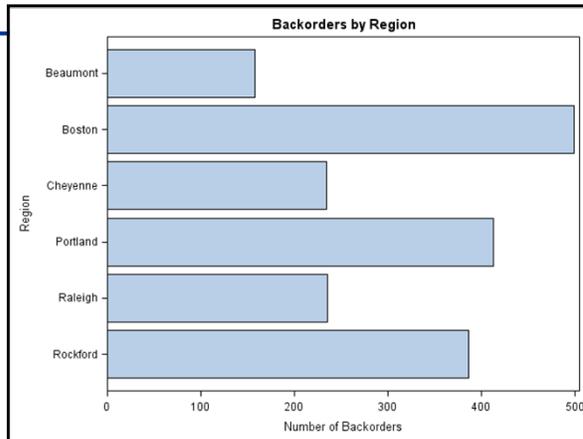
```
proc sgplot data=orion.back_orders;  
  vbar region;  
  title "Frequency Count by Region";  
run;
```



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## Horizontal Bar Charts

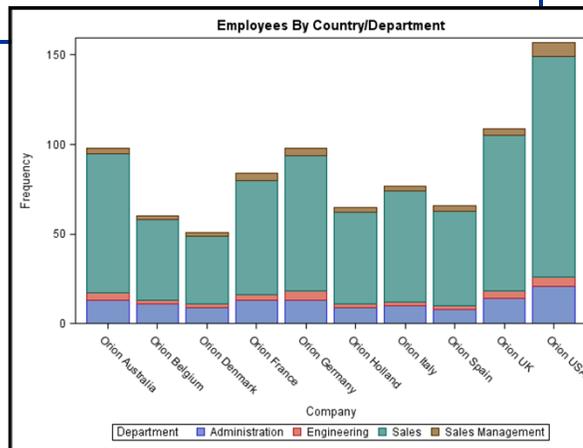
```
proc sgplot data=orion.back_orders;
  hbar region / response=number_of_orders
  stat=sum;
  title "Backorders by Region";
run;
```



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## Subgrouped Bar Chart

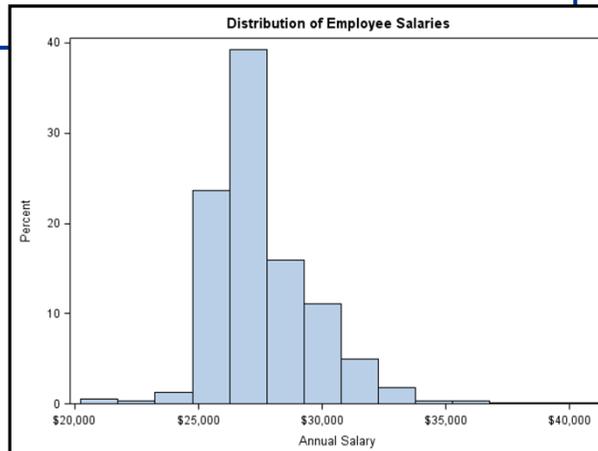
```
proc sgplot data=orion.employees;
  where company='Orion';
  vbar company / group=department;
  title 'Employees By Country/Department';
run;
```



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## Histogram

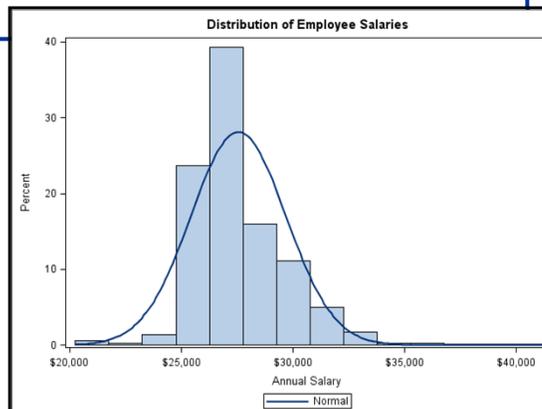
```
proc sgplot data=orion.employees;
  where department='Sales';
  histogram salary;
  title 'Distribution of Employee Salaries';
run;
```



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## Overlaying Graphs

```
proc sgplot data=orion.employees;
  histogram salary;
  density salary / type=normal;
  where department='Sales';
  title 'Distribution of Employee Salaries';
run;
```



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## Scatter Plot

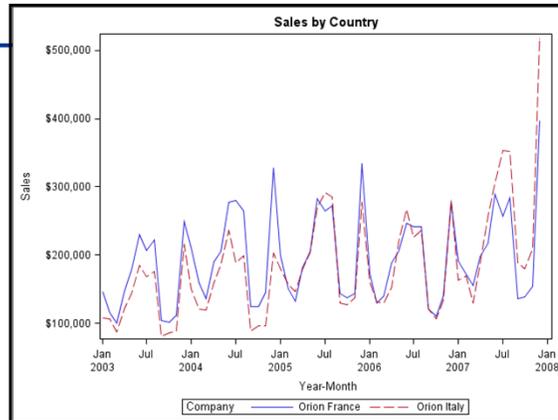
```
proc sgplot data=orion.employees;
where company='Orion Italy' and
department='Sales';
scatter y=salary x=employee_birthdate;
title 'Salary by Birth Date';
run;
```



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## Grouped Series Plot

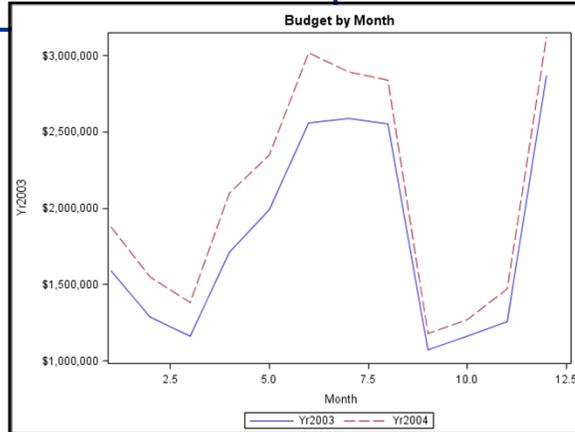
```
proc sgplot data=orion.profit;
where company in ('Orion France','Orion
Italy');
series y=sales x=yyymm / group=company;
title 'Sales by Country';
run;
```



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## Overlaid Series Plot (Multiple Y Variables)

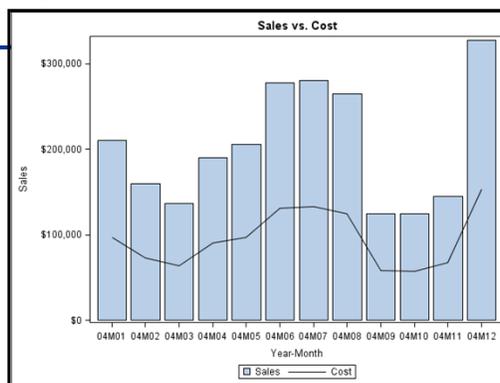
```
proc sgplot data=orion.budget;
  series y=yr2003 x=month;
  series y=yr2004 x=month;
  title 'Budget by Month';
run;
```



61

## Overlaid Bar Chart and Line Plot

```
proc sgplot data=orion.profit;
  where company='Orion France' and
        year(yymm)=2004;
  vbar yymm / response=sales;
  vline yymm / response=cost;
  title 'Sales vs. Cost';
run;
```

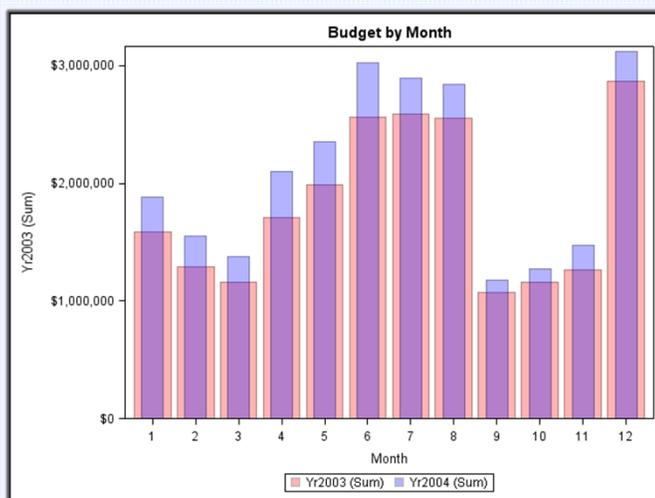


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# Section 1: ODS Graphics for the Non-Statistician

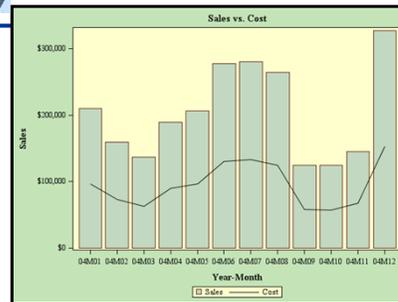
1.1 What is ODS Graphics?
1.2 Producing Non-Statistical Graphs Using Base SAS Procedures
1.3 SAS/GRAPH "SG" Procedures
1.4 Using PROC SGPLOT to Produce Non-Statistical Charts and Plots
<b>1.5 Controlling Graph Appearance with SGPLOT</b>
1.6 Using PROC SGPANEL to Display Multiple Cells Per Page
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1.8 The ODS Graphics Designer
1.9 Editing Graphs Produced by SG Procedures
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# Controlling Graph Appearance with SGPLOT



## Using ODS Styles

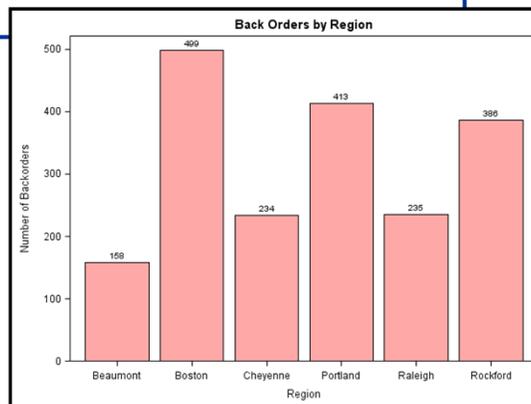
```
ods listing style=banker;
proc sgplot data=orion.profit;
  where company='Orion France' and
  year(yymm)=2004;
  vbar yymm / response=sales;
  vline yymm / response=cost;
  title 'Sales vs. Cost';
run;
ods listing style=listing;
```



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## Controlling Fills and Labeling Bars

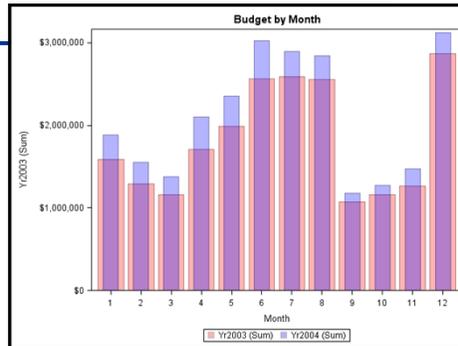
```
proc sgplot data=orion.back_orders;
  vbar region/response=number_of_orders
  fillattrs=(color="verylightred")
  datalabel;
  title "Back Orders by Region";
run;
```



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## Overlaid Bars with Transparency

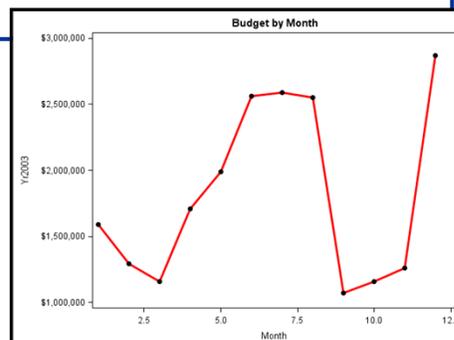
```
proc sgplot data=orion.budget;
  vbar month/response=yr2003
    fillattrs=(color=red)
    transparency=.7;
  vbar month/response=yr2004
    fillattrs=(color=blue)
    transparency=.7 barwidth=.5;
run;
```



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## Controlling Lines and Markers

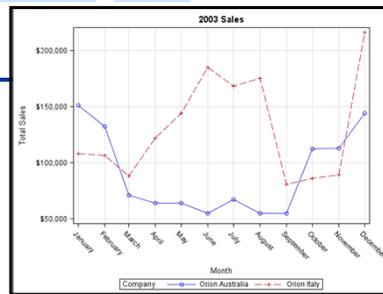
```
proc sgplot data=orion.budget;
  series y=yr2003 x=month/ markers
    lineattrs=(color=red thickness=3)
    markerattrs=(color=black
    symbol=circlefilled
    size=8);
  title 'Budget by Month';
run;
```



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## Controlling Axis Attributes

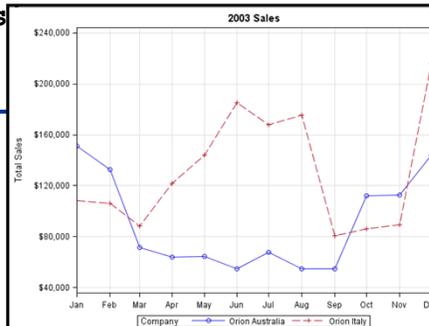
```
proc sgplot data=orion.profit;
where (company='Orion Australia' or
      company='Orion Italy') and
      year(yymm)=2003;
series y=sales x=yymm/ markers group=company;
xaxis fitpolicy=rotate
      tickvalueformat=monname.
      grid label='Month';
yaxis label='Total Sales' grid;
title '2003 Sales';
run;
```



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## Additional Axis Options

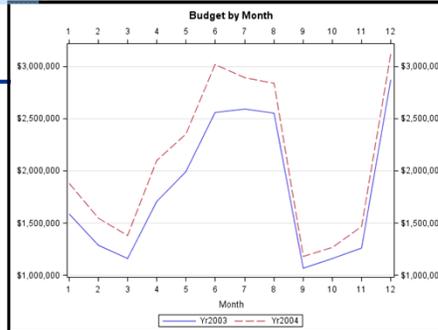
```
proc sgplot data=orion.profit;
where company in ('Orion Australia' 'Orion
                  Italy') and year(yymm)=2003;
series y=sales x=yymm/ markers group=company;
xaxis display=(nolabel)
      tickvalueformat=monname3.
      offsetmin=0 offsetmax=0 grid;
yaxis values=(40000 to 240000 by 40000) grid
      label='Total Sales';
title '2003 Sales';
run;
```



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## Adding Top and Right Axes

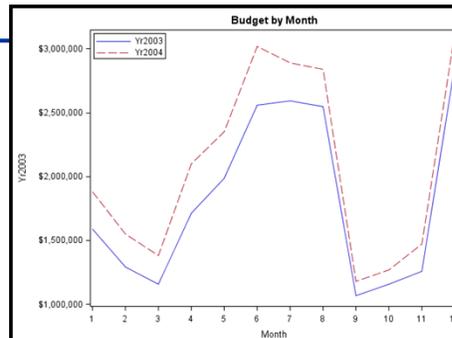
```
proc sgplot data=orion.budget;
series y=yr2003 x=month;
series y=yr2004 x=month/x2axis y2axis;
xaxis type=discrete;
yaxis display=(nolabel) grid offsetmax=.1;
x2axis type=discrete display=(nolabel);
y2axis display=(nolabel) values=(1e6 to 3e6 by
500000)offsetmax=.1;
title 'Budget by Month';
run;
```



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## Controlling the Legend

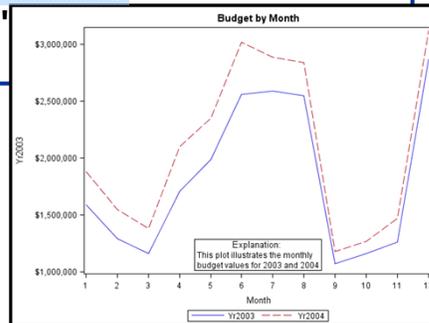
```
proc sgplot data=orion.budget;
series y=yr2003 x=month;
series y=yr2004 x=month;
xaxis type=discrete;
keylegend / location=inside down=2
position=topleft;
title 'Budget by Month';
run;
```



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## Adding a Text Box With INSET Statement

```
proc sgplot data=orion.budget;
series y=yr2003 x=month / name='2003';
series y=yr2004 x=month / name='2004';
xaxis type=discrete;
inset 'This plot illustrates the monthly'
      'budget values for 2003 and 2004'/
      position=bottom border
      title='Explanation: ';
title 'Budget by Month'
run;
```



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## The ODS GRAPHICS Statement

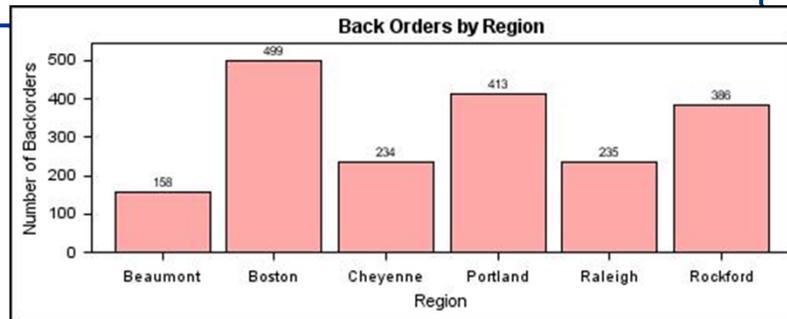
You can specify options on the ODS GRAPHICS statement to control some aspects of your graphics output. Note that you do not need to use the ODS GRAPHICS statement with the SG procedures unless you want to specify options. Some of the options that you can specify are:

- Height and width of the graph
- Format (file type) and name of the graphics file
- Whether a border is drawn around the graph

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## Using the ODS GRAPHICS Statement

```
ods graphics / height=200px width=500px
imagefmt=jpeg;
proc sgplot data=orion.back_orders;
  vbar region/response=number_of_orders
    fillattrs=(color="verylightred")
    datalabel;
title "Back Orders by Region";
run;
```



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## The ODS GRAPHICS Statement

Options specified on the ODS GRAPHICS statement remain in effect until they are reset or the SAS session ends. To reset the options, submit the following statement:

```
ods graphics/reset;
```

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## Creating Tool Tips with the IMAGEMAP Option

The IMAGEMAP option is used with the HTML destination and controls the generation of data tips. Data tips are pieces of explanatory text that appear when you mouse-over the data portions of a graph contained in an HTML page. The TIPMAX option specifies the maximum number of distinct tooltips permitted before tooltips are disabled.

```
ods graphics / imagemap tipmax=1500;

ods html path='path-for-output' (url=none)
         gpath='path-for-image'
         file='myfile.html' style=analysis;

. . . code that generates ODS GRAPHICS image . . .

ods html close;
```

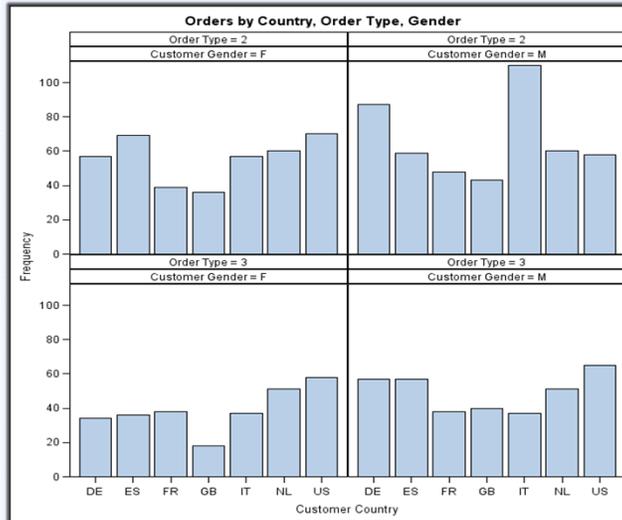
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## Section 1: ODS Graphics for the Non-Statistician

- |   |
|---|
| 1.1 What is ODS Graphics?   |
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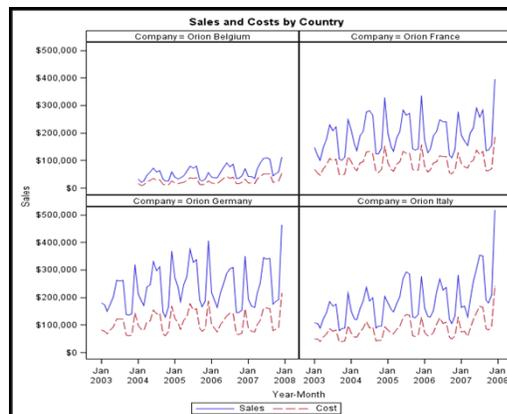
## Using PROC SGPANEL to Display Multiple Cells Per Page



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## PROC SGPANEL

PROC SGPANEL produces graphs similar to PROC SGPLOT, but creates separate cells for each value of a categorical variable or crossing of multiple categorical variables. You can control the placement of the cells on a graph.



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## General SGPANEL Syntax

- PROC SGPANEL statement – invokes the procedure and specifies input data set
- Plot statement – specifies type of graph, variables, and options.
- PANELBY statement – specifies the classification variables and the arrangement of cells on the page.
- Axis statements – control appearance of axes (optional)
- KEYLEGEND statement – controls appearance of legend (optional)

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## PROC SGPANEL: Plot Statements

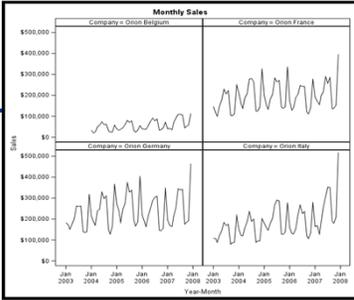
- The plot statements supported by PROC SGPANEL are the same as those supported by PROC SGPLOT. They include HBAR, VBAR, HISTOGRAM, SCATTER, SERIES, and others.
- As with PROC SGPLOT, multiple plot statements produce overlay graphs.
- The same options used to control plot appearance with PROC SGPLOT (such as LINEATTRS, FILLATTRS, etc.) can be used with PROC SGPANEL.

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## The PANELBY Statement

The PANELBY statement lists one or more categorical variables.

```
proc sgpanel data=orion.profit;
where company in ('Orion Belgium'
                  'Orion Germany'
                  'Orion France'
                  'Orion Italy');
panelby company;
series y=sales x=yymm;
title 'Monthly Sales';
run;
```

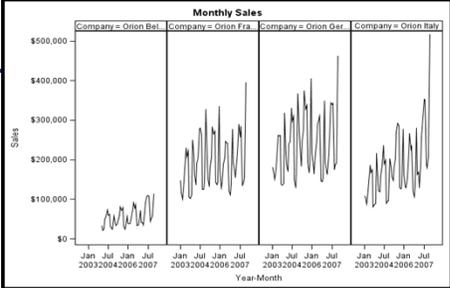


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## PANELBY Statement Options

Options on the PANELBY statement specify the arrangement of cells

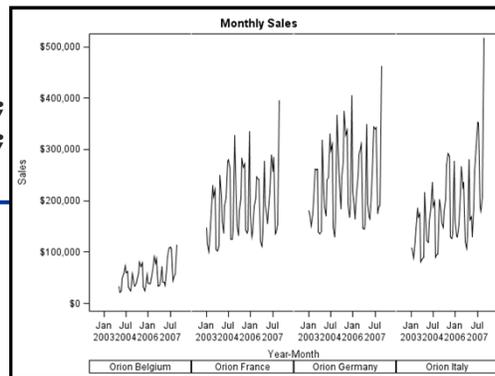
```
proc sgpanel data=orion.profit;
where company in ('Orion Belgium'
                  'Orion Germany' 'Orion France'
                  'Orion Italy');
panelby company/layout=columnlattice onepanel;
series y=sales x=yymm;
title 'Monthly Sales';
run;
```



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## Additional PANELBY Statement Options

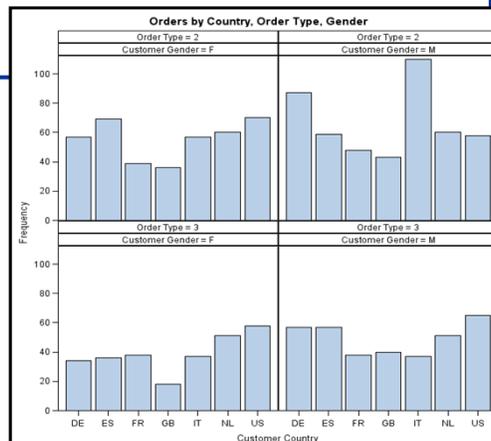
```
proc sgpanel data=orion.profit;
  where company in ('Orion Belgium'
    'Orion Germany' 'Orion France'
    'Orion Italy');
  panelby company/layout=columnlattice
    colheaderpos=bottom
    onepanel
    noborder
    novarname;
  series y=sales x=yymm;
  title 'Monthly Sales';
run;
```



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## Multiple PANELBY Variables

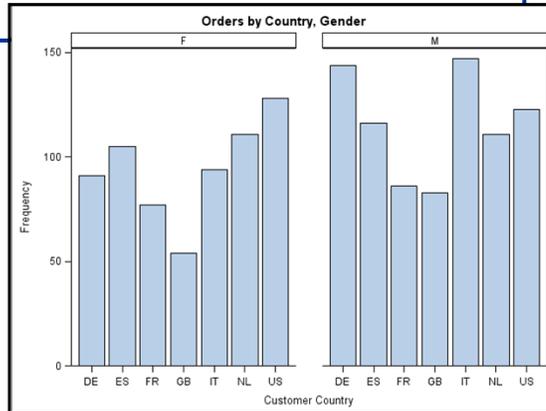
```
proc sgpanel data=orion.customer_orders;
  panelby order_type customer_gender;
  vbar customer_country;
  title 'Orders by Country, Order Type,
    Gender';
run;
```



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## Removing Borders Between Cells

```
proc sgpanel data=orion.customer_orders;
panelby customer_gender / noborder
spacing=30 novarname;
vbar customer_country;
title 'Orders by Country, Gender';
run;
```



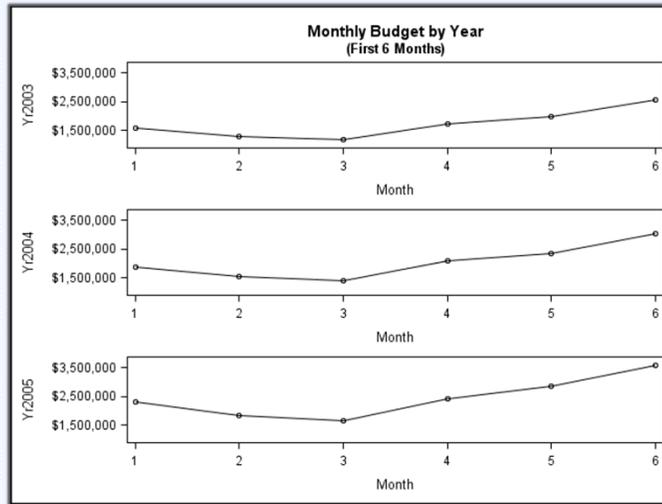
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## Section 1: ODS Graphics for the Non-Statistician

1.1 What is ODS Graphics?
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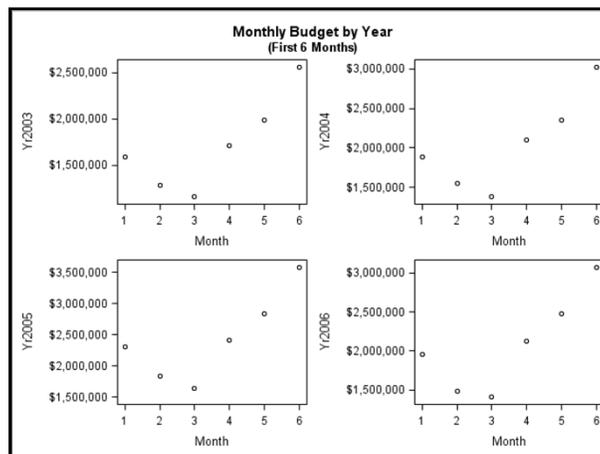
## Using PROC SGSCATTER to Produce Multiple Plots Per Page



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## PROC SGSCATTER

PROC SGSCATTER produces multiple scatter or line plots on a page, with the cells reflecting different combinations of plot variables.



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## General SGSCATTER Syntax

- PROC SGSCATTER Statement – invokes the procedure and specifies input data set
- PLOT, COMPARE, MATRIX statement – specifies type of graph, variables, and options.
- Axis statements are not supported
- Legend is controlled by options in PLOT statement

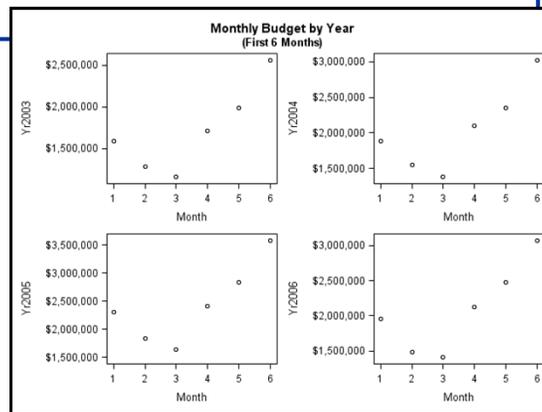
Note that:

- Only certain types of plots can be produced
- Plot type is specified as an option on the PLOT, COMPARE, or MATRIX statement.

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## PLOT Statement

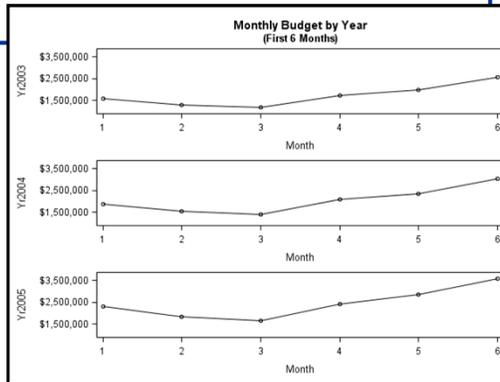
```
proc sgscatter data=orion.budget;
where month le 6;
plot (yr2003 yr2004 yr2005 yr2006)*month;
title 'Monthly Budget by Year';
title2 '(First 6 Months)';
run;
```



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## Arranging Multiple Cells on a Page

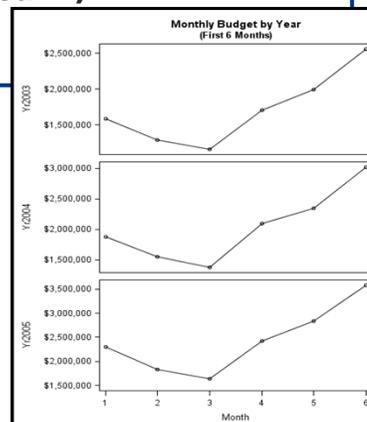
```
proc sgscatter data=orion.budget;
where month le 6;
plot (yr2003 yr2004 yr2005)*month/join
columns=1 uniscale=y;
title 'Monthly Budget by Year';
title2 '(First 6 Months)';
run;
```



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## COMPARE Statement – Shared Axes

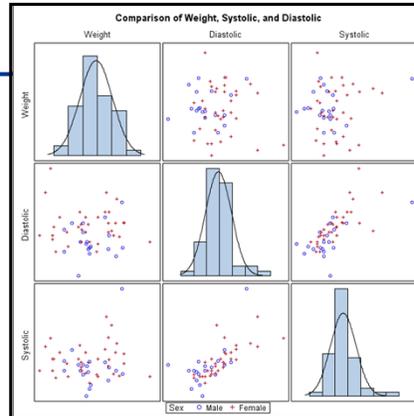
```
proc sgscatter data=orion.budget;
where month le 6;
compare x=month y=(yr2003 yr2004 yr2005) /
join spacing=10;
title 'Monthly Budget by Year';
title2 '(First 6 Months)';
run;
```



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## MATRIX Statement – Scatterplot Matrices

```
proc sgscatter data=orion.heart;
where ageatstart>60;
matrix weight diastolic systolic/group=sex
diagonal=(histogram normal);
title 'Comparison of Weight, Systolic, and
Diastolic';
run;
```



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## SGPANEL vs. SGSCATTER

What's the difference?

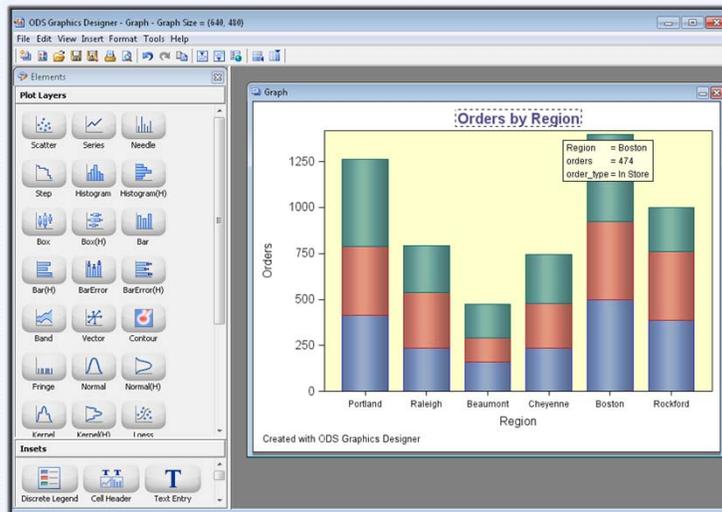
- SGPANEL creates a separate cell for each value of a categorical variable or variables.
  - Example: Sales by Month with a separate cell for each country
- SGSCATTER creates cells for different combinations of variables
  - Example: Sales by Month and Cost by Month (for all countries), on the same page

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# Section 1: ODS Graphics for the Non-Statistician

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<b>1.8 The ODS Graphics Designer</b>
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# The ODS Graphics Designer



## ODS Graphics Designer

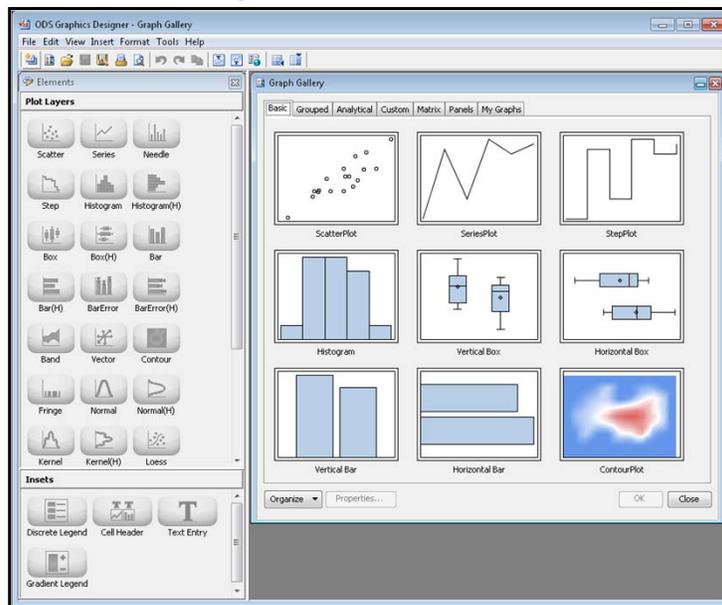
The ODS Graphics Designer provides an interactive interface for creating the same types of graphs produced by the SGPLOT, SGPANEL, and SGRENDER procedures. It also allows creation of some types of graphs that cannot be created with the above procedures.

To invoke the ODS Graphics Designer, submit the following statement from your SAS Editor:

```
%sgdesign;
```

The ODS Graphics Designer comes up in a separate application window.

## Graphics Designer Main Window



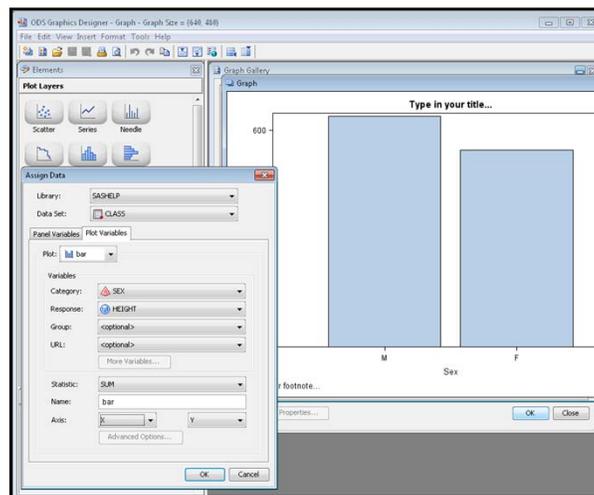
## Creating a Graph Using the Designer

- Select a graph type from the Graph Gallery. Graph is displayed using default data sets and variables.
- Fill in popup form to specify your data set, variables, and options. Updated graph is displayed.
- Add additional plots and elements by dragging them from the Elements Pane onto the graph  
or
- Add additional panels to the graph and then drag plots and elements into the panels.

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## Select a Graph from Graph Gallery

- Graph is created with default data
- Data menu is displayed



102

## Choose Data Set and Variables

ODS Graphics Designer - Graph - Graph Size = (640, 480)

File Edit View Insert Format Tools Help

Elements

Plot Layers

- Scatter
- Series
- Needle
- Step
- Histogram
- Histogram(H)
- Box
- Box(H)
- Bar
- Bar(H)
- BarError
- BarError(H)
- Band
- Vector
- Contour
- Fringe
- Normal
- Normal(H)
- Kernel
- Kernel(H)
- Line

Assign Data

Library: ORION

Data Set: ORDERS

Panel Variables Plot Variables

Plot: bar

Variables

Category: REGION

Response: ORDERS

Group: ORDER\_TYPE

URL: <optional>

More Variables...

Statistics: SUM

Name: bar

Axis: X Y

Advanced Options...

OK Cancel

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## Add Title and Right Click for Options

ODS Graphics Designer - Graph - Graph Size = (640, 480)

File Edit View Insert Format Tools Help

Elements

Plot Layers

- Scatter
- Series
- Needle
- Step
- Histogram
- Histogram(H)
- Box
- Box(H)
- Bar
- Bar(H)
- BarError
- BarError(H)
- Band
- Vector
- Contour
- Fringe
- Normal
- Normal(H)
- Kernel
- Kernel(H)
- Line

Graph

Orders by Region

orders

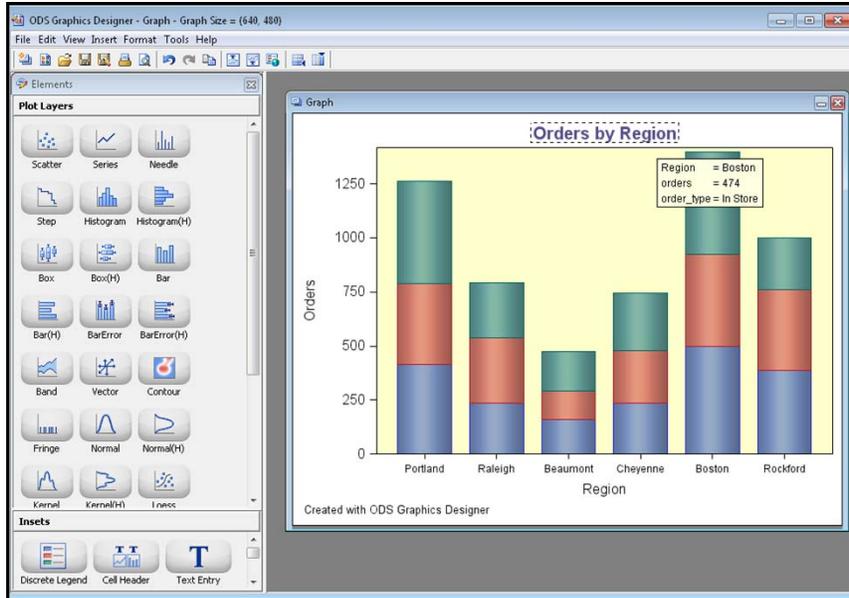
Portland Raleigh Boston Rockford

Created with ODS Graphics Designer

- Assign Data...
- Plot Properties...
- Axis Properties...
- Cell Contents...
- Add an Element...
- Add a Row
- Add a Column
- Remove Row
- Remove Column
- Move Row
- Move Column
- Graph Properties...

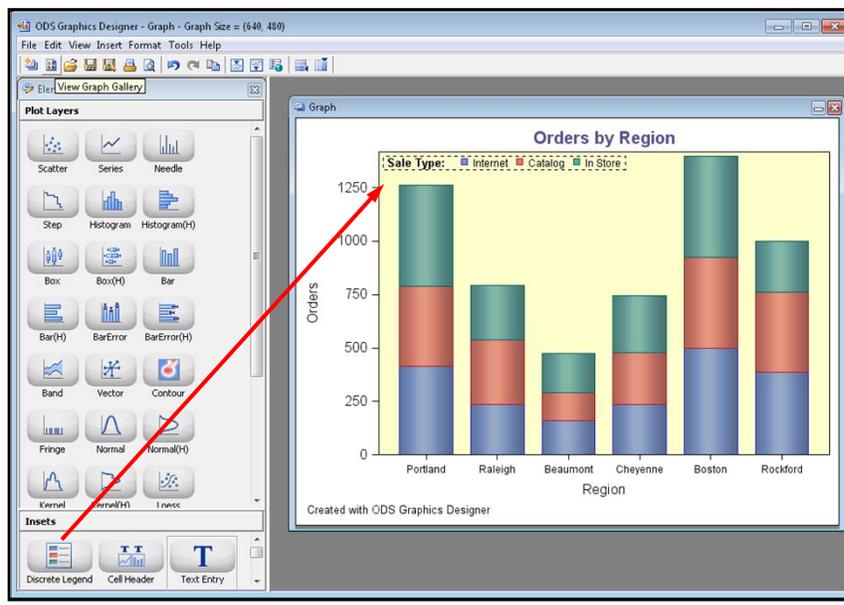
104

## After Changes



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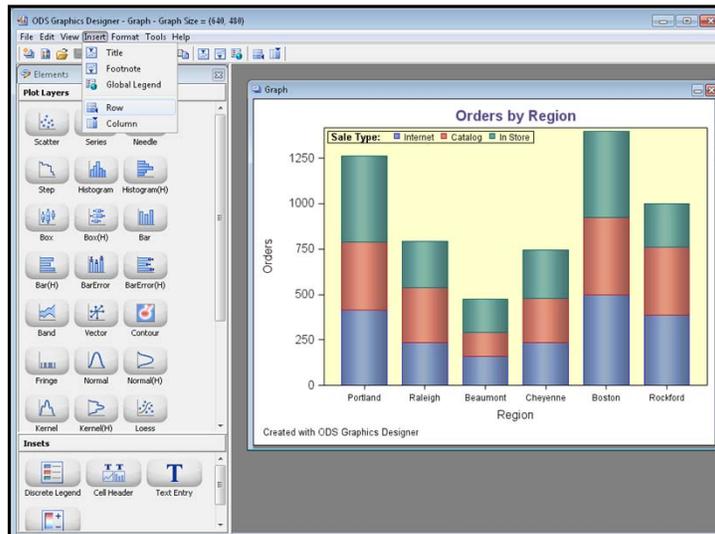
## Drag Legend On To Graph



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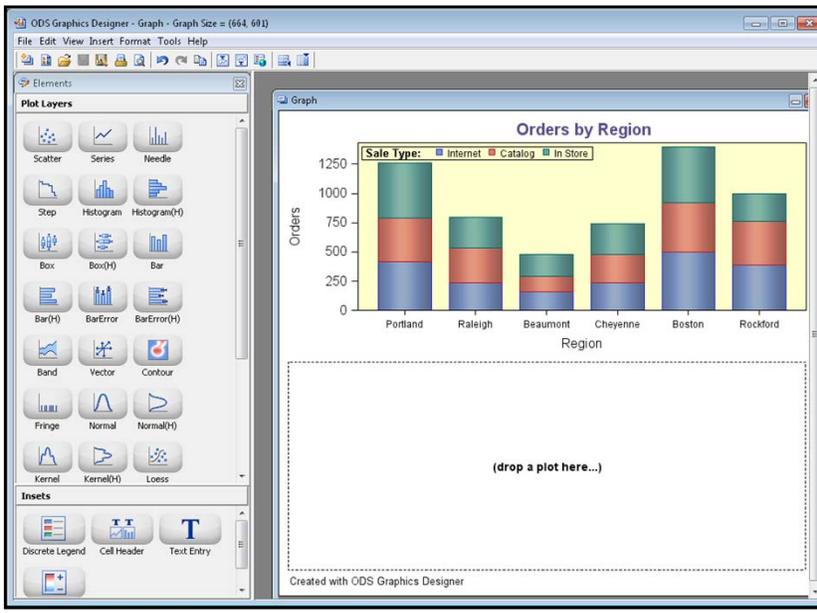
## Add Another Panel to Graph

Select **Row** from Insert pull-down.



107

## New Row Is Added



108

## Drag a Plot Into Empty Row & Specify Details

The screenshot shows the ODS Graphics Designer interface. On the left, the 'Elements' pane contains 'Plot Layers' and 'Insets'. A red arrow points from the 'Series' plot layer icon to the 'Assign Data - Series' dialog box. The dialog box is open, showing the following configuration:

- Library: ORION
- Data Set: BUDGET
- Variables: MONTH (X), YR2003 (Y)
- Group: <optional>
- Curve Label: (empty)
- Name: series
- Axis: X (Month), Y (YR2003)

In the background, a bar chart titled 'Orders by Region' is visible, showing data for Cheyenne, Boston, and Rockford. The chart has three bars, each with three stacked segments in blue, red, and green.

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## Overlay Another Plot in Panel

Drag Plot Layer into Panel and Fill in Details.

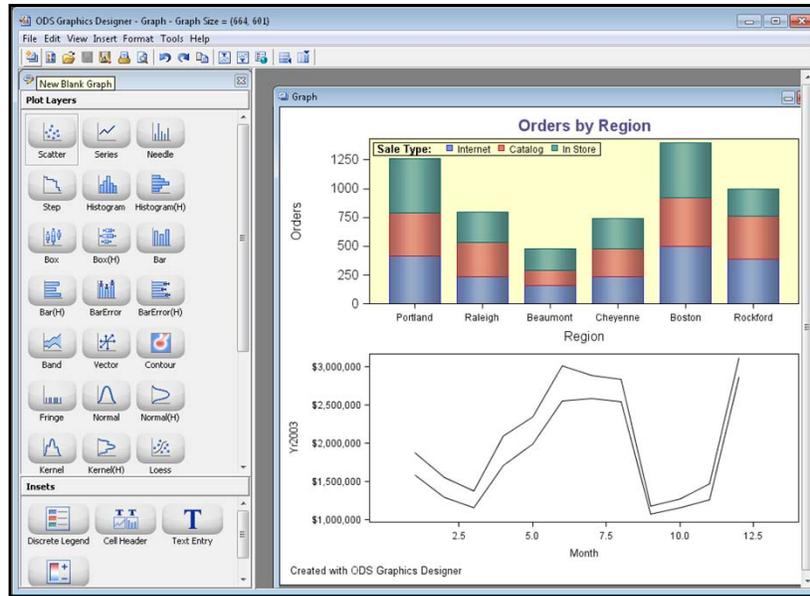
The screenshot shows the ODS Graphics Designer interface. On the left, the 'Elements' pane contains 'Plot Layers' and 'Insets'. A red arrow points from the 'Series' plot layer icon to the 'Assign Data - Series' dialog box. The dialog box is open, showing the following configuration:

- Library: ORION
- Data Set: BUDGET
- Variables: MONTH (X), MONTH (Y)
- Group: YR2004
- Curve Label: <optional>
- Name: series2
- Axis: X (Month), Y (YR2004)

In the background, a line plot is visible, showing data for 'Month' on the x-axis (ranging from 2.5 to 12.5) and 'YR2004' on the y-axis (ranging from \$1,000,000 to \$2,000,000). The line plot shows a fluctuating trend over time.

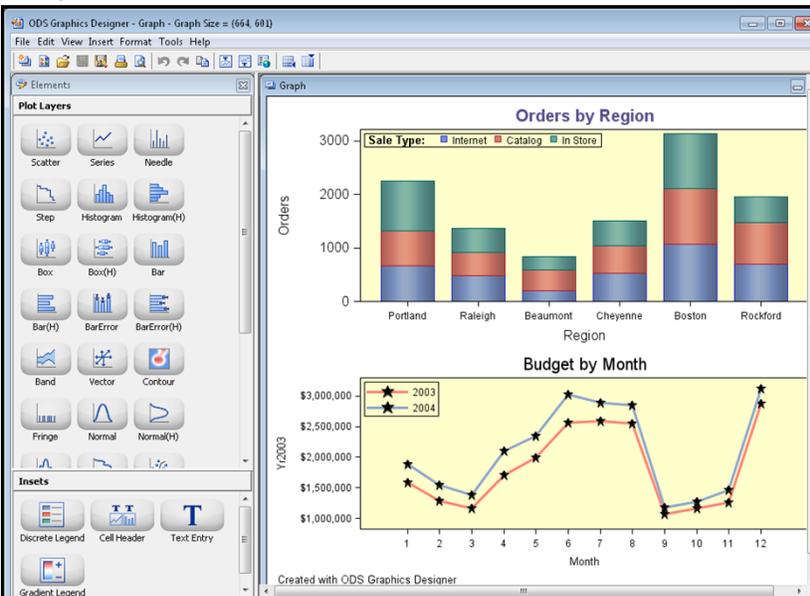
110

## Plot After Adding Overlay



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## Right Click Plot and Add Enhancements



112

## Save Graph to Gallery

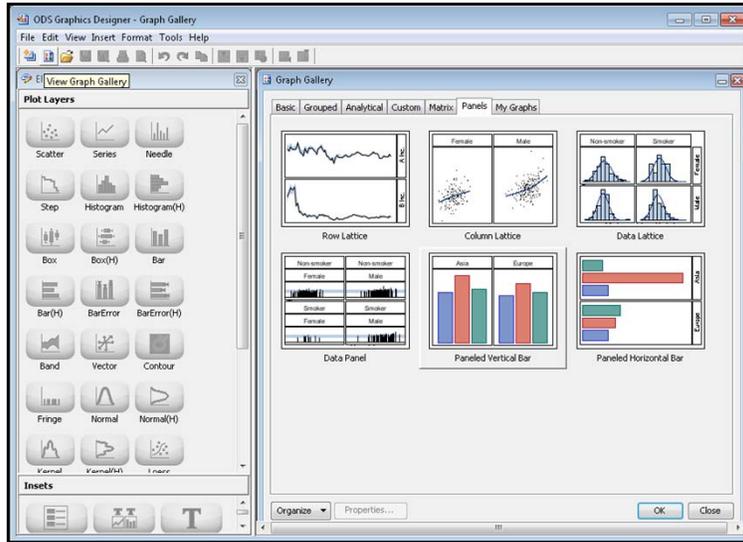
113

## Specify Location and Name, then Save

114

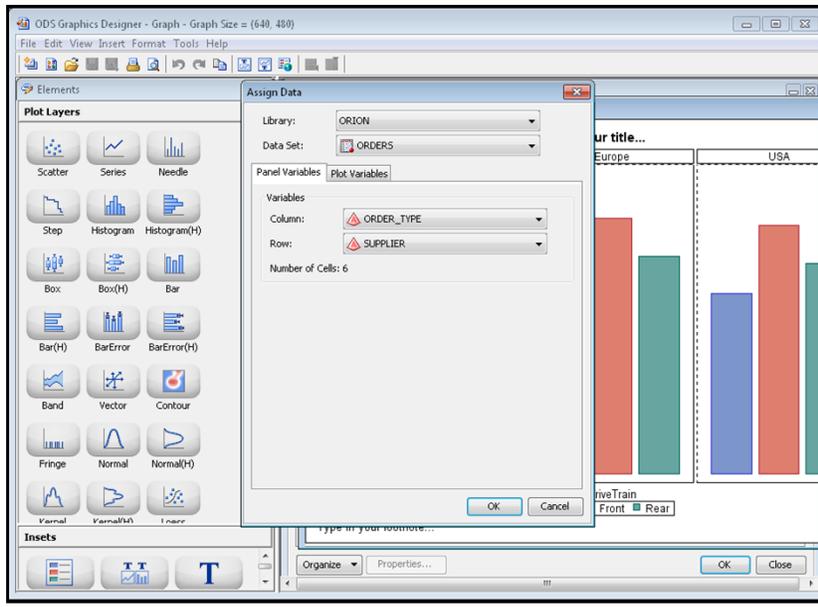
# Creating Paneled Graphs

Select **Panel** tab from Gallery and choose graph type.



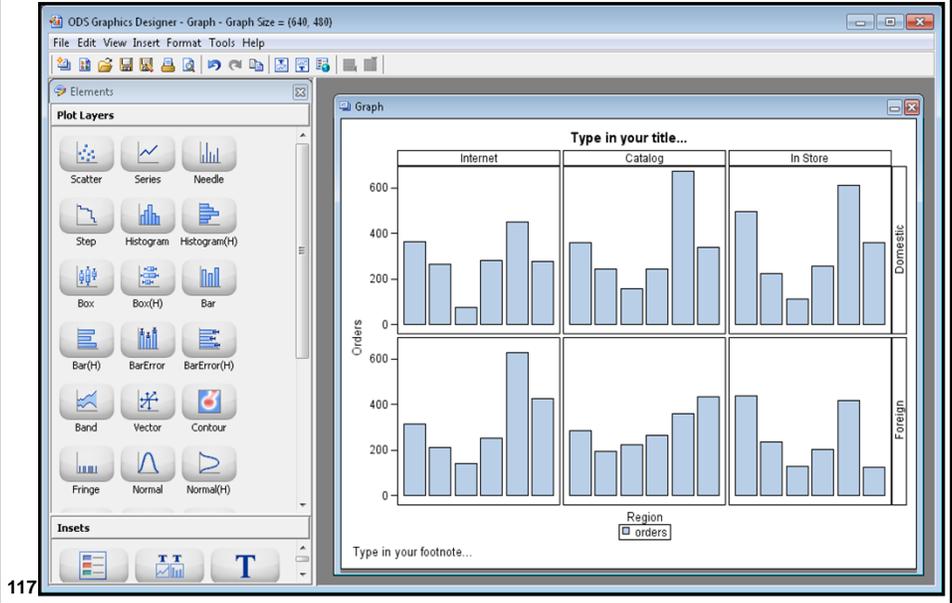
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# Fill in Panel and Plot Variables



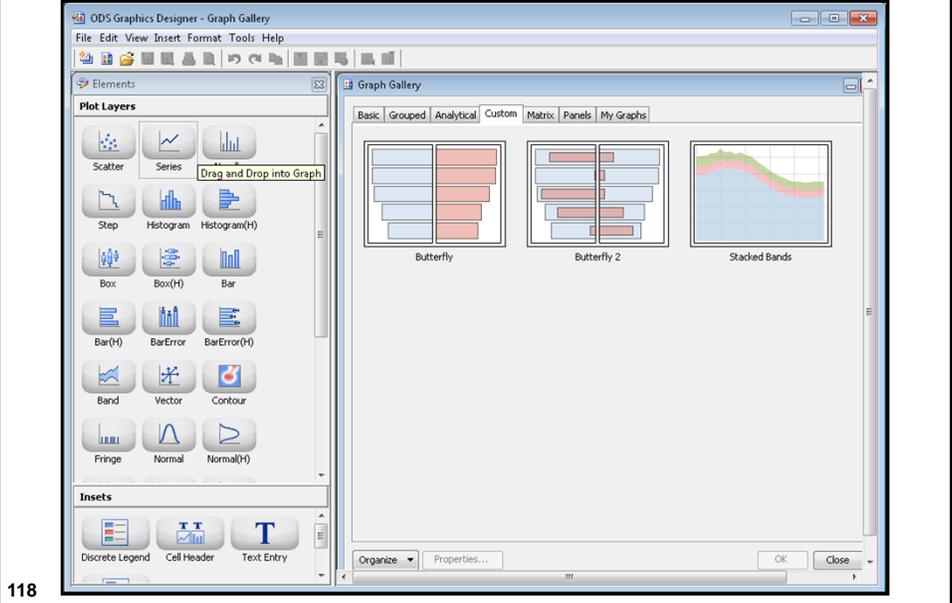
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# Paneled Graph



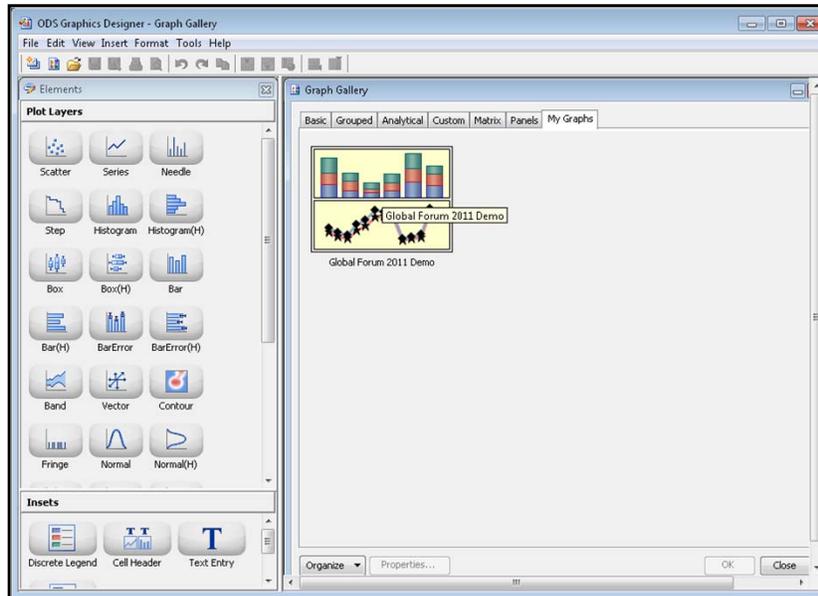
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# Some Other Graphs in the Gallery



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## Click "My Graphs" Tab to See Saved Graphs



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## Can I Save Code Generated by the Designer?

- Good news – code can be viewed and saved
- Bad news – code is Graphics Template Language and PROC SGRENDER, but...
- Good news – the code is a good way to learn GTL!

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## Click View ⇒ Code to See Generated Code

The screenshot shows the SAS ODS Graphics Designer interface. On the left is a 'Plot Layers' gallery with various chart types like Scatter, Series, Needs, Step, Histogram, Histogram(H), Box, Box(H), Bar, Bar(H), BarError, BarError(H), Band, Vector, Contour, Fringe, Normal, Normal(H), Insets, Discrete Legend, Cell Header, Text Entry, and Gradient Legend. The main window displays a three-panel bar chart titled 'Type in your title...' with panels for 'Internet', 'Catalog', and 'In Store'. The y-axis is labeled 'Orders' and ranges from 0 to 600. Below the chart, the 'Code - Graph' window shows the generated GTL code:

```

proc template;
  define statgraph sgdesign;
    dynamic _REGION_ORDERS_SUPPLIER_ORDER_TYPE;
    dynamic _panelnumber_;
  begstatgraph;
    entrytitle _id='title' halign=center 'Type in your title...';
    entryfootnote _id='footnote' halign=left 'Type in your footnote...';
    layout datalattice _id='datalattice2' columnsvar=_ORDER_TYPE rowsvar=_SUPPLIER /
      panelnumber=_panelnumber_ cellheightmix=1 cellwidthmix=1 column2datarange=unionsall
      columnaxisopts=(display=(LABEL)) column2datarange=unionsall columnwidth=3 headerlabeldisplay=value
      row2datarange=unionsall rowaxisopts=(label='Orders') row2datarange=unionsall rowwidth=3;
      layout prototype _id='prototype' /;
        barchart _id='bar' x=_REGION y=_ORDERS / barwidth=0.85 name='bar' stat=sum;
      endlayout;
    endbar / align=bottom spacefill=false;
    discretelegend _id='legend' 'bar' / border=true displayclipped=true halign=center opaque=true
    order=rowmajor valign=center;
  endstatbar;
  endlayout;
endstatgraph;
end;
run;

proc sgrender data=ORION.ORDERS template=sgdesign;
  
```

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## Using Saved Layouts as Templates for Other Graphs

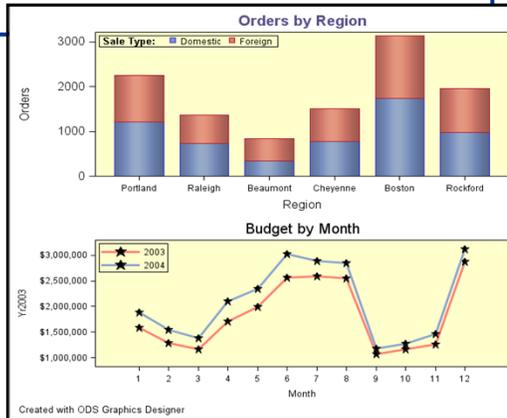
- Double-click graphs from Gallery window, and change parameters as needed
- Modify and run the generated GTL code with PROC SGRENDER
- Use PROC SGDESIGN
  - You can change input data set and plot variables in the PROC SGDESIGN code.

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## Using PROC SGDESIGN

This program replays the saved graph, specifying a different grouping variable for the bar chart.

```
proc sgdesign sgd='globalforum2011.sgd';
dynamic _order_type='supplier';
run;
```



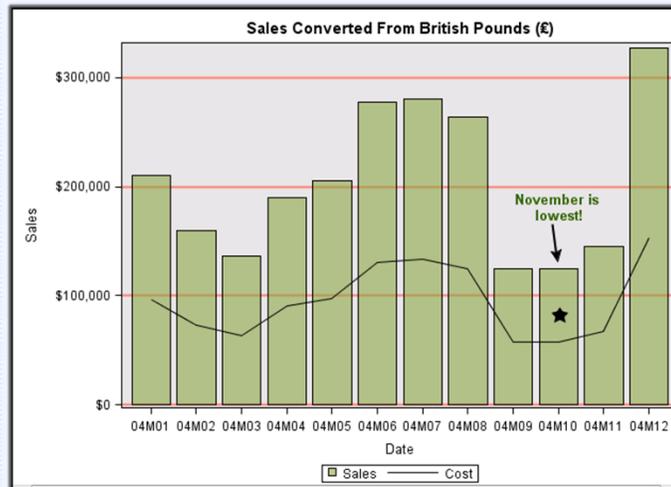
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## Section 1: ODS Graphics for the Non-Statistician

1.1 What is ODS Graphics?
1.2 Producing Non-Statistical Graphs Using Base SAS Procedures
1.3 SAS/GRAPH "SG" Procedures
1.4 Using PROC SGPLOT to Produce Non-Statistical Charts and Plots
1.5 Controlling Graph Appearance with SGPLOT
1.6 Using PROC SGPANEL to Display Multiple Cells Per Page
1.7 Using PROC SGSCATTER to Produce Multiple Plots Per Page
1.8 The ODS Graphics Designer
1.9 Editing Graphs Produced by SG Procedures
1.10 Upcoming Features and Conclusions

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## Editing Graphs Produced by SG Procedures



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## Purpose of the ODS Graphics Editor

- Primary purpose – make simple, ad-hoc changes to graphs created by SG and other procedures.
- Add simple annotation to graphs (text, lines, symbols)
- Data components (including tick labels) cannot be modified.

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## Enabling the Editing of ODS Graphics

You can use the ODS Graphics Editor to make edits to graphs created with ODS graphics. The ODS Editor cannot be used to edit graphs created with "classic" SAS/GRAPH procedures.

To enable use of the editor, submit the following statement:

```
ods listing sge=on;
```

## Creating an Editable Graph

When a SG procedure is run and SGE=ON is specified, the results window shows two graphs – one is an image file, and the second is the editable graph.

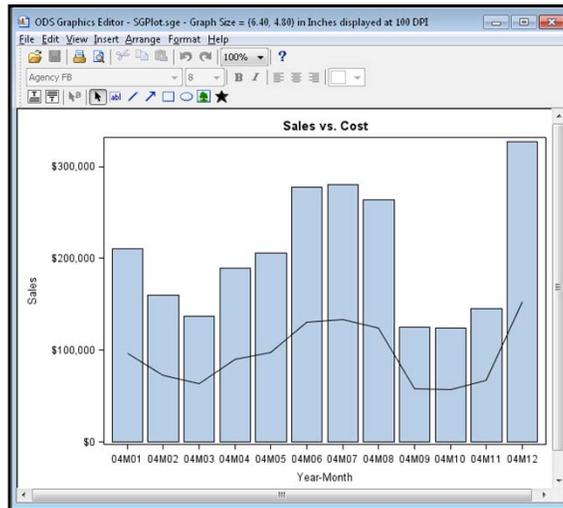
The screenshot shows the SAS interface with the following components:

- Results Window:** Contains two entries for 'The SGPlot Procedure'. The first is labeled 'image file' and the second is labeled 'editable graph'.
- Log Window:** Displays the following SAS code:
 

```
ods listing sge=on;
proc sgplot data=orion.profit;
  where company='Orion France' and year(yymm)=2004;
  vbar yymm / response=sales;
  vline yymm / response=cost;
  title 'Sales vs. Cost';
run;
```
- Editor Window:** Shows the same SAS code as the log window, with the first line highlighted in blue.

## Opening the Editable Graph

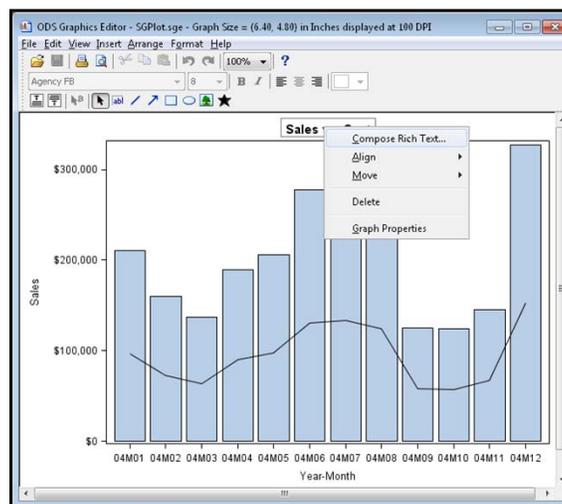
Double-clicking on the editable graph opens it in the ODS Graphics Editor.



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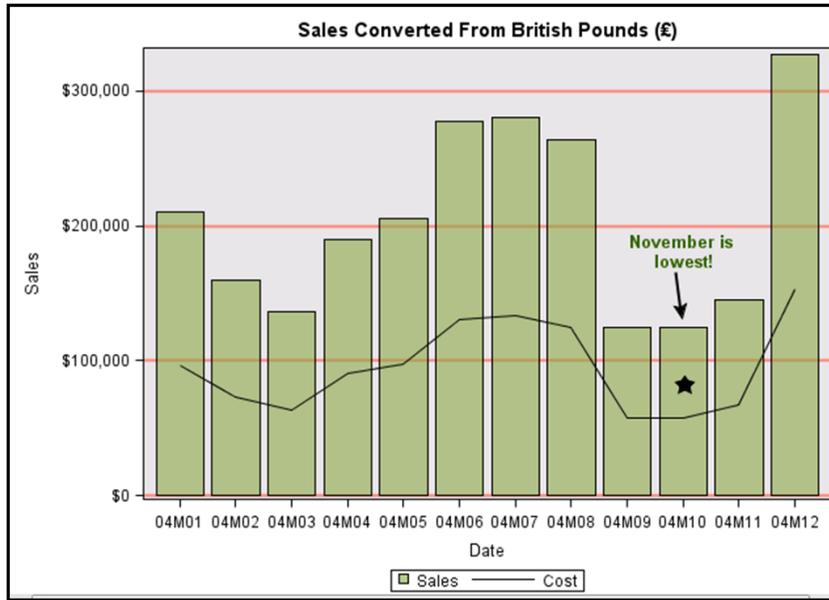
## Editing the Graph

Right clicking on a graph component brings us a dialog you can use to modify the component.



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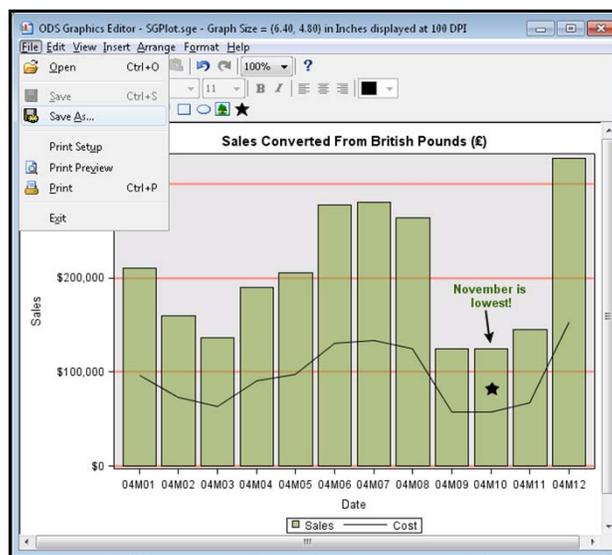
## Graph After Editing



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## Saving the Edited Graph

Click on **File** ⇒ **Save as....**



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## Saving the Edited Graph

You can save the edited graph as either:

- A .png (Portable Network Graphics) file, which can be printed or inserted into other documents
- A .sge file, which can be opened and re-edited with the ODS Graphics Editor
- The ODS Graphics Editor does not generate SAS code.

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1.10 Upcoming Features and Conclusions

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## Upcoming Features and Conclusions



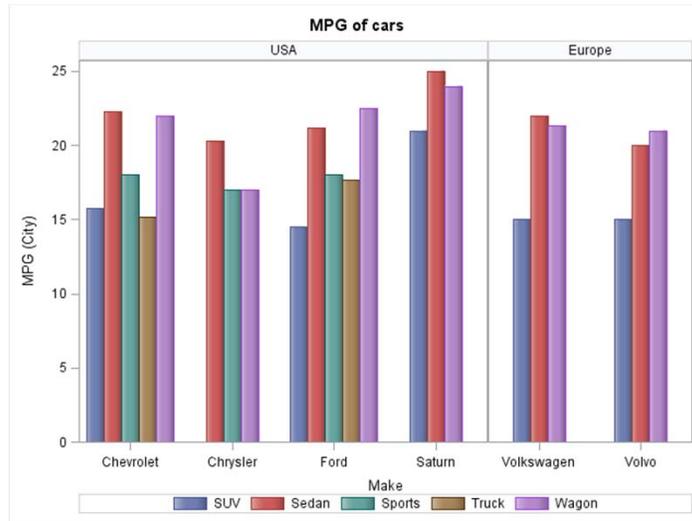
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## Upcoming ODS Graphics Features in SAS 9.3

- Clustered groups for bar charts
- Fill pattern "skins" for bar charts
- Bubble plots
- High-Low Plots
- Pie Charts
- Attribute maps
- Annotation
- Maps (experimental)
- Default output to web page instead of image file

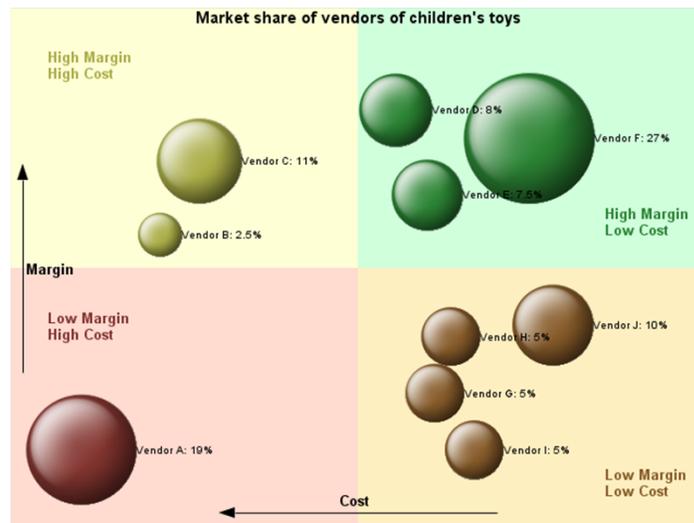
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## Clustered Groups and "Skins" for Bar Charts



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## Bubble Plots



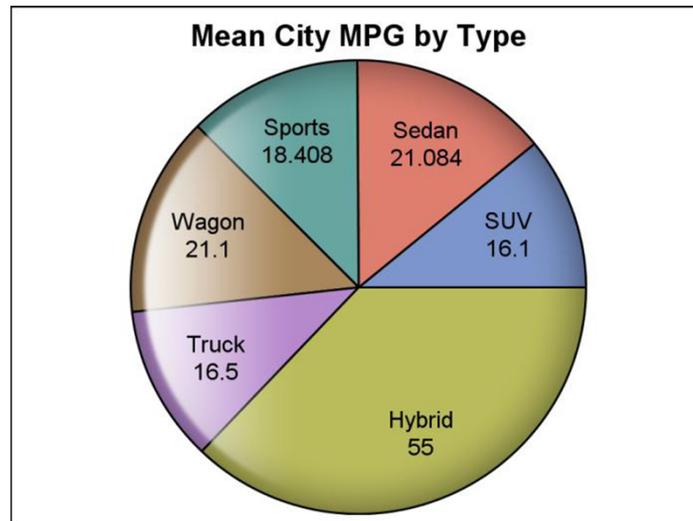
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## High-Low Plots



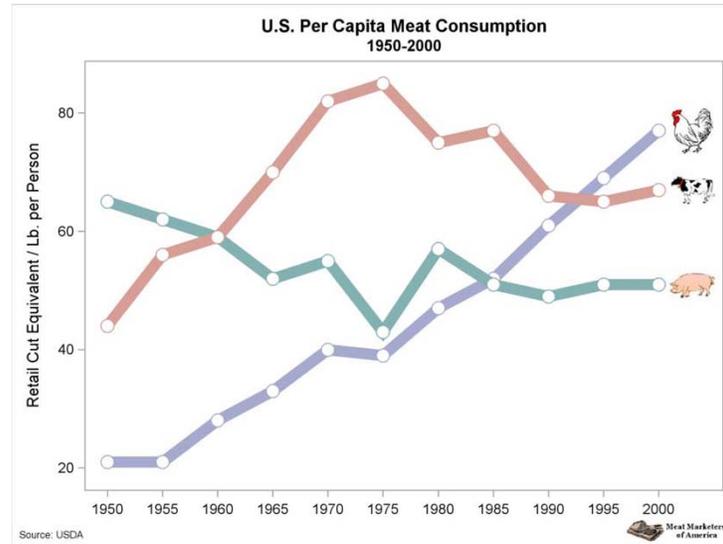
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## Pie Charts



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## Annotate



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## Some Considerations

You cannot use SAS to combine ODS Graphics with graphs produced by "classic" SAS/GRAPH procedures  
 ODS Graphics cannot produce some types of graphs that "classic" SAS/GRAPH procedures can, such as:

- Pie and donut charts
- Radar charts
- 3D bar charts
- Maps
- Tile charts

ODS Graphics does not (yet) support Annotate

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*continued...*

## Some Considerations

ODS Graphics can produce the following types of graphs that "classic" procedures cannot, including:

- Density plots
- Ellipse plots
- Vector plots
- Horizontal box plots

ODS Graphics can produce the following types of graphs much more easily than "classic" SAS/GRAPH procedures:

- Overlay plots
- Panel graphs
- Plot matrices

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## Which Should I Choose?

- If you are already creating graphs for a specific application using "classic" SAS/GRAPH procedures, continue to use them (they won't go away).
- If your graphs require complex annotation, use "classic" SAS/GRAPH procedures.
- Consider using SG procedures for new applications that do not require complex annotation.



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