



# Introducing Statistical Graphics (SG):

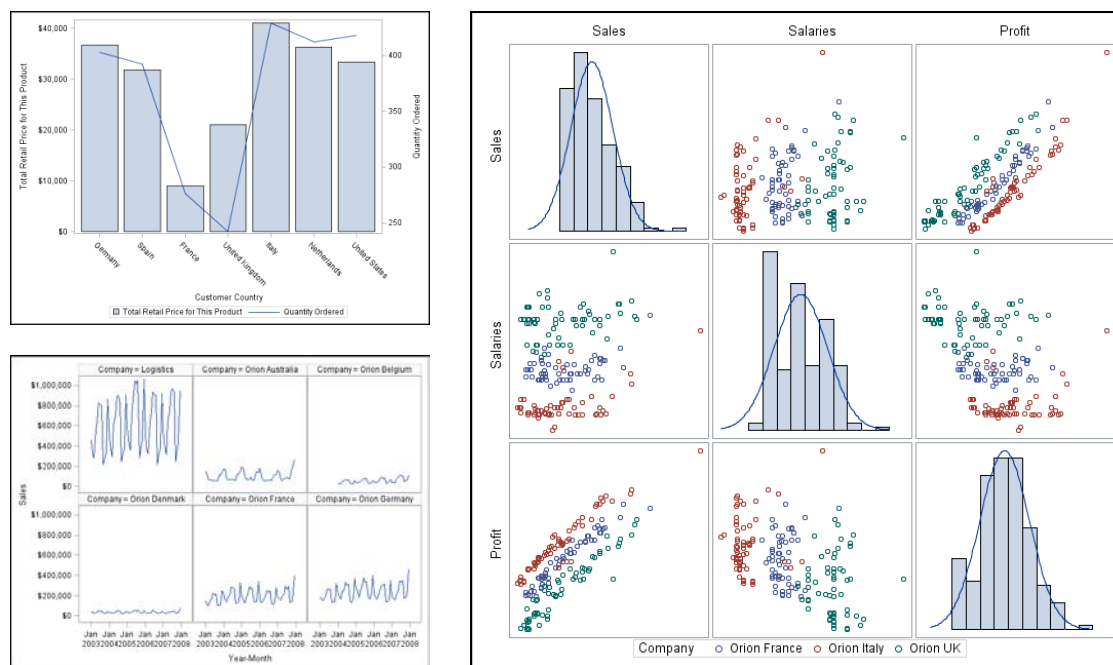
**Vancouver UG**  
**May 2018**  
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*SAS Canada*  
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# Agenda

- Introduction to Statistical Graphics
  
- PROC SGPLOT
  - General purpose
  - Overlays
  - Statistical
  
- Quick look at SGPANEL and SGSCATTER
  
- Supporting Statements/Facilities
  
- Questions

# Statistical Graphics (ODS Graphics)

*ODS Graphics* is based on Graph Template Language (GTL), which provides the power and flexibility to create many complex statistical and non-statistical graphs.



Prior to SAS 9.3, ODS Graphics was part of SAS/GRAPH. Starting in SAS 9.3, ODS Graphics is part of Base SAS.

# Statistical Graphics

Statistical Graphics, also referred to as *ODS Graphics*, as it is an extension of the SAS Output Delivery System (ODS).

## ***ODS Graphics Procedures***

Provide a concise syntax for creating statistical and non-statistical graphs.

# ODS Graphics Procedures

The ODS Graphics procedures provide a traditional SAS procedure interface for the most commonly used features of the SAS Graph Template Language.

## ***SGPLOT***

Creates a single-celled graph, and multiple plots are overlaid within a single set of axes.

## ***SGPANEL***

Creates classification panels containing either a simple plot or multiple overlaid plots.

## ***SGSCATTER***

Creates panels with multiple scatter plots.

# SGPLOT Procedure

The SGPLOT procedure can produce the following and more:

<b><i>Basic Plots</i></b>	Scatter plots, series plots, band plots, bubble plots, high-low charts, needle plots and vector plots
<b><i>Fit and Confidence Plots</i></b>	Loess curves, regression curves, penalized B-spline curves, and ellipses
<b><i>Distribution Plots</i></b>	Histograms, box plots, and density curves
<b><i>Categorization Plots</i></b>	Bar charts, dot plots, and bar-line charts

# SGPLOT Procedure

Combining graphs: Which can be overlaid together?

**Basic Plots**

Overlay only with



**Other Basic Plots  
and Fit and  
Confidence Plots**

**Distribution Plots**

Overlay only with



**Other Distribution  
Plots**

**Categorization Plots**

Overlay only with



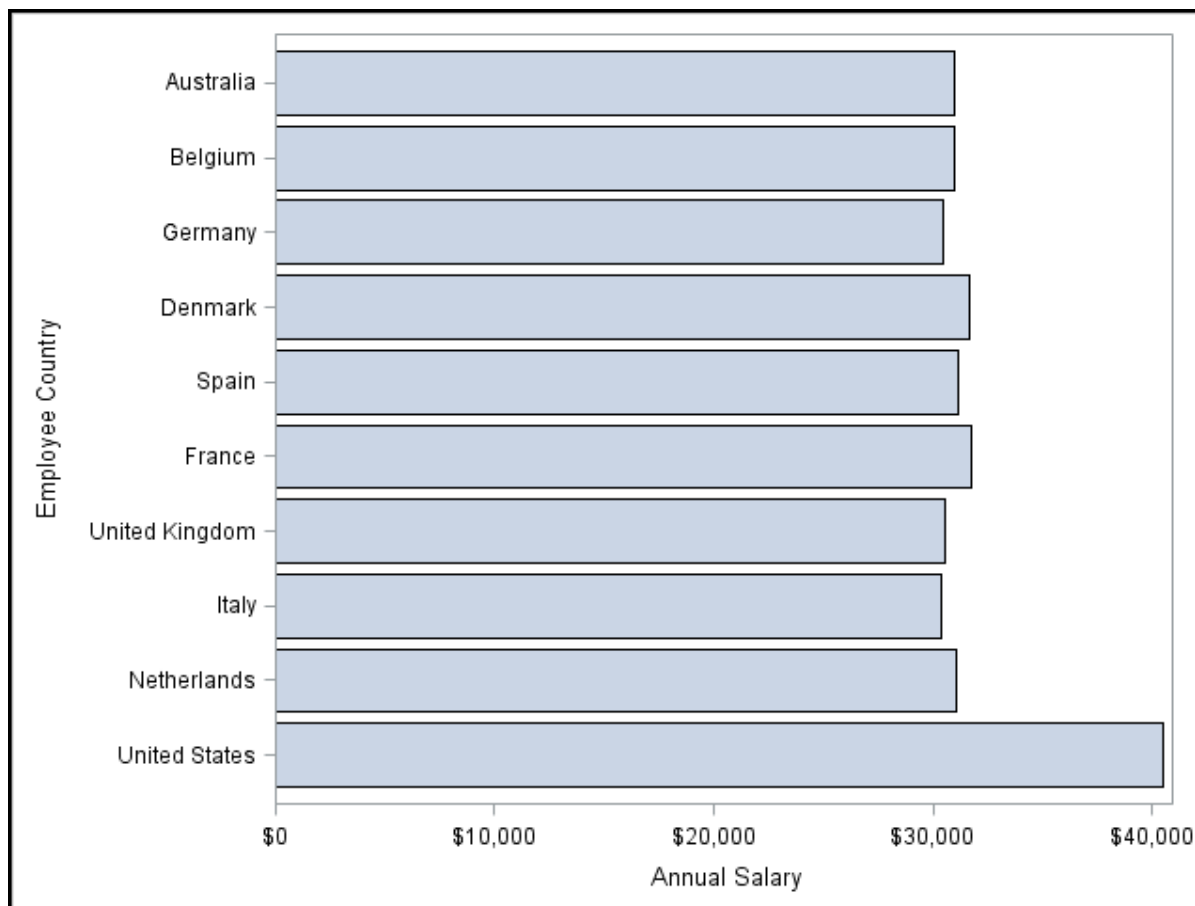
**Other  
Categorization  
Plots**

# GENERAL PURPOSE GRAPHS



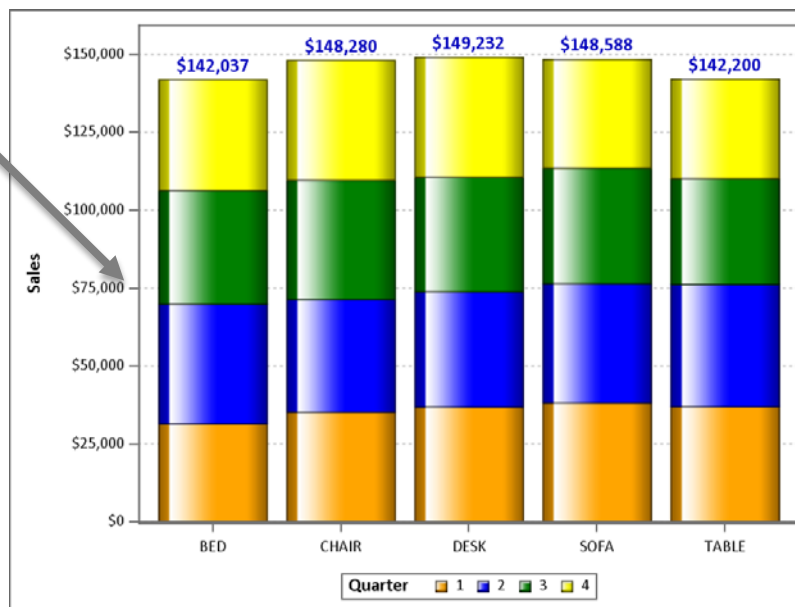
# Bar Chart : Basic

```
proc sgplot data=orion.emps;  
  hbar Country / response=Salary stat=mean;  
run;
```



# Bar Chart : Advanced

Actual Sales by Product and Quarter



Add grid lines to Y-axis and assign label "Sales" to column Actual.

```
Yaxis grid
label='Sales';
```

Add Datalabels to bars, use Style attributes to adjust font weight, color and size

```
VBAR product /
response=actual
group=quarter
stat=sum
datalabel
datalabelattrs=(weight
=bold color='dark
blue' size=10pt)
dataskin=gloss ;
```

Suppress the X axis column Product: `xaxis display=(nolabel);`

Assigns colours in specified order:

```
styleattrs datacolors=(orange blue green yellow);
```

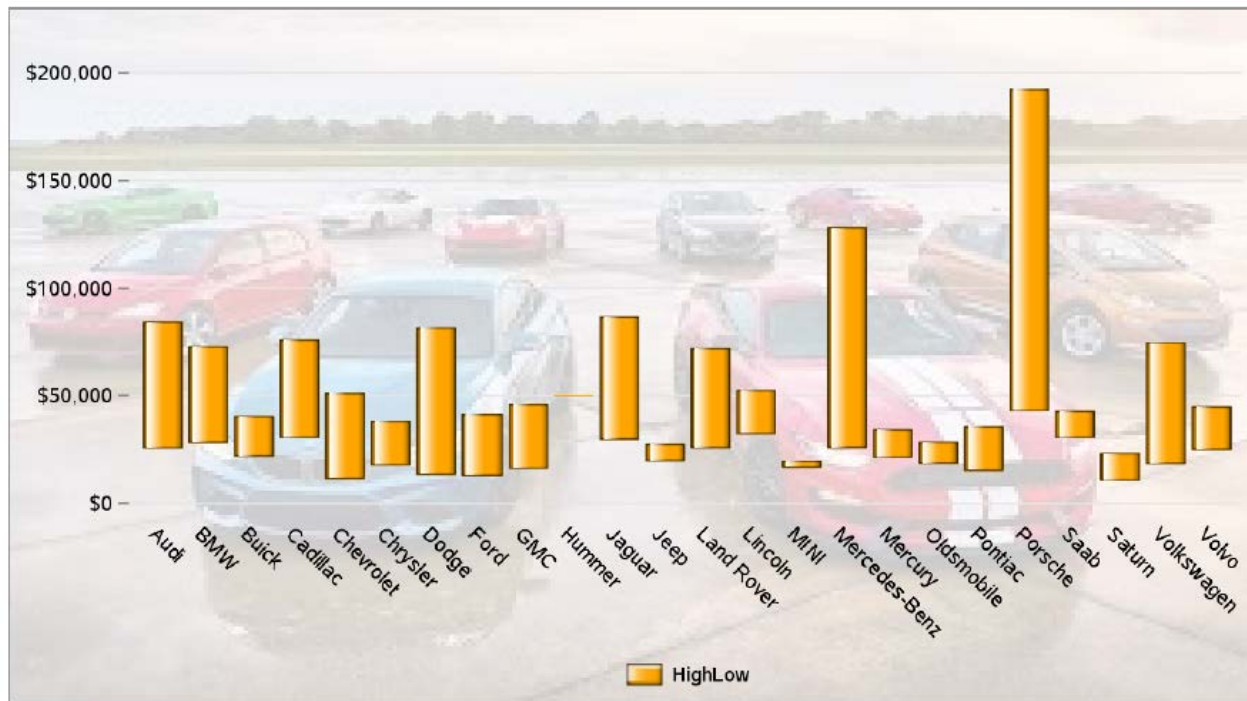
Make it look slick with `dataskin=gloss|sheen|crisp|Matte|pressed`

# Bar Chart : Advanced

```
Proc SGPLOT data=sashelp.prdsale;  
  format actual dollar6.0;  
  title 'Actual Sales by Product and Quarter';  
  vbar product / response=actual group=quarter  
    stat=sum  
    datalabel datalabelattrs=(weight=bold  
      color='dark blue' size=10pt)  
    dataskin=gloss;  
  xaxis display=(nolabel);  
  yaxis grid label='Sales';  
  styleattrs datacolors=(orange blue green  
    yellow);  
run;
```

# High Low with Background: Use Annotate

Minimum and Maximum MSRP by Make  
Europe and USA



Use SQL or Data step to calculate Minimum and Maximum values of MSRP by Make.

PROC SGPLOT Options:

Suppress background and borders, use annotate dataset:

```
proc sgplot data=cars
nowall noborder
sganno=annoImage ;
```

Create Annotate dataset with background image `image="&path\cars.jpg"; layer='back';`

Assign other options to annotate dataset such as `dataspace`, which controls positioning and scaling.

This graph has `DRAWSPACE= 'GRAPHPERCENT'` as we want the entire annotation (background image to take up the entire graph

# High Low with Background: Annotate Table

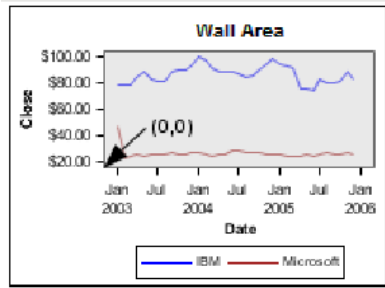
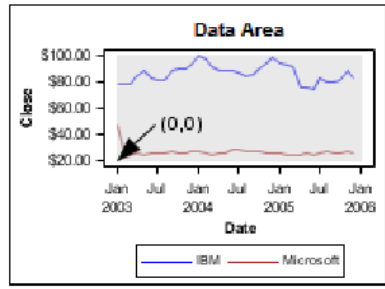
```
data annoImage;
  length function $10;
  function='image'; height=100; width=100;
  transparency=0.8; drawspace='GraphPercent';
  image="&path\cars.jpg"; layer='back';
run;

ods graphics / reset width=9in height=5in
imagenamename='Car Make Minimum & Maximum MSRP';
proc sql;
  create table cars as
  select make ,min(msrp) format=Dollar14.0
  as min_MSRP, max(msrp) as max_msrp
  format=Dollar14.0
  from sashelp.cars
  where origin in('Europe','USA')
  group by make;
quit;
```

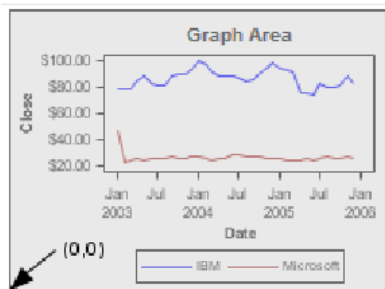
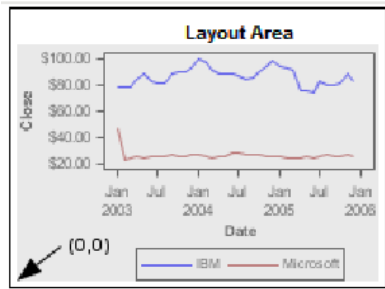
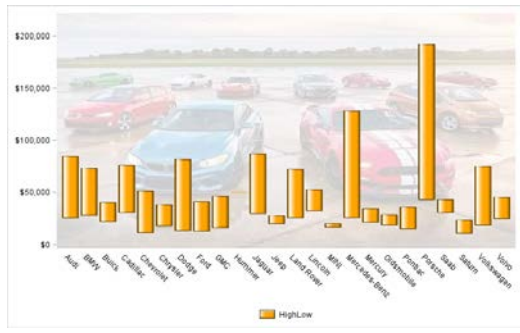
# High Low with Background :SGPLOT

```
title color=bib height=16pt 'Minimum and Maximum  
MSRP values by Make';  
title2 color=bib 'Europe and USA';  
PROC SGPLOT data=cars nowall noborder  
  sganno=annoImage ;  
  highlow x=make low=min_MSRP high=max_msrp /  
  type=bar name='h' lineattrs=graphoutlines  
  dataskin=gloss fillattrs=(transparency=0  
  color=orange);  
  xaxis display=(nolabel noline noticks);  
  yaxis display=(nolabel noline)grid  
  offsetmax=0.1;  
keylegend 'h' / noopaque noborder fillheight=14  
fillaspect=golden;  
RUN;
```

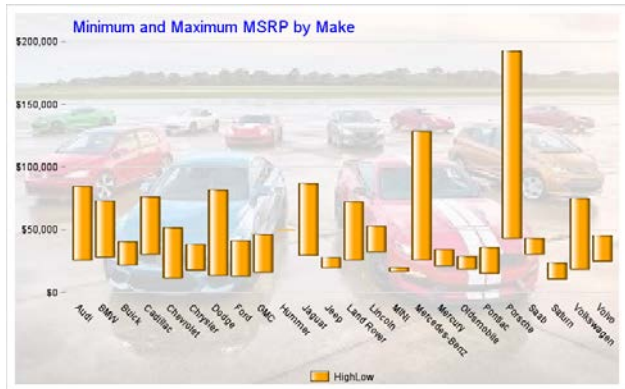
# High Low with Background: Drawspace



`drawspace='wallpercent';`



`drawspace='graphpercent';`



# SGPLOT: Series

Monthly Sales for France Italy and UK Orion Offices



Insert a text inset box within graph:  
 Inset "Monthly target is  
 \$300,000"/position=topright  
 textattrs=(size=14pt color=white  
 weight=bold);

Insert reference line with attributes

```
refline 300000/label='$300,000'  

  lineattrs=( color=blue  

  pattern=dash thickness=0.5mm) ;
```

Show Distinct X axis numeric values

```
XAXIS type=discrete  

  labelattrs=(size=15pt  

  color=white);
```



# SGPLOT: Series

```
ods graphics / border reset width=9in height=5in ;  
Title "Monthly Sales for France Italy and UK Orion  
Offices" ;
```

```
proc sgplot data=retail.profit sganno=annoImage_vic nowall  
where Country in ('France', 'Italy', 'UK')  
and Year=2007 ;
```

```
series x=Month y=Sales / group=Company  
lineattrs=(thickness=0.15cm) ;
```

```
refline 300000 / label='$300,000'
```

```
lineattrs=(color=blue pattern=dash thickness=0.5mm) ;
```

```
XAXIS type=discrete labelattrs=(size=15pt  
color=white) ; /*show exact numeric values for month*/
```

```
YAXIS label='Monthly Sales' labelattrs=(size=15pt  
color=white) ;
```

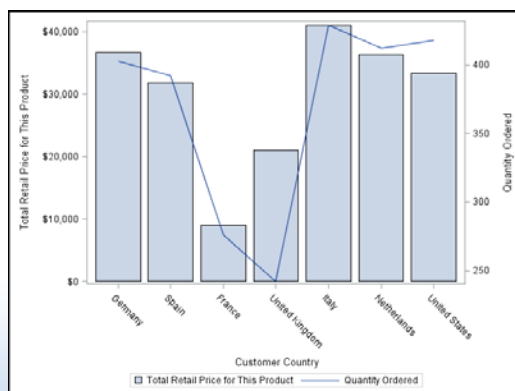
```
inset "Monthly target is $300,000" / position=topright  
textattrs=(size=14pt color=white weight=bold) ;
```

```
run ;
```

# OVERLAY GRAPHS

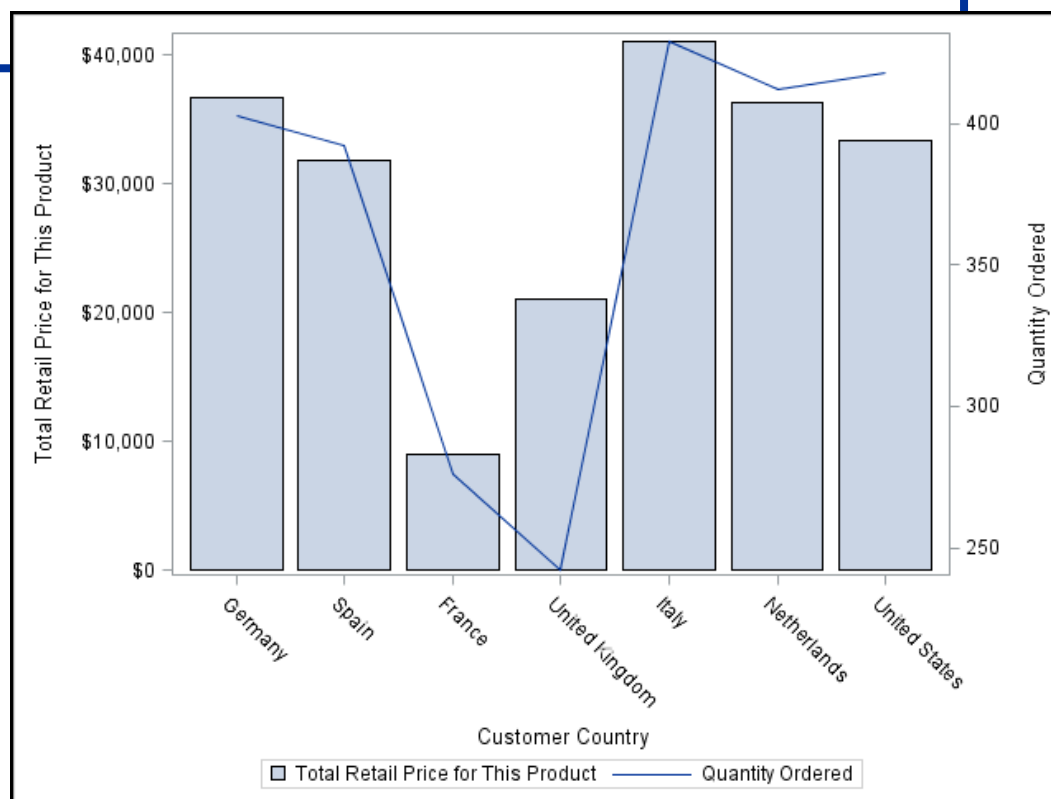
# SGPLOT : Multiple Plots

Overlaid graphs are

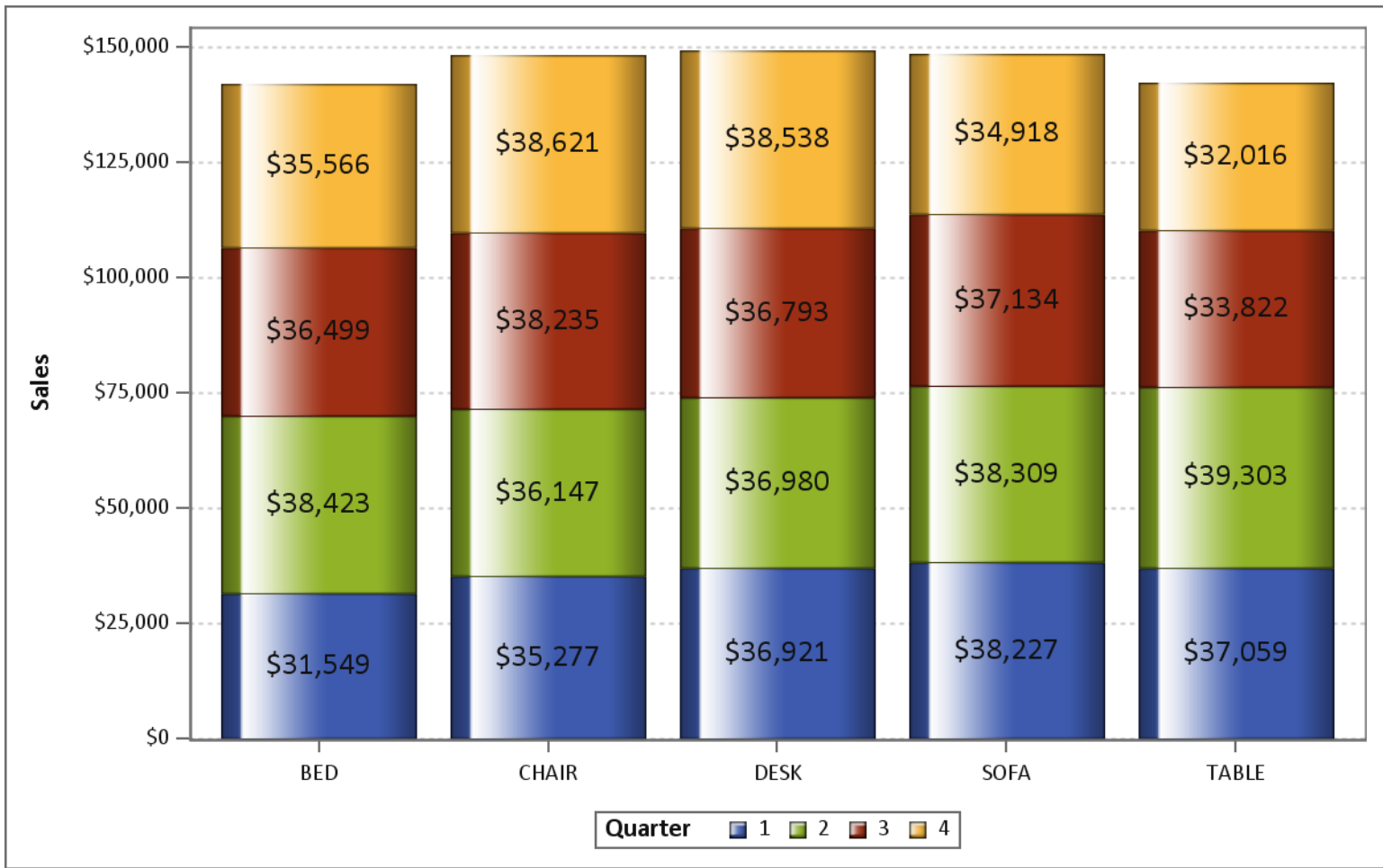


# Bar-Line Chart

```
proc sgplot data=orion.orders;  
  vbar CustomerCountry /  
    response=TotalRetailPrice;  
  vline CustomerCountry /  
    response=Quantity y2axis;  
run;
```



# HIGHLOW and SCATTER Overlay with Segment Labels



# HIGHLOW and SCATTER Overlay with Segment Labels

Data preparation:

```
data HighLow;
  format low mid high actualsum dollar7.0;
  format highlabel dollar8.0;
  retain low 0;
  set prdsale (drop=_type_);
  by product;

  if first.product then low=0;
  high=low+ActualSum;
  mid = (low+high)/2;

  if last.product then highlabel=high;
  output;
  low=high;
run;
```

# HIGHLOW and SCATTER Overlay with Segment Labels

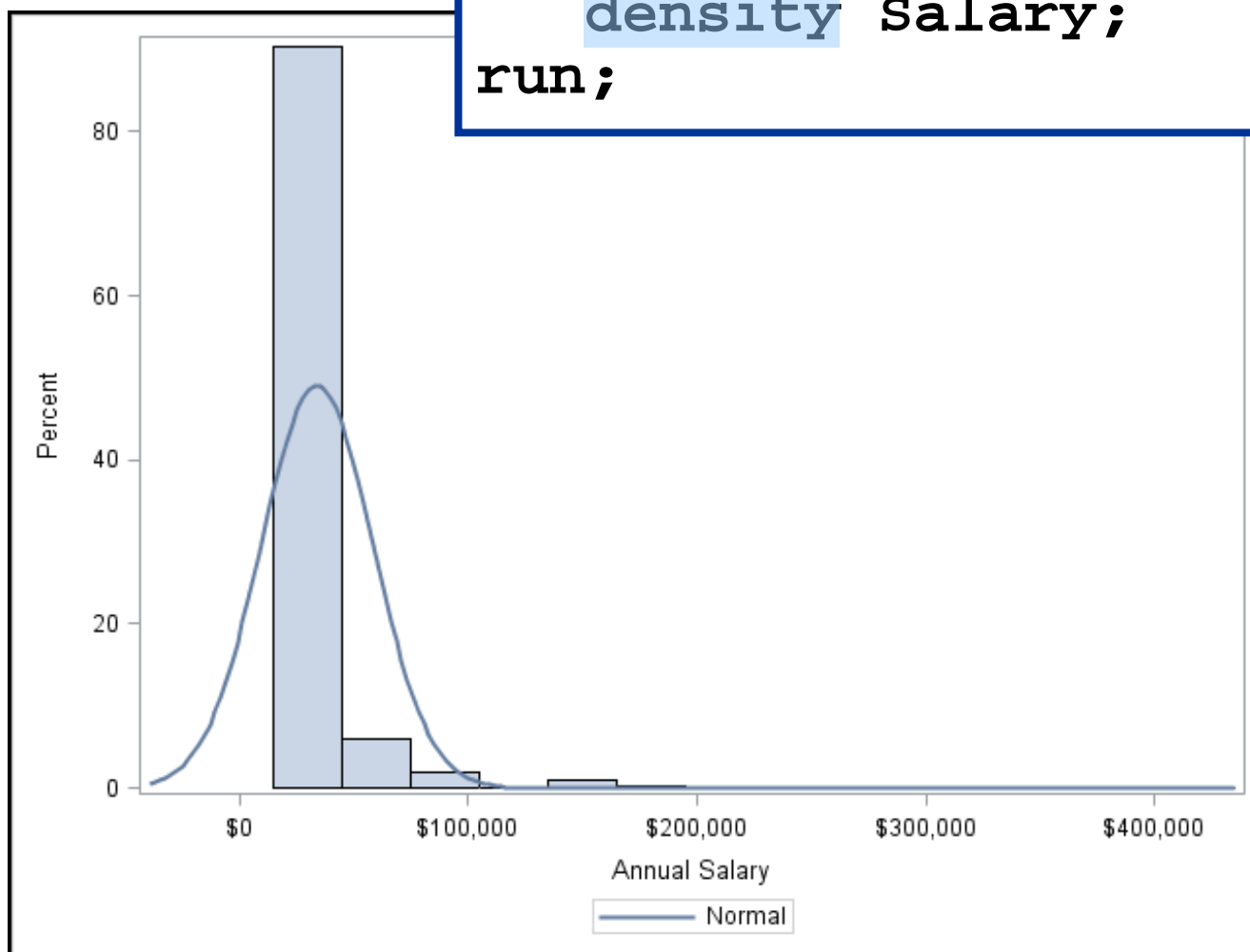
```
/*--Stacked Group with segment Labels--*/  
ods graphics / reset width=8in height=5in;  
proc sgplot data=HighLow;  
  title 'Actual Sales by Product and Quarter';  
  highlow x=product low=low high=high / group=quarter  
          type=bar lineattrs=(pattern=solid) dataskin=gloss;  
  scatter x=product y=mid / markerchar=actualsum  
          markercharattrs=(size=12pt);  
  xaxis display=(nolabel);  
  yaxis grid offsetmin=0 label='Sales';  
run;
```

# STATISTICAL



# Histogram and Density Curve

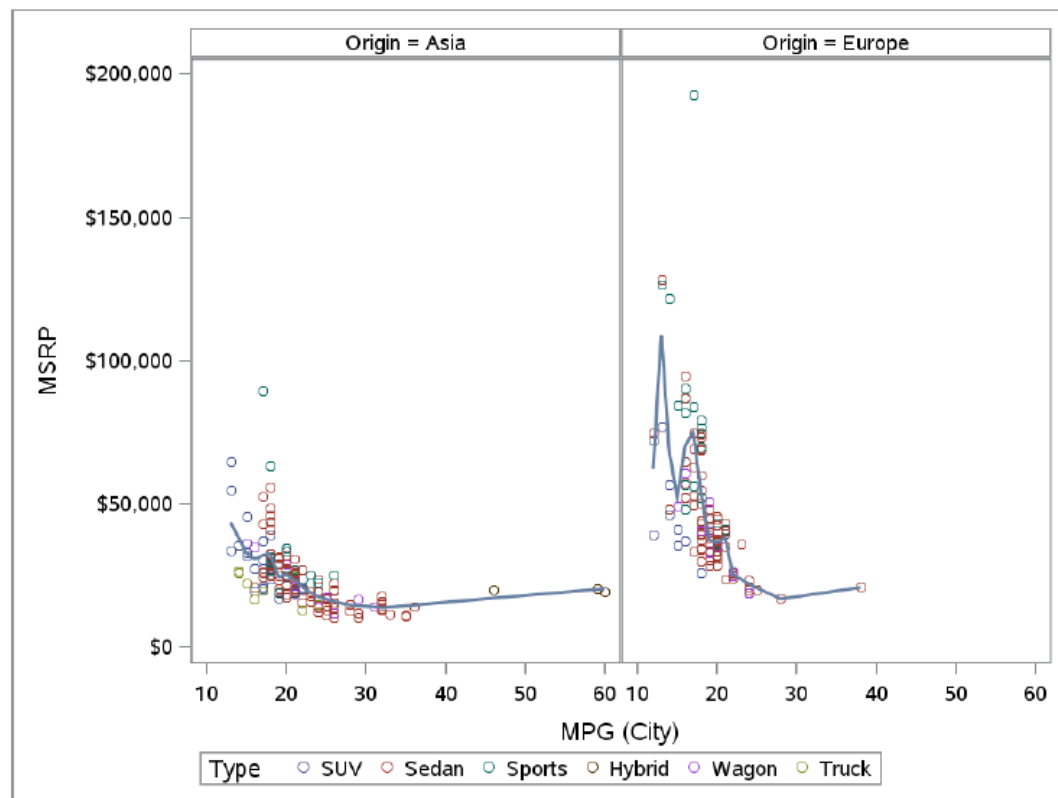
```
proc sgplot data=orion.emps;  
  histogram Salary;  
  density Salary;  
run;
```



# Loess and Scatter Plot Overlaid

```
proc sgpanel data=sashelp.cars;  
where origin in ("Asia" "Europe");  
panelby origin;  
scatter x=mpg_city y=msrp / group=type;  
loess x=mpg_city y=msrp / nomarkers name="fit";  
run;
```

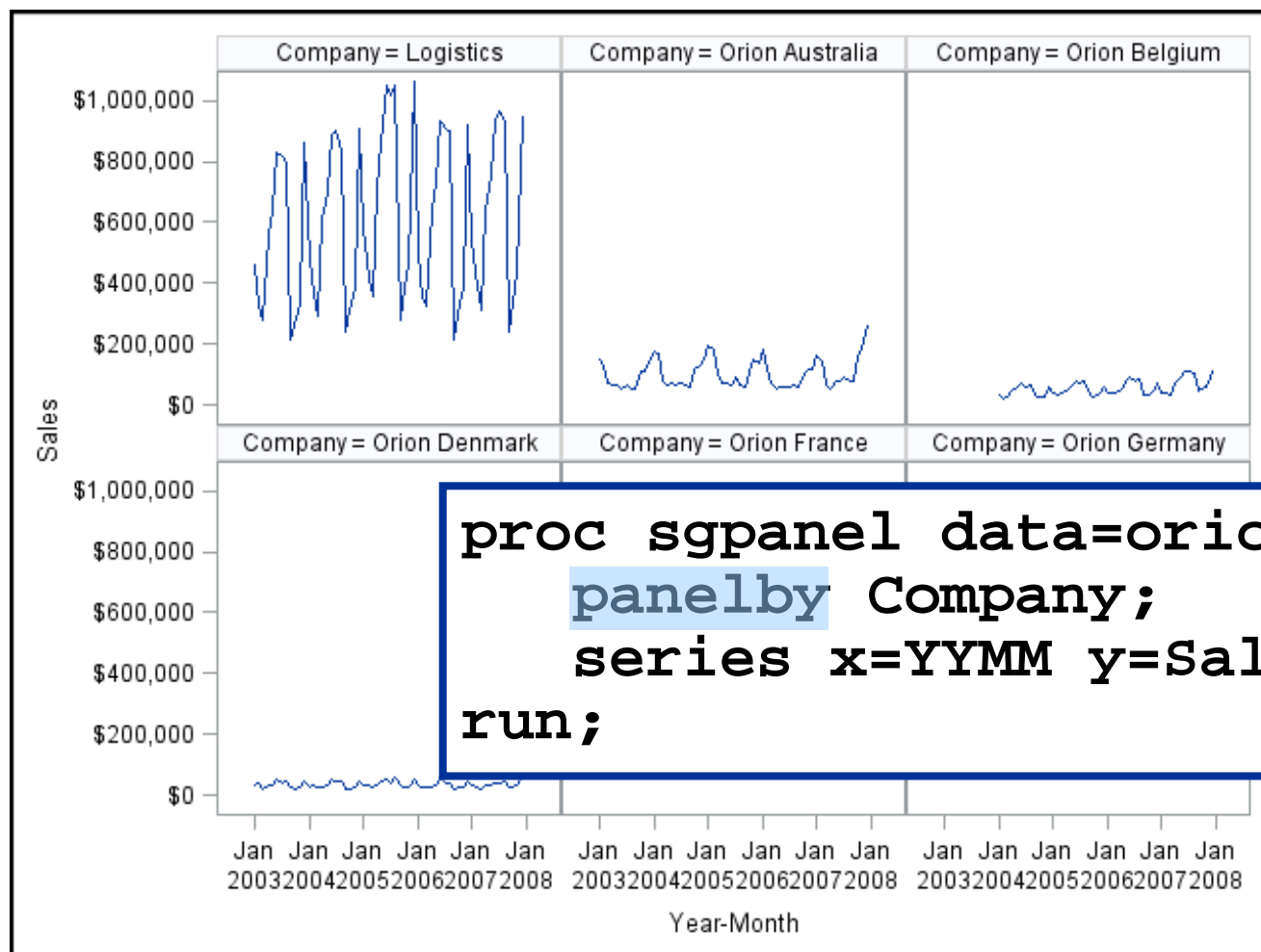
MSRP and MPG for Various Vehicle Types



# QUICK LOOK AT SGPANEL AND SGSCATTER

# SGPANEL Procedure

The SGPANEL procedure creates a panel for the values of one or more classification variables.



```
proc sgpanel data=orion.profit;
  panelby Company;
  series x=YYMM y=Sales;
run;
```

# SGSCATTER Procedure

The SGSCATTER procedure creates panels with multiple scatter plots.

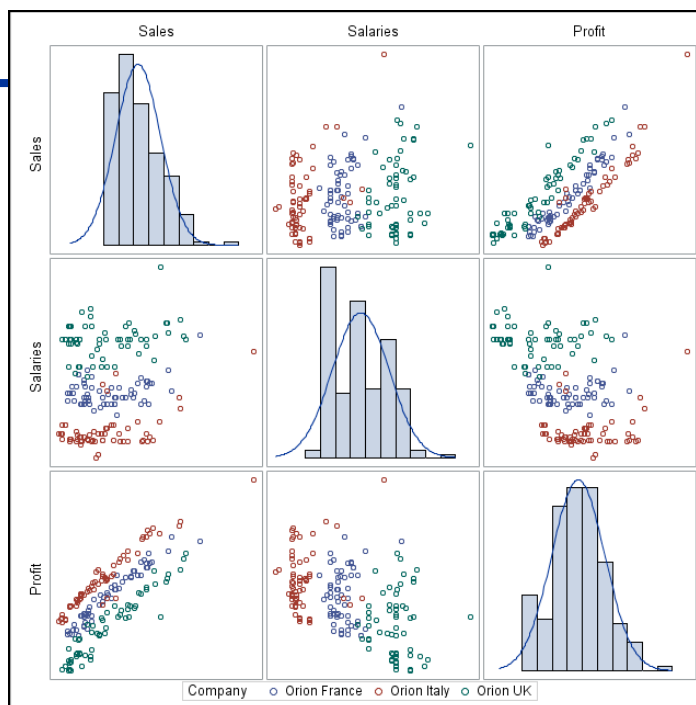
The procedure syntax supports the following features:

- three types of graph layouts: PLOT, COMPARE, and MATRIX
- basic scatter plots, fit and confidence plots, and distribution plots

# MATRIX Layout

The MATRIX statement creates scatter plots where each variable is graphed against each other.

```
proc sgscatter data=orion.profit;
  where Country in ('France','Italy','UK');
  matrix sales salaries profit / group=company
    diagonal=(histogram normal);
run;
```



# **SUPPORTING STATEMENTS/FACILITIES**

# Supporting Statements and Facilities

Further control and enhance Graphics

- AXIS Statements (including secondary axes)
  - Legend Statements
  - Reference Statements
  - ODS graphics statement
  - Annotate Facility
- more.....

If your ODS graphs are not working, ODS Graphics may be off. On most operating systems the default is ON.

ODS Graphics on;



# Supporting Statements and Facilities

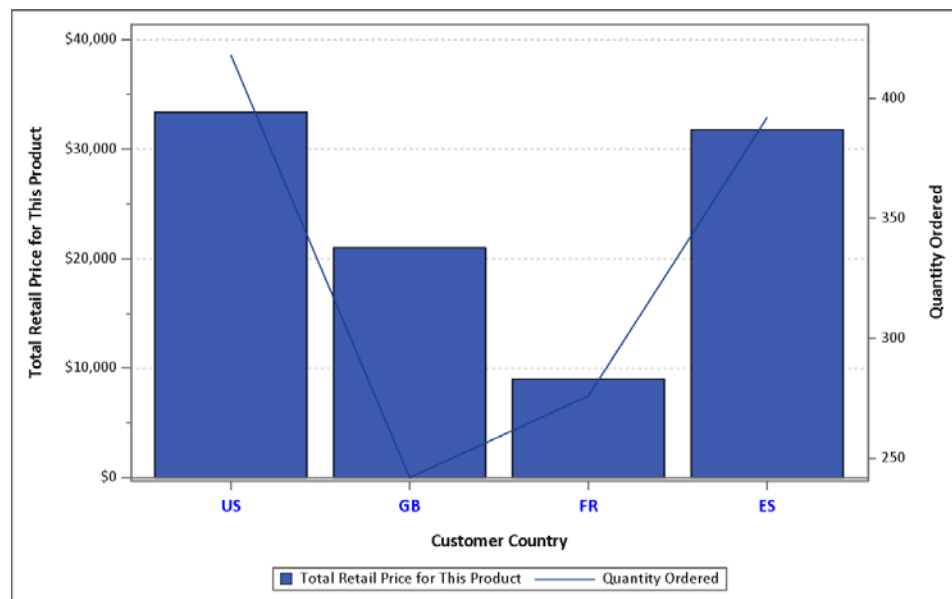
Use supporting SG Statements to further control and enhance the plots.

## AXIS Statements:

- Axis labels
- Grid lines
- Major and minor tick marks

## Example

```
axis values=( 'US' 'GB' 'FR' 'ES' )
fitpolicy=rotate valueattrs=(color=blue
weight=bold size=10);
yaxis grid minor;
```



# Supporting Statements

Legend: Impacts the legend border, entries, legend title, inside/outside graph

Reference lines: Add horizontal or vertical

## NEW SAS 9.4 M1

The DATASKIN= option has been added to the following plot types: DOT, DROPLINE, HBOX, VBOX, HLINE, VLINE, HIGHLOW, REFLINE, NEEDLE, SERIES, STEP, and VECTOR

# Supporting Statements

ODS Graphics: Manage the settings for your graphics output, layout, sizing, adding tips

Example:

```
ods graphics on / reset width=3in  
height=5in outputfmt=gif imagemap=on  
imagename="MyBoxplot"  
border=off;
```

# Resources

Examples of ODS Graphics examples:

<https://blogs.sas.com/content/graphicallyspeaking/>

Collection of sample graphs by Procedure:

<http://support.sas.com/sassamples/graphgallery/index.html>

ODS Community:

[https://communities.sas.com/t5/SAS-GRAPH-and-ODS-Graphics/bd-p/sas\\_graph](https://communities.sas.com/t5/SAS-GRAPH-and-ODS-Graphics/bd-p/sas_graph)

Tip Sheet

[https://support.sas.com/rnd/app/ODSGraphics/TipSheet\\_ODSGraphics.pdf](https://support.sas.com/rnd/app/ODSGraphics/TipSheet_ODSGraphics.pdf)

.....AND MANY MORE

Questions?





# Thank You

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