Highly Customized Graphs Using ODS Graphics

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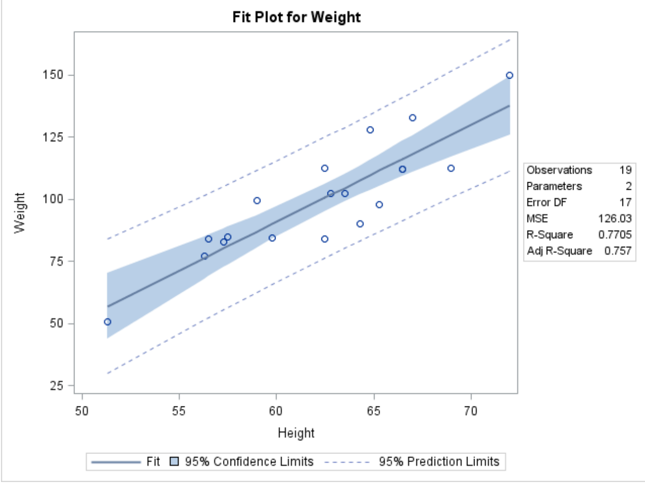
Graph Components

- Graph template (can be modified)
- Style template (can be modified or in SAS 9.4, overridden)
- Data object (can be output)

- Dynamic variables

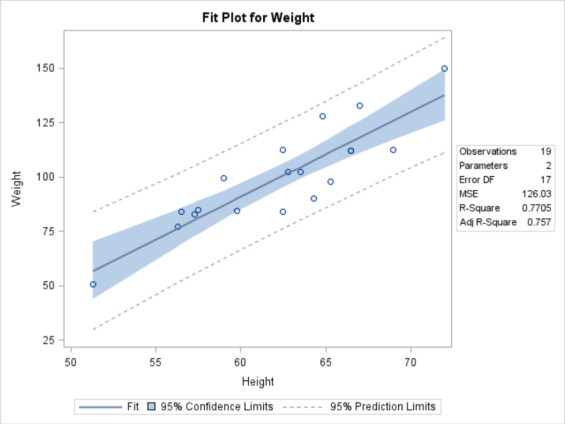


```
ods graphics on;
proc reg data=sashelp.class;
   model weight = height;
quit;
```

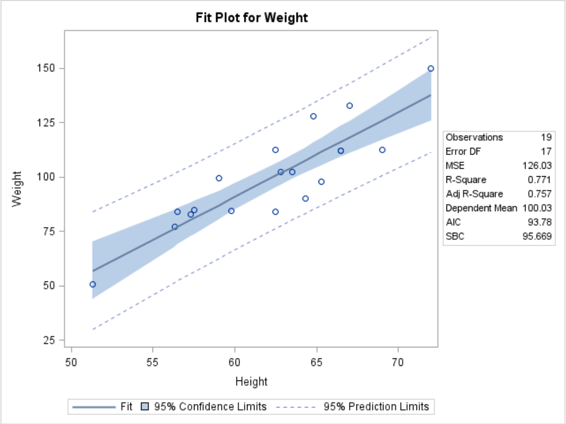
You can use an SG procedure (SGPLOT, SGPANEL, SGSCATTER) to make a graph from raw data or from the output data object from a graph.

You can then use SG Annotation to customize the graph.

Customized Dynamic Variables

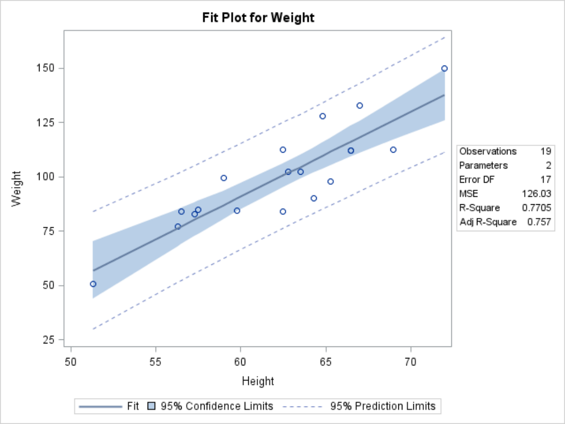


Observations	19
Parameters	2
Error DF	17
MSE	126.03
R-Square	0.7705
Adj R-Square	0.757

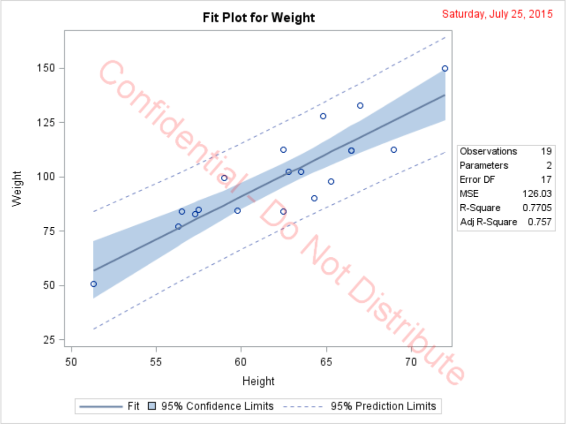


Observations	19
Error DF	17
MSE	126.03
R-Square	0.771
Adj R-Square	0.757
Dependent Mean	100.03
AIC	93.78
SBC	95.669

SG Annotation: Text and Watermark

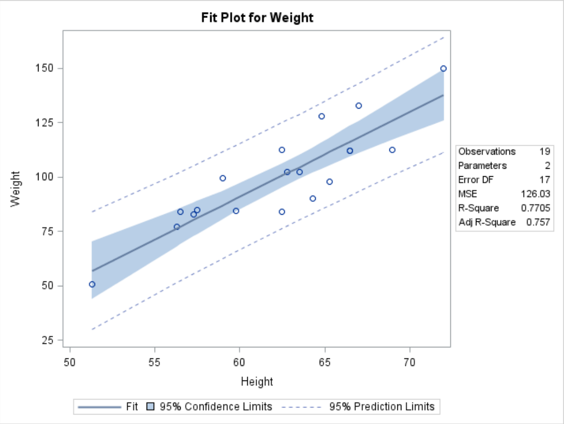


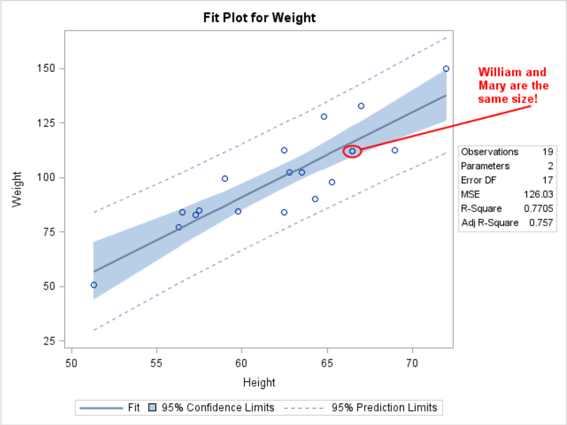
Observations	19
Parameters	2
Error DF	17
MSE	126.03
R-Square	0.7705
Adj R-Square	0.757



Observations	19
Parameters	2
Error DF	17
MSE	126.03
R-Square	0.7705
Adj R-Square	0.757

SG Annotation: Oval, Line, and Text

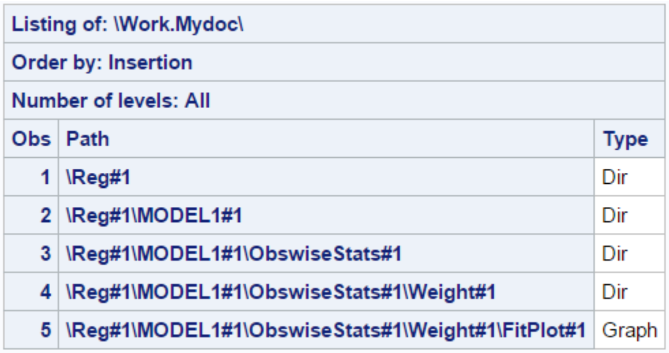




ODS Document

```
ods document name=MyDoc (write);
proc reg data=sashelp.class;
  ods select fitplot;
  model weight=height;
quit;
ods document close;

proc document name=MyDoc;
  list / levels=all;
quit;
```



Listing of: \Work.Mydoc\		
Order by: Insertion		
Number of levels: All		
Obs	Path	Type
1	\Reg#1	Dir
2	\Reg#1\MODEL1#1	Dir
3	\Reg#1\MODEL1#1\ObswiseStats#1	Dir
4	\Reg#1\MODEL1#1\ObswiseStats#1\Weight#1	Dir
5	\Reg#1\MODEL1#1\ObswiseStats#1\Weight#1\FitPlot#1	Graph

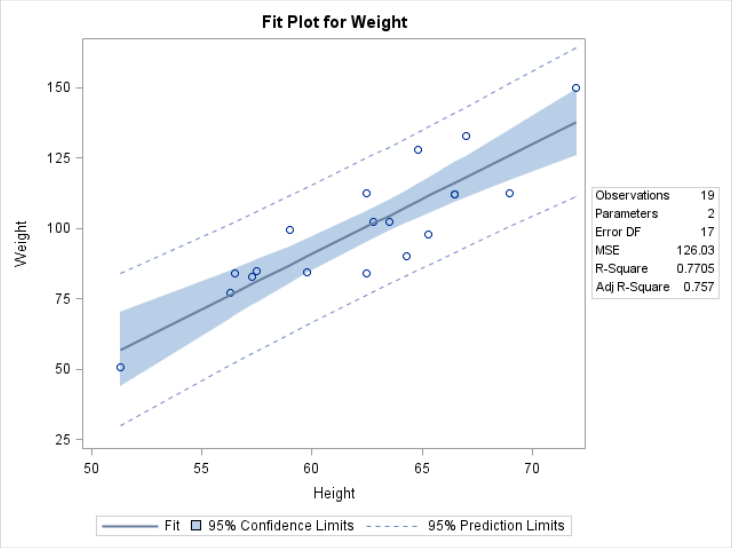
```
proc document name=MyDoc;
  replay \Reg#1\MODEL1#1\ObswiseStats#1\Weight#1\FitPlot#1;
quit;

proc document name=MyDoc;
  ods exclude dynamics;
  ods output dynamics=dynamics;
  obdynam \Reg#1\MODEL1#1\ObswiseStats#1\Weight#1\FitPlot#1;
quit;
```

Replay from an ODS Document

```
ods document name=MyDoc (write);
proc reg data=sashelp.class;
   ods select fitplot;
   model weight=height;
quit;
ods document close;

proc document name=MyDoc;
   list / levels=all;
quit;
```



```
proc document name=MyDoc;
   replay \Reg#1\MODEL1#1\ObswiseStats#1\Weight#1\FitPlot#1;
quit;
```

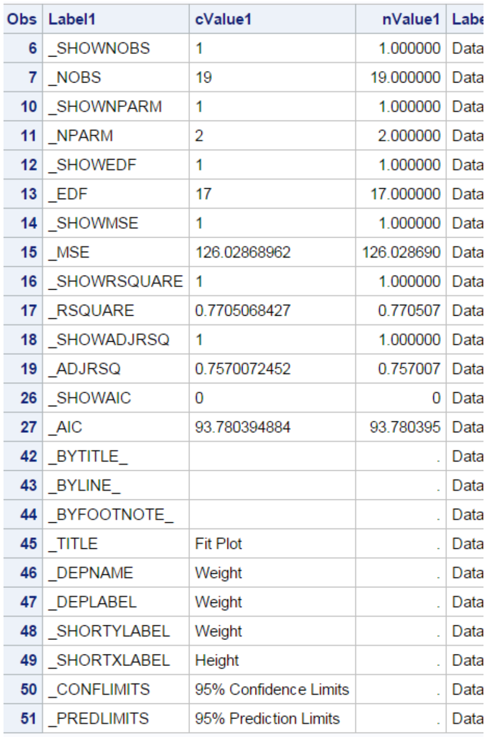
Dynamic Variables

```
ods document name=MyDoc (write);
proc reg data=sashelp.class;
   ods select fitplot;
   model weight=height;
quit;
ods document close;

proc document name=MyDoc;
   list / levels=all;
quit;

proc document name=MyDoc;
   ods exclude dynamics;
   ods output dynamics=dynamics;
   obdynam \Reg#1\MODEL1#1\ObswiseStats#1\Weight#1\FitPlot#1;
quit;

proc print;
   where label1 in ( . . . );
run;
```



Obs	Label1	cValue1	nValue1	Labe
6	_SHOWNOBS	1	1.000000	Data
7	_NOBS	19	19.000000	Data
10	_SHOWNPARM	1	1.000000	Data
11	_NPARM	2	2.000000	Data
12	_SHOWEDF	1	1.000000	Data
13	_EDF	17	17.000000	Data
14	_SHOWMSE	1	1.000000	Data
15	_MSE	126.02868962	126.028690	Data
16	_SHOWRSQUARE	1	1.000000	Data
17	_RSQUARE	0.7705068427	0.770507	Data
18	_SHOWADJRSQ	1	1.000000	Data
19	_ADJRSQ	0.7570072452	0.757007	Data
26	_SHOWAIC	0	0	Data
27	_AIC	93.780394884	93.780395	Data
42	_BYTITLE_		.	Data
43	_BYLINE_		.	Data
44	_BYFOOTNOTE_		.	Data
45	_TITLE	Fit Plot	.	Data
46	_DEPNAME	Weight	.	Data
47	_DEPLABEL	Weight	.	Data
48	_SHORTYLABEL	Weight	.	Data
49	_SHORTXLABEL	Height	.	Data
50	_CONFLIMITS	95% Confidence Limits	.	Data
51	_PREDLIMITS	95% Prediction Limits	.	Data

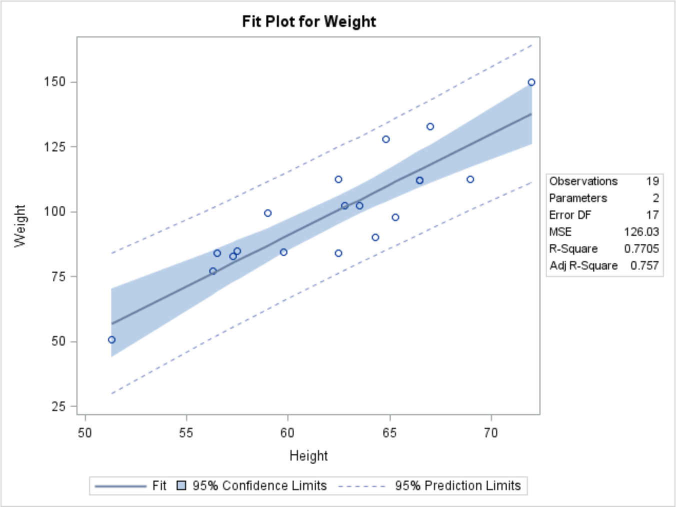
Replay with Dynamics Specified

```
ods document name=MyDoc (write);
proc reg data=sashelp.class;
   ods select fitplot;
   model weight=height;
quit;
ods document close;

proc document name=MyDoc;
   list / levels=all;
quit;

proc document name=MyDoc;
   ods exclude dynamics;
   ods output dynamics=dynamics;
   obdynam \Reg#1\MODEL1#1\ObswiseStats#1\We
quit;

proc document name=MyDoc;
   replay \Reg#1\MODEL1#1\ObswiseStats#1\Weight#1\FitPlot#1 /
       dynamdata=dynamics;
quit;
```



```
Observations       19
Parameters          2
Error DF           17
MSE            126.03
R-Square       0.7705
Adj R-Square    0.757
```

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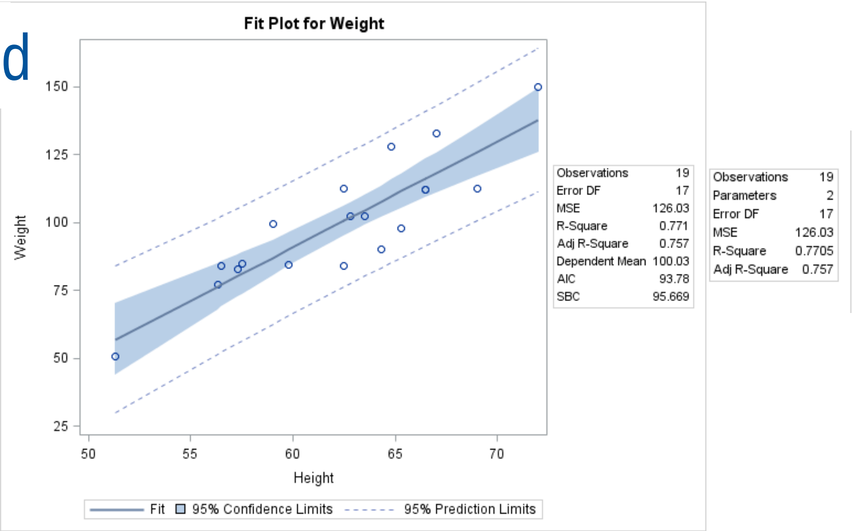
Dynamics Modified

```
data dynamics2;
   set dynamics;
   if label1 = '_SHOWNPARM'
      then nvalue1 = 0;
   if label1 = '_SHOWAIC'
      then nvalue1 = 1;
   if label1 = '_SHOWSBC'
      then nvalue1 = 1;
   if label1 = '_SHOWDEPMEAN'
      then nvalue1 = 1;
   if label1 in ('_RSQUARE'
                 '_ADJRSQ')
      then nvalue1 =
           round(nvalue1, 0.001);
run;

proc document name=MyDoc;
   replay \Reg#1\MODEL1#1\ObswiseStats#1\Weight#1\FitPlot#1 /
       dynamdata=dynamics2;
quit;
```



```
Observations       19
Error DF           17
MSE            126.03
R-Square        0.771
Adj R-Square    0.757
Dependent Mean 100.03
AIC             93.78
SBC            95.669
```

```
Observations       19
Parameters          2
Error DF           17
MSE            126.03
R-Square       0.7705
Adj R-Square    0.757
```

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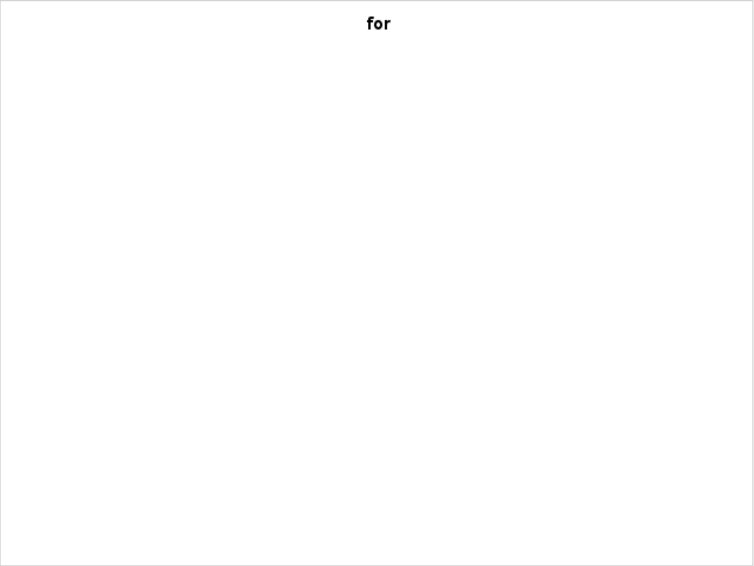
Naïve Rendering

```
proc reg data=sashelp.class;
   ods output fitplot=fp;
   model weight = height;
quit;

proc sgrender data=fp
        template=Stat.REG.Graphics.Fit;
run;
```



```
WARNING: The SCATTERPLOT statement will not be drawn because one or more of the
             required arguments were not supplied.
WARNING: The SERIESPLOT statement named 'Fit' will not be drawn because one or
             more of the required arguments were not supplied.
```

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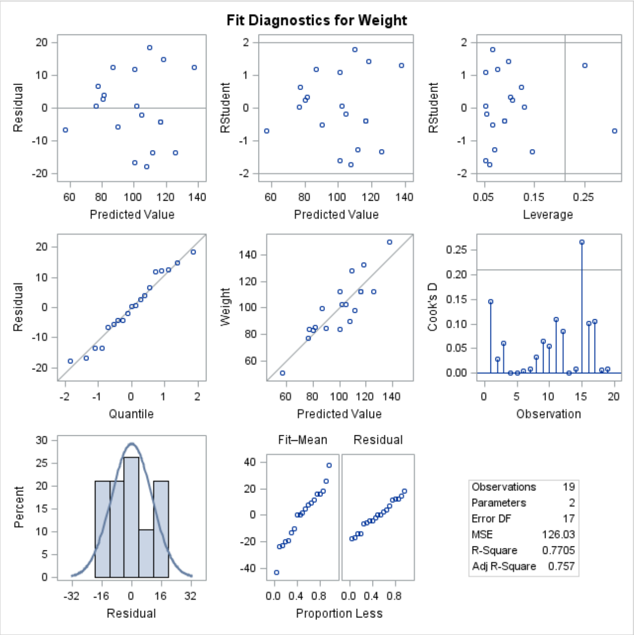
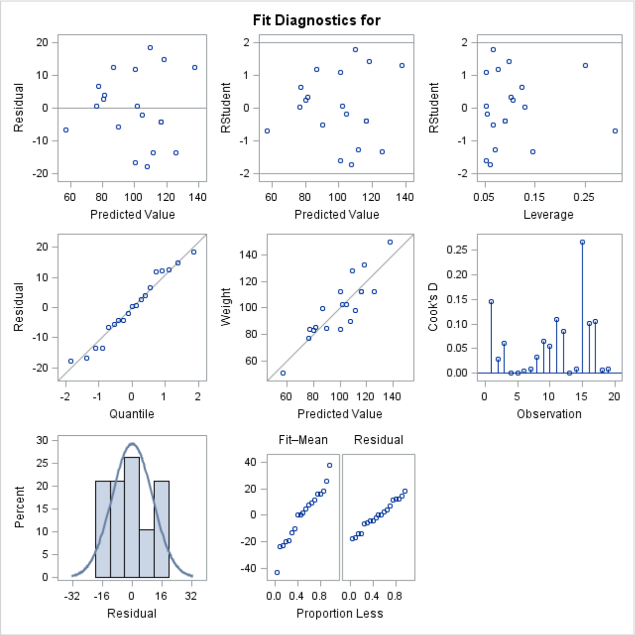
Diagnostics Panel



```
Observations       19
Parameters          2
Error DF           17
MSE            126.03
R-Square       0.7705
Adj R-Square    0.757
```

Naïve Rendering



PROC SGRENDER Code with Dynamic Variables

The next two slides show how to use CALL EXECUTE and a DATA step to generate this step:

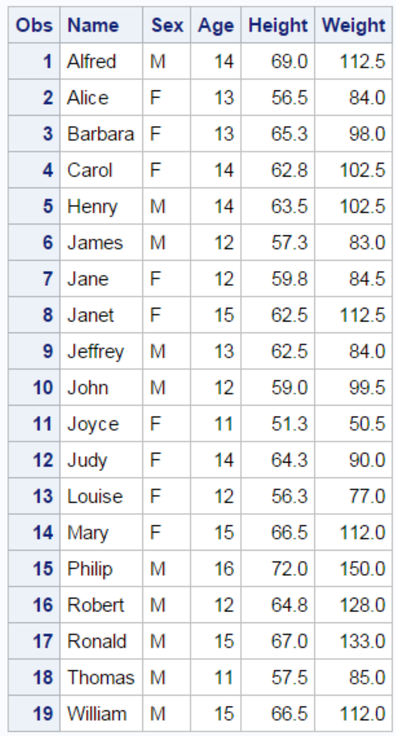
```
proc sgrender data=fp template=Stat.REG.Graphics.Fit;
  dynamic _SHOWCLM = 1 _SHOWCLI = 1 _WEIGHT = 0 _SHOWSTATS = 1 _NSTATSCOLS = 2
     _SHOWNOBS = 1 _NOBS = 19 _SHOWTOTFREQ = 0 _TOTFREQ = 19 _SHOWNPARM = 1
     _NPARM = 2 _SHOWEDF = 1 _EDF = 17 _SHOWMSE = 1 _MSE = 126.02868962
     _SHOWRSQUARE = 1 _RSQUARE = 0.7705068427 _SHOWADJRSQ = 1 _ADJRSQ = 0.7570072452
     _SHOWSSE = 0 _SSE = 2142.4877235 _SHOWDEPMEAN = 0 _DEPMEAN = 100.02631579
     _SHOWCV = 0 _CV = 11.223296526 _SHOWAIC = 0 _AIC = 93.780394884 _SHOWBIC = 0
     _BIC = 96.223301459 _SHOWCP = 0 _CP = 2 _SHOWGMSEP = 0 _GMSEP = 140.9531397
     _SHOWJP = 0 _JP = 139.29486747 _SHOWPC = 0 _PC = 0.2834915472 _SHOWSBC = 0
     _SBC = 95.669272843 _SHOWSP = 0 _SP = 7.876793101 _TITLE = "Fit Plot"
     _DEPNAME = "Weight" _DEPLABEL = "Weight" _SHORTYLABEL = "Weight"
     _SHORTXLABEL = "Height" _CONFLIMITS = "95% Confidence Limits"
     _PREDLIMITS = "95% Prediction Limits" _XVAR = "_INDEPVAR1";
run;
```

Primer on CALL EXECUTE

```
data _null_;
  call execute('proc print data=sashelp.class; run;');
run;

data _null_;
  input;
  call execute(_infile_);
  datalines4;
proc
print
data
=
sashelp
.
class
; run
;
;;;;
```

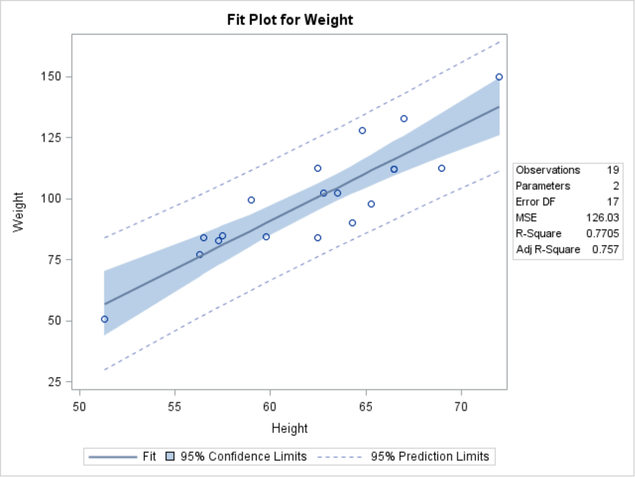
- Use CALL EXECUTE to generate PROC SGRENDER code to replay the graph and use the dynamic variables
- The automatic variable **_infile_** contains the contents of the input buffer



Obs	Name	Sex	Age	Height	Weight
1	Alfred	M	14	69.0	112.5
2	Alice	F	13	56.5	84.0
3	Barbara	F	13	65.3	98.0
4	Carol	F	14	62.8	102.5
5	Henry	M	14	63.5	102.5
6	James	M	12	57.3	83.0
7	Jane	F	12	59.8	84.5
8	Janet	F	15	62.5	112.5
9	Jeffrey	M	13	62.5	84.0
10	John	M	12	59.0	99.5
11	Joyce	F	11	51.3	50.5
12	Judy	F	14	64.3	90.0
13	Louise	F	12	56.3	77.0
14	Mary	F	15	66.5	112.0
15	Philip	M	16	72.0	150.0
16	Robert	M	12	64.8	128.0
17	Ronald	M	15	67.0	133.0
18	Thomas	M	11	57.5	85.0
19	William	M	15	66.5	112.0

Render with PROC SGRENDER and Dynamics

```
data _null_;
   set dynamics(where=(label1 ne '___NOBS___')) end=eof;
   if _n_ = 1 then do;
      call execute('proc sgrender data=fp ' ||
                   'template=Stat.REG.Graphics.Fit;');
      call execute('dynamic');
   end;
   if cvalue1 ne ' ' then
      call execute(catx(' ', label1, '=',
               ifc(n(nvalue1), cvalue1,
                        quote(trim(cvalue1)))));
   if eof then call execute('; run;');
run;
```



_SHOWCLM = 1
_XVAR = "_INDEPVAR1"

OPTIONS SOURCE;
displays code

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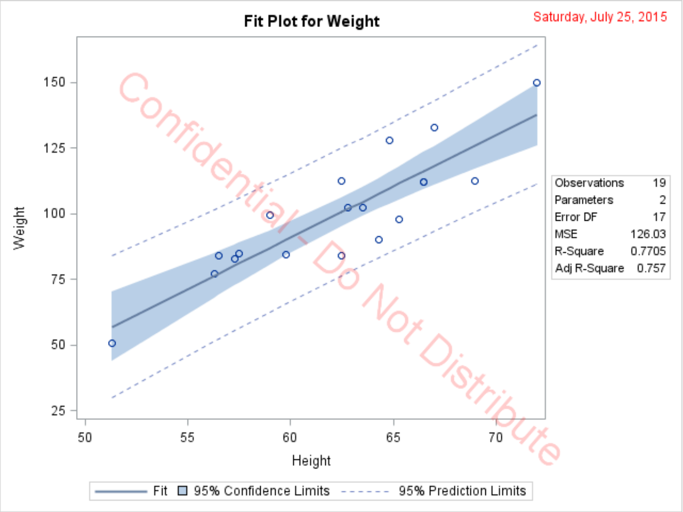
Annotate the Layout Space

```
proc template;
   delete  Stat.REG.Graphics.Fit / store=sasuser.templat;
   source Stat.REG.Graphics.Fit / file='temp.tmp';
quit;

data _null_;
   infile 'temp.tmp';
   input;
   if _n_ = 1 then call execute('proc template;');
   call execute(_infile_);
   if _infile_ =: '   BeginGraph' then bg + 1;
   if bg and index(_infile_, ';') then do;
      bg = 0;
      call execute('annotate;');
   end;
run;
```



BeginGraph;
annotate;

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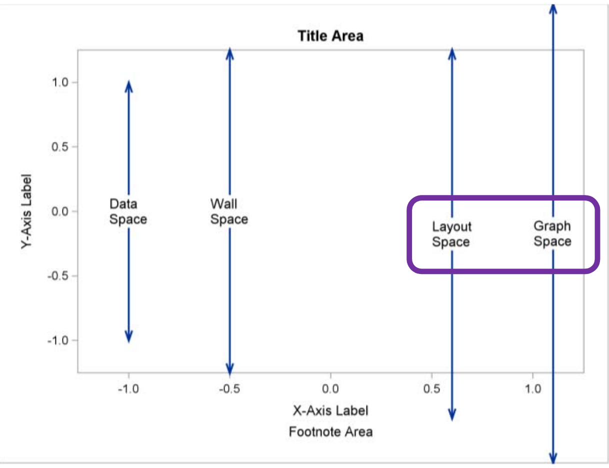
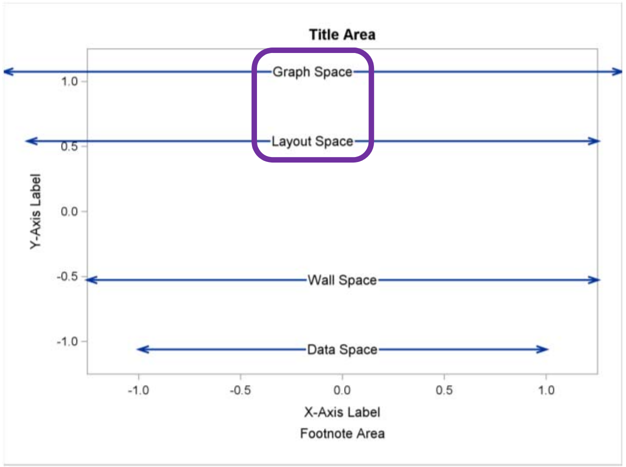
Primer on Drawing Spaces





- Drawing spaces: 'DataPercent', 'DataPixel', 'DataValue', 'GraphPercent', 'GraphPixel', 'LayoutPercent', 'LayoutPixel', 'WallPercent', and 'WallPixel'
- **'LayoutPercent'** is the default for PROC SGRENDER (**'GraphPercent'** for PROC SGPLOT)
- 'Graph…' and 'Layout…' work with an ANNOTATE statement in the BEGINGRAPH block
- 'Data…' and 'Wall…' produce: WARNING: XSPACE= is invalid. Draw statement discarded

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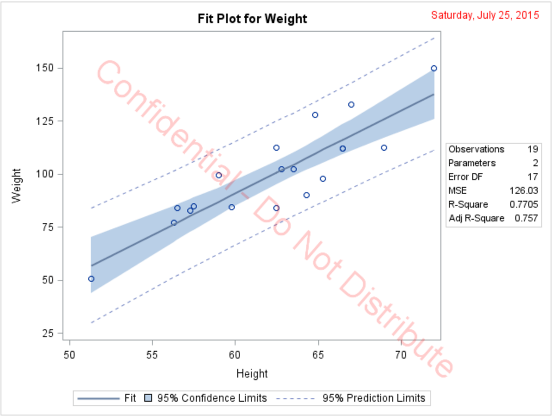
Annotate the Layout Space

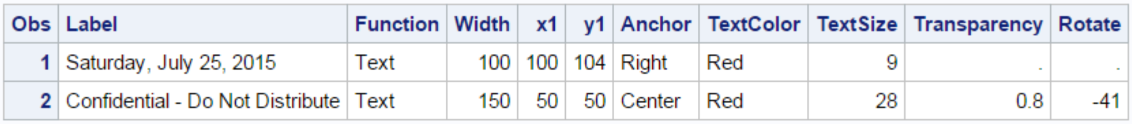


```
data anno;
   length Label $ 40;
   Function = 'Text';     Label  = 'Saturday, July 25, 2015';
   Width     = 100;       x1 = 100;   y1 = 104;
   Anchor    = 'Right';    TextColor = 'Red'; TextSize  = 9;
   output;

   Label = 'Confidential - Do Not Distribute';
   Width = 150;           x1 = 50;   y1 =  50;
   Anchor = 'Center';
   Transparency = 0.8;    TextSize  = 28;   Rotate = -41;
   output;
run;

proc print;
run;
```

Default coordinates are percentages of the layout area ('LayoutPercent')



Obs	Label	Function	Width	x1	y1	Anchor	TextColor	TextSize	Transparency	Rotate
1	Saturday, July 25, 2015	Text	100	100	104	Right	Red	9	.	.
2	Confidential - Do Not Distribute	Text	150	50	50	Center	Red	28	0.8	-41

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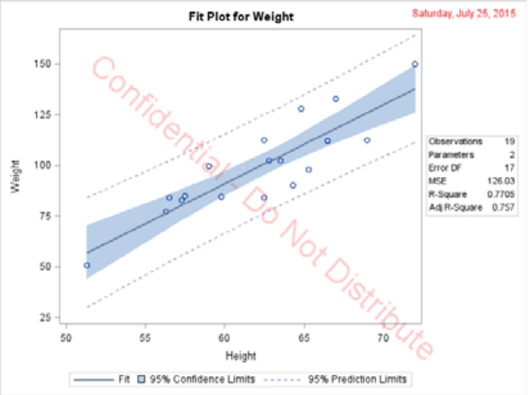
Annotate the Layout Space



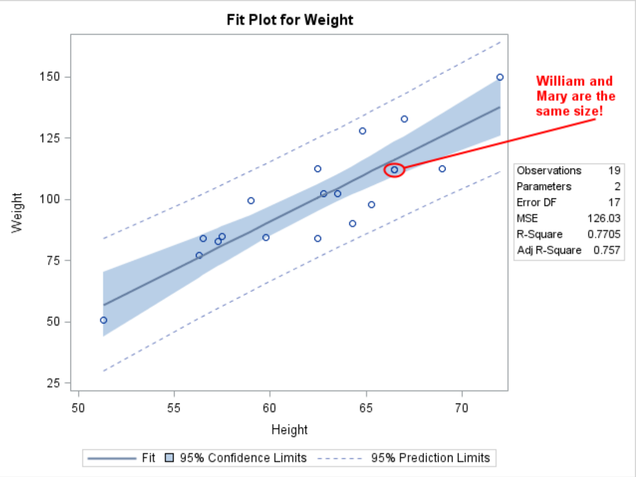
```
data _null_;
   set dynamics(where=(label1 ne '___NOBS___')) end=eof;
   if _n_ = 1 then do;
      call execute('proc sgrender data=fp sganno=anno ' ||
                   'template=Stat.REG.Graphics.Fit;');
      call execute('dynamic');
   end;
   if cvalue1 ne ' ' then
      call execute(catx(' ', label1, '=',
                 ifc(n(nvalue1), cvalue1, quote(trim(cvalue1)))));
   if eof then call execute('; run;');
run;

proc template;
   delete Stat.REG.Graphics.Fit / store=sasuser.templat;
quit;
```

Annotate the Data Space

```
define statgraph Stat.Reg.Graphics.Fit;
   notes "Fit Plot";
   dynamic . . .;
   BeginGraph;
      entrytitle halign=left textattrs=GRAPHVALUETEXT _MODELLABEL halign=center
         textattrs=GRAPHTITLETEXT _TITLE " for " _DEPNAME;
      layout Overlay / yaxisopts=(label=_DEPLABEL shortlabel=_SHORTYLABEL)
         xaxisopts=(shortlabel=_SHORTXLABEL);
         . . .
         annotate / id="a";
         SCATTERPLOT y=DEPVAR x=_XVAR / markerattrs=GRAPHDATADEFAULT primary=
            true rolename=(_tip1=OBSERVATION _id1=ID1 _id2=ID2 _id3=ID3 _id4=
            ID4 _id5=ID5) tip=(y x _tip1 _id1 _id2 _id3 _id4 _id5);
         SERIESPLOT y=PREDICTEDVALUE x=_XVAR / lineattrs=GRAPHFIT connectorder=
            xaxis name="Fit" LegendLabel="Fit";
         . . .
      endlayout;
      . . .
   EndGraph;
end;
```

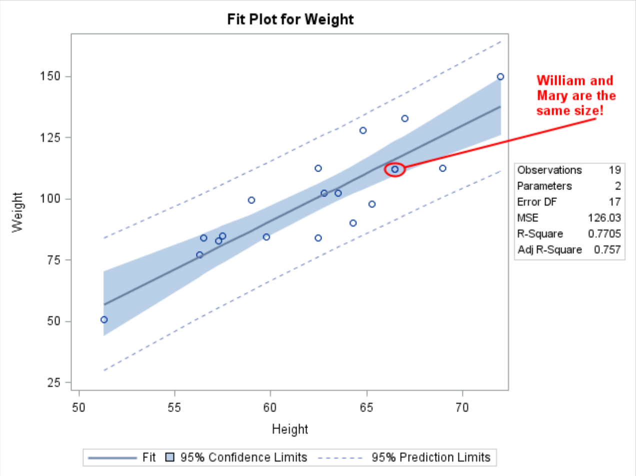
Annotate the Data Space

```
data _null_;
   infile 'temp.tmp';
   input;
   if _n_ = 1                         then call execute('proc template;');
   if left(_infile_) =: 'SCATTERPLOT' then call execute('annotate / id="a";');
   call execute(_infile_);
run;
```

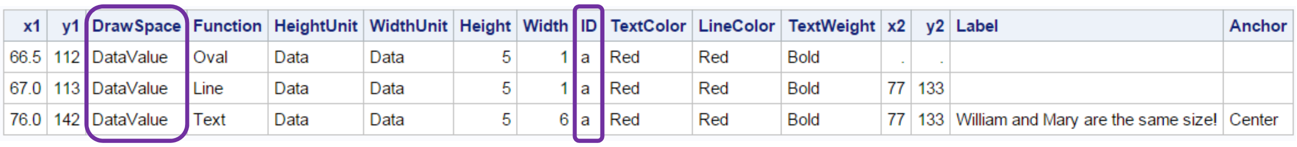


Annotate the Data Space

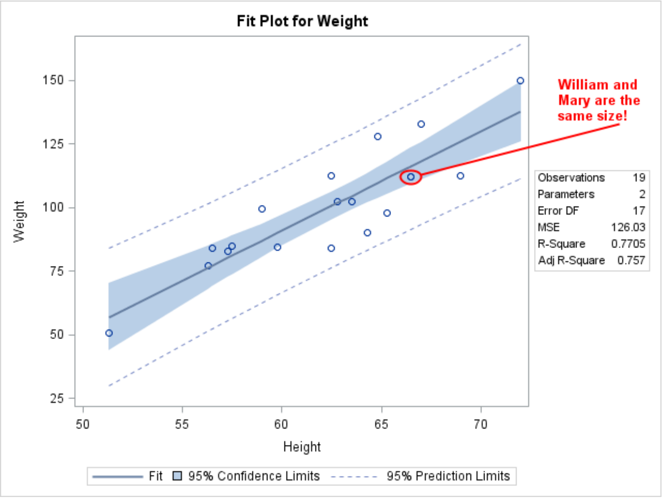
```
data anno(drop=name sex age);
   set sashelp.class(where=(name='William') rename=(height=x1 weight=y1));
   retain DrawSpace 'DataValue' Function 'Oval' HeightUnit WidthUnit 'Data'
          Height 5 Width 1 ID 'a' TextColor LineColor 'Red' TextWeight 'Bold';
   output;
   function = 'Line';
   x1 + 0.5;
   y1 + 1;
   x2 = x1 + 10;
   y2 = y1 + 20;
   output;
   x1 = x2 - 1;
   y1 = y2 + 9;
   function = 'Text';
   Label = 'William and Mary are the same size!';
   Anchor = 'Center';
   Width = 6;
   output;
run;
```



SG Annotation Data Set

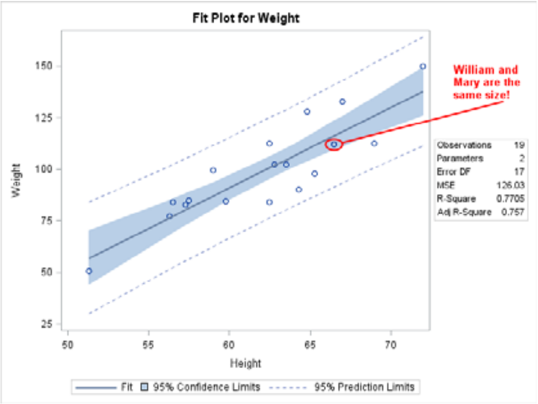


x1	y1	DrawSpace	Function	HeightUnit	WidthUnit	Height	Width	ID	TextColor	LineColor	TextWeight	x2	y2	Label	Anchor
66.5	112	DataValue	Oval	Data	Data	5	1	a	Red	Red	Bold	.	.		
67.0	113	DataValue	Line	Data	Data	5	1	a	Red	Red	Bold	77	133		
76.0	142	DataValue	Text	Data	Data	5	6	a	Red	Red	Bold	77	133	William and Mary are the same size!	Center



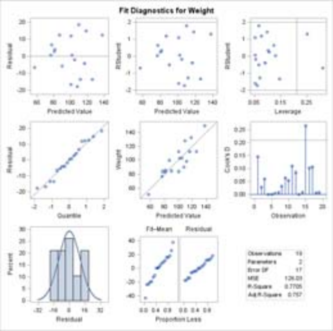
Annotate the Data Space

```
data _null_;
   set dynamics(where=(label1 ne '___NOBS___')) end=eof;
   if _n_ = 1 then do;
      call execute('proc sgrender data=fp sganno=anno ' ||
                   'template=Stat.REG.Graphics.Fit;');
      call execute('dynamic');
   end;
   if cvalue1 ne ' ' then
      call execute(catx(' ', label1, '=',
                  ifc(n(nvalue1), cvalue1, quote(trim(cvalue1)))));
   if eof then call execute('; run;');
run;
```



Multiple Overlays

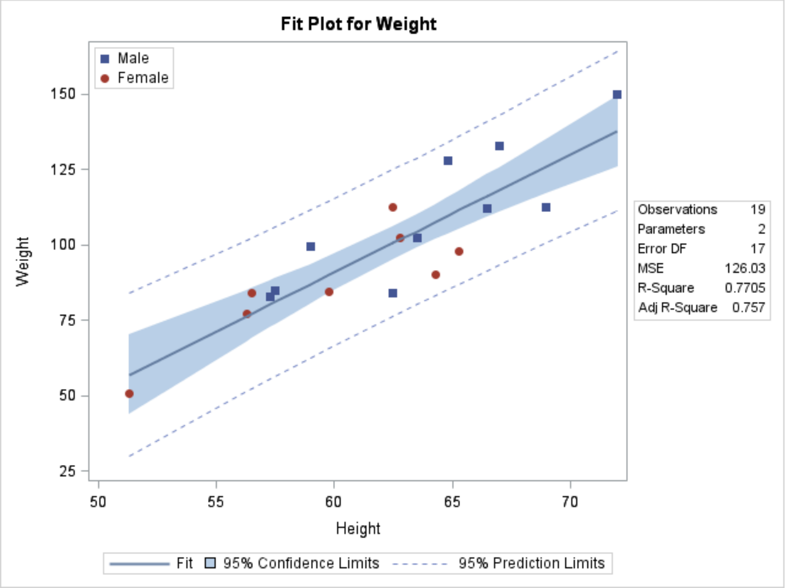
```
data _null_;
   infile 'temp.tmp';
   input;
   if _n_ = 1 then call execute('proc template;');
   call execute(_infile_);
   if index(_infile_, '   layout overlay') then lo + 1;
   if lo and index(_infile_, ';') then do;
      lo = 0;
      lonum + 1;
      call execute(catt('annotate / id="LO', lonum, '";'));
   end;
run;
```



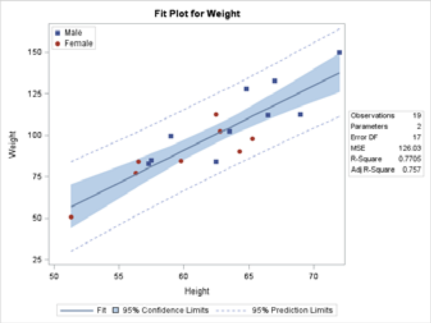
```
define statgraph Stat.Reg.Graphics.DiagnosticsPanel;
  . . .
  BeginGraph / designheight=defaultDesignWidth;
    layout lattice / columns=3 rows=3 ...;
      layout overlay / xaxisopts=(shortlabel='Predicted');
        annotate / id="LO1";
        . . .
      endlayout;
      layout overlay / xaxisopts=(shortlabel='Predicted');
        annotate / id="LO2";
        . . .
      endlayout;
      layout overlay / xaxisopts=(label='Leverage' offsetmax=0.05)
                  yaxisopts=(offsetmin=0.05 offsetmax=0.05);
        annotate / id="LO3";
        . . .
      endlayout;
      layout overlay / yaxisopts=(label="Residual"
        shortlabel="Resid")
        xaxisopts=(label="Quantile");
        annotate / id="LO4";
        . . .
      endlayout;
      . . .
    endlayout;
    . . .
  EndGraph;
end;
```

Template Modification and Style Overrides

```
proc template;
   delete  Stat.REG.Graphics.Fit /
           store=sasuser.templat;
   source Stat.REG.Graphics.Fit /
           file='temp.tmp';
quit;

proc format;
   value $sex 'M' = 'Male' 'F' = 'Female';
run;
```



Template Modification



```
data _null_;
   infile 'temp.tmp';
   input;
   if _n_ = 1 then call execute('proc template;');
```

Modify scatter plot

```
   if left(_infile_) =: 'SCATTERPLOT y=DEPVAR' then do;
      _infile_ = tranwrd(_infile_, 'markerattrs=GRAPHDATADEFAULT', ' ');
      _infile_ = tranwrd(_infile_, '/', '/ group=id1 name="sc"');
      end;
```

Style override

```
   if left(_infile_) =: 'BeginGraph' then
      _infile_ = 'BeginGraph / attrpriority=none datasymbols=(squarefilled circlefilled);';
```

Write

```
   call execute(_infile_);
```

Add legend

```
   if left(_infile_) =: 'SCATTERPLOT y=DEPVAR' then
      call execute('discretelegend "sc" / location=inside across=1 autoalign=(topleft);');
run;
```

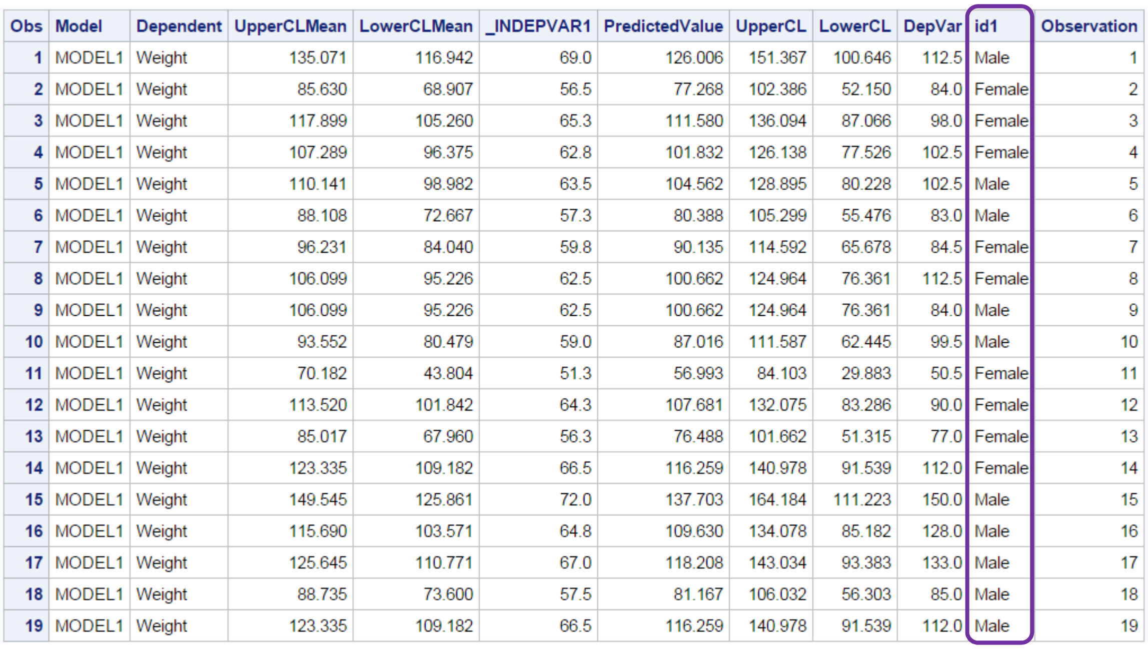
```
proc reg data=sashelp.class;
   ods output fitplot=fp;
   model weight=height;
   id sex;
   format sex $sex.;
quit;
```

AttrPriority=None enables markers of different shapes

The next slide shows that the **sex** variable is in the data object and is named **id1**

28

Data Object

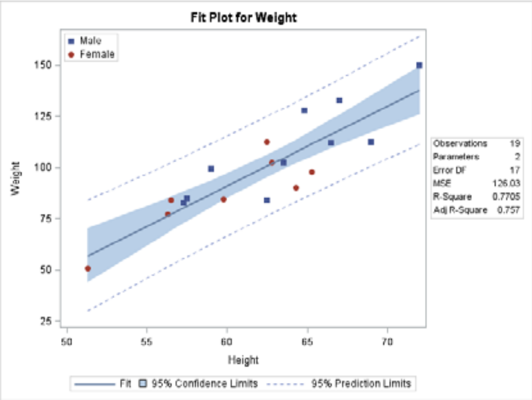


Obs	Model	Dependent	UpperCLMean	LowerCLMean	_INDEPVAR1	PredictedValue	UpperCL	LowerCL	DepVar	id1	Observation
1	MODEL1	Weight	135.071	116.942	69.0	126.006	151.367	100.646	112.5	Male	1
2	MODEL1	Weight	85.630	68.907	56.5	77.268	102.386	52.150	84.0	Female	2
3	MODEL1	Weight	117.899	105.260	65.3	111.580	136.094	87.066	98.0	Female	3
4	MODEL1	Weight	107.289	96.375	62.8	101.832	126.138	77.526	102.5	Female	4
5	MODEL1	Weight	110.141	98.982	63.5	104.562	128.895	80.228	102.5	Male	5
6	MODEL1	Weight	88.108	72.667	57.3	80.388	105.299	55.476	83.0	Male	6
7	MODEL1	Weight	96.231	84.040	59.8	90.135	114.592	65.678	84.5	Female	7
8	MODEL1	Weight	106.099	95.226	62.5	100.662	124.964	76.361	112.5	Female	8
9	MODEL1	Weight	106.099	95.226	62.5	100.662	124.964	76.361	84.0	Male	9
10	MODEL1	Weight	93.552	80.479	59.0	87.016	111.587	62.445	99.5	Male	10
11	MODEL1	Weight	70.182	43.804	51.3	56.993	84.103	29.883	50.5	Female	11
12	MODEL1	Weight	113.520	101.842	64.3	107.681	132.075	83.286	90.0	Female	12
13	MODEL1	Weight	85.017	67.960	56.3	76.488	101.662	51.315	77.0	Female	13
14	MODEL1	Weight	123.335	109.182	66.5	116.259	140.978	91.539	112.0	Female	14
15	MODEL1	Weight	149.545	125.861	72.0	137.703	164.184	111.223	150.0	Male	15
16	MODEL1	Weight	115.690	103.571	64.8	109.630	134.078	85.182	128.0	Male	16
17	MODEL1	Weight	125.645	110.771	67.0	118.208	143.034	93.383	133.0	Male	17
18	MODEL1	Weight	88.735	73.600	57.5	81.167	106.032	56.303	85.0	Male	18
19	MODEL1	Weight	123.335	109.182	66.5	116.259	140.978	91.539	112.0	Male	19

29

Data Object Modification – What if Sex had not been there?

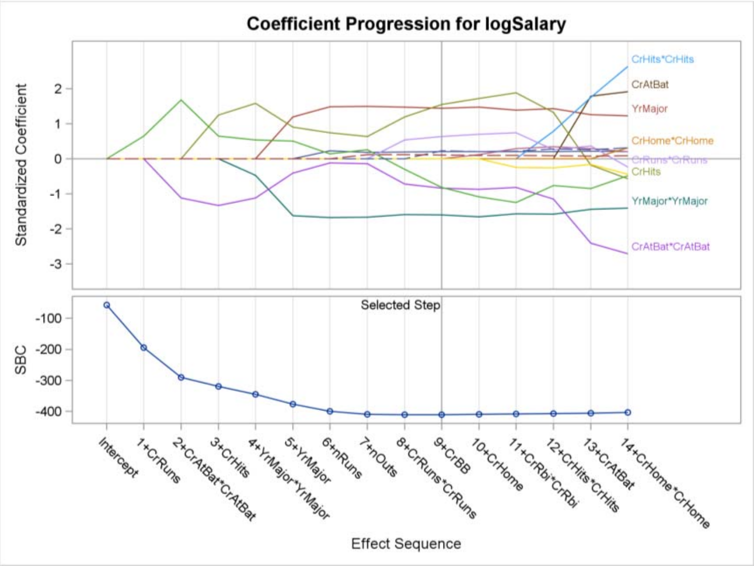
```
data both(drop=height weight rename=(sex=id1));
   merge sashelp.class(keep=height weight sex) fp;
   if height ne _indepvar1 or weight ne depvar then put _all_;
   format sex $sex.;
run;

data _null_;
   set dynamics(where=(label1 ne '___NOBS___')) end=eof;
   if _n_ = 1 then do;
      call execute('proc sgrender data=both');
      call execute('template=Stat.REG.Graphics.Fit;');
      call execute('dynamic');
   end;
   if cvalue1 ne ' ' then
      call execute(catx(' ', label1, '=',
                  ifc(n(nvalue1), cvalue1, quote(trim(cvalue1)))));
   if eof then call execute('; run;');
run;
```



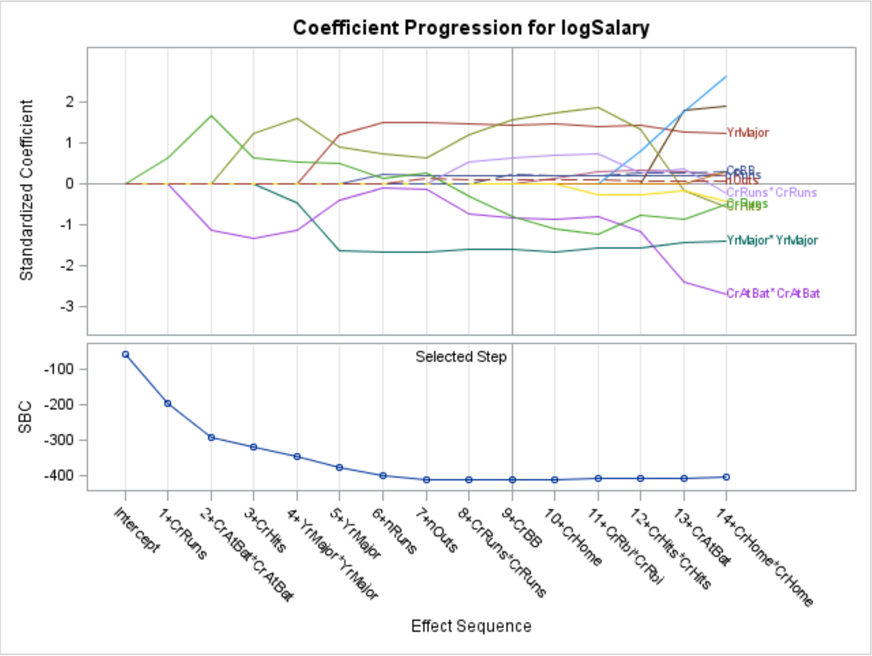
Observations	19
Parameters	2
Error DF	17
MSE	126.03
R-Square	0.7705
Adj R-Square	0.757

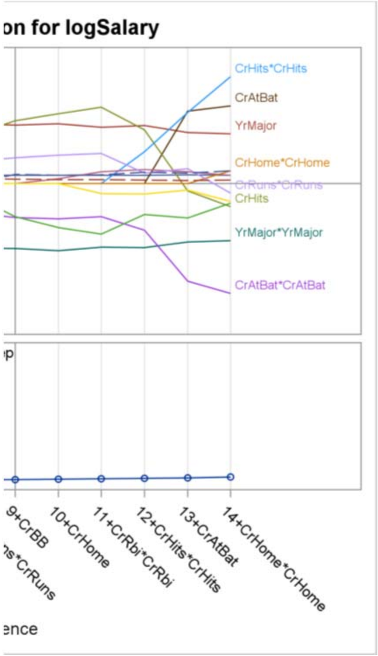
PROC GLMSELECT

```
proc glmselect data=sashelp.baseball plots=coefficients;
      class league division;
      model logSalary = nAtBat nHits nHome
                  nRuns nRBI nBB yrMajor|yrMajor
                  crAtBat|crAtBat crHits|crHits
                  crHome|crHome crRuns|crRuns
                  crRbi|crRbi crBB|crBB league
                  division nOuts nAssts nError /
                  selection=forward(stop=AICC
                                    choose=SBC);
run;
```



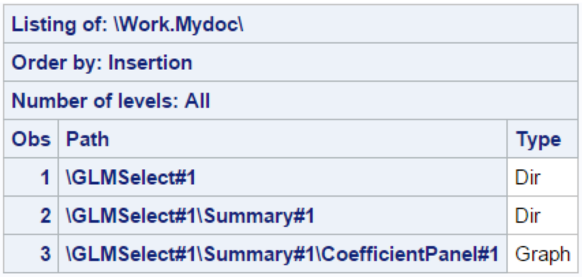
PROC GLMSELECT





Create ODS Document and Data Object

```
ods document name=MyDoc (write);
proc glmselect data=sashelp.baseball plots=coefficients;
   ods select CoefficientPanel;
   ods output CoefficientPanel=cp;
   class league division;
   model logSalary = nAtBat nHits nHome nRuns nRBI nBB yrMajor|yrMajor
             crAtBat|crAtBat crHits|crHits crHome|crHome crRuns|crRuns
             crRbi|crRbi crBB|crBB league division nOuts nAssts nError /
             selection=forward(stop=AICC choose=SBC);
run;
ods document close;

proc document name=MyDoc;
   list / levels=all;
quit;
```



Listing of: \Work.Mydoc\

Order by: Insertion

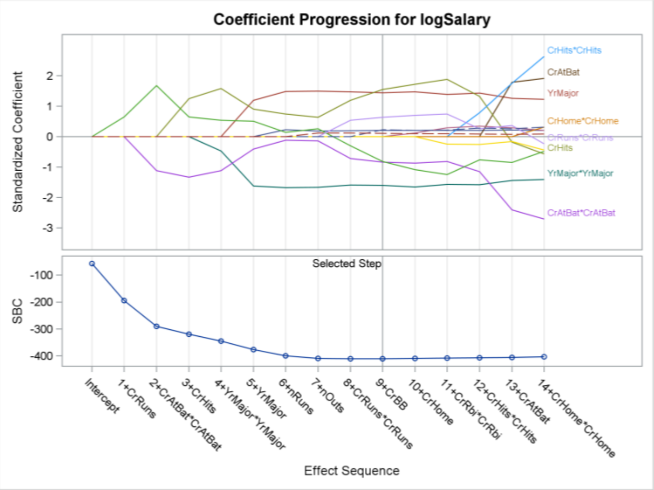
Number of levels: All

Obs	Path	Type
1	\GLMSelect#1	Dir
2	\GLMSelect#1\Summary#1	Dir
3	\GLMSelect#1\Summary#1\CoefficientPanel#1	Graph

Dynamic Variables and Step Chosen

```
proc document name=MyDoc;
   ods exclude dynamics;
   ods output dynamics=dynamics;
   obdynam \GLMSelect#1\Summary#1\CoefficientPanel#1;
quit;

data _null_;
   set dynamics;
   if label1 = '_CHOSENVALUE'
      then call symputx('cv', cvalue1);
run;

%put &cv;
```

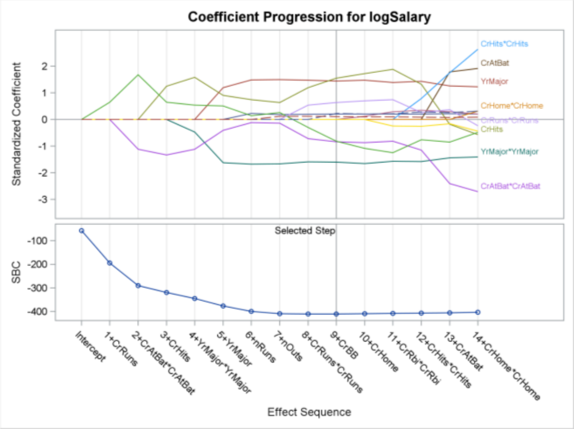
9+CrBB

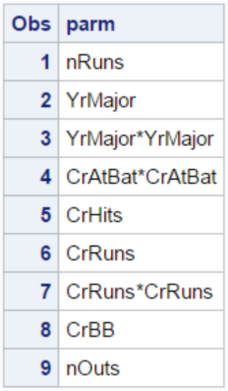


Chosen Parameters and Label of the Last Step

```
data chosen(keep=parameter rename=(parameter=parm));
   set cp(where=(steplabel = "&cv"));
   if standardizedest ne 0;
run;

proc print;
run;

data _null_;
   set cp;
   call symputx('last', steplabel);
run;

%put &last;
```

&cv: 9+CrBB





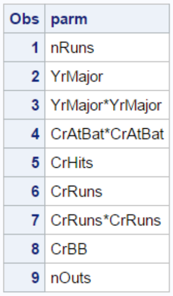
Obs	parm
1	nRuns
2	YrMajor
3	YrMajor*YrMajor
4	CrAtBat*CrAtBat
5	CrHits
6	CrRuns
7	CrRuns*CrRuns
8	CrBB
9	nOuts

14+CrHome*CrHome

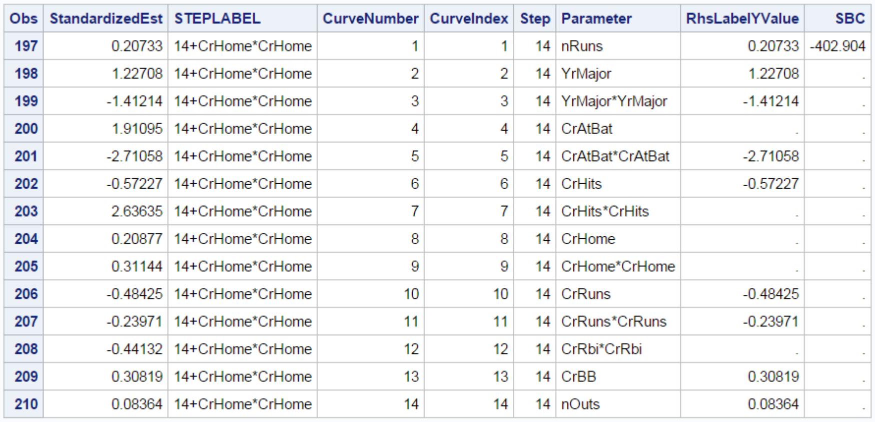
Modify Data Object

```
data cp2;
   set cp;
   rhslabelyvalue = .;
   if steplabel = "&last" then do i = 1 to nobs;
      set chosen point=i nobs=nobs;
      if parm eq parameter then rhslabelyvalue = standardizedest;
   end;
run;

proc print;
   where steplabel = "&last";
run;
```

&last: 14+CrHome*CrHome

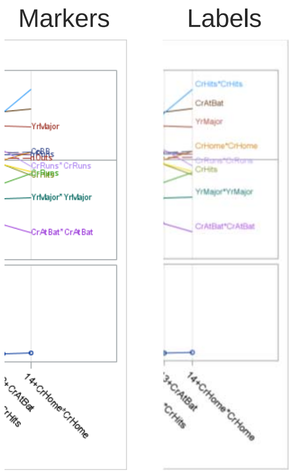


Obs	parm
1	nRuns
2	YrMajor
3	YrMajor*YrMajor
4	CrAtBat*CrAtBat
5	CrHits
6	CrRuns
7	CrRuns*CrRuns
8	CrBB
9	nOuts

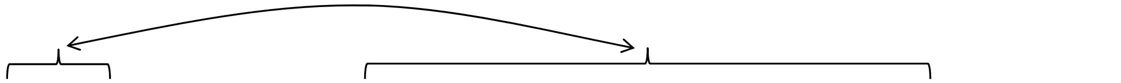


Obs	StandardizedEst	STEPLABEL	CurveNumber	CurveIndex	Step	Parameter	RhsLabelYValue	SBC
197	0.20733	14+CrHome*CrHome	1	1	14	nRuns	0.20733	-402.904
198	1.22708	14+CrHome*CrHome	2	2	14	YrMajor	1.22708	.
199	-1.41214	14+CrHome*CrHome	3	3	14	YrMajor*YrMajor	-1.41214	.
200	1.91095	14+CrHome*CrHome	4	4	14	CrAtBat	.	.
201	-2.71058	14+CrHome*CrHome	5	5	14	CrAtBat*CrAtBat	-2.71058	.
202	-0.57227	14+CrHome*CrHome	6	6	14	CrHits	-0.57227	.
203	2.63635	14+CrHome*CrHome	7	7	14	CrHits*CrHits	.	.
204	0.20877	14+CrHome*CrHome	8	8	14	CrHome	.	.
205	0.31144	14+CrHome*CrHome	9	9	14	CrHome*CrHome	.	.
206	-0.48425	14+CrHome*CrHome	10	10	14	CrRuns	-0.48425	.
207	-0.23971	14+CrHome*CrHome	11	11	14	CrRuns*CrRuns	-0.23971	.
208	-0.44132	14+CrHome*CrHome	12	12	14	CrRbi*CrRbi	.	.
209	0.30819	14+CrHome*CrHome	13	13	14	CrBB	0.30819	.
210	0.08364	14+CrHome*CrHome	14	14	14	nOuts	0.08364	.

Modify Template



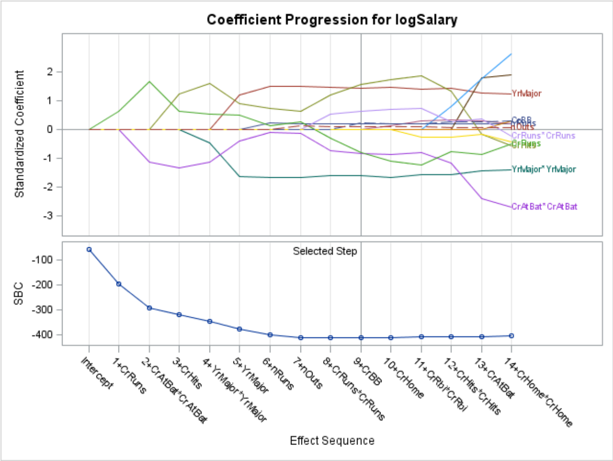
```
proc template;
   delete  Stat.GLMSELECT.Graphics.CoefficientPanel;
   source Stat.GLMSELECT.Graphics.CoefficientPanel / file='temp.tmp';
quit;

data _null_;
   infile 'temp.tmp';
   input;
   if _n_ = 1 then call execute('proc template;');
   if index(_infile_, 'datalabel=PARAMETER') then
      _infile_ = tranwrd(_infile_, 'datalabel',
                        'markercharacterposition=right markercharacter');
   call execute(_infile_);
run;
```



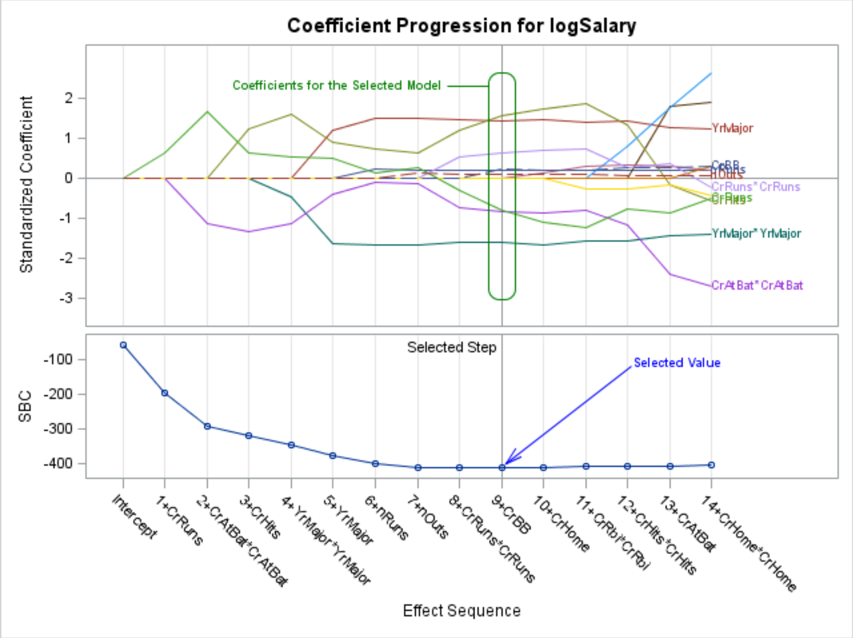
datalabel=PARAMETER markercharacterposition=right markercharacter=PARAMETER

Make Graph

```
data _null_;
   set dynamics(where=(label1 ne '___NOBS___')) end=eof;
   if _n_ = 1 then do;
      call execute('proc sgrender data=cp2');
      call execute('template=Stat.GLMSELECT.Graphics.CoefficientPanel;');
      call execute('dynamic');
   end;
   if cvalue1 ne ' ' then
      call execute(catx(' ', label1, '=',
                   ifc(n(nvalue1), cvalue1,
                                          quote(trim(cvalue1)))));
   if eof then call execute('; run;');
run;
```



PROC GLMSELECT with Annotation



Modify the Template

```
data _null_;
   infile 'temp.tmp';
   input;
   if _n_ = 1 then call execute('proc template;');
   if index(_infile_, 'datalabel=PARAMETER') then
      _infile_ = tranwrd(_infile_, 'datalabel',
             'markercharacterposition=right markercharacter');
   call execute(_infile_);
   if index(_infile_, ' layout overlay') then lo + 1;
   if lo and index(_infile_, ';') then do;
      lo = 0;
      lonum + 1;
      call execute(catt('annotate / id="LO', lonum, '";'));
   end;
run;
```

```
define statgraph Stat.GLMSelect.Graphics.CoefficientPanel;
  . . .
  BeginGraph;
    layout lattice . . .;
      layout overlay . . .;
        annotate / id="LO1";
        . . .
      endlayout;
      if (_SHOWPVAL = 1)
        layout overlay . . .;
          annotate / id="LO2";
          . . .
        endlayout;
      else
        layout overlay . . .;
          annotate / id="LO3";
          . . .
        endlayout;
      endif;
    endlayout;
    . . .
  EndGraph;
end;
```

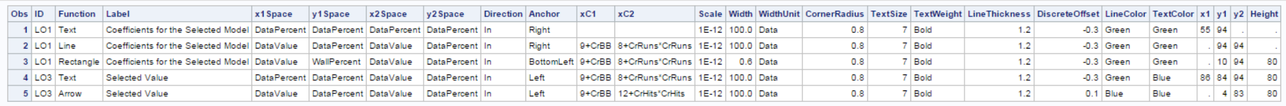
Annotation Data Set

```
data anno;
   length ID $ 3 Function $ 9 Label $ 40;
   retain x1Space y1Space x2Space y2Space 'DataPercent' Direction 'In';
   length Anchor $ 10 xC1 xC2 $ 20;
   retain Scale 1e-12 Width 100 WidthUnit 'Data' CornerRadius 0.8
          TextSize 7 TextWeight 'Bold'
          LineThickness 1.2 DiscreteOffset -0.3 LineColor 'Green';

   ID       = 'LO1';            Function  = 'Text';
   Anchor   = 'Right';          TextColor = 'Green';
   x1       = 55;               y1        = 94;
   Label    = 'Coefficients for the Selected Model';               output;

   Function = 'Line';           x1        = .;
   x1Space  = 'DataValue';      x2Space   = x1Space;
   xc1      = '9+CrBB';         xc2       = '8+CrRuns*CrRuns';
   y1       = 94;               y2        = 94;                    output;

   Function = 'Rectangle';      y1Space   = 'WallPercent';
   Anchor   = 'BottomLeft';     y1        = 10;
   Height   = 80;               Width     = 0.6;                   output;

   ID       = 'LO3';            Width     = 100;
   Function = 'Text ';          Label     = 'Selected Value';
   x1Space  = 'DataPercent';    y1Space   = x1Space;
   Anchor   = 'Left';           TextColor = 'Blue';
   x1       = 86;               y1        = 84;                    output;

   Function = 'Arrow';          LineColor = 'Blue';
   x1Space  = 'DataValue';      x2Space   = x1Space;
   xc1      = '9+CrBB';         xc2       = '12+CrHits*CrHits';
   y1       = 4;                y2        = 83;
   DiscreteOffset = .1;         x1        = .;                     output;
run;
```

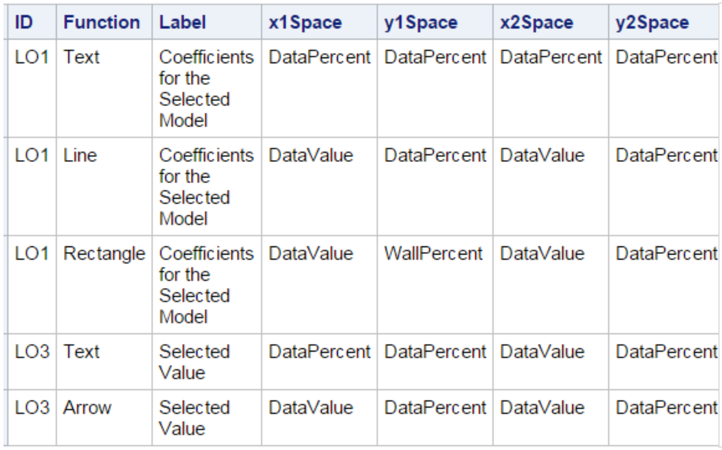
Created by:

- RETAIN statement
- Assignment statements

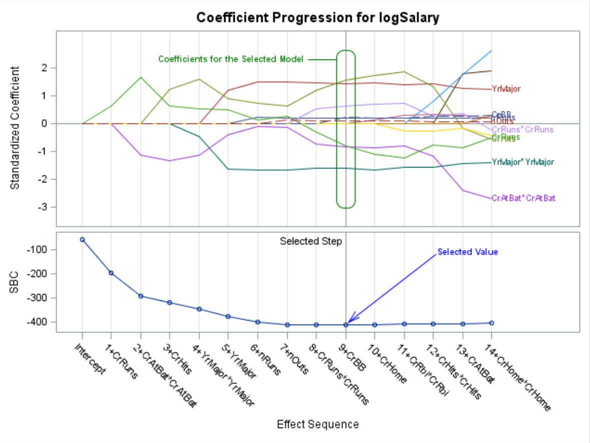
Annotation Data Set



Obs	ID	Function	Label	x1Space	y1Space	x2Space	y2Space	Direction	Anchor	xC1	xC2	Scale	Width	WidthUnit	CornerRadius	TextSize	TextWeight	LineThickness	DiscreteOffset	LineColor	TextColor	x1	y1	y2	Height
1	LO1	Text	Coefficients for the Selected Model	DataPercent	DataPercent	DataPercent	DataPercent	In	Right			1E-12	100.0	Data	0.8	7	Bold	1.2	-0.3	Green	Green	55	94	.	.
2	LO1	Line	Coefficients for the Selected Model	DataValue	DataPercent	DataValue	DataPercent	In	Right	9+CrBB	8+CrRuns*CrRuns	1E-12	100.0	Data	0.8	7	Bold	1.2	-0.3	Green	Green	.	94	94	.
3	LO1	Rectangle	Coefficients for the Selected Model	DataValue	WallPercent	DataValue	DataPercent	In	BottomLeft	9+CrBB	8+CrRuns*CrRuns	1E-12	0.6	Data	0.8	7	Bold	1.2	-0.3	Green	Green	.	10	94	80
4	LO3	Text	Selected Value	DataPercent	DataPercent	DataValue	DataPercent	In	Left	9+CrBB	8+CrRuns*CrRuns	1E-12	100.0	Data	0.8	7	Bold	1.2	-0.3	Green	Blue	86	84	94	80
5	LO3	Arrow	Selected Value	DataValue	DataPercent	DataValue	DataPercent	In	Left	9+CrBB	12+CrHits*CrHits	1E-12	100.0	Data	0.8	7	Bold	1.2	0.1	Blue	Blue	.	4	83	80



ID	Function	Label	x1Space	y1Space	x2Space	y2Space
LO1	Text	Coefficients for the Selected Model	DataPercent	DataPercent	DataPercent	DataPercent
LO1	Line	Coefficients for the Selected Model	DataValue	DataPercent	DataValue	DataPercent
LO1	Rectangle	Coefficients for the Selected Model	DataValue	WallPercent	DataValue	DataPercent
LO3	Text	Selected Value	DataPercent	DataPercent	DataValue	DataPercent
LO3	Arrow	Selected Value	DataValue	DataPercent	DataValue	DataPercent



Create Graph

Modifications:

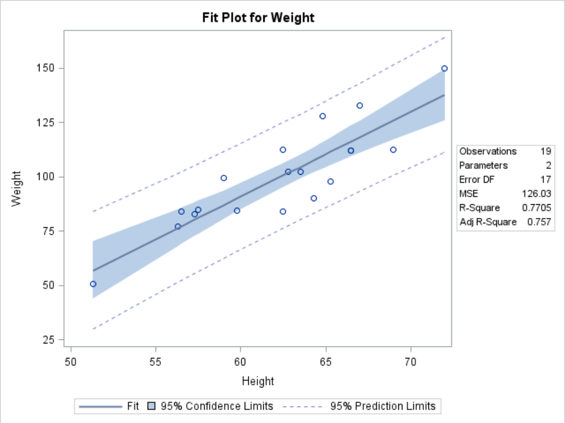
- Data object
- Template
- Annotation

```
data _null_;
   set dynamics(where=(label1 ne '___NOBS___')) end=eof;
   if _n_ = 1 then do;
      call execute('proc sgrender data=cp2 sganno=anno');
      call execute('template=Stat.GLMSELECT.Graphics.CoefficientPanel;');
      call execute('dynamic');
   end;
   if cvalue1 ne ' ' then
      call execute(catx(' ', label1, '=',
                   ifc(n(nvalue1), cvalue1, quote(trim(cvalue1)))));
   if eof then call execute('; run;');
run;
```

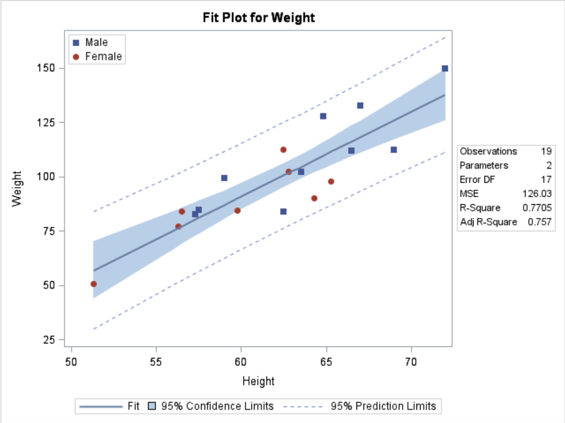
- We processed the dynamic variables but did not modify them
- The paper provides macros that make it easy to modify graphs

Conclusions

- You can modify graph templates
- Use newer appearance options (or modify styles)
  - In BEGINGRAPH in GTL or STYLEATTRS in SG procedures



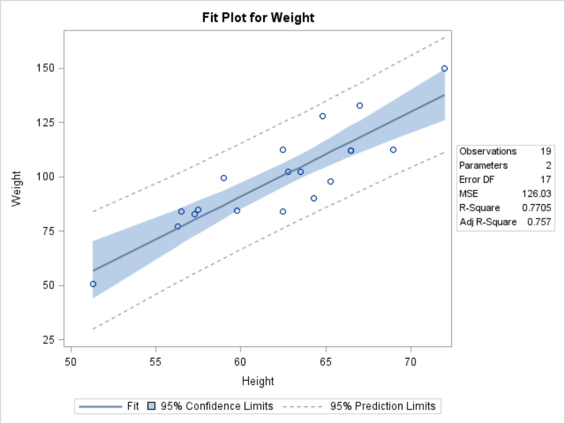
Observations	19
Parameters	2
Error DF	17
MSE	126.03
R-Square	0.7705
Adj R-Square	0.757



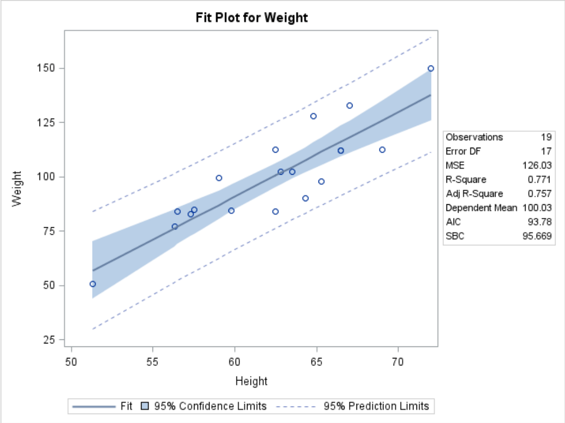
Observations	19
Parameters	2
Error DF	17
MSE	126.03
R-Square	0.7705
Adj R-Square	0.757

Conclusions

- You can capture, display, output, and modify dynamic variables; then you can recreate the graph



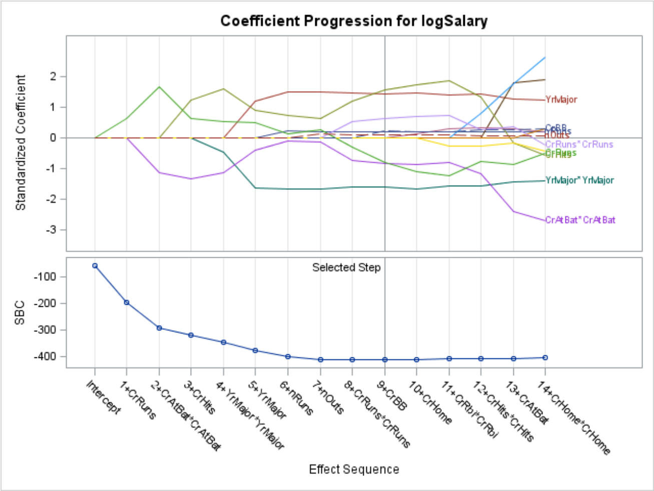
Observations	19
Parameters	2
Error DF	17
MSE	126.03
R-Square	0.7705
Adj R-Square	0.757

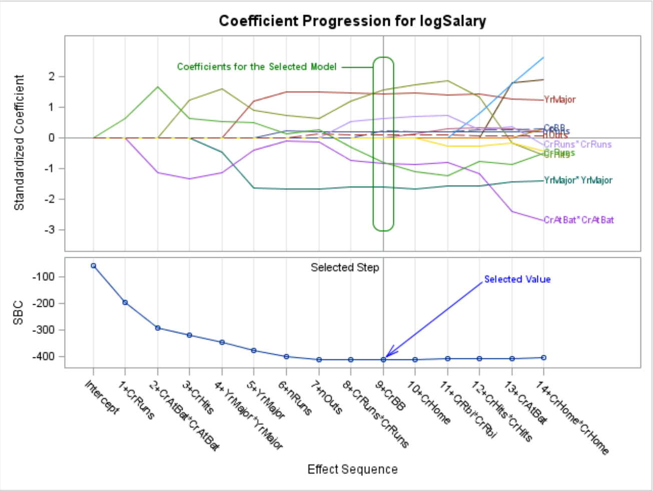


Observations	19
Error DF	17
MSE	126.03
R-Square	0.771
Adj R-Square	0.757
Dependent Mean	100.03
AIC	93.78
SBC	95.669

Conclusions

- You can annotate single- and multiple-panel graphs
- You can do as many or as few modifications as you want and in any combination





For More Information

- **Graphically Speaking SAS Blog**
  http://blogs.sas.com/content/graphicallyspeaking/
- ***Advanced ODS Graphics Examples***
  http://support.sas.com/documentation/prod-p/grstat/9.4/en/PDF/odsadvg.pdf
- SAS/STAT introductory chapters
- ***Statistical Graphics in SAS***
  https://support.sas.com/publishing/authors/kuhfeld.html
- Books by Sanjay Matange and Dan Heath
  http://support.sas.com/publishing/authors/matange.html

Free!

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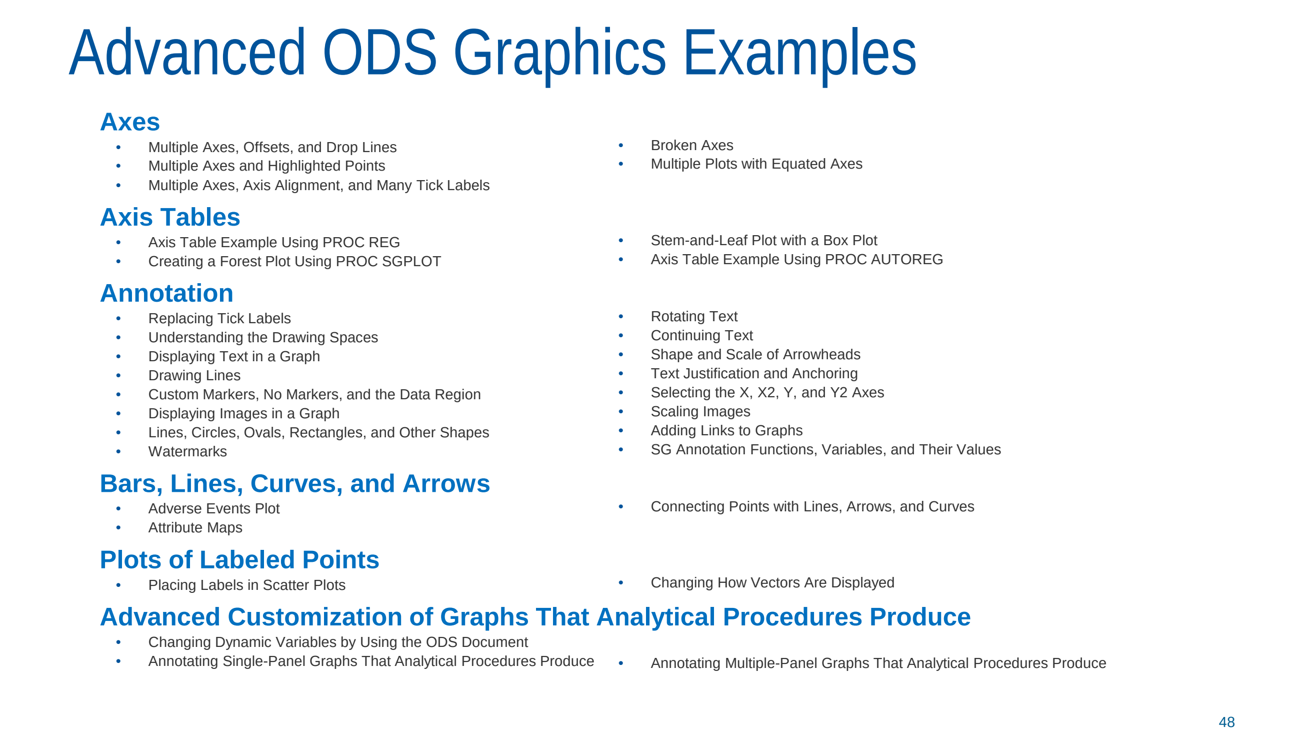

Advanced ODS Graphics Examples

Axes

- Multiple Axes, Offsets, and Drop Lines
- Multiple Axes and Highlighted Points
- Multiple Axes, Axis Alignment, and Many Tick Labels
- Broken Axes
- Multiple Plots with Equated Axes

Axis Tables

- Axis Table Example Using PROC REG
- Creating a Forest Plot Using PROC SGPLOT
- Stem-and-Leaf Plot with a Box Plot
- Axis Table Example Using PROC AUTOREG

Annotation

- Replacing Tick Labels
- Understanding the Drawing Spaces
- Displaying Text in a Graph
- Drawing Lines
- Custom Markers, No Markers, and the Data Region
- Displaying Images in a Graph
- Lines, Circles, Ovals, Rectangles, and Other Shapes
- Watermarks
- Rotating Text
- Continuing Text
- Shape and Scale of Arrowheads
- Text Justification and Anchoring
- Selecting the X, X2, Y, and Y2 Axes
- Scaling Images
- Adding Links to Graphs
- SG Annotation Functions, Variables, and Their Values

Bars, Lines, Curves, and Arrows

- Adverse Events Plot
- Attribute Maps
- Connecting Points with Lines, Arrows, and Curves

Plots of Labeled Points

- Placing Labels in Scatter Plots
- Changing How Vectors Are Displayed

Advanced Customization of Graphs That Analytical Procedures Produce

- Changing Dynamic Variables by Using the ODS Document
- Annotating Single-Panel Graphs That Analytical Procedures Produce
- Annotating Multiple-Panel Graphs That Analytical Procedures Produce

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