**ABSTRACT**

The SAS Graph Template Language (GTL) is an extension to the Output Delivery System (ODS) that enables you to create sophisticated graphics. And it is template based language which gives drawer the full space to customize a graph. However, sometimes you will find it difficult to do some small revision when you finish the figure. And you may need to change the layout and even cannot draw that as some statement do not have this or that function.

Luckily, since the release of SAS9.3, we have the draw statements which enable you to customize a graph by drawing visual elements anywhere within the graph and things become easy.

This paper will introduce draw statement and show some examples that how draw statements make difficult things easy in our routine work.

**INTRODUCTION**

The SAS Graph Template Language (GTL) is template based language that enables us to create various beautiful sophisticated graphics. However, we have to follow its structure and rule e.g we could not customize the color of label of Axis. Of course, we could do it with another method. For example, we could draw the label with scatterplot statement. But it also has its limitation. This paper will introduce how we could draw figures for clinical trial with more flexibility in daily work.

**WHAT YOU CAN DRAW WITH DRAW STATEMTNS**

There are general eight types of Graphics Element we could draw on the figure. As we always need to add some descriptive text to the figure to make it clearer, so DRAWTEXT is more often used than others.

<table>
<thead>
<tr>
<th>To Draw this Type of Graphics Element</th>
<th>Use this GTL Statement or Block</th>
</tr>
</thead>
<tbody>
<tr>
<td>Text</td>
<td>DRAWTEXT</td>
</tr>
<tr>
<td>An arrow</td>
<td>DRAWARROW</td>
</tr>
<tr>
<td>A line</td>
<td>DRAWWLINE</td>
</tr>
<tr>
<td>An oval or circle</td>
<td>DRAWWOVAL</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>To Draw this Type of Graphics Element</th>
<th>Use this GTL Statement or Block</th>
</tr>
</thead>
<tbody>
<tr>
<td>A square or rectangle</td>
<td>DRAWRCTANGLE</td>
</tr>
<tr>
<td>A polyline</td>
<td>DRAW statements within a BEGINPOLYLINE/ENDPOLYLINE block</td>
</tr>
<tr>
<td>A polygon</td>
<td>DRAW statements within a STARTPOLYGON/ENDPOLYGON block</td>
</tr>
<tr>
<td>An image</td>
<td>DRAWIMAGE</td>
</tr>
</tbody>
</table>
proc template;
define statgraph modelfit;
begingraph;
entrytitle "Regression Fit Plot";
layout lattice;
layout overlay / xaxisopts=(offsetmin=.1);
drawtext textattrs=(style=italic size=8pt)
"Band shows 99% Confidence Limit of Mean" /
anchor=bottomleft width=15 widthunit=percent
xspace=wallpercent yspace=wallpercent
x=0 v=10 justify=center ;
modelband "myclm";
scatterplot x=height y=weight / primary=true;
regressionplot x=height y=weight / alpha=.01 clm="myclm";
endlayout;
endlayout;

drawtext textattrs=(color=gray size=52pt) "CONFIDENTIAL" /
transparency=.75 rotate=-35
width=110 widthunit=percent justify=center ;
endgraph;
end;

proc sgrender data=sashelp.class template=modelfit;
run;

WHERE YOU CAN DRAW THE GRAPHICS ELEMENT

There are general eight types of Graphics Element we could draw on the figure. As we always need to add some descriptive text to the figure to make it clearer, so DRAWTEXT is more often used than others.

DrawingSpace : DATA, WALL, LAYOUT, or GRAPH
DrawingUnits : PIXEL, PERCENT, VALUE(only for the DATA drawing space)
EXAMPLE GRAMMER OF DRAWTEXT STATEMENT

drawtext textattrs=() "XXX" / xspace=wallpercent yspace=wallpercent x =0 y=10
  anchor=bottomleft width=15 widthunit=percent justify=center ROTATE=0;
drawtext textattrs=() "XXX" / xspace=datapercnet yspace=datapercnet x =0 y=10
  anchor=bottomleft width=15 widthunit=percent justify=center ROTATE=0;

HOW THE GRAPHICS ELEMENTS ARE ANCHORED

When you specify the X and Y coordinates for a graphics element, the element is drawn from an anchor point that is placed in the drawing area at the X and Y coordinates that you specify. For lines and arrows, the anchor point is the starting point of the line or arrow, which is specified with the X1 and Y1 options on the draw statement. For elements that have height and width, the anchor point can be one of the points shown in the following figure. By default, the anchor point is CENTER. You can use the ANCHOR= option on the draw statements to change the anchor point of your graphics elements.
Draw statement, the third hand of GTL (Graph Template Language), continued

**ISSUE 1 DESCRIPTION**

- **Request:** Client ask to show different color for subjects who discontinue and still active on study. Like in green = active on study, in red = discontinue.
- **Barchartparm, Oncology**
  - **Axis label:** We could use TICKVALUEFITPOLICY=ROTATE to rotate label of axis, but could not define the color of label.
- **ScatterPlot + MARKERCHARACTER:** We could use Scatterplot statement to draw the label and define its color, but could not rotate the character.

```

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<th>q-value</th>
<th>method</th>
<th>color</th>
<th>dnr</th>
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<td>Y</td>
</tr>
</tbody>
</table>
```
Draw statement, the third hand of GTL (Graph Template Language), continued

**ISSUE 1 SOLUTION**

\[
\text{DrawText} \text{ textAttr=| COLOR=red SIZE=8| "0061016(0.75)" /}
\]

\[
Y=2 X=0061026(3.75) XSPACE=datavalue YSPACE=datapercent ROTATE=45 ANCHOR=right WIDTH=20
\]

\[
\text{DrawText} \text{ textAttr=| COLOR=red SIZE=8| "0011001(1.41)" /}
\]

\[
Y=2 X=0011001(1.41) XSPACE=datavalue YSPACE=datapercent ROTATE=45 ANCHOR=right WIDTH=20
\]

\[
\text{DrawText} \text{ textAttr=| COLOR=green SIZE=8| "0141003(24.11)" /}
\]

\[
Y=9 X=0141003(24.11) XSPACE=datavalue YSPACE=datapercent ROTATE=45 ANCHOR=right WIDTH=20
\]

**ISSUE 2 TEXT POSITION, WRAPPING AND INDENTION**

- Sometimes, many of us will found it is difficult to deal with text position, wrapping and indentation.
- In GTL, leading and trailing blanks are removed from the axis tick values and marker character strings.
- Forestplot

```
<table>
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<tr>
<th>Overall</th>
<th>In favor of Aprinol</th>
<th>In favor of Placebo</th>
<th>Act vs. Placebo in LS Mean/N</th>
<th>DIF (95% CI) in LS Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
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</tr>
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</tr>
<tr>
<td>Non-White</td>
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<td></td>
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<td></td>
</tr>
</tbody>
</table>
```

**ISSUE 3**

- Like add additionally information
- Client ask to mark one subject who receive treatment again after discontinuation
- Oncology

*Figure 14.1.1.1*

Percent Change from Baseline in Total Length of Target Lesions up to Initial Progression
All-Subjects-Treated Population, Pancreatic Cancer, Arm A Part 1 (Nivolumab 3 mg/kg)

Confirmed Best Overall Response [b]
- PR
- SD
- PD

Treatment Discontinuation
- Adverse Event
- Progession
- Other reason

Subjects in green = active on study, in red = discontinued, in dash = never received Nivolumab.

Total length = Sum of the longest diameters of the non-nodal target lesions and the shortest axis of lymph nodes.

[a] Total length of target lesions after initial progression is excluded for calculating best percent change.

[b] Only responses up to initial progression are included to find best percent change in total length.
ISSUE 3 SOLUTION

drawimage x1=10 y1=20 x2=55 y2=35
   /xspace=datavalue yspace=datavalue xspace=datavalue yspace=datavalue
   accrovalueshape=filled linestyle=color=lightblue
   /width=25 anchor=bottom border=true
datavalue xspace=datavalue yspace=datavalue;

drawtext text=(style=italic size=8pt) "Subject who receive treatment again after discontinuation : 060604"
   /width=30 anchor=topright height=20 heightunit=percent;

drawimage "XXX\hi.jpg" /x=98 y=98 drawspace=wallpercent width=30 widthunit=percent
   anchor=topright height=20 heightunit=percent;

CONCLUSION

Draw statement does make drawing figures with GTL more flexible. This paper details how we leverage this function to do our daily work.

REFERENCES

SAS(R) 9.3 Graph Template Language: Reference, Third Edition. Available at

SAS(R) 9.3 Graph Template Language: User's Guide

CONTACT INFORMATION

Your comments and questions are valued and encouraged. Contact the author at:

Name: Kuangye Fang
Enterprise: PPD Inc.
Address: Unit 1101, Henderson Metropolitan, No. 155 Tianjin Road
City, State ZIP: Shanghai, 200001
Work Phone: +86 021 3307 2222
E-mail: Kuangye.Fang@ppdi.com
Draw statement, the third hand of GTL (Graph Template Language), continued

Web: www.ppdi.com

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