**Draw statement, more flexibility with GTL(Graph Template Language)**

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**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 STATEMENTS**

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 DRAWTXT 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>DRAWTXT</td>
</tr>
<tr>
<td>An arrow</td>
<td>DRAWAARROW</td>
</tr>
<tr>
<td>A line</td>
<td>DRAWLINE</td>
</tr>
<tr>
<td>An oval or circle</td>
<td>DRAWOVAL</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>DRAWRRECTANGLE</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>
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)
Draw statement, the third hand of GTL (Graph Template Language), continued

**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=datapercent yspace=datapercent 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.
ISSUE 1 DESCRIPTION

- Request: 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.
Draw statement, the third hand of GTL(Graph Template Language), continued

ISSUE 1 SOLUTION

```plaintext
DATA a4;
  LENGTH color $10. draw_statement chars $1000. ;
  RETAIN chars ;
  IF dis='Y' THEN color='red';
  ELSE color='green';
  draw_statement='DrawText textAttrs=( COLOR=' || strip(color)
  || ' SIZE=8) ""||strip(x_value)||" / Y=2 X="' ||strip(x_value)
  || '" XSPACE=datavalue YSPACE=datapercent ROTATE=45 ANCHOR=right WIDTH=20';
  CALL symputx("draw"||strip(put(_n_,best.)),strip(draw_statement) );
  IF eof THEN CALL symputx("num",put(_n_,best.));
RUN;
%PUT &draw1.;
%PUT &draw4.;
%PUT &num.;
DATA aa9;
  LENGTH chars $500. ;
  RETAIN chars; 
  DO i=1 TO &num. ;
    IF i=1 THEN chars="%nrstr(&draw)||strip(put(i,best.)) ;
    IF i ne 1 THEN
      chars=strip(chars)||repeat('',3)||"%nrstr(&draw)||strip(put(i,best.)) ;
  END;
  CALL symputx("all", strip(chars),'g');
RUN;
%PUT &all. ;

ISSUE 2 TEXT POSITION, WRAPPING AND INDENTION

- Sometimes, many of us will find 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 markercharacter strings.
- Forestplot

<table>
<thead>
<tr>
<th>Sex</th>
<th>In favor of Apremilast</th>
<th>In favor of Placebo</th>
<th>Act vs Placebo in LS Mean/N</th>
<th>DME (95% CI) in LS Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age &lt; 40</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40 - 65</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt; 65</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-White</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

ISSUE 3

- Like add additionally information
- To mark one subject who receive treatment again after discontinuation
Draw statement, the third hand of GTL (Graph Template Language), continued

- Oncology

**ISSUE 3 SOLUTION**

```plaintext
drawtype xl=11 y1=-20 xl=11 y2=-55
   / xttspacing yttspacing=datavalue xttspacing yttspacing=datavalue arrowheadshape=filled linetype=color=lighblue
   / dcrentext textcenter style=italic size=9pt "Subject who receive treatment again after discontinuation: 0081024"
   / width=25 anchor=bottom border=true borderattrs=color=lighblue x=-1 y=-20 xttspacing yttspacing=datavalue;

SHOW WHICH APPLICATION TO DRAW THIS FIGURE
```
Draw statement, the third hand of GTL (Graph Template Language), continued

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

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