

Animate your Data!

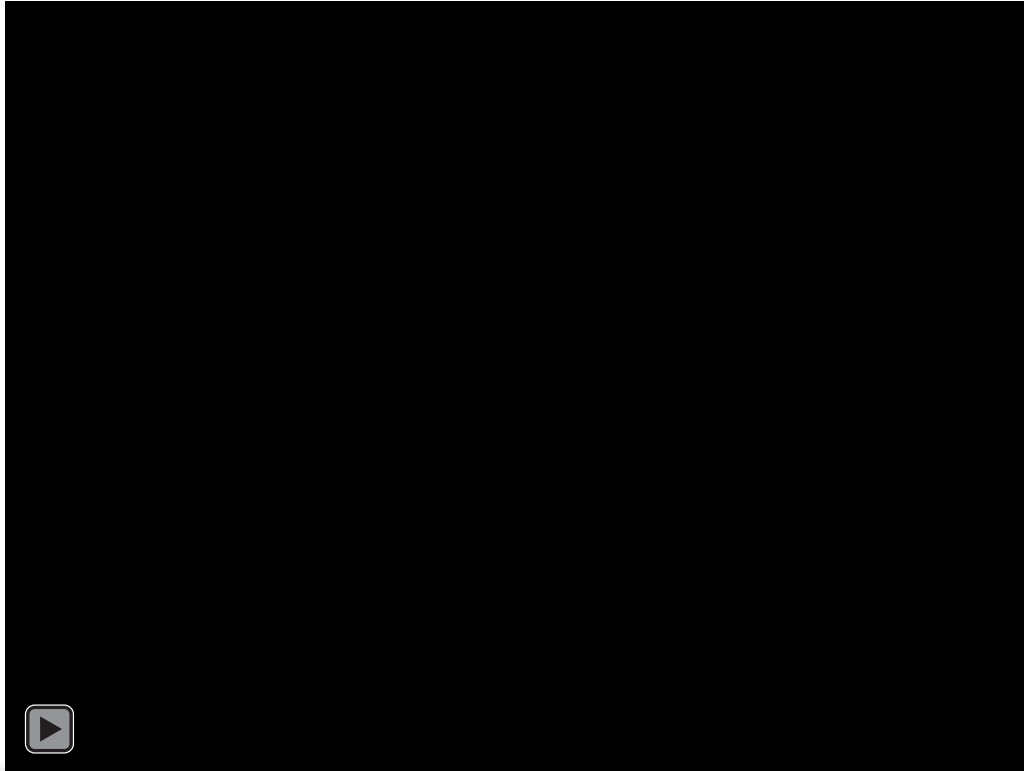
Kriss Harris and Richann Watson

Presented by:

Richann Watson is an independent statistical programmer and CDISC consultant. She has been using SAS since 1996. She has worked on various therapeutic areas including Oncology and Diabetes. She is also a member of the CDISC ADaM team and various sub-teams. In addition, she is the chairperson for the local SAS user group in her area and is actively involved with SAS Global Forum, PharmaSUG, MWSUG and other SAS User Groups.

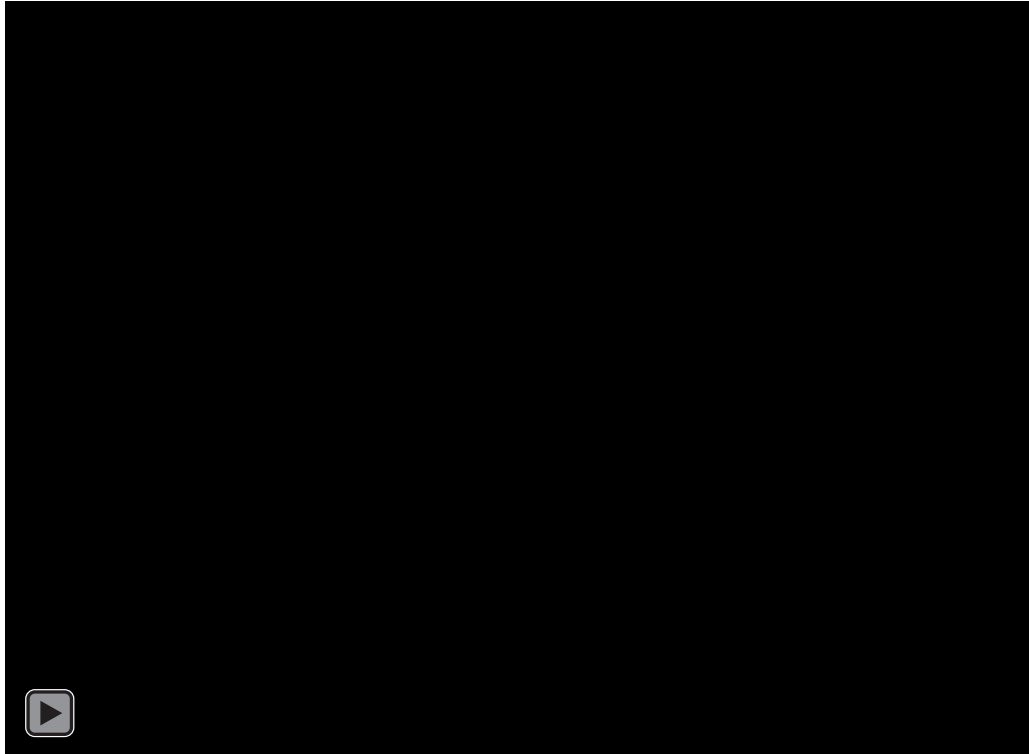
Agenda

Show you how to produce animations



Agenda

Show you how to produce smooth animations



Why use Animation?

- You can understand and interpret your data.
 - You can quickly get an idea of the number of subjects that had abnormal laboratory results at each visit.
 - You are also able to easily determine the adverse events each subject had and the duration of the adverse event.
 - You can monitor blood pressure over time by treatment.
 - You can easily discern a dip or a spike in someone's heart rate.

How to Animate

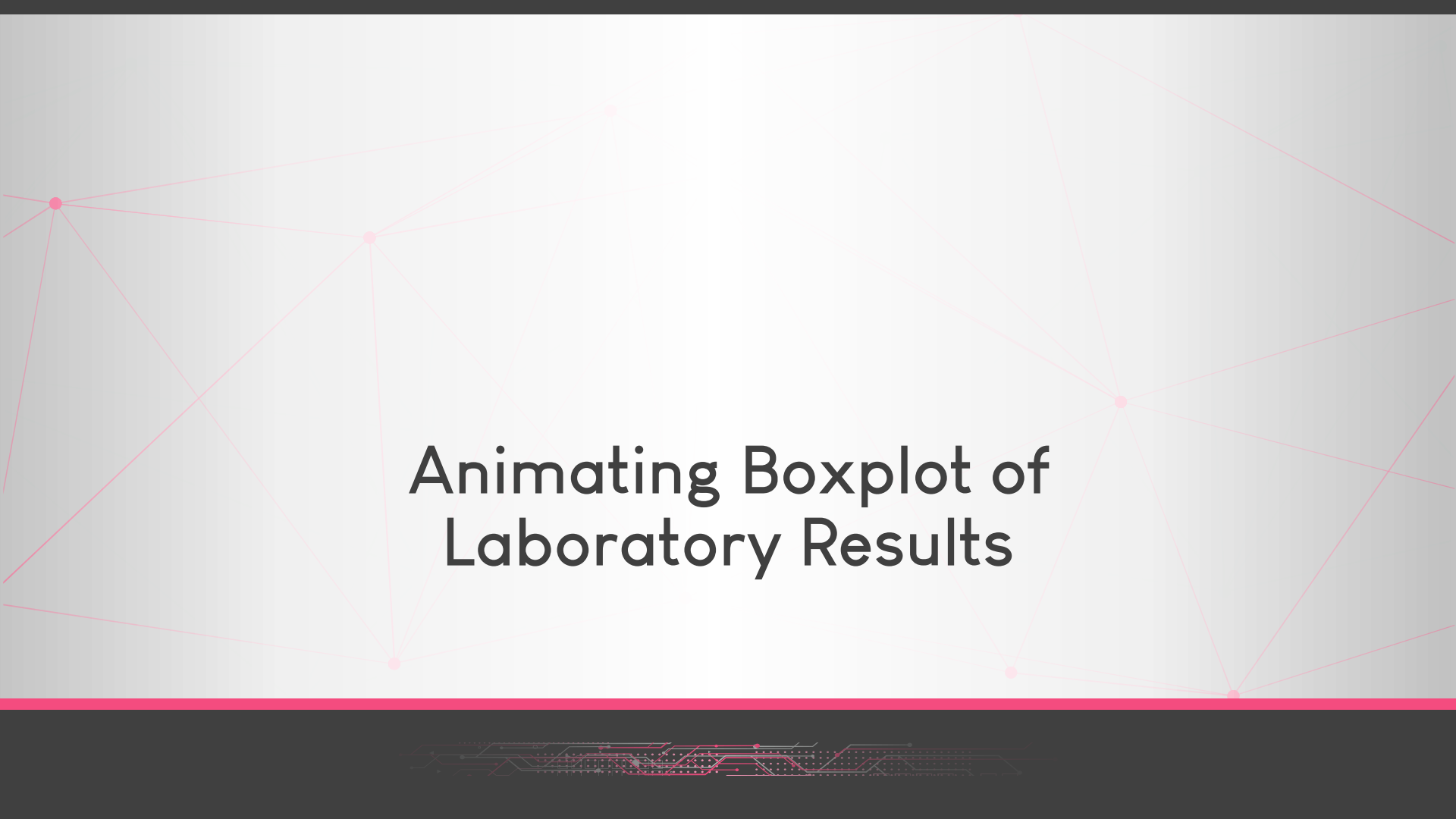
```
ods printer file="C:\animation.gif";  
options printerpath=gif animation=start  
    animduration=0.5 animloop=yes  
    noanimoverlay;  
  
proc sgrender data=<data-set-name>  
    template=<template-name>;  
    <other optional statements>;  
run;  
  
options printerpath=gif animation=stop;  
ods printer close;
```

How to Animate

```
/* define template here */  
  
ods printer file = "C:\animation.gif";  
options printerpath = gif animation = start  
      animduration = 0.5 animloop = yes noanimoverlay;  
  
/* or could define the template here */  
  
proc sgrender data = <data-set-name>  
  template = <template-name>;  
  <other optional statements>;  
run;  
  
options printerpath = gif animation = stop;  
ods printer close;
```

How to Animate

```
proc template;  
  define statgraph <template-name>;  
    begingraph / <options>;  
      <GTL statements>;  
    endgraph;  
  end;  
run;
```



Animating Boxplot of Laboratory Results



Example 1: Animated Boxplot of Lab Results

Creatinine
was selected

	Actual Treatment	Actual Treatment (N)	Sex	Analysis Visit	Analysis Visit (N)	Parameter	Analysis Range 1 Lower Limit	Analysis Range 1 Upper Limit
1	Placebo	0	F	Week 2	2	Creatinine (umol/L)	62	124
2	Placebo	0	F	Week 4	4	Creatinine (umol/L)	62	124
3	Placebo	0	F	Week 6	6	Creatinine (umol/L)	62	124
4	Placebo	0	F	Week 8	8	Creatinine (umol/L)	62	124
5	Placebo	0	M	Week 2	2	Creatinine (umol/L)	71	141
6	Placebo	0	M	Week 4	4	Creatinine (umol/L)	71	141
7	Xanomeline High Dose	81	M	Week 2	2	Creatinine (umol/L)	71	141
8	Xanomeline High Dose	81	M	Week 4	4	Creatinine (umol/L)	71	141
9	Xanomeline High Dose	81	M	Week 6	6	Creatinine (umol/L)	71	141
10	Xanomeline High Dose	81	M	Week 8	8	Creatinine (umol/L)	71	141
11	Xanomeline Low Dose	54	M	Week 2	2	Creatinine (umol/L)	71	141
12	Xanomeline Low Dose	54	M	Week 4	4	Creatinine (umol/L)	71	141

The Data

Example 1: Animated Boxplot of Lab Results

Number of subjects calculated at each visit for each treatment

	Actual Treatment	Actual Treatment (N)	Sex	Analysis Visit	Analysis Visit (N)	Analysis Range 1 Upper Limit	Analysis Range 1 Lower Limit	N Subjects/Visit
1	Placebo	0	M	Week 2	2	141	71	33
2	Xanomeline Low Dose	54	M	Week 2	2	141	71	33
3	Xanomeline High Dose	81	M	Week 2	2	141	71	41
4	Placebo	0	M	Week 4	4	141	71	32
5	Xanomeline Low Dose	54	M	Week 4	4	141	71	29
6	Xanomeline High Dose	81	M	Week 4	4	141	71	37
7	Placebo	0	M	Week 6	6	141	71	31

```
proc sql;  
  create table lab_data_with_n as  
  select *, count(distinct usubjid) as nobs_subject_visit  
  from lab_data  
  group by trtan, avisitn, sex;  
quit;
```

Data Manipulations

Example 1: Animated Boxplot of Lab Results

```
proc template;  
  define statgraph boxplot_template_sex;  
    dynamic _byval_ _byval2_ _byval4_ upperlim lowerlim;  
    begingraph;  
  
      entrytitle halign = center _byval_ ":" " Sex = " _byval2_ " and Visit = " _byval4_ ;  
  
      layout overlay / yaxisopts = (linearopts = (viewmin = 60 viewmax = 180  
        tickvaluesequence = (start = 60 end = 180 increment = 30)));  
  
      boxplot x = trtan y = aval / group = trtan groupdisplay = cluster;  
  
      referenceline y = lowerlim / lineattrs = (pattern = 2);  
      referenceline y = upperlim / lineattrs = (pattern = 2);  
  
      innermargin;  
        axistable x = trtan value = nobs_subject_visit / stat = mean  
          label = "n" valueattrs = (size = 9);  
  
      endinnermargin;  
    endlayout ;  
  endgraph;  
end;  
run;
```

First Create the Template with Graph Template Language (GTL)

Example 1: Animated Boxplot of Lab Results

```
options nobyline;
options papersize=('8 in', '4.8 in') printerpath = gif
      animation = start animduration = 0.5 animloop = yes
      noanimoverlay;
ods printer file = "&outpath\boxplotM1.gif";

ods graphics / width = 8in height = 4.8in imagefmt = gif;

proc sgrender data = adlbc_all_n_gen
      template = boxplot_template_sex;
  where avisitn ne . and sex = "M";
  by param sex avisitn avisit;
  dynamic upperlim = "a1hi" lowerlim = "a1lo";
  format trtan trtfmt.;
run;

options printerpath = gif animation = stop;
ods printer close;
```

Animation Options and SGRENDER

Example 1: Animated Boxplot of Lab Results

```
options nobyline;  
options papersize = ('8 in', '4.8 in')  
printerpath = gif  
animation = start animduration = 0.5  
animloop = yes      noanimoverlay;  
ods printer  
    file = "&outpath\boxplotM1.gif";  
ods graphics /  
    width = 8in height = 4.8in  
    imagefmt = gif;
```

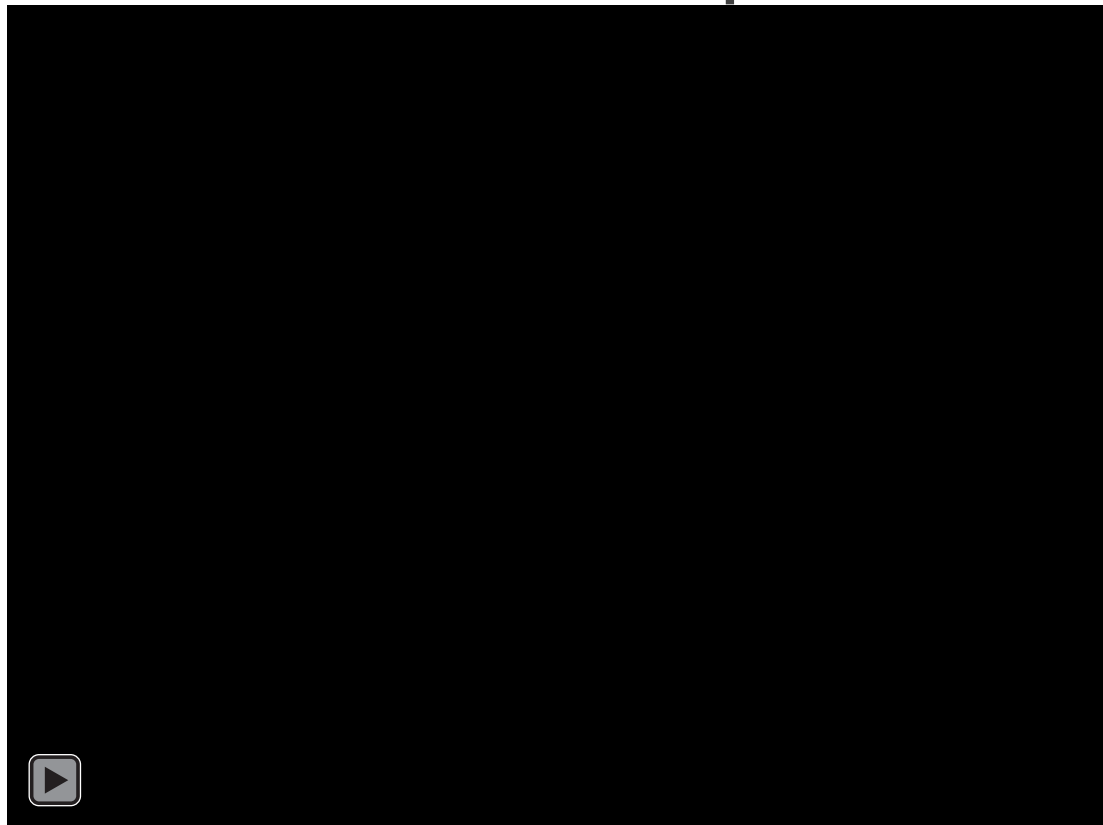
Animation Options Before SGRENDER

Example 1: Animated Boxplot of Lab Results

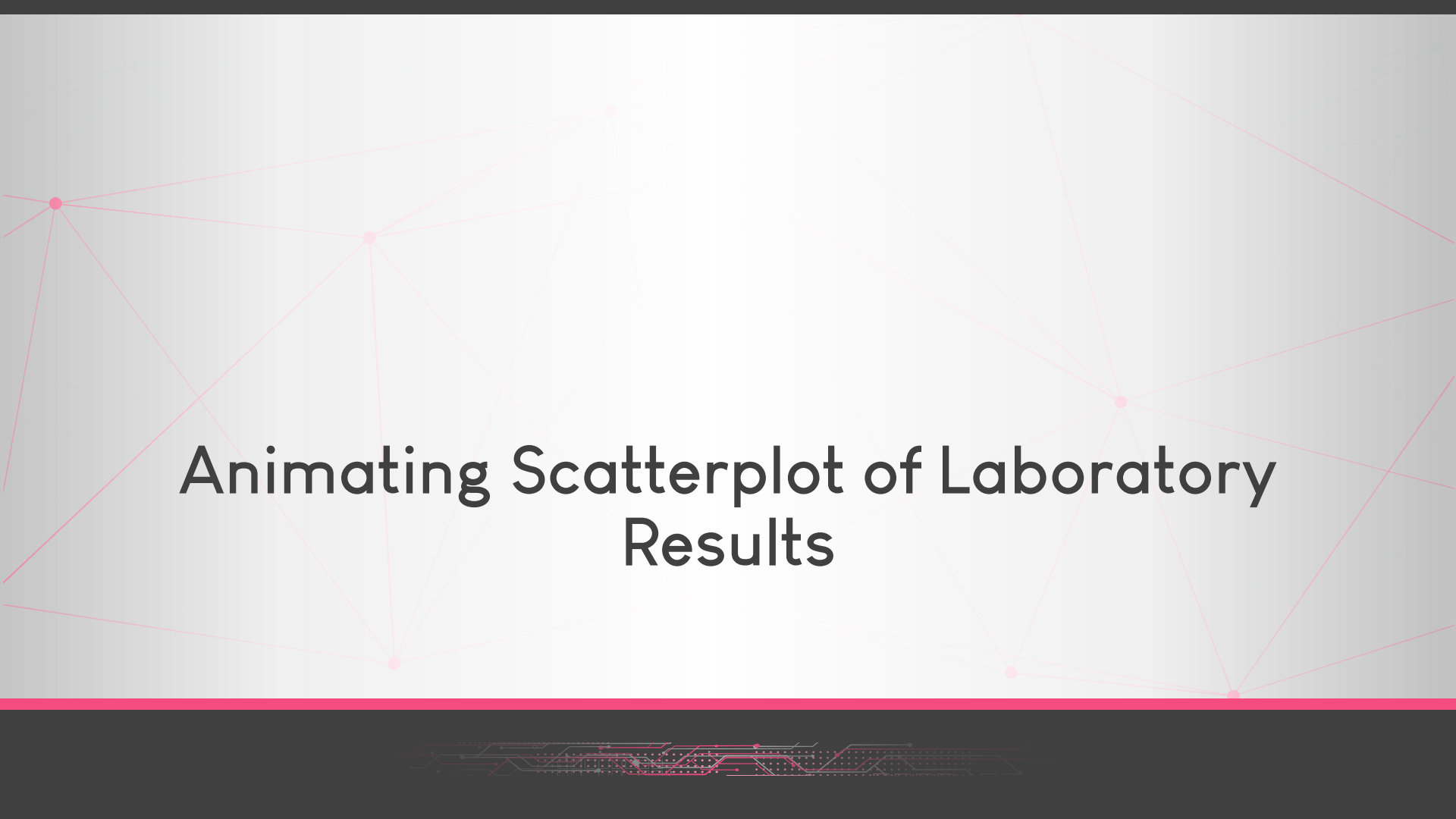
```
proc sgrender data =adlbc_all_n_gen  
  template = boxplot_template_sex;  
  where avisitn ne . and sex = "M";  
  by param sex avisitn avisit;  
  dynamic upperlim = "a1hi"  
           lowerlim = "a1lo";  
  format trtan trtfmt.;  
run;  
  
options printerpath = gif animation = stop;  
ods printer close;
```

SGRENDER

Example 1: Animated Boxplot of Lab Results



Output



Animating Scatterplot of Laboratory Results



Example 2: Animated Scatterplot of Laboratory Results

Same data as in Example 1
But ...

	Actual Treatment	Actual Treatment (N)	Sex	Analysis Visit	Analysis Visit (N)	Analysis Range 1 Lower Limit	Analysis Range 1 Upper Limit	N Subjects with Abnormal Records / Visit
1	Placebo	0	M	Week 2	2	71	141	0
2	Xanomeline Low Dose	54	M	Week 2	2	71	141	4
3	Xanomeline High Dose	81	M	Week 2	2	71	141	2
4	Placebo	0	M	Week 4	4	71	141	1
5	Xanomeline Low Dose	54	M	Week 4	4	71	141	3
6	Xanomeline High Dose	81	M	Week 4	4	71	141	1
7	Placebo	0	M	Week 6	6	71	141	1
8	Xanomeline Low Dose	54	M	Week 6	6	71	141	2
9	Xanomeline High Dose	81	M	Week 6	6	71	141	2

Number of subjects with abnormal results were
calculated at each visit for each treatment

The Data

Example 2: Animated Scatterplot of Laboratory Results

GTL

```
layout overlay / yaxisopts = (linearopts = (viewmin = 60
viewmax = 180 tickvaluesequences = (start = 60 end = 180
increment = 30))) xaxisopts = (type = discrete);
scatterplot x = trtan y = aval / group = trtan
groupdisplay = cluster jitter = auto
jitteropts = (axis = x);
referenceline y = lowerlim / lineattrs = (pattern = 2);
referenceline y = upperlim / lineattrs = (pattern = 2);
innermargin;
axistable x = trtan value = nobs_abn_subject_visit /
stat = mean label = "n"
valueattrs = (size = 9);
endinnermargin;
endlayout;
```

Example 2: Animated Scatterplot of Laboratory Results

Animation Options (the same as the Boxplot options)

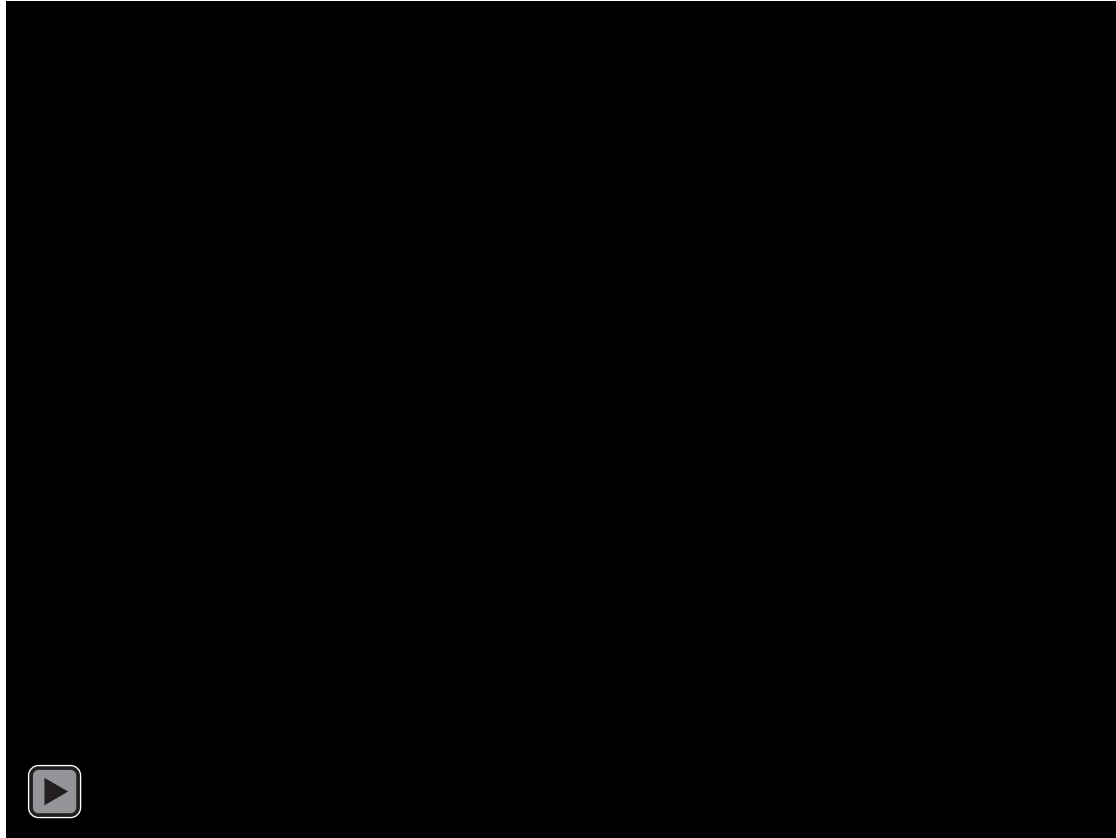
```
ods printer file = "&outpath\scatterplotM1.gif";
ods graphics / width = 8in height = 4.8in
               imagefmt = gif;

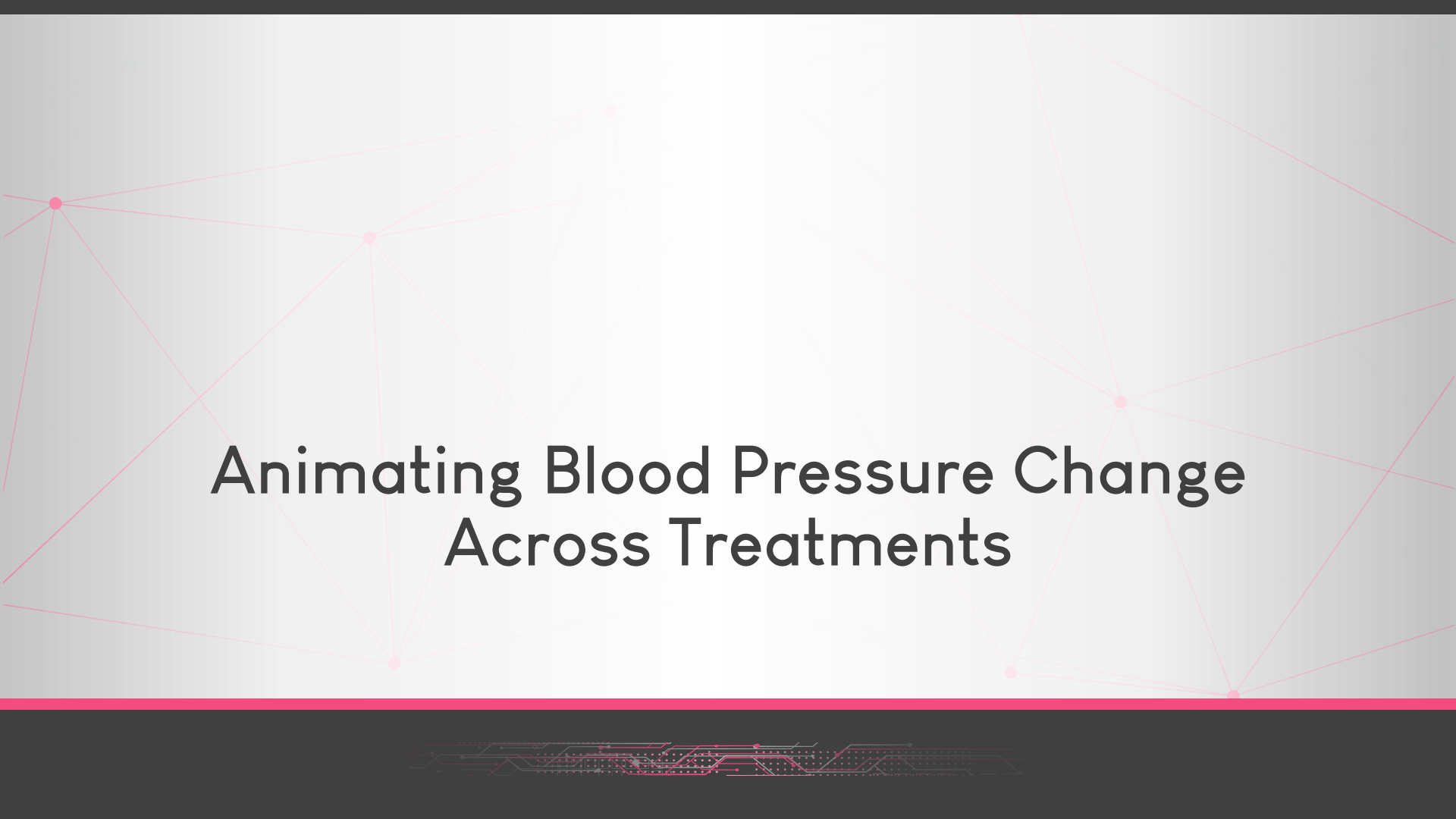
proc sgrender data = adlbc_all_abnormal_n_gen
  template = scatterplot template sex;
  where avisitn ne . and sex = "M";
  by param sex avisitn avisit;
  dynamic upperlim = "a1hi" lowerlim = "a1lo";
  format trtan trtfmt.;
run;

ods printer close;
```

Example 2: Animated Scatterplot of Laboratory Results

Output





Animating Blood Pressure Change Across Treatments

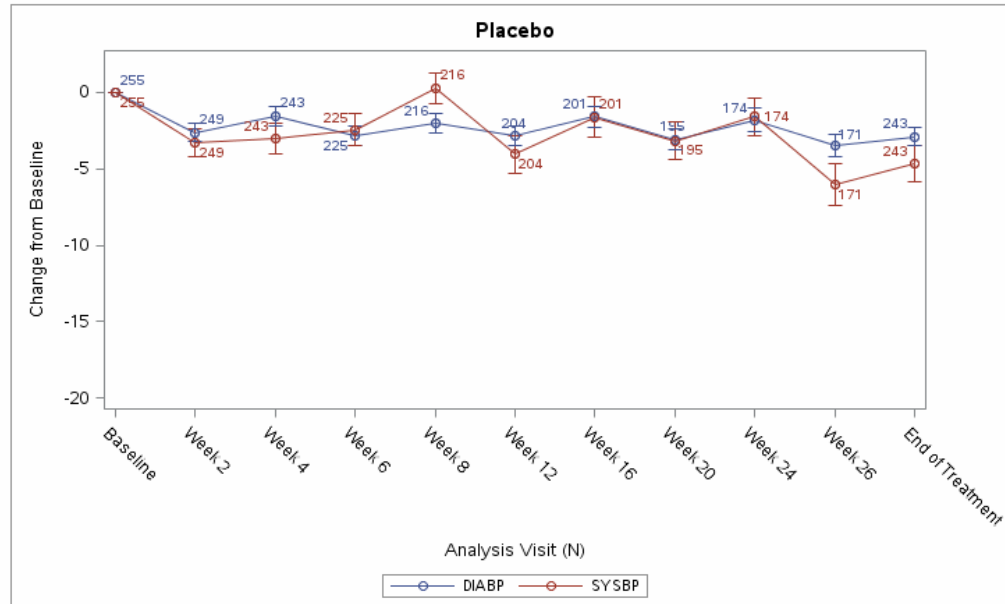


Example 3: Change in Blood Pressure Across Treatments

Animation is Not Time Dependent

- Sometimes what we want is not based only on time but based on a category as well

Wednesday, March 7, 2018 03:23:49 AM 1



Example 3: Change in Blood Pressure Across Treatments

The Data

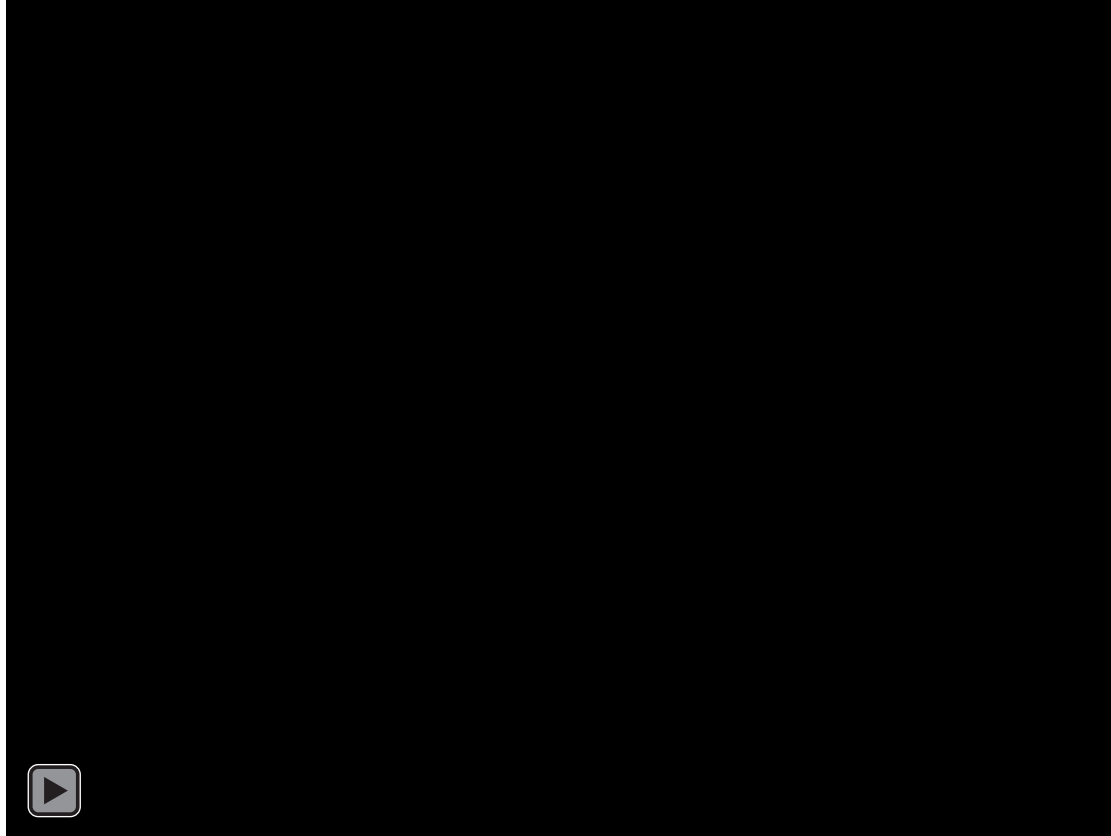
	USUBJID	TRTA	TRTAN	PARAMCD	AVISIT	AVISITN	AVAL	BASE	CHG
1	01-701-1015	Placebo	0	DIABP	Baseline	0	56	56	0
2	01-701-1015	Placebo	0	DIABP	Week 2	2	56	56	0
3	01-701-1015	Placebo	0	DIABP	Week 4	4	64	56	8
4	01-701-1015	Placebo	0	SYSBP	Baseline	0	130	130	0
5	01-701-1015	Placebo	0	SYSBP	Week 2	2	114	130	-16
6	01-701-1015	Placebo	0	SYSBP	Week 4	4	138	130	8
7	01-701-1028	Xanomeline High Dose	81	DIABP	Baseline	0	85	85	0
8	01-701-1028	Xanomeline High Dose	81	DIABP	Week 2	2	78	85	-7
9	01-701-1028	Xanomeline High Dose	81	DIABP	Week 4	4	69	85	-16
10	01-701-1028	Xanomeline High Dose	81	SYSBP	Baseline	0	138	138	0
11	01-701-1028	Xanomeline High Dose	81	SYSBP	Week 2	2	134	138	-4
12	01-701-1028	Xanomeline High Dose	81	SYSBP	Week 4	4	130	138	-8
13	01-716-1298	Xanomeline Low Dose	54	DIABP	Baseline	0	82	82	0
14	01-716-1298	Xanomeline Low Dose	54	DIABP	Week 2	2	72	82	-10
15	01-716-1298	Xanomeline Low Dose	54	DIABP	Week 4	4	74	82	-8
16	01-716-1298	Xanomeline Low Dose	54	SYSBP	Baseline	0	156	156	0
17	01-716-1298	Xanomeline Low Dose	54	SYSBP	Week 2	2	160	156	4
18	01-716-1298	Xanomeline Low Dose	54	SYSBP	Week 4	4	138	156	-18

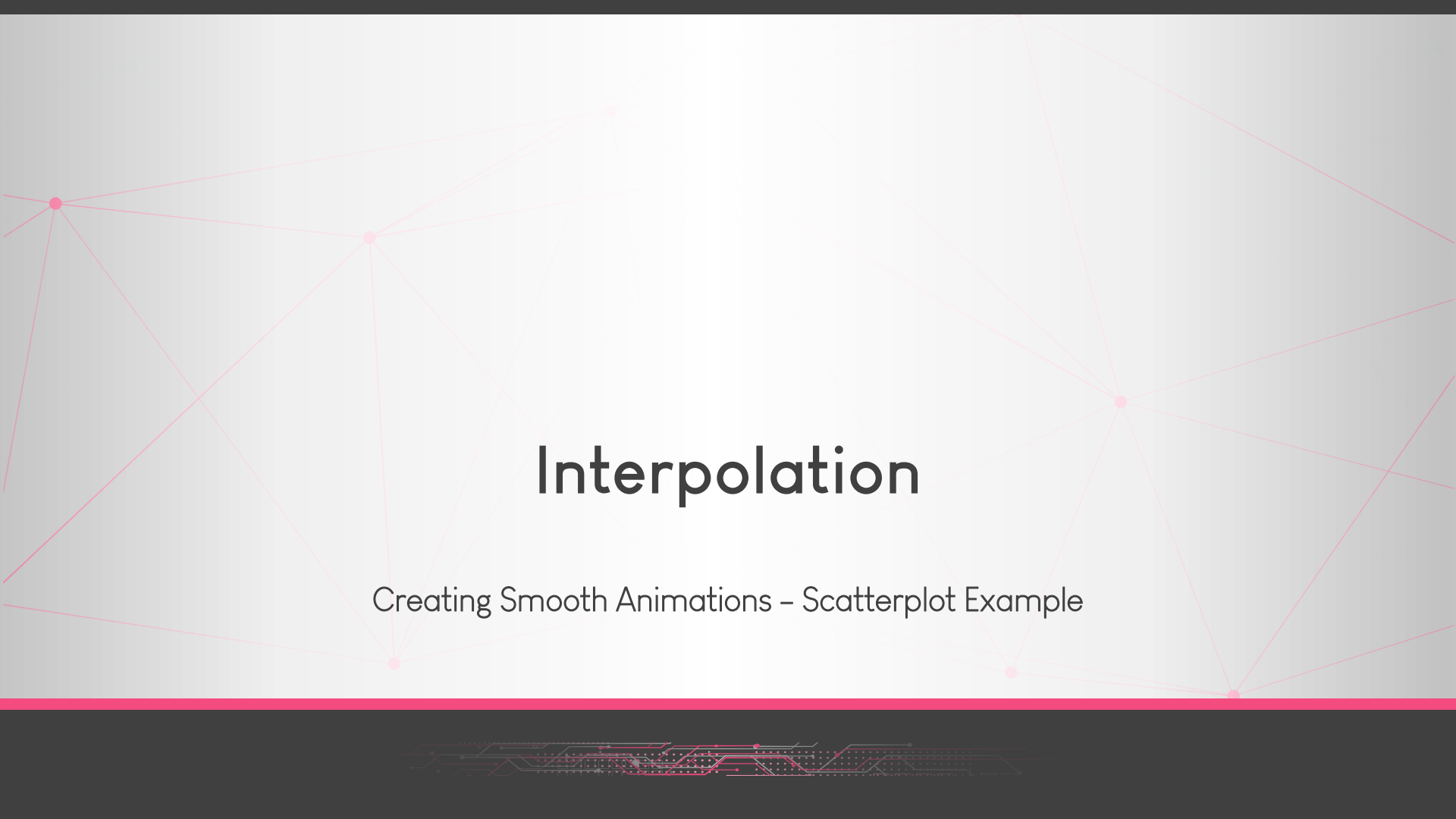
Comparison of Change in Blood Pressure Across Treatments

```
begingraph;  
  entrytitle halign = center byval ;  
  layout overlay / xaxisopts = (type = discrete discreteopts  
                                (tickvaluelist = ('0' '2' '4' '6' '8'  
                                                  '12' '16' '20' '24'  
                                                  '26' '99')))  
                                yaxisopts = (linearopts = (viewmin = -20  
                                                            viewmax = 2));  
  
  seriesplot x = AVISITN y = mean / display = all group = PARAMCD  
             datalabel = n name = "prm";  
  
  scatterplot x = AVISITN y = mean / group = PARAMCD  
             yerrorupper = eval(mean + se)  
             yerrorlower = eval(mean - se);  
  
  discretelegend "prm" / across = 2 location = outside;  
endlayout;  
endgraph;
```

Example 3: Change in Blood Pressure Across Treatments

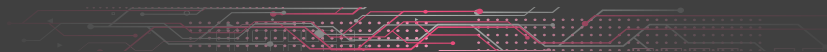
Output





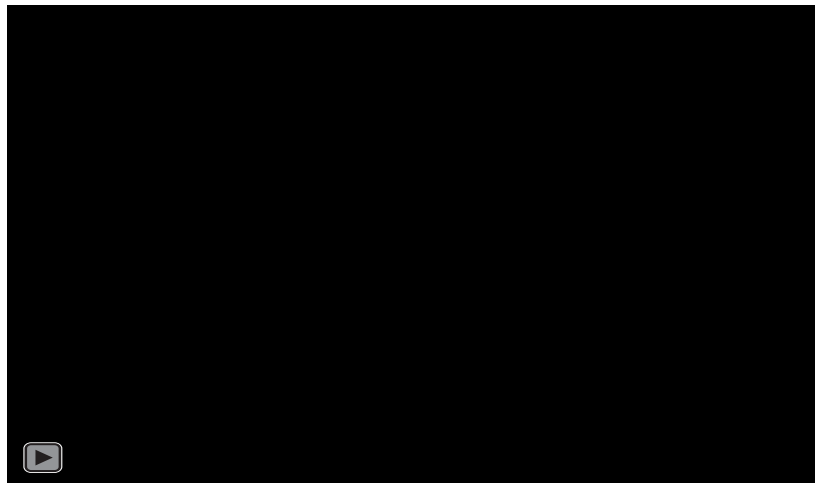
Interpolation

Creating Smooth Animations – Scatterplot Example

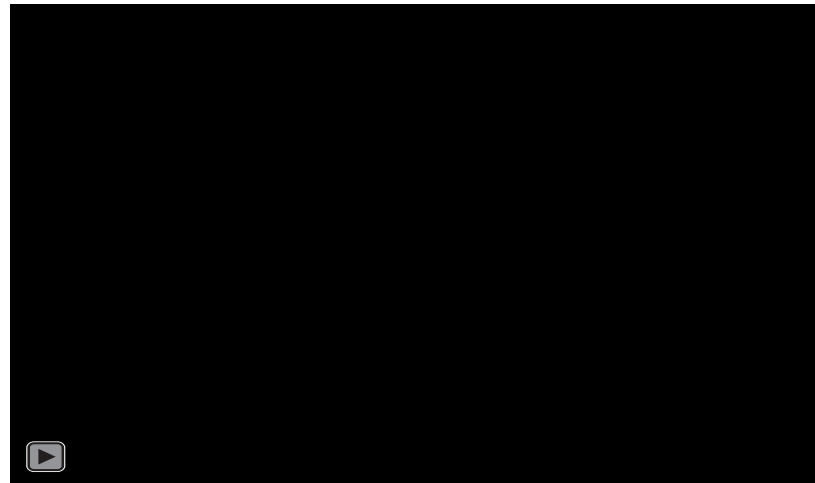


Why Interpolate?

Without Interpolation



With Interpolation



How to Interpolate?

- First step is determine variable that will drive animation (e.g., AVISITN)

	AVISITN
1	2
2	4
3	6
4	8
5	12
6	16
7	20
8	24
9	26
10	99



There are 10
visits

How to Interpolate?

- First step is determine variable that will drive animation (e.g., AVISITN)

	AVISITN
1	2
2	4
3	6
4	8
5	12
6	16
7	20
8	24
9	26
10	99

	New AVISITN
1	2
2	2.4
3	2.8
4	3.2
5	3.6
6	4
7	4.4
8	4.8
9	5.2
10	5.6
11	6

Add visits in between
the original visits

How to Interpolate?

- Merge the data together so that the new visit records are between the existing visit records

Unique Subject Identifier	Analysis Visit	Analysis Visit (N)	New AVISITN	Actual Treatment (N)	Analysis Value	Analysis Visit (N)
01-701-1023	Week 2	2	2	0	132.6	2
01-701-1023	Week 2	2	2.4	0		
01-701-1023	Week 2	2	2.8	0		
01-701-1023	Week 2	2	3.2	0		
01-701-1023	Week 2	2	3.6	0		
01-701-1023	Week 4	4	4	0	114.92	4
01-701-1023	Week 4	4	4.4	0		
01-701-1023	Week 4	4	4.8	0		
01-701-1023	Week 4	4	5.2	0		
01-701-1023	Week 4	4	5.6	0		
01-701-1023	End of Treatment	99	99	0	114.92	99
01-701-1023	End of Treatment	99	99.8	0		
01-701-1023	End of Treatment	99	100.2	0		
01-701-1023	End of Treatment	99	100.6	0		
01-701-1023	End of Treatment	99	101	0		

Linear interpolation

LOCF

How to Interpolate?

Interpolated Data set

Unique Subject Identifier	Analysis Visit	Analysis Visit (N)	New AVISITN	Actual Treatment (N)	Analysis Value	Analysis Values with Interpolation	Analysis Visit (N)
01-701-1023	Week 2	2	2	0	132.6	132.6	2
01-701-1023	Week 2	2	2.4	0	.	129.064	.
01-701-1023	Week 2	2	2.8	0	.	125.528	.
01-701-1023	Week 2	2	3.2	0	.	121.992	.
01-701-1023	Week 2	2	3.6	0	.	118.456	.
01-701-1023	Week 4	4	4	0	114.92	114.92	4
01-701-1023	Week 4	4	4.4	0	.	114.92	.
01-701-1023	Week 4	4	4.8	0	.	114.92	.
01-701-1023	Week 4	4	5.2	0	.	114.92	.
01-701-1023	Week 4	4	5.6	0	.	114.92	.
01-701-1023	End of Treatment	99	99	0	114.92	114.92	99
01-701-1023	End of Treatment	99	99.8	0	.	114.92	.
01-701-1023	End of Treatment	99	100.2	0	.	114.92	.
01-701-1023	End of Treatment	99	100.6	0	.	114.92	.
01-701-1023	End of Treatment	99	101	0	.	114.92	.

Example 4: Scatterplot Animation with Linear Interpolation

GTL

- This example uses GTL code similar to Example 2

```
layout overlay / yaxisopts =  
    (linearopts = (viewmin = 60 viewmax = 180  
        tickvaluesequences = (start = 60 end = 180  
            increment = 30)))  
    xaxisopts = (type = discrete);  
scatterplot x = trtan y = aval / group = trtan  
    groupdisplay = cluster jitter = auto  
    jitteropts = (axis = x);  
referenceline y = lowerlim / lineattrs = (pattern = 2);  
referenceline y = upperlim / lineattrs = (pattern = 2);  
endlayout;
```

Example 4: Scatterplot Animation with Linear Interpolation

Animation options

```
options papersize = ('8 in', '4.8 in')  
printerpath = gif animation = start  
animduration = 0.16 animloop = yes  
noanimoverlay nonumber;
```

Animation duration has been decreased compared to Example 2, because now there are a lot more frames, and we want to have a smooth animation.



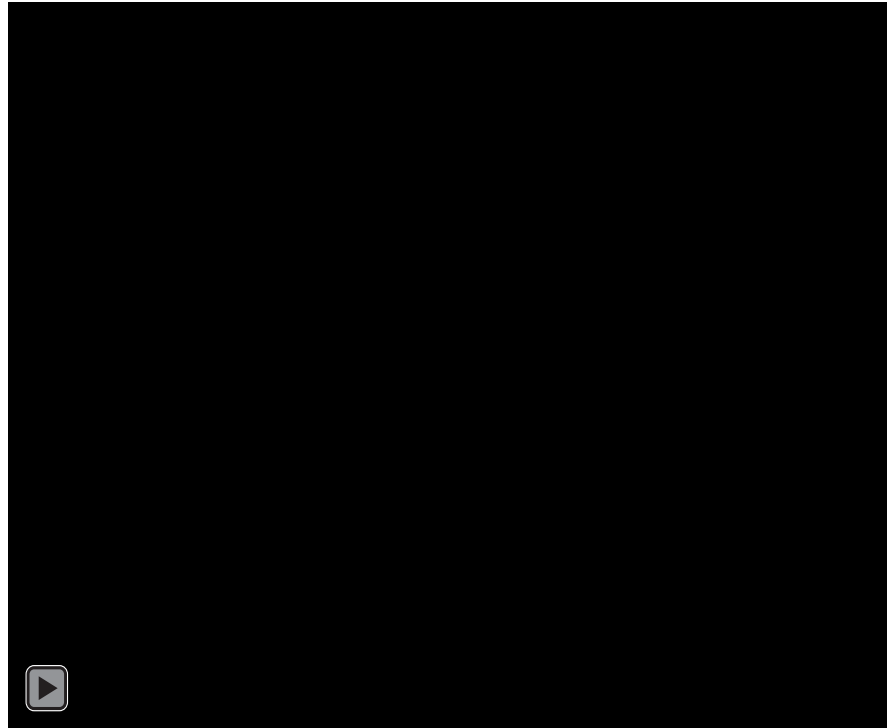
Interpolation

Creating Smooth Animations – Adverse Events (AEs) over time Example



Example 5: AEs over time by Baseline Laboratory Results

- A great way to assess the AE counts and visualize the relationship



Example 5: AEs over time by Baseline Laboratory Results

Input and Intermediate Data sets

ADAE where TRTEMFL = "Y"

Week AE started
was calculated

	Unique Subject Identifier	Dictionary-Derived Term	Actual Treatment (N)	Analysis Start Relative Day	Week AE started
1	01-701-1015	APPLICATION SITE ERYTHEMA	0	2	1
2	01-701-1015	APPLICATION SITE PRURITUS	0	2	1
3	01-701-1015	DIARRHOEA	0	8	2

No. of AEs for each
week were calculated

Actual Treatment (N)	Unique Subject Identifier	week	count_week
0	01-701-1015	1	2
0	01-701-1015	2	1

Cumulative Counts ranged
from Week 0 to Week 28

Unique Subject Identifier	Actual Treatment (N)	week	count_week	cum_counts
01-701-1015	0	0	0	0
01-701-1015	0	1	2	2
01-701-1015	0	2	1	3
01-701-1015	0	3	0	3

Example 5: AEs over time by Baseline Laboratory Results

Final Data set

Unique Subject Identifier	Actual Treatment (N)	Baseline Creatinine (umol/L)	Week	Cumulative TEAE counts with Interpolation
01-701-1015	0	79.56	0	0
01-701-1015	0	79.56	0.2	0.4
01-701-1015	0	79.56	0.4	0.8
01-701-1015	0	79.56	0.6	1.2
01-701-1015	0	79.56	0.8	1.6
01-701-1015	0	79.56	1	2
01-701-1015	0	79.56	1.2	2.2
01-701-1015	0	79.56	1.4	2.4
01-701-1015	0	79.56	1.6	2.6
01-701-1015	0	79.56	1.8	2.8
01-701-1015	0	79.56	2	3
01-701-1015	0	79.56	2.2	3
01-701-1015	0	79.56	2.4	3
01-701-1015	0	79.56	2.6	3
01-701-1015	0	79.56	2.8	3
01-701-1015	0	79.56	3	3

Interpolated
Counts

Example 5: AEs over time by Baseline Laboratory Results

GTL

```
begingraph / designwidth = 1200px designheight = 960px;  
  entrytitle textattrs = (size = 18pt) halight = center "Week = "_byval_;  
  
  layout datapanel classvars = (trtan) / headerlabeldisplay = value  
    headerlabelattrs = (size = 15pt) columns = 3 rows = 1  
    rowaxisopts=(label = "TEAE counts" labelattrs = (size = 18pt)  
      tickvalueattrs = (size = 16pt) linearopts = (viewmin = 0 viewmax = 25  
        tickvaluesequence = (start = 0 end = 25 increment = 5)))  
    columnaxisopts = (label = "Baseline Creatinine (umol/L)"  
      labelattrs = (size = 18pt) tickvalueattrs = (size = 16pt));  
  layout prototype;  
    scatterplot x = baseline_creatinine y = aval / group = trtan  
      markerattrs = (size = 15px symbol = circlefilled);  
  endlayout;  
endlayout;  
  
endgraph;
```

Example 5: AEs over time by Baseline Laboratory Results

Animation Options

```
ods printer file="&outpath\ae_anim1_scat.gif";  
options papersize = ('8 in', '6.4 in') printerpath = gif  
animation = start animduration = 0.13 animloop = yes noanimoverlay  
nonumber;
```

```
ods graphics / reset = all width = 8in height = 6.4in  
imagefmt = png;
```

```
proc sgrender data = final_dataset template = aedecod_anim_scat;  
  by avisitn;  
  format trtan trtfmt.;  
run;
```

```
ods graphics / reset = all;  
options printerpath = gif animation = stop;  
ods printer close;
```



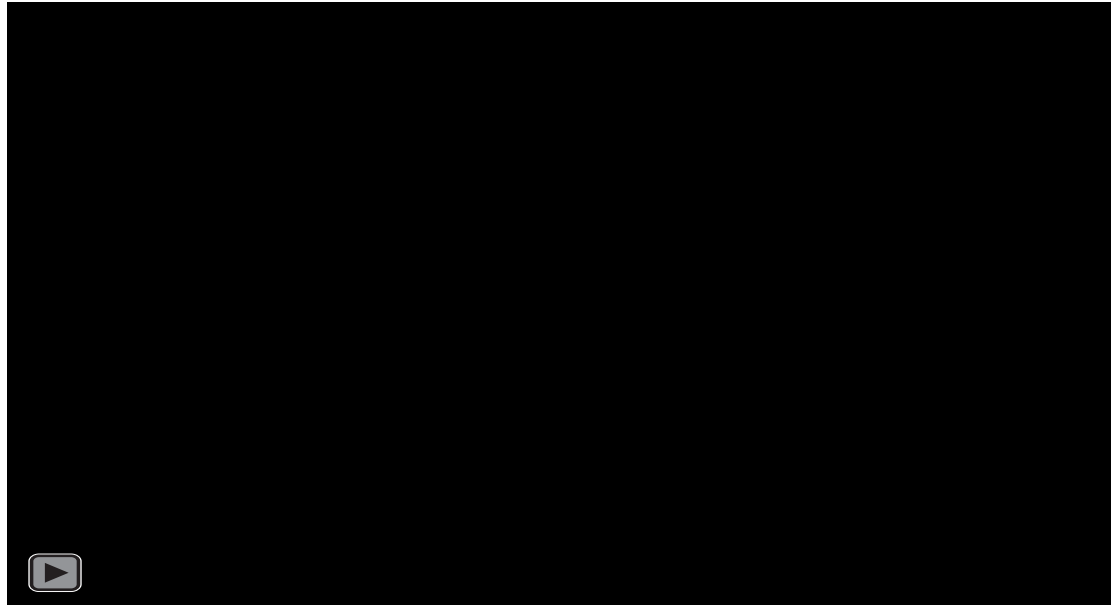
Expansion

Electrocardiogram (ECG) Heart Rate over Time



Example 6: ECG Heart Rate over Time

- On TV and in real life, we've all seen a heart rate monitor that display's how someone heart is beating over time.
- How is this heart rate monitor display achieved with SAS?



Example 6: ECG Heart Rate over Time

Data sets

	USUBJID	paramcd	param	ATPT	HR	AVISITN
1	001-001	HR	Heart Rate (beat per minute)	1	84.2697	1
2	001-001	HR	Heart Rate (beat per minute)	2	84.2697	1
3	001-001	HR	Heart Rate (beat per minute)	3	84.0619	1
4	001-001	HR	Heart Rate (beat per minute)	4	85.6542	1
5	001-001	HR	Heart Rate (beat per minute)	5	87.2093	1
6	001-001	HR	Heart Rate (beat per minute)	6	87.1246	1
7	001-001	HR	Heart Rate (beat per minute)	7	86.8726	1
8	001-001	HR	Heart Rate (beat per minute)	8	86.7052	1
9	001-001	HR	Heart Rate (beat per minute)	9	87.5899	1
10	001-001	HR	Heart Rate (beat per minute)	10	89.1475	1
11	001-001	HR	Heart Rate (beat per minute)	11	89.8204	1
12	001-001	HR	Heart Rate (beat per minute)	12	89.8204	1

Example 6: ECG Heart Rate over Time

Data sets

	USUBJID	paramcd	param	ATPT	HR	AVISITN
1	001-001	HR	Heart Rate (beat per minute)	1	84.2697	1
2	001-001	HR	Heart Rate (beat per minute)	2	84.2697	1
3	001-001	HR	Heart Rate (beat per minute)	3	84.0619	1
4	001-001	HR	Heart Rate (beat per minute)	4	85.6542	1
5	001-001	HR	Heart Rate (beat per minute)	5	87.2093	1
6	001-001	HR	Heart Rate (beat per minute)	6	87.1246	1
7	001-001	HR	Heart Rate (beat per minute)	7	86.8726	1
8	001-001	HR	Heart Rate (beat per minute)	8	86.7052	1
9	001-001	HR	Heart Rate (beat per minute)	9	87.5899	1
10	001-001	HR	Heart Rate (beat per minute)	10	89.1475	1
11	001-001	HR	Heart Rate (beat per minute)	11	89.8204	1
12	001-001	HR	Heart Rate (beat per minute)	12	89.8204	1

Each row represents 0.5 seconds

Example 6: ECG Heart Rate over Time

Data sets

	USUBJID	paramcd	param	ATPT	HR	AVISITN
1	001-001	HR	Heart Rate (beat per minute)	1	84.2697	1
2	001-001	HR	Heart Rate (beat per minute)	2	84.2697	1
3	001-001	HR	Heart Rate (beat per minute)	3	84.0619	1
4	001-001	HR	Heart Rate (beat per minute)	4	85.6542	1
5	001-001	HR	Heart Rate (beat per minute)	5	87.2093	1
6	001-001	HR	Heart Rate (beat per minute)	6	87.1246	1
7	001-001	HR	Heart Rate (beat per minute)	7	86.8726	1
8	001-001	HR	Heart Rate (beat per minute)	8	86.7052	1
9	001-001	HR	Heart Rate (beat per minute)	9	87.5899	1
10	001-001	HR	Heart Rate (beat per minute)	10	89.1475	1
11	001-001	HR	Heart Rate (beat per minute)	11	89.8204	1
12	001-001	HR	Heart Rate (beat per minute)	12	89.8204	1

There is 15 minutes of data and so we thought to speed the animation up 6 times faster.

Example 6: ECG Heart Rate over Time

Data sets

	USUBJID	paramcd	param	ATPT	HR	AVISITN	ATPT2	final_visit	final_animation_visit
1	001-001	HR	Heart Rate (beat per minute)	1	84.2697	1	0.5	1	1
2	001-001	HR	Heart Rate (beat per minute)	2	84.2697	1	1	1	1
3	001-001	HR	Heart Rate (beat per minute)	3	84.0619	1	1.5	1	1
4	001-001	HR	Heart Rate (beat per minute)	4	85.6542	1	2	1	1
5	001-001	HR	Heart Rate (beat per minute)	5	87.2093	1	2.5	1	1
6	001-001	HR	Heart Rate (beat per minute)	6	87.1246	1	3	1	1

This was achieved by grouping the animations every 3 seconds.

Example 6: ECG Heart Rate over Time

Data sets

	USUBJID	paramcd	param	ATPT	HR	AVISITN	ATPT2	final_visit	final_animation_visit
1	001-001	HR	Heart Rate (beat per minute)	1	84.2697	1	0.5	1	2
2	001-001	HR	Heart Rate (beat per minute)	2	84.2697	1	1	1	2
3	001-001	HR	Heart Rate (beat per minute)	3	84.0619	1	1.5	1	2
4	001-001	HR	Heart Rate (beat per minute)	4	85.6542	1	2	1	2
5	001-001	HR	Heart Rate (beat per minute)	5	87.2093	1	2.5	1	2
6	001-001	HR	Heart Rate (beat per minute)	6	87.1246	1	3	1	2
7	001-001	HR	Heart Rate (beat per minute)	7	86.8726	1	3.5	2	2
8	001-001	HR	Heart Rate (beat per minute)	8	86.7052	1	4	2	2
9	001-001	HR	Heart Rate (beat per minute)	9	87.5899	1	4.5	2	2
10	001-001	HR	Heart Rate (beat per minute)	10	89.1475	1	5	2	2
11	001-001	HR	Heart Rate (beat per minute)	11	89.8204	1	5.5	2	2
12	001-001	HR	Heart Rate (beat per minute)	12	89.8204	1	6	2	2

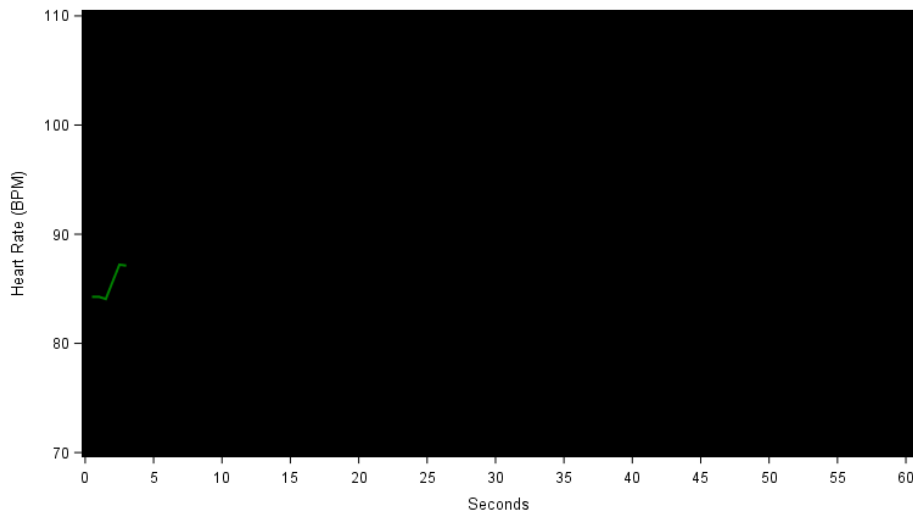
A drawing effect was achieved by keeping records from previous animation and adding the heart rate information of the current visit.

Example 6: ECG Heart Rate over Time

Data sets

	USUBJID	paramcd	param	ATPT	HR	AVISITN	ATPT2	final_visit	final_animation_visit
1	001-001	HR	Heart Rate (beat per minute)	1	84.2697	1	0.5	1	2
2	001-001	HR	Heart Rate (beat per minute)	2	84.2697	1	1	1	2
3	001-001	HR	Heart Rate (beat per minute)	3	84.0619	1	1.5	1	2
4	001-001	HR	Heart Rate (beat per minute)	4	85.6542	1	2	1	2
5	001-001	HR	Heart Rate (beat per minute)	5	87.2093	1	2.5	1	2
6	001-001	HR	Heart Rate (beat per minute)	6	87.1246	1	3	1	2
7	001-001	HR	Heart Rate (beat per minute)	7	86.8726	1	3.5	2	2
8	001-001	HR	Heart Rate (beat per minute)	8	86.7052	1	4	2	2
9	001-001	HR	Heart Rate (beat per minute)	9	87.5899	1	4.5	2	2
10	001-001	HR	Heart Rate (beat per minute)	10	89.1475	1	5	2	2
11	001-001	HR	Heart Rate (beat per minute)	11	89.8204	1	5.5	2	2
12	001-001	HR	Heart Rate (beat per minute)	12	89.8204	1	6	2	2

Minute 1



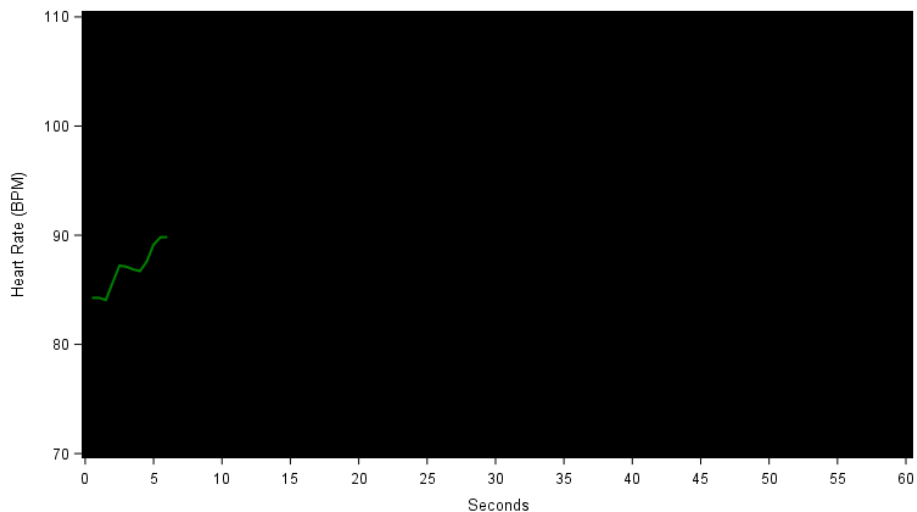
Animation Series 1

Example 6: ECG Heart Rate over Time

Data sets

	USUBJID	paramcd	param	ATPT	HR	AVISITN	ATPT2	final_visit	final_animation_visit
1	001-001	HR	Heart Rate (beat per minute)	1	84.2697	1	0.5	1	2
2	001-001	HR	Heart Rate (beat per minute)	2	84.2697	1	1	1	2
3	001-001	HR	Heart Rate (beat per minute)	3	84.0619	1	1.5	1	2
4	001-001	HR	Heart Rate (beat per minute)	4	85.6542	1	2	1	2
5	001-001	HR	Heart Rate (beat per minute)	5	87.2093	1	2.5	1	2
6	001-001	HR	Heart Rate (beat per minute)	6	87.1246	1	3	1	2
7	001-001	HR	Heart Rate (beat per minute)	7	86.8726	1	3.5	2	2
8	001-001	HR	Heart Rate (beat per minute)	8	86.7052	1	4	2	2
9	001-001	HR	Heart Rate (beat per minute)	9	87.5899	1	4.5	2	2
10	001-001	HR	Heart Rate (beat per minute)	10	89.1475	1	5	2	2
11	001-001	HR	Heart Rate (beat per minute)	11	89.8204	1	5.5	2	2
12	001-001	HR	Heart Rate (beat per minute)	12	89.8204	1	6	2	2

Minute 1



Animation Series 2

Conclusions

- Animations can be done quite easily with SAS 9.4. All that is needed is to wrap the appropriate `OPTIONS` and the `ODS PRINTER` statements around the plots.
- Smoother animations can be created by interpolating results in between the visits (if there are not enough visits for smooth animation), and then producing the animation on the data set which contains interpolated results.
- A drawing effect can be achieved by grouping data into series and retaining a duplicate of set of records for each subsequent series.

Questions?



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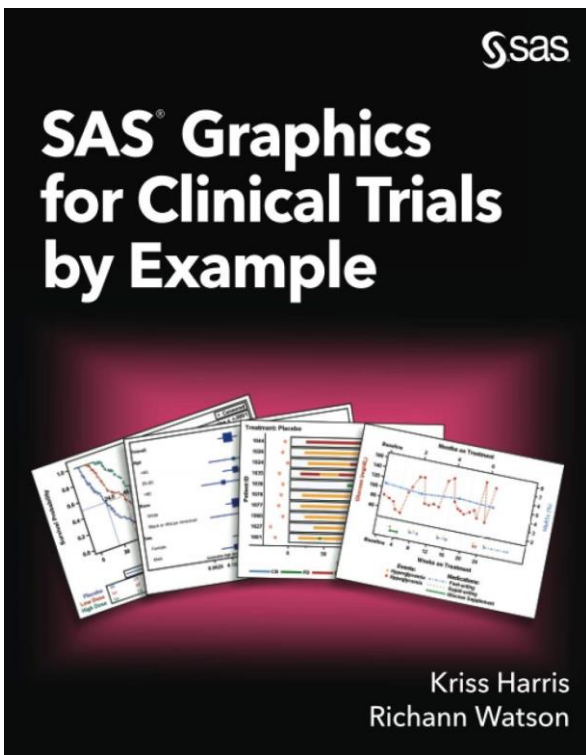
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For More Information on Graphs



SAS Ask the Expert

March 4, 2021

References

- CDISC. (2013). CDISC. Retrieved from SDTM/ADaM Pilot Project: http://www.cdisc.org/system/files/members/article/application/zip/updated_pilot_submission_package.zip
- Harris, K. (2016). Animate Your Safety Data. PharmaSUG China. Beijing: PharmaSUG.
- Harris, K. (2017). Hands-On Graph Template Language (GTL): Part A. SAS Global Forum. Denver: SAS Global Forum.
- Harris, K., & Watson, R. (2018). Great Time to Learn GTL. PharmaSUG. Seattle: PharmaSUG.
- Matange, S. (n.d.). Animation using SGPLOT. Retrieved from Graphically Speaking: <https://blogs.sas.com/content/graphicallyspeaking/2013/05/23/animation-using-sgplot/>
- McCarthy, A. (2017). Using Animated Graphics to Show PKPD Relationships in SAS 9.4. PharmaSUG (pp. 4-6). Baltimore: PharmaSUG.

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