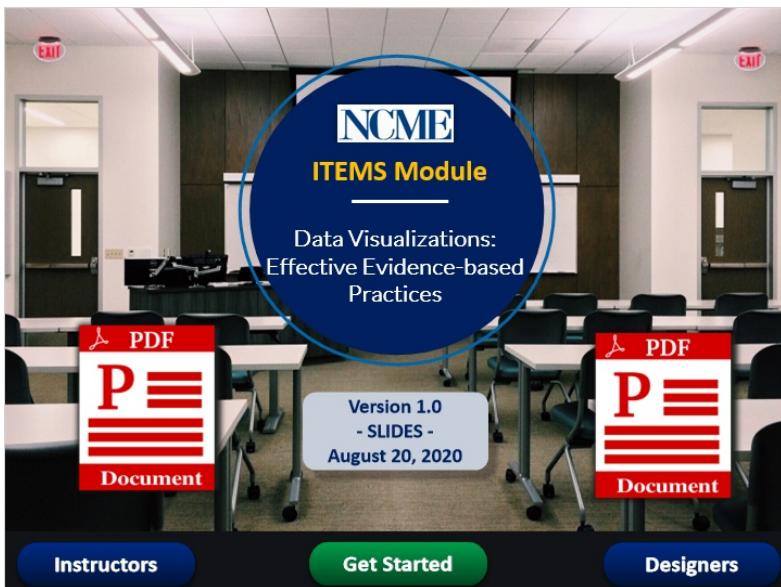


ITEMS: Data Visualizations (DM17, Version 1.0)

1. Module Overview

1.1 Module Cover (START)



1.2 Instructors

A screenshot of a mobile application interface showing 'Meet the instructors:' section. It features two profiles: Brian Leventhal and Nikole Gregg, both from James Madison University. Each profile includes a photo, a play button icon, and their names and university affiliation. A 'Back' button is located at the bottom.

1.3 Designers

Meet the designers:



André A. Rupp
Mindful Measurement

Xi Lu
Florida State University

Back

1.4 Welcome



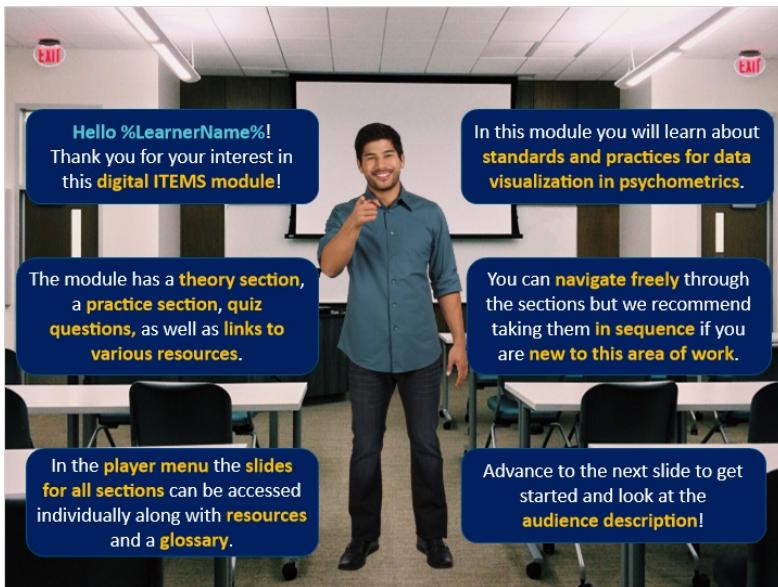
Welcome to the
ITEMS Module!

The man to the left is Jet!

Along with the instructors
he will be guiding you through
the module content.

Type your name here:

1.5 Overview



1.6 Target Audience

Target Audience

Anyone who would like a gentle statistical introduction to this topic:

- graduate students and faculty in Master's, Ph.D., or certificate programs
- psychometricians and other measurement professionals
- data scientists / analysts
- research assistants or research scientists
- technical project directors
- assessment developers



However, we hope that you find the information in this module useful no matter
what your official title or role in an organization is!

1.7 Expectations (I)



Let's discuss expectations....

1.8 Expectations (II)



1.9 Learning Objectives (I)

Learning Objectives (I)



- 1.** Explain how graphical excellence guidelines portray information in an efficient, effective, and accurate way
- 2.** Assess the efficiency, effectiveness, and accuracy of data visualizations and suggest appropriate modifications for improvement
- 3.** Evaluate whether a visualization should display patterns or details depending on the purpose of the graphic

1.10 Learning Objectives (II)

Learning Objectives (II)



- 4.** Apply the guidelines of graphical excellence to your own research
- 5.** Construct SAS graphics (e.g., scatterplots, bar graphs, and line graphs) in the *Graphical Template Language*
- 6.** Write SAS syntax to align graphics with the guidelines for graphical excellence in order to make graphics more efficient, effective, and accurate

1.11 Prerequisites

Prerequisites

To get the most out of this module it is beneficial to have the following background knowledge and experiences:

- Basic knowledge of descriptive statistics
- Basic knowledge of foundational display types
- Practical experience with analyzing data with SAS
- Practical experience with writing basic SAS code



1.12 Resources

Resources

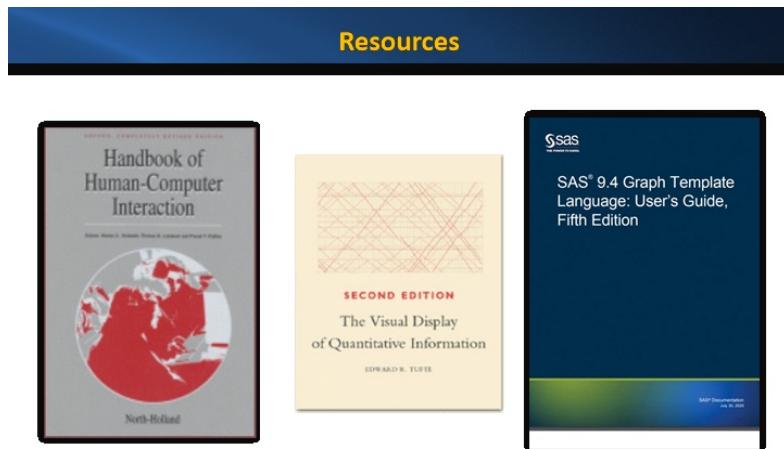
Module Citation

Gregg, N. L., & Leventhal, B. C. (2020). Data visualizations: Effective evidence-based practices (Digital ITEMS Module 17). *Educational Measurement: Issues and Practice*, 39(3), XX-XX. Available online at <https://ncme.elevate.commpartners.com/>



Additional Resources

References (Slide Layer)



Click on the citations, which link to the publisher websites



Back

1.13 Main Menu

The image shows the 'Main Menu' slide. It features a navigation bar at the top with icons for Home and Help. Below the menu, there are five numbered modules arranged in two columns:

Module	Description	Duration
01	Conceptual Foundations	[15 Minutes]
02	Graphical Excellence	[20 Minutes]
03	SAS Template Language	[55 Minutes]
04	Examples & Videos	[5 Minutes]
05	Quizzes	[10 Minutes]

A large red circle with a diagonal slash is overlaid on the 'Examples & Videos' module, indicating it is not accessible. The word 'Theory' is positioned above the first two modules, and 'Practice' is positioned to the right of the last three modules.

2. Section 1: Conceptual Foundations

2.1 Cover: Section 1

Welcome
%LearnerName%

Section 1:
Conceptual
Foundations

[15 Minutes]

2.2 Objectives: Section 1

Learning Objectives



1. Recall the relationship between graphical perception research and data visualization
2. Discuss a graphical perception framework as a means to graphical excellence
3. Explain general considerations that will improve the efficiency, effectiveness, and accuracy of a graphic

2.3 Historical Note

The screenshot shows a digital document with a dark blue header. On the left, there is a small icon of a house with a tree-like structure above it. To its right, the words "Historical Note" are written in yellow. Below the header, there is a thumbnail image of a journal cover for "JOURNAL OF COMPUTATIONAL AND GRAPHICAL STATISTICS". The journal cover has a teal background and features a grid of small, colorful bar charts. To the right of the thumbnail, the title "Graphical Criticism: Some Historical Notes" is displayed in white, followed by the author's name "Hadley WICKHAM" in a smaller font. Underneath the author's name, the section "1. INTRODUCTION" is visible. A large, dark blue rectangular box contains a quote in white text: "'There is little evidence that the quality of the best graphics has improved over the last 100 years. I wonder if technology serves primarily as a quantity-multiplier, rather than a quality-multiplier'" (Wickham, 2013, p. 43). At the bottom right of the page, there is a small purple button labeled "Reference".

2.4 Definition

The screenshot shows a digital document with a dark blue header. On the left, there is a small icon of a house with a tree-like structure above it. To its right, the words "Graphical Perception" are written in yellow. Below the header, there is a large, dark blue rectangular box containing a quote in white text: "'the visual decoding of categorical and quantitative information from a graph'" (Cleveland & McGill, 1986, p. 491). Below this box, another dark blue rectangular box contains the text "Graphical perception research can be found across multiple fields:" followed by a bulleted list: ➤ Psychology
➤ Statistics
➤ Computer Programming
➤ Human Factors. At the bottom right of the page, there is a small purple button labeled "Reference".

Reference (Slide Layer)

Reference

 International Journal of Man-Machine Studies
Volume 25, Issue 5, November 1986, Pages 491-500
ELSEVIER

An experiment in graphical perception

William S. Cleveland, Robert McGill
[Show more](#)

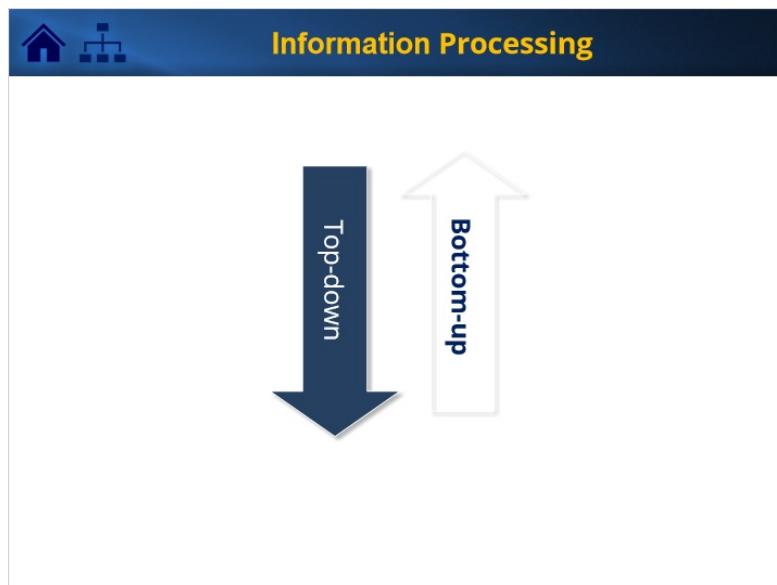
[https://doi.org/10.1016/S0020-7373\(86\)80019-0](https://doi.org/10.1016/S0020-7373(86)80019-0) [Get rights and content](#)

Abstract

Graphical perception is the visual decoding of categorical and quantitative information from a graph. Increasing our basic understanding of graphical perception will allow us to make graphs that convey quantitative information to viewers with more accuracy and efficiency. This paper describes an experiment that was conducted to investigate the accuracy of six basic judgments of graphical perception. Two types of position judgments were found to be the most accurate, length judgments were second, angle and slope judgments were third, and area judgments were last. Distance between judged objects was found to be a factor in the accuracy of the basic judgments.

Back

2.5 Cognitive Foundations



Reference (Slide Layer)

Reference

**Freedman & Shah
(2012)**

Chapter 11

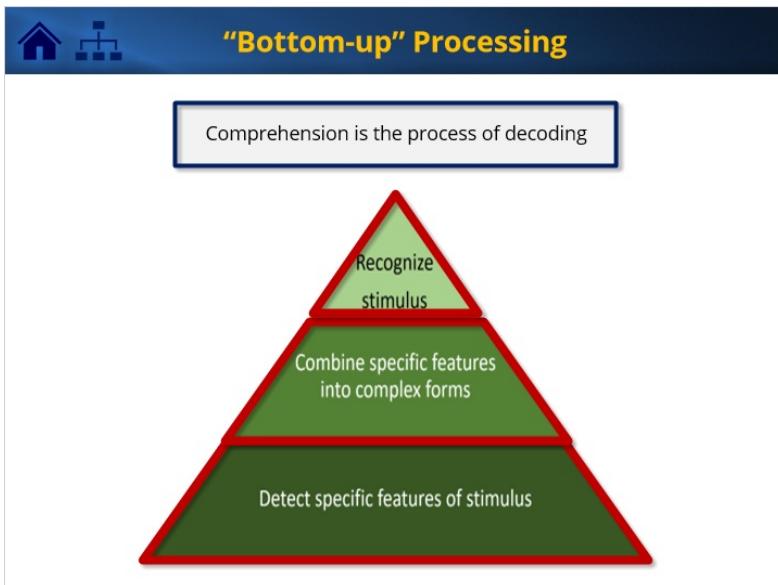
[Back](#)

2.6 Top-down Processing

“Top-down” Processing

Involvement of previous knowledge and past experience with graphics

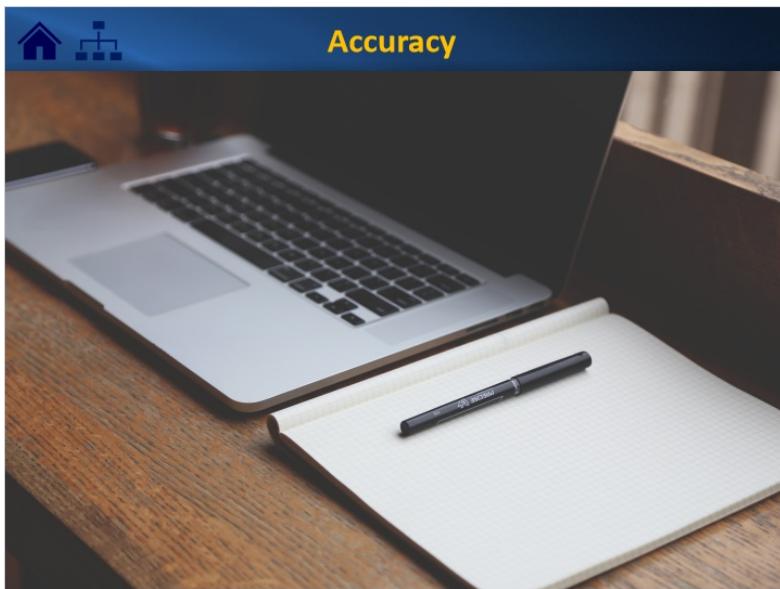
2.7 Bottom-up Processing



2.8 Topic Selection



2.9 Bookmark: Accuracy



2.10 Definition

Definition: Accuracy

The visual aspects of a graphic that lead to possible misinterpretation of information
(Cleveland & McGill, 1987)

A 3D white humanoid figure is standing behind a red and white bullseye target. Three red arrows are embedded in the bullseye, symbolizing accuracy or hitting the mark. The figure has its right arm raised in a gesture of triumph or success.

Reference

Reference (Slide Layer)

Reference

Journal of the Royal Statistical Society: Series A (General)

Article
Graphical Perception: The Visual Decoding of Quantitative Information on Graphical Displays of Data

William S. Cleveland, Robert McGill

First published: May 1987 | <https://doi.org/10.2307/2981473> | Citations: 8

Address for correspondence: AT&T Bell Laboratories, 600 Mountain Avenue, Murray Hill, N.J. 07974, USA.

SUMMARY
Studies in graphical perception, both theoretical and experimental, provide a scientific foundation for the construction area of statistical graphics. From these studies a paradigm has emerged that graphical perception has to do with decoding information encoded in a graph that is based on elementary codes: Basic geometric and textual aspects of a graph that encode the quantitative information. The methodology that can be invoked to study graphical perception is illustrated by an investigation of the shape parameter of a two-variable graph, a topic that has had much discussion, but little scientific study, for at least 70 years.

Citing Literature

Volume 150, Issue 3
May 1987
Pages 192-210

Resolved Information

Metrics
Citations: 8

Publication History
Issue Online:
05 December 2018
Version of Record online:
05 December 2018

Back

2.11 Research

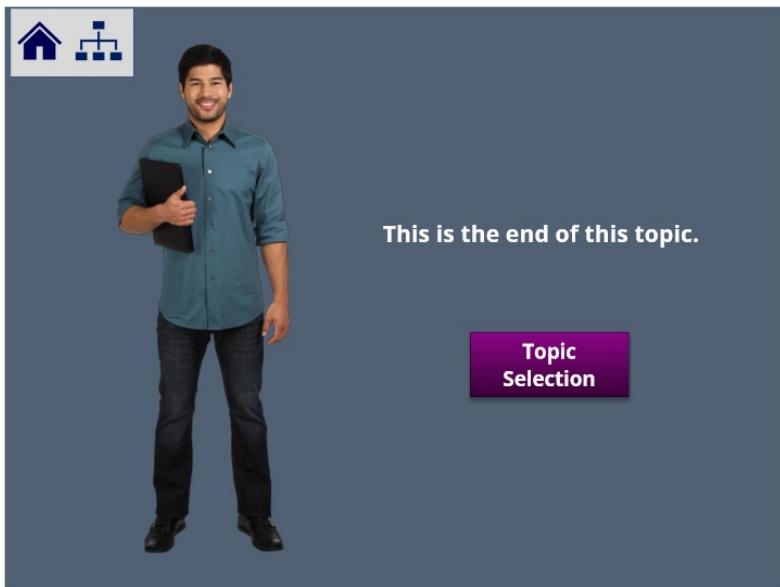
  **Perception Research: Accuracy**



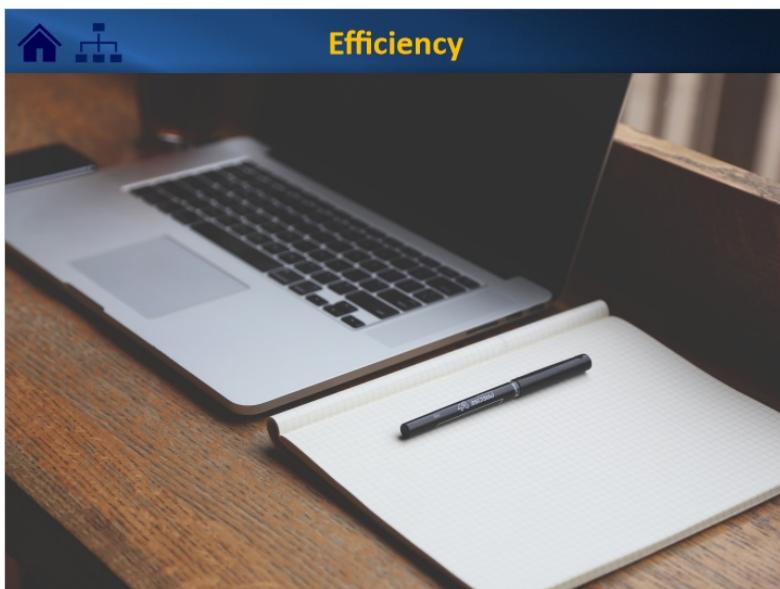
Role of cognitive load in the decision efficiency and accuracy
(Lohse, 1997)

Objects and Attributes + Task Complexity = Accuracy

2.12 Bookend: Accuracy



2.13 Bookmark: Efficiency

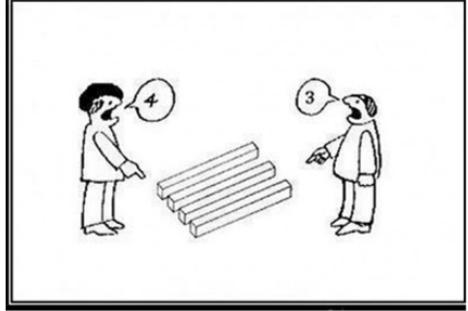


2.14 Definition

Definition: Efficiency

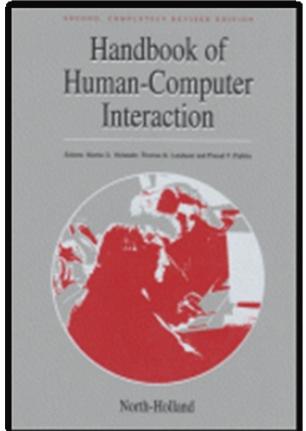
The ease with which information is perceived or encoded
(Lohse, 1997)



Reference

Reference (Slide Layer)

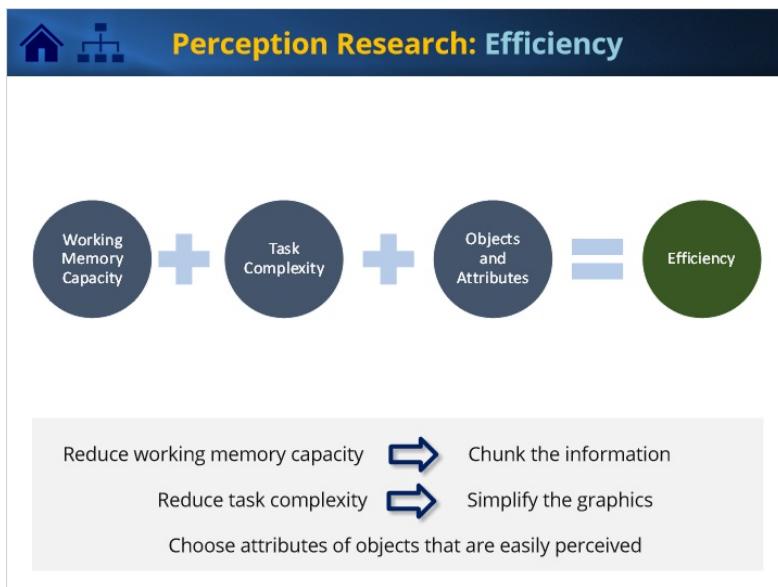
Reference



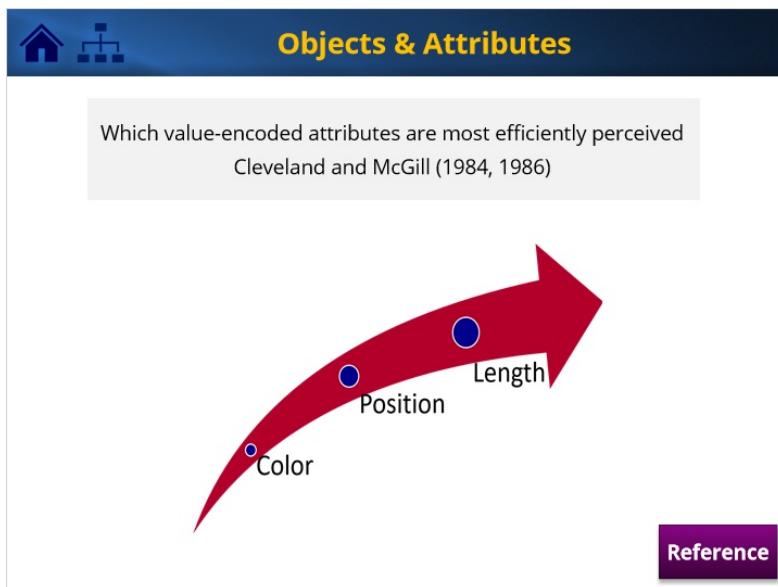
Handbook of
Human-Computer
Interaction
Second, Completely Revised Edition
Edited by Martin J. Helander, Dennis K. Kortum and Paul F. Tractinsky
North-Holland

Back

2.15 Research



2.16 Objects and Attributes



Reference (Slide Layer)

Reference



Graphical Perception: Theory, Experimentation, and Application to the Development of Graphical Methods

Abstract

The output of graphical methods for data analysis and for data presentation needs a scientific foundation. In this article we take a first step in the direction of establishing such a foundation. Our approach is based on the theory of graphical perception, which is the study of how people perceive graphical displays. The theory and experimentation to test the theory. The theory deals with a small but important piece of the whole problem of graphical perception: the visual decoding of categorical and quantitative information from graphs. The research is carried out when people extract quantitative information from graphs. The second part is an ordering of the tasks on the basis of how accurately people perform them. Elements of the theory are tested by experiments. The theory provides a guide for graphical design and emphasizes the tasks that should be avoided. The experiments validate these elements but also suggest that the set of elementary tasks should be expanded. The theory provides a guide for graphical design and emphasizes the tasks that should be avoided. The experiments validate these elements but also suggest that the set of elementary tasks should be expanded.



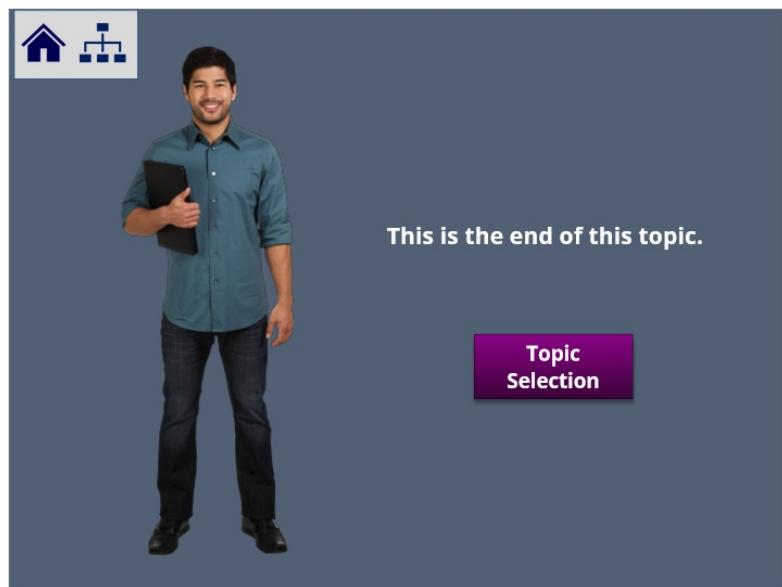
An experiment in graphical perception

Abstract

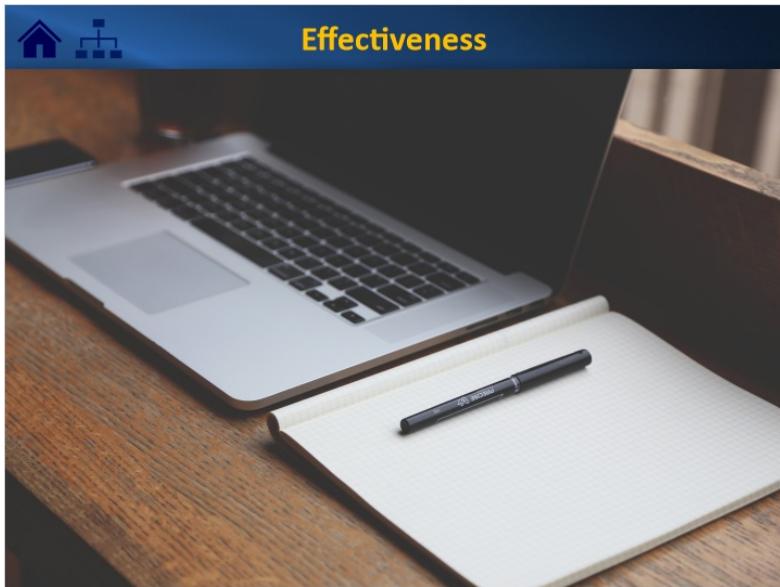
Graphical perception is the visual decoding of categorical and quantitative information from a graph. Increasing our basic understanding of graphical perception will allow us to make graphs that convey quantitative information to viewers with more accuracy and efficiency. This paper describes an experiment that was conducted to investigate the accuracy of six basic judgments of graphical perception. Two types of position judgments were found to be the most accurate, length judgments were second, angle and slope judgments were third, and area judgments were last. Distance between judged objects was found to be a factor in the accuracy of the basic judgments.

Back

2.17 Bookend: Efficiency



2.18 Bookmark: Effectiveness



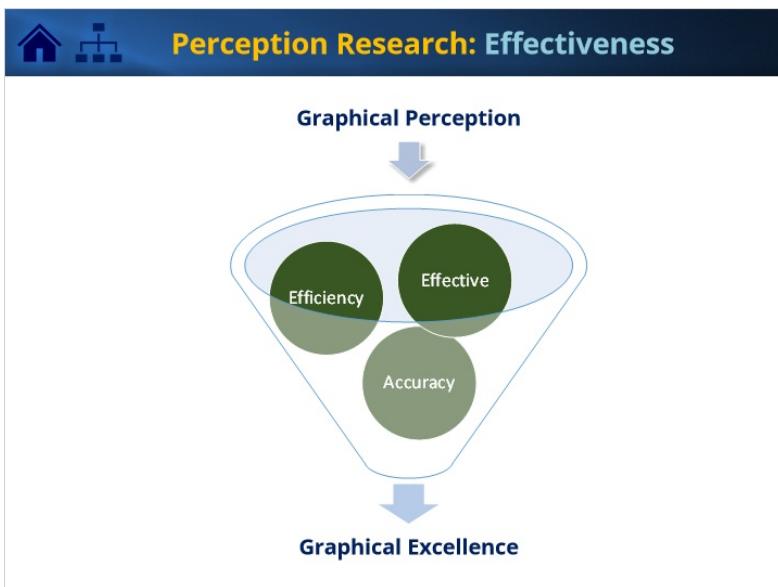
2.19 Definition

The graphic accomplishes what it was intended to accomplish

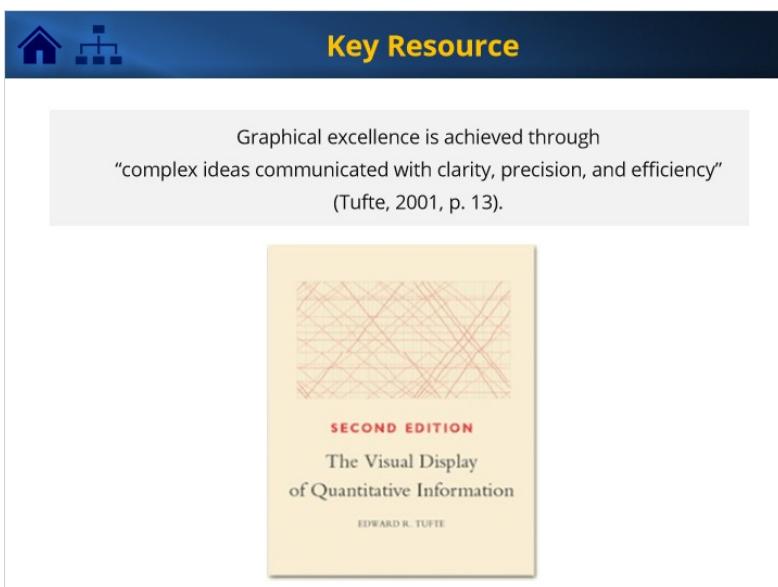
Context and Purpose + Audience = Effective

A diagram titled "Definition: Effectiveness". It features three circular elements: a dark blue circle on the left labeled "Context and Purpose", a light blue plus sign in the center, a dark blue circle in the middle labeled "Audience", another light blue plus sign in the center, and a dark green circle on the right labeled "Effective".

2.20 Research



2.21 Resources (I)



2.22 Resources (II)

 Additional Resources

Mylavaramu, P., Yalcin, A., Gregg, X., & Elmqvist, N. (2019, May). **Ranked-list visualization: A graphical perception study.** In Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems (pp. 1-12).

Reda, K., Nalawade, P., & Ansah-Koi, K. (2018, April). **Graphical perception of continuous quantitative maps: the effects of spatial frequency and colormap design.** In Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems (pp. 1-12).

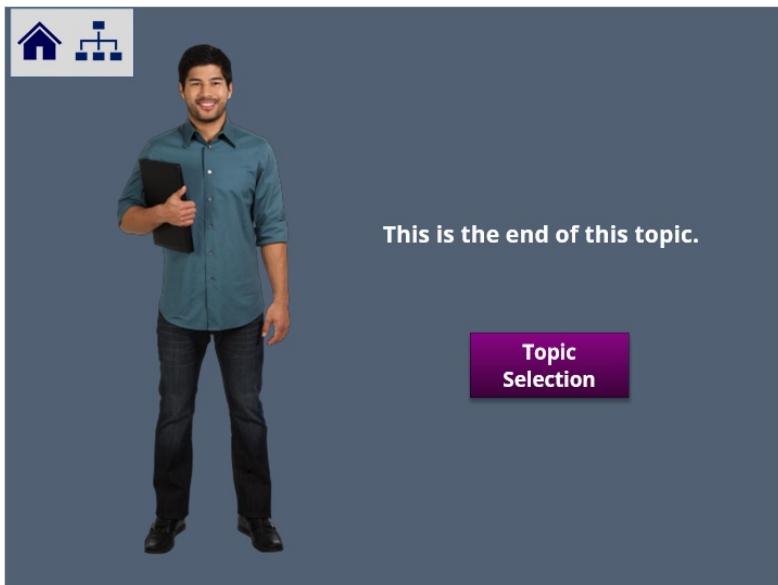
Saket, B., Srinivasan, A., Ragan, E. D., & Endert, A. (2017). **Evaluating interactive graphical encodings for data visualization.** IEEE transactions on visualization and computer graphics, 24(3), 1316-1330.

Ware, C. (2019). **Information visualization: perception for design.** Morgan Kaufmann.

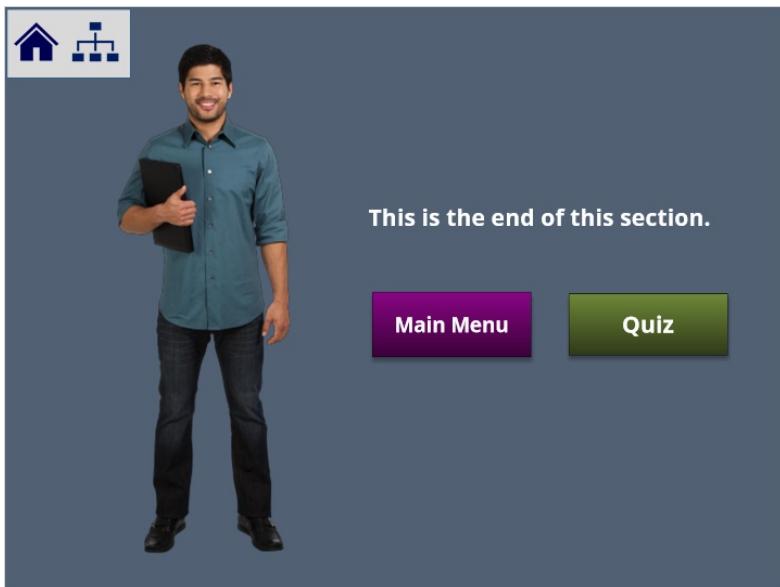
Zubiaga, A., & Mac Namee, B. (2016). **Graphical Perception of Value Distributions: An Evaluation of Non-Expert Viewers' Data Literacy.** The Journal of Community Informatics, 12(3).

Click on the citations, which link to the publisher websites 

2.23 Bookend: Effectiveness



2.24 Bookend: Section 1



3. Section 2: Guidelines for Excellence

3.1 Cover: Section 2

A split-screen cover slide. The left side shows a classroom with desks and a projector screen displaying "Welcome %LearnerName%". The right side has a dark blue background with yellow and white text: "Section 2:", "Guidelines for Excellence", and "[20 Minutes]".

3.2 Objectives: Section 2

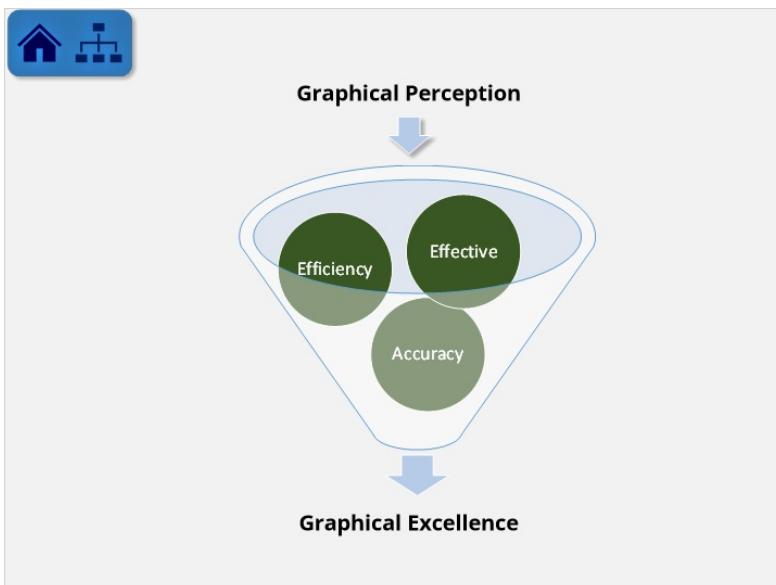
 

Learning Objectives

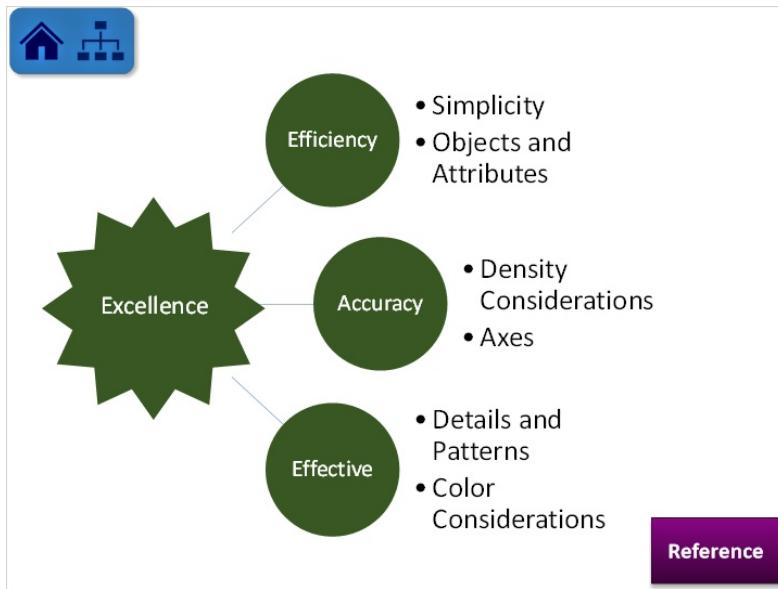


- 1. Describe methods to simplify a graphic
- 2. Assess the efficiency, effectiveness, and accuracy of data visualizations
- 3. Suggest appropriate modifications for graph improvement involving the graph's accuracy, efficiency, and effectiveness

3.3 Integrated Approach (I)



3.4 Integrated Approach (II)



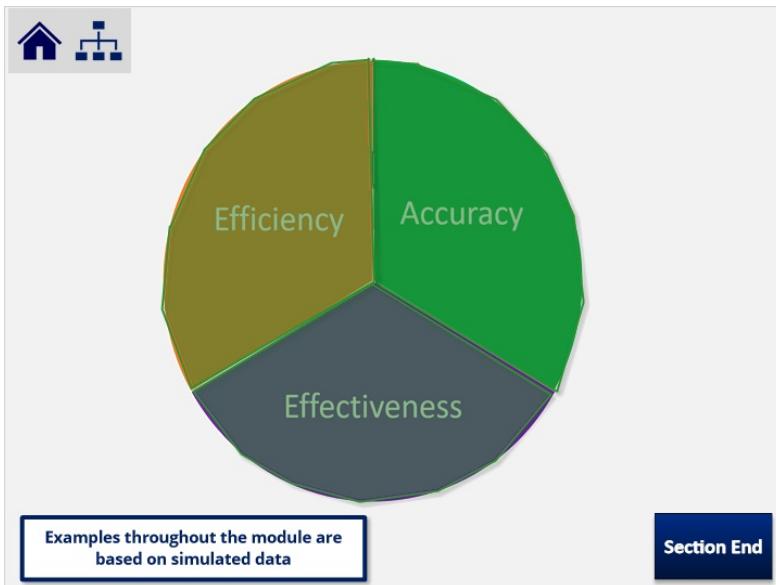
Reference (Slide Layer)

The screenshot shows a digital journal article from *Environmental Modelling & Software*, Volume 26, Issue 6, June 2011, Pages 822-827. The title is "Ten guidelines for effective data visualization in scientific publications" by Christa Kellner et al. The abstract discusses common pitfalls in scientific journals and presents ten guidelines for effective data visualization. The research highlights section includes:

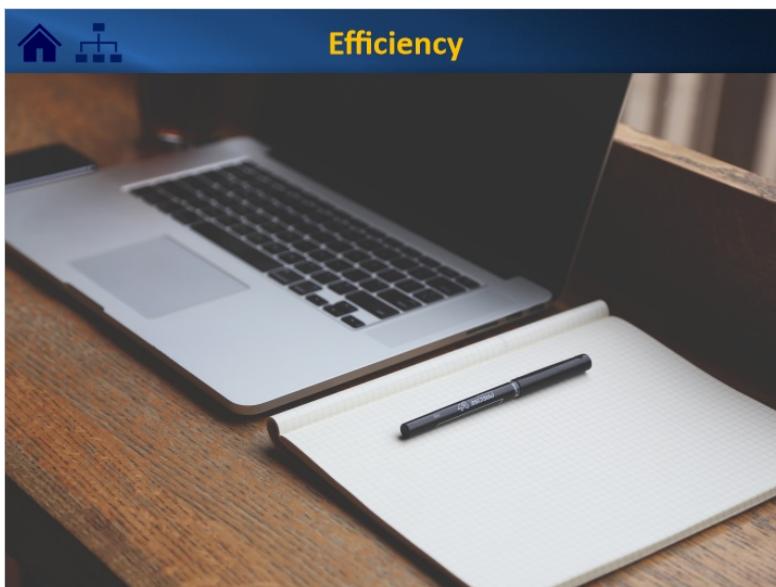
- We identify data visualization pitfalls common to many scientific publications.
- We present ten guidelines for effective data visualization in scientific publications.
- Following these simple guidelines will ensure visualization quality.

A blue navigation bar at the top left contains icons for Home, Back, Forward, and Search. A purple "Back" button is located at the bottom right.

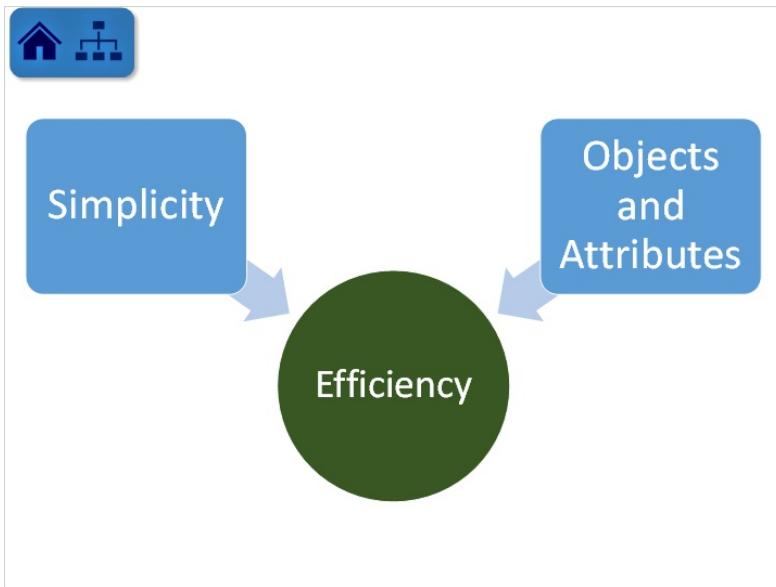
3.5 Topic Selection



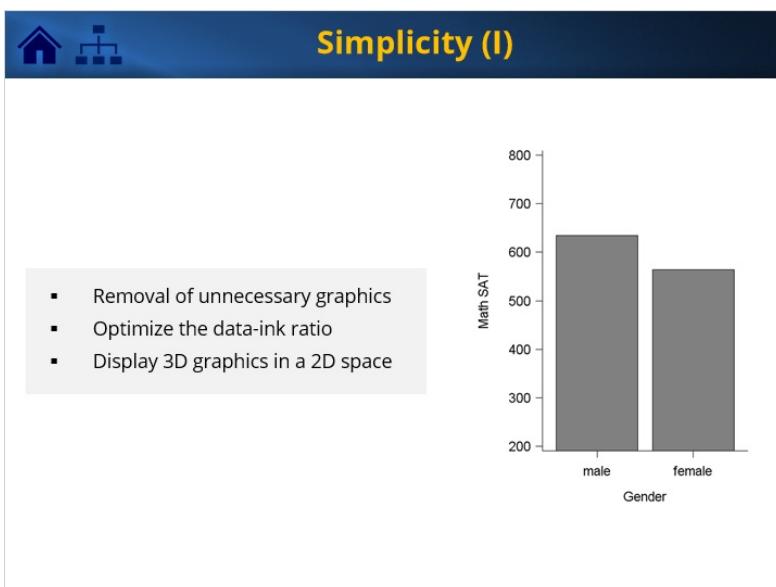
3.6 Bookmark: Efficiency



3.7 Factors



3.8 Simplicity (I)



3.9 Simplicity (II)

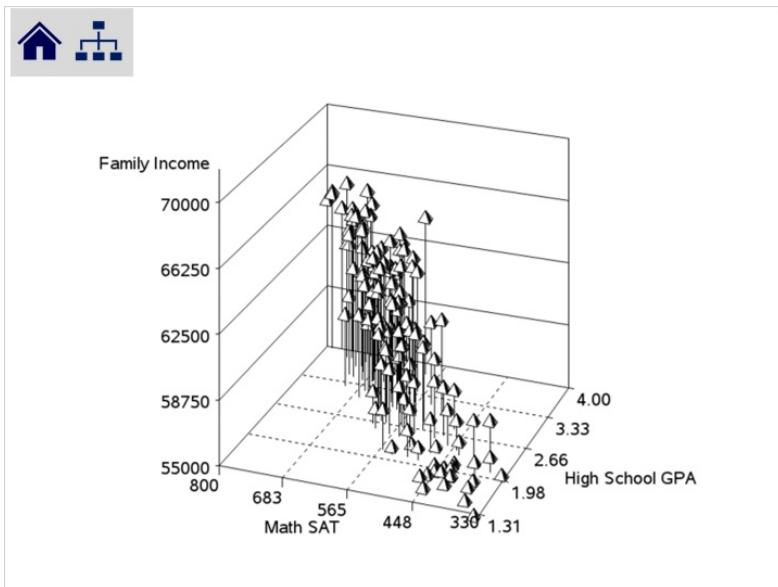
 

Simplicity (II)

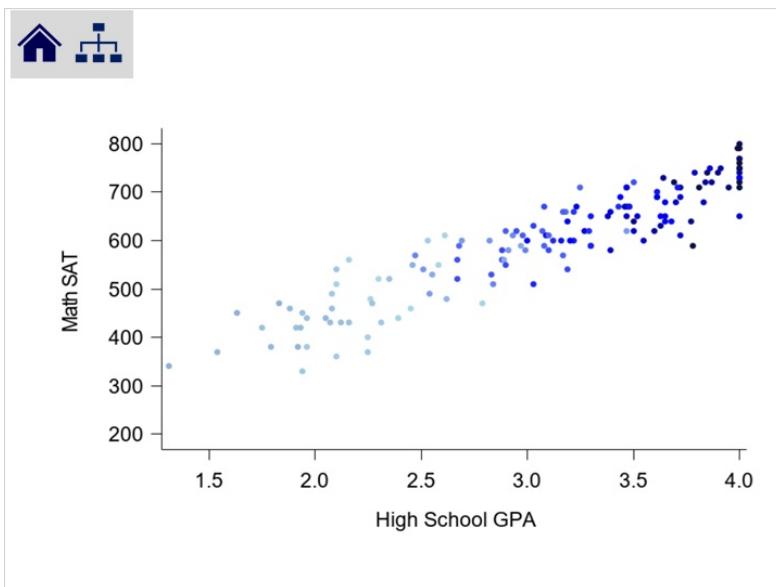
$$\text{Data - Ink Ratio} = \frac{\text{data ink}}{\text{total ink used to print the graphic}}$$

Amount of Redundant Information

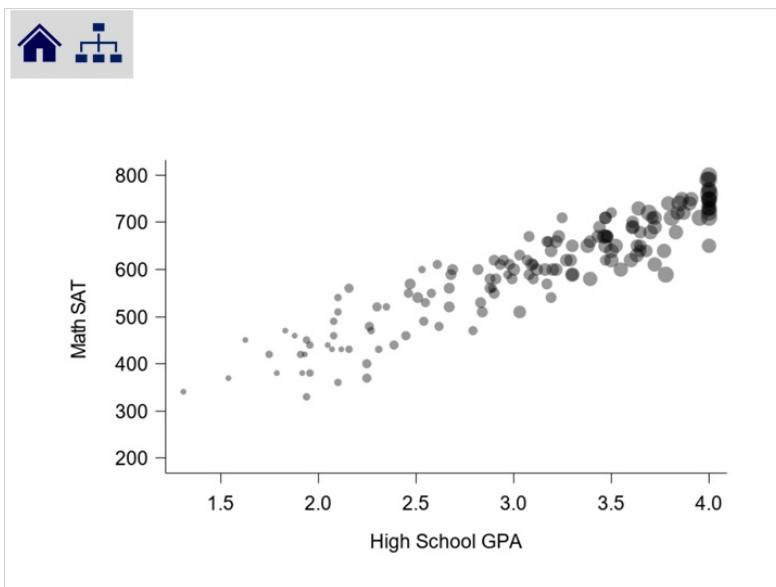
3.10 Example (I)



3.11 Example (II)



3.12 Example (III)



3.13 Objects & Attributes

The slide has a dark blue header bar with a house icon and the title 'Objects & Attributes' in yellow. Below the header is a light gray box containing the text: 'Consider the type of **encoding object** and **attribute** used to create a plot'. The main content area is divided into two sections: 'Encoding objects:' and 'Value-encoding attributes:'. Under 'Encoding objects:', there are three examples: a group of four small blue circles, a group of four horizontal blue lines of increasing length, and a single tall blue bar. Under 'Value-encoding attributes:', there are four examples of horizontal lines with different styles: solid, dashed, dotted, and dash-dot.

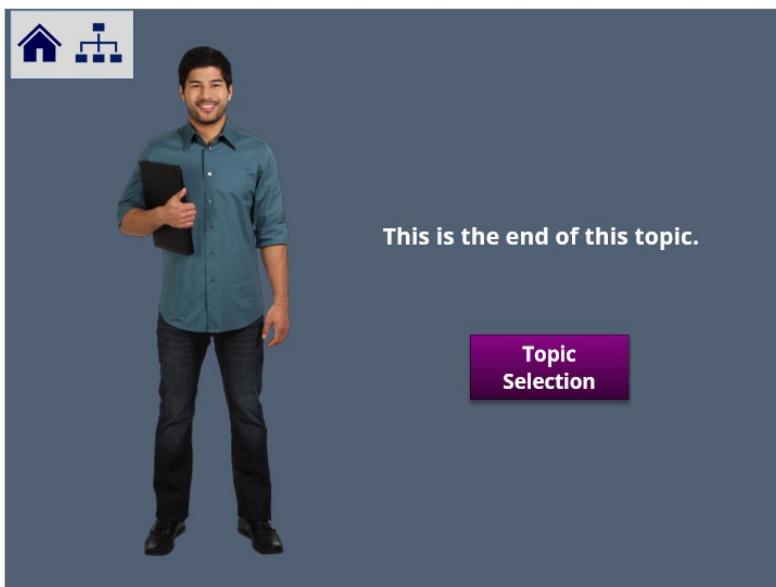
Encoding objects:

- points
- lines
- bars

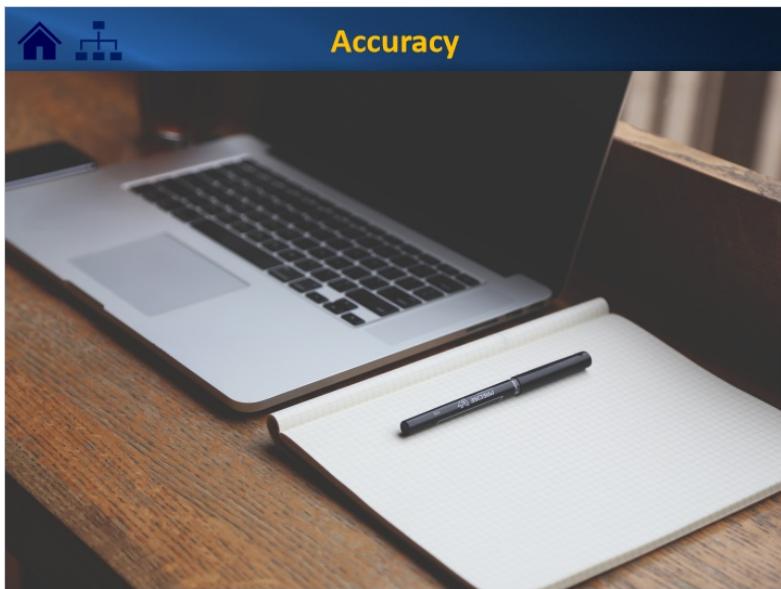
Value-encoding attributes:

- point position
- point size
- line length
- line width
- color hue

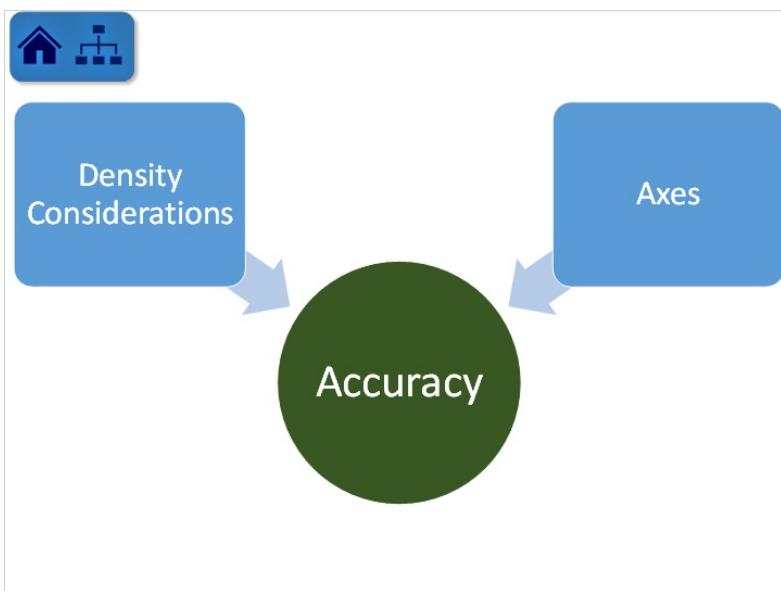
3.14 Bookend: Efficiency



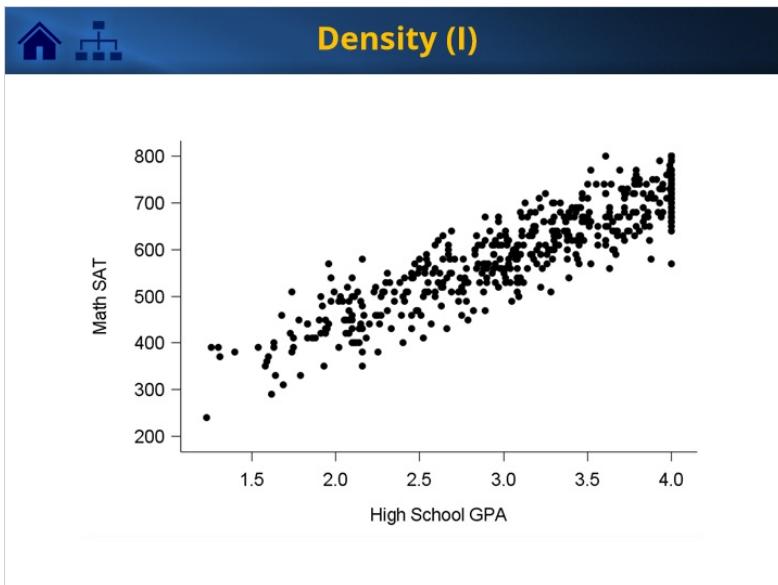
3.15 Bookmark: Accuracy



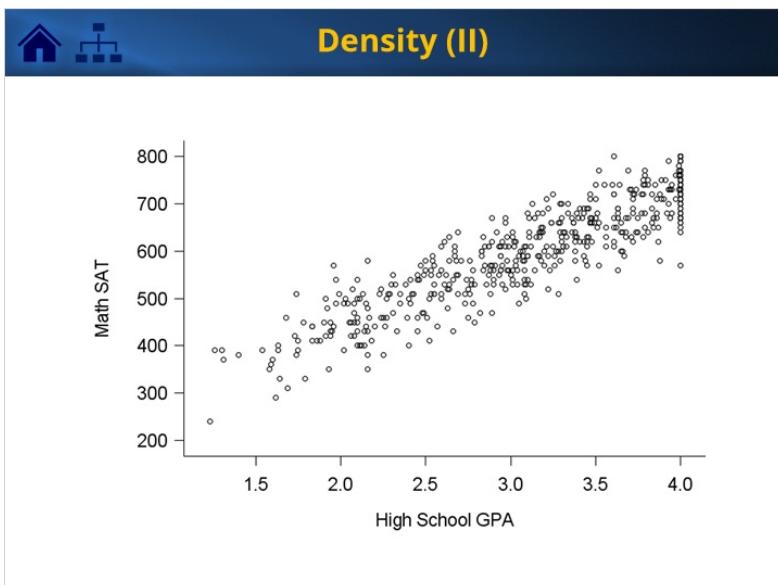
3.16 Factors



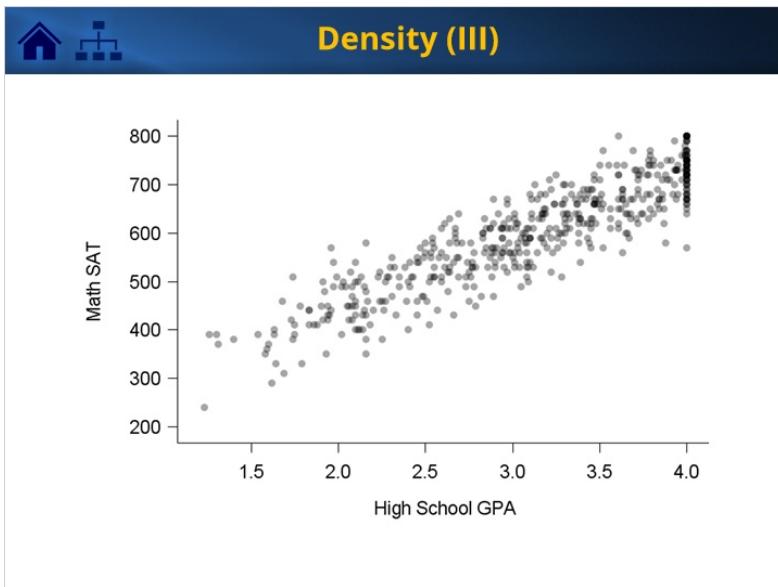
3.17 Density (I)



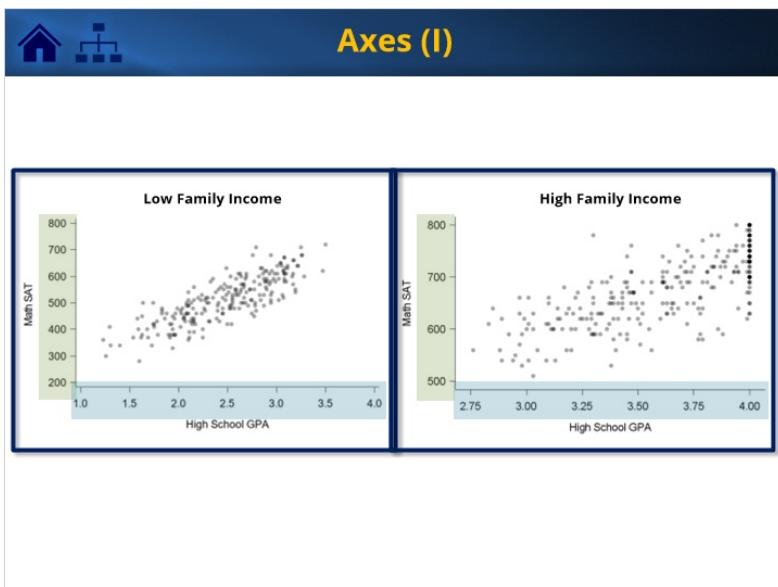
3.18 Density (II)



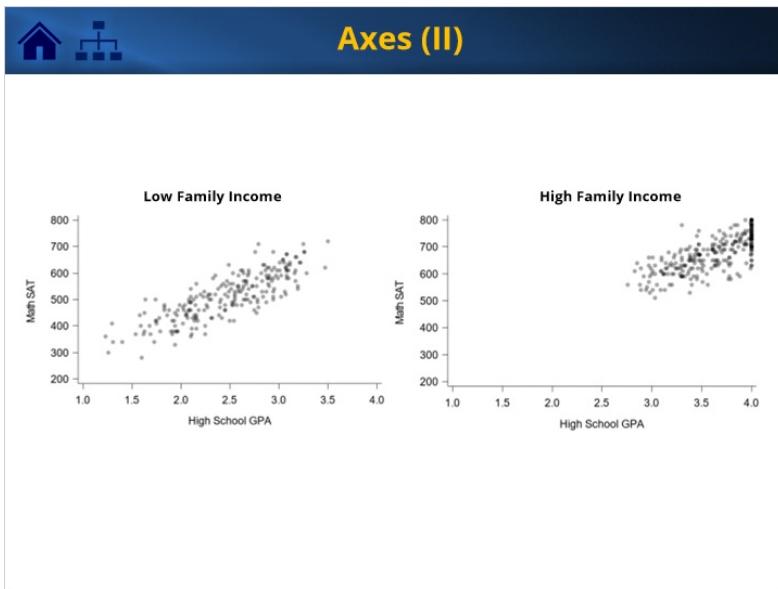
3.19 Density (III)



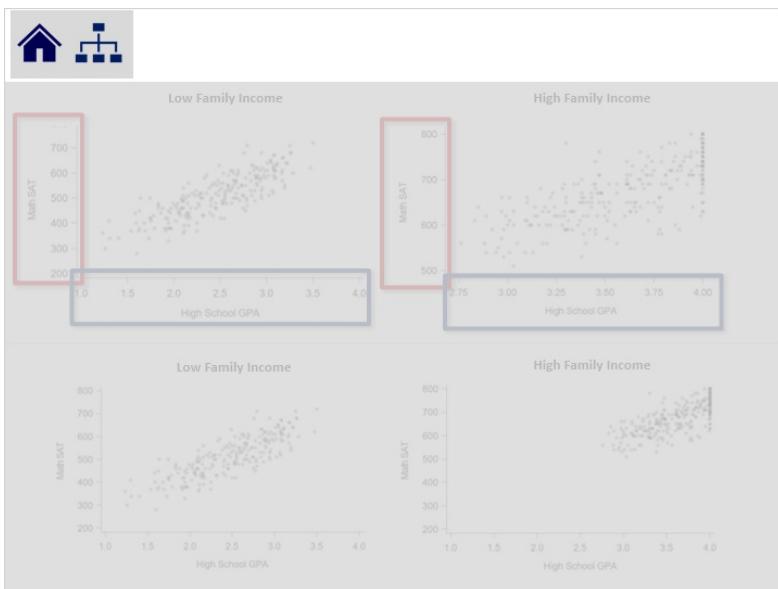
3.20 Axes (I)



3.21 Axes (II)



3.22 Comparison



3.23 Common Mistakes

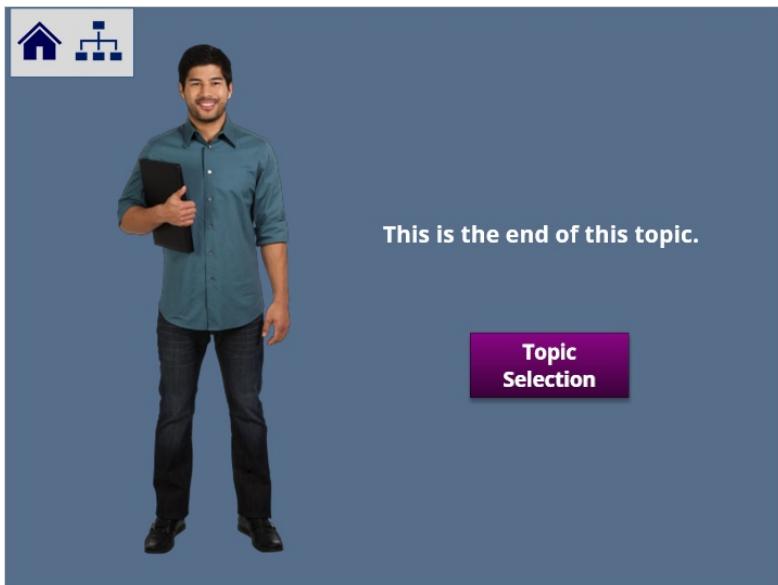
Common Mistakes

Consistent axes allow for accurate interpretations when graphics are put side by side or are intended for comparisons!

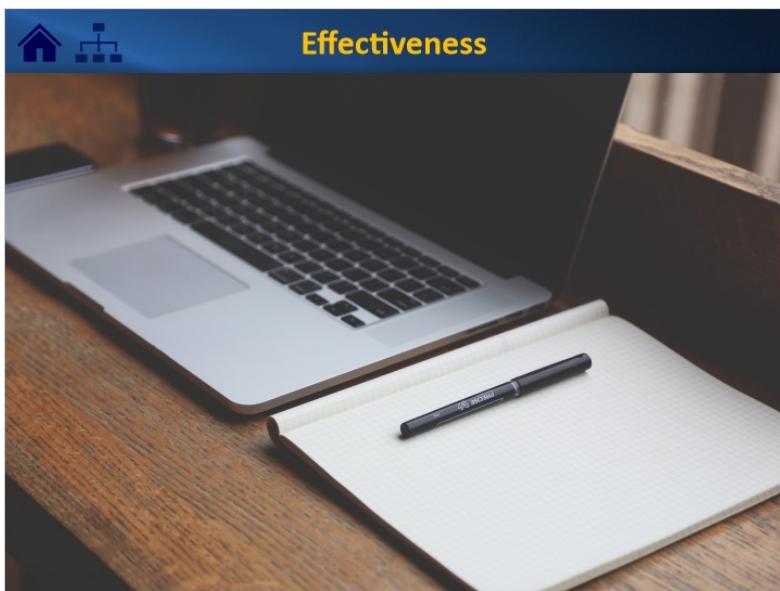
Other **common mistakes** involving axes include:

1. Not labeling the **unit of measurement** on the axis (e.g., secs vs. mins)
2. Cutting off **part of the scale** for the axis, which ultimately exaggerates the effect in the data (e.g. a depression scale has a range of possible scores of 0 to 50, but the axis only ranges from 0 to 25)
3. Providing **axes names**, but not designating their range of values / units (e.g., labeling an X-axis 'Time', but not indicating that it is in years)

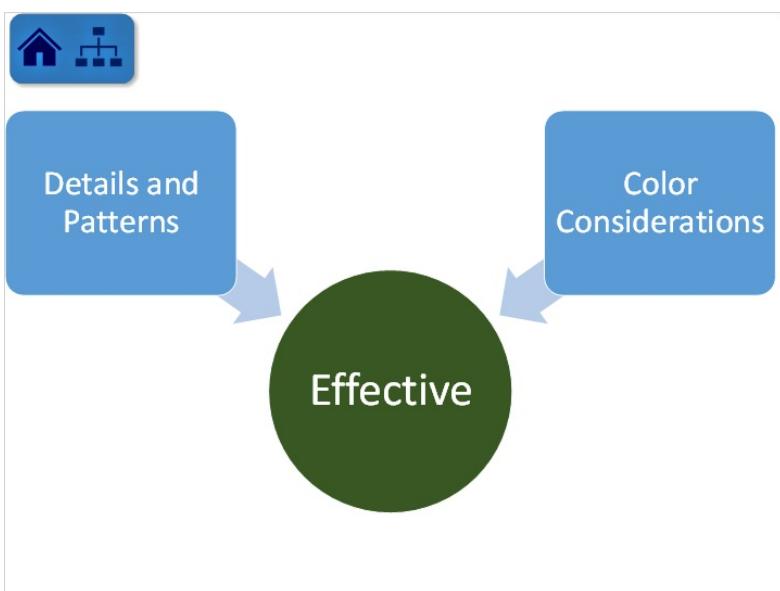
3.24 Bookend: Accuracy



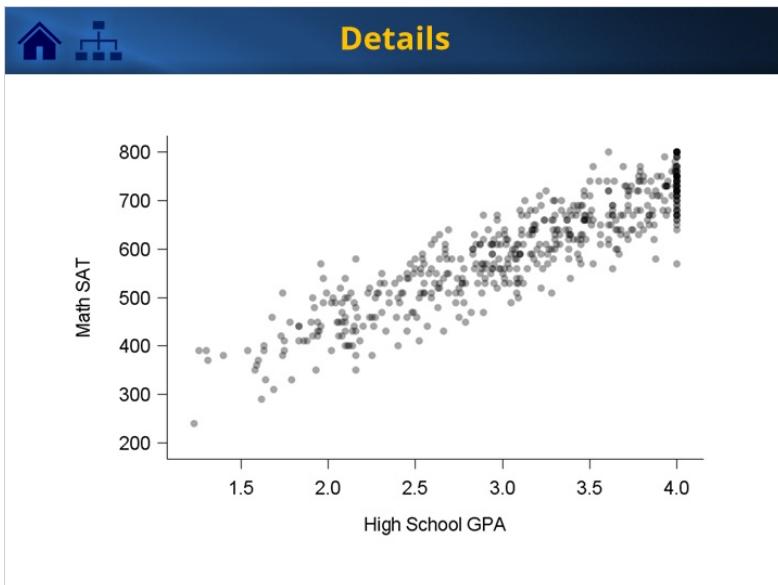
3.25 Bookmark: Effectiveness



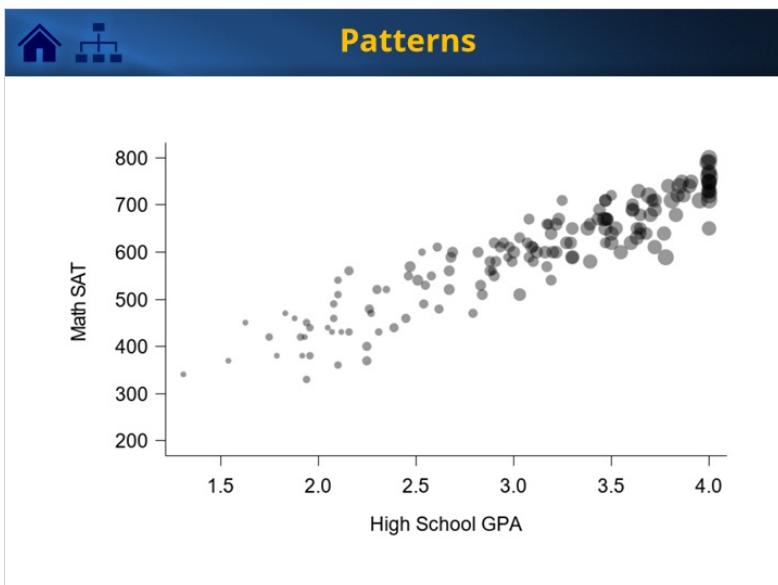
3.26 Factors



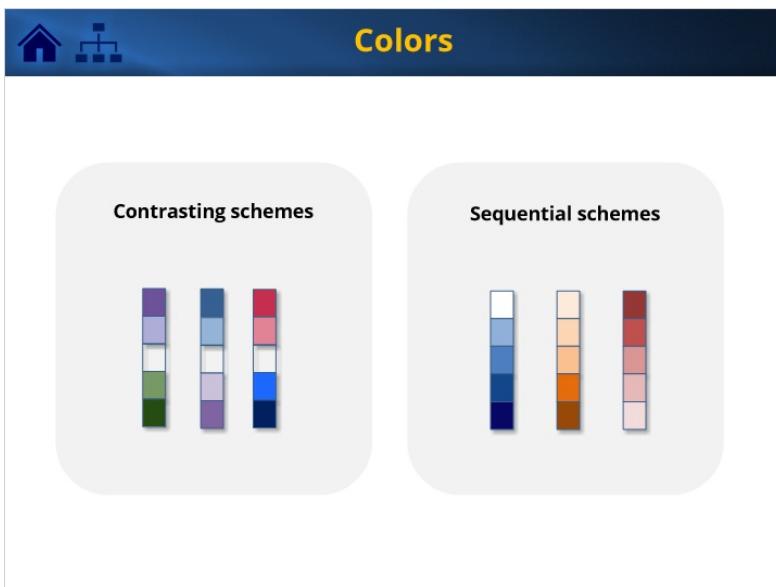
3.27 Details



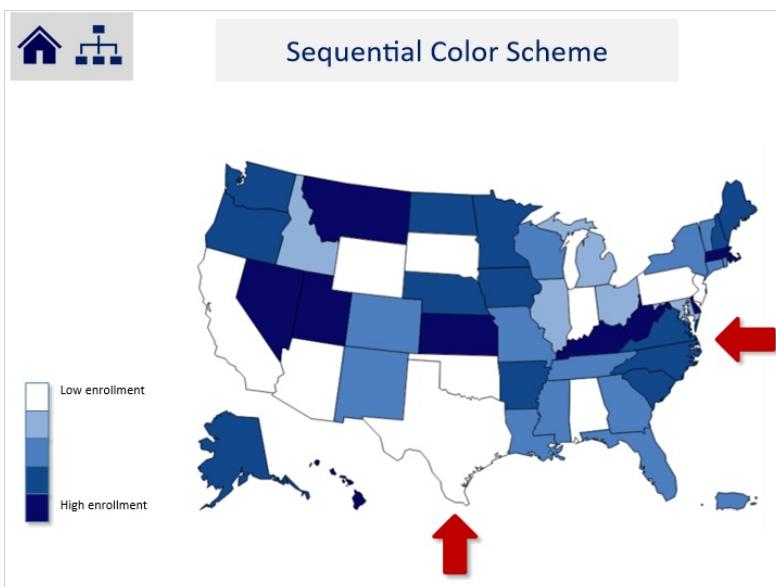
3.28 Patterns



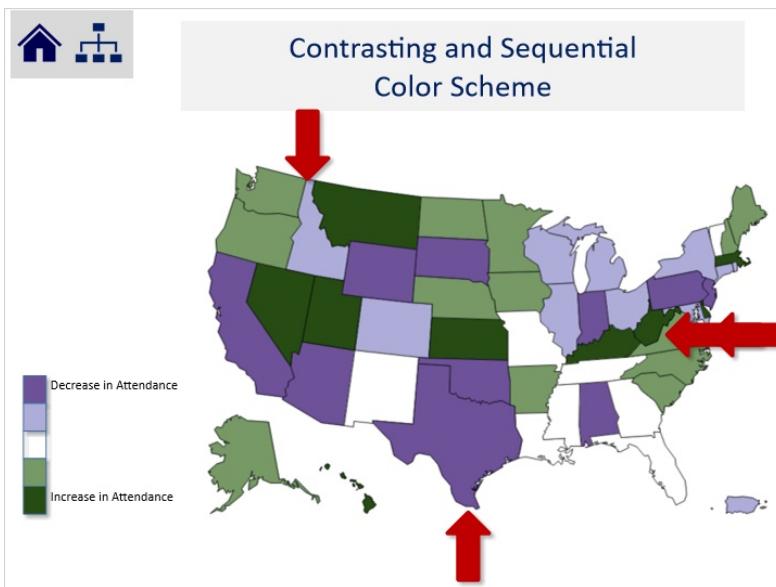
3.29 Colors



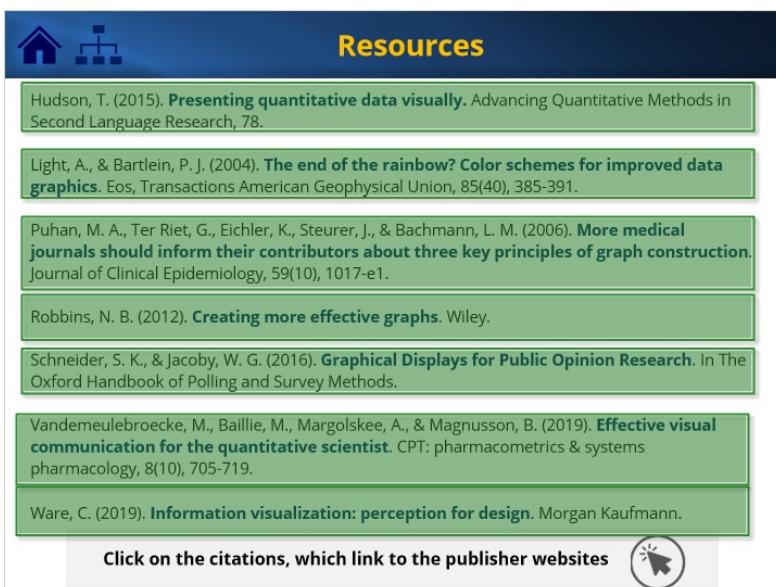
3.30 Example (I)



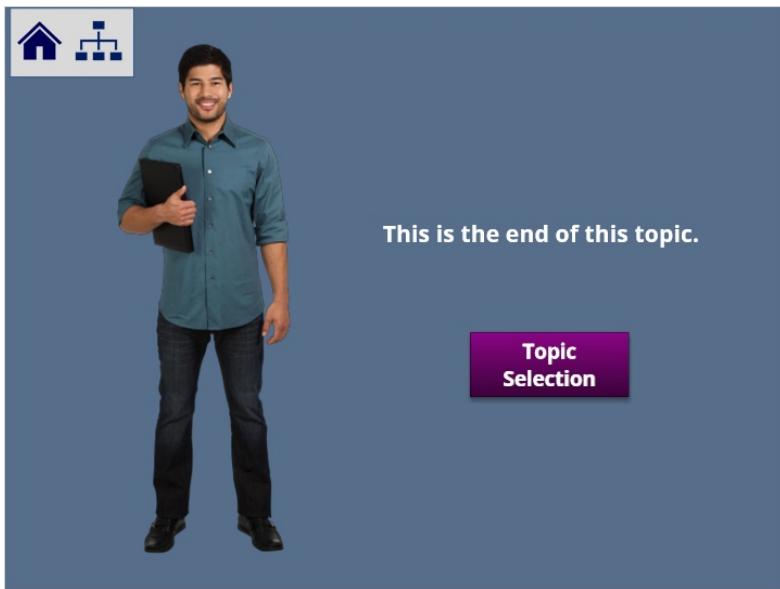
3.31 Example (II)



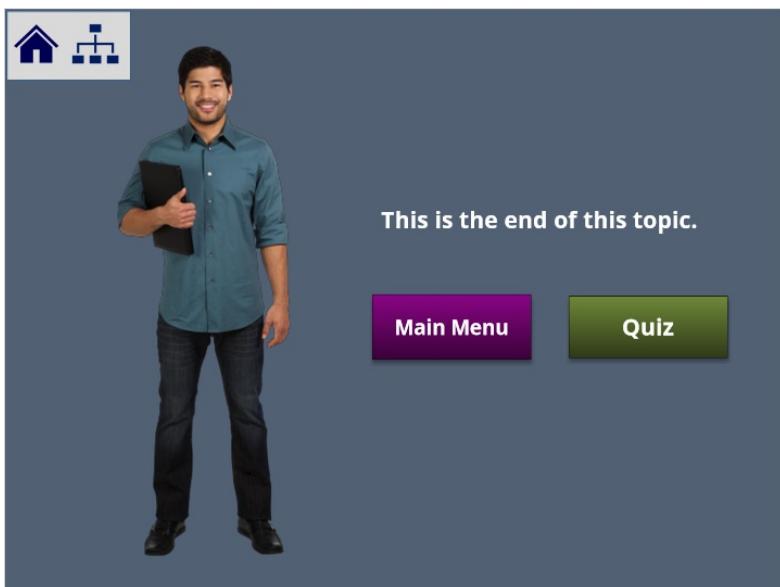
3.32 Resources



3.33 Bookend: Effectiveness



3.34 Bookend: Section 2



4. Section 3: Template Language in SAS

4.1 Cover: Section 3

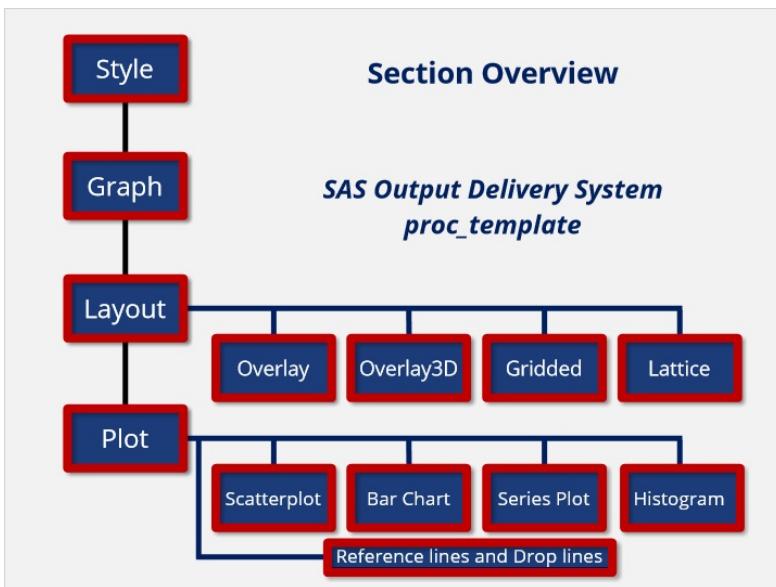
Section 3:
Template
Language in SAS
[55 Minutes]

4.2 Objectives: Section 3

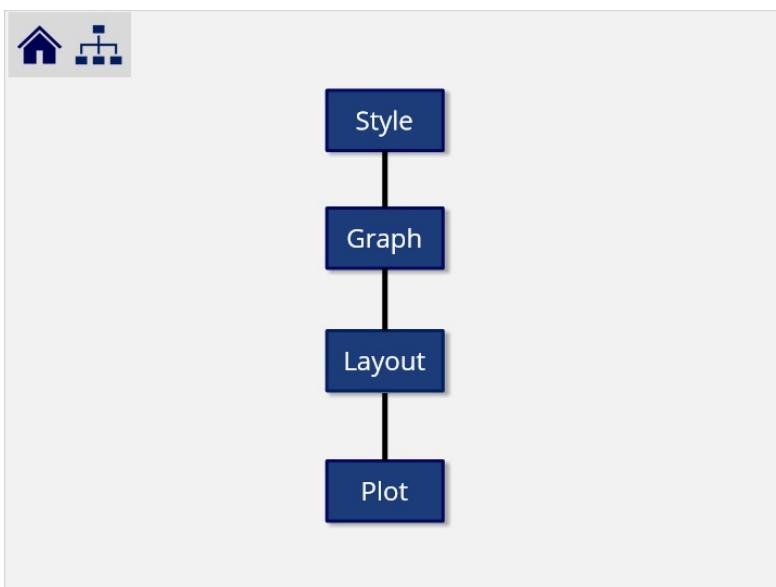
Learning Objectives

1. Define your drawing canvas
2. Create a customized two-dimensional graphing layout
3. Plot scatter plots, series plots, bar graphs, and histograms
4. Add non-dependent elements to your graph

4.3 Section Overview



4.4 Overview



4.5 Topic Selection

Overview

```
proc template;
  define statgraph GRAPHNAME;
    begingraph/<options>;
    layout TYPE_NAME/<options>;
      PLOT STATEMENTS;
    endlayout;
    endgraph;
  end;
run;

proc sgrender data=DATASETNAME
               template=GRAPHNAME;
run;
```

Click on each button to learn more

End Section

4.6 Bookmark: Graph



4.7 Overview

```
graph TD; Style[Style] --> Graph[Graph]; Graph --> Layout[Layout]; Layout --> Plot[Plot];
```

The flowchart illustrates the sequential steps in creating a plot: Style, Graph, Layout, and Plot. The 'Graph' step is highlighted in yellow. To the right, a code snippet shows how these steps are implemented:

```
proc template;
  define statograph GRAPHNAME;
    begingraph/<options>;
      layout TYPE_NAME/ <options>;
        PLOT STATEMENTS;
      endlayout;
      endgraph;
    end;
run;

proc sgrender data=DATASETNAME
               template=GRAPHNAME;
run;
```

4.8 Setup

The diagram shows a plot area with X and Y axes. Above the plot, a bracket groups two parameters: `designwidth = 650px` and `designheight=450px;`. Below the plot, there are two buttons: `BORDER = TRUE|FALSE` and `BACKGROUNDCOLOR =`.

4.9 Line Attributes

The screenshot shows a list of line styles numbered 1 through 42. To the right, there is a legend box containing three entries:

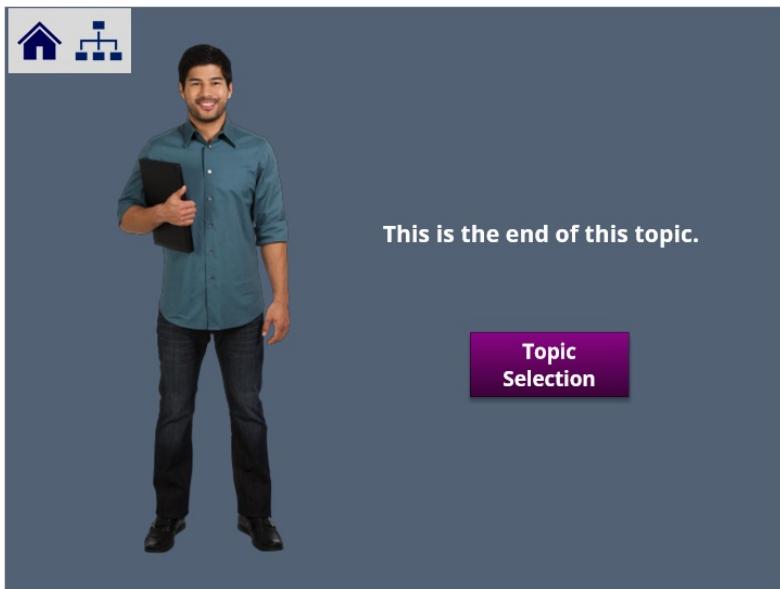
- COLOR = color
- PATTERN = pattern
- THICKNESS = number

4.10 Colors

Lightness	Saturation	Hue
Very Dark	Moderate	Blue
Dark	Strong	Purple
Medium	Vivid	Red
Light		Orange/Brown
Very Light		Yellow
		Green

- For gray, you may choose a lightness and "gray"
- You may also use just "black" or "white"
- Color Name separated by "_": Very_dark_vivid_blue

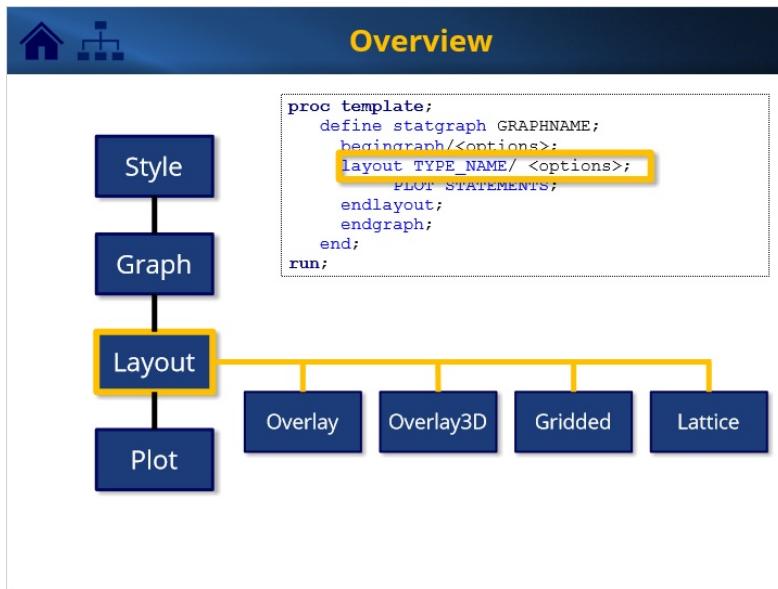
4.11 Bookend: Graph



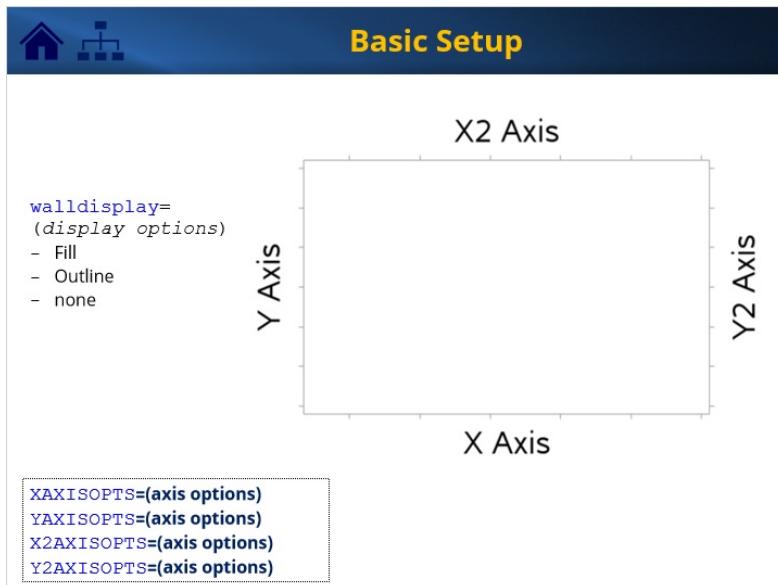
4.12 Bookmark: Layout



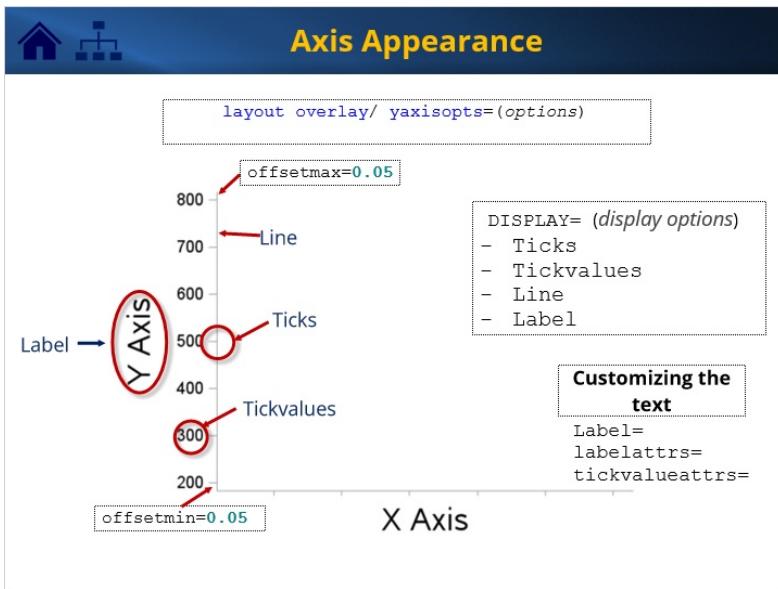
4.13 Overview



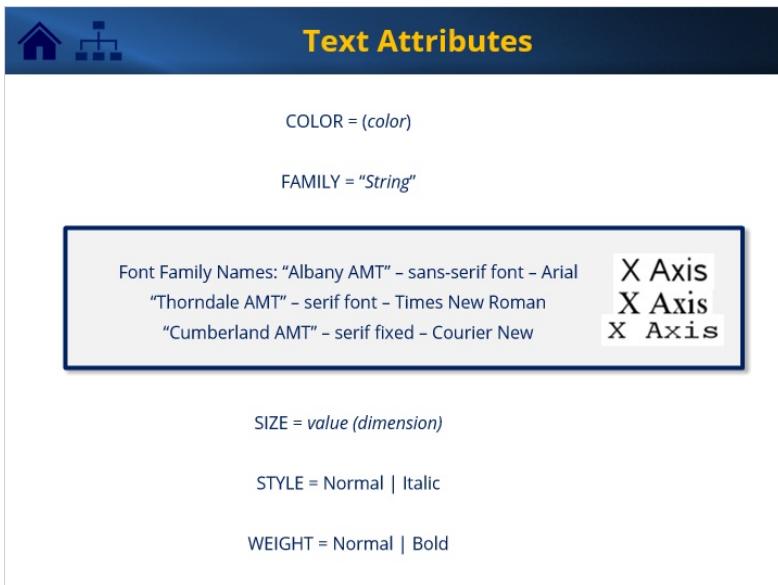
4.14 Setup



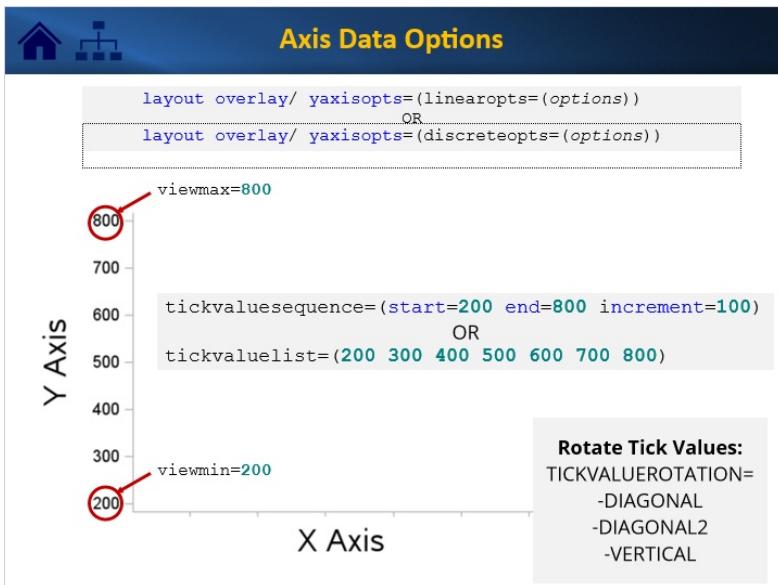
4.15 Axes



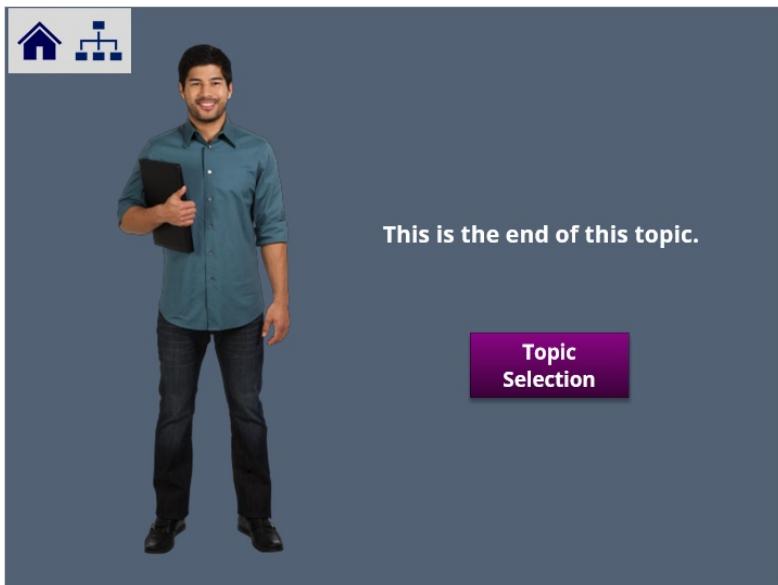
4.16 Text Attributes



4.17 Axis Data Options



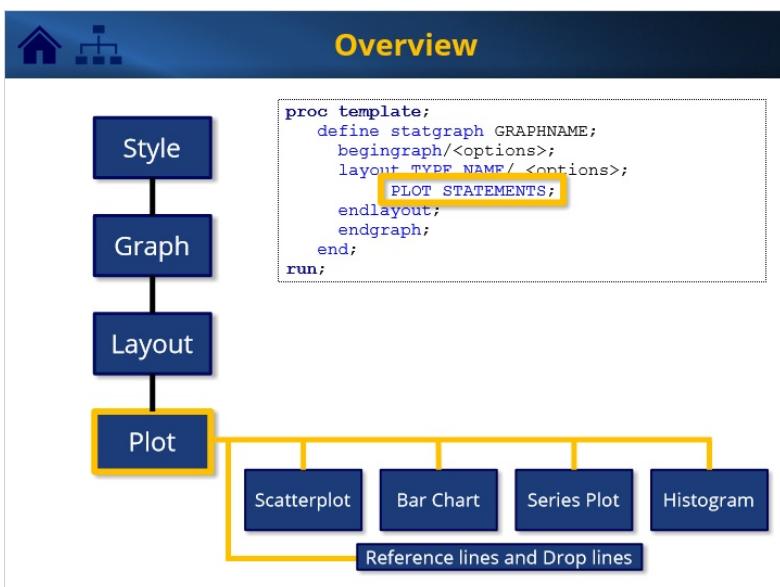
4.18 Bookend: Layout



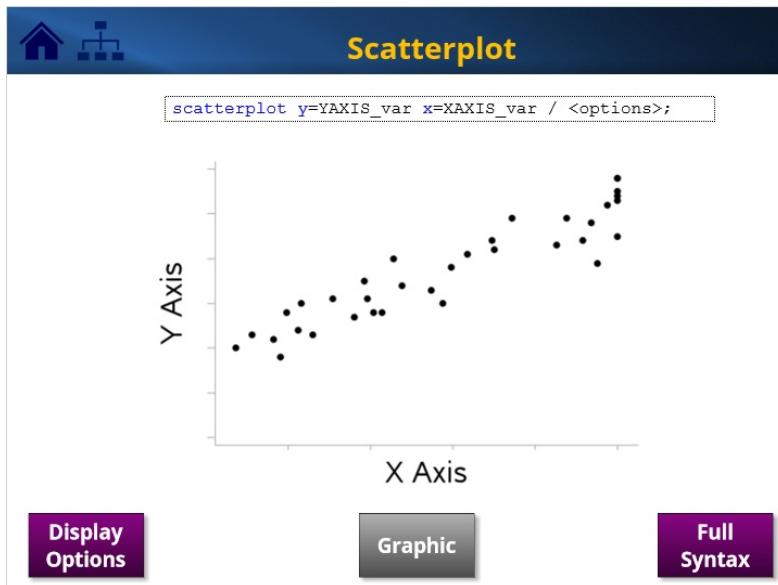
4.19 Bookmark: Plot



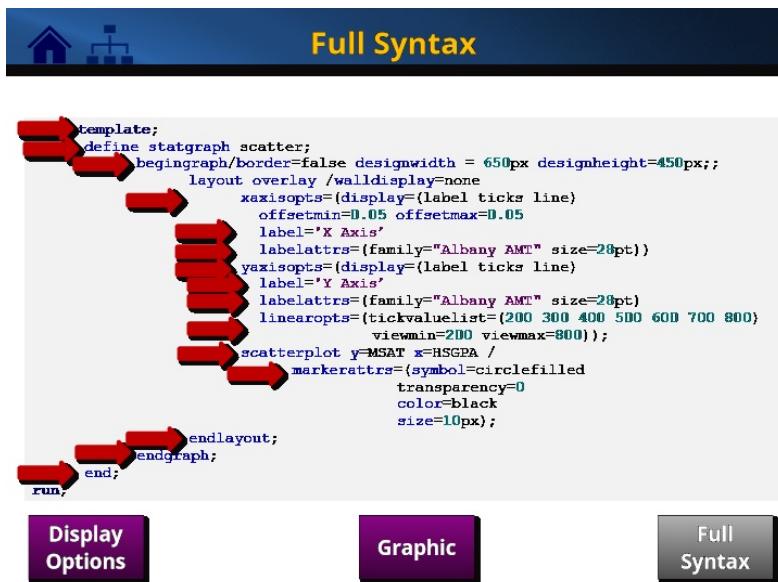
4.20 Overview



4.21 Scatterplot



Full Syntax (Slide Layer)



Options (Slide Layer)

Marker Attributes

COLOR = *color*
SIZE = *integer*
SYMBOL = *symbol-name*
TRANSPARENCY = *number*

<Lessthan	☆Star	○TriangleRight	◆DiamondFilled	◀TriangleLeftFilled	▶TriangleRightFilled
>Greaterthan	□Square	◀TriangleLeft	●CircleFilled	▼TriangleDownFilled	
◊Diamond	+Plus	▽TriangleDown	ZZ	▲TriangleFilled	
○Circle	Ibeam	△Triangle	YY	★StarFilled	
*Asterisk	○HomeDown	˜Tilde	XX	■SquareFilled	
↓ArrowDown	#Hash	TTack	UUnion	◊HomeDownFilled	

Display Options **Graphic** **Full Syntax**

4.22 Custom Markers

Custom Markers: Unicode

Under `begingraph` line, define the symbol:

```
symbolchar name=zero char='0030'x/textattrs=(weight:bold) ;
```

Whenever using a marker, you can now use the symbol you created:

```
markerattrs=(symbol=one size=10pt color=black)
```

Unicode Symbol Database

Nominal Response Model Full Syntax

Nominal Response (Slide Layer)

```
proc template;
  define statgraph Item_Response_Cat;
    begingraph /border=false designwidth = 650px designheight=450px;
      symbolchar name=zero char='0030'x/textattrs=(weight:bold);
      symbolchar name=one char='0031'x/textattrs=(weight:bold);
      symbolchar name=two char='0032'x/textattrs=(weight:bold);
      symbolchar name=three char='0033'x/textattrs=(weight:bold);
      symbolchar name=four char='0034'x/textattrs=(weight:bold);
      layout overlay /waldisplay=none
        xaxisopts=(label="Theta"
                   linearopts=(tickvaluelist=(-4 -2 0 2 4));
        yaxisopts=(label="Response Probability"
                   linearopts=(tickvaluelist=(0 0.2 0.4 0.6 0.8 1));
        scatterplot x=theta y=prob1/
          markerattrss=(symbol=zero size=10pt color=black);
        scatterplot x=theta y=prob21/
          markerattrss=(symbol=one size=10pt color=black);
        scatterplot x=theta y=prob31/
          markerattrss=(symbol=two size=10pt color=black);
        scatterplot x=theta y=prob41/
          markerattrss=(symbol=three size=10pt color=black);
        scatterplot x=theta y=prob51/
          markerattrss=(symbol=four size=10pt color=black);
      endlayout;
    endgraph;
  end;
run;
```

[Back](#)

4.23 Third Variables

Third Variables

```
scatterplot y=YAXIS_var x=XAXIS_var / <options>;
```

Categorical Variable

```
group = third_Categorical_Variable
```

Example

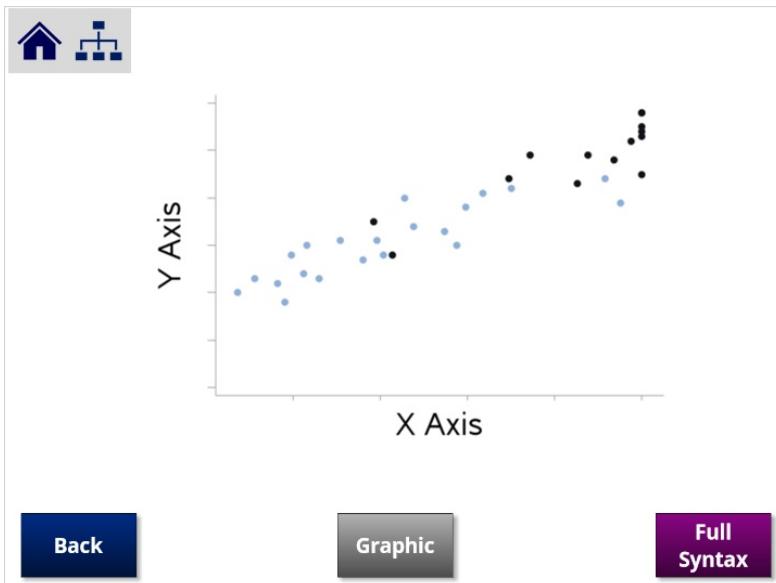
Continuous Variable

```
markersizeresponse = Third_Cont_Variable  
OR  
colorresponse = Third_Cont_Variable  
colormodel= (VLIGB lightblue blue VDAGB)
```

Example

[Back](#)

4.24 Grouping Variable I: Graphic

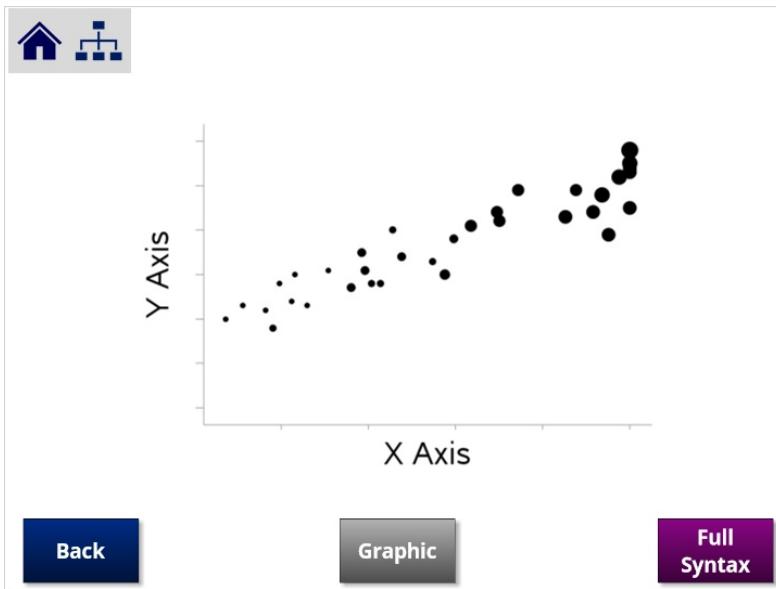


4.25 Grouping Variable II: Full Syntax

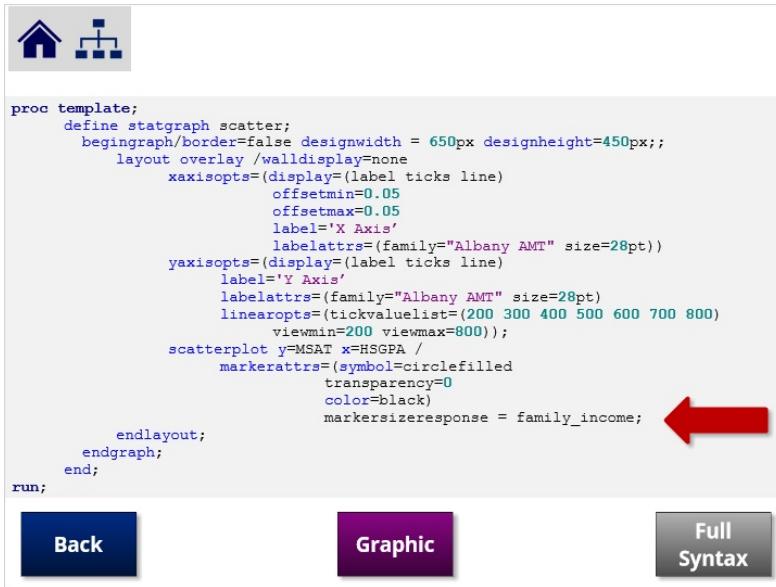
```
proc template;
  define statgraph scatter;
    begingraph/border=false designwidth = 650px designheight=450px
      datacontrastcolors=(very_light_green_blue
                           very_dark_green_blue);
    layout overlay /walldisplay=none
      xaxisopts=(display=(label ticks line)
                 offsetmin=0.05 offsetmax=0.05
                 label='X Axis'
                 labelattrs=(family="Albany AMT" size=28pt))
      yaxisopts=(display=(label ticks line)
                 label='Y Axis'
                 labelattrs=(family="Albany AMT" size=28pt)
                 linearopts=(tickvaluelist=(200 300 400 500 600 700 800)
                             viewmin=200 viewmax=800));
    scatterplot y=MSAT x=HSGPA /
      markerattrs=(symbol=circlefilled
                   transparency=0
                   size=10px)
      group=z;
    endlayout;
  endgraph;
end;
run;
```

Back Graphic Full Syntax

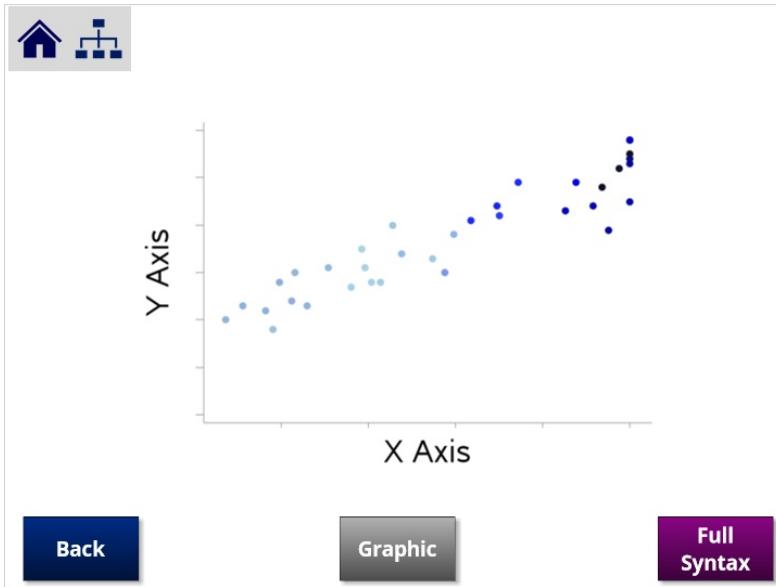
4.26 Marker Size I: Graphic



4.27 Marker Size II: Full Syntax



4.28 Color I: Graphic

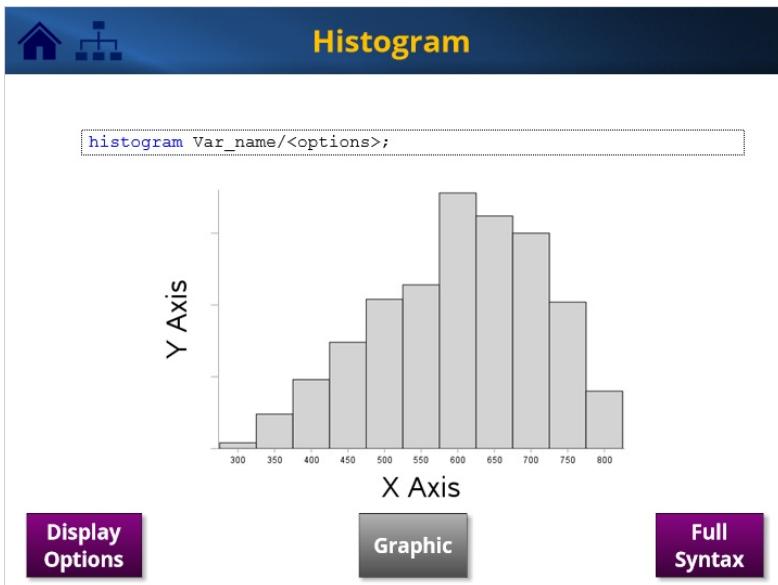


4.29 Color II: Full Syntax

```
proc template;
  define statgraph scatter;
    begingraph/border=false designwidth = 650px designheight=450px;;
      layout overlay /walldisplay=none
        xaxisopts=(display=(label ticks line)
          offsetmin=0.05 offsetmax=0.05
          label='X Axis'
          labelattr=(family="Albany AMT" size=20pt))
        yaxisopts=(display=(label ticks line)
          label='Y Axis'
          labelattr=(family="Albany AMT" size=20pt)
          linearopts=(tickvaluelist=(200 300 400 500 600 700 800)
            viewmin=200 viewmax=800));
      scatterplot y=MSAT x=HSGPA /
        markerattrs=(symbol=circlefilled
          transparency=0
          size=10px)
        colorresponse = family_income
        colormodel= (very_light_green_blue
          light_blue
          blue
          very_dark_green_blue);
    endlayout;
  endgraph;
end;
run;
```

Back Graphic Full Syntax

4.30 Histogram



Options (Slide Layer)

Options

Orientation Custom Bins

Display Content Custom Colors
Fill vs. Outline Attributes

Scale

Display Options Graphic Full Syntax

Syntax (Slide Layer)

Full Syntax

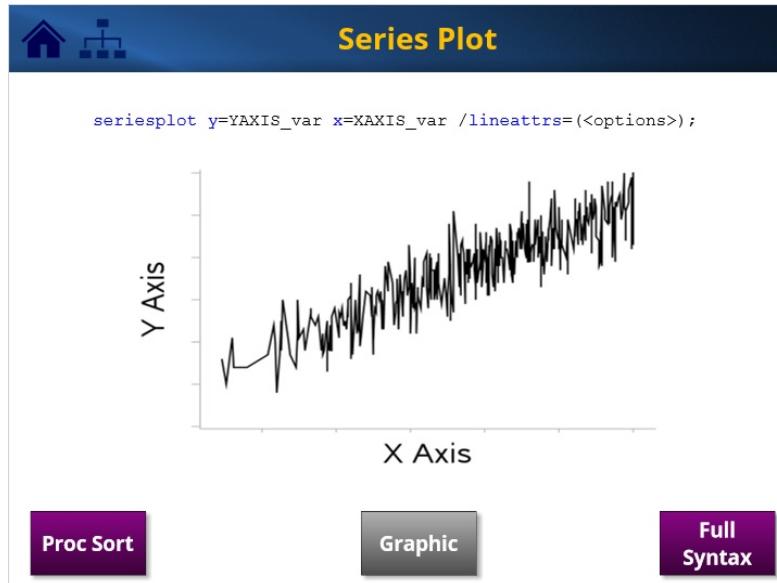
```
proc template;
  define statgraph histogram;
    begingraph/border=false designwidth = 650px designheight=450px;
      layout overlay /walldisplay=none
        xaxisopts=(display=(label ticks line tickvalues)
          offsetmin=0.05 offsetmax=0.05
          label='X Axis'
          labelattrs=(family="Albany AMT" size=28pt)
          linearopts=(tickvaluessequence=(start=300 end=800
            increment=50)
            viewmin=300 viewmax=800))
        yaxisopts=(display=(label ticks line )
          label='Y Axis'
          labelattrs=(family="Albany AMT" size=28pt)
          tickvalueattrs=(size=14pt));
      histogram MSAT/orient=vertical
        binstart=275 binwidth=50
        display=(fill outline)
        fillattrs=(color=lightgray)
        outlineattrs=(color=black);
    endlayout;
  endgraph;
end;
run;
```

Display Options

Graphic

Full Syntax

4.31 Series Plot



Proc Sort

Graphic

Full Syntax

Full Syntax (Slide Layer)

Full Syntax

```
proc sort data=sim_all;
  by HSGPA;
run;

proc template;
  define statgraph series;
    begingraph/border=false designwidth = 650px designheight=450px;
      layout overlay /walldisplay=none
        xaxisopts=(display=(label ticks line)
          offsetmin=0.05 offsetmax=0.05
          label='X Axis'
          labelattrs=(family="Albany AMT" size=28pt))
        yaxisopts=(display=(label ticks line)
          label='Y Axis'
          labelattrs=(family="Albany AMT" size=28pt)
          linearopts=(tickvaluelist=(200 300 400 500 600 700 800)
            viewmin=200 viewmax=800));
      seriesplot y=MSAT x=HSGPA/
        lineattrs=(thickness=2px color=black);
    endlayout;
  endgraph;
end;
run;
```

Proc Sort

Graphic

Full
Syntax

Proc Sort (Slide Layer)



Proc Sort

```
proc sort data=DATASET_NAME out=SORTED_DATASET
  by <Descending> SORTING_VAR;
run;
```



Proc Sort

Graphic

Full
Syntax

4.32 Bar Graph

Bar Graph

```
barchart x=Var_Name/<options>
or
barchart y=Var_Name/<options>
```

Y Axis

X Axis

category 1 category 2

Display Options Graphic Full Syntax

Full Syntax (Slide Layer)

Full Syntax

```
proc template;
  define statgraph bar_graph;
    begingraph/border=false designwidth = 650px designheight=450px;
      layout overlay /waldisplay=none
        xaxisopts=(display=(label line tickvalues)
          label='X Axis'
          labelattrs=(family="Albany AMT" size=28pt)
          tickvalueattrs=(weight =normal
            family="Albany AMT"
            color=black
            size=14pt))
        yaxisopts=(display=(label ticks line)
          label='Y Axis'
          labelattrs=(family="Albany AMT" size=28pt));
      barchart x=cat/ display=(fill outline)
        fillattrs=(color=lightgray)
        outlineattrs=(color=black);
    endlayout;
  endgraph;
end;
run;
```

Display Options Graphic Full Syntax

Options (Slide Layer)

Display Options

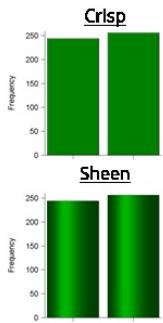
`display=(fill outline)`

`fillattrs=(color=light_gray)`

`COLOR = color`
`TRANSPARENCY = number`
`FILLPATTERNS = <options>`
`L1 - L5; R1 - R5; X1 - X5`

`outlineattrs=(color=black)`

`DATASKIN=`
NONE|CRISP|GLOSS
MATTE|PRESSED|SHEEN



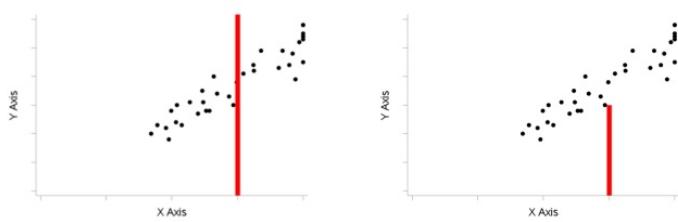
The first chart, labeled 'Crisp', shows two solid green bars with sharp edges and high contrast. The second chart, labeled 'Sheen', shows two green bars with a subtle gradient and a slight glow or highlight along the edges, giving it a more polished appearance.

Display Options Graphic Full Syntax

4.33 Reference and Drop Lines

Reference Lines and Drop Lines

`referenceline x=X_value / <options>;` `dropline x=X_value y=Y_value/`
`dropto=x <options>;`



The left plot shows a scatter of black dots with a vertical red reference line extending from the bottom to the top of the plot at a specific x-value. The right plot shows a similar scatter of black dots with a vertical red drop line extending from a specific y-value down to the bottom of the plot at a specific x-value.

Full Syntax Full Syntax

Full Syntax (Slide Layer)



Reference Line Syntax

```
proc template;
  define statgraph scatter_ref;
    begingraph/border=false designwidth = 650px designheight=450px;;
      layout overlay /walldisplay=none
        xaxisopts=(display=(label ticks line)
          label='X Axis'
          labelattrs=(family="Albany AMT" size=16pt)
          linearopts=(tickvaluelist=(0 1 2 3 4)
            viewmin=0 viewmax=4));
        yaxisopts=(display=(label ticks line)
          label='Y Axis'
          labelattrs=(family="Albany AMT" size=16pt)
          linearopts=(tickvaluelist=(200 300 400 500 600 700 800)
            viewmin=200 viewmax=800));
      scatterplot y=MSAT x=HSGPA / markerattrs=(symbol=circlefilled
        transparency=0
        color=black
        size=10px);
      reference line x=3/lineattrs=(color=red
        thickness=10px);
    endlayout;
  endgraph;
end;
run;
```

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Full Syntax 2 (Slide Layer)

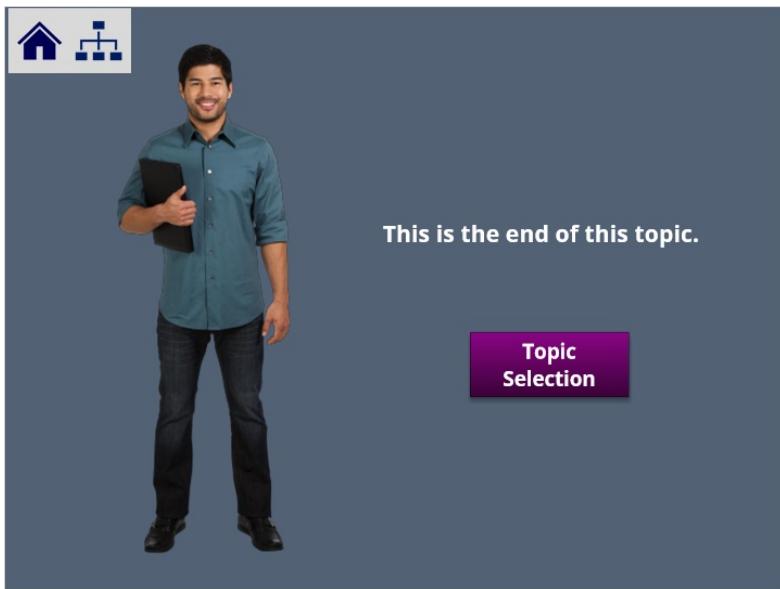


Drop Line Syntax

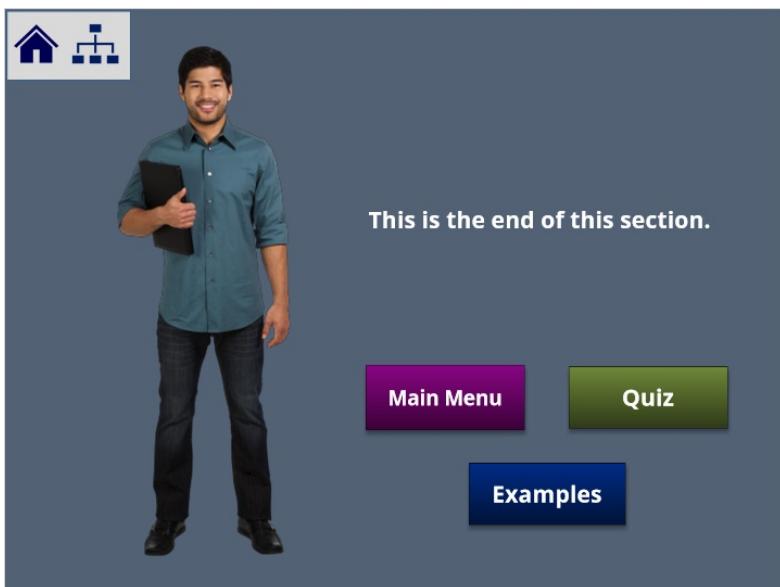
```
proc template;
  define statgraph scatter_ref;
    begingraph/border=false designwidth = 650px designheight=450px;;
      layout overlay /walldisplay=none
        xaxisopts=(display=(label ticks line)
          label='X Axis'
          labelattrs=(family="Albany AMT" size=16pt)
          linearopts=(tickvaluelist=(0 1 2 3 4)
            viewmin=0 viewmax=4));
        yaxisopts=(display=(label ticks line)
          label='Y Axis'
          labelattrs=(family="Albany AMT" size=16pt)
          linearopts=(tickvaluelist=(200 300 400 500 600 700 800)
            viewmin=200 viewmax=800));
      scatterplot y=MSAT x=HSGPA / markerattrs=(symbol=circlefilled
        transparency=0
        color=black
        size=10px);
      dropline x=3 y=500/dropto=x
        lineattrs=(color=dark_strong_red thickness=10px);
    endlayout;
  endgraph;
end;
run;
```

[Back](#)

4.34 Bookend: Plot



4.35 Bookend: Section 3



4.36 Module Cover (END)

