Data visualization with ggplot2

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The Grammar of Graphics

- A way of thinking about how graphs are constructed

- In language grammar, sentences have different structures or components that are layered together
  - Nouns, verbs, pronouns, conjunctions, propositions, etc

- This is the same idea behind the grammar of graphs, a series of structures that together form the graph

- This creates a highly customizable and powerful system

The Grammar of Graphics

- We will use the grammar of graphs implemented in the package ggplot2

- This package is part of a group of packages known as tidyverse

The Grammar of Graphics

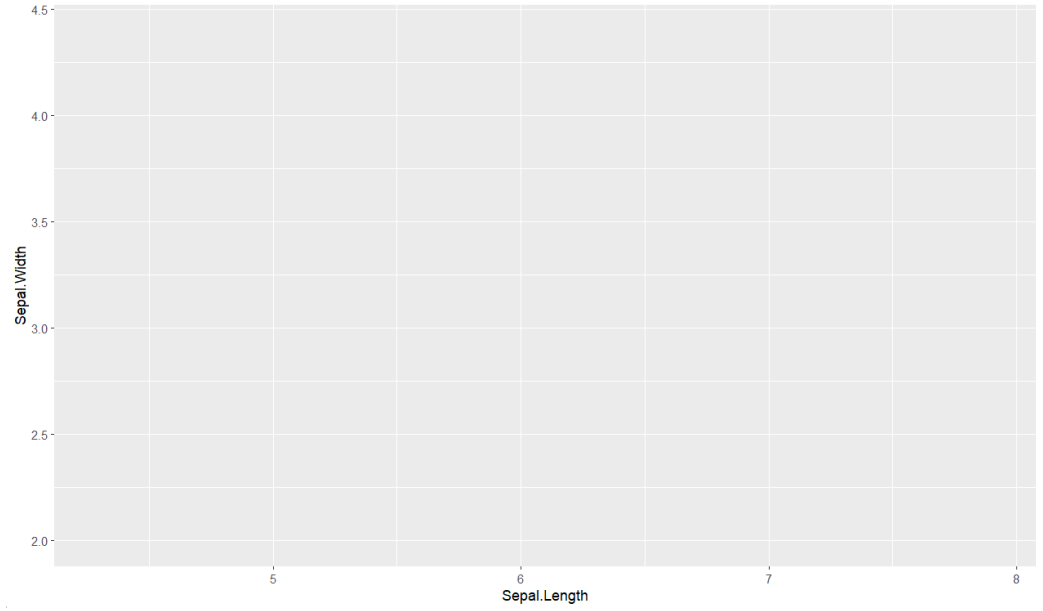
- Ggplot2 graphs have 3 required layers (or structures) for any type of plot
  - **Data**: a data frame (table) that contain the observations and variables we want to plot

	A	B	C	D	E	F
1	ID	Sepal.Length	Sepal.Width	Petal.Length	Petal.Width	Species
2	1	5.1	3.5	1.4	0.2	setosa
3	2	4.9	3	1.4	0.2	setosa
4	3	4.7	3.2	1.3	0.2	setosa
5	4	4.6	3.1	1.5	0.2	setosa
6	5	5	3.6	1.4	0.2	setosa
7	6	5.4	3.9	1.7	0.4	setosa
8	7	4.6	3.4	1.4	0.3	setosa
9	8	5	3.4	1.5	0.2	setosa
10	9	4.4	2.9	1.4	0.2	setosa
11	10	4.9	3.1	1.5	0.1	setosa
12	11	5.4	3.7	1.5	0.2	setosa

```
ggplot(iris,
```

The Grammar of Graphics

- Ggplot2 graphs have 3 required layers (or structures) for any type of plot
  - Data: a data frame (table) that contain the observations and variables we want to plot
  - **Aesthetic:** the mapping of our variables of interest (the x and y axis, for example)



ggplot(iris, aes(x = Sepal.Length, y = Sepal.Width))

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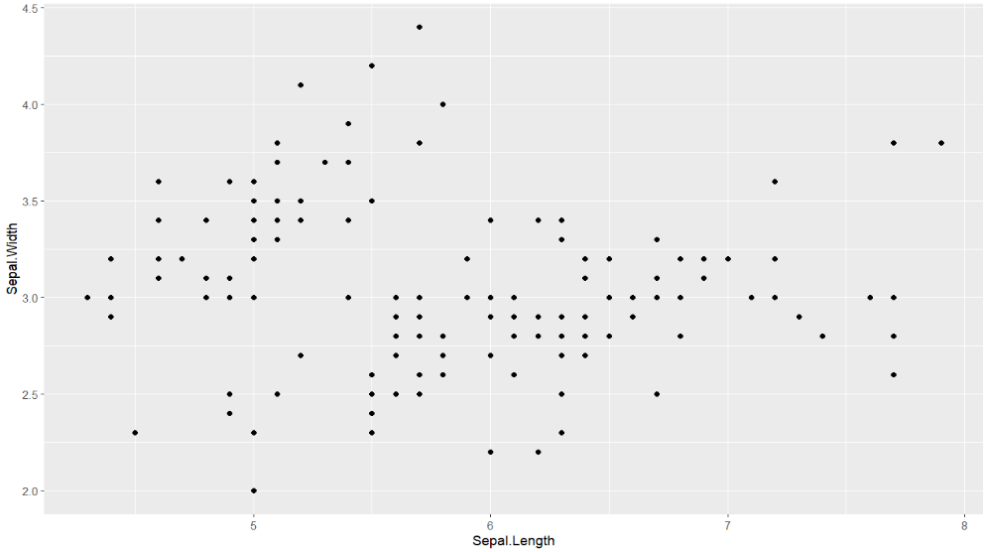
  - **Geometry**: the type or shape of the visual elements of the graph (for example, bars or points)

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ggplot(iris, aes(x = Sepal.Length, y = Sepal.Width)) +
  geom_point( )
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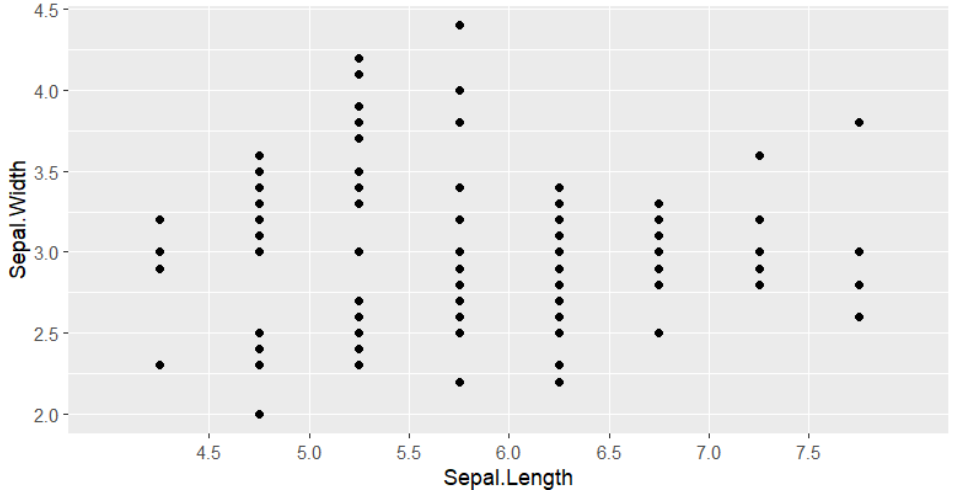
The Grammar of Graphics

- There are other elements that can be added to make modifications to how data or other elements appear in the plot

  - Scales: can be used to adjust axis coordinates, add color to geometry structures, etc.

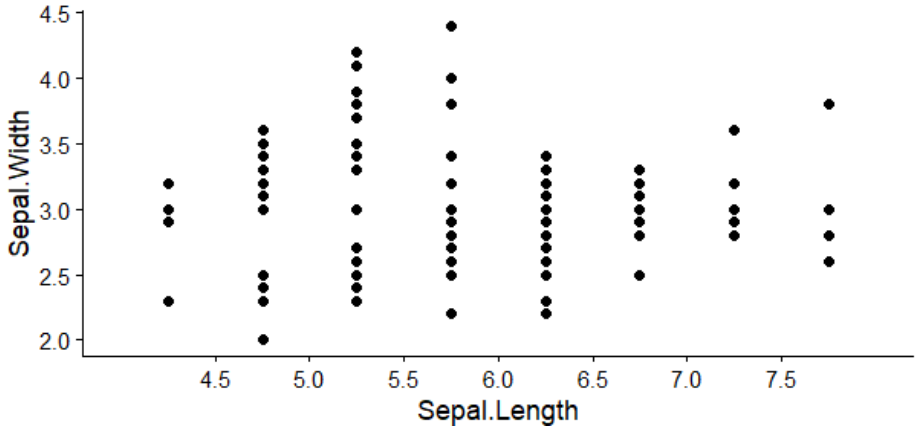



```
ggplot(iris, aes(x = Sepal.Length, y = Sepal.Width))+
        geom_point( ) +
         scale_x_binned( )
```

The Grammar of Graphics

- There are other elements that can be added to make modifications to how data or other elements appear in the plot

  - Scales: can be used to adjust axis coordinates, add color to geometry structures, etc.
  - Themes: change and control non-data display elements




```
ggplot(iris, aes(x = Sepal.Length, y = Sepal.Width))+
        geom_point( ) +
          scale_x_binned( ) +
          theme_classic( )
```

Workshop

- Here we will use RStudio for interfacing with R
- We will use the “iris” dataset included in the ggplot package. It has four **continuous** variables and one **categorical** variable.
- We will learn how to make scatter plots, histograms and box plots.
- We will also learn how to change different aspects of our plots.
- Link for the tutorial: https://github.com/carol-siniscalchi/public_tutorials/blob/main/ggplot_dataviz/20250923_data_viz.R

Useful Resources

- R install: https://cran.r-project.org/
- RStudio install: https://posit.co/download/rstudio-desktop/
- The R Graph Gallery: https://r-graph-gallery.com/
- Data to Viz: https://www.data-to-viz.com/
- ggplot vignettes: https://ggplot2.tidyverse.org/articles/ggplot2.html
- ggplot cheat sheet: https://posit.co/wp-content/uploads/2022/10/data-visualization-1.pdf