Universidade Federal do Rio Grande do Norte
Instituto Metrópole Digital
IMD0601 - Bioestatística

Visualização dos dados em R

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Baixe a aula (e os arquivos)

- Para aqueles que não clonaram o repositório:

```
> git clone https://github.com/tetsufmbio/IMD0601.git
```

- Para aqueles que já tem o repositório local:

```
> cd /path/to/IMD0601
```

```
> git pull
```

ggplot2

Hadley Wickham

“The Grammar of Graphics”

Adiciona camadas nos gráficos para melhor visualização dos dados;

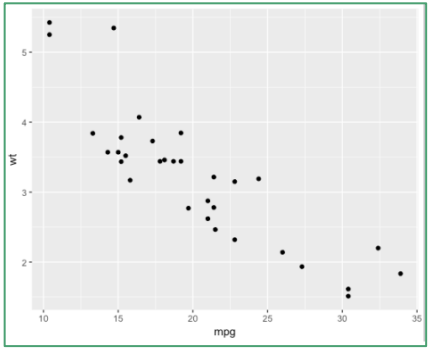
```
library(ggplot2)
```

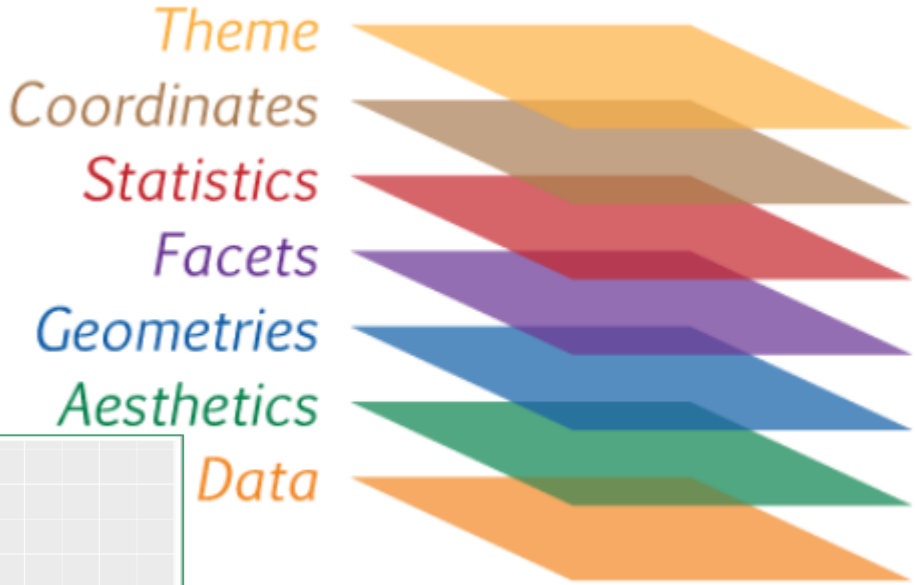
ggplot2

Geometries

Camada que indica a forma como os dados devem ser apresentados no gráfico.

```
ggplot(mtcars, aes(x=mpg, y=wt)) + geom_point()
```





A sintaxe do ggplot

```
ggplot(data = <DATA>) +
  <GEOM_FUNCTION>(
     mapping = aes(<MAPPINGS>),
     stat = <STAT>,
     position = <POSITION>
  ) +
  <COORDINATE_FUNCTION> +
  <FACET_FUNCTION>
```

Data	*{variables of interest}*				
Aesthetics	*x-axis* *y-axis*	*colour* *fill*	*size* *labels*	*alpha* *shape*	*line width* *line type*
Geometries	*point*	*line*	*histogram*	*bar*	*boxplot*
Themes	*non-data ink*				
Statistics	*binning*	*smoothing*	*descriptive*	*inferential*	
Coordinates	*cartesian*	*fixed*	*polar*	*limits*	
Facets	*columns*	*rows*			

r4ds.had.co.nz/

Iris dataset


```
data(iris)

str(iris)

'data.frame':  150 obs. of  5 variables:
 $ Sepal.Length: num  5.1 4.9 4.7 4.6 5 5.4 4.6 5 4.4 4.9 ...
 $ Sepal.Width : num  3.5 3 3.2 3.1 3.6 3.9 3.4 3.4 2.9 3.1 ...
 $ Petal.Length: num  1.4 1.4 1.3 1.5 1.4 1.7 1.4 1.5 1.4 1.5 ...
 $ Petal.Width : num  0.2 0.2 0.2 0.2 0.2 0.4 0.3 0.2 0.2 0.1 ...
 $ Species     : Factor w/ 3 levels "setosa","versicolor",..: 1 1
1 1 1 1 1 1 1 1 ...
```

ggplot2

Exercício

Adicione uma coluna na tabela **iris** que corresponda a um identificador único de cada observação.

```
> iris$Flower <- 1:nrow(iris)
```

Crie uma tabela onde as variáveis Length e Width estejam cada uma em uma coluna, como abaixo.

```
  Species Flower  part Length Width
1  setosa      1 Petal    1.4   0.2
2  setosa      1 Sepal    5.1   3.5
...
```

ggplot2

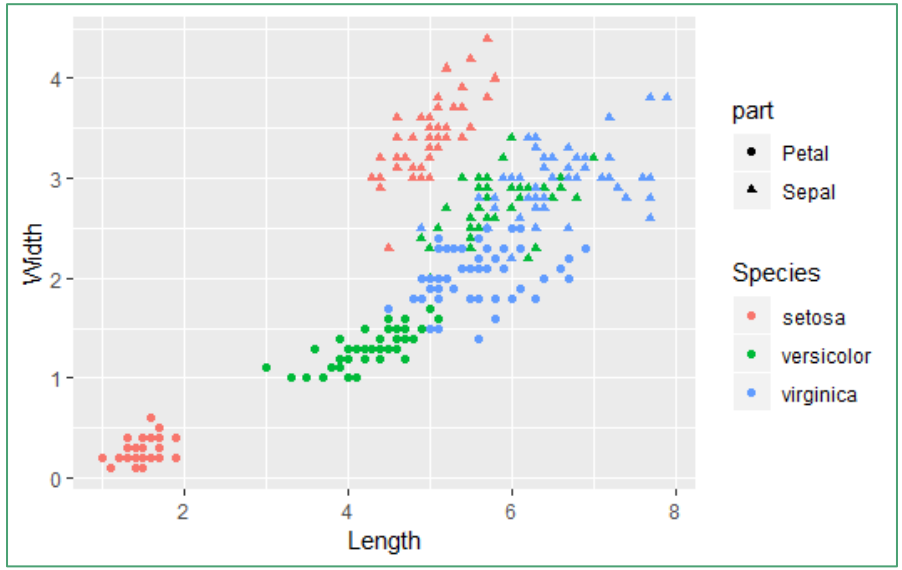
Exercício

```
> library(tidyr)

> iris$Flower <- 1:nrow(iris)

> iris.wide <- gather(iris, part_measure, val, -Species, -Flower )

> iris.wide <- separate(iris.wide, part_measure,
c("part","measure"))

> iris.wide <- spread(iris.wide, measure, val)
```

ggplot2

Exercício

Plote um gráfico abaixo usando o ggplot2:

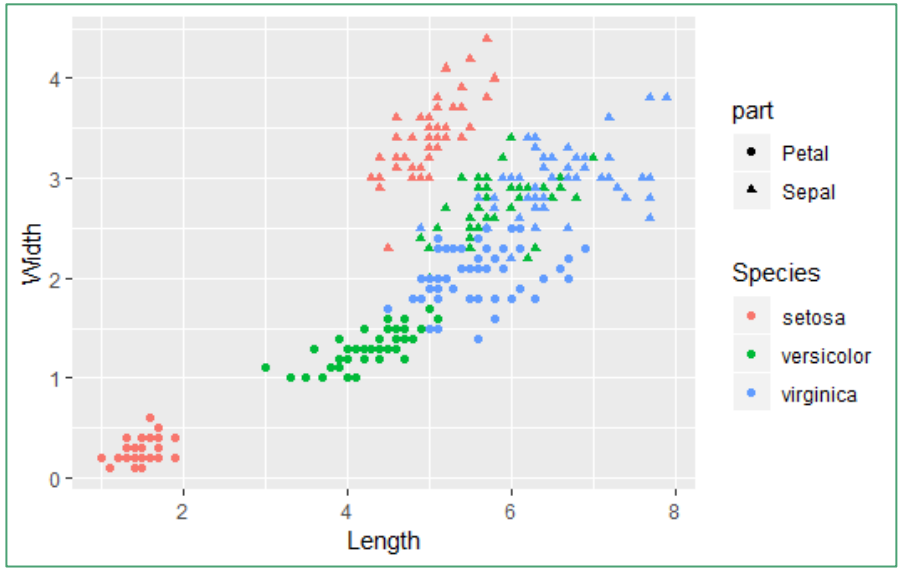


ggplot2

Exercício

Plote um gráfico abaixo usando o ggplot2:

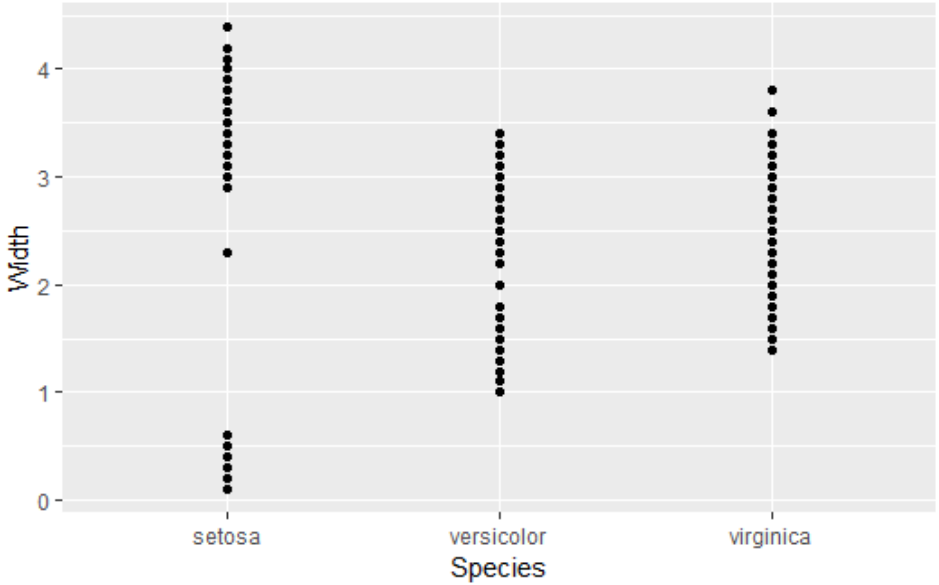
```
> ggplot(iris.wide, aes(Length, Width, col = Species, shape = part)) + geom_point()
```



ggplot2

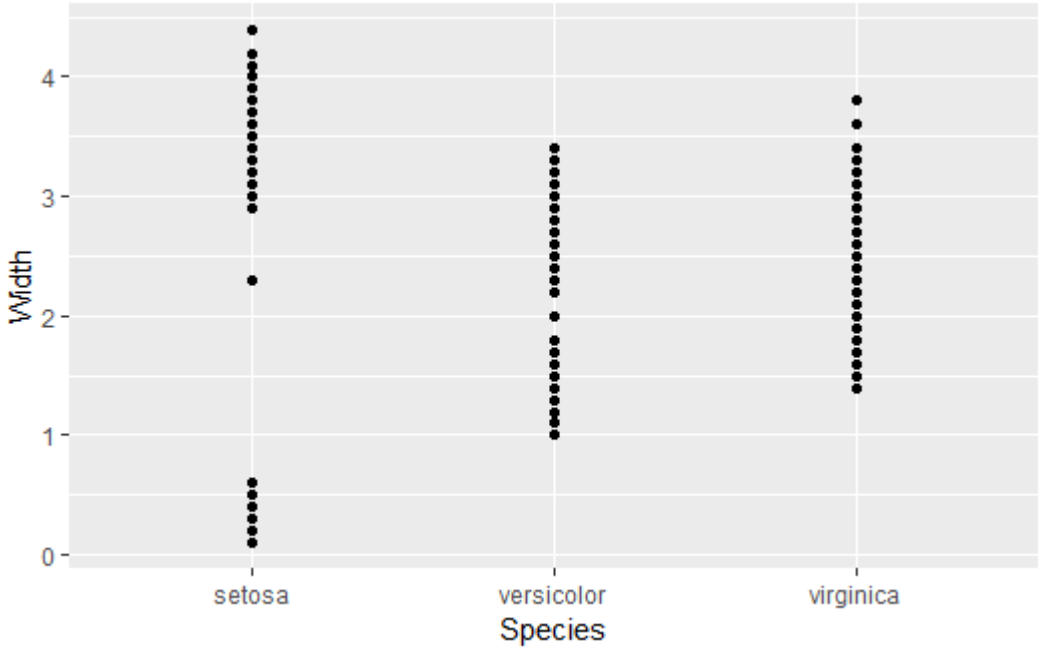
Exercício

Plote um gráfico abaixo usando o ggplot2:



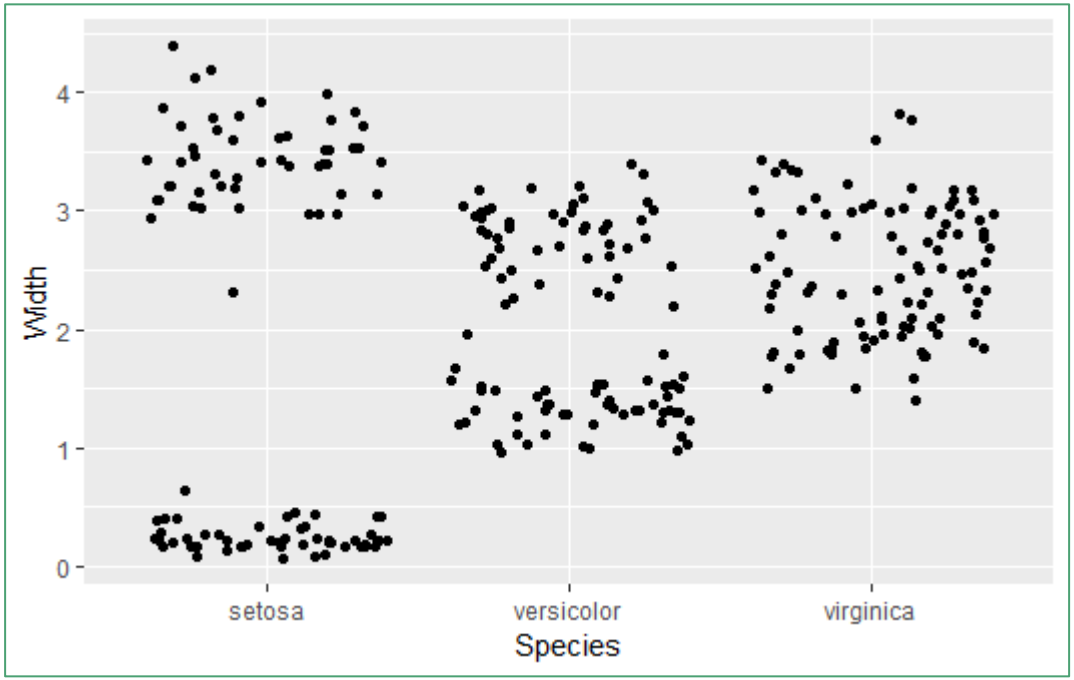
ggplot

```
> ggplot(iris.wide, aes(Species, Width)) + geom_point()
```



ggplot

```
ggplot(iris.wide, aes(Species, Width)) + geom_point(position =
"jitter")
```

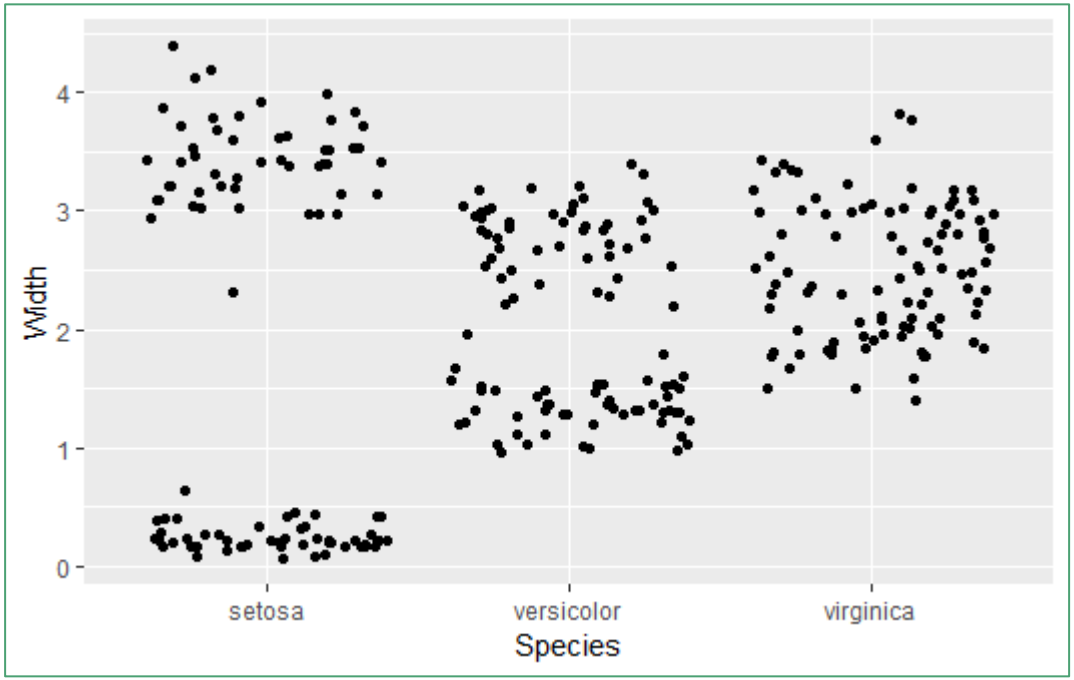


position:

- identity
- jitter
- dodge
- stack
- fill

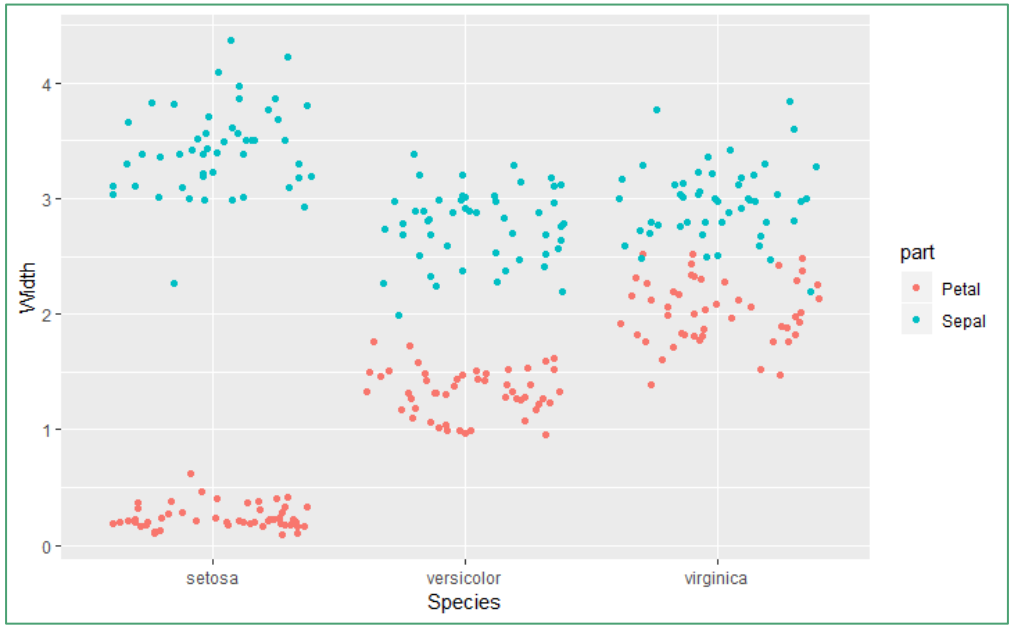
ggplot

```
> ggplot(iris.wide, aes(Species, Width)) + geom_jitter()
```



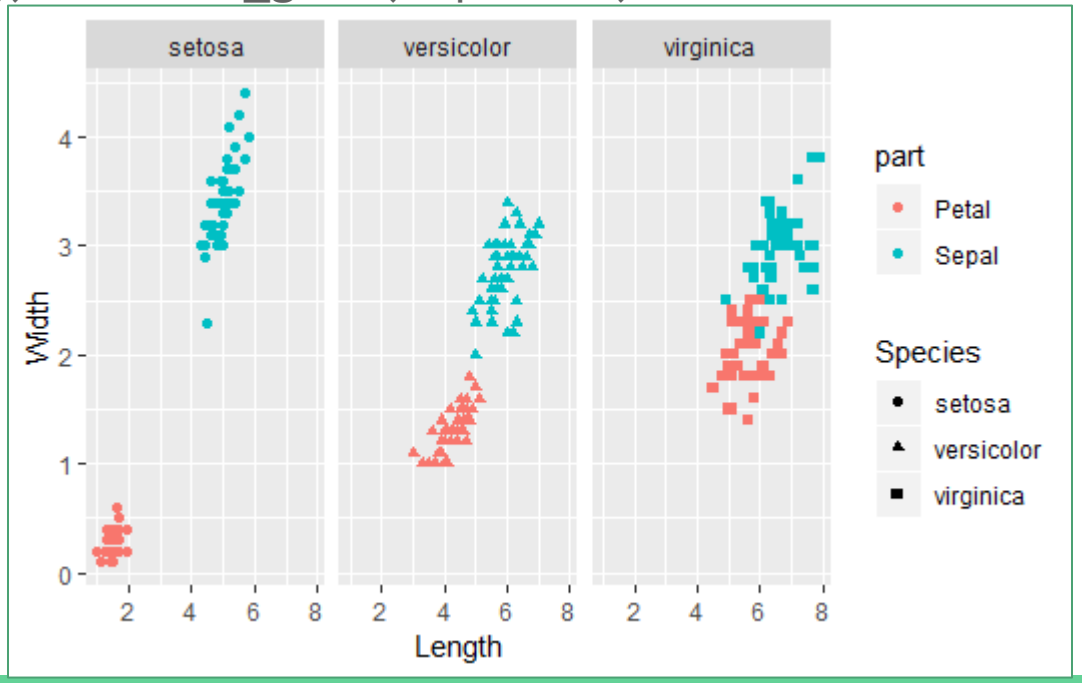
ggplot

```
> ggplot(iris.wide, aes(Species, Width)) +
geom_jitter(aes(col=part))
```



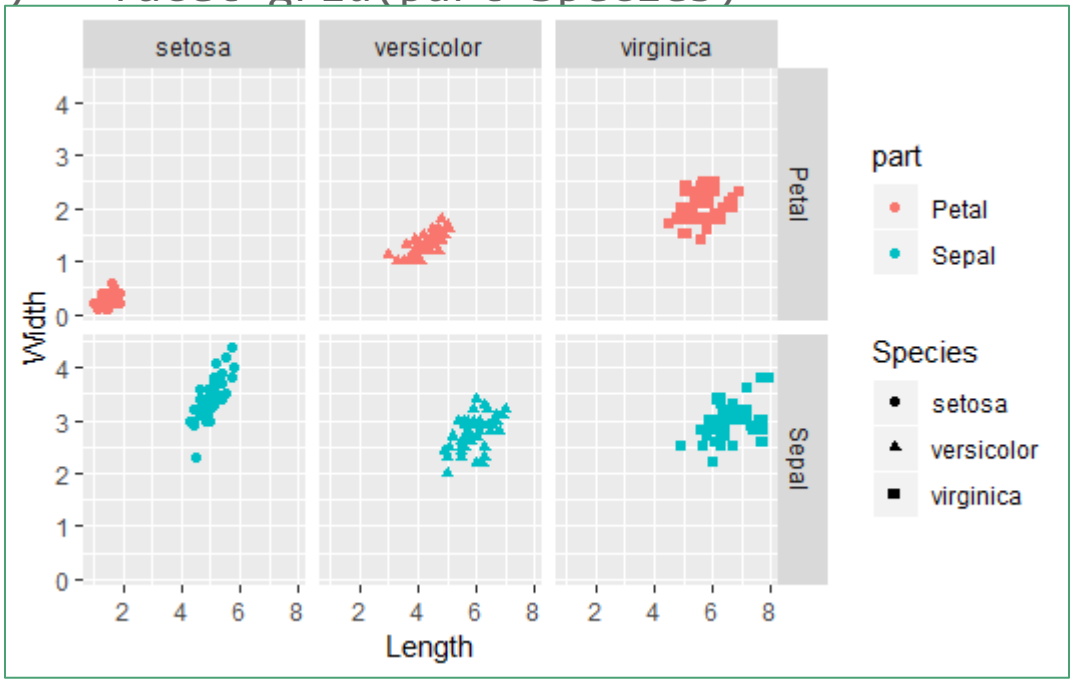
ggplot2 - facet

```
ggplot(iris.wide, aes(Length, Width, col = part, shape = Species))
+ geom_point() + facet_grid(~Species)
```



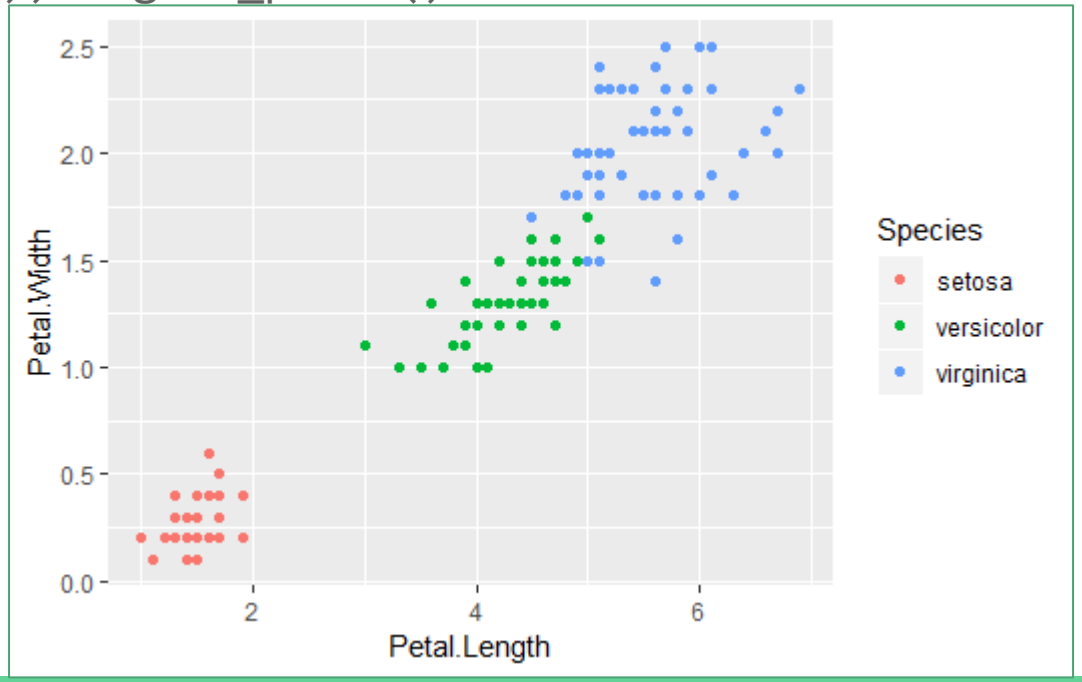
ggplot2

```
ggplot(iris.wide, aes(Length, Width, col = part, shape = Species))
+ geom_point() + facet_grid(part~Species)
```



ggplot2 - adicionando camadas

```
> ggplot(iris, aes(x = Petal.Length, y = Petal.Width, col = Species)) + geom_point()
```



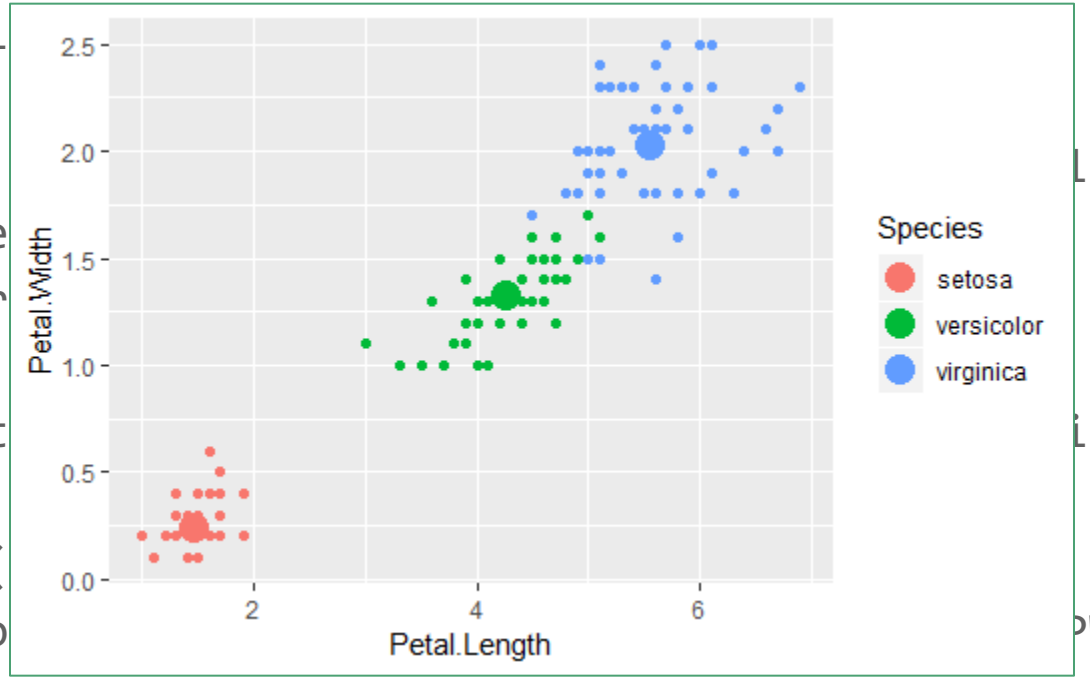
Como adicionar a média do comprimento e da largura de cada espécie?

ggplot2 - adicionando camadas

```
> library(dplyr)
> iris.group <- group_by(iris, Species)
> iris.group <- summarise(iris.group, PLM = mean(Petal.Length), PWM = mean(Petal.Width))
> str(iris.group)

> g <- ggplot(iris, aes(x = Petal.Length, y = Petal.Width, col = Species)) +
  geom_point()
> g + geom_point(data = iris.group, aes(x = PLM, y = PWM), size = 5)
```

ggplot2 - adicionando camadas

```
> library(dpl
> iris.group
> iris.group                                                    l.Length),
PWM = mean(Pe
> str(iris.gr

> g <- ggplot                                                   idth, col =
Species)) +
  geom_point(
> g + geom_po                                                   PWM), size =
5)
```



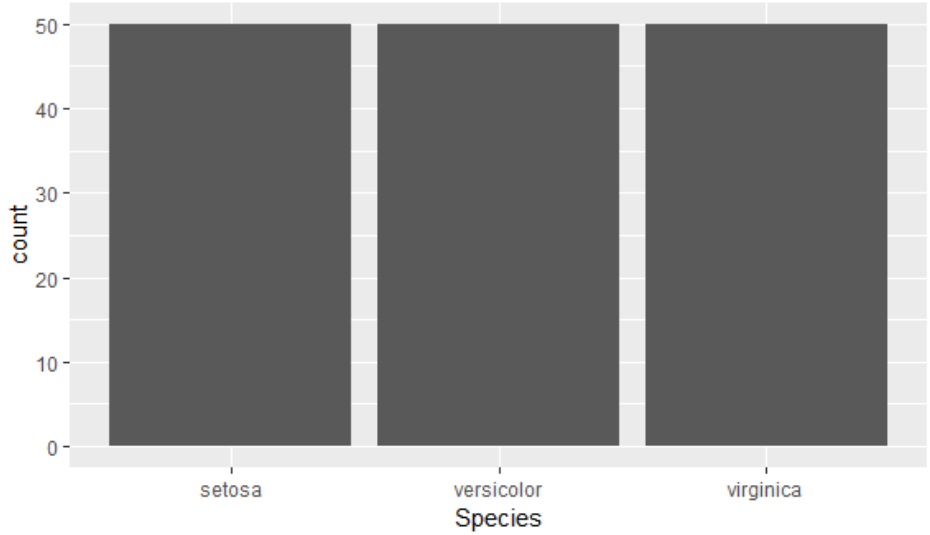
ggplot2 - Camada Geométrica

37 geometrias

abline	contour	errorbarh	line	polygon	segment	vline
area	crossbar	freqpoly	linerange	quantile	smooth	
bar	density	hex	map	raster	step	
bin2d	density2d	histogram	path	rect	text	
blank	dotplot	hline	point	ribbon	tile	
boxplot	errorbar	jitter	pointrange	rug	violin	

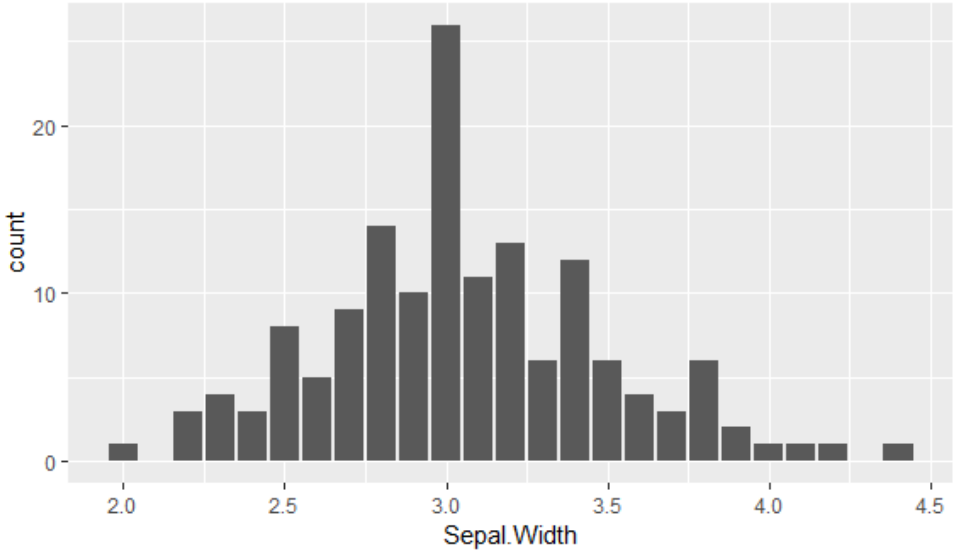
ggplot2 - gráfico de barra

```
data(iris)
str(iris)
ggplot(iris, aes(Species)) + geom_bar()
```



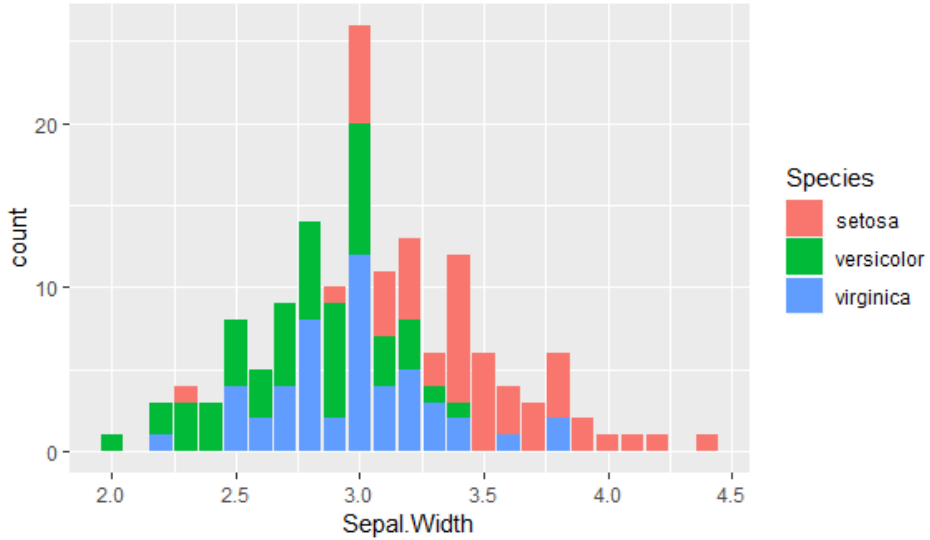
ggplot2 - gráfico de barra

```
data(iris)
str(iris)
ggplot(iris, aes(Sepal.Width)) + geom_bar()
```



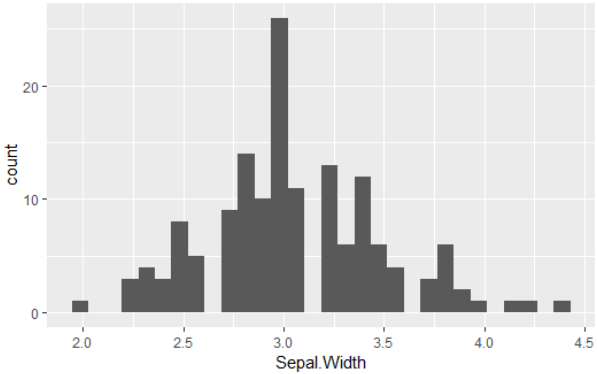
ggplot2 - gráfico de barra

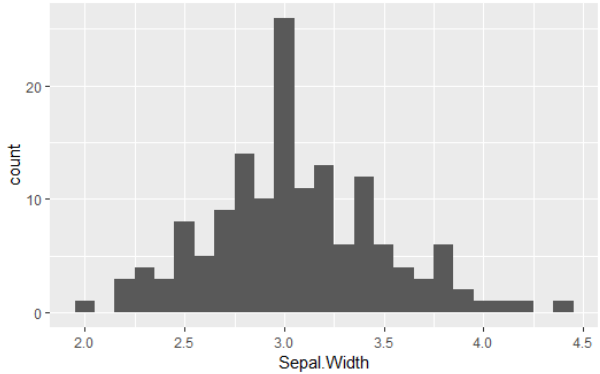
```
data(iris)
str(iris)
ggplot(iris, aes(Sepal.Width, fill = Species)) + geom_bar()
```

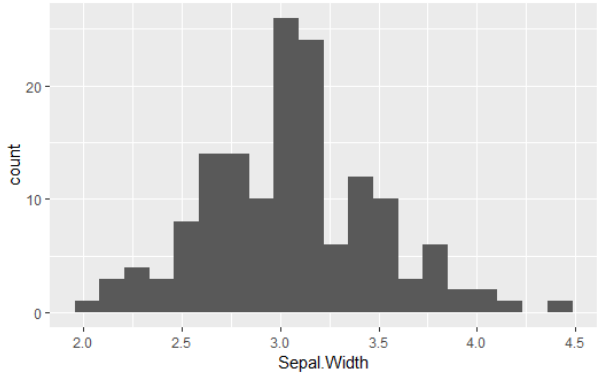


ggplot2 - Histogramas

```
ggplot(iris, aes(x = Sepal.Width)) + geom_histogram()
# default: bins = 30, position = stacks;
ggplot(iris, aes(x = Sepal.Width)) + geom_histogram(binwidth = 0.1)
ggplot(iris, aes(x = Sepal.Width)) + geom_histogram(bins = 20)
```

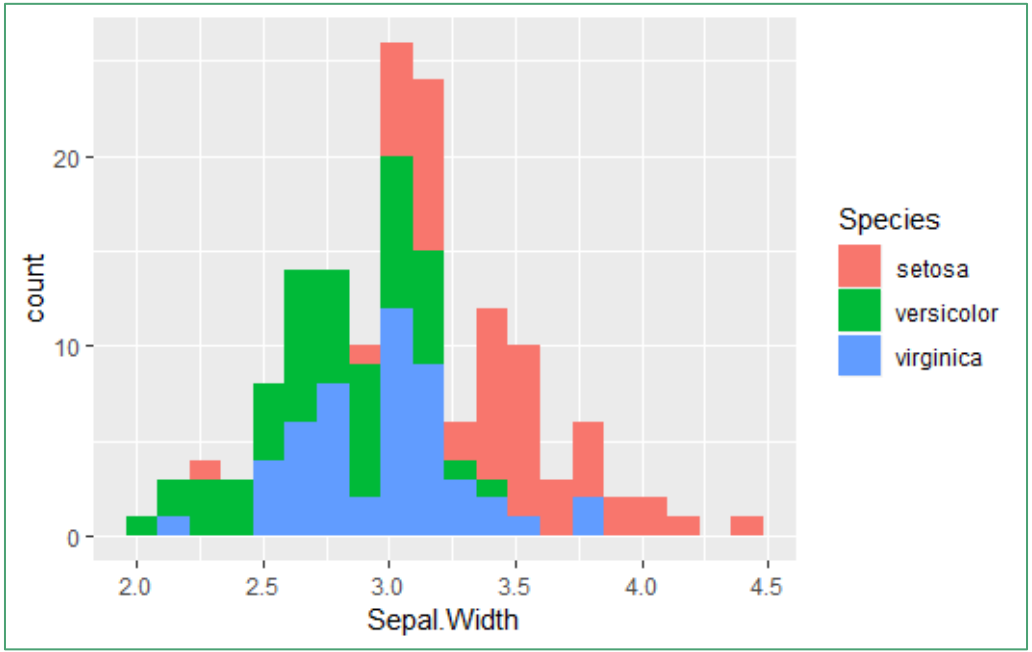






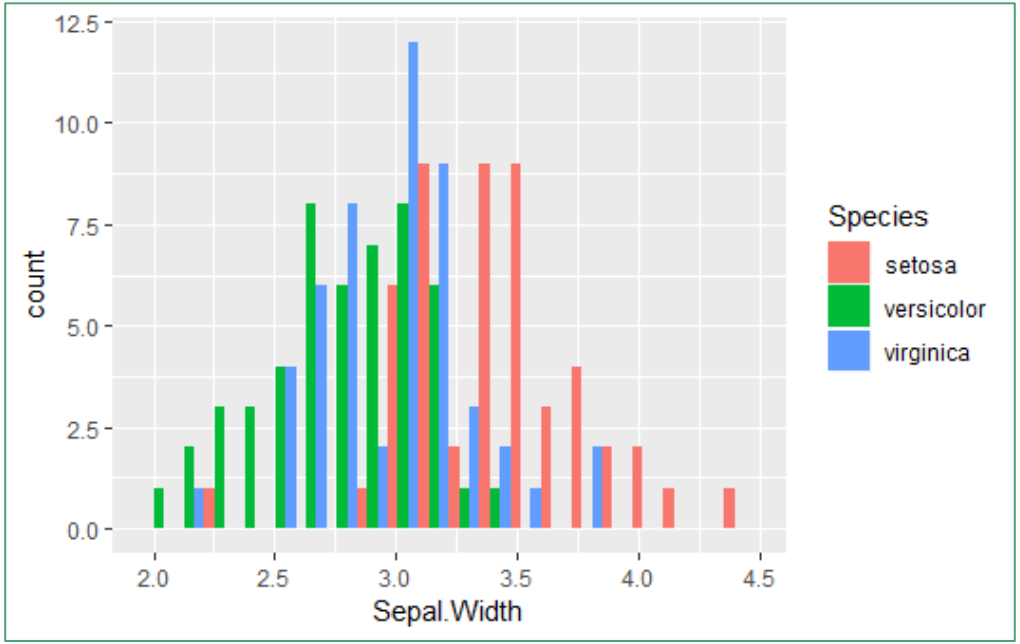
ggplot2 - Histogramas

```
ggplot(iris, aes(x = Sepal.Width, fill = Species)) +
geom_histogram(bins = 20)
```



ggplot2 - Histogramas

```
ggplot(iris, aes(x = Sepal.Width, fill = Species)) +
geom_histogram(bins = 20, position = "dodge")
```

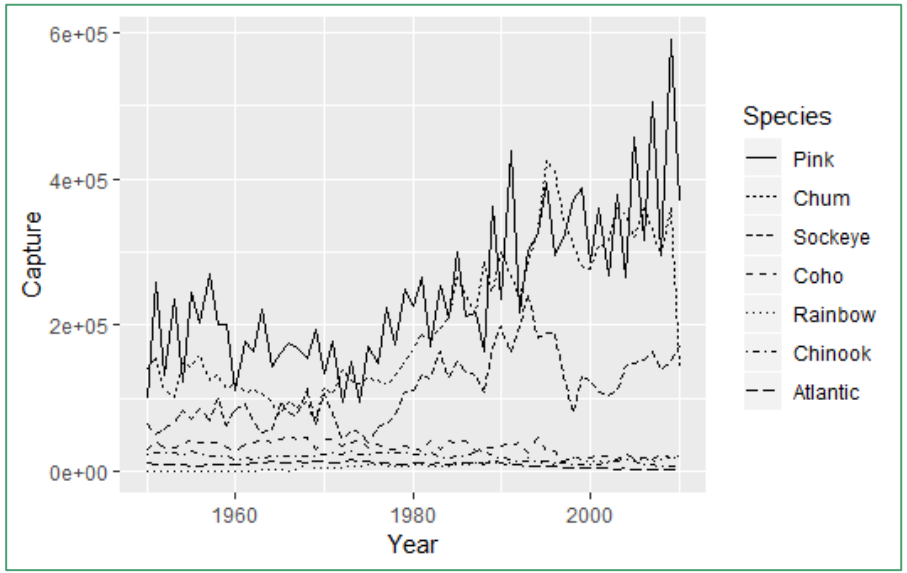


ggplot2 - Histogramas

```
ggplot(iris, aes(x = Sepal.Width, fill = Species)) +
geom_histogram(bins = 20, position = "fill")
```

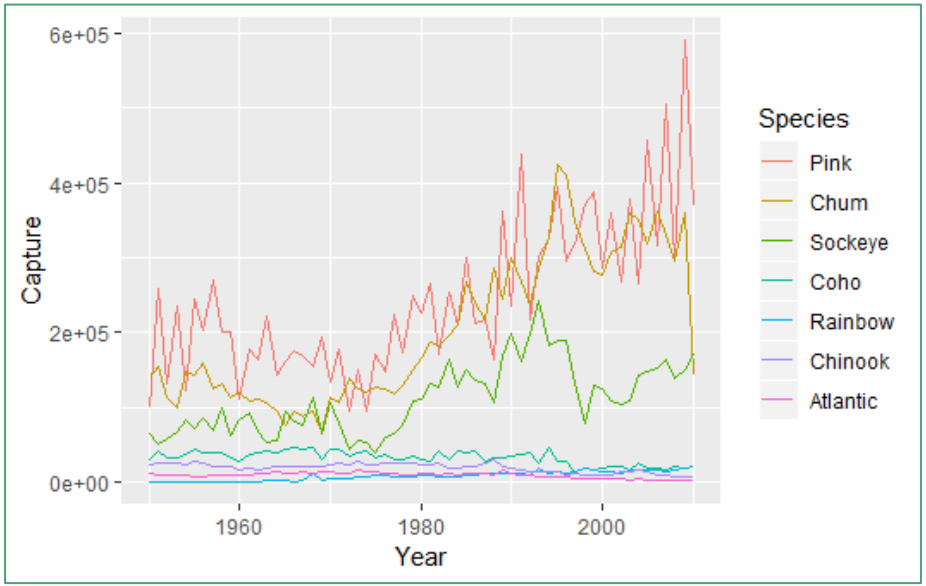
ggplot2 - gráfico de linha

```
load("fish.RData")
str(fish.tidy)
ggplot(fish.tidy,aes(x=Year, y=Capture, linetype = Species)) +
geom_line()
```



ggplot2 - gráfico de linha

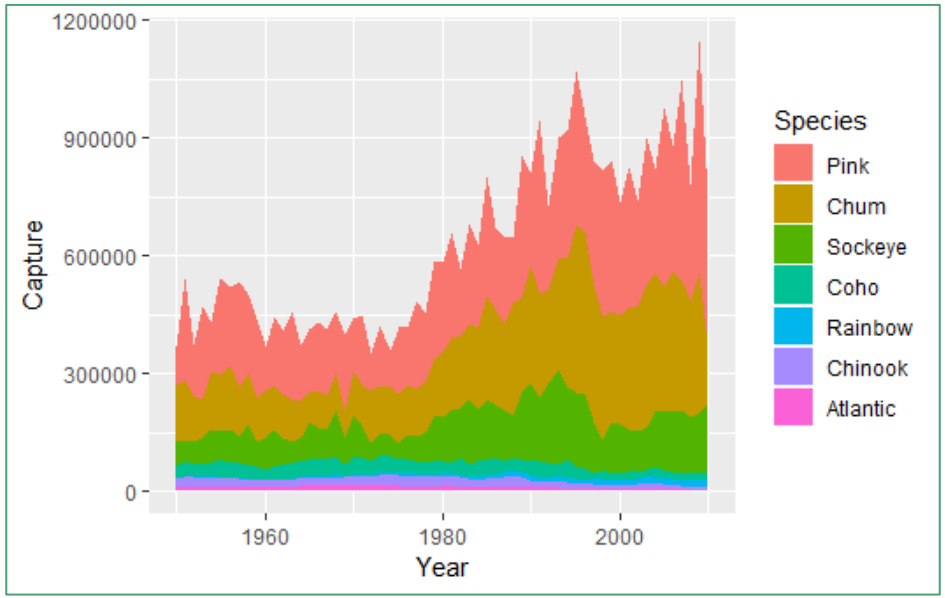
```
load("fish.RData")
str(fish.tidy)
ggplot(fish.tidy,aes(x=Year, y=Capture, col = Species)) +
geom_line()
```



ggplot2 - gráfico de área

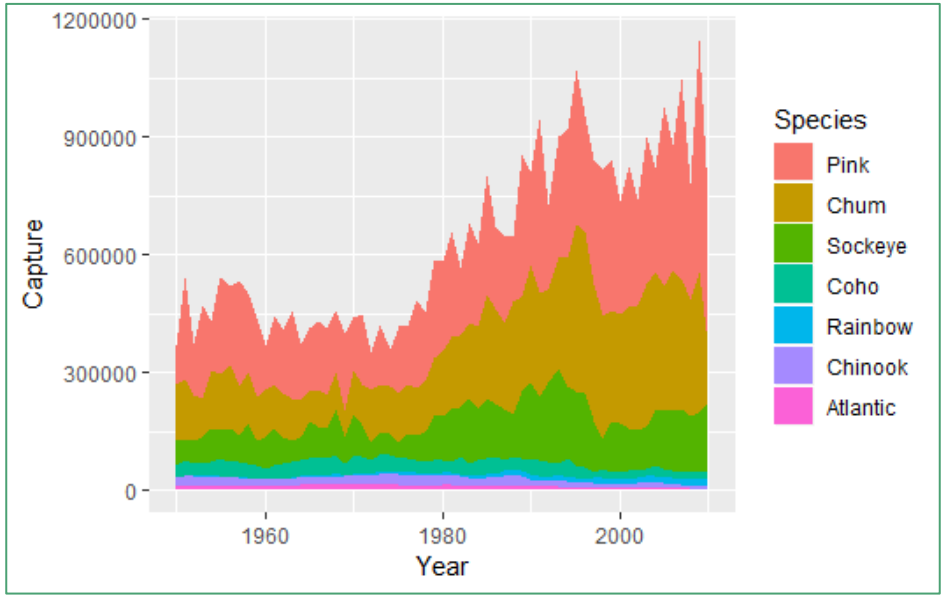
Exercício

Plote o gráfico abaixo usando o **ggplot2** e os dados **`fish.tidy`**:



ggplot2 - gráfico de área

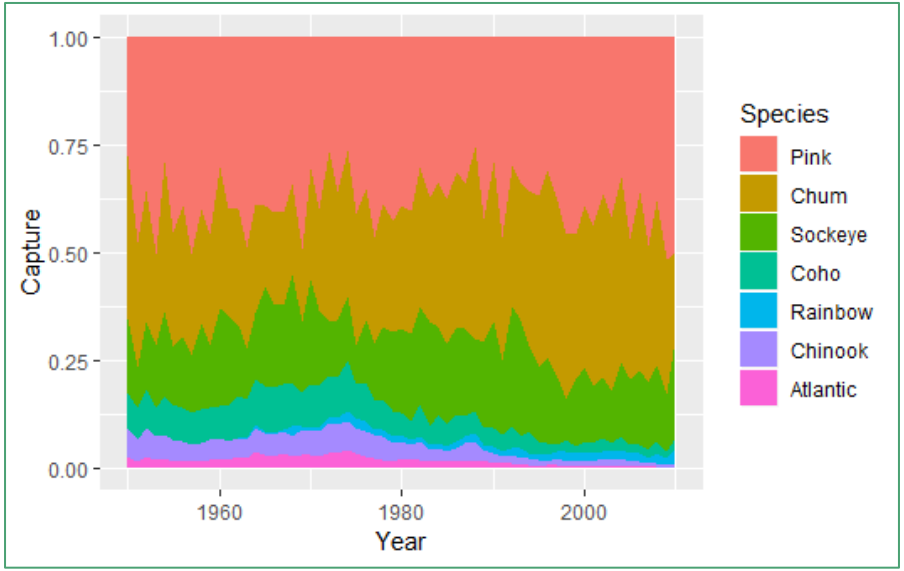
```
load(fish.RData)
str(fish.tidy)
ggplot(fish.tidy,aes(x=Year, y=Capture, fill = Species)) +
geom_area()
```



ggplot2 - gráfico de área

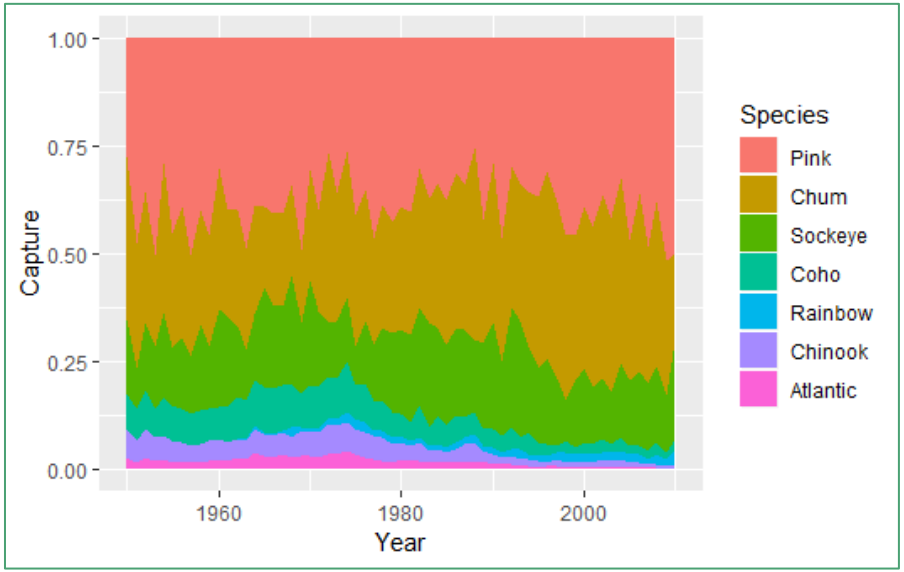
Exercício

Plote o gráfico abaixo usando o **ggplot2** e os dados **`fish.tidy`**:



ggplot2 - gráfico de área

```
load(fish.RData)
str(fish.tidy)
ggplot(fish.tidy,aes(x=Year, y=Capture, fill = Species)) +
geom_area(position = "fill")
```

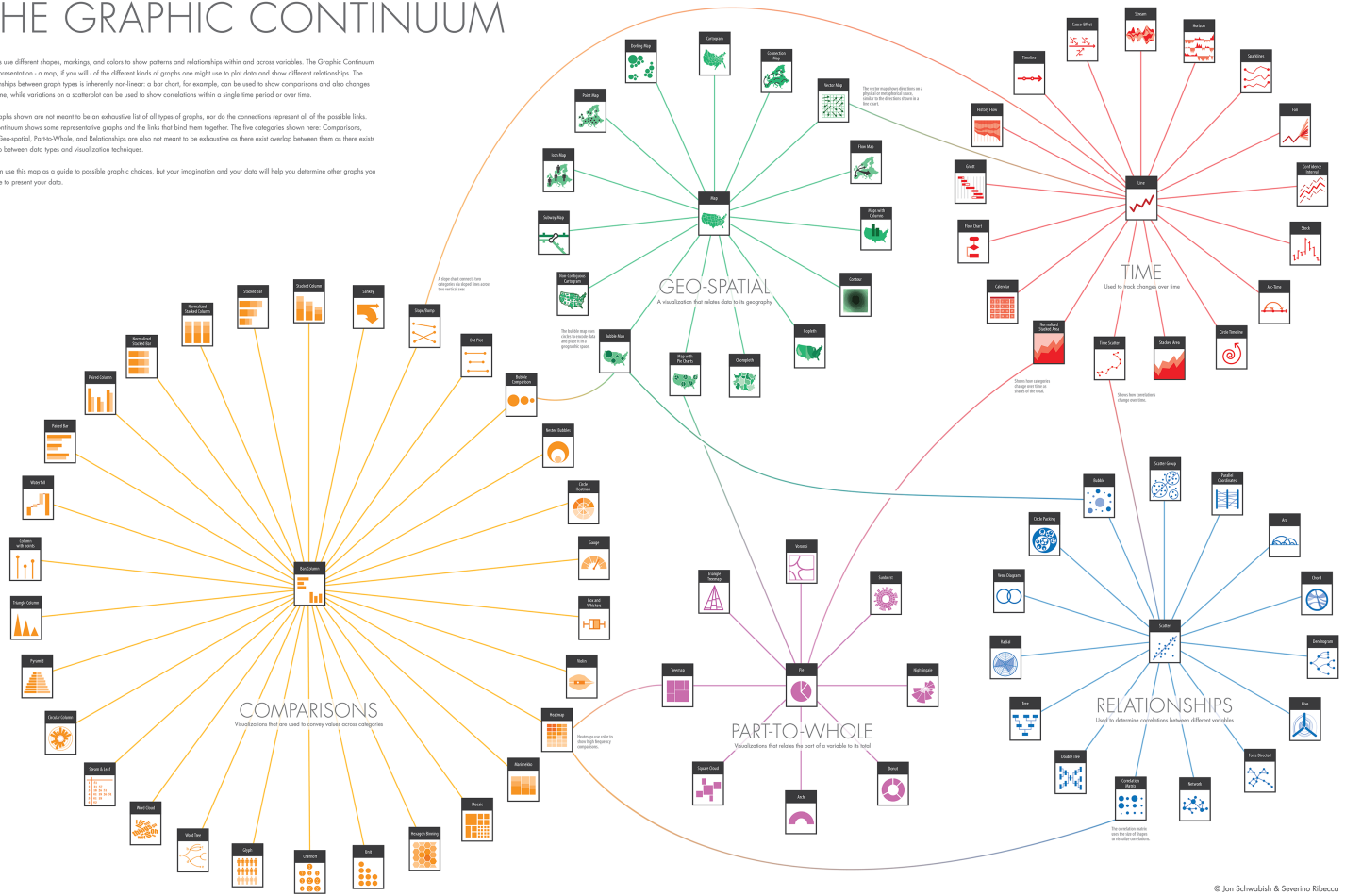


THE GRAPHIC CONTINUUM

Graphs use different shapes, markings, and colors to show patterns and relationships within and across variables. The Graphic Continuum is a representation - a map, if you will - of the different kinds of graphs one might use to plot data and show different relationships. The relationships between graph types is inherently non-linear: a bar chart, for example, can be used to show comparisons and also changes over time, while variations on a scatterplot can be used to show correlations within a single time period or over time.

The graphs shown are not meant to be an exhaustive list of all types of graphs, nor do the connections represent all of the possible links. The Continuum shows some representative graphs and the links that bind them together. The five categories shown here: Comparisons, Time, Geo-spatial, Part-to-Whole, and Relationships are also not meant to be exhaustive as there exist overlap between them as there exists overlap between data types and visualization techniques.

You can use this map as a guide to possible graphic choices, but your imagination and your data will help you determine other graphs you can use to present your data.



https://en.rockcontent.com/blog/graphic-continuum/

Boas Práticas

Cor

- Incompatível com daltônicos (principalmente vermelho e verde)
- Paleta incorreta para o tipo de dados (sequencial, qualitativa e divergente)
- Grupos indistinguíveis (cores muito semelhantes)
- Feio (cores primárias de alta saturação)

Texto

- Ilegível (resolução muito pequena e baixa)
- Não descritivo (i.e., "comprimento" - de quê? Quais unidades?)
- Ausência de texto

Conteúdo informativo

- Muita informação
- Pouca informação
- Nenhuma mensagem ou finalidade clara

Eixos

- Relação de aspecto ruim
- Supressão da origem
- Eixos x ou y quebrados
- Comum, mas não alinhado

Estatísticas

- Visualização não corresponde às estatísticas reais

Boas Práticas

Geometrias

- Tipo de plotagem errado
- Orientação incorreta

Non-data ink **(tudo o que não é do próprio dado)**

- Uso inadequado

Gráficos 3D

- Problemas perceptivos
- Terceiro eixo inútil

Use seu bom senso:

Existe algo no meu gráfico que obscurece uma leitura clara do dados ou a mensagem?

Referências

- Aula baseada no curso “**Data Visualization with ggplot2 (Part 1)**” de Rick Scavetta: https://www.datacamp.com/courses/data-visualization-with-ggplot2-1

- Ciência de Dados com R – IBPAD: https://www.ibpad.com.br/o-que-fazemos/publicacoes/introducao-ciencia-de-dados-com-r/

- Tidyverse: https://ggplot2.tidyverse.org/index.html (link para cheat sheet!)

- R for data Science: https://r4ds.had.co.nz/

- https://skillgaze.com/2017/10/31/understanding-different-visualization-layers-of-ggplot/