

Introduction

INTRODUCTION TO DATA VISUALIZATION WITH GGPLOT2



Rick Scavetta

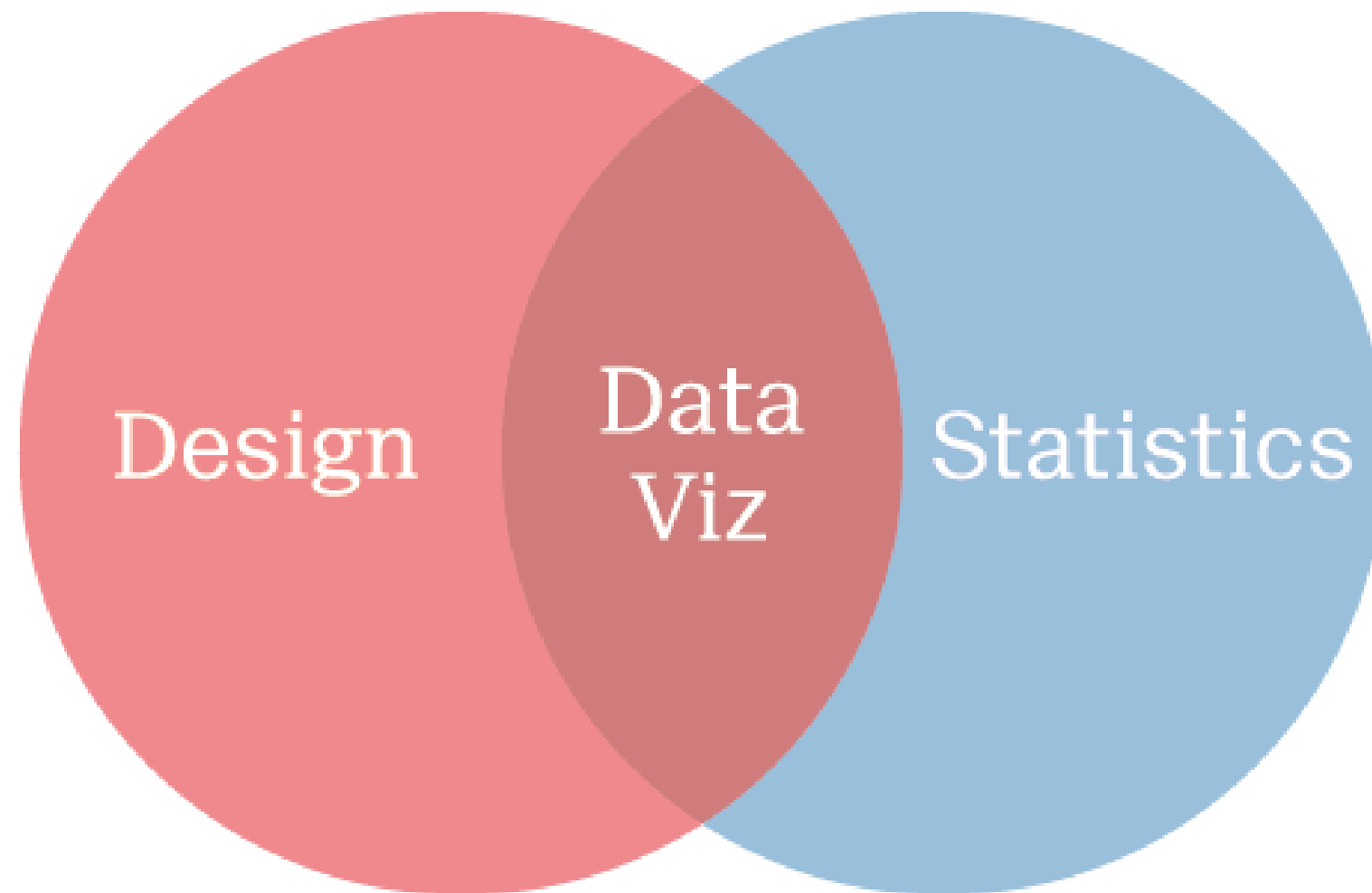
Founder, Scavetta Academy

Your instructor - Rick Scavetta

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- Twitter: [@Rick_Scavetta](https://twitter.com/Rick_Scavetta)

Data visualization & data science

- A core skill in Data Science.



Exploratory versus explanatory



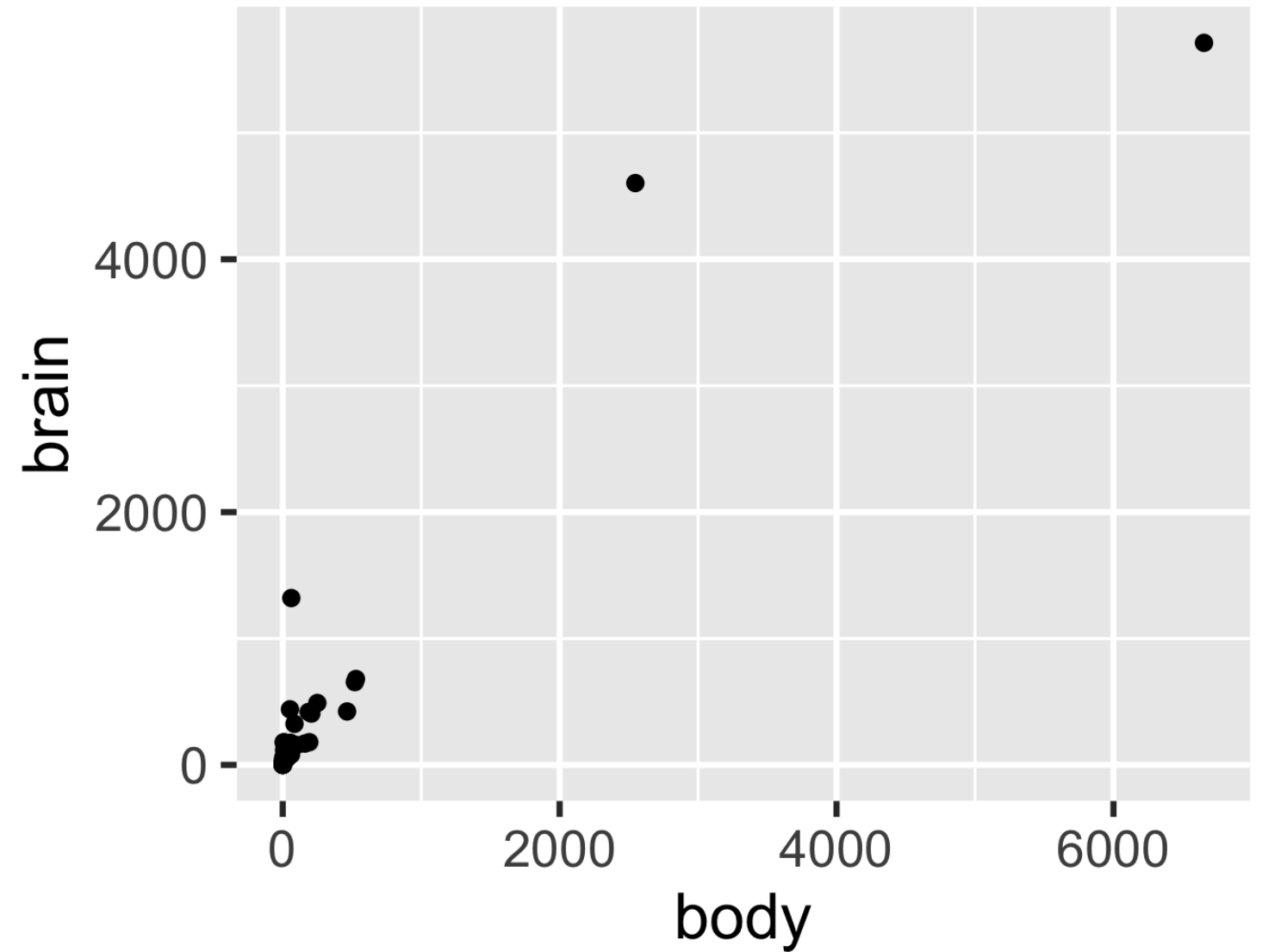
MASS::mammals

MASS::mammals

	body	brain
Arctic fox	3.385	44.50
Owl monkey	0.480	15.50
Mountain beaver	1.350	8.10
Cow	465.000	423.00
Grey wolf	36.330	119.50
Goat	27.660	115.00
Roe deer	14.830	98.20
...		
Pig	192.000	180.00
Echidna	3.000	25.00
Brazilian tapir	160.000	169.00
Tenrec	0.900	2.60
Phalanger	1.620	11.40
Tree shrew	0.104	2.50
Red fox	4.235	50.40

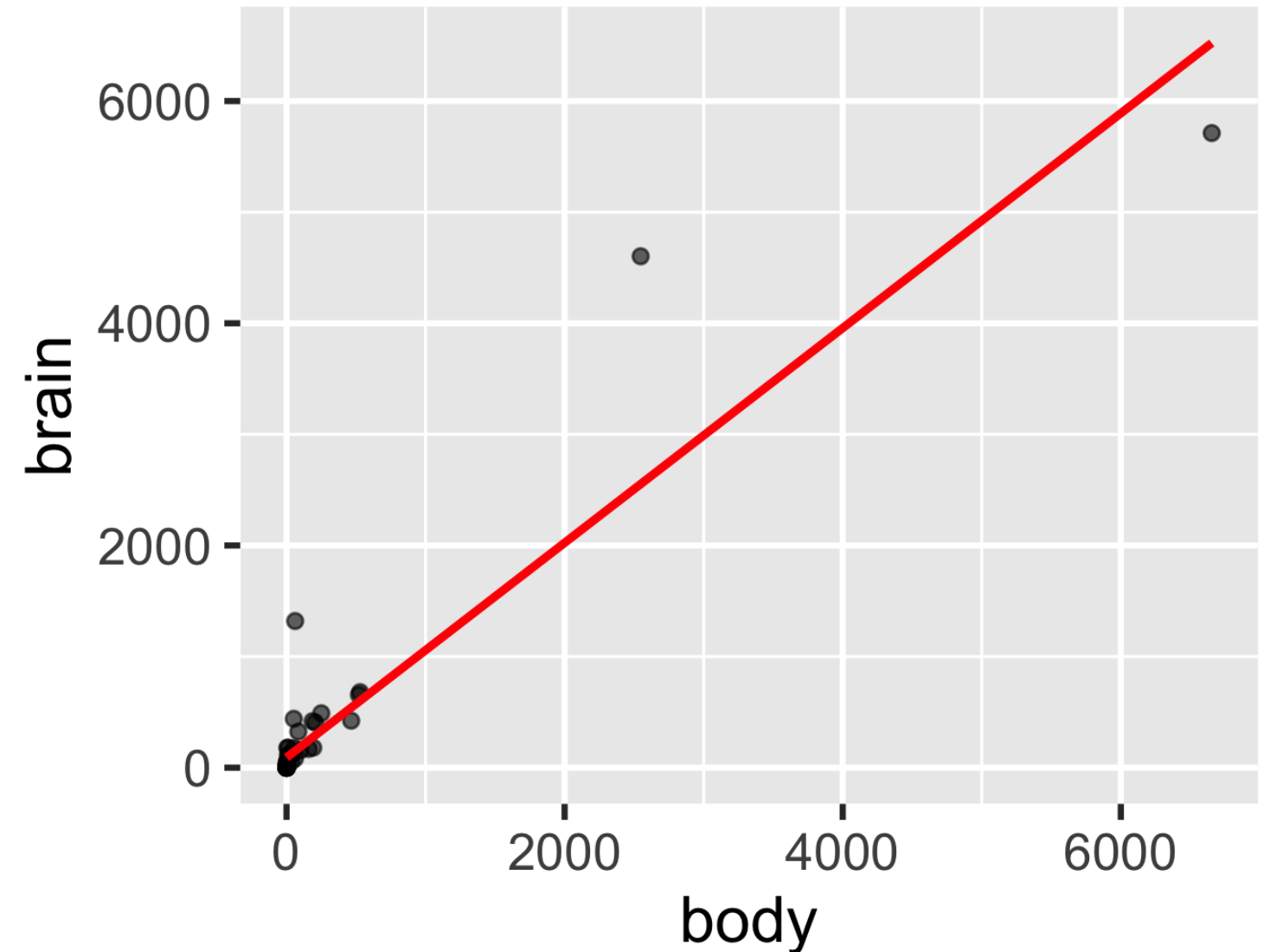
A scatter plot

```
ggplot(mammals, aes(x = body, y = brain))  
  geom_point()
```



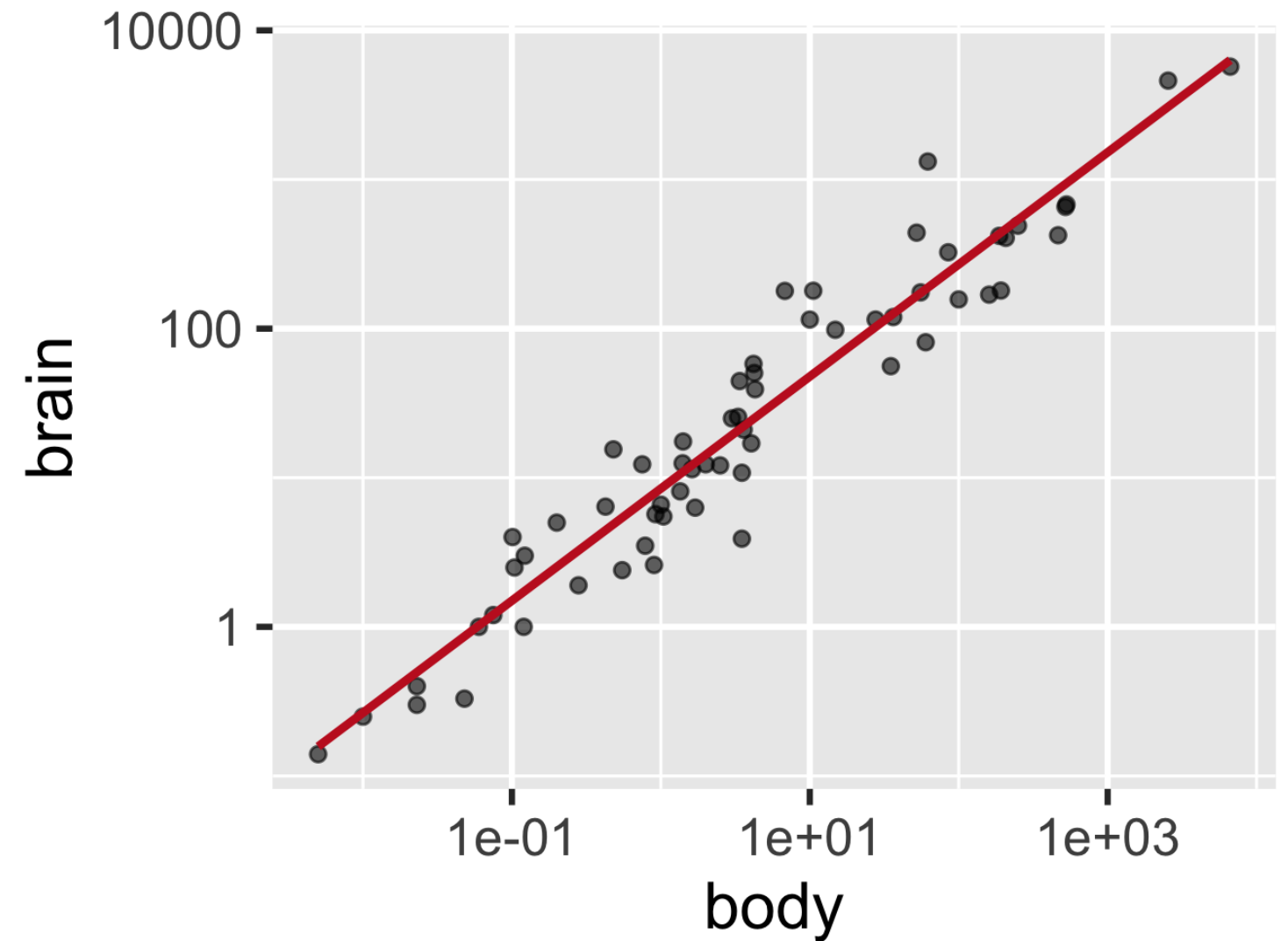
Explore with a linear model

```
ggplot(mammals, aes(x = body, y = brain))  
  geom_point(alpha = 0.6) +  
  stat_smooth(  
    method = "lm",  
    color = "red",  
    se = FALSE  
  )
```

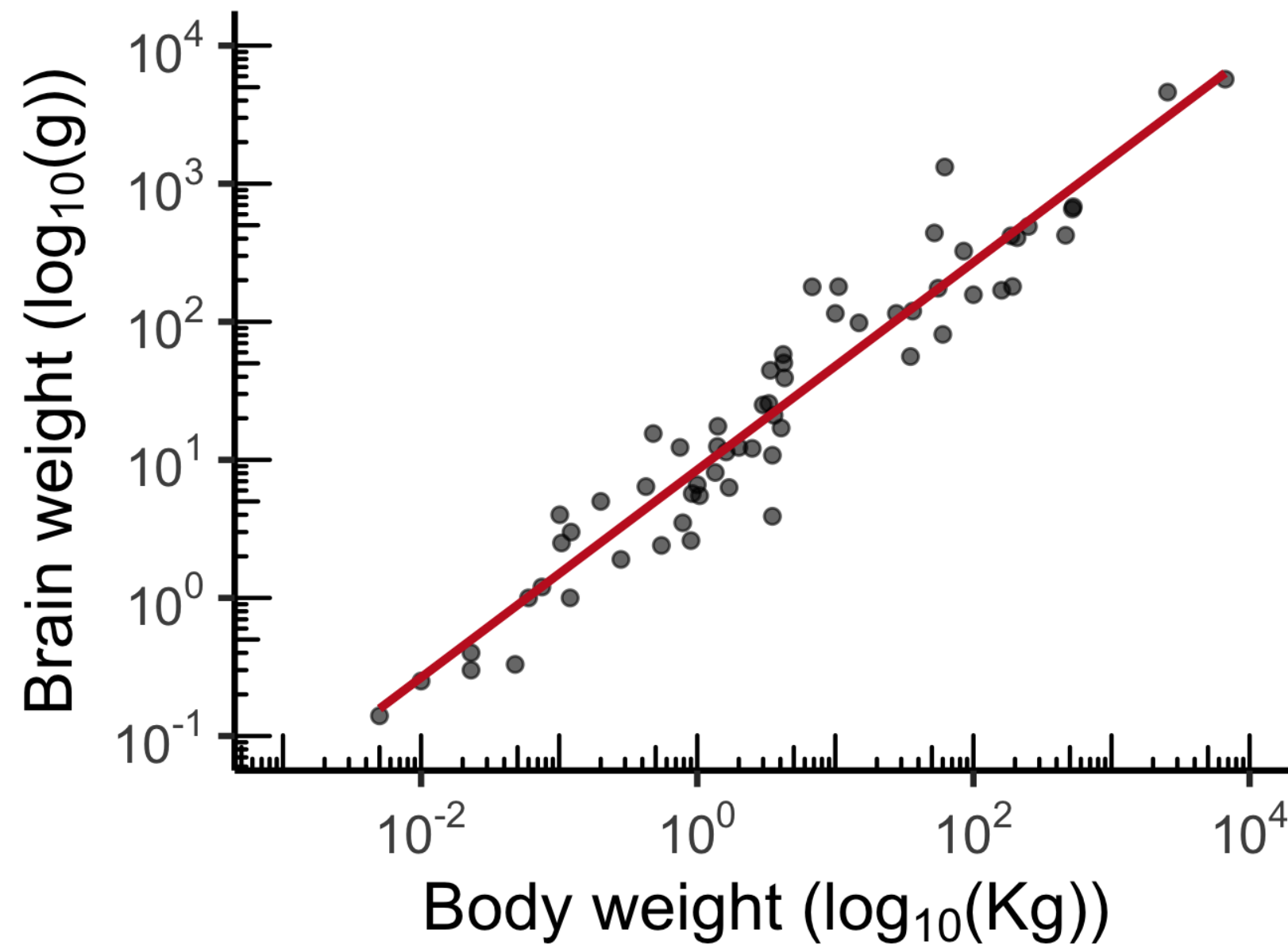


Explore: fine-tuning

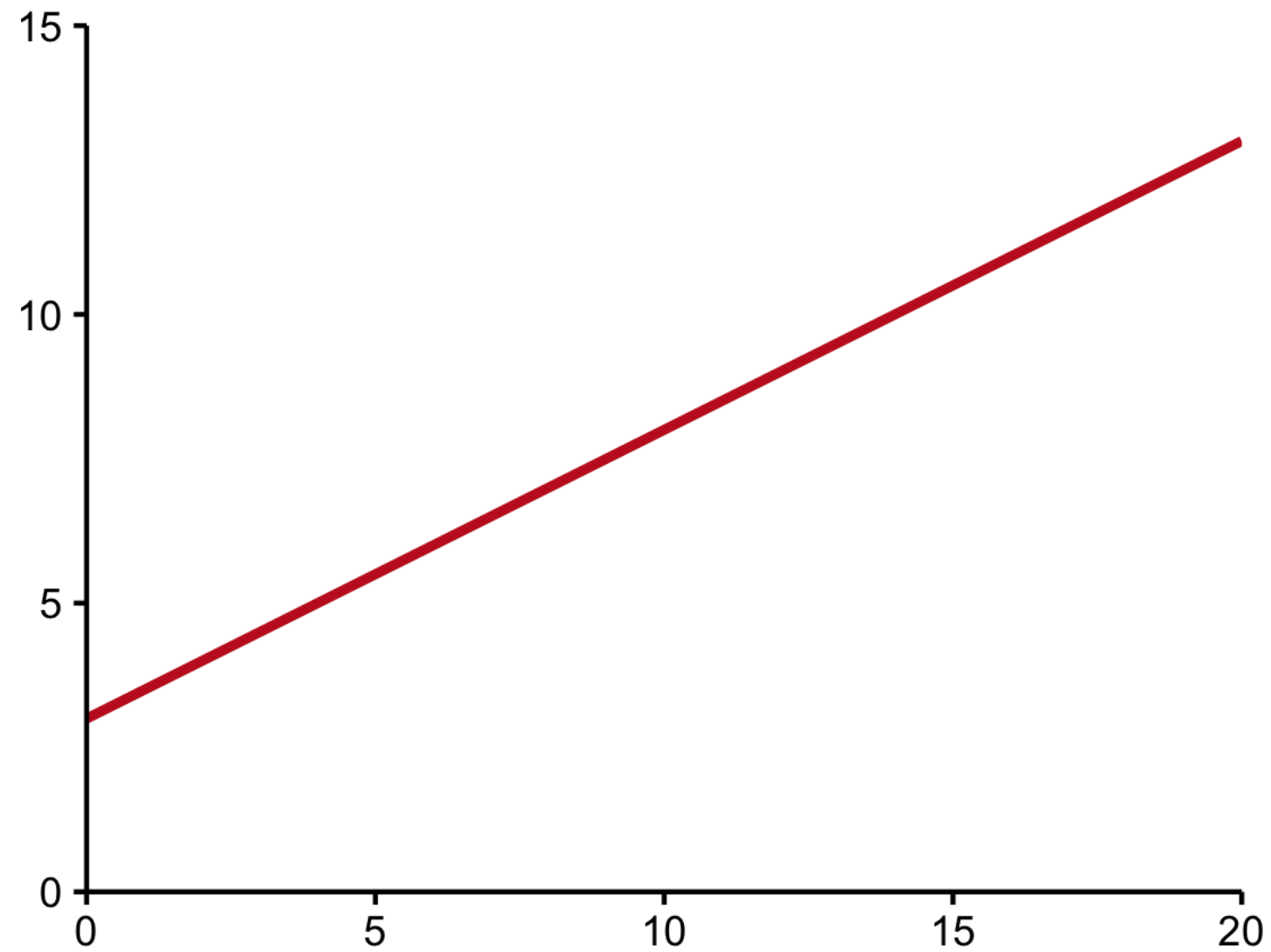
```
ggplot(mammals, aes(x = body, y = brain))  
  geom_point(alpha = 0.6) +  
  coord_fixed() +  
  scale_x_log10() +  
  scale_y_log10() +  
  stat_smooth(  
    method = "lm",  
    color = "#C42126",  
    se = FALSE,  
    size = 1  
  )
```



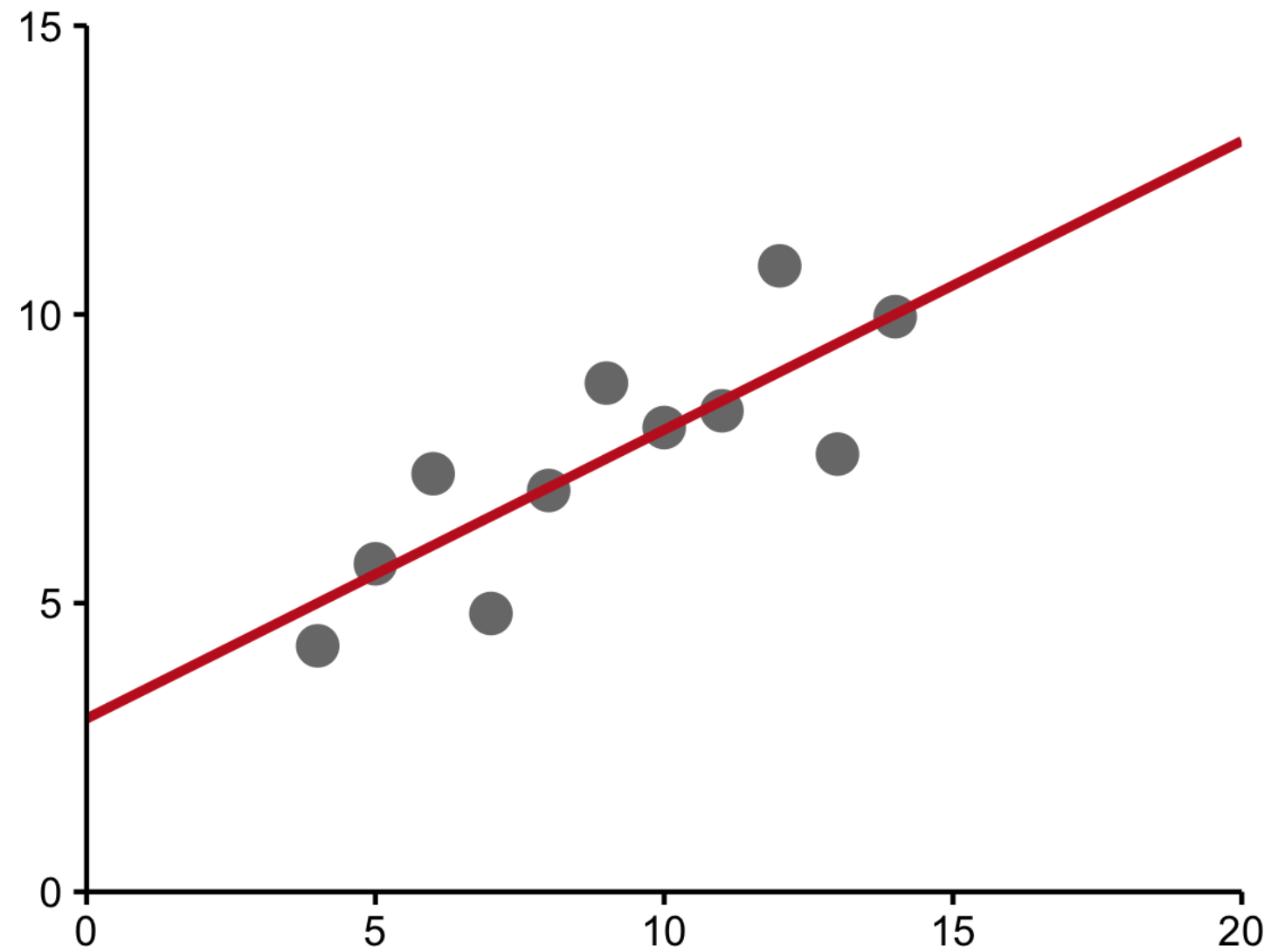
Publication-ready plot



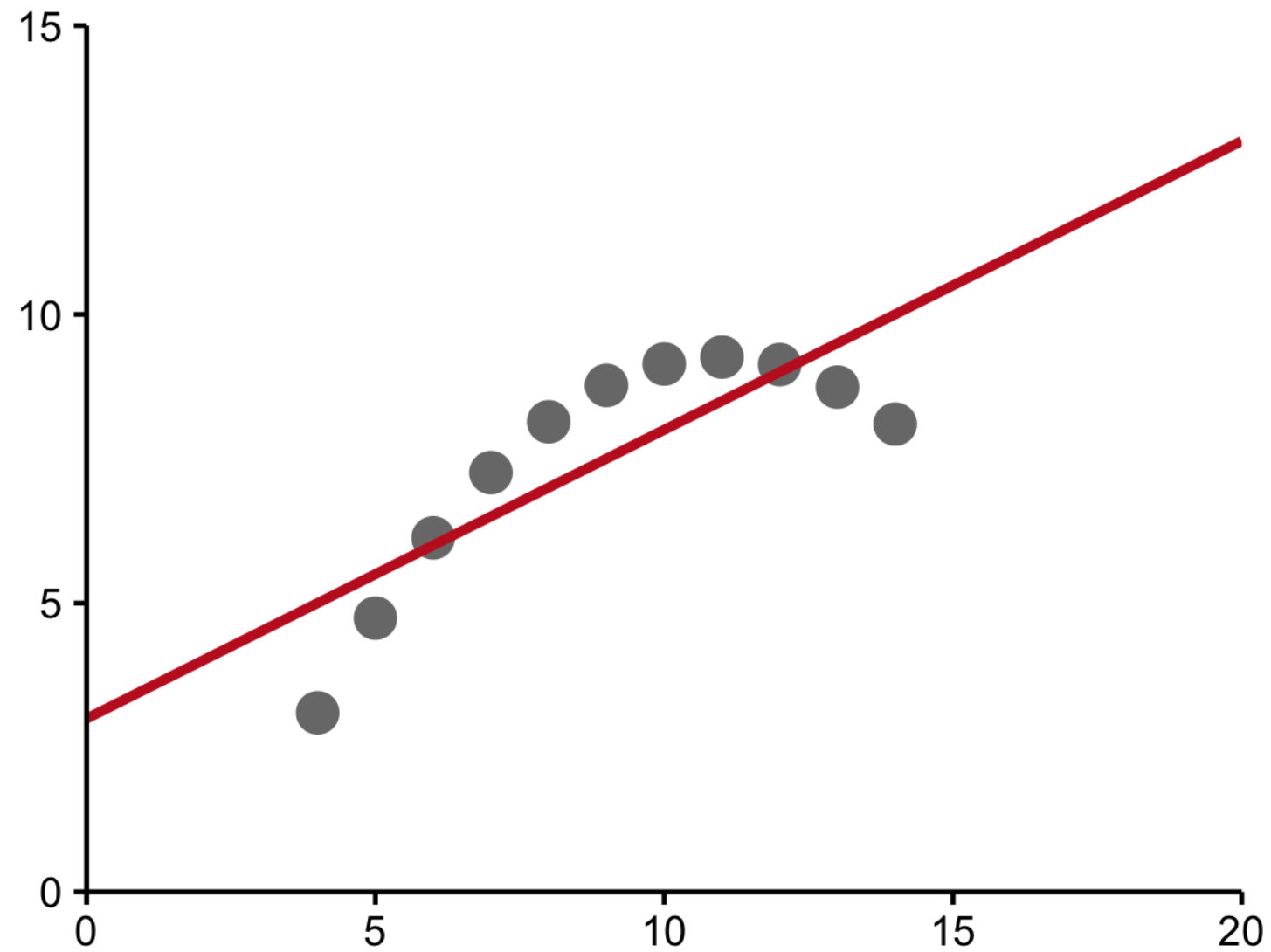
Anscombe's plots



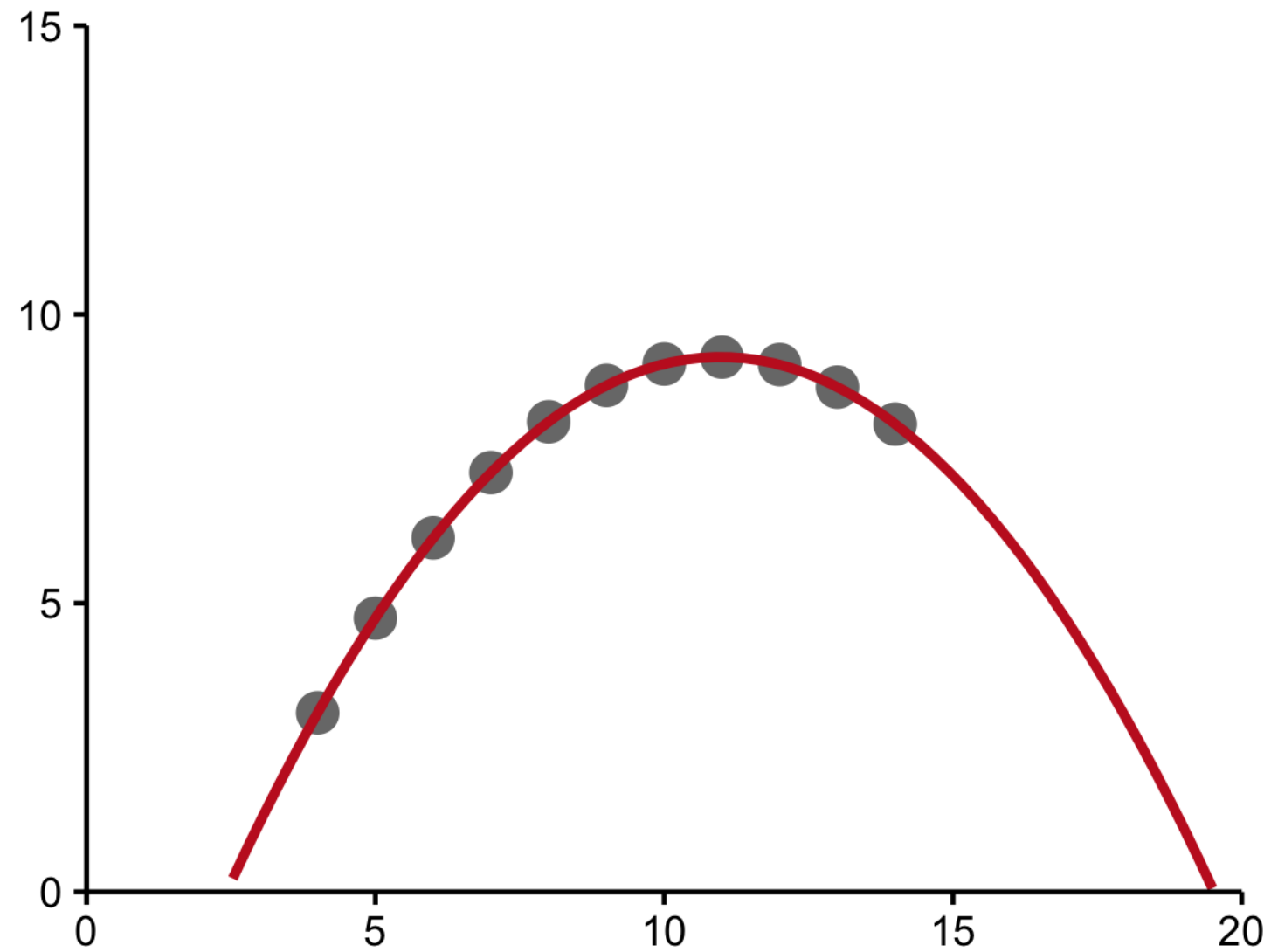
Anscombe's plots



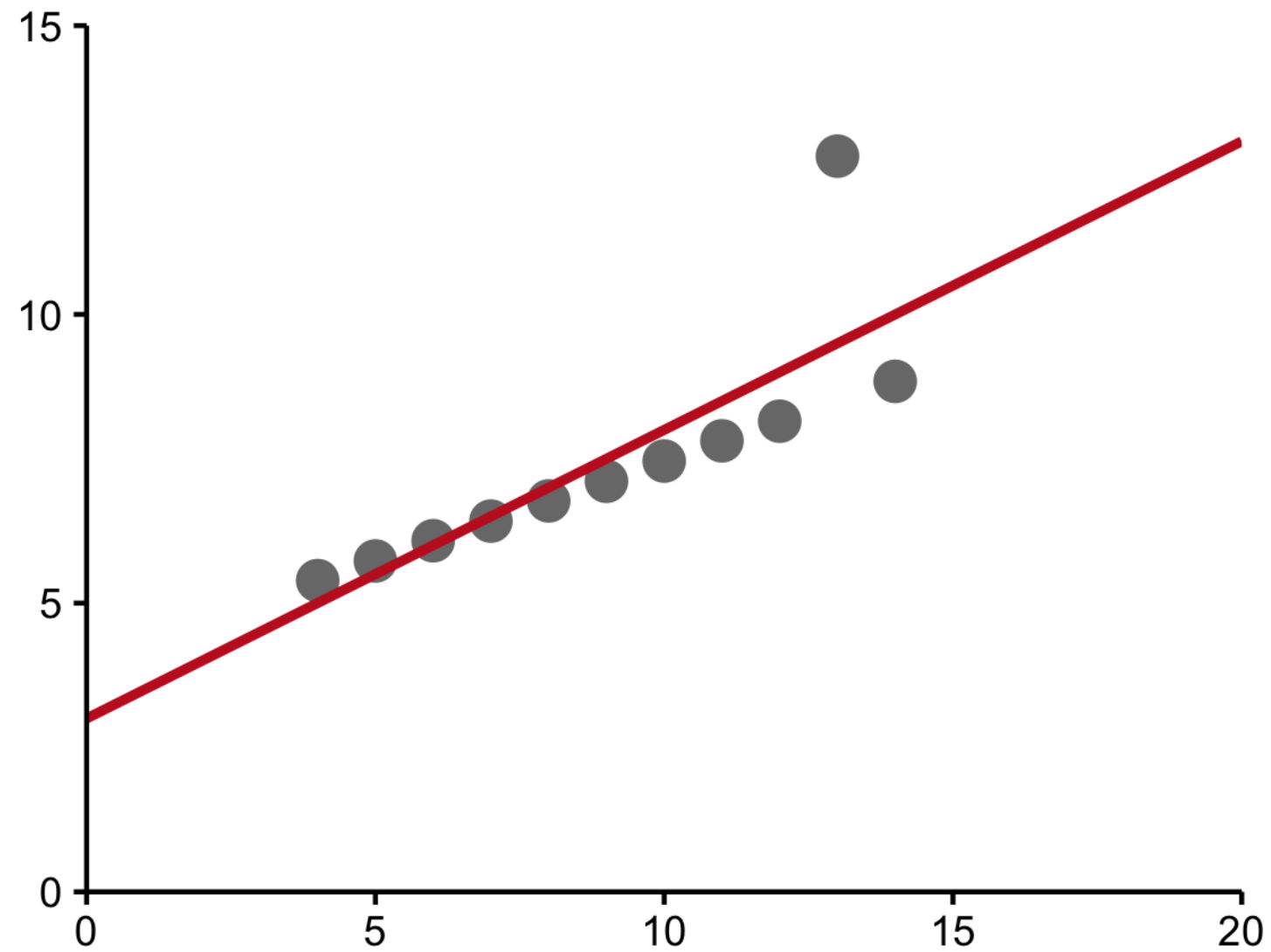
Anscombe's plots



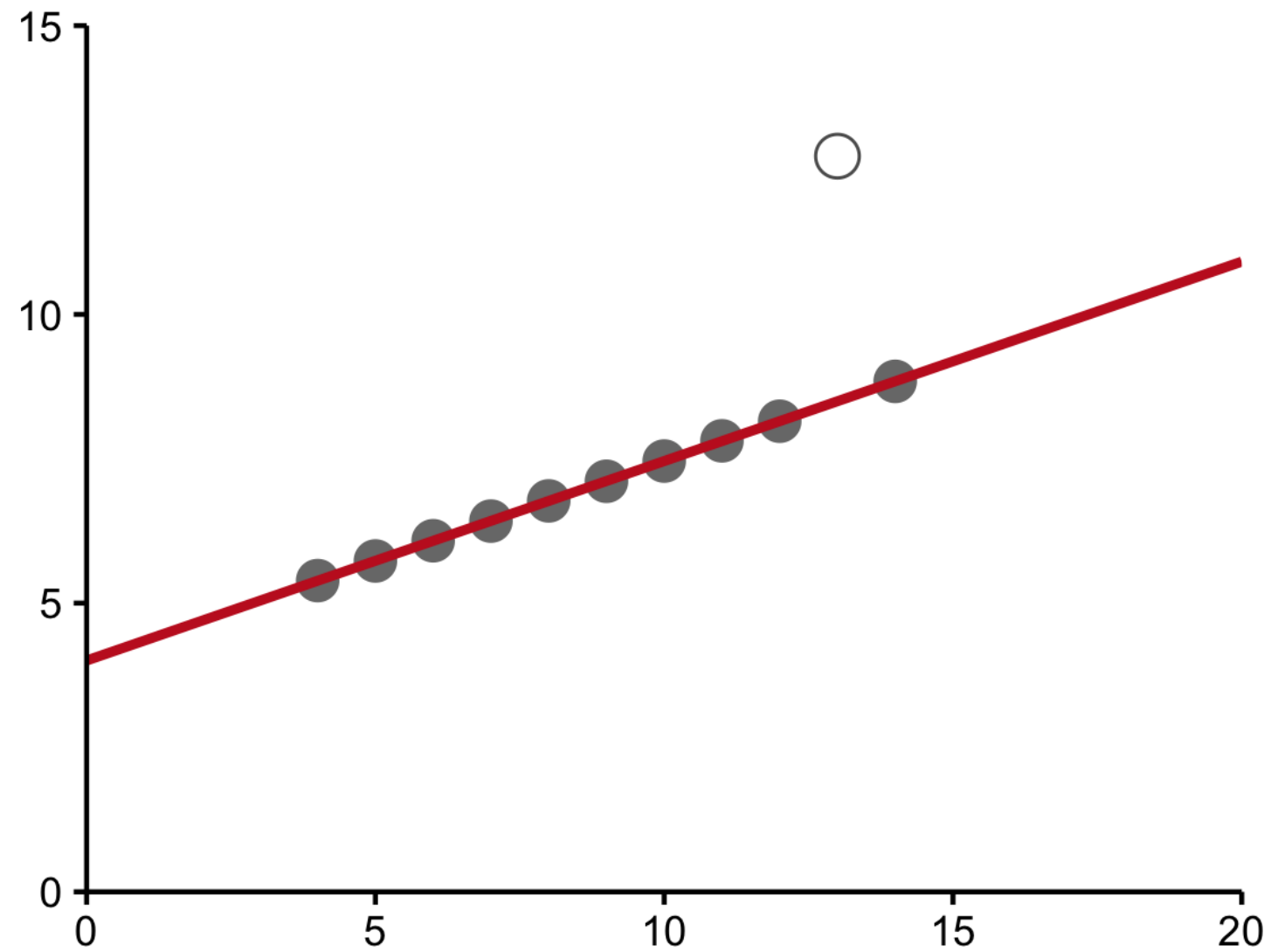
Anscombe's plots



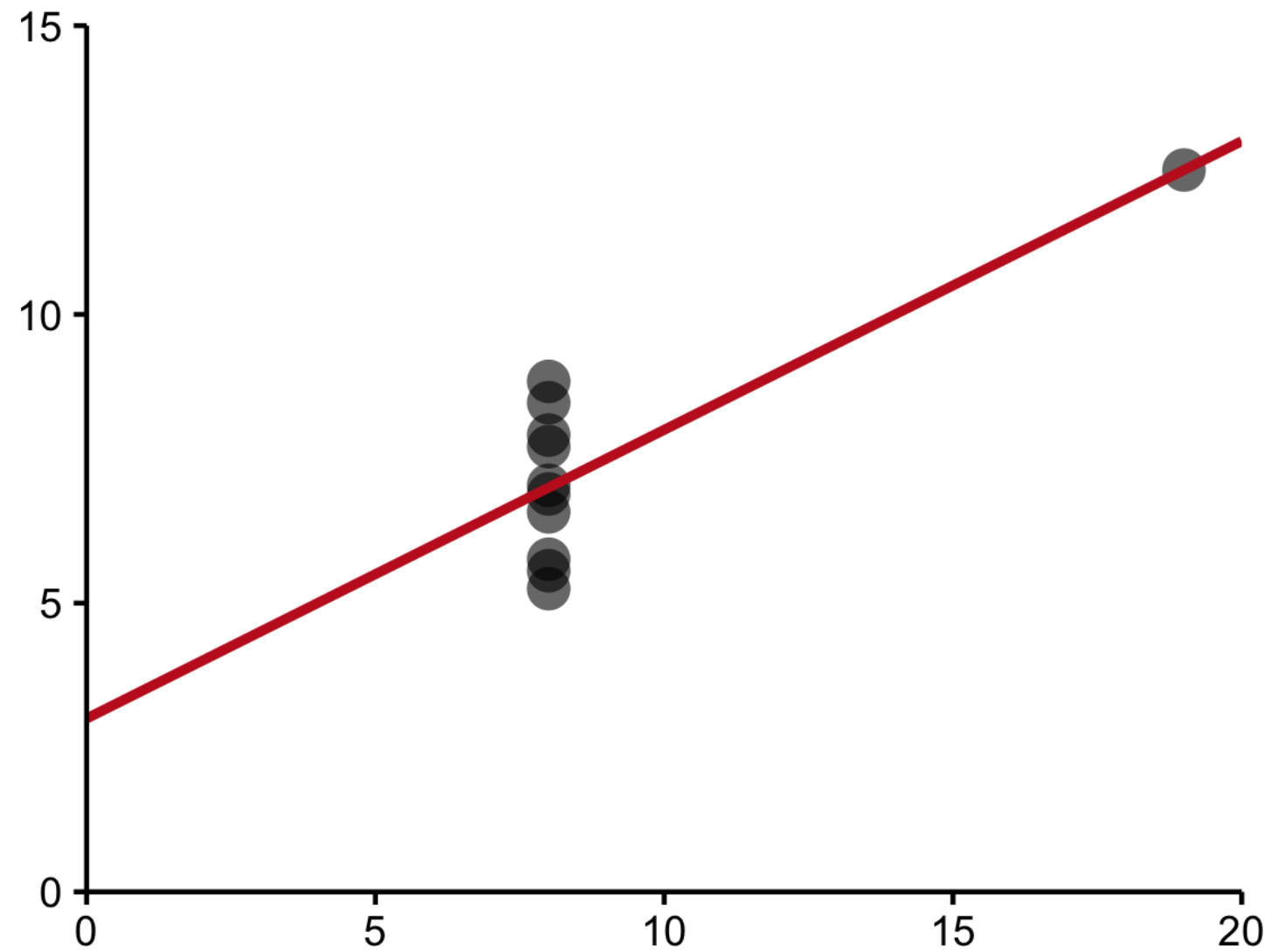
Anscombe's plots



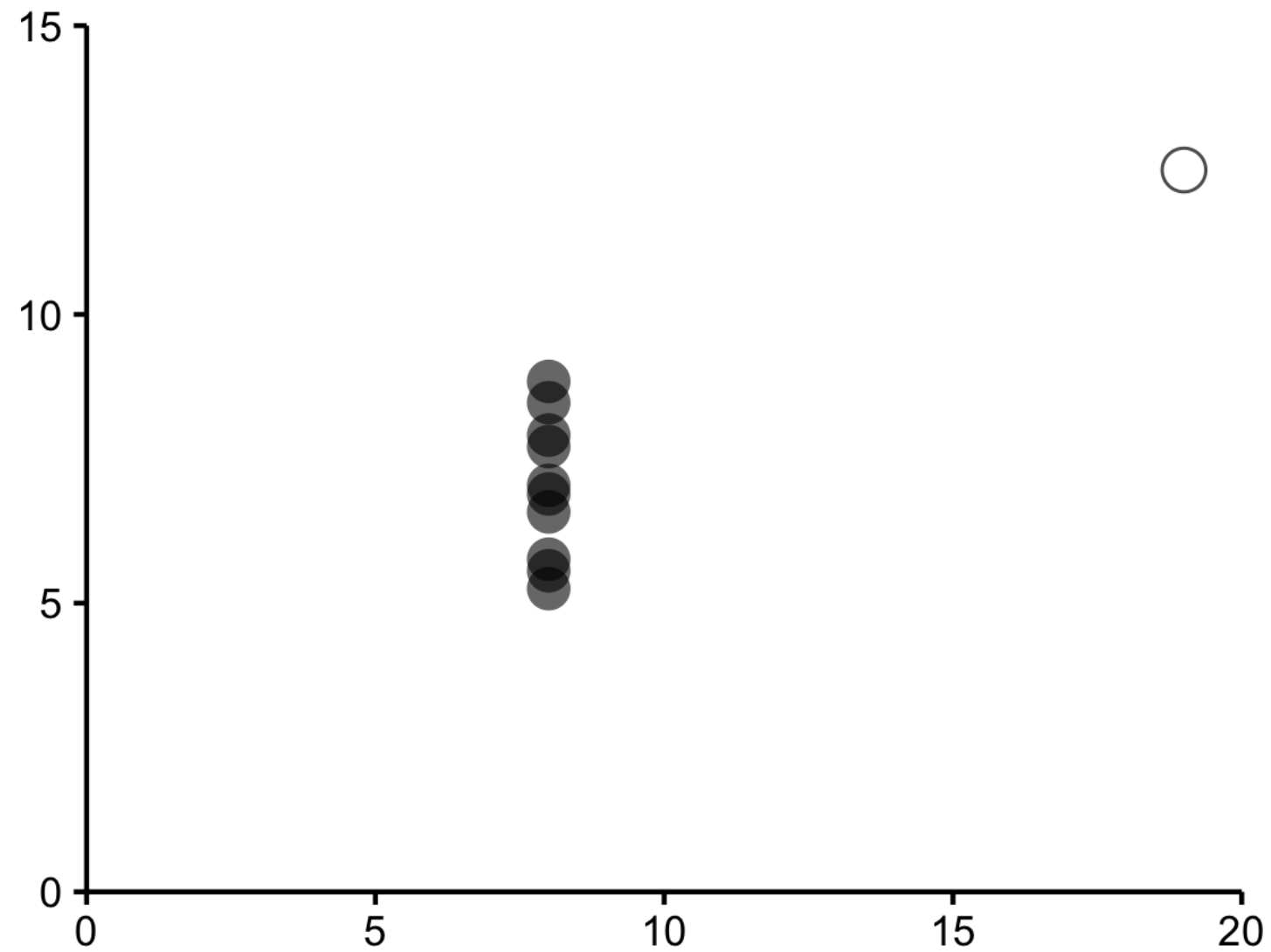
Anscombe's plots



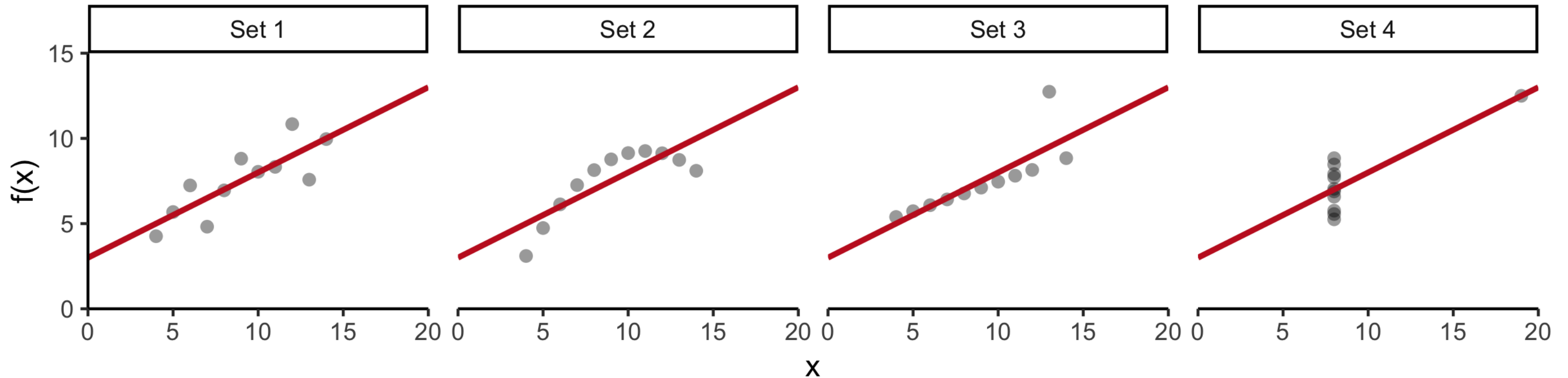
Anscombe's plots



Anscombe's plots



Anscombe's plots



Let's practice!

INTRODUCTION TO DATA VISUALIZATION WITH GGPLOT2

The grammar of graphics

INTRODUCTION TO DATA VISUALIZATION WITH GGPLOT2



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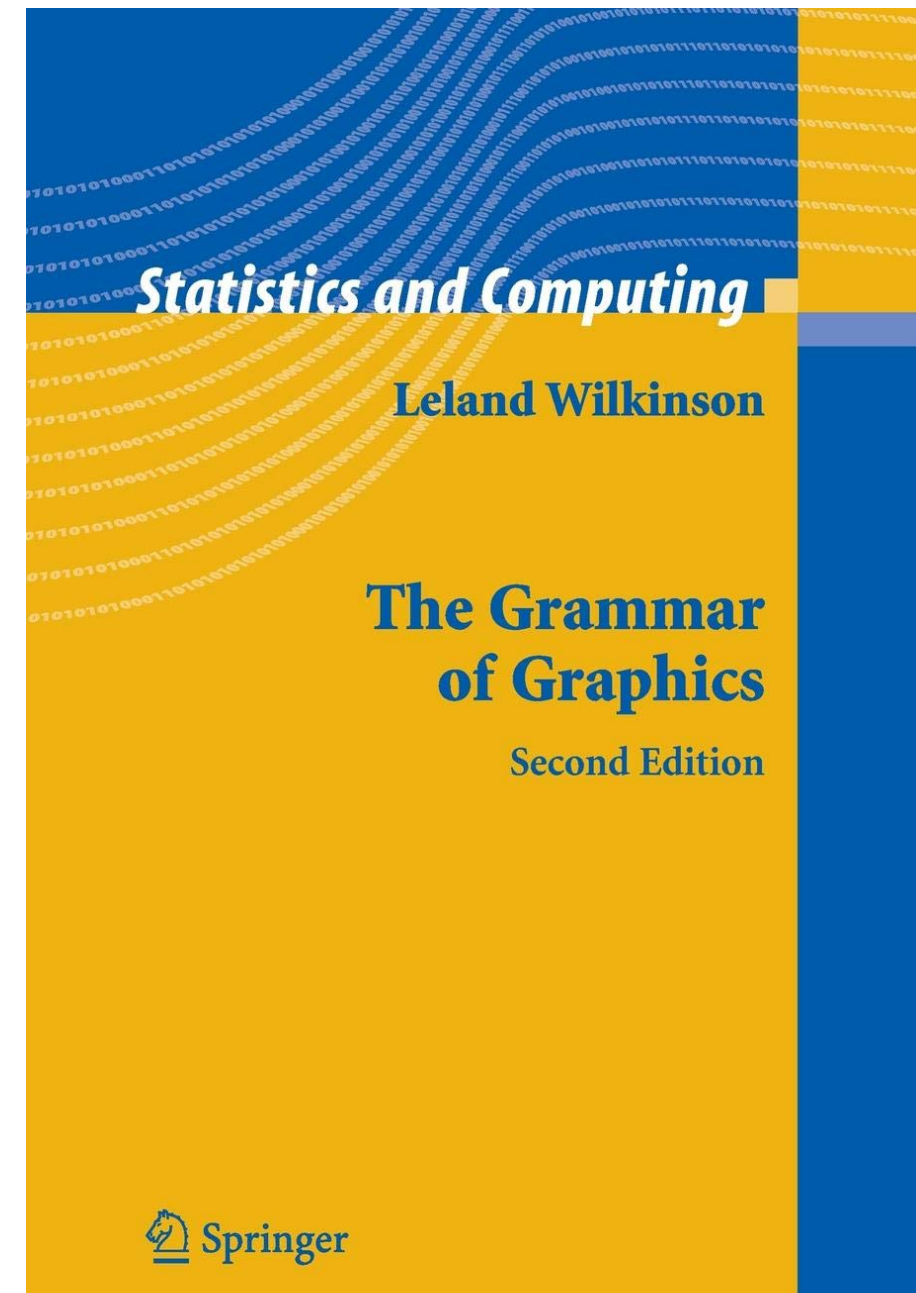
The quick brown fox jumps over the lazy dog

The quick brown fox jumps over the lazy dog

Article	<i>The</i>	<i>A</i>	<i>The</i>
Adjective	<i>quick brown</i>	<i>rabid red</i>	
Noun	<i>fox</i>	<i>fox</i>	<i>Hunter</i>
Verb	<i>jumps</i>	<i>bit</i>	<i>shot</i>
Preposition	<i>over</i>		
Article	<i>the</i>	<i>the</i>	<i>the</i>
Adjective	<i>lazy</i>	<i>friendly</i>	<i>rabid red</i>
Noun	<i>dog.</i>	<i>dog.</i>	<i>fox.</i>

Grammar of graphics

- Plotting framework
- Leland Wilkinson, Grammar of Graphics, 1999
- 2 principles
 - Graphics = distinct layers of grammatical elements
 - Meaningful plots through aesthetic mappings



The three essential grammatical elements

Element	Description
Data	The data-set being plotted.
Aesthetics	The scales onto which we <i>map</i> our data.
Geometries	The visual elements used for our data.

Course 1: core competency

Element	Description
Data	The data-set being plotted.
Aesthetics	The scales onto which we <i>map</i> our data.
Geometries	The visual elements used for our data.
Themes	All non-data ink.

The seven grammatical elements

Element	Description
Data	The data-set being plotted.
Aesthetics	The scales onto which we <i>map</i> our data.
Geometries	The visual elements used for our data.
Themes	All non-data ink.
Statistics	Representations of our data to aid understanding.
Coordinates	The space on which the data will be plotted.
Facets	Plotting small multiples.

Jargon for each element

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

Course 2: Tools for EDA

- Remaining 3 layers
- Best practices for Data Viz

Course 3: The Next Level

- Advanced plot types
- Plots for special data types
 - Graphics of large data
 - Geospatial plots
 - Networks
 - Sankey
- Animation as a tool for exploration

Course 4: Programming with ggplot2

- Programming with ggplot2 and tidyeval
- Creating custom geoms
- Interactivity
- In-depth case study

Let's practice!

INTRODUCTION TO DATA VISUALIZATION WITH GGPLOT2

ggplot2 layers

INTRODUCTION TO DATA VISUALIZATION WITH GGLOT2



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Founder, Scavetta Academy

ggplot2 package

- The grammar of graphics implemented in R
- Two key concepts:
 1. Layer grammatical elements
 2. Aesthetic mappings

Data

Data

A large orange parallelogram graphic, tilted to the right, positioned to the right of the word 'Data'.

Iris dataset

Setosa



Versicolor



Virginica



- ¹ Fisher, R. A. (1936) The use of multiple measurements in taxonomic problems. Annals of Eugenics, 7, Part II, 179–188.
- ² Anderson, Edgar (1935). The irises of the Gaspé Peninsula, Bulletin of the American Iris Society, 59, 2–5.

Iris dataset

```
iris
```

```
   Sepal.Length Sepal.Width Petal.Length Petal.Width Species
1           5.1         3.5         1.4         0.2   setosa
2           4.9         3.0         1.4         0.2   setosa
3           4.7         3.2         1.3         0.2   setosa
...
50          5.0         3.3         1.4         0.2   setosa
51          7.0         3.2         4.7         1.4 versicolor
52          6.4         3.2         4.5         1.5 versicolor
53          6.9         3.1         4.9         1.5 versicolor
...
100         5.7         2.8         4.1         1.3 versicolor
101         6.3         3.3         6.0         2.5  virginica
102         5.8         2.7         5.1         1.9  virginica
103         7.1         3.0         5.9         2.1  virginica
...
150         5.9         3.0         5.1         1.8  virginica
```

Aesthetics

Aesthetics
Data



Iris aesthetics

Species	Sepal.Length	Sepal.Width	Petal.Length	Petal.Width
	X	Y		

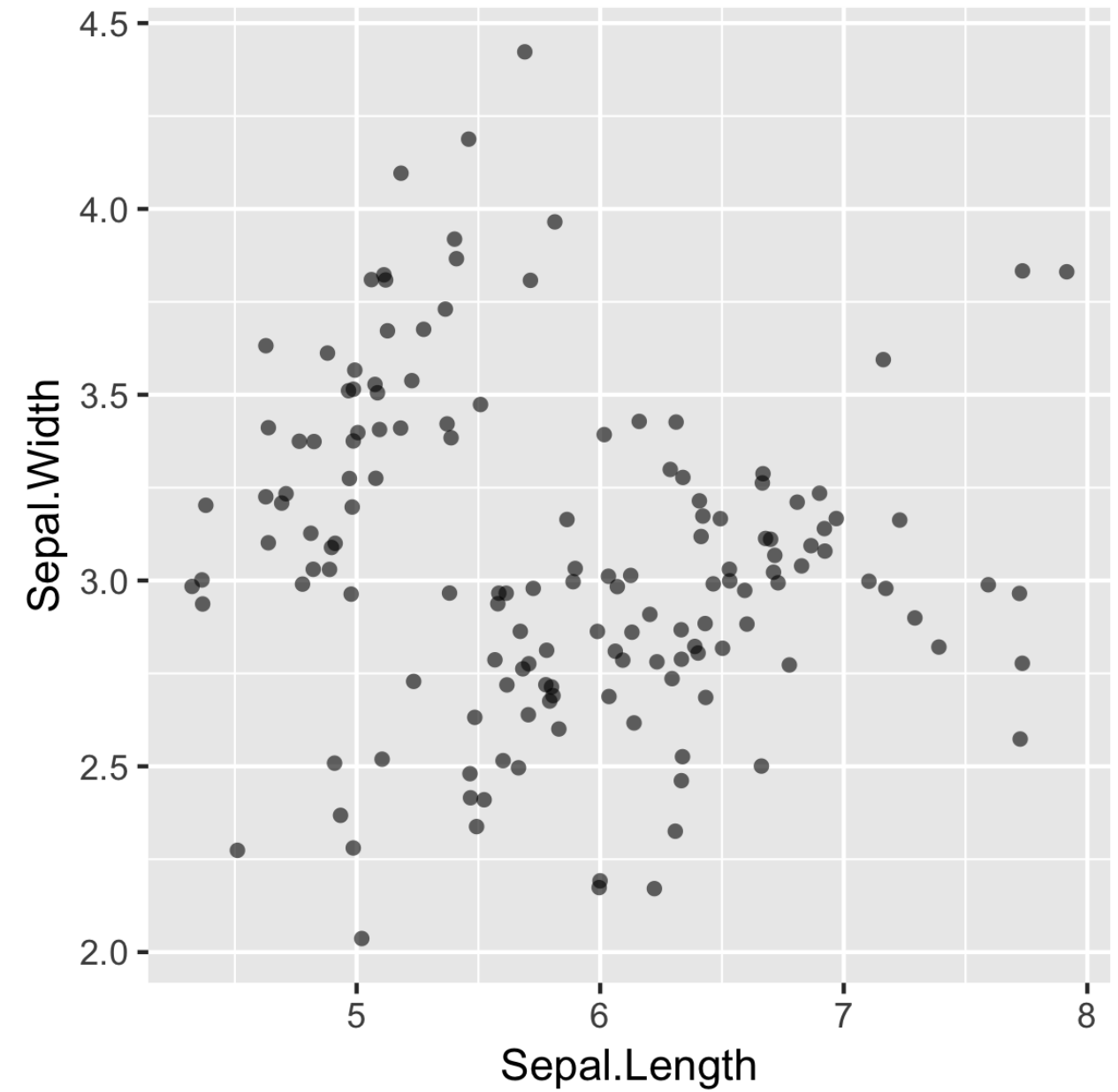
Geometries

Geometries
Aesthetics
Data



Iris geometries

```
g <- ggplot(iris, aes(x = Sepal.Length, y = Sepal.Width)) +  
  geom_jitter()  
g
```



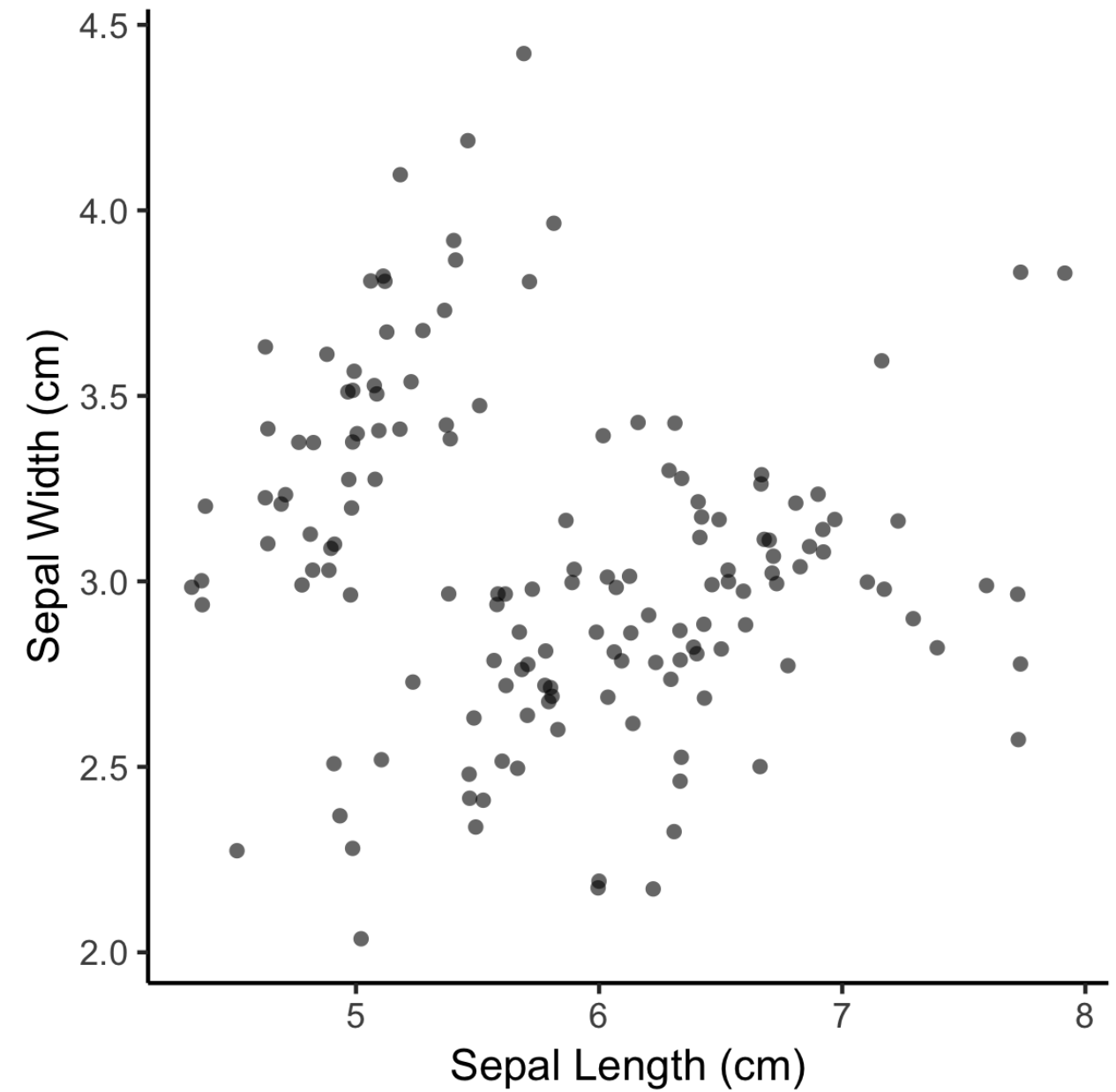
Themes

Theme
Geometries
Aesthetics
Data



Iris themes

```
g <- g +  
  labs(x = "Sepal Length (cm)", y = "Sepal Width (cm)")  
  theme_classic()  
g
```



Let's practice!

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