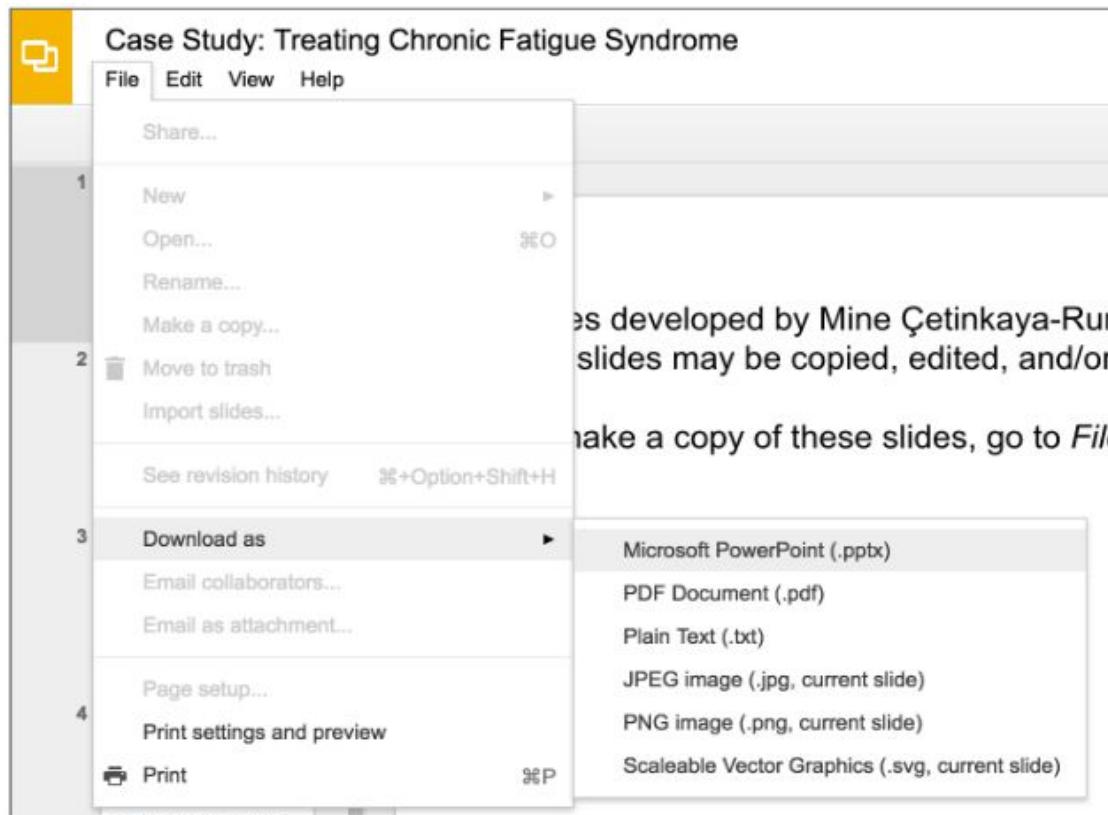


Slides developed by Mine Çetinkaya-Rundel of OpenIntro.

Translated from LaTeX to Google Slides by Curry Hilton of OpenIntro.

The slides may be copied, edited, and/or shared via the [CC BY-SA license](#).

To make a copy of these slides, go to *File > Download as > [option]*, as shown below. Or if you are logged into a Google account, you can choose *Make a copy...* to create your own version in Google Drive.



Data Basics

Classroom survey

A survey was conducted on students in an introductory statistics course. Below are a few of the questions on the survey, and the corresponding variables the data from the responses were stored in:

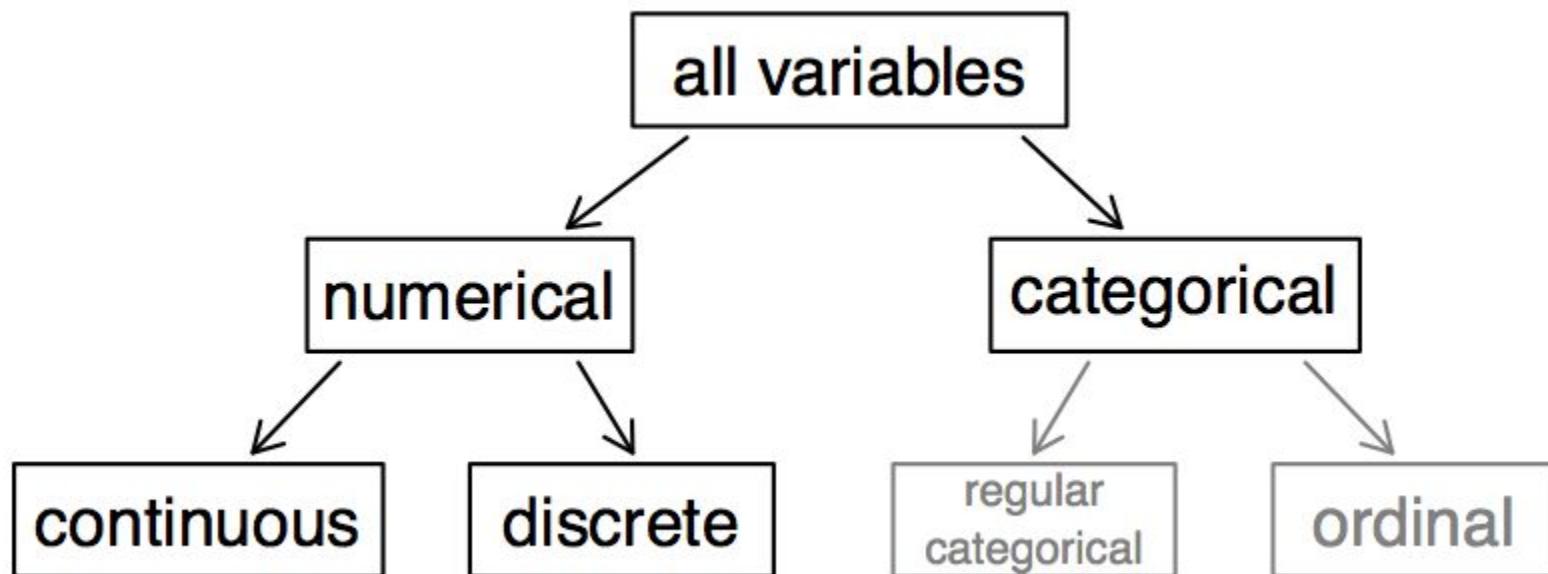
- **gender**: What is your gender?
- **intro_extra**: Are you an introvert or an extrovert?
- **sleep**: How many hours do you sleep at night, on average?
- **bedtime**: What time do you usually go to bed?
- **countries**: How many countries have you visited?
- **dread**: On a scale of 1-5, how much do you dread being here?

Data matrix

Data collected on students in a statistics class on a variety of variables:

		<i>variable</i>			
Stu.	gender	intro_extra	...	dread	
1	male	extravert	...	3	
2	female	extravert	...	2	
3	female	introvert	...	4	←
4	female	extravert	...	2	<i>observation</i>
:	:	:	:	:	
86	male	extravert	...	3	

Types of variables



Types of variables (cont.)

	gender	sleep	bedtime	countries	dread
1	male	5	12-2	13	3
2	female	7	10-12	7	2
3	female	5.5	12-2	1	4
4	female	7	12-2		2
5	female	3	12-2	1	3
6	female	3	12-2	9	4

- gender:

Types of variables (cont.)

	gender	sleep	bedtime	countries	dread
1	male	5	12-2	13	3
2	female	7	10-12	7	2
3	female	5.5	12-2	1	4
4	female	7	12-2		2
5	female	3	12-2	1	3
6	female	3	12-2	9	4

- gender: *categorical*

Types of variables (cont.)

	gender	sleep	bedtime	countries	dread
1	male	5	12-2	13	3
2	female	7	10-12	7	2
3	female	5.5	12-2	1	4
4	female	7	12-2		2
5	female	3	12-2	1	3
6	female	3	12-2	9	4

- gender: *categorical*
- sleep:

Types of variables (cont.)

	gender	sleep	bedtime	countries	dread
1	male	5	12-2	13	3
2	female	7	10-12	7	2
3	female	5.5	12-2	1	4
4	female	7	12-2		2
5	female	3	12-2	1	3
6	female	3	12-2	9	4

- **gender**: *categorical*
- **sleep**: *numerical, continuous*

Types of variables (cont.)

	gender	sleep	bedtime	countries	dread
1	male	5	12-2	13	3
2	female	7	10-12	7	2
3	female	5.5	12-2	1	4
4	female	7	12-2		2
5	female	3	12-2	1	3
6	female	3	12-2	9	4

- **gender:** *categorical*
- **sleep:** *numerical, continuous*
- **bedtime:**

Types of variables (cont.)

	gender	sleep	bedtime	countries	dread
1	male	5	12-2	13	3
2	female	7	10-12	7	2
3	female	5.5	12-2	1	4
4	female	7	12-2		2
5	female	3	12-2	1	3
6	female	3	12-2	9	4

- **gender**: *categorical*
- **sleep**: *numerical, continuous*
- **bedtime**: *categorical, ordinal*

Types of variables (cont.)

	gender	sleep	bedtime	countries	dread
1	male	5	12-2	13	3
2	female	7	10-12	7	2
3	female	5.5	12-2	1	4
4	female	7	12-2		2
5	female	3	12-2	1	3
6	female	3	12-2	9	4

- **gender:** *categorical*
- **sleep:** *numerical, continuous*
- **bedtime:** *categorical, ordinal*
- **countries:**

Types of variables (cont.)

	gender	sleep	bedtime	countries	dread
1	male	5	12-2	13	3
2	female	7	10-12	7	2
3	female	5.5	12-2	1	4
4	female	7	12-2		2
5	female	3	12-2	1	3
6	female	3	12-2	9	4

- **gender**: *categorical*
- **sleep**: *numerical, continuous*
- **bedtime**: *categorical, ordinal*
- **countries**: *numerical, discrete*

Types of variables (cont.)

	gender	sleep	bedtime	countries	dread
1	male	5	12-2	13	3
2	female	7	10-12	7	2
3	female	5.5	12-2	1	4
4	female	7	12-2		2
5	female	3	12-2	1	3
6	female	3	12-2	9	4

- **gender**: *categorical*
- **sleep**: *numerical, continuous*
- **bedtime**: *categorical, ordinal*
- **countries**: *numerical, discrete*
- **dread**:

Types of variables (cont.)

	gender	sleep	bedtime	countries	dread
1	male	5	12-2	13	3
2	female	7	10-12	7	2
3	female	5.5	12-2	1	4
4	female	7	12-2		2
5	female	3	12-2	1	3
6	female	3	12-2	9	4

- **gender**: *categorical*
- **sleep**: *numerical, continuous*
- **bedtime**: *categorical, ordinal*
- **countries**: *numerical, discrete*
- **dread**: *categorical, ordinal - could also be used as numerical*

Practice

What type of variable is a telephone area code?

- (a) numerical, continuous
- (b) numerical, discrete
- (c) categorical
- (d) categorical, ordinal

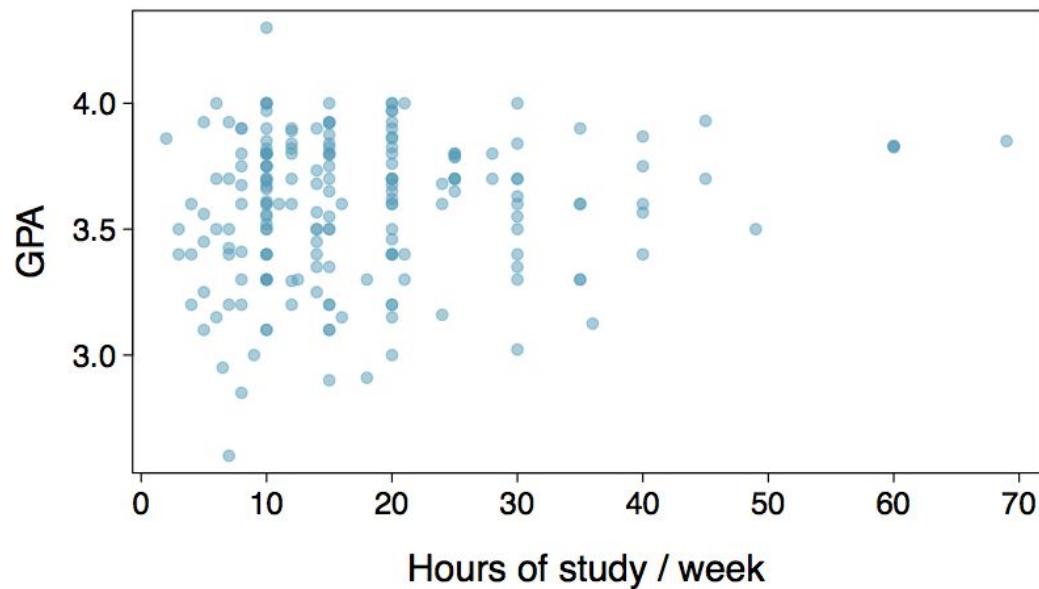
Practice

What type of variable is a telephone area code?

- (a) numerical, continuous
- (b) numerical, discrete
- (c) *categorical*
- (d) categorical, ordinal

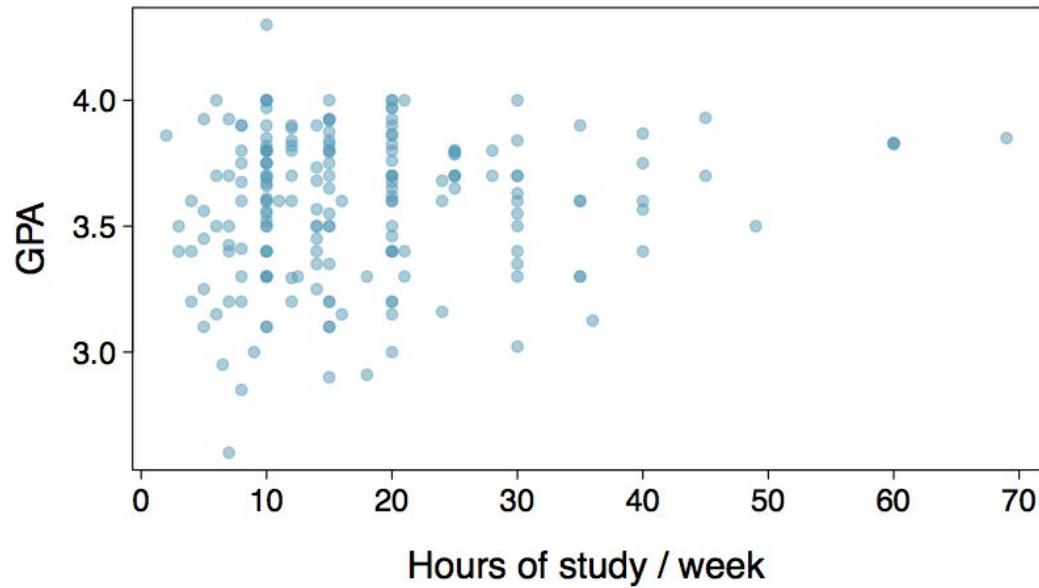
Relationships among variables

Does there appear to be a relationship between the hours of study per week and the GPA of a student?



Relationships among variables

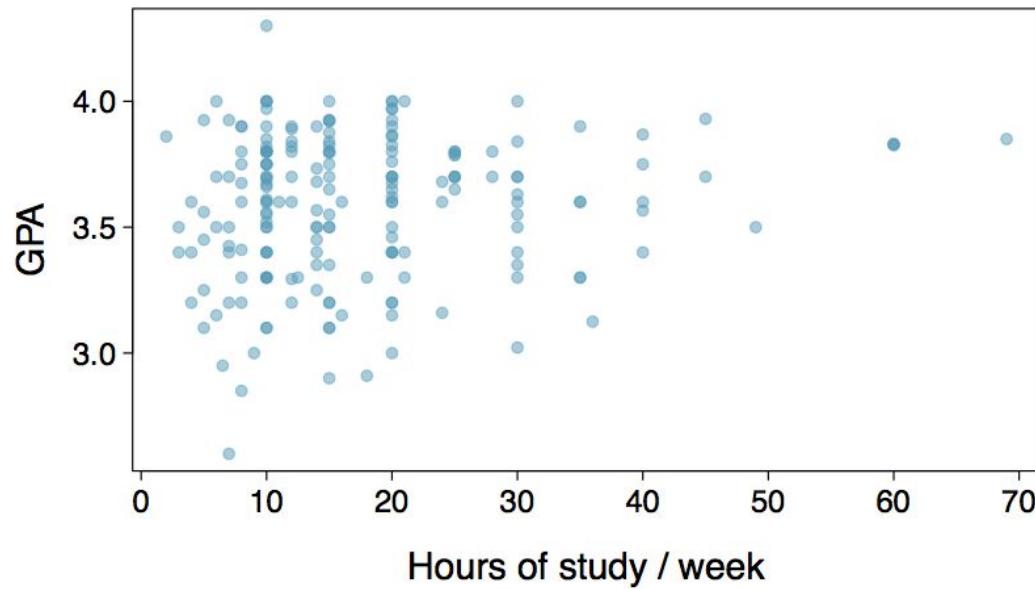
Does there appear to be a relationship between the hours of study per week and the GPA of a student?



Can you spot anything unusual about any of the data points?

Relationships among variables

Does there appear to be a relationship between the hours of study per week and the GPA of a student?

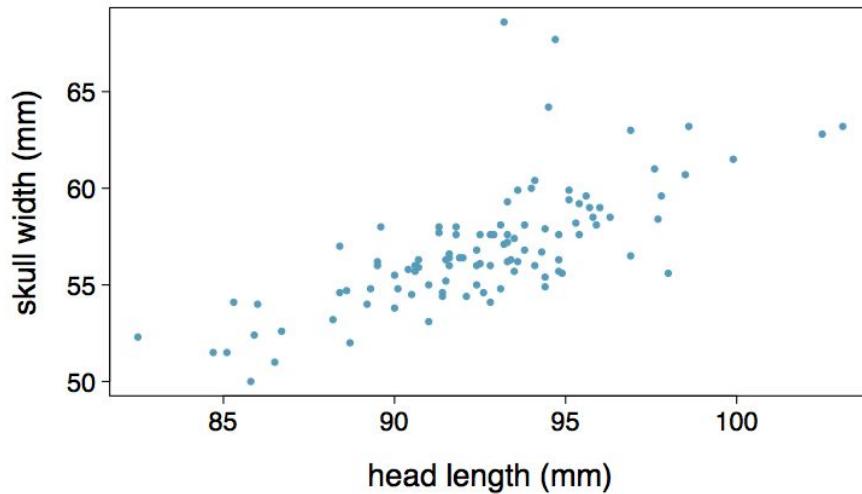


Can you spot anything unusual about any of the data points?

There is one student with $GPA > 4.0$, this is likely a data error.

Practice

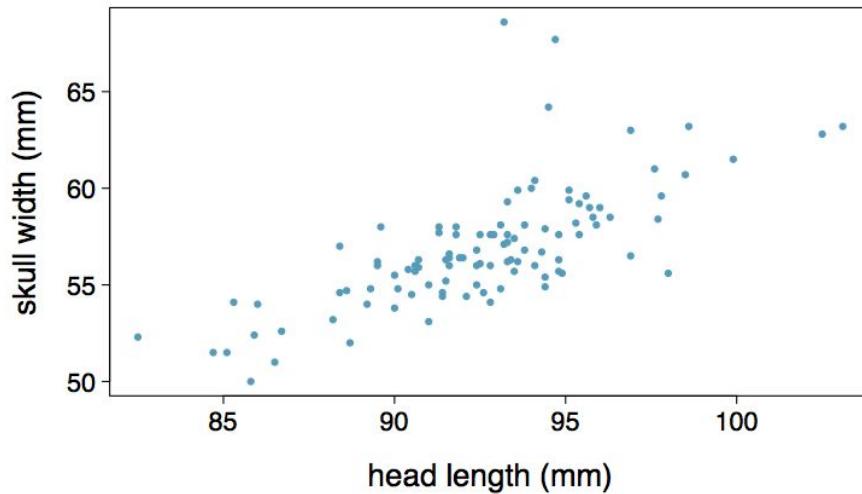
Based on the scatterplot on the right, which of the following statements is correct about the head and skull lengths of possums?



- (a) There is no relationship between head length and skull width, i.e. the variables are independent.
- (b) Head length and skull width are positively associated.
- (c) Skull width and head length are negatively associated.
- (d) A longer head causes the skull to be wider.
- (e) A wider skull causes the head to be longer.

Practice

Based on the scatterplot on the right, which of the following statements is correct about the head and skull lengths of possums?



- (a) There is no relationship between head length and skull width, i.e. the variables are independent.
- (b) *Head length and skull width are positively associated.*
- (c) Skull width and head length are negatively associated.
- (d) A longer head causes the skull to be wider.
- (e) A wider skull causes the head to be longer.

Associated vs. independent

- When two variables show some connection with one another, they are called *associated* variables.
 - Associated variables can also be called *dependent* variables and vice-versa.
- If two variables are not associated, i.e. there is no evident connection between the two, then they are said to be *independent*.

Find more resources at openintro.org/os, including

- Slides
- Videos
- Statistical Software Labs
- Discussion Forums (free support for students and teachers)
- Learning Objectives

Teachers only content is also available for [Verified Teachers](#), including

- Exercise solutions
- Sample exams
- Ability to request a free desk copy for a course
- Statistics Teachers email group

Questions? [Contact us.](#)