Documents

Quarto - authoring and publishing tools for collaborative scientific writing

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https://quarto-rdmss-24.github.io/website/

Anatomy of a Quarto document

https://quarto-rdmss-24.github.io/website/

Components

1. Metadata: YAML
2. Text: Markdown
3. Code: Executed via `knitr` or `jupyter`

Weave it all together, and you have beautiful, powerful, and useful outputs!

Literate programming

Literate programming is writing out the program logic in a human language with included (separated by a primitive markup) code snippets and macros.

````
---
title: "ggplot2 demo"
date: "5/23/2023"
format: html
---

## MPG

There is a relationship between city and highway mileage.

```{r}
#| label: fig-mpg

library(ggplot2)

ggplot(mpg, aes(x = cty, y = hwy)) +
  geom_point() +
  geom_smooth(method = "loess")
```
````

Metadata

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YAML

“Yet Another Markup Language” or “YAML Ain’t Markup Language” is used to provide document level metadata.

```yaml
---
key: value
---
```

Output options

```yaml
---
format: something
---
```

```yaml
---
format: html
---
```

```yaml
---
format: pdf
---
```

```yaml
---
format: revealjs
---
```

Output option arguments

Indentation matters!

```yaml
---
format:
  html:
    toc: true
    code-fold: true
---
```

YAML validation

- Invalid: No space after `:`

```
---
format:html
---
```

- Invalid: Read as missing

```
---
format:
html
---
```

YAML validation

There are multiple ways of formatting valid YAML:

- Valid: There's a space after `:`

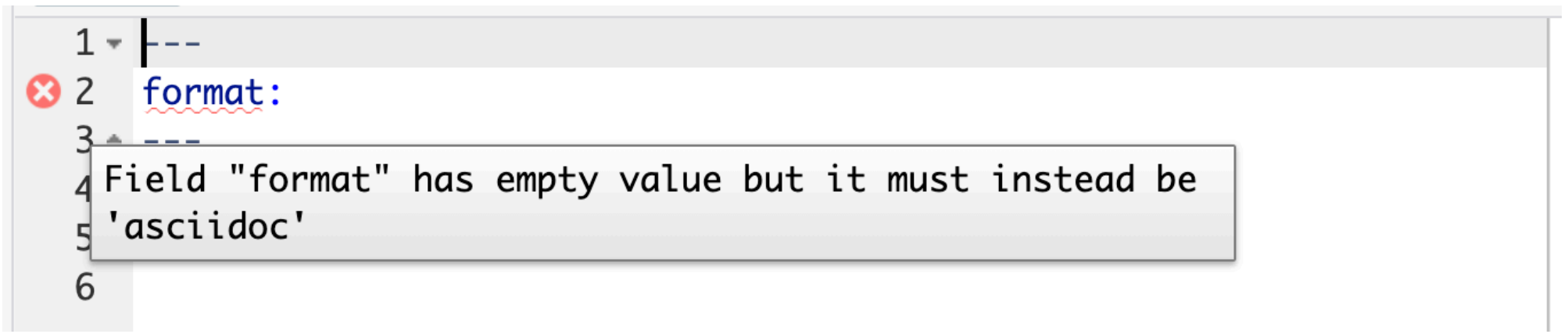
```yaml
format: html
```

- Valid: `format: html` with selections made with proper indentation

```yaml
format:
  html:
    toc: true
```

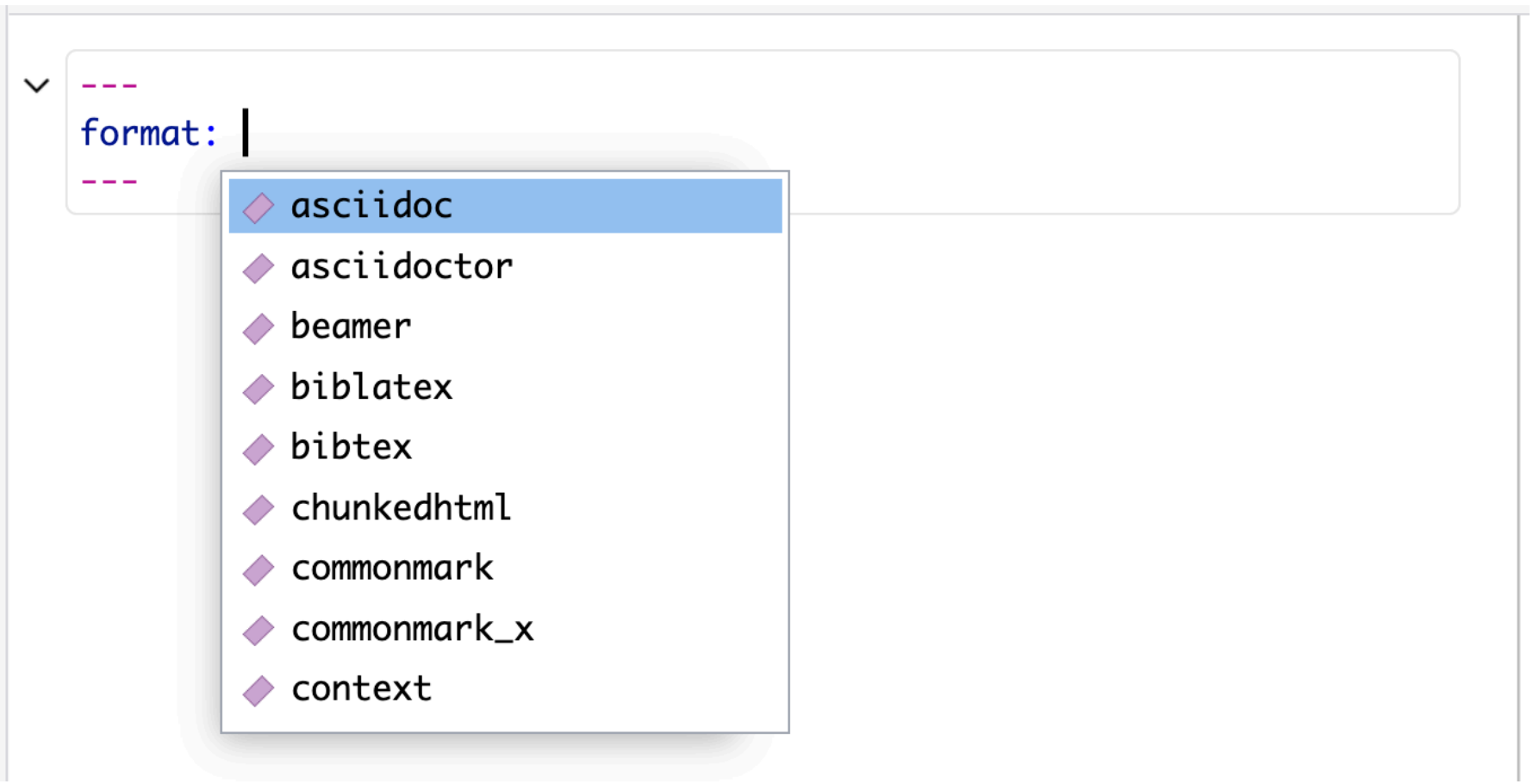
Quarto linting

Lint, or a linter, is a static code analysis tool used to flag programming errors, bugs, stylistic errors and suspicious constructs.



Quarto YAML Intelligence

RStudio + VSCode provide rich tab-completion - start a word and tab to complete, or `Ctrl + space` to see all available options.



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List of valid YAML fields

- Many YAML fields are common across various outputs
- But also each output type has its own set of valid YAML fields and options
- Definitive list: quarto.org/docs/reference/formats/html

Text

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Text Formatting

Markdown Syntax	Output
`*italics* and **bold**`	*italics* and **bold**
`superscript^2^ / subscript~2~`	superscript^2 / subscript$_2$
`~~strikethrough~~`	~~strikethrough~~
`` `verbatim code` ``	`verbatim code`

Headings

Markdown Syntax	Output
`# Header 1`	# Header 1
`## Header 2`	## Header 2
`### Header 3`	### Header 3
`#### Header 4`	#### Header 4
`##### Header 5`	##### Header 5
`###### Header 6`	###### Header 6

Links

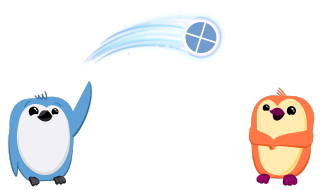
There are several types of “links” or hyperlinks.

Markdown

```
You can embed [named hyperlinks](https://quarto.org/),
direct urls like <https://quarto.org/>, and links to
[other places](#quarto-anatomy) in
the document. The syntax is similar for embedding an
inline image:
![Penguins playing with ball](images/penguins-quarto-ba
```

Output

You can embed named hyperlinks, direct urls like https://quarto.org/, and links to other places in the document. The syntax is similar for embedding an inline image:



Lists

Unordered list:

Markdown:

```
- unordered list
    - sub-item 1
    - sub-item 1
        - sub-sub-item 1
```

Output

- unordered list
    - sub-item 1
    - sub-item 1
        - sub-sub-item 1

Ordered list:

Markdown:

```
1. ordered list
2. item 2
    i. sub-item 1
        A. sub-sub-item 1
```

Output

1. ordered list
2. item 2
    i. sub-item 1
        a. sub-sub-item 1

Quotes

Markdown:

```
> Let us change our traditional attitude to the
> - Donald Knuth, Literate Programming
```

Output:

> Let us change our traditional attitude to the construction of programs: Instead of imagining that our main task is to instruct a computer what to do, let us concentrate rather on explaining to human beings what we want a computer to do. - Donald Knuth, Literate Programming

Your turn

- Open `markdown-syntax.qmd` in RStudio.
- Use the source editor mode
- Follow the instructions in the document, then exchange one new thing you've learned with your neighbor.

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07:00

Callouts

```
::: callout-note
Note that there are five types of callouts, including:
`note`, `tip`, `warning`, `caution`, and `important`.
:::
```

Note

Note that there are five types of callouts, including: `note`, `tip`, `warning`, `caution`, and `important`.

More callouts

Warning

Callouts provide a simple way to attract attention, for example, to this warning.

Important

Danger, callouts will really improve your writing.

Caution

Here is something under construction.

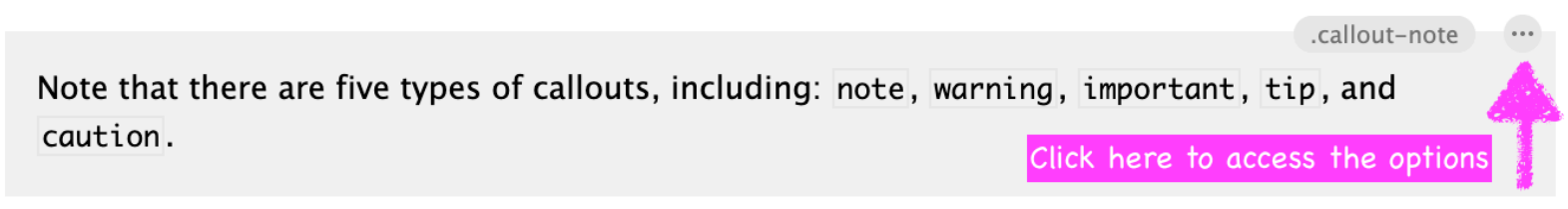
Caption

Tip with caption.

Your turn

- Open `callout-boxes.qmd` and render the document.
- Using the visual editor mode, change the type of the first callouts box and then re-render.
- Add a caption to the second callout box.
- Make the third callout box collapsible. Then, switch over to the source editor mode to inspect the markdown code.
- Change the format to PDF and re-render.

How to edit the options?



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07:00

Footnotes

Numbering and formatting footnotes is supported.

Inline footnotes

```
Here is an inline note.^[Inlines notes are easier to write,
since you don't have to pick an identifier and move down to
type the note.]
```

Here is an inline note.[1]

> **Use the source editor mode**
>
> The source editor mode is the recommended way to add footnotes.

Code

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Anatomy of a code chunk

````
```{r}
#| label: penguins
#| message: false

library(tidyverse)
library(palmerpenguins)
library(knitr)

penguins |>
  count(species) |>
  kable()
```
````

species	n
Adelie	152
Chinstrap	68
Gentoo	124

- Has 3x backticks on each end
- Engine (`r`) is indicated between curly braces `{r}`
- Options stated with the `#|` (hashpipe)

Code, who is it for?

- The way you display code is very different for different contexts.
- In a teaching scenario like today, I *really* want to display code.
- In a business, you may want to have a data-science facing output which displays the source code AND a stakeholder-facing output which hides the code.

Showing and hiding code with `echo`

- The `echo` option shows the code when set to `true` and hides it when set to `false`.

Tables and figures

- In reproducible reports and manuscripts, the most commonly included code outputs are **tables** and **figures**.
- So they get their own special sections in our deep dive!

Tables

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Markdown tables

Markdown:

```
| Right | Left | Default | Center |
|------:|:-----|---------|:------:|
|   12  |  12  |    12   |   12   |
|  123  |  123 |   123   |  123   |
|    1  |    1 |     1   |    1   |
```

> **Use the source editor mode**
>
> The source editor mode is the recommended way to add markdown tables. These are tables, which are not generated from code.

Output:

Right	Left	Default	Center
12	12	12	12
123	123	123	123
1	1	1	1

Tables from code

The **knitr** package can turn data frames into tables with `knitr::kable()`:

```
library(knitr)

penguins |>
  count(species, island) |>
  kable()
```

species	island	n
Adelie	Biscoe	44
Adelie	Dream	56
Adelie	Torgersen	52
Chinstrap	Dream	68
Gentoo	Biscoe	124

Tables from code

If you want fancier tables, try the **gt** package and all that it offers!

```
1  library(gt)
2
3  head(penguins) |>
4    gt() |>
5    tab_style(
6      style = list(
7        cell_fill(color = "pink
8        cell_text(style = "ital
9        ),
10     locations = cells_body(
11       columns = bill_length_m
12       rows = bill_length_mm >
13     )
14   )
```

species	island	bill_length_mm	bill_depth_mm	flipper_length_m
Adelie	Torgersen	39.1	18.7	18
Adelie	Torgersen	39.5	17.4	18
Adelie	Torgersen	*40.3*	18.0	19
Adelie	Torgersen	NA	NA	N
Adelie	Torgersen	36.7	19.3	19
Adelie	Torgersen	39.3	20.6	19

Figures

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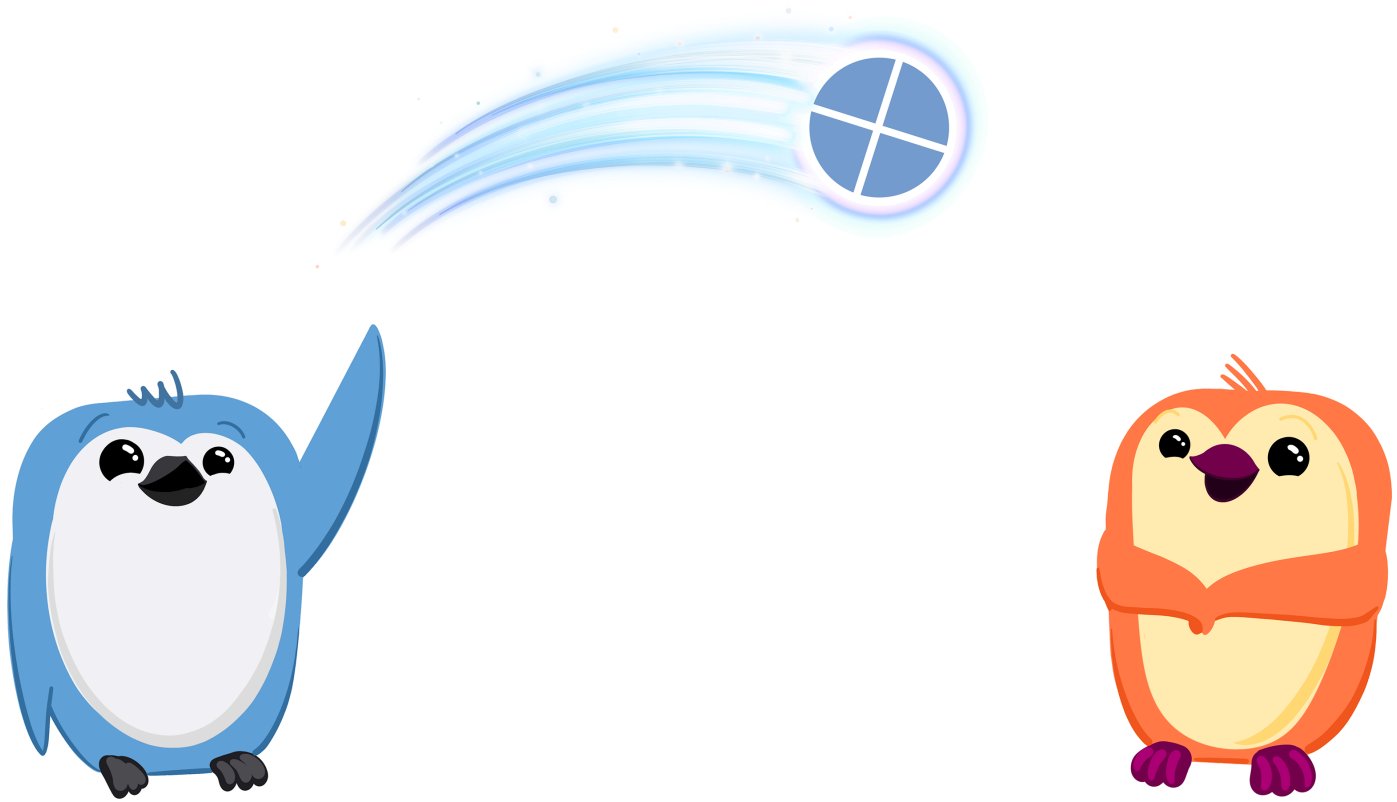
Markdown figures

```
![Penguins playing with a Quarto ball](images/penguins-quarto-ball.png)
```



Penguins playing with a Quarto ball

Subfigures

Markdown:

```
::: {#fig-penguins layout-ncol=2}

![Blue penguin](images/blue-penguin.png){#fig-blue
width="250px"}

![Orange penguin](images/orange-penguin.png){#fig-orange
width="250px"}

Two penguins

:::
```

Subfigures

Output:

(a) Blue penguin

(b) Orange penguin

Figure 1: Two penguins

Finding the figures to include

In places like markdown, YAML, or the command line/shell/terminal, you'll need to use **absolute** or **relative** file paths:

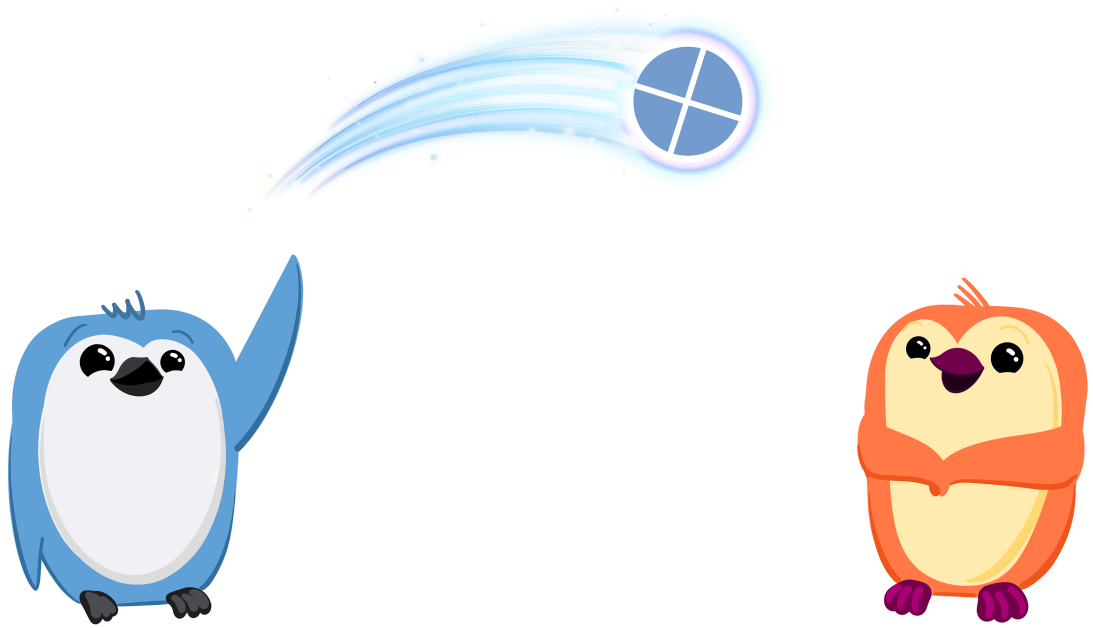
- Absolute = BAD: `"/Users/lars/exercises"` - Whose computer will this work on?

- Relative = BETTER:
  - `"../` = up one directory, `../../` = up two directories, etc.
  - `/..` or `/` = start from `root` directory of your current computer

Figures with code

````
```{r}
#| fig-width: 4
#| fig-align: right

knitr::include_graphics("images/penguins-quarto-l
```
````



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Referencing paths in R code

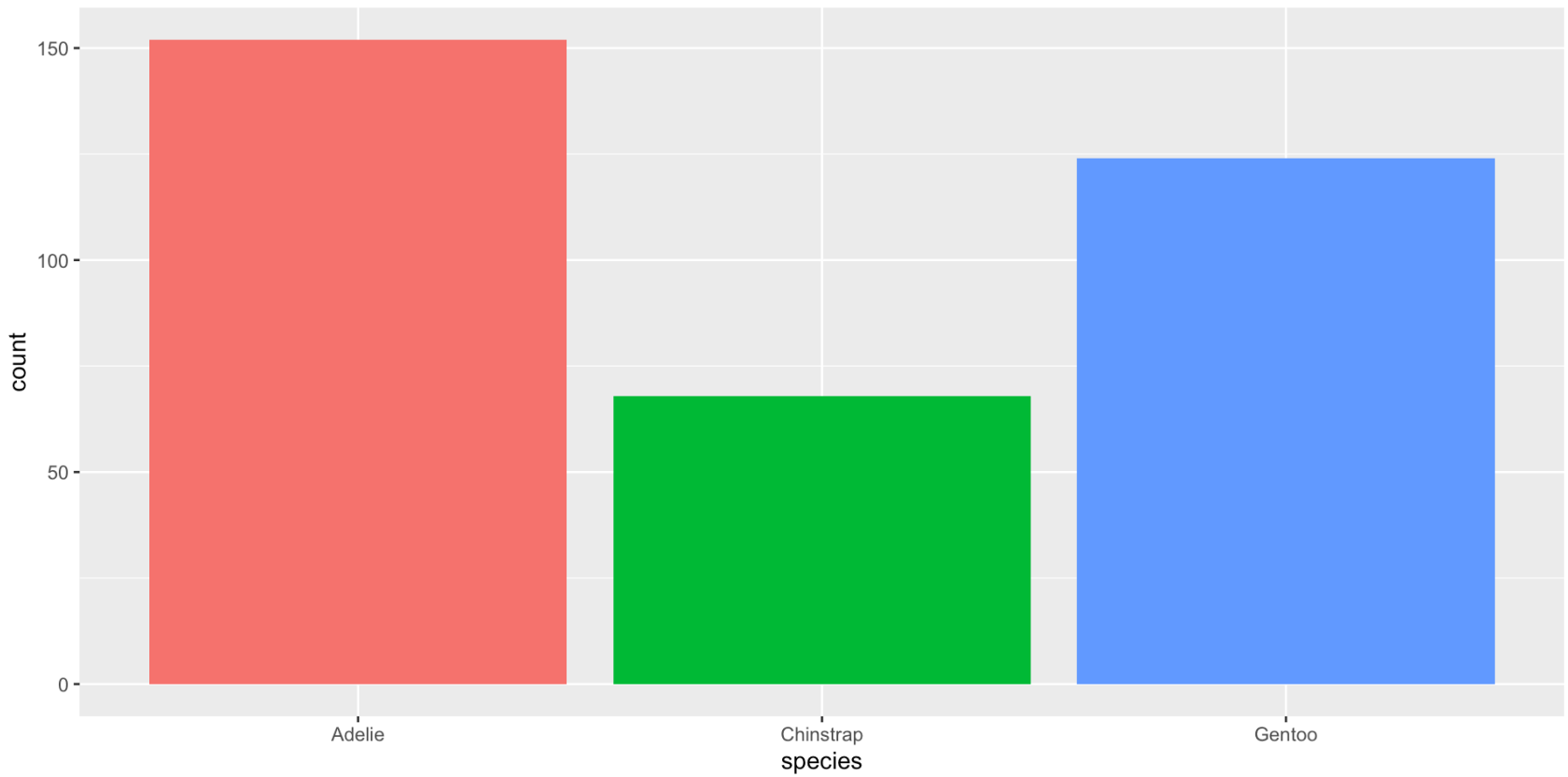
Use the **here** package to reference the project root, as `here::here()` always starts at the top-level directory of a `.Rproj`:

```
1 here::here()
```

```
[1] "/Users/lschoebitz/Documents/gitrepos/gh-org-quarto-rdmss-24/website"
```

Figures from code

```
1 ```{r}
2 ggplot(penguins, aes(x = species, fill = species
3   geom_bar(show.legend = FALSE)
4 ```
```



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Cross references

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Cross references

- Help readers to navigate your document with numbered references and hyperlinks to entities like figures and tables.
- Cross referencing steps:
  - Add a caption to your figure or table.
  - Give an ID to your figure or table, starting with `fig-` or `tbl-`.
  - Refer to it with `@fig-...` or `@tbl-...`.

Figure cross references

The presence of the caption (`Blue penguin`) and label (`#fig-blue-penguin`) make this figure referenceable:

Markdown:

```
See @fig-blue-penguin for a cute blue penguin.
![Blue penguin](images/blue-penguin.png){#fig-blue-
```

Output:

See Figure 2 for a cute blue penguin.

Figure 2: Blue penguin

Table cross references

The presence of the caption (`A few penguins`) and label (`#tbl-penguins`) make this table referenceable:

Markdown:

````
See @tbl-penguins for data on
```{r}
#| label: tbl-penguins
#| tbl-cap: A few penguins

head(penguins) |>
  gt()
```
````

Output:

See Table 1 for data on a few penguins.

```
head(penguins) |>
  gt()
```

Table 1: A few penguins

species	island	bill_length_mm	bill_depth_mm	flipper_length_m
Adelie	Torgersen	39.1	18.7	18
Adelie	Torgersen	39.5	17.4	18
Adelie	Torgersen	40.3	18.0	19
Adelie	Torgersen	NA	NA	N
Adelie	Torgersen	36.7	19.3	19
Adelie	Torgersen	39.3	20.6	19

Thanks! 🌻

Slides created via revealjs and Quarto: https://quarto.org/docs/presentations/revealjs/

Knuth, D. E. 1984. “Literate Programming.” *The Computer Journal* 27 (2): 97–111. https://doi.org/10.1093/comjnl/27.2.97.

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