Intro to R Markdown

Biological statistics III

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Today's session

Learn the basics of making a report using R Markdown

Produce neat, reproducible reports directly from your code

Reproducibility & repeatability

- Code, notes and output in one document

More on repeatability and reproducibility here and here

R Markdown

Save and execute R code

Add text with simple formatting to produce

- Documents (reports, manuscripts ...)
- Presentations
- Web pages
- Books

directly from your code and data

https://rmarkdown.rstudio.com/

Prerequisites

An editor, e.g. RStudio, to create and edit R Markdown document

The `rmarkdown` package

```
install.packages("rmarkdown",
dependencies = TRUE)
```

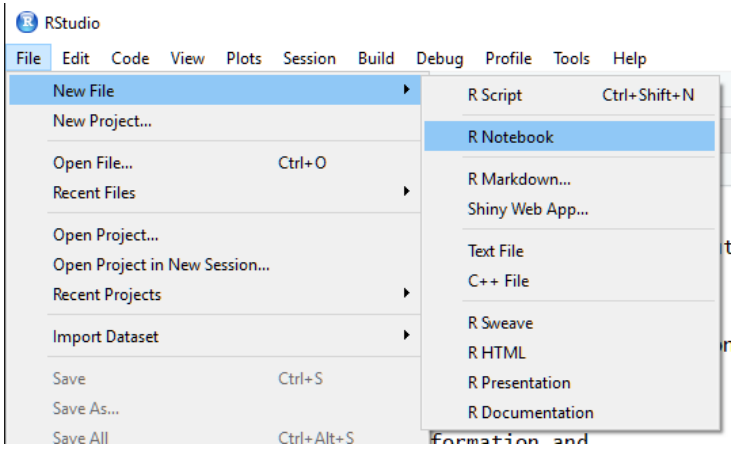
LaTeX, e.g. TinyTeX, to produce PDF documents

```
install.packages("tinytex")
tinytex::install_tinytex()
```

Installing `tidyverse` will install both RMarkdown and TinyTeX. Tidyverse contains many useful packages for data management and visualization.

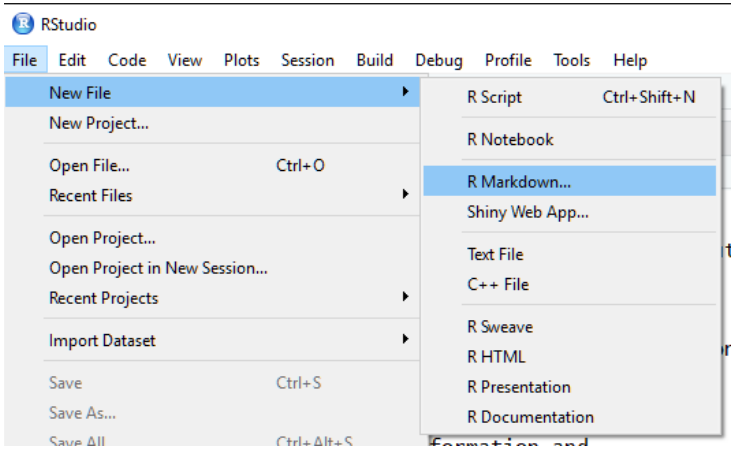
```
install.packages("tidyverse",
dependencies = TRUE)
```

Creating an R Markdown document



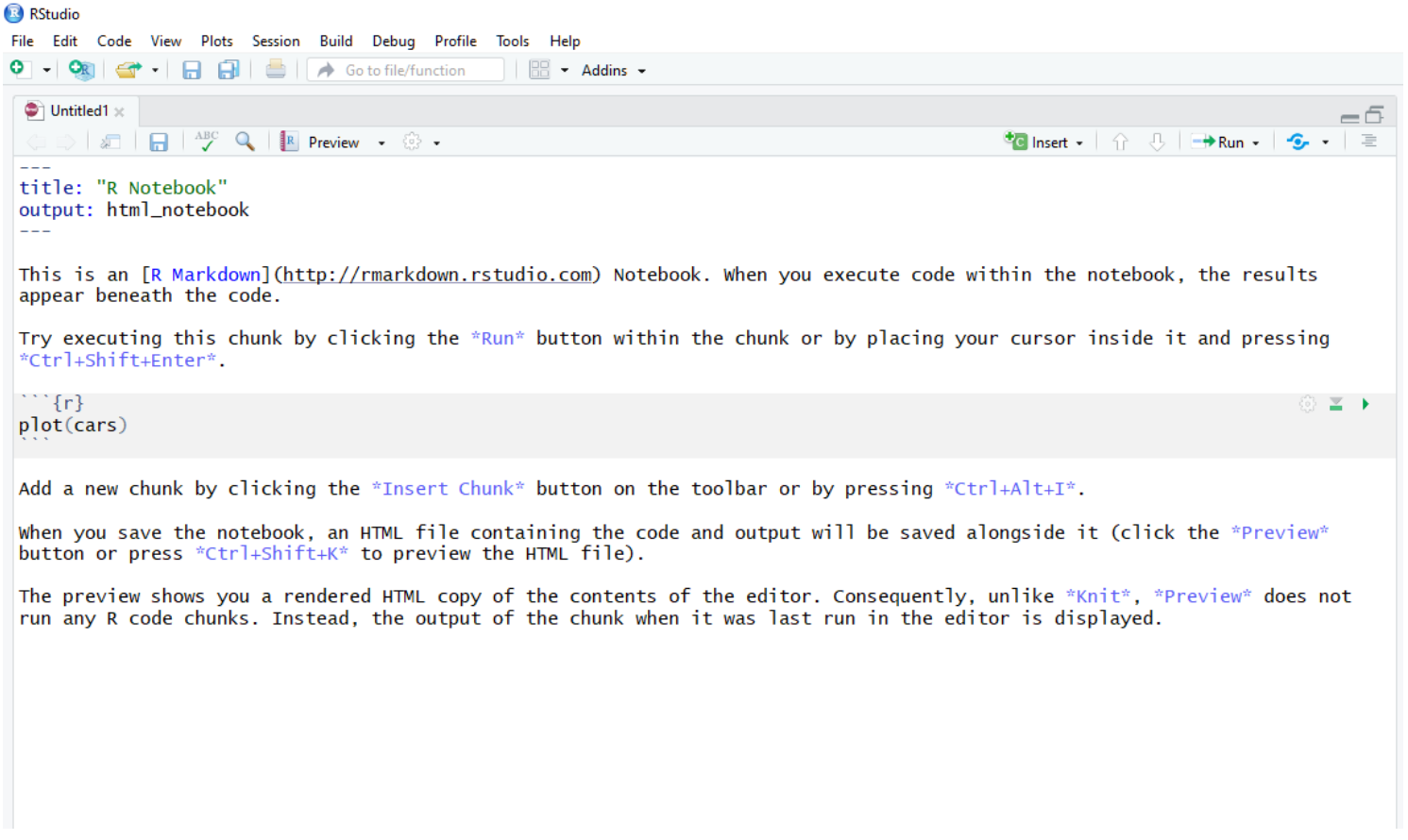
Create an basic .Rmd document

.rmd documents are displayed in "notebook-mode" per default

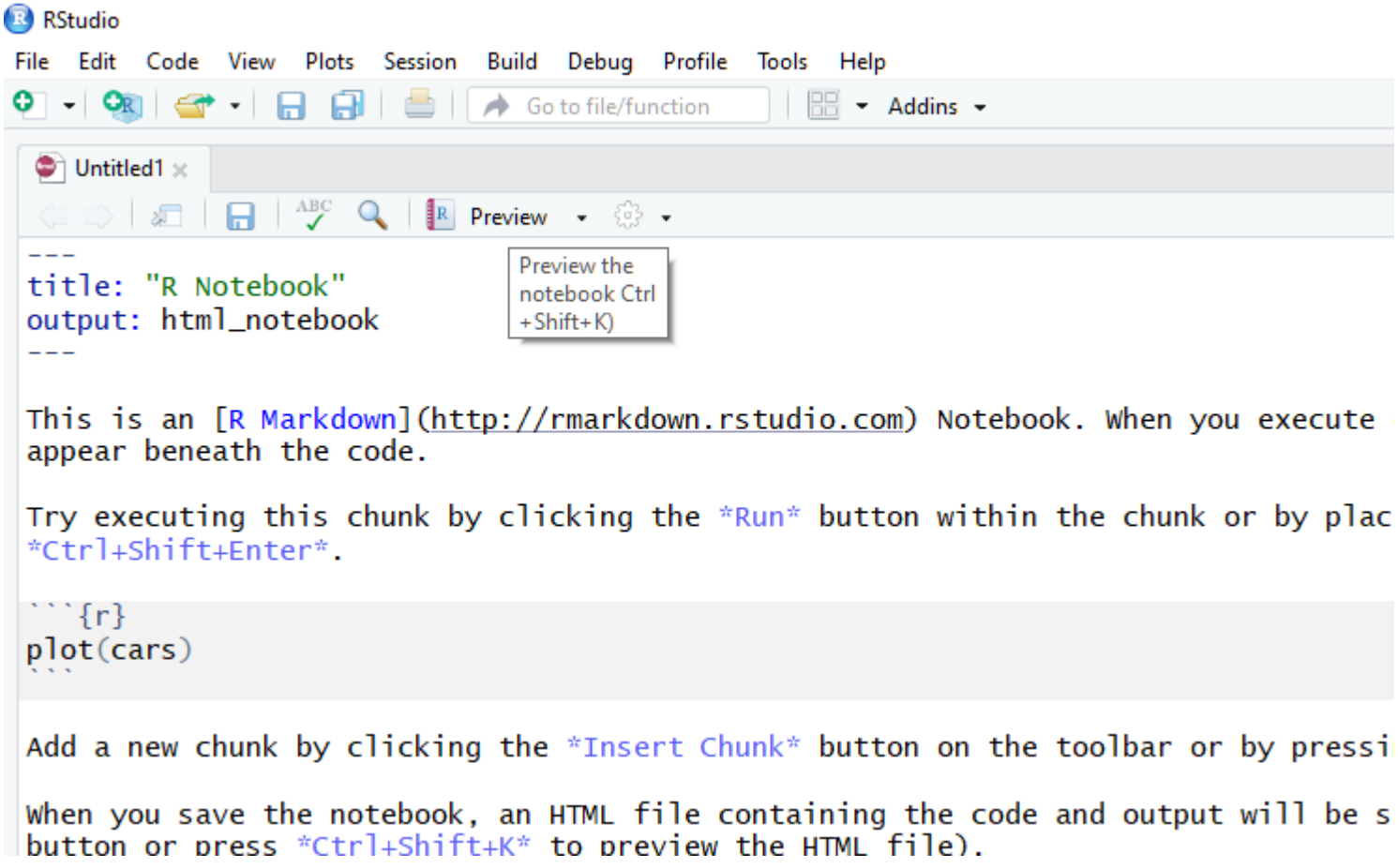


Create .Rmd documents, presentations and more

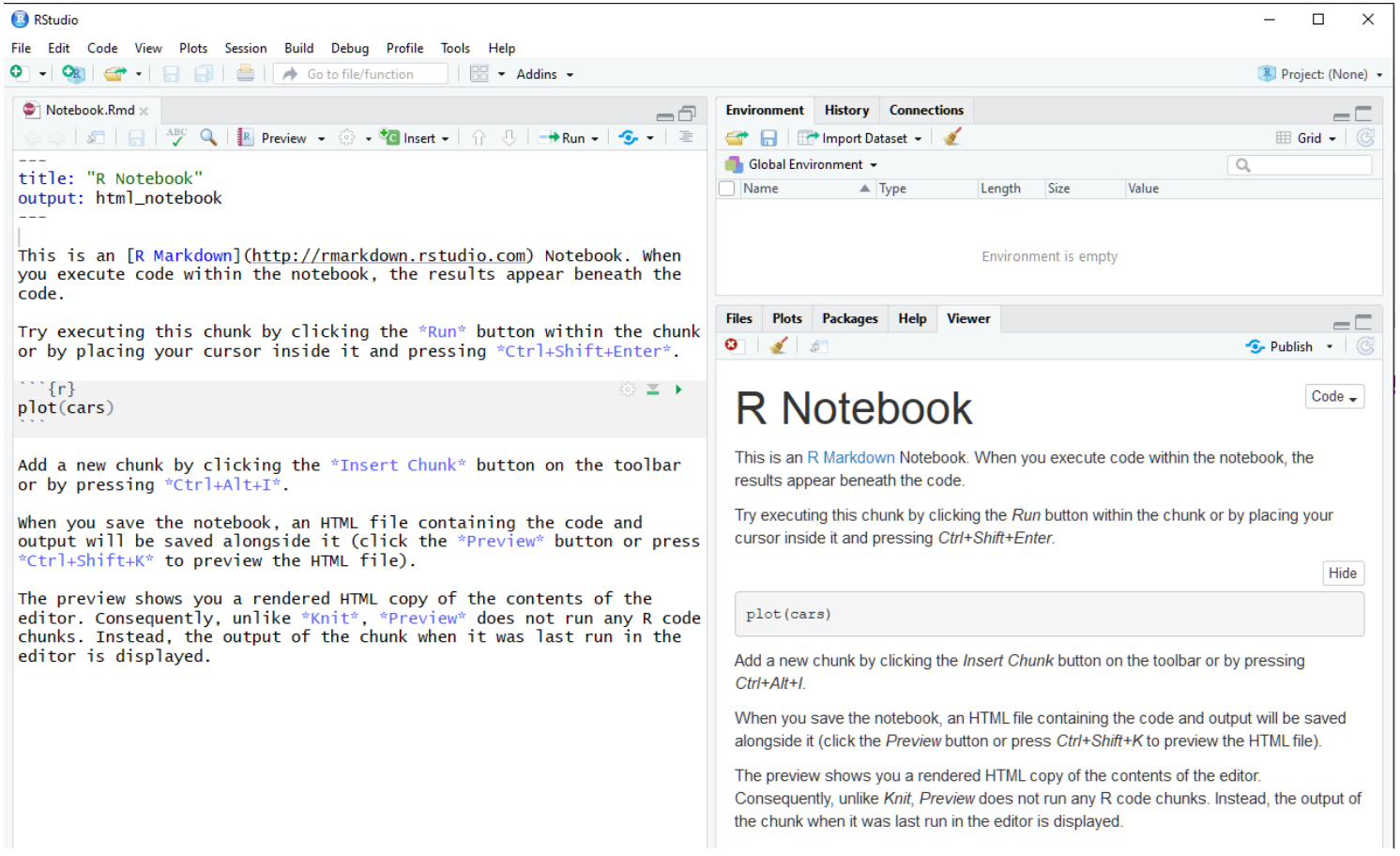
Creating an R Markdown document



Previewing an R Markdown document



Previewing an R Markdown document

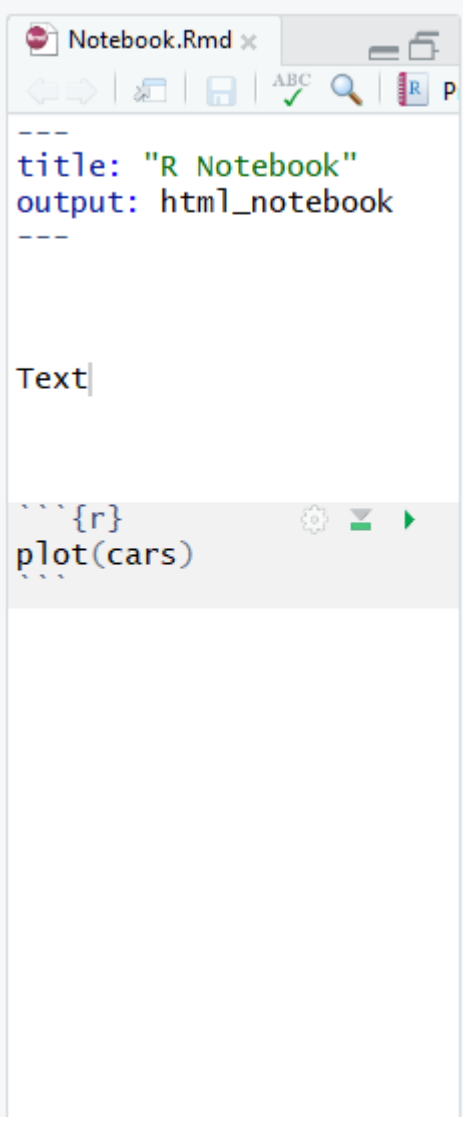


R Markdown (.rmd) document components

Metadata

Text

Code chunks



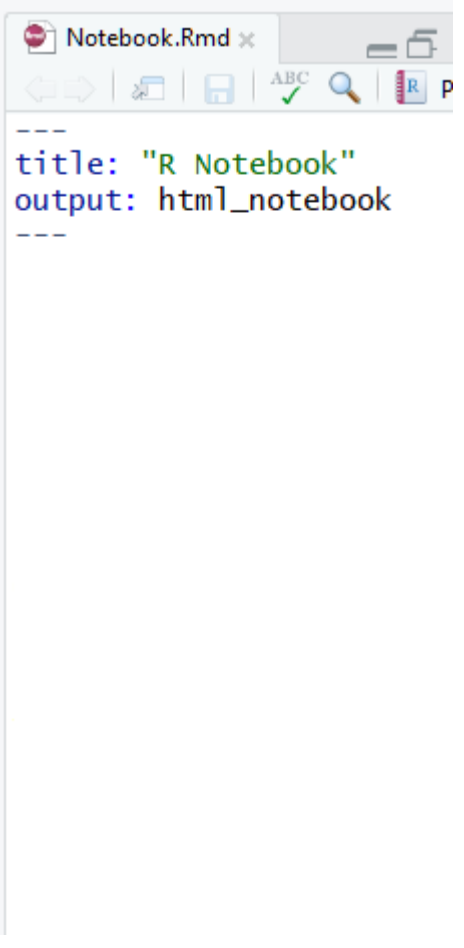
Metadata

Document specific settings (author, date, output format ...)

Separated with 3 dashes (`---`)

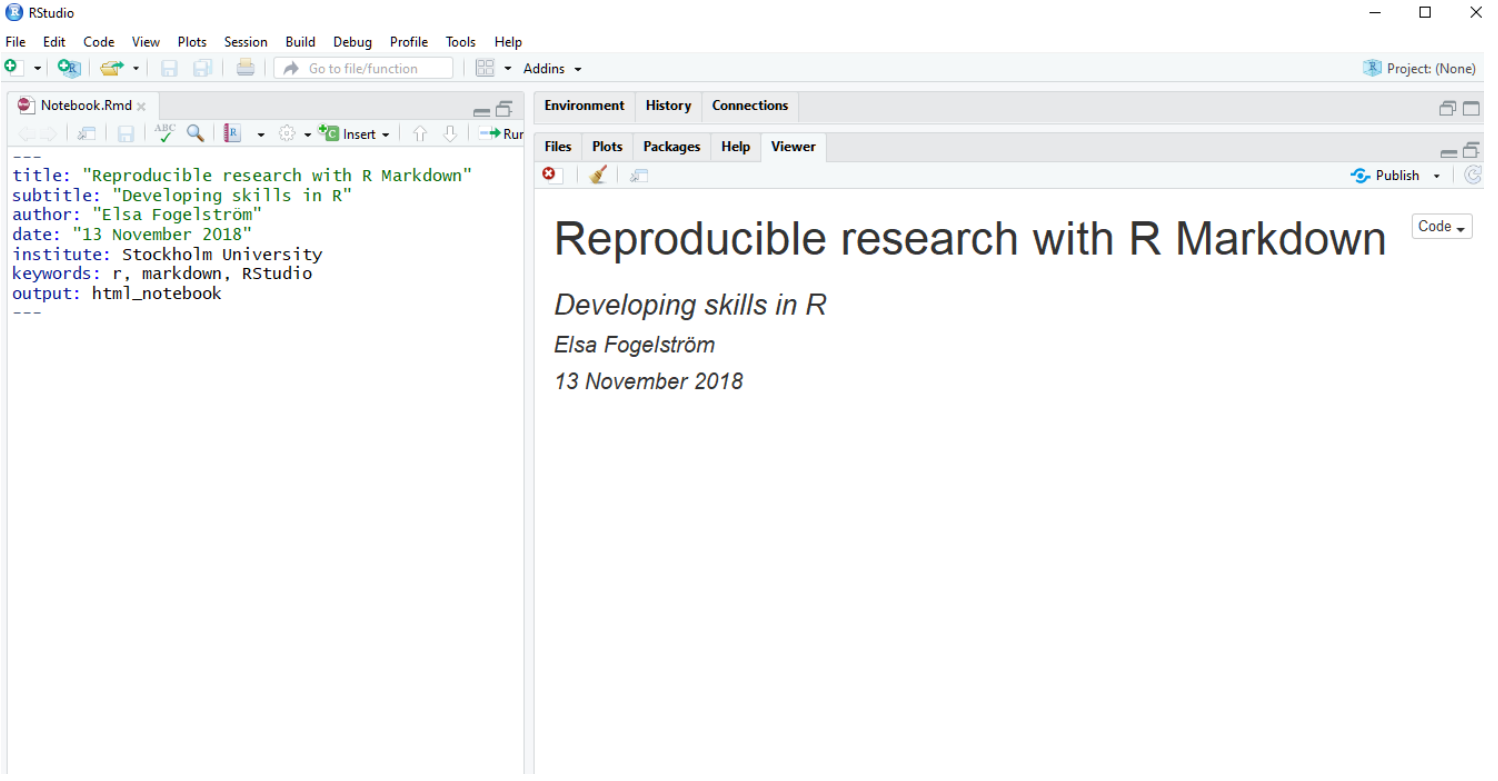
Syntax = YAML

Often referred to as "YAML metadata", "YAML header", "YAML frontmatter" ...



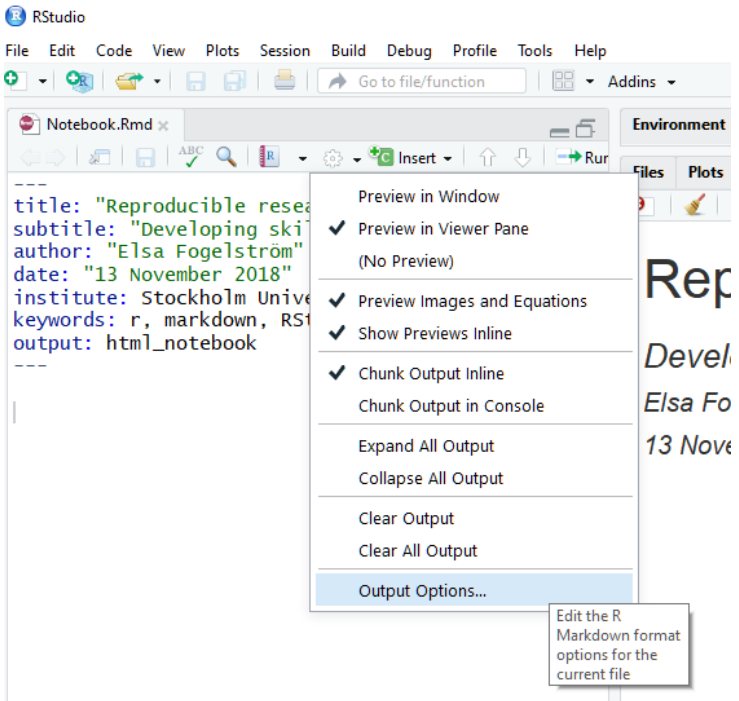
Editing metadata

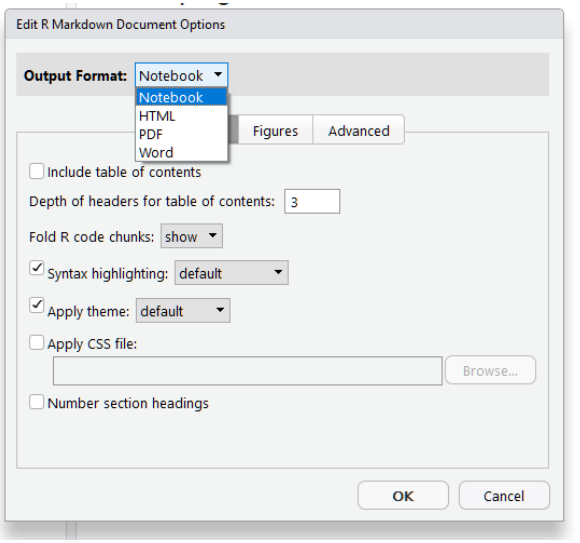
Title, author(s), date



Editing metadata

Output options (doesn't cover all output formats):





Editing metadata

Output formats

`github_document`

`html_document`

`latex_document`

`md_document`

`odt_document`

`pdf_document`

`word_document`

`beamer_presentation`

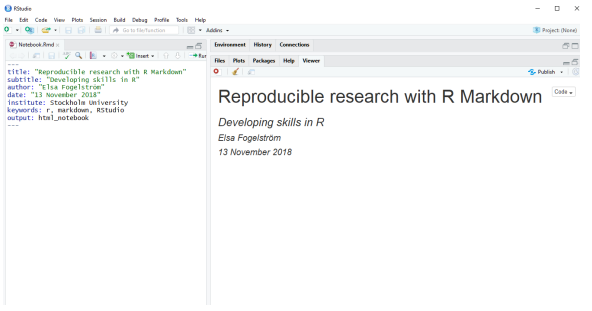
`ioslides_presentation`

`powerpoint_presentation`

`rtf_document`

`slidy_presentation`

and more from templates



Text

Markdown, a simple formatting language (official website)

Plain text with simple formatting

Other laguages are also supported (e.g. HTML, LaTeX ...)

Text formatting

To make sure that a line break is made, **use double space**

```
*italics*
```

italics

```
**bold**
```

bold

```
# header1
```

header1

```
## header2
```

header2

```
### header3
```

header3

Text formatting: Lists

```
* this is
* a list
```

- this is
- a list

```
- this is
- another list
```

- this is
- another list

```
1. this is a
2. numbered list
```

1. this is a
2. numbered list

remember double space

Text formatting: Mathematical annotation (LaTeX)

inline mathematical annotation:

```
Eqn. 1: $\frac{x}{x^2}$
```

Eqn. 1: $\frac{x}{x^2}$

centered mathematical annotation:

```
$$Y \tilde~\beta_0~+~\beta_1*x~+~\epsilon$$
```

$$Y \tilde~ \beta_0 ~+~ \beta_1 * x ~+~ \epsilon$$

Code

Code is included in *chunks* separated by three backticks

````
A chunk:
```{r}
plot(iris$Petal.Length, iris$Petal.Length)
```
````

Code

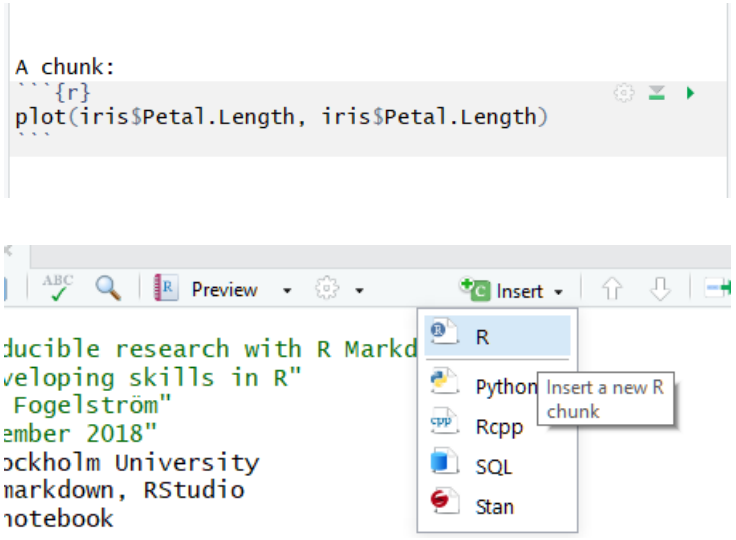
Code is included in *chunks* separated by three backticks (```)

"insert"/"R"

keyboard shortcuts:

Ctrl+Alt+i

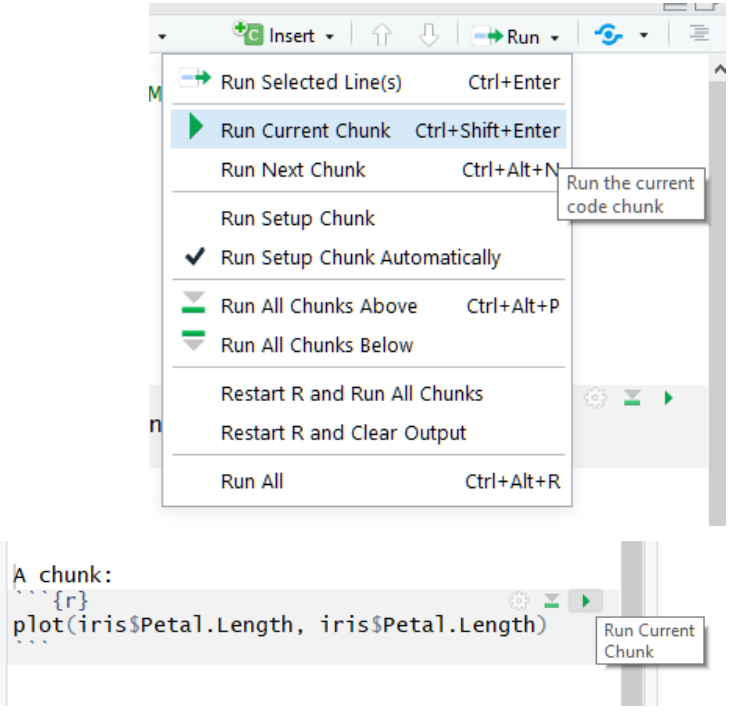
Cmd+Option+i



Code

Run a chunk (execute code)

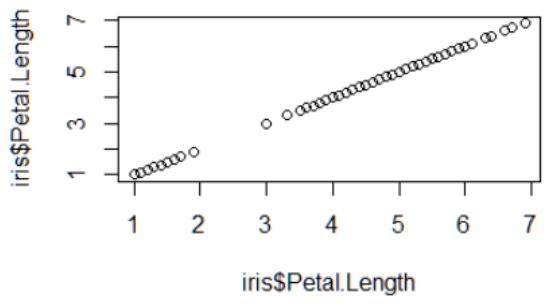
- click "Run" and select an option from the list
- click the the play symbol in the chunk corner
- place cursor within the chunk and press *Ctrl/Cmd+Shift+Enter*
- run one or more rows: Place the cursor in (or mark) the code you want to run and press *Ctrl/Cmd + Enter*



[More keyboard shortcuts]

Code

````
A chunk:
```{r}
plot(iris$Petal.Length, iris$Petal.Length)
```
````




````
This is plain text

type two spaces to make a line break


Simple formatting

- something in *italics*
- something in **bold**

Two ways of previewing the HTML document:
````

12:1 (Top Level) R Markdown

Console

Developing skills in R

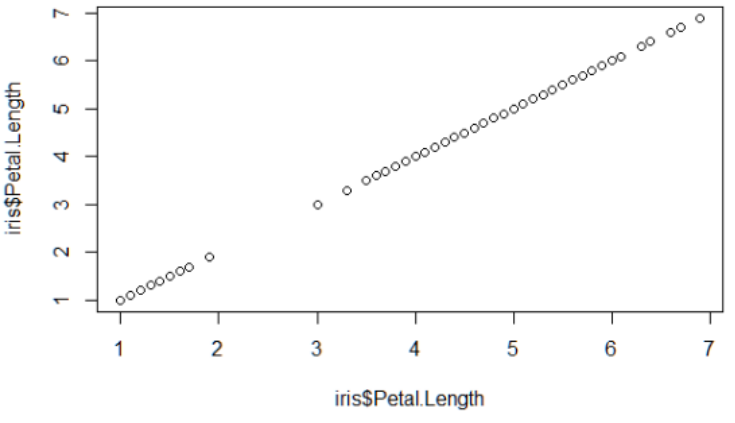
Elsa Fogelström

13 November 2018

A chunk:

Hide

```
plot(iris$Petal.Length, iris$Petal.Length)
```



This is plain text

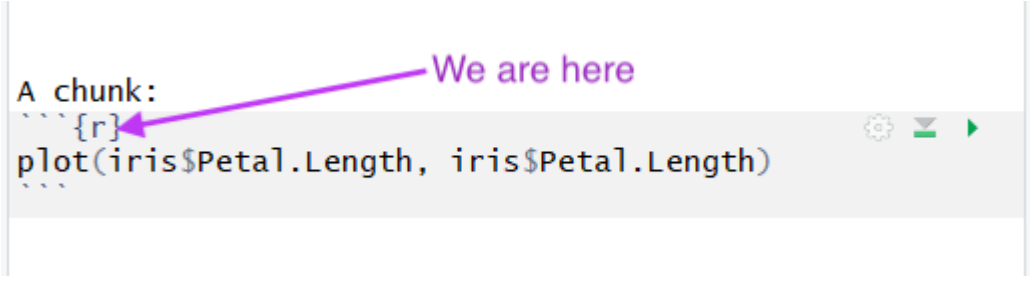
type two spaces to make a line break

Simple formatting

- something in *italics*

More formatting

Knitr options



Show/hide code and output

Hide code: `{r echo=FALSE}`

Hide code and output: `{r include=FALSE}`

Don't run chunk: `{r eval=FALSE}`

Knitr options

Figure size/position

Figure size: `{r fig.width = 3, fig.height = 4}`

Figure position: `{r fig.align = 'default'}`

Options: `'left', 'right', 'center'`

supress messages and warnings

```
{r warning=FALSE,message=FALSE}
```

Knitr options

Set knitr options for the entire document

using `knitr::opts_chunk$set()` within an R code chunk:

```
knitr::opts_chunk$set(echo = FALSE, # hide code
                      # align figues left
                      # (does not work with word):
                      fig.align = "left")
```

Make a table using the `kable` function

```
# library (knitr)
# specify a model:
mod <- lm(Petal.Length ~ Species, data =iris)

# present model output as table
knitr::kable(summary(mod)$coefficients, digits=3, format = 'html')
```

	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	1.462	0.061	24.023	0
Speciesversicolor	2.798	0.086	32.510	0
Speciesvirginica	4.090	0.086	47.521	0

Works for .html and .pdf documents. Does not work for making .docx documents.

`format` needs to be set to `format = 'latex'` when knitting to pdf

Make a table using the `pander` function

```
library(pander)
panderOptions('round', 3)
pander(mod)
```

I use it a lot for making tables for word documents. Works for .pdf and .html documents too. Did not work well in this .htlm presentation.

Examples and formatting options can be found here and here

Combine text and code

Inline code

If not to be executed: surrounded with single backticks (`)

`Inline` code

code to be executed is surrounded by a single backtick and starts with a small 'r'

There are `` `r nrow(iris)` `` entries in the iris dataset

There are 150 entries in the iris dataset

Images

Within an r-chunk:

```
knitr::include_graphics(
'Iris_virginica.jpg')
```

In markdown (text):

```
![an image](Iris_virginica.jpg)
```

Both methods work with either path to local file or URL to an online file.

Here are some Tips and tricks for working with images and figures in R Markdown documents

Embedded links

Add the description within brackets and the URL within parentheses:

```
[Iris versicolor](http://www.florafinder.com/LargePhotos/D9/Iris_versicolor-81C439DB39.jpg)
```

It will end up looking something like this in the output document:

Iris versicolor

Rendering ('knitting') files

Render: the process of producing an output file from your .Rmd file

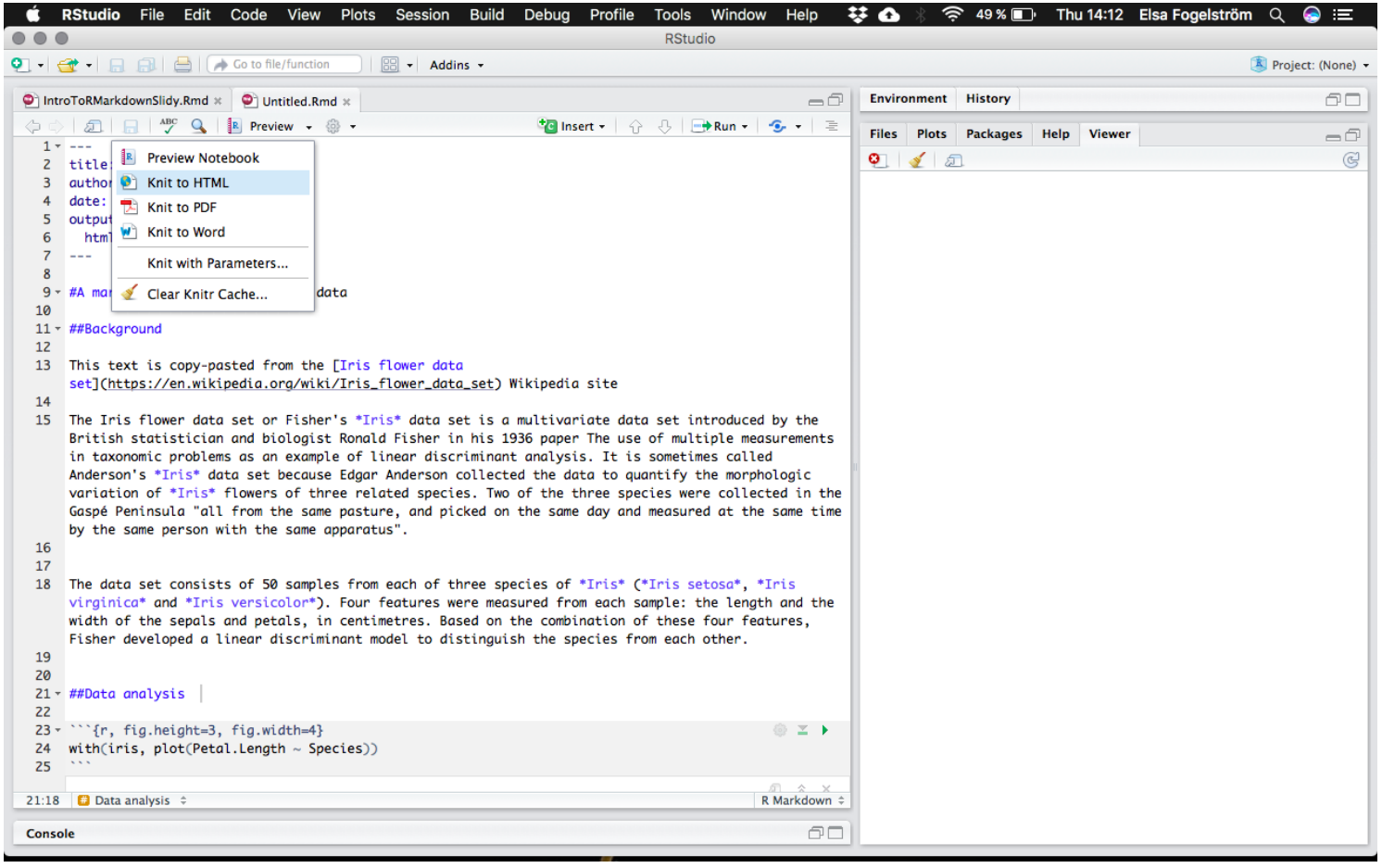
knitr executes code and saves your output to a markdown (.md) document

pandoc converts the markdown document to format of your choice

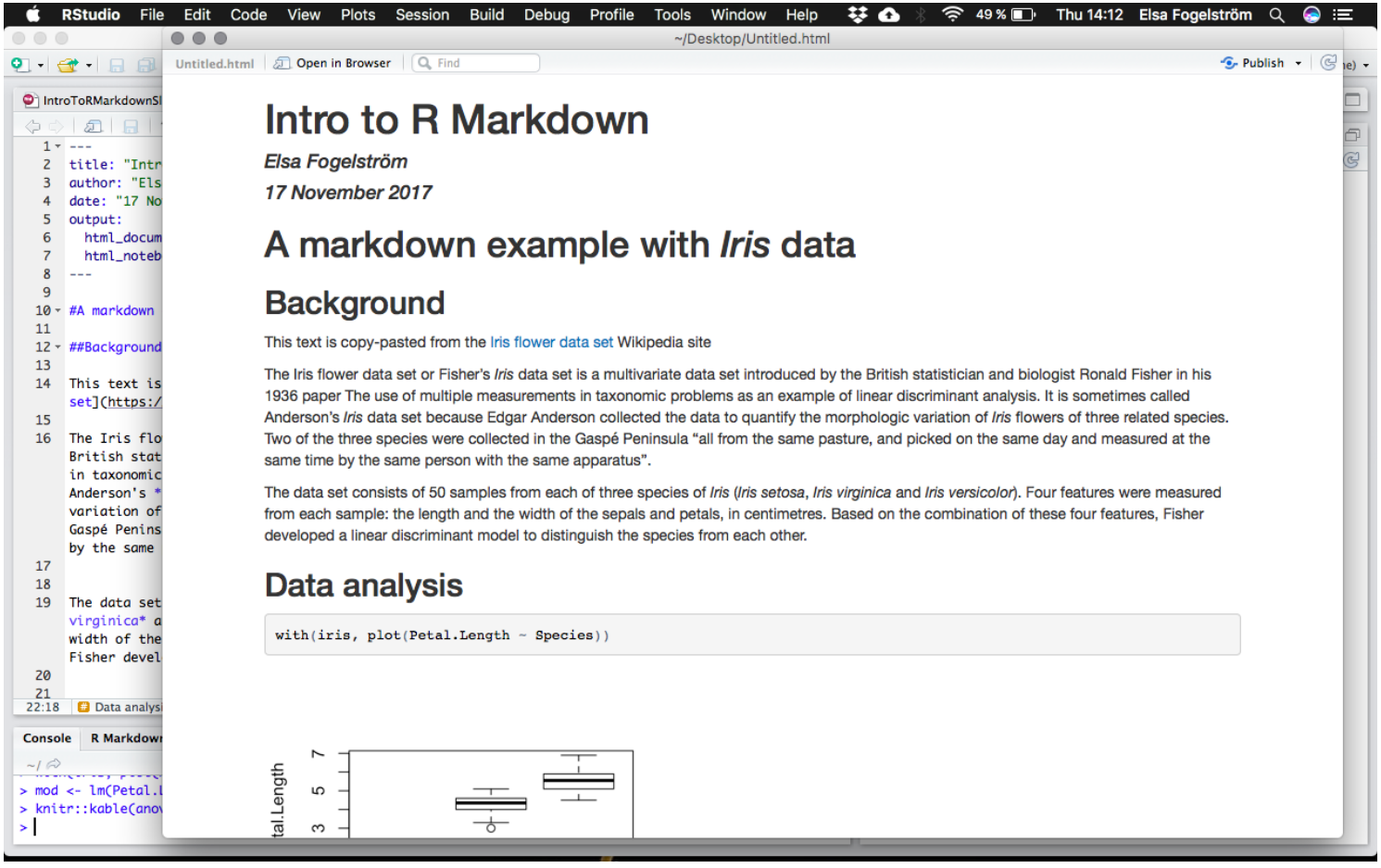
https://d33wubrfki0l68.cloudfront.net/61d189fd9cdf955058415d3e1b28dd60e1bd7c9b/b739c/lesson-images/rmarkdownflow.png

use `render` function or simply click *knit* (in drop-down menu next to *Preview* button)

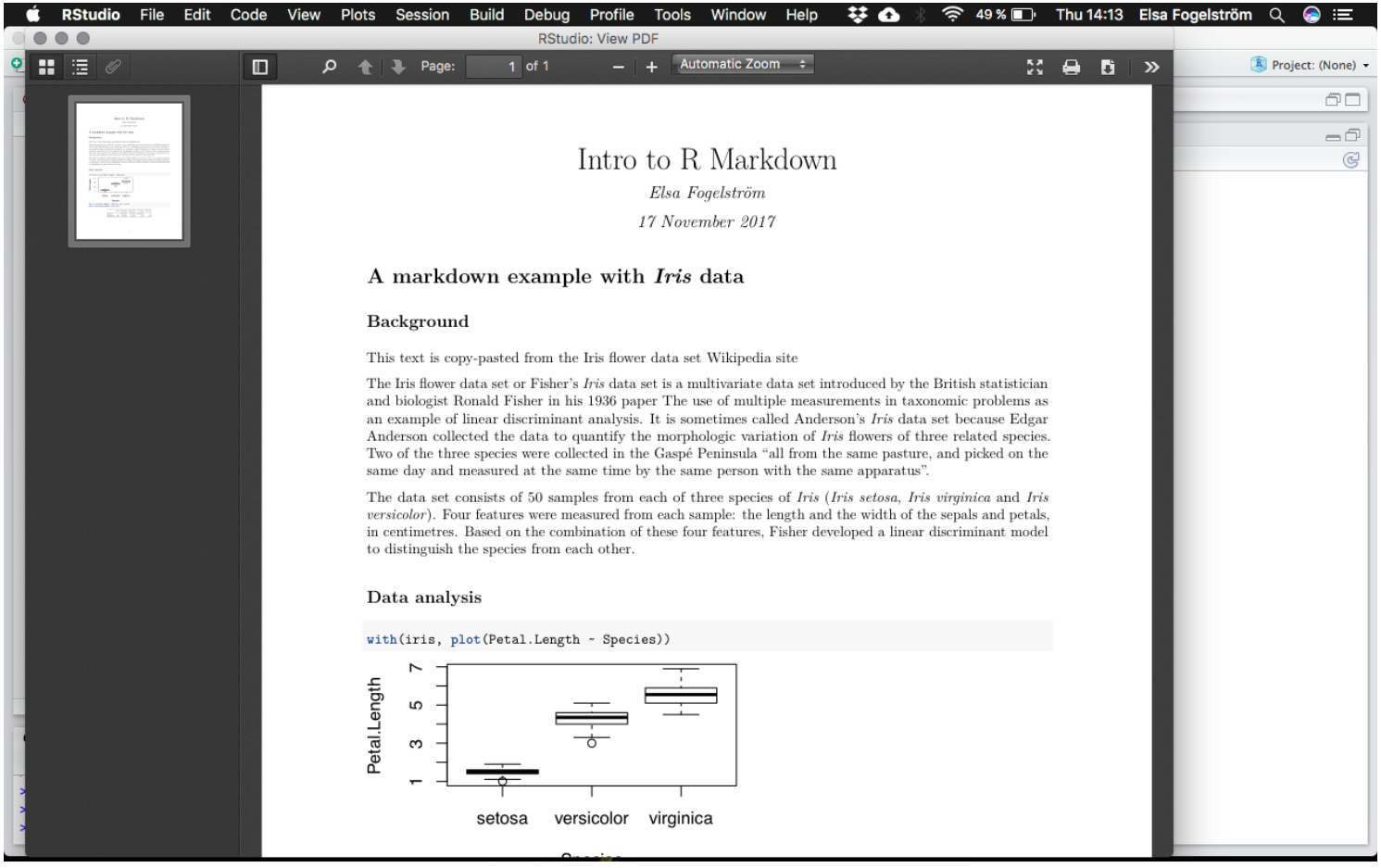
Render document: HTML



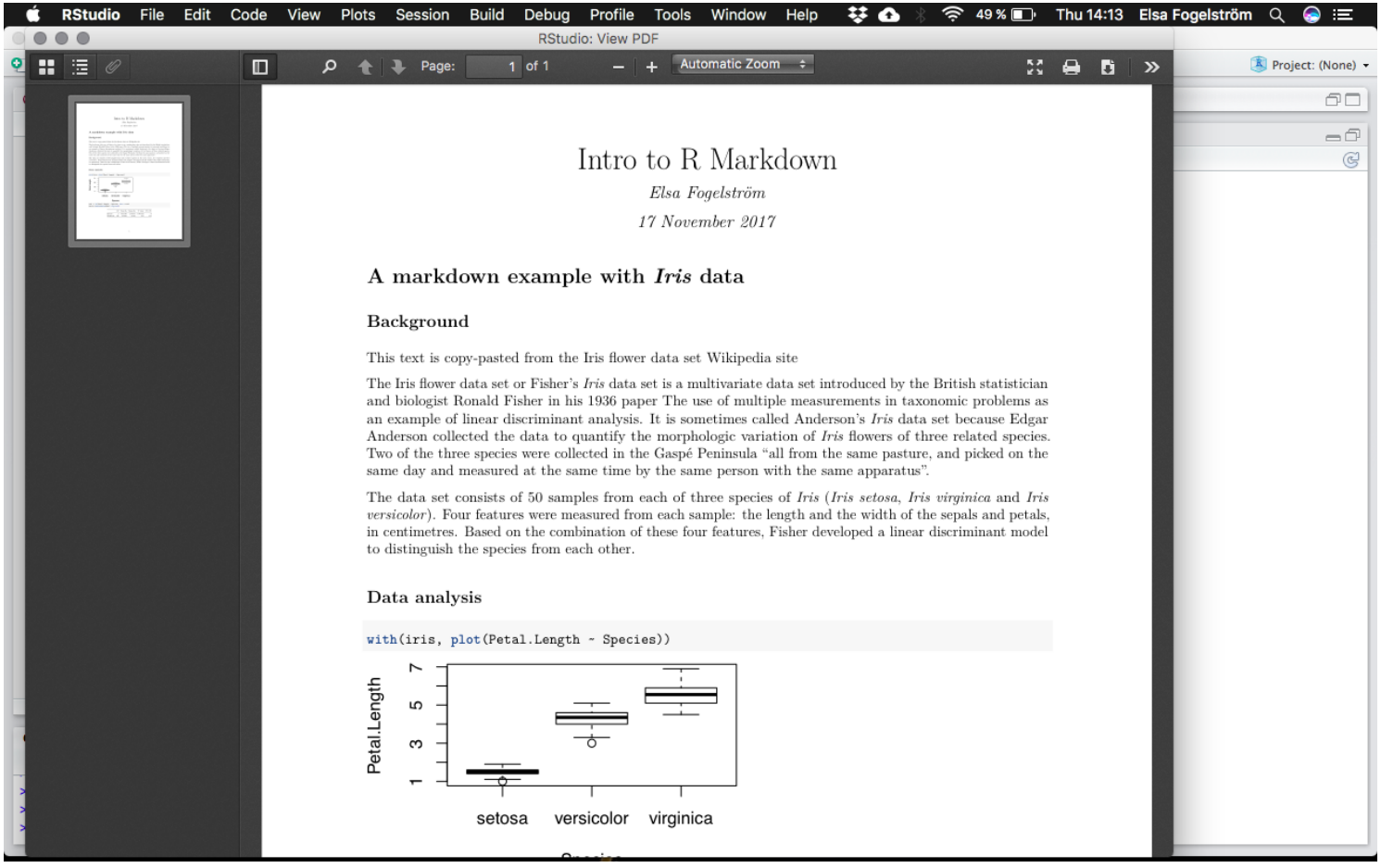
Render document: HTML



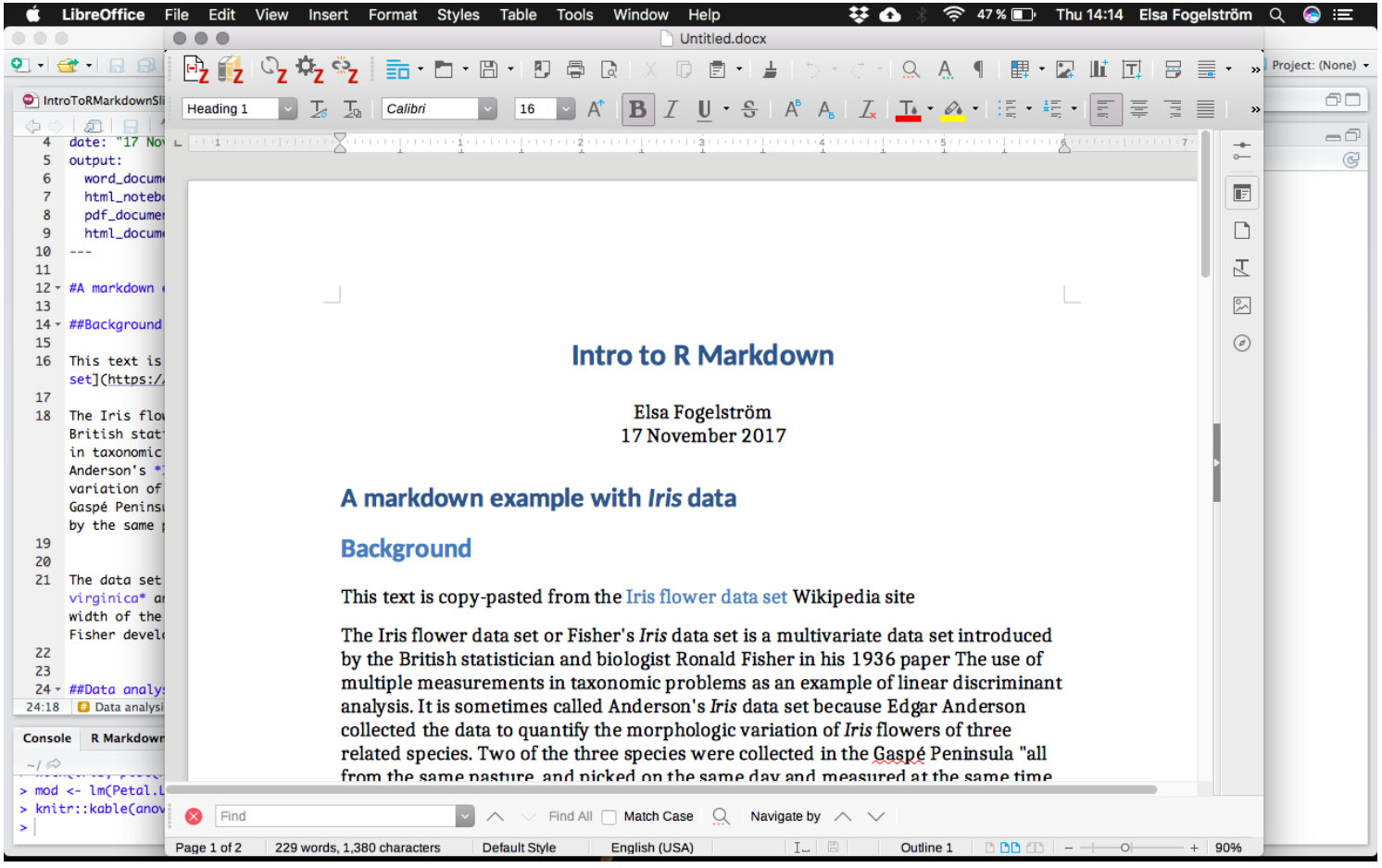
Render document: PDF



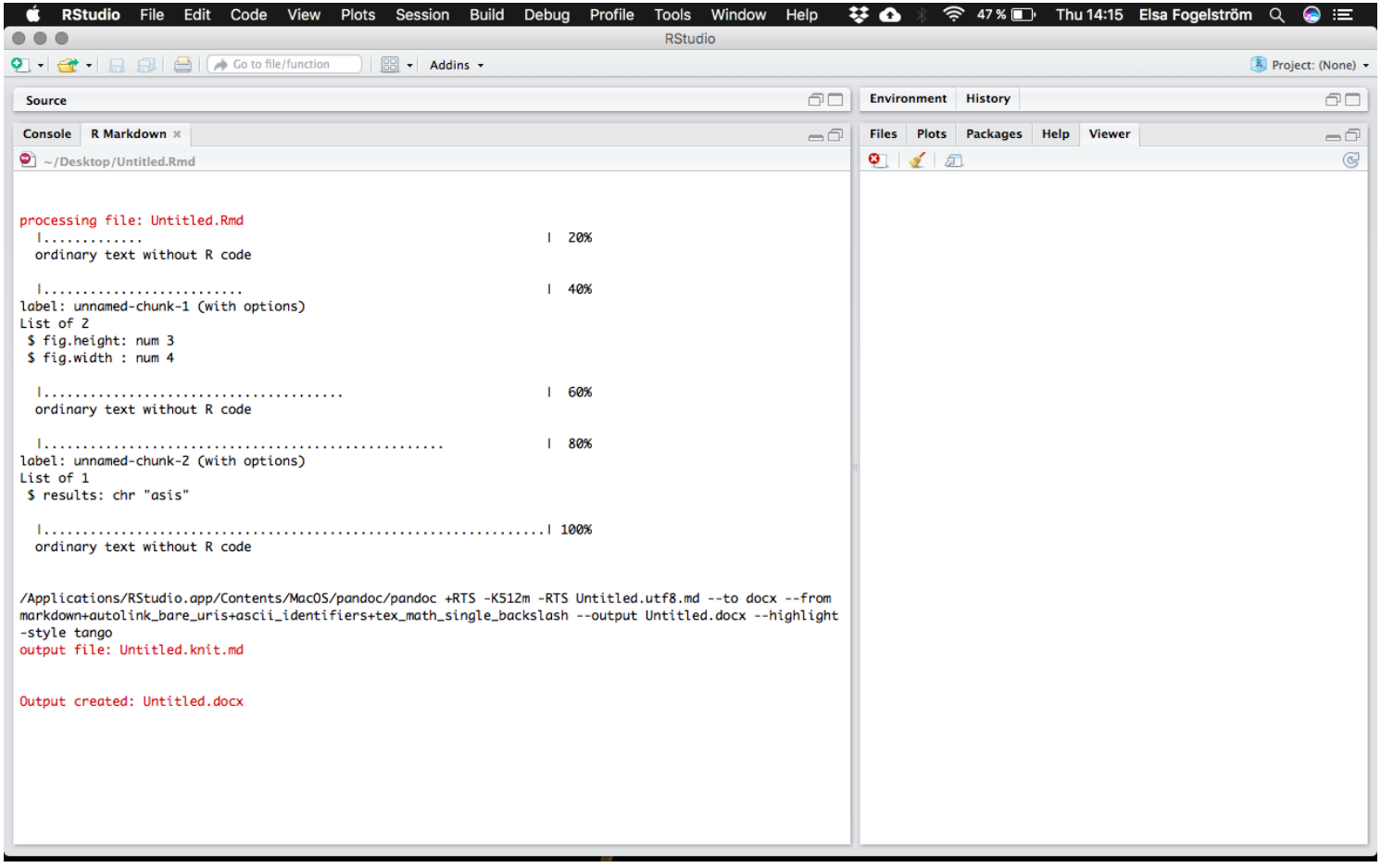
Render document: PDF



Render document: .docx



Render document



Try it for yourselves!

1. Create a new .Rmd file
2. Play around with as much formatting as possible:
    - edit the YAML metadata
    - headers
    - **bold**, *italics*, lists
    - inline code
    - figures from data (using your own data or the `iris` dataset)
    - mathematical annotation
    - visible/hidden r code
    - ...
3. Click the *Preview* button to see how it turned out
4. Render your report to different document formats

If you run into problems

Is everything in the right place?

Within/outside code chunks?

Error message:

Search online! You're probably not the first to get that error message

Best practices and solutions to common problems:

https://rmd4sci.njtierney.com/common-problems-with-rmarkdown-and-some-solutions.html

Problems with LaTex and knitting to .pdf

TinyTex

Error message when installing on mac: https://github.com/yihui/tinytex/issues/24

Update or reinstall TinyTex https://yihui.name/tinytex/r/#debugging

If TinyTex doesn't work, try using texworks

Knitting to pdf: Error messages

- Try to figure out problem from message
    - code chunk that doesn't run?
    - weird symbols?
- File/Save with encoding/UTF-8
- Change LaTeX engine to 'xelatex' (output options/advanced)
- Ask Google

- This is an R Markdown presentation.
- Markdown is a simple formatting syntax for authoring HTML, PDF, and MS Word documents.
- This presentation was created in RStudio using `remarkjs` framework through R package `xaringan` .
- This template uses custom CSS style.
- For R Markdown, see http://rmarkdown.rstudio.com
- For R Markdown presentations, see https://rmarkdown.rstudio.com/lesson-11.html

References/tutorials

R Markdown cheat sheet

Introduction to R Markdown (RStudio)

R Markdown: The Definitive Guide (Yihui Xie, J. J. Allaire, Garrett Grolemund)

Knitr output options (Yihui Xie)

Try it for yourselves!

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Thank you