R COURSE

Markdown and Quarto

Daniel Vaulot

2025-01-17

R - Session 04

- What is Markdown ?
- Rmarkdown syntax
- R chunks
- Some applications
- Quarto - the new Rmarkdown
- Cooperative writing

What is markdown

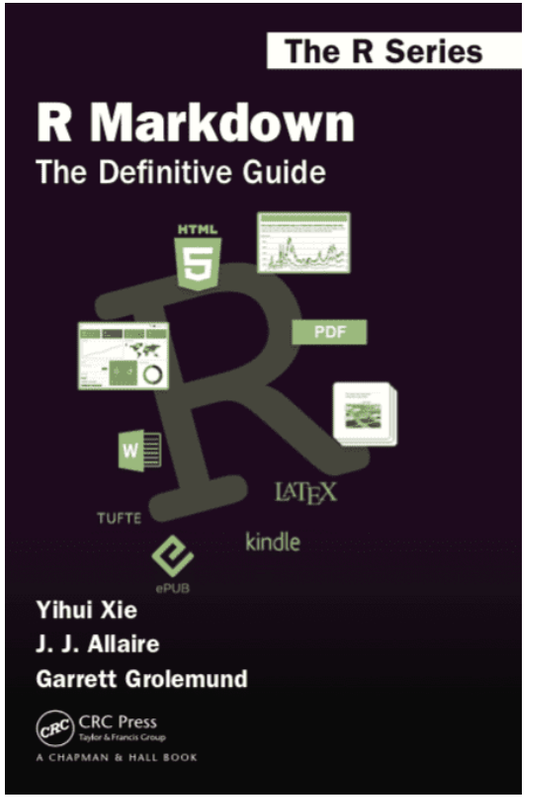
Installation and Resources

Packages

- rmarkdown (will install also knitr)
- tinytex (Latex)

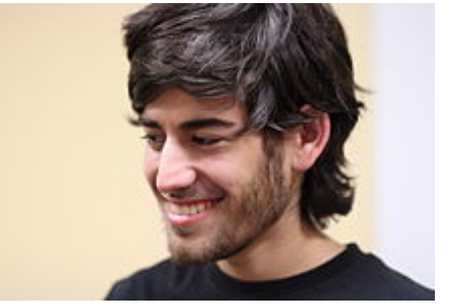
Resources

- On-line Book
- Cheat sheet



What is markdown ?

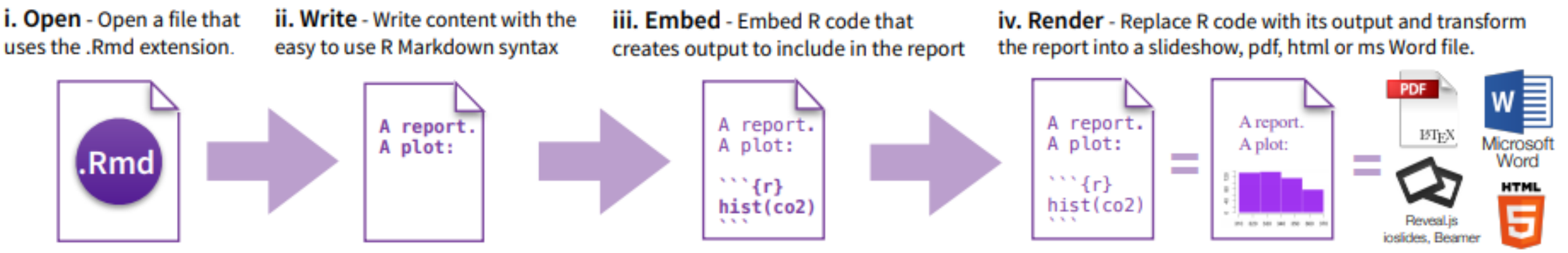
- Created in 2004 by John Gruber and Aaron Swartz
- Goal : “to write using an easy-to-read and easy-to-write plain text format, optionally convert it to structurally valid HTML”.



Many flavors…

- MultiMarkdown
- GitHub Flavored Markdown (GFM)
- Pandoc
- CommonMark

Rmarkdown



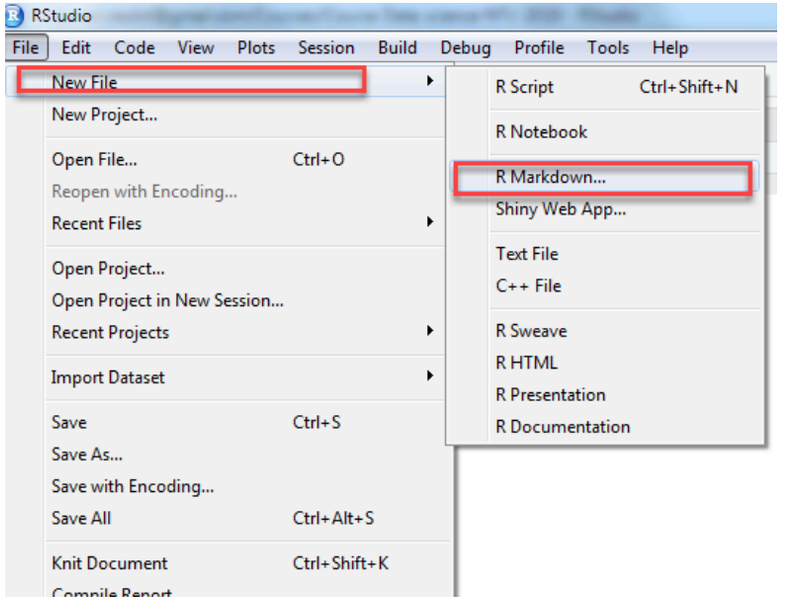
Mix

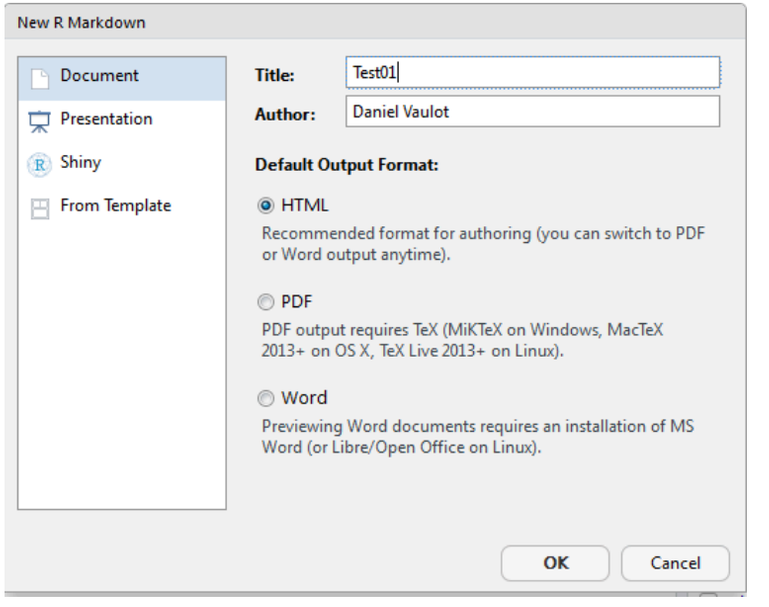
- Markdown
  - paragraph structure
  - comments
  - links
- R code (“chunks”)
- Output of R code

Your first Rmarkdown file

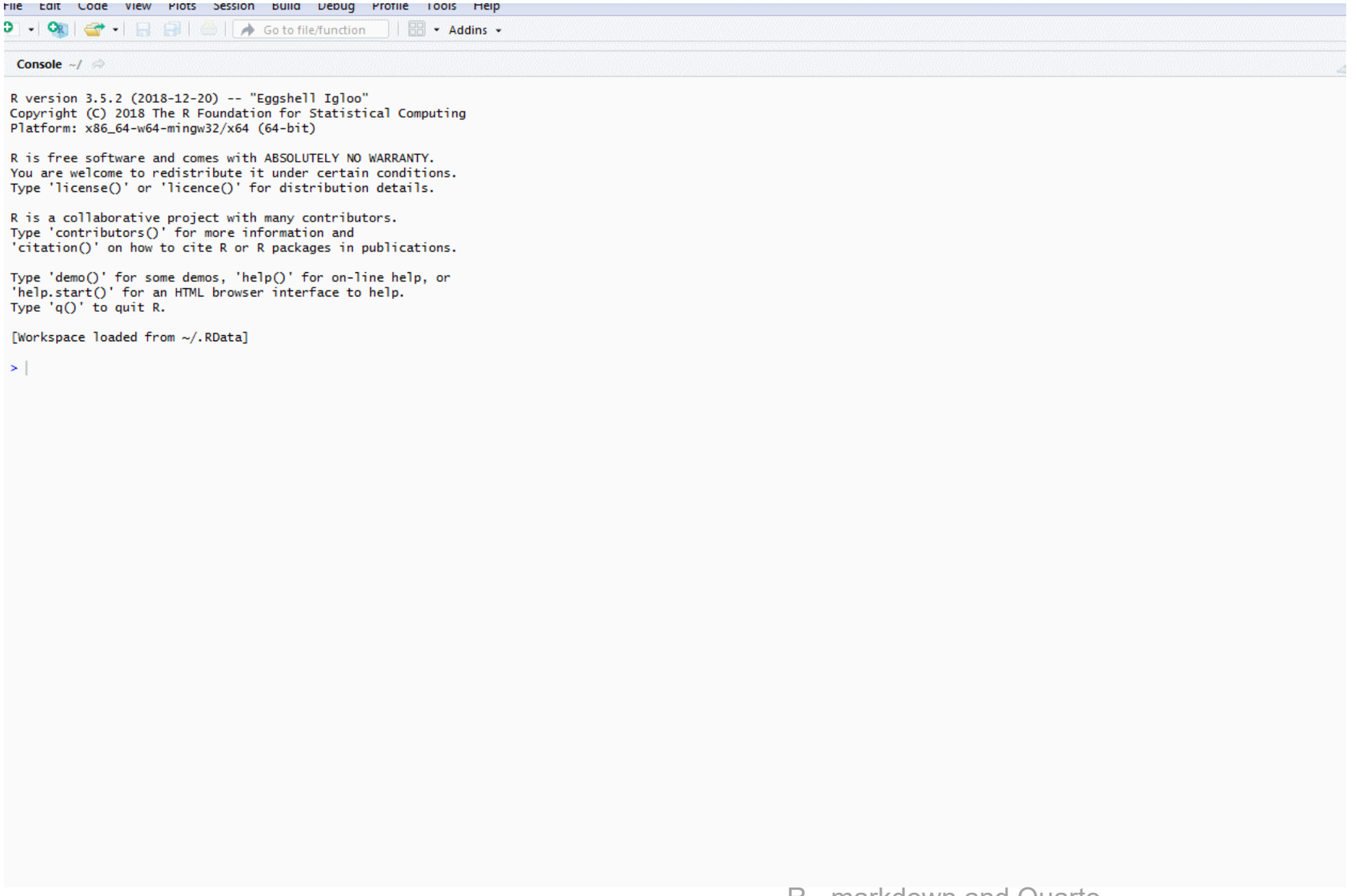
Your first Rmarkdown file

- Who has not been able to install Rmarkdown and Latex ?



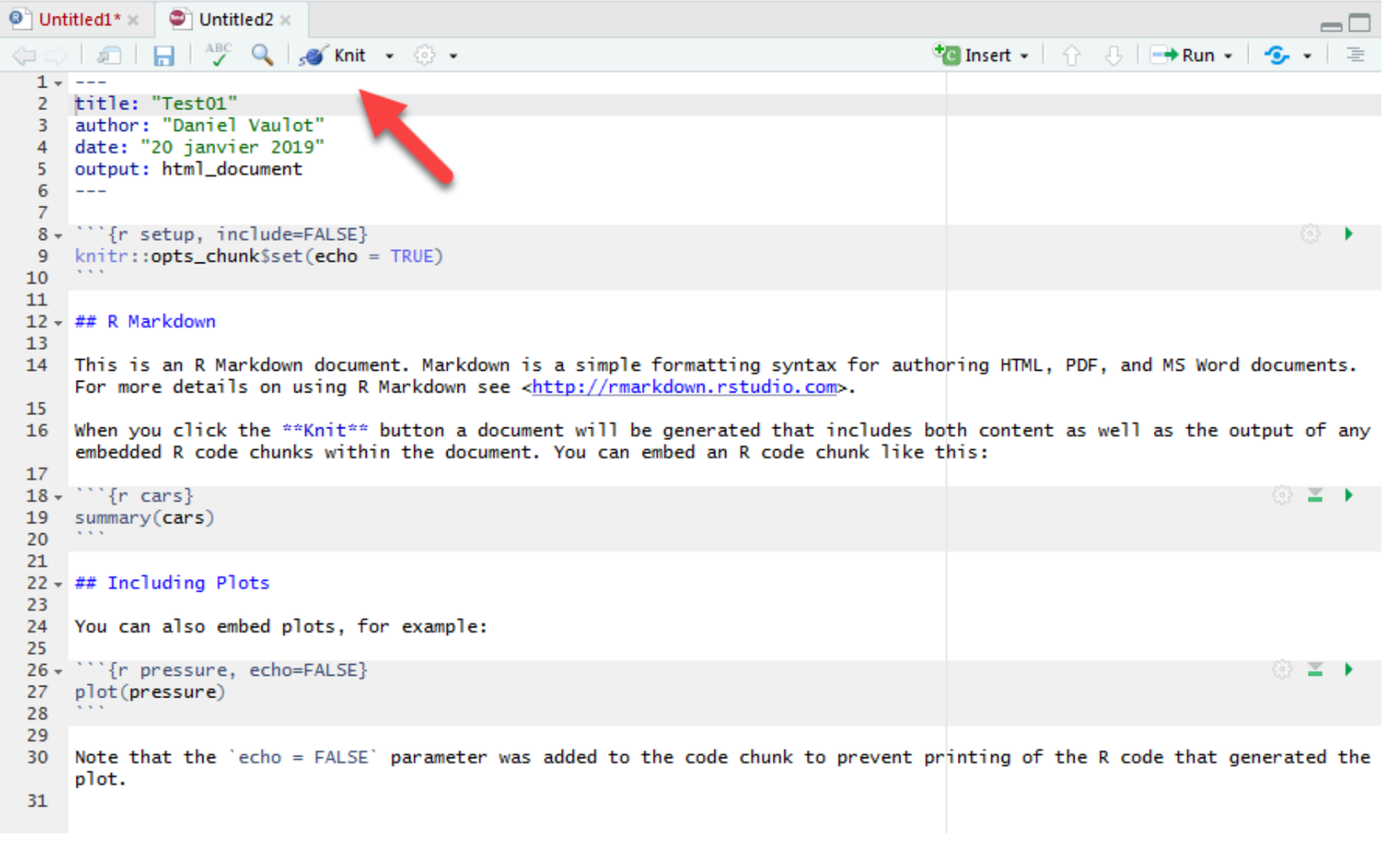


Your first Rmarkdown file

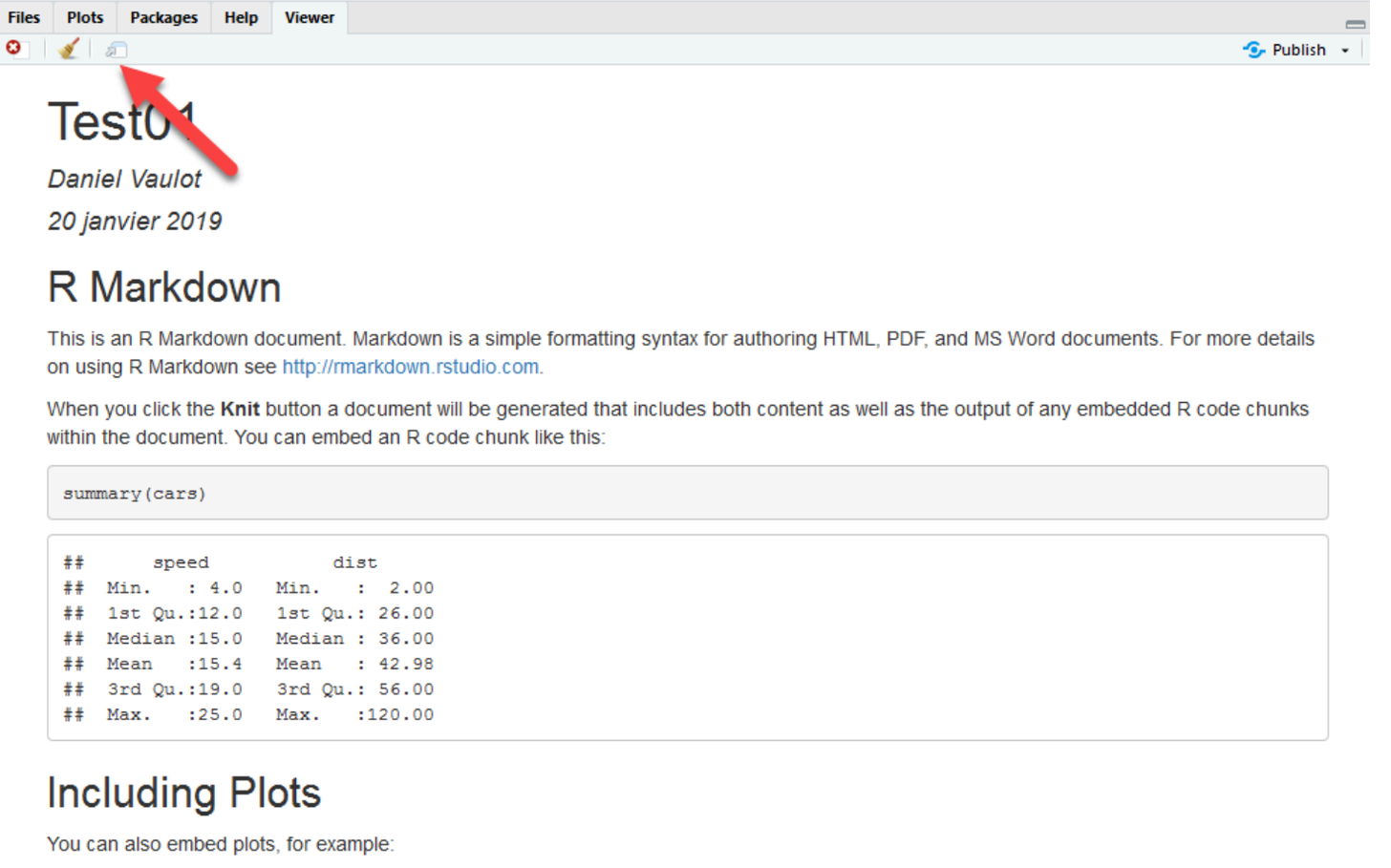


Knit to HTML

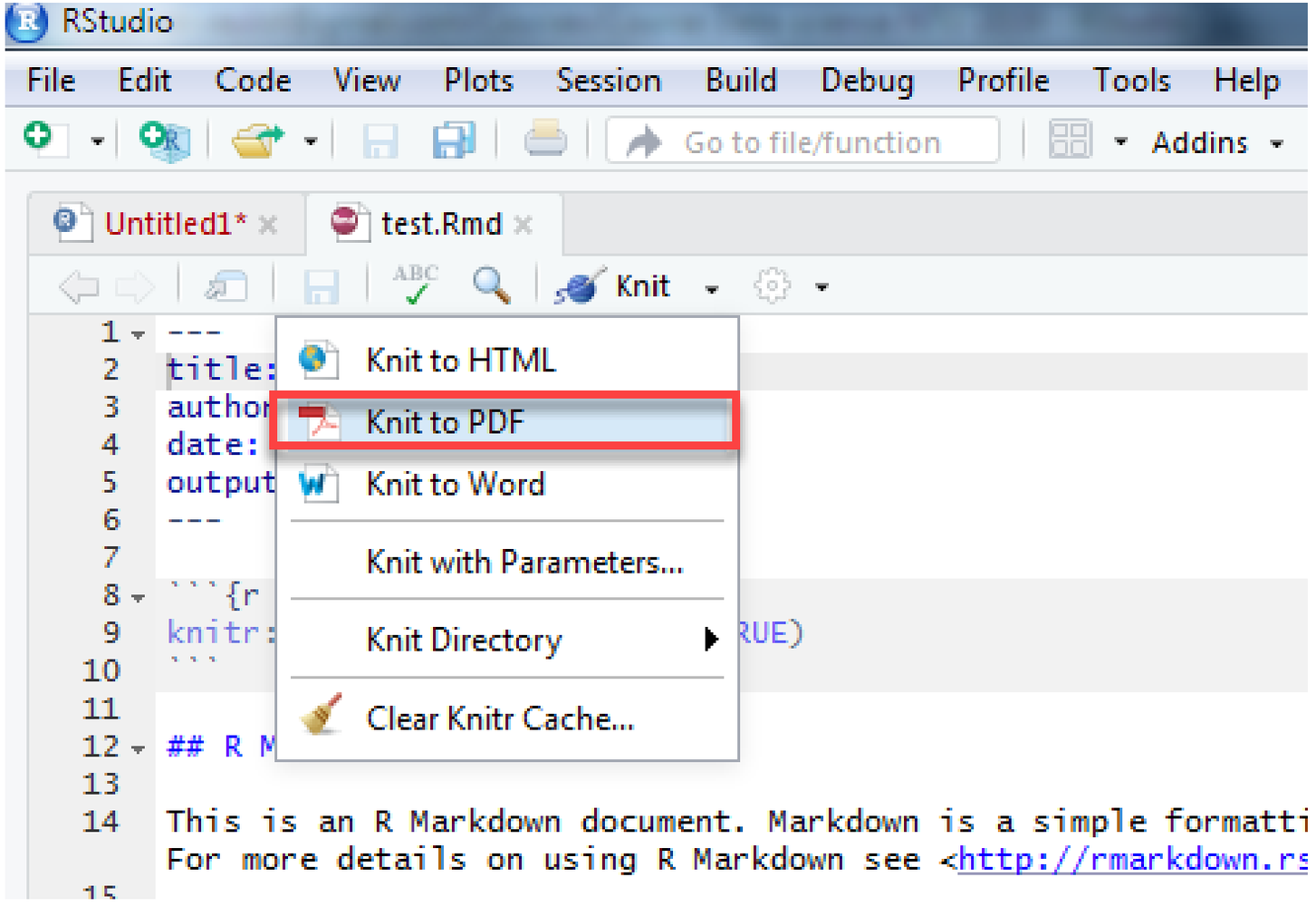
- Save to “xxx.Rmd”



Knit to HTML


Files
Plots
Packages
Help
Viewer
Publish
Test01
Daniel Vaulot
20 janvier 2019
R Markdown
This is an R Markdown document. Markdown is a simple formatting syntax for authoring HTML, PDF, and MS Word documents. For more details on using R Markdown see http://rmarkdown.rstudio.com.
When you click the Knit button a document will be generated that includes both content as well as the output of any embedded R code chunks within the document. You can embed an R code chunk like this:
summary(cars)
speed dist
Min. : 4.0 Min. : 2.00
1st Qu.:12.0 1st Qu.: 26.00
Median :15.0 Median : 36.00
Mean :15.4 Mean : 42.98
3rd Qu.:19.0 3rd Qu.: 56.00
Max. :25.0 Max. :120.00
Including Plots
You can also embed plots, for example:

Knit of pdf


RStudio
File Edit Code View Plots Session Build Debug Profile Tools Help
Go to file/function
Addins
Untitled1*
test.Rmd
Knit
Knit to HTML
Knit to PDF
Knit to Word
Knit with Parameters...
Knit Directory
Clear Knitr Cache...
---
title:
author
date:
output

```{r
knitr:
RUE)
```
R M
This is an R Markdown document. Markdown is a simple formatti
For more details on using R Markdown see <http://rmarkdown.rs

Knit of pdf

Test01

Daniel Vaulot

20 janvier 2019

R Markdown

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```
summary(cars)
```

```
##      speed           dist
##  Min.   : 4.0   Min.   :  2.00
##  1st Qu.:12.0   1st Qu.: 26.00
##  Median :15.0   Median : 36.00
##  Mean   :15.4   Mean   : 42.98
##  3rd Qu.:19.0   3rd Qu.: 56.00
##  Max.   :25.0   Max.   :120.00
```

Including Plots

You can also embed plots, for example:

Markdown syntax

Quick guide

Structure

Headings

```
# Heading - level 1

## Heading - level 2
```

Heading - level 1

Heading - level 2

Paragraphs

```
Paragraphs are separated
by a blank line.

Two spaces at the end of a line
produces a line break.
```

Paragraphs are separated by a blank line.

Two spaces at the end of a line
produces a line break.

Formatting

Characters

```
_italic_, *italic*, **bold**, `monospace`.
```

italic, *italic*, **bold**, `monospace`.

- Do not mix straight and backward quotes

Formatting

Bullet lists

```
        Bullet list:

          * apples
          * oranges
          * pears
              * passe crassane (4 spaces to indent)
```

- apples
- oranges
- pears
    - passe crassane

Formatting

Numbered lists

```
Numbered list:

1. wash
1. rinse
1. repeat
```

1. wash
2. rinse
3. repeat

Formatting

Hyperlinks

```
[Text of the link](URL of the link)

# Example
[Markdown syntax](https://www.markdownguide.org/basic-syntax/)
```

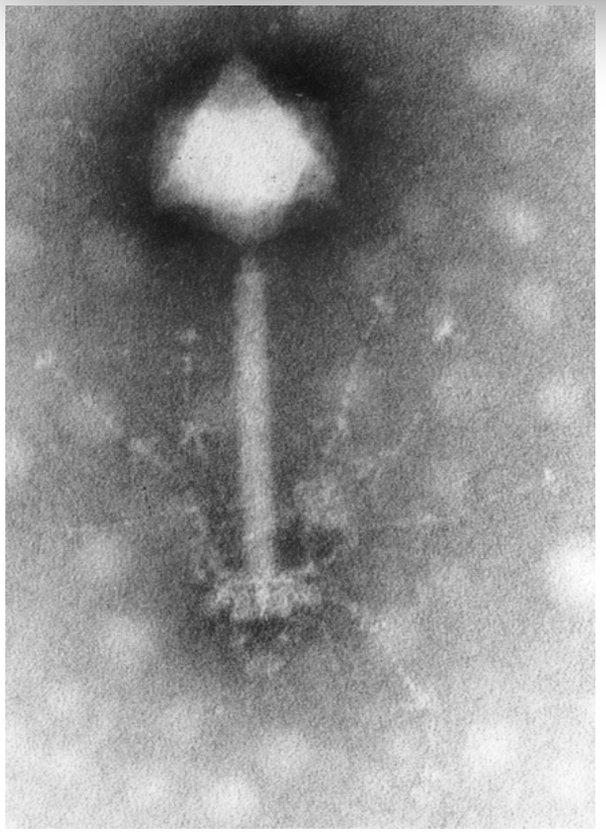
Markdown syntax

Formatting

Images

```
  ![Image name](URL of the link - can also be a local file on your computer)

# Example
  ![](../../../Images/R/Synechococcus_phage.png)
```



Formatting

Tables

```
ID | First | Last
 --|-- -|-- 
1 | Joe | Biden
```

ID	First	Last
1	Joe	Biden

Alignement

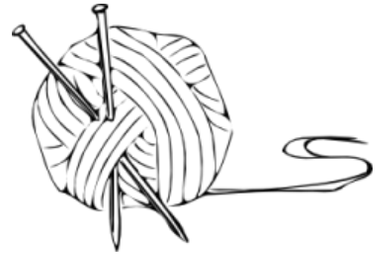
```
| Default | Left | Right | Center |
|---------|:-----|------:|:------:|
| 12      | 12   |    12 |   12   |
| 123     | 123  |   123 |  123   |
| 1       | 1    |     1 |   1    |
```

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

Rmarkdown

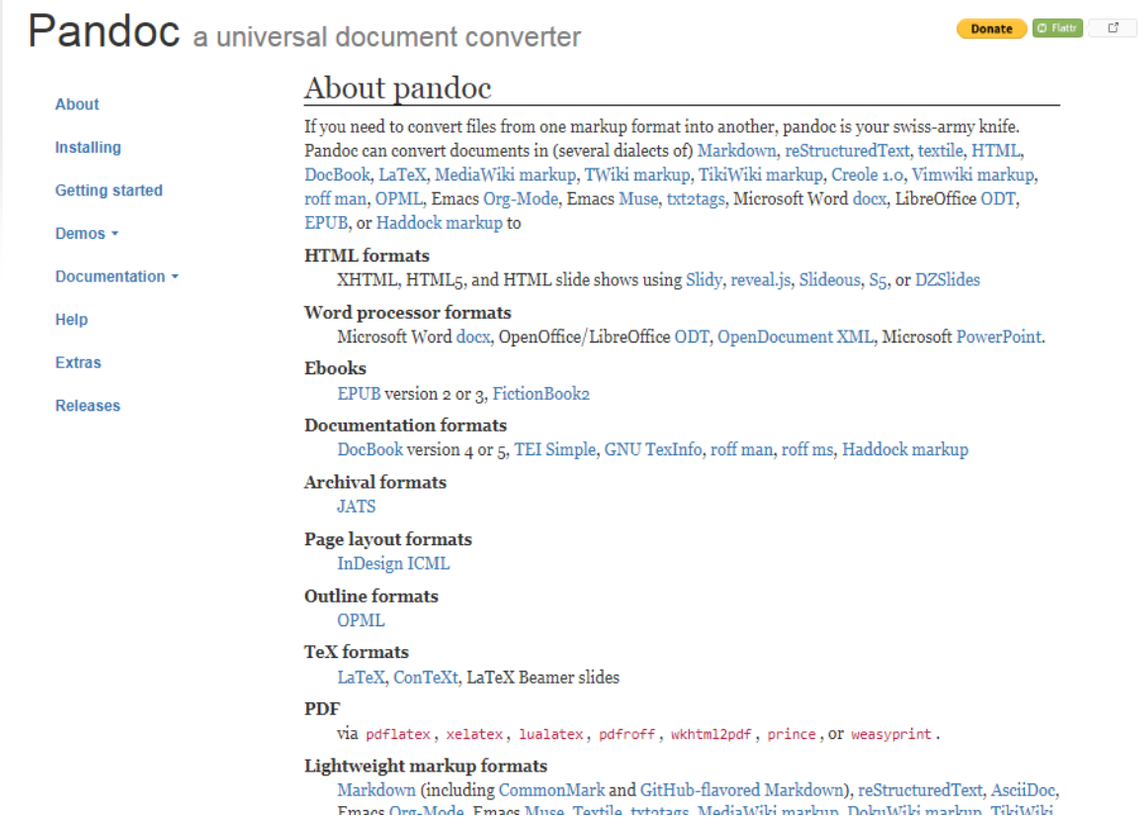
Rmarkdown conversion process

- knitr : R library
- Pandoc : command line tool
  - Converts from **md** to **pdf**, **html**, **docx**…



```
# HTML
> pandoc test1.md -f markdown -t html -s -o

# pdf
> pandoc test1.md -s -o test1.pdf
```



Pandoc a universal document converter

Donate Flattr

About
Installing
Getting started
Demos
Documentation
Help
Extras
Releases

About pandoc

If you need to convert files from one markup format into another, pandoc is your swiss-army knife. Pandoc can convert documents in (several dialects of) Markdown, reStructuredText, textile, HTML, DocBook, LaTeX, MediaWiki markup, TWiki markup, TikiWiki markup, Creole 1.0, Vimwiki markup, roff man, OPML, Emacs Org-Mode, Emacs Muse, txt2tags, Microsoft Word docx, LibreOffice ODT, EPUB, or Haddock markup to

HTML formats
XHTML, HTML5, and HTML slide shows using Slidy, reveal.js, Slideous, S5, or DZSlides

Word processor formats
Microsoft Word docx, OpenOffice/LibreOffice ODT, OpenDocument XML, Microsoft PowerPoint.

Ebooks
EPUB version 2 or 3, FictionBook2

Documentation formats
DocBook version 4 or 5, TEI Simple, GNU TexInfo, roff man, roff ms, Haddock markup

Archival formats
JATS

Page layout formats
InDesign ICML

Outline formats
OPML

TeX formats
LaTeX, ConTeXt, LaTeX Beamer slides

PDF
via `pdflatex`, `xelatex`, `lualatex`, `pdfroff`, `wkhtml2pdf`, `prince`, or `weasyprint`.

Lightweight markup formats
Markdown (including CommonMark and GitHub-flavored Markdown), reStructuredText, AsciiDoc,

The Rmarkdown file structure

Untitled1* | Untitled2

Knit | Insert | Run

```
---
title: "Test01"
author: "Daniel Vaulot"
date: "20 janvier 2019"
output: html_document
---

```{r setup, include=FALSE}
knitr::opts_chunk$set(echo = TRUE)
```

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```{r cars}
summary(cars)
```

Including Plots

You can also embed plots, for example:

```{r pressure, echo=FALSE}
plot(pressure)
```

Note that the `echo = FALSE` parameter was added to the code chunk to prevent printing of the R code that generated the plot.
```

YaML

R chunk

Markdown

Knit process

Console | R Markdown

C:/Users/vaulot/Desktop/test.Rmd

```
processing file: test.Rmd
  |.........                                                |  14%
  ordinary text without R code

  |...................                                      |  29%
label: setup (with options)
List of 1
 $ include: logi FALSE

  |.............................                            |  43%
  ordinary text without R code

  |.........................................                |  57%
label: cars
  |.................................................         |  71%
  ordinary text without R code

  |.....................................................    |  86%
label: pressure (with options)
List of 1
 $ echo: logi FALSE

  |.........................................................| 100%
  ordinary text without R code


"C:/Program Files/RStudio/bin/pandoc/pandoc" +RTS -K512m -RTS test.utf8.md --to latex --from markdown+autolink_bare_uris+asci
i_identifiers+tex_math_single_backslash --output test.tex --template "C:\PROGRA~1\R\R-35~1.2\library\RMARKD~1\rmd\latex\DEFAU
L~3.TEX" --highlight-style tango --pdf-engine pdflatex --variable graphics=yes --variable "geometry:margin=1in" --variable "c
ompact-title:yes"
output file: test.knit.md


Output created: test.pdf
```

Output

Test01

Daniel Vaulot

20 janvier 2019

Markdown

R Markdown

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R code

```
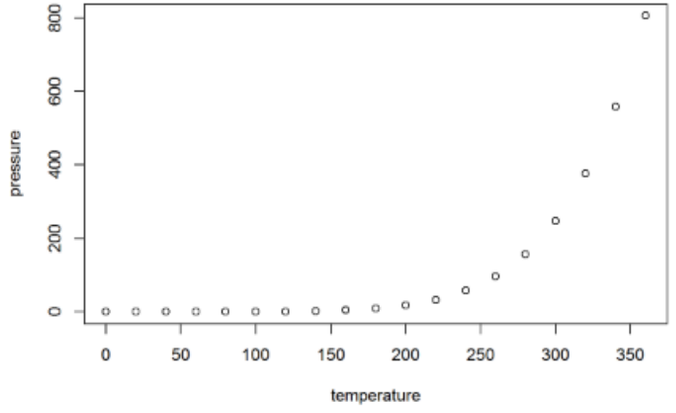
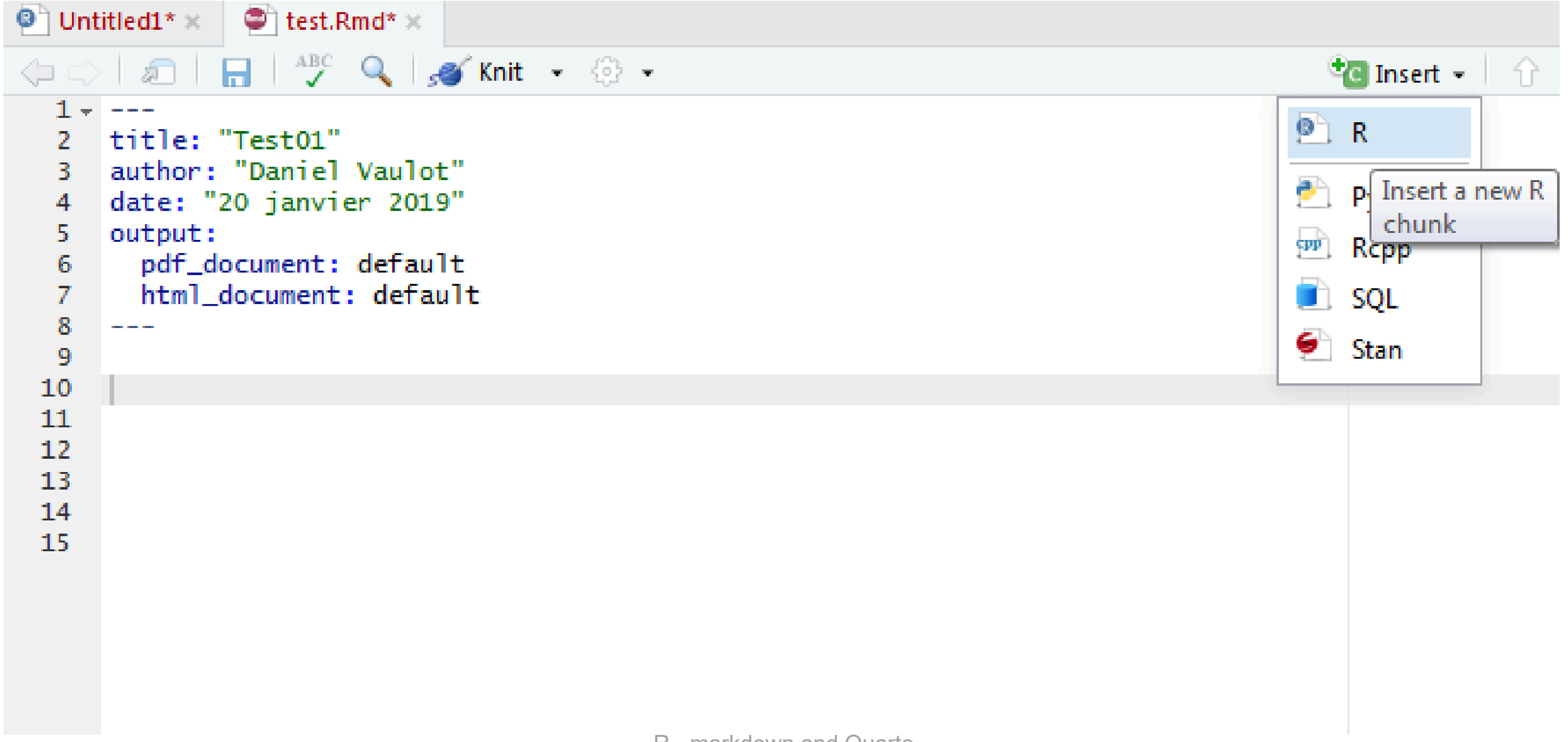
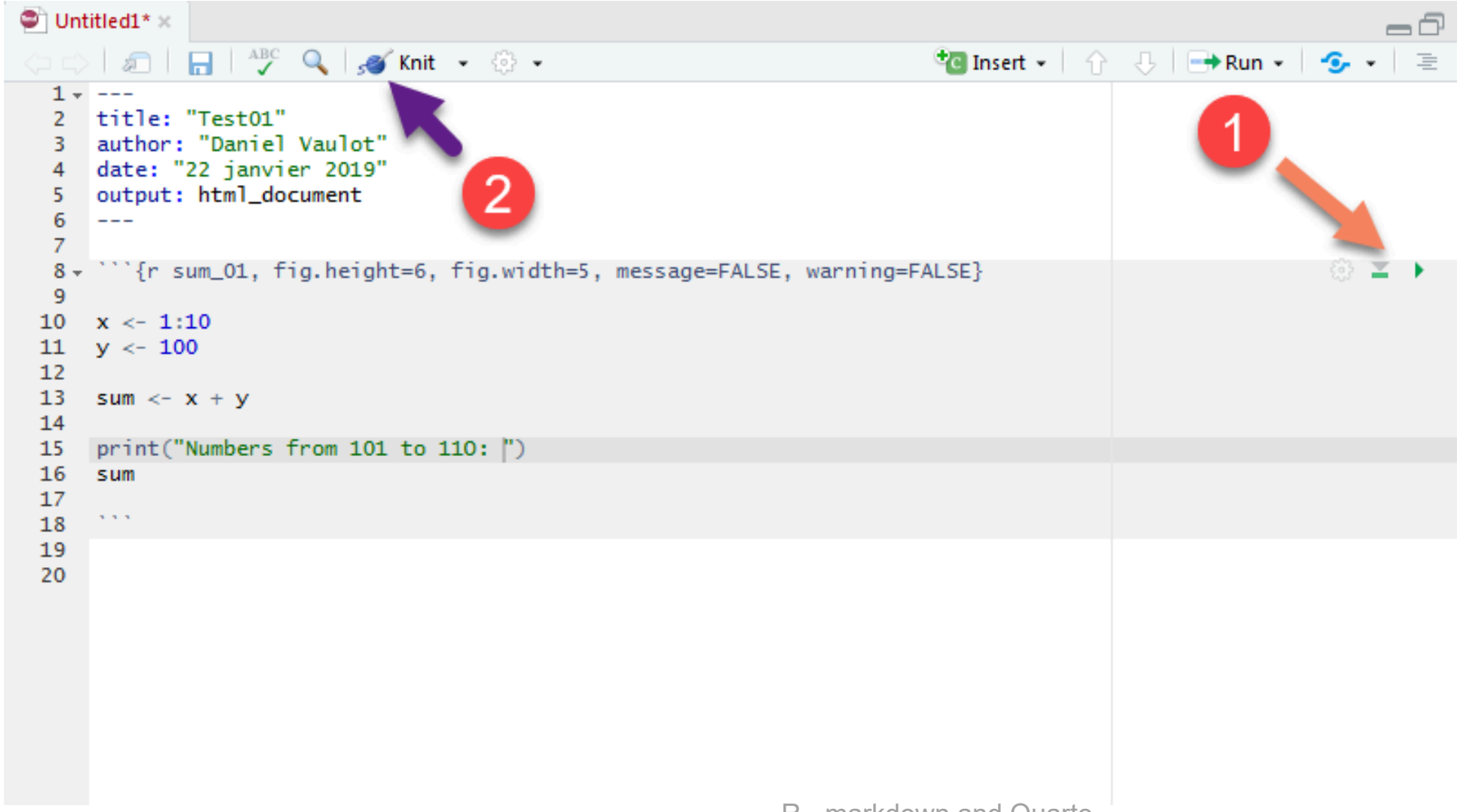
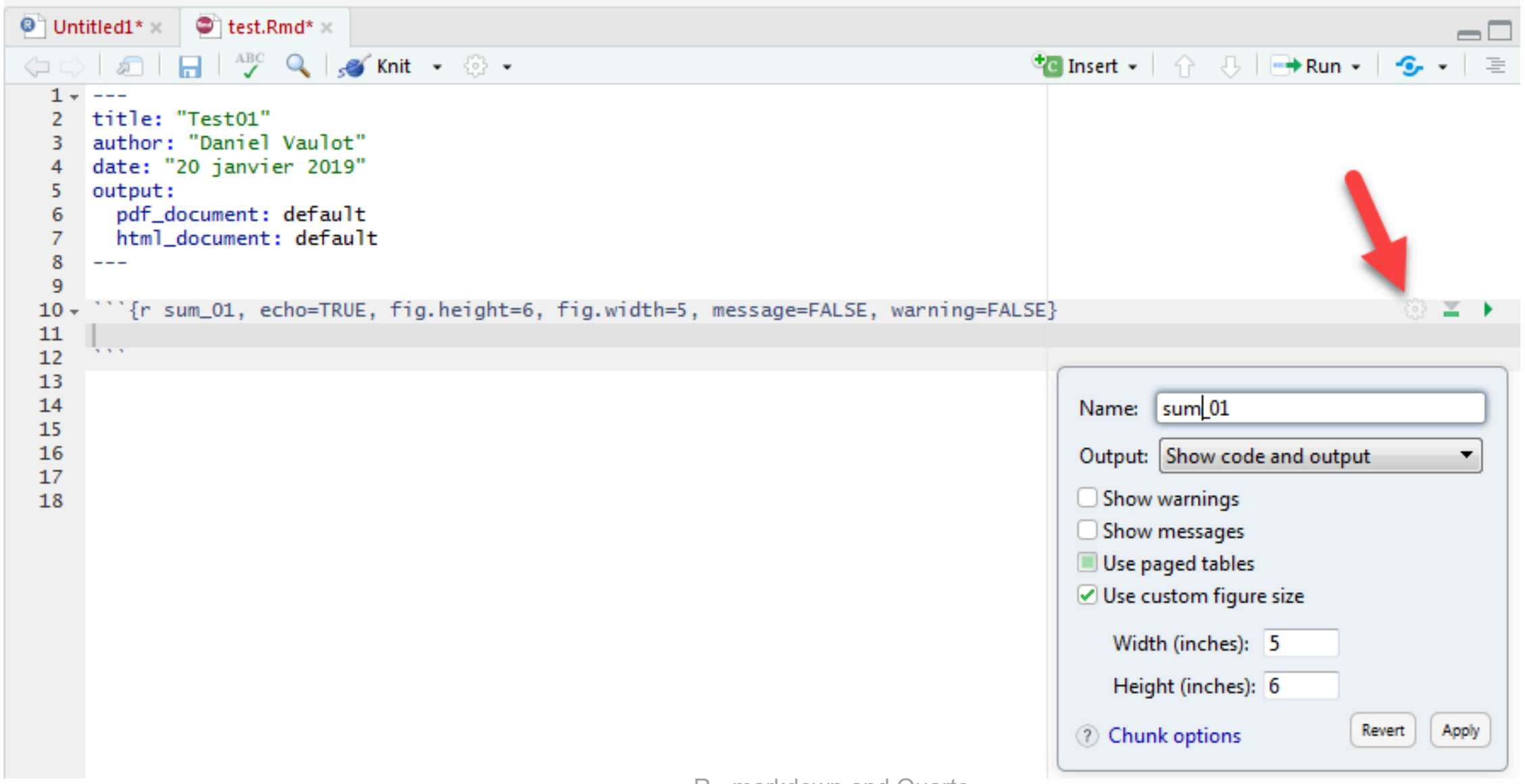
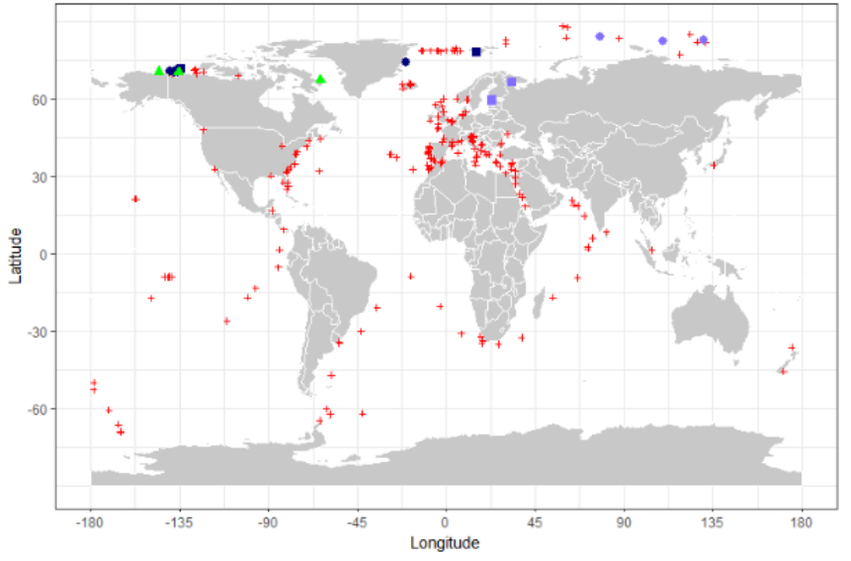
summary(cars)
```

R output

```
##      speed           dist       
##  Min.   : 4.0   Min.   :  2.00  
##  1st Qu.:12.0   1st Qu.: 26.00  
##  Median :15.0   Median : 36.00  
##  Mean   :15.4   Mean   : 42.98  
##  3rd Qu.:19.0   3rd Qu.: 56.00  
##  Max.   :25.0   Max.   :120.00
```

Including Plots

You can also embed plots, for example:



Note that the `echo = FALSE` parameter was added to the code chunk to prevent printing of the R code that generated the plot.

Insert R chunk



Run R chunk

Two options



Run R chunk

Option 1: Run R chunk inside Rmd file

- Use when building and debugging an Rmd file

Run R chunk

Option 2: Knit R chunk to HTML

- Use for final production

Test01

Daniel Vaulot

22 janvier 2019

```
x <- 1:10
y <- 100

sum <- x + y

print("Numbers from 101 to 110: ")
```

```
## [1] "Numbers from 101 to 110: "
```

```
sum
```

```
##  [1] 101 102 103 104 105 106 107 108 109 110
```

Options for R chunks



Useful options

Options	Default value	Aim
echo	TRUE	Print code (= FALSE in a report for example)
eval	TRUE	Evaluate code (= FALSE if want to show code only)
warning	TRUE	Warning message (= FALSE to remove long warnings)
message	TRUE	Messages (= FALSE to remove long messages)
cache	FALSE	If TRUE only modified chunks will be evaluated
		very useful for computing heavy codes
fig.height		inches
fig.width		inches

What can you do with Rmarkdown ?

Document your data analyses

- If the data changes, you can re-run analysis in a matter of minutes
- More and more journal request analyses scripts



Draw maps

Mercator projection

```
species_map <- ggplot() + geom_polygon(data = world.df, aes(x = long, y = lat,
    group = group, fill = ""), colour = "white", size = 0.1) + scale_fill_manual(values = color_cont
    guide = FALSE) + scale_x_continuous(breaks = (-4:4) * 45) + scale_y_continuous(breaks = (-2:2) *
    30) + xlab("Longitude") + ylab("Latitude") + coord_fixed(1.3) + theme_bw()
# species_map <- species_map + coord_map () # Mercator projection
# species_map <- species_map + coord_map('gilbert') # Nice for the poles

# Add points where not detected
df_map <- dplyr::filter(metabarcodes_species, is.na(reads_total_species))
species_map <- species_map + geom_point(data = df_map, aes(x = longitude, y = latitude),
    color = color_not_present, size = size_cross, shape = 3)

# Add the ice metabarcodes
df_map <- dplyr::filter(metabarcodes_species, !is.na(reads_total_species) &
    substrate == "ice")
species_map <- species_map + geom_point(data = df_map, aes(x = longitude, y = latitude),
    color = color_ice, size = size_points)

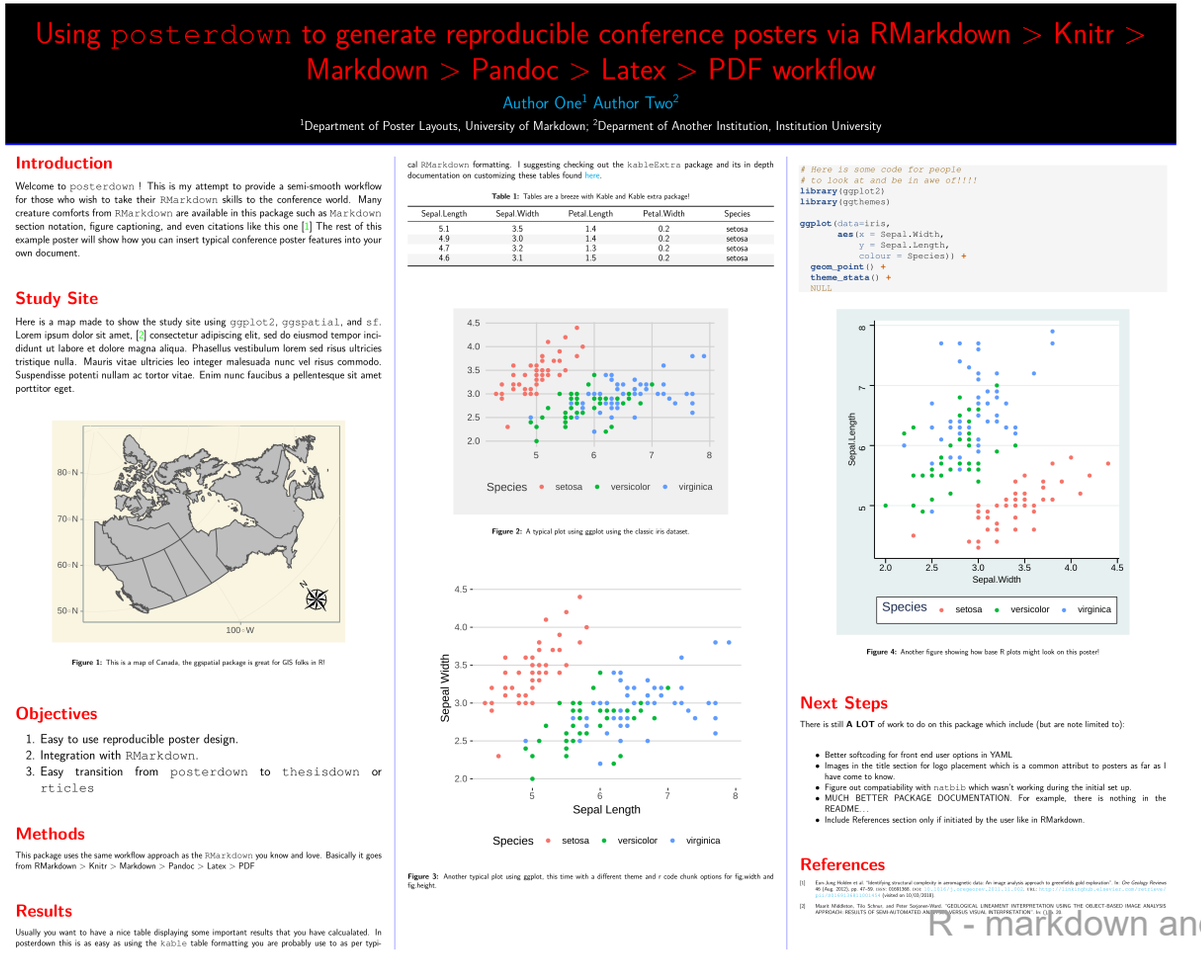
# Add the water metabarcodes
df_map <- dplyr::filter(metabarcodes_species, !is.na(reads_total_species) &
    substrate == "water")
species_map <- species_map + geom_point(data = df_map, aes(x = longitude, y = latitude),
    color = color_water, size = size_points)

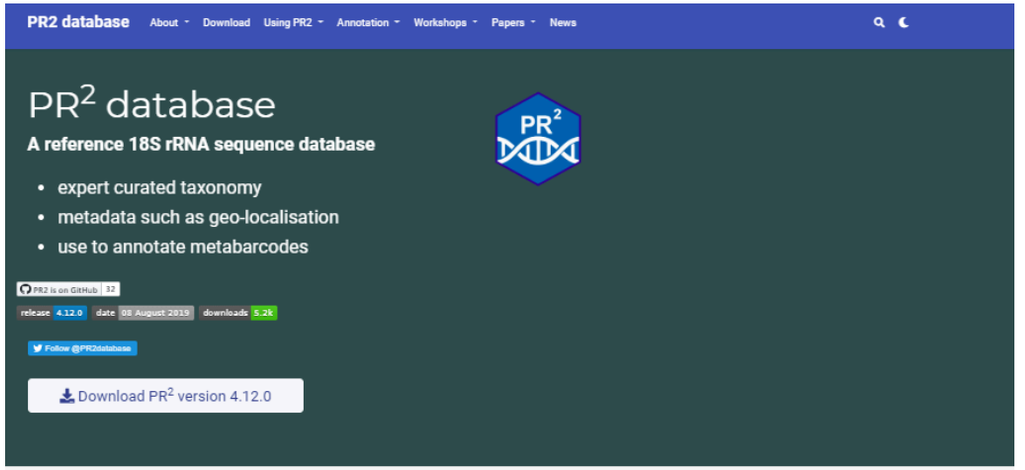
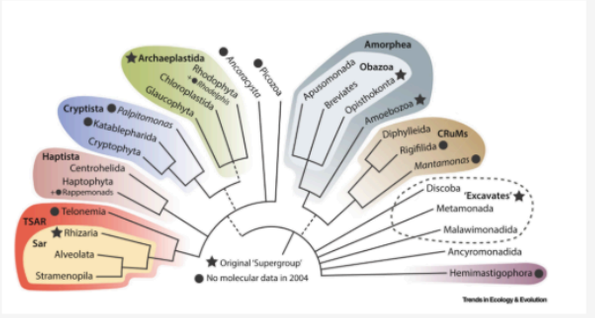
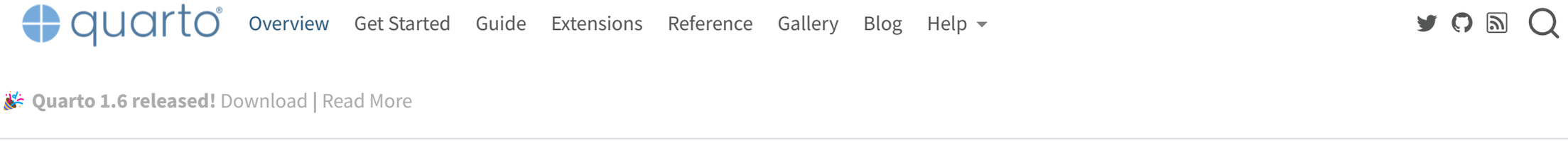
# Add the water sequence
df_map <- dplyr::filter(genbank_species, substrate == "water")
species_map <- species_map + geom_point(data = df_map, aes(x = longitude, y = latitude),
    color = color_water, size = size_points, shape = 15)

# Add the ice sequence
df_map <- dplyr::filter(genbank_species, substrate == "ice")
species_map <- species_map + geom_point(data = df_map, aes(x = longitude, y = latitude),
    color = color_ice, size = size_points, shape = 15)

# Add the culture
df_map <- dplyr::filter(cultures)
species_map <- species_map + geom_point(data = df_map, aes(x = longitude, y = latitude),
    color = color_cultures, size = size_points, shape = 17)

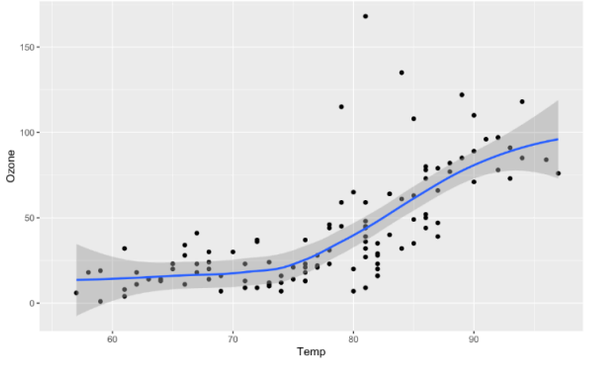
# Disply and save

species_map
```

Presentation

https://github.com/yihui/xaringan

Posters

https://github.com/brentthorne/posterdown



Using posterdown to generate reproducible conference posters via RMarkdown > Knitr > Markdown > Pandoc > Latex > PDF workflow

Author One[1] Author Two[2]

[1]Department of Poster Layouts, University of Markdown; [2]Deparment of Another Institution, Institution University

Introduction

Welcome to posterdown ! This is my attempt to provide a semi-smooth workflow for those who wish to take their RMarkdown skills to the conference world. Many creature comforts from RMarkdown are available in this package such as Markdown section notation, figure captioning, and even citations like this one [1] The rest of this example poster will show how you can insert typical conference poster features into your own document.

Study Site

Here is a map made to show the study site using ggplot2, ggspatial, and sf. Lorem ipsum dolor sit amet, [2] consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Phasellus vestibulum lorem sed risus ultricies tristique nulla. Mauris vitae ultricies leo integer malesuada nunc vel risus commodo. Suspendisse potenti nullam ac tortor vitae. Enim nunc faucibus a pellentesque sit amet porttitor eget.

Figure 1: This is a map of Canada, the ggspatial package is great for GIS folks in R!

Objectives

1. Easy to use reproducible poster design.
2. Integration with RMarkdown.
3. Easy transition from posterdown to thesisdown or rticles

Methods

This package uses the same workflow approach as the RMarkdown you know and love. Basically it goes from RMarkdown > Knitr > Markdown > Pandoc > Latex > PDF

Results

Usually you want to have a nice table displaying some important results that you have calcualated. In posterdown this is as easy as using the kable table formatting you are probably use to as per typical RMarkdown formatting. I suggesting checking out the kableExtra package and its in depth documentation on customizing these tables found here.

Table 1: Tables are a breeze with Kable and Kable extra package!

Sepal.Length	Sepal.Width	Petal.Length	Petal.Width	Species
5.1	3.5	1.4	0.2	setosa
4.9	3.0	1.4	0.2	setosa
4.7	3.2	1.3	0.2	setosa
4.6	3.1	1.5	0.2	setosa

Figure 2: A typical plot using ggplot using the classic iris dataset.

Figure 3: Another typical plot using ggplot, this time with a different theme and r code chunk options for fig.width and fig.height.

```
# Here is some code for people
# to look at and be in awe of!!!!
library(ggplot2)
library(ggthemes)

ggplot(data=iris,
       aes(x = Sepal.Width,
           y = Sepal.Length,
           colour = Species)) +
  geom_point() +
  theme_stata() +
  NULL
```


Figure 4: Another figure showing how base R plots might look on this poster!

Next Steps

There is still **A LOT** of work to do on this package which include (but are note limited to):

- Better softcoding for front end user options in YAML
- Images in the title section for logo placement which is a common attribut to posters as far as I have come to know.
- Figure out compatiability with natbib which wasn't working during the initial set up.
- MUCH BETTER PACKAGE DOCUMENTATION. For example, there is nothing in the README...
- Include References section only if initiated by the user like in RMarkdown.

References

[1] Eam Jung Holden et al. "Identifying structural complexity in aeromagnetic data: An image analysis approach to greenfields gold exploration". In: Ore Geology Reviews 46 (Aug. 2012), pp. 47–59. ISSN: 01691368. DOI: 10.1016/j.oregeorev.2012.11.002. URL: http://linkinghub.elsevier.com/retrieve/pii/S0169136812001173 (visited on 10/02/2018).

[2] Mauri Middleton, Tilo Schraa, and Peter Sorjonen-Ward. "GEOLOGICAL LINEAMENT INTERPRETATION USING THE OBJECT-BASED IMAGE ANALYSIS APPROACH: RESULTS OF SEMI-AUTOMATED AND MANUAL". In: (), p. 26.

Curriculum vitae

https://cloud.r-project.org/web/packages/vitae/index.html

Eric Scott

PhD Candidate

Ecometabolomics, multivariate statistics, R

Education

2014–2019 **PhD**, *Tufts University*, Medford.

2007 2010 **MS**, *University of Illinois at Urbana-Champaign*, Urbana.

2002–2006 **B.A.**, *Whitman College*, Walla Walla.

Research Experience

2017–2018 **NSF grant coordinator**, *Tufts University*, Medford, MA.

- Schedule and implement conference calls
- Coordinate in-person meetings

Website

https://bookdown.org/yihui/blogdown/



About PR2



The eukaryotic tree. From Burki et al. 2019. The New Tree of Eukaryotes. Trends in Ecology & Evolution. DOI: 10.1016/j.tree.2019.08.008.

Current version : 4.12.0
Last update : 8 August 2019
DOI : 10.6084/m9.figshare.5913181

Quarto

Quarto

- New flavor of markdown
- Independant of R
- Can include also Python, Julia chunks
- Will evolve while R markdown will not be updated
- Many new powerful feature



Welcome to Quarto

An open-source scientific and technical publishing system

- Author using Jupyter notebooks or with plain text markdown in your favorite editor.
- Create dynamic content with Python, R, Julia, and Observable.
- Publish reproducible, production quality articles, presentations, dashboards, websites, blogs, and books in HTML, PDF, MS Word, ePub, and more.
- Share knowledge and insights organization-wide by publishing to Posit Connect, Confluence, or other publishing systems.
- Write using Pandoc markdown, including equations, citations, crossrefs, figure panels, callouts, advanced layout, and more.

Quarto vs Rmarkdown

1. Different formatting of yaml options
2. Different formatting of chunk options

Hello, Quarto

Python | R | Julia | Observable

Quarto is a multi-language, next generation version of R Markdown from RStudio, with many new new features and capabilities. Like R Markdown, Quarto uses Knitr to execute R code, and is therefore able to render most existing Rmd files without modification.

```
---
title: "ggplot2 demo"
author: "Norah Jones"
date: "5/22/2021"
format:
  html:
    fig-width: 8
    fig-height: 4
    code-fold: true
---

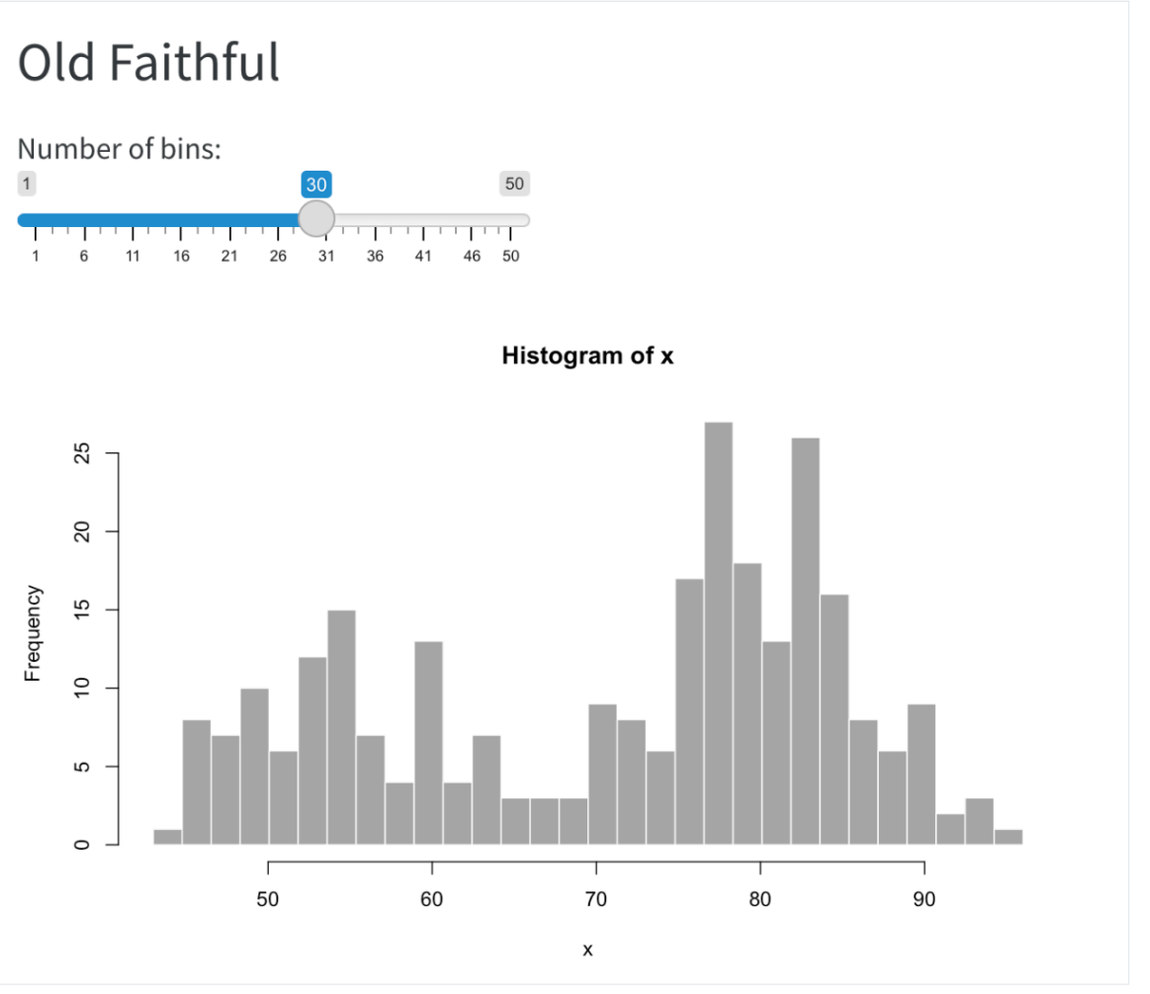
## Air Quality

@fig-airquality further explores the impact of temperature
on ozone level.

```{r}
#| label: fig-airquality
#| fig-cap: Temperature and ozone level.
#| warning: false

library(ggplot2)

ggplot(airquality, aes(Temp, Ozone)) +
  geom_point() +
  geom_smooth(method = "loess"
)
```
```

1

2

ggplot2 demo

Norah Jones

May 22nd, 2021

Air Quality

Figure 1 further explores the impact of temperature on ozone level.

▶ Code



Figure 1: Temperature and ozone level.

Interactive documents (Shiny)

````
---
title: "Old Faithful"
format: html
server: shiny
---

```{r}
sliderInput("bins", "Number of bins:",
            min = 1, max = 50, value = 30)
plotOutput("distPlot")
```

```{r}
#| context: server
output$distPlot <- renderPlot({
  x <- faithful[, 2]  # Old Faithful Geyser data
  bins <- seq(min(x), max(x), length.out = input$bins + 1)
  hist(x, breaks = bins, col = 'darkgray', border = 'white')
})
```
````



Writing a report with quarto

- `report-quarto` folder in data.zip file
- Files
  - `img`
    - Tara_Ocean.png
  - bibliography.bib
  - report.pdf
  - report.qmd

Report.qmd

Yaml header

```yaml
title: "Report template"
format: pdf
author:
  - name: Name1 Surname
  - name: Name2 Surname
  - name: Name3 Surname
  - name: Name4 Surname
  - name: Name5 Surname
abstract: |
  Lorem ipsum dolor sit amet, consectetur adipiscing elit. Curabitur eget porta erat. Morbi consect
  est vel gravida pretium. Suspendisse ut dui eu ante cursus gravida non sed sem. Nullam sapien tel
  commodo id velit id, eleifend volutpat quam. Phasellus mauris velit, dapibus finibus elementum ve
bibliography: bibliography.bib
```

Report.qmd

Text

```
# Introduction

Lorem ipsum dolor sit [@bib1] amet, consectetur adipiscing elit.
Curabitur eget porta erat. Morbi consectetur est vel gravida pretium.

# Materials and methods

## Etiam eget sapien nibh

Nulla mi mi,  venenatis sed ipsum varius, volutpat euismod diam.

# Results

Nulla mi mi, venenatis sed ipsum varius, volutpat euismod diam.

## 2 Level

### 3rd level heading

Maecenas convallis mauris sit amet sem ultrices gravida. Etiam eget
```

Report.qmd

References

Call a reference

```
Lorem ipsum dolor sit [@bib1] amet, consectetur adipiscing elit.
Curabitur eget porta erat. Morbi consectetur est vel gravida pretium.
```

Create list of references

- Use file bibliography.bib defined in yaml header

```
\newpage

# References

::: {#refs}
:::
```

bibliography.bib

- bibtex format for references
- Created from Zotero

```
@article{bib1,
  language = {eng},
  number = {12},
  pages = {938-950},
  title = {Turning a hobby into a job: How duplicated genes find new functions},
  volume = {9},
  year = {2008},
  author = {Wolfe, Kenneth H and Conant, Gavin C},
  address = {England},
  copyright = {COPYRIGHT 2008 Nature Publishing Group},
  issn = {1471-0056},
  journal = {Nature reviews. Genetics},
}
```

Report.qmd

Tables

Call a table

```
# Results

Aliquam in enim semper, aliquam massa id, cursus neque. Praesent
faucibus semper libero (@tbl-summary).
```

Display a table

```
# Tables

| Col1 | Col2 | Col3 |
|------|------|------|
| A    | B    | C    |
| E    | F    | G    |
| A    | G    | G    |

: My Caption {#tbl-summary}
```

Report.qmd

Figures

Call a figure

```
# Results

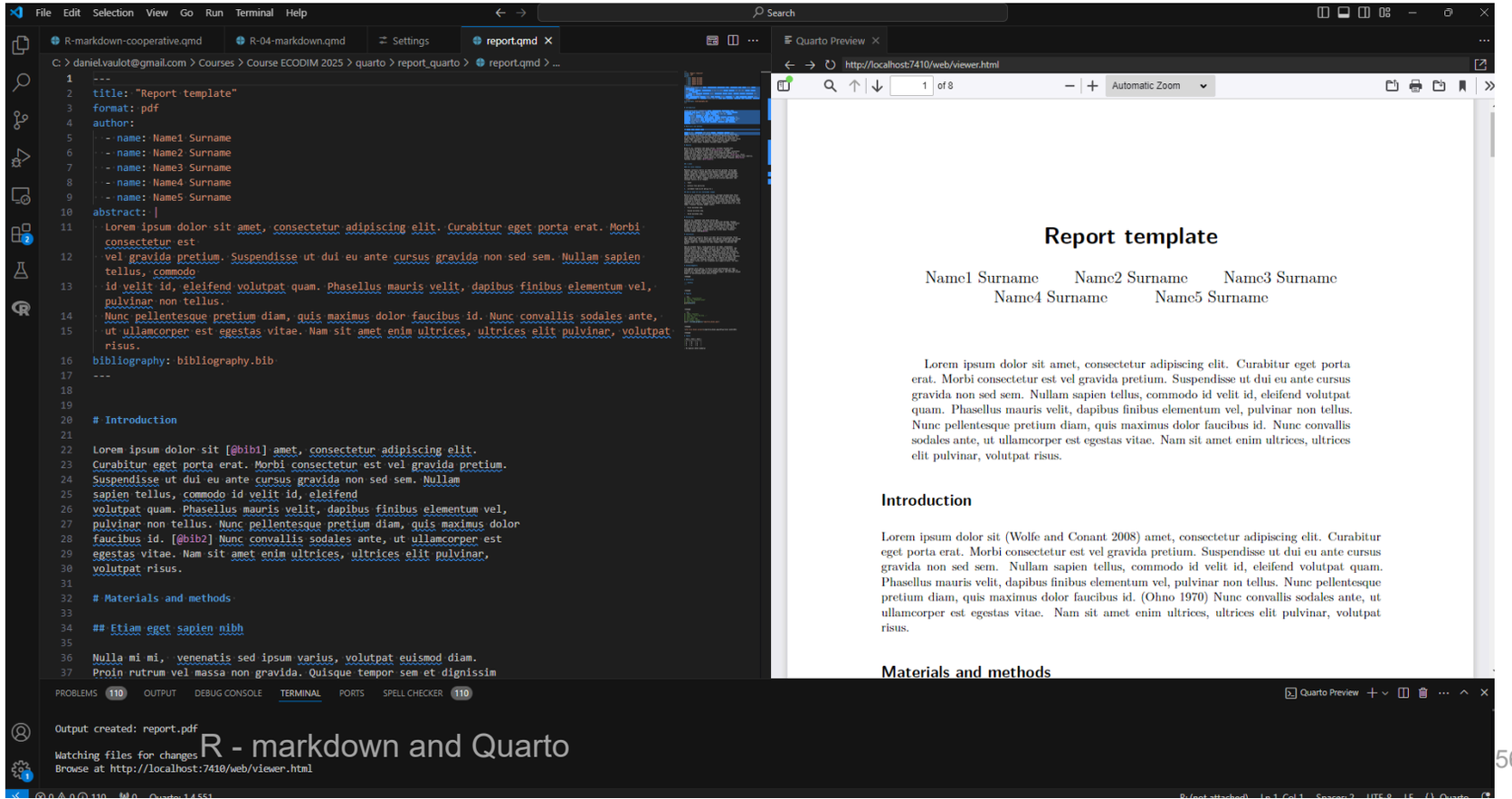
massa. In vitae diam ac augue semper tincidunt eu ut eros  (@fig-tara). Fusce
```

Display a figure

```
![The Tara Ocean project](img/Tara_Ocean.png){#fig-tara}
```

Compile to pdf or html

- R studio
- Visual Studio Code
  - Need to install Quarto extension



Cooperative writing

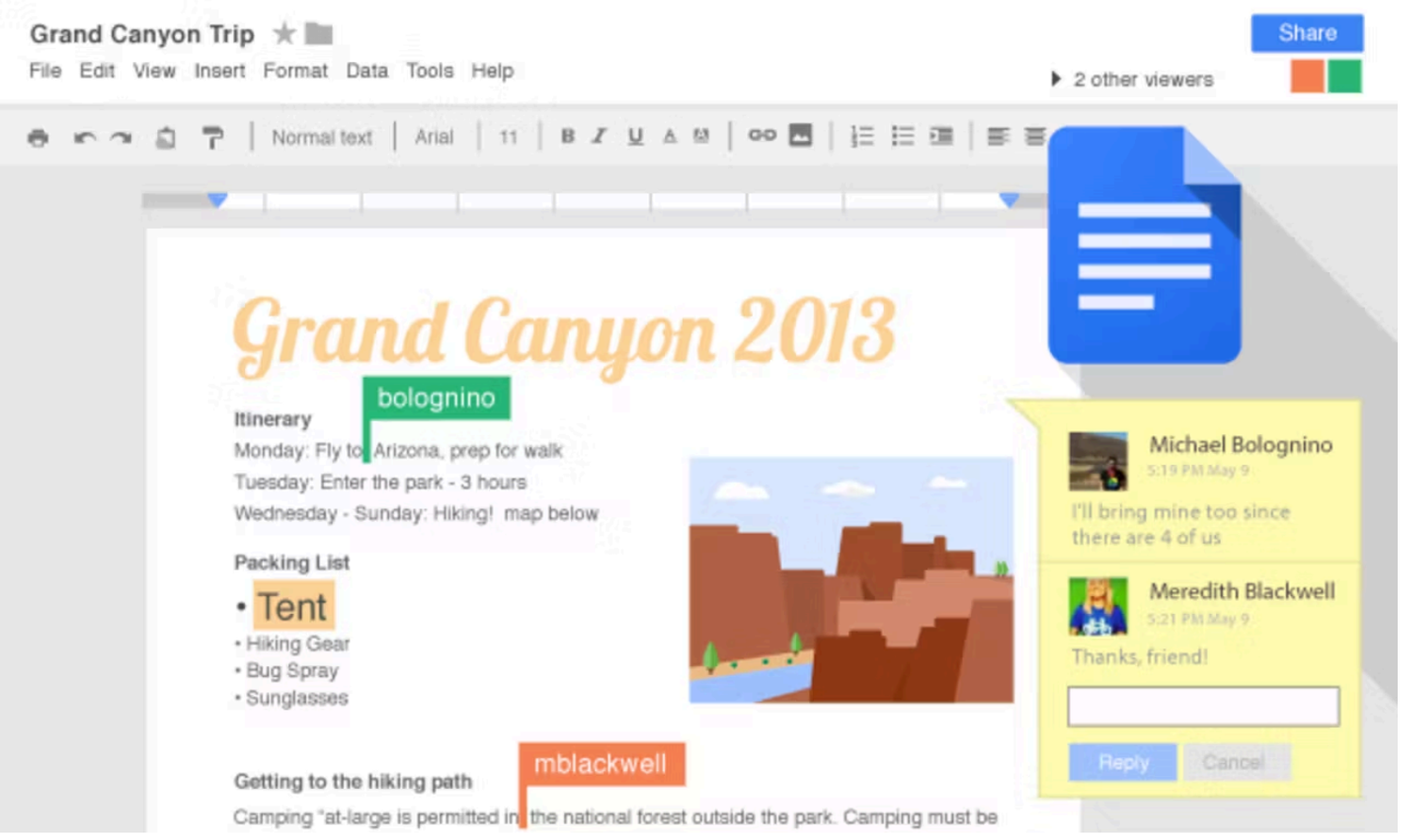
Word / Google doc

Advantages

- Easy to use
- “Free”
- Reference management easy

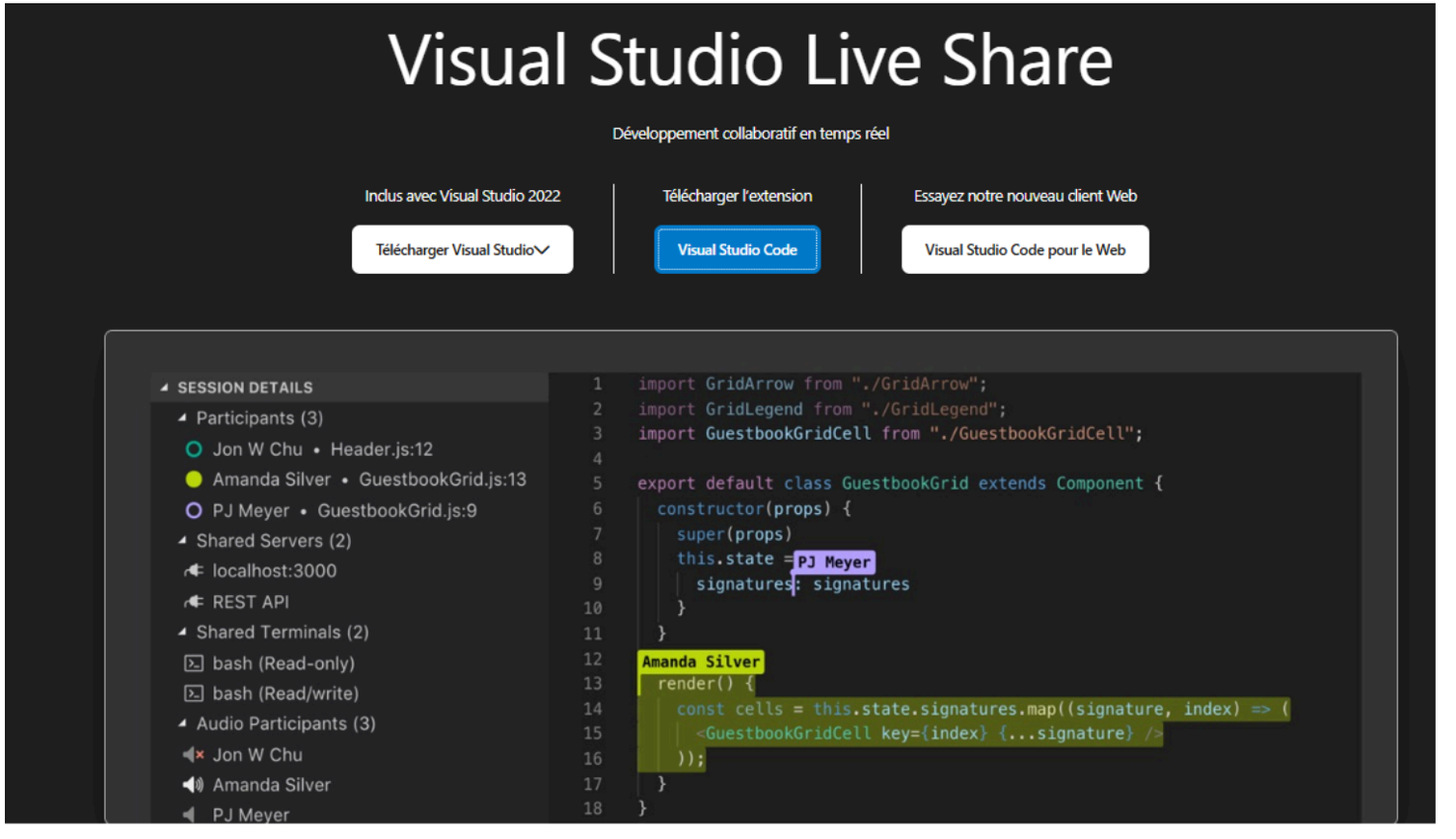
Disadvantages

- Can become very messy
- Output is often ugly
- Figure management awful
- Hard to reformat



Visual Studio

Live Share extension



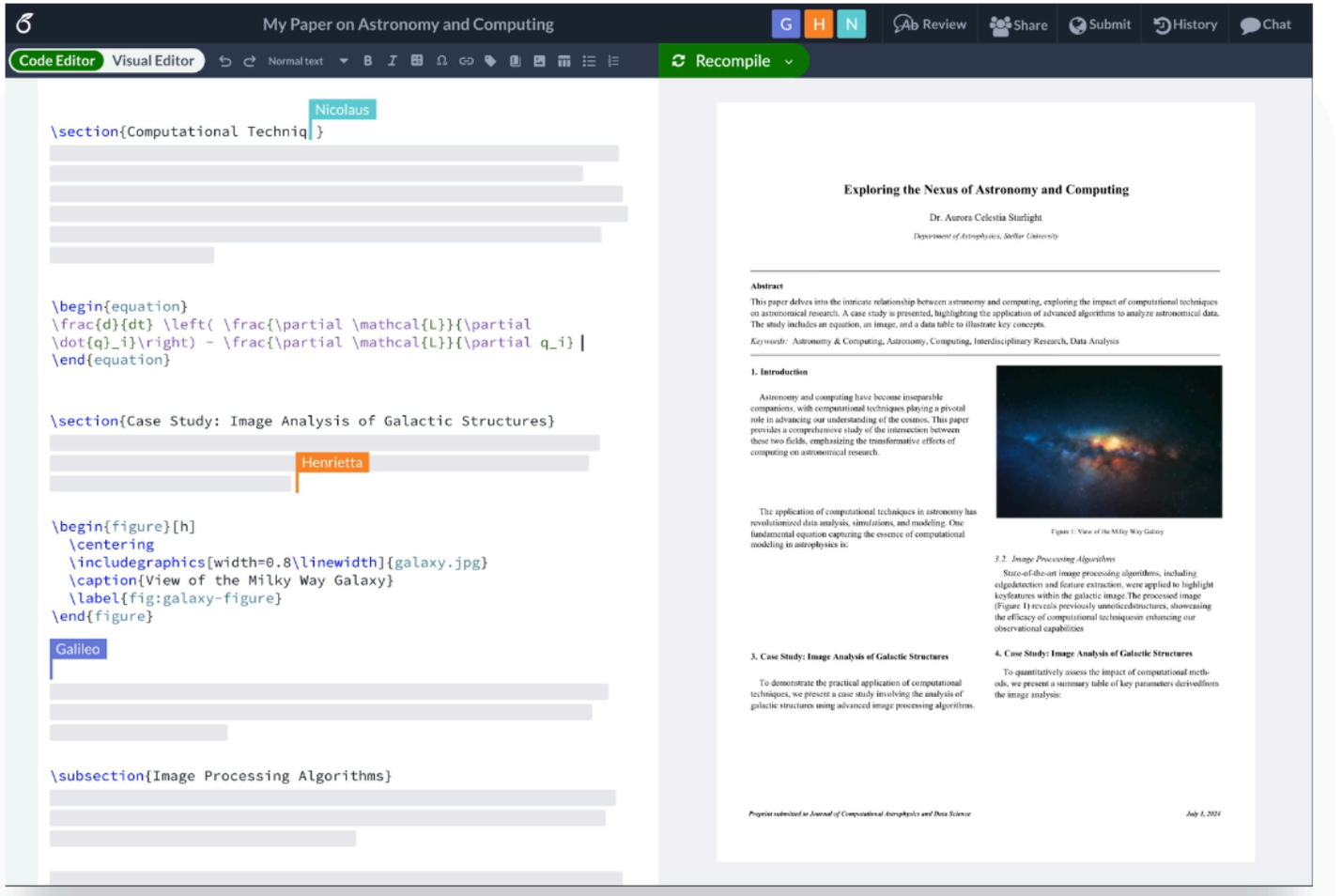
Overleaf

- https://overleaf.com/
- Based on Latex

Advantages

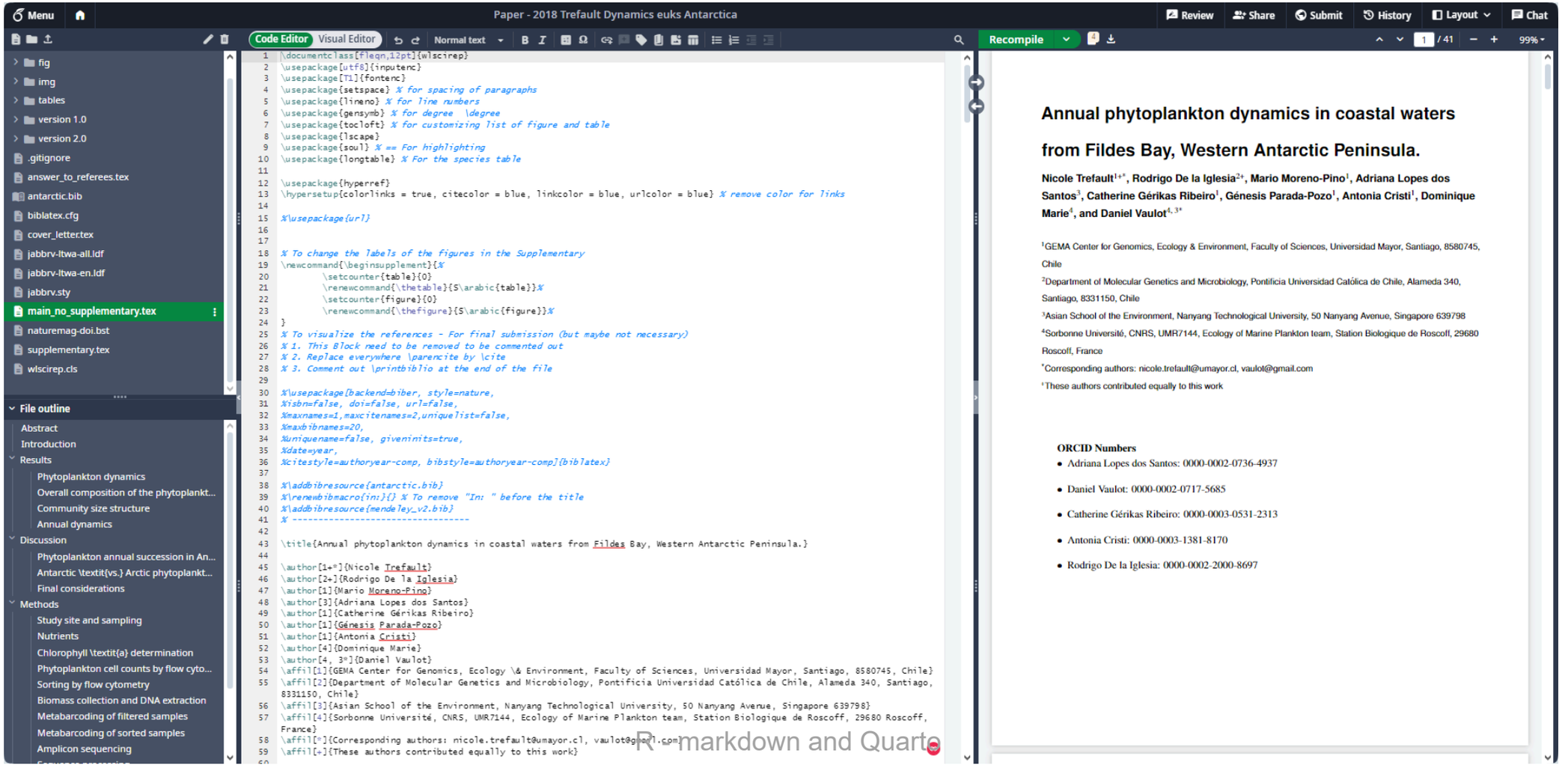
- Very powerful
- Can be used to write papers and thesis
- Very professional look (pdf)
- Reformatting quite easy
- No jumping of figures
- Sharing and comments
- Handle equations

Disadvantages



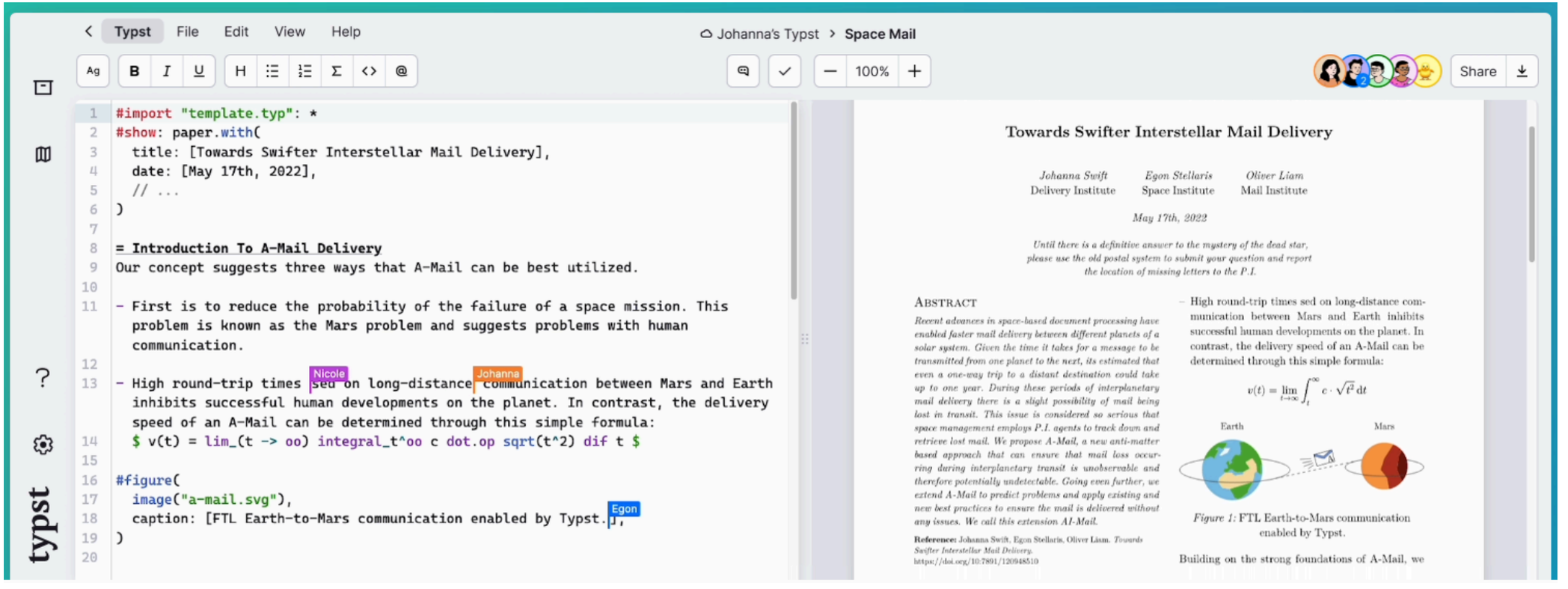
Overleaf

- Really good for papers



Typst

- https://typst.app/
- Own language close to Markdown
- Quarto can export to typst format



Recap

- Rmarkdown: mix text, R chunk, R output
- Compile to HTML or to PDF
- Can be used for many different purposes
- Use to document your analysis process (for papers…)
- Use Quarto rather than R markdown
- Cooperative writing is very useful

Other R topics

- Make interactive maps
- Git and GitHub - Cooperate
- Create your own package
- Create interactive applications (Shiny)
- Interact with database (MySQL, SQLite)
- Google/Amazon cloud