

# R COURSE

## Markdown and Quarto

**Daniel Vault**

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

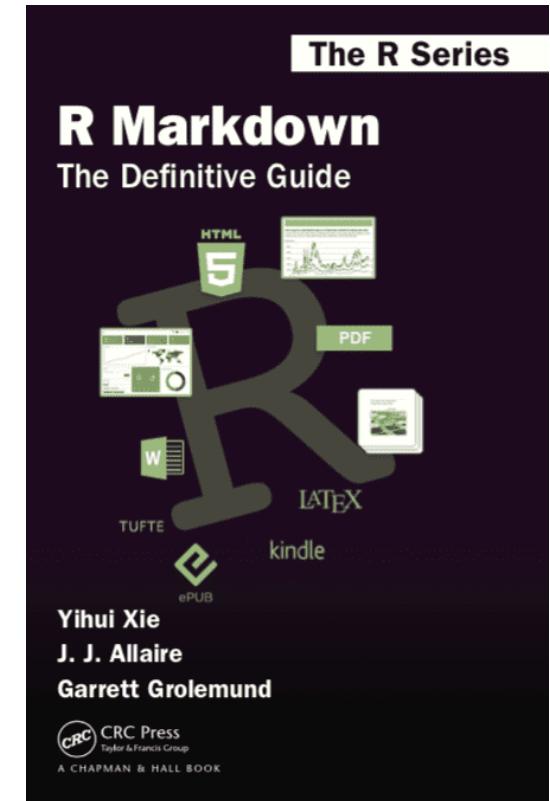
---

## Packages

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

## Resources

- [On-line Book](#)
- [Cheat sheet](#)



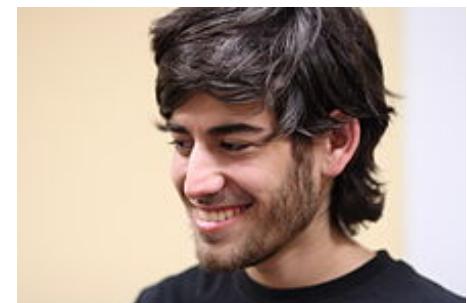
# What is markdown ?

---

- 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...

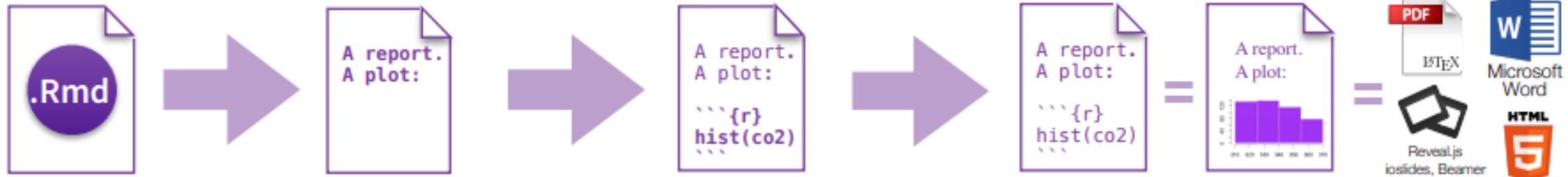
- MultiMarkdown
- GitHub Flavored Markdown (GFM)
- Pandoc
- CommonMark



# Rmarkdown

---

- i. **Open** - Open a file that uses the .Rmd extension.
- ii. **Write** - Write content with the easy to use R Markdown syntax
- iii. **Embed** - Embed R code that creates output to include in the report
- iv. **Render** - Replace R code with its output and transform the report into a slideshow, pdf, html or ms Word file.



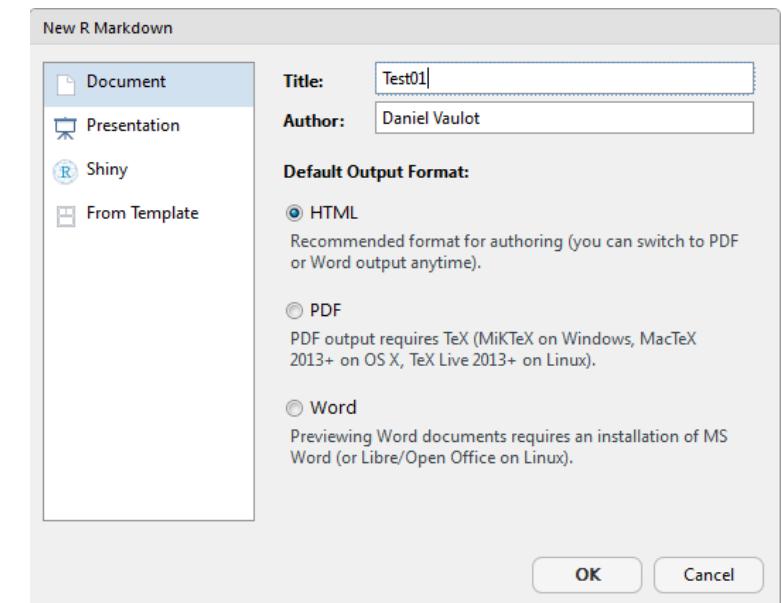
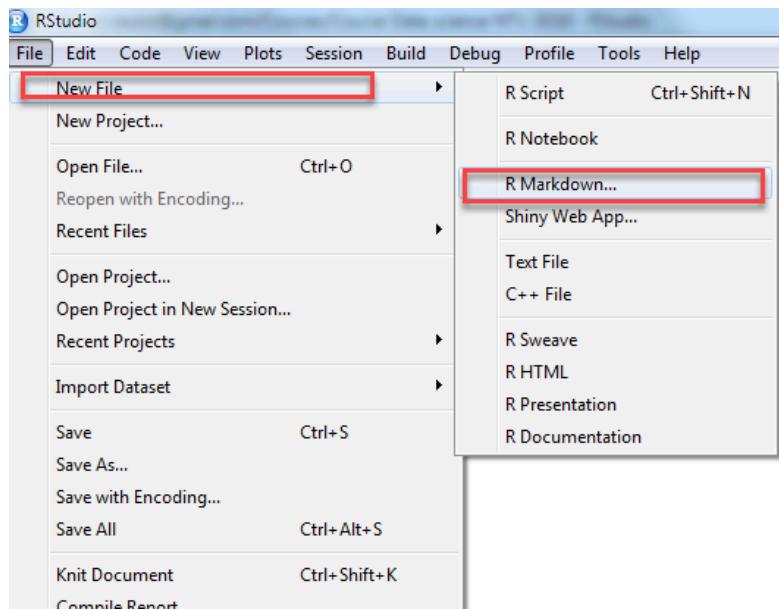
## Mix

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

# Your first Rmarkdown file

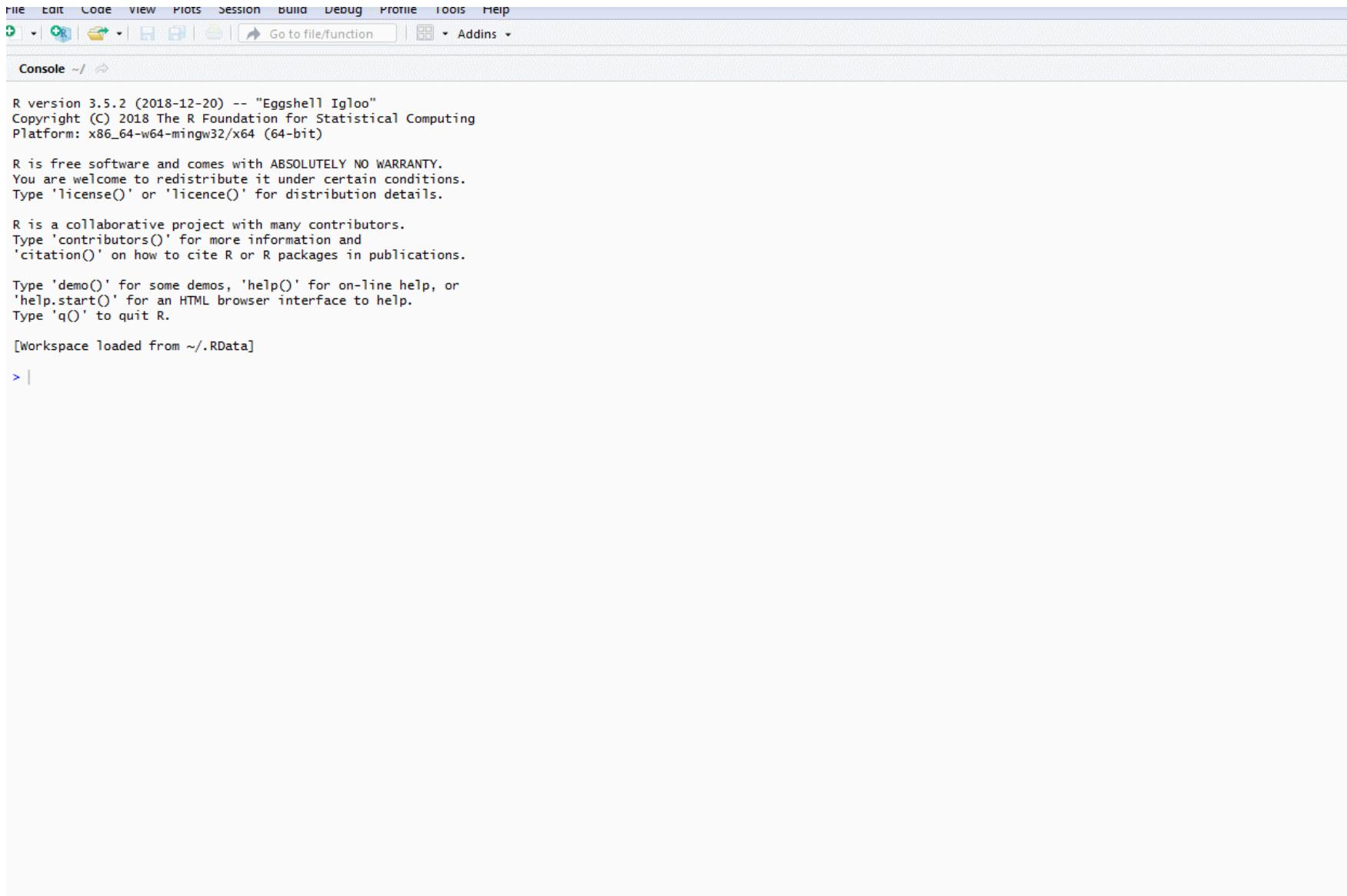
# Your first Rmarkdown file

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



# Your first Rmarkdown file

---



The screenshot shows the RStudio IDE interface. The top menu bar includes File, Edit, Code, View, Plots, Session, Build, Debug, Profile, Tools, and Help. Below the menu is a toolbar with various icons. The main area is the "Console" tab, which displays the standard R startup message, license information, and workspace loading details.

```
File Edit Code View Plots Session Build Debug Profile Tools Help
Go to file/function | Addins ▾
Console ~/ ↻

R version 3.5.2 (2018-12-20) -- "Eggshell Igloo"
Copyright (C) 2018 The R Foundation for Statistical Computing
Platform: x86_64-w64-mingw32/x64 (64-bit)

R is free software and comes with ABSOLUTELY NO WARRANTY.
You are welcome to redistribute it under certain conditions.
Type 'license()' or 'licence()' for distribution details.

R is a collaborative project with many contributors.
Type 'contributors()' for more information and
'citation()' on how to cite R or R packages in publications.

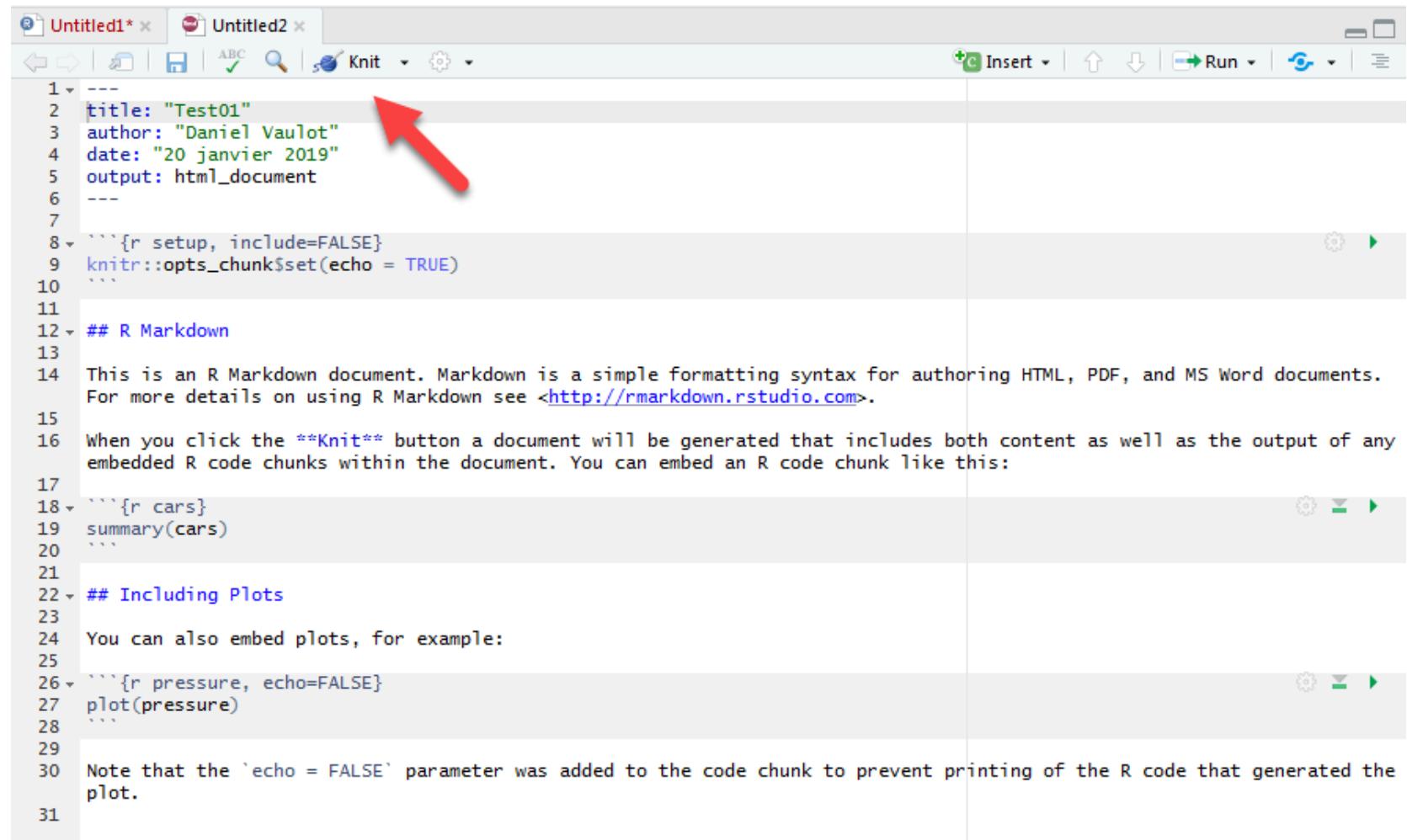
Type 'demo()' for some demos, 'help()' for on-line help, or
'help.start()' for an HTML browser interface to help.
Type 'q()' to quit R.

[Workspace loaded from ~/RData]
> |
```

# Knit to HTML

---

- Save to “xxx.Rmd”



The screenshot shows the RStudio interface with an R Markdown file open. The file contains the following code:

```
1 ---  
2 title: "Test01"  
3 author: "Daniel Vaulot"  
4 date: "20 janvier 2019"  
5 output: html_document  
---  
8 ```{r setup, include=FALSE}  
9 knitr::opts_chunk$set(echo = TRUE)  
10  
11  
12 ## R Markdown  
13  
14 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>.  
15  
16 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:  
17  
18 ```{r cars}  
19 summary(cars)  
20  
21  
22 ## Including Plots  
23  
24 You can also embed plots, for example:  
25  
26 ```{r pressure, echo=FALSE}  
27 plot(pressure)  
28  
29  
30 Note that the `echo = FALSE` parameter was added to the code chunk to prevent printing of the R code that generated the  
plot.  
31
```

A red arrow points to the 'Knit' button in the top toolbar.

# Knit to HTML

---



The screenshot shows the RStudio interface with a document titled "Test01". The title, author ("Daniel Vaulot"), and date ("20 janvier 2019") are displayed above the main content. The main content is an R Markdown document. A red arrow points to the "Knit" button in the toolbar, which is located next to the "Publish" button. The content includes a code chunk for "summary(cars)" and its output, which is a table of statistics for the "cars" dataset.

```
summary(cars)
```

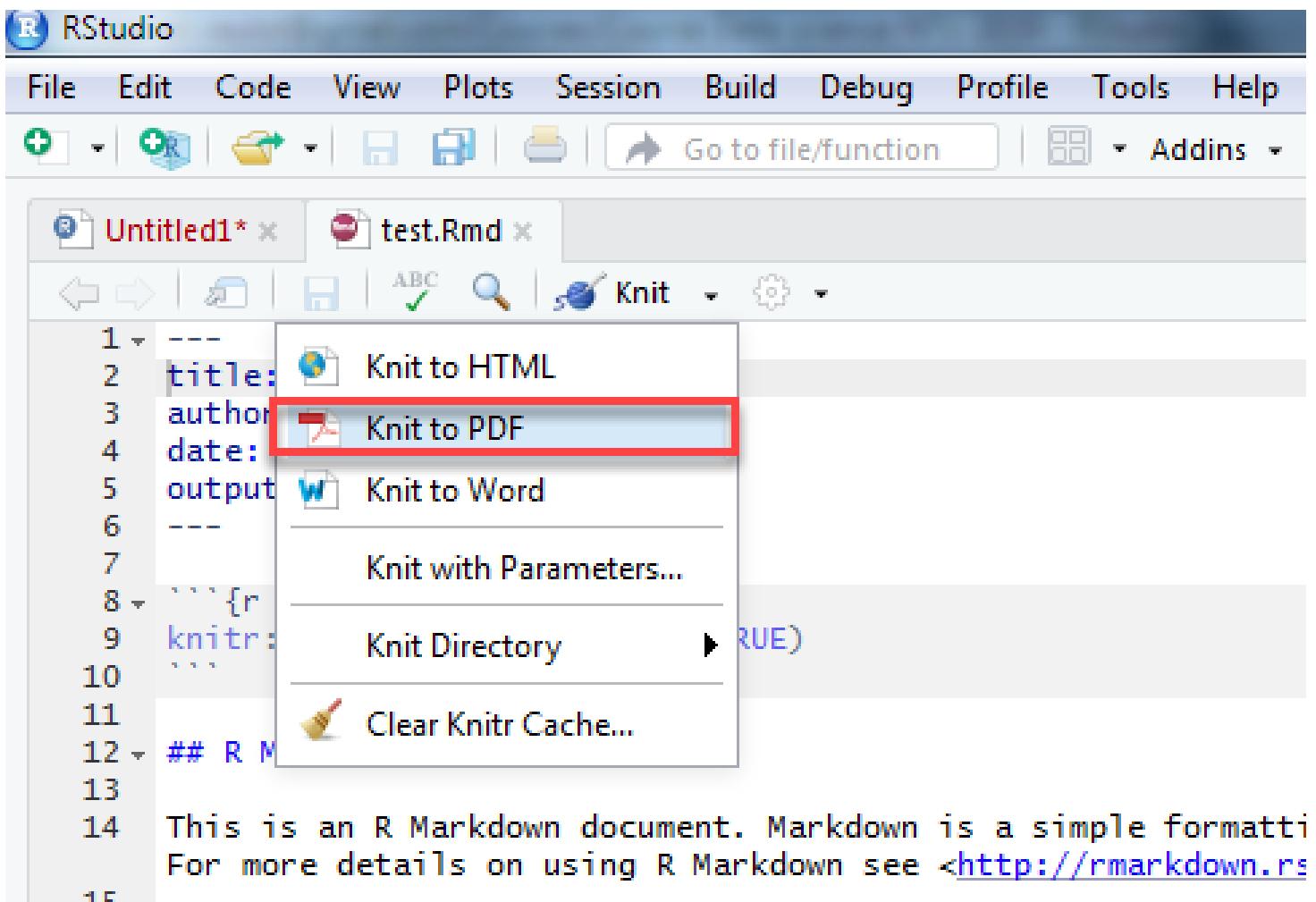
	speed	dist
## Min.	4.0	Min. : 2.00
## 1st Qu.	12.0	1st Qu.: 26.00
## Median	15.0	Median : 36.00
## Mean	15.4	Mean : 42.98
## 3rd Qu.	19.0	3rd Qu.: 56.00
## Max.	25.0	Max. :120.00

## Including Plots

You can also embed plots, for example:

# Knit of pdf

---



# Knit of pdf

---

## 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:

# 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

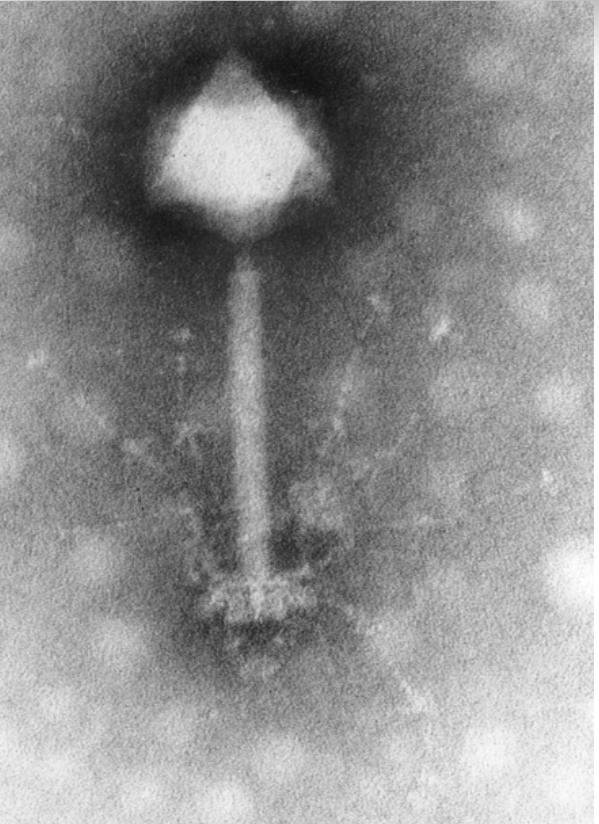
---

## 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

## Alignment

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

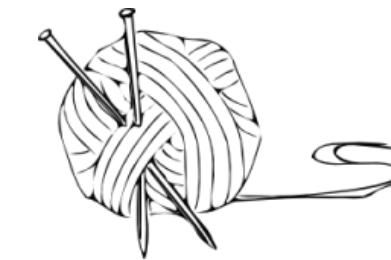
---



- [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

[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, Emacs Org-Mode, Emacs Muse, Textile, txt2tags, MediaWiki markup, DolceWiki markup, TikiWiki

# The Rmarkdown file structure

---

The screenshot shows an RStudio interface with an RMarkdown file open. The code editor displays the following structure:

```
1 ---  
2 title: "Test01"  
3 author: "Daniel Vaulot"  
4 date: "20 janvier 2019"  
5 output: html_document  
---  
8 ```{r setup, include=FALSE}  
9 knitr::opts_chunk$set(echo = TRUE)  
10 ...  
11  
12 ## R Markdown  
13  
14 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>.  
15  
16 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:  
17  
18 ```{r cars}  
19 summary(cars)  
20 ...  
21  
22 ## Including Plots  
23  
24 You can also embed plots, for example:  
25  
26 ```{r pressure, echo=FALSE}  
27 plot(pressure)  
28 ...  
29  
30 Note that the `echo = FALSE` parameter was added to the code chunk to prevent printing of the R code that generated the  
plot.  
31
```

Annotations highlight specific parts of the code:

- YAML**: Points to the YAML header (lines 1-7).
- R chunk**: Points to the first R code chunk (line 8).
- Markdown**: Points to the explanatory text and code chunk examples (lines 14-16).

# Knit process

---

```
Console R Markdown ×
C:/Users/vault/Desktop/test.Rmd

processing file: test.Rmd
|..... ordinary text without R code | 14%
|..... label: setup (with options) | 29%
List of 1
$ include: logi FALSE

|..... ordinary text without R code | 43%
|..... label: cars | 57%
|..... ordinary text without R code | 71%

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

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

"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

### 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:

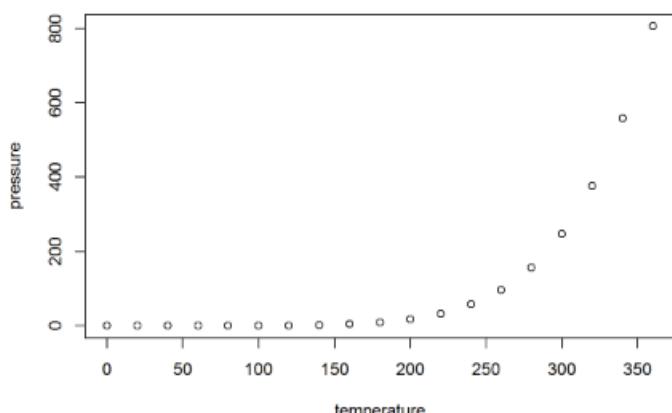
```
summary(cars)
```

```
##      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:



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

## Markdown

### R code

### R output

# Insert R chunk

The screenshot shows the RStudio interface with the following details:

- Top Bar:** Shows two files: "Untitled1\*" and "test.Rmd\*".
- Toolbar:** Includes icons for back, forward, file, ABC, search, and Knit.
- Code Editor:** Displays the YAML front matter of an R Markdown file:

```
1 ---  
2 title: "Test01"  
3 author: "Daniel Vaulot"  
4 date: "20 janvier 2019"  
5 output:  
6   pdf_document: default  
7   html_document: default  
8 ---  
9  
10  
11  
12  
13  
14  
15
```
- Knit Button:** A green "Knit" button with a checkmark icon.
- Insert Menu:** An open dropdown menu under the "Insert" button. The "R chunk" option is highlighted with a blue selection bar.
- Right Margin:** A vertical scroll bar on the right side of the code editor.

# Run R chunk

## Two options

The screenshot shows an RStudio interface with a code editor and a preview pane. The code editor contains an R script with the following content:

```
1 ---  
2 title: "Test01"  
3 author: "Daniel Vaultot"  
4 date: "22 janvier 2019"  
5 output: html_document  
6 ---  
7  
8 ```{r sum_01, fig.height=6, fig.width=5, message=FALSE, warning=FALSE}  
9  
10 x <- 1:10  
11 y <- 100  
12  
13 sum <- x + y  
14  
15 print("Numbers from 101 to 110: ")  
16 sum  
17  
18 ...  
19  
20
```

Two annotations are present: a purple arrow points to the 'Knit' button in the toolbar, which is circled in red and labeled '2'; an orange arrow points to the green 'Run' button in the toolbar, which is circled in red and labeled '1'.

# Run R chunk

## Option 1: Run R chunk inside Rmd file

- Use when building and debugging an Rmd file



```
1 ---  
2 title: "Test01"  
3 author: "Daniel Vaulot"  
4 date: "22 janvier 2019"  
5 output: html_document  
6 ---  
7  
8 ```{r sum_01, fig.height=6, fig.width=5, message=FALSE, warning=FALSE}  
9  
10 x <- 1:10  
11 y <- 100  
12  
13 sum <- x + y  
14  
15 print("Numbers from 101 to 110: ")  
16 sum  
17  
18 ...  
19  
20
```

[1] "Numbers from 101 to 110: "  
[1] 101 102 103 104 105 106 107 108 109 110

# 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

The screenshot shows the RStudio interface with two tabs open: "Untitled1\*" and "test.Rmd\*". The "test.Rmd\*" tab is active, displaying the following R Markdown code:

```
1 ---  
2 title: "Test01"  
3 author: "Daniel Vaultot"  
4 date: "20 janvier 2019"  
5 output:  
6   pdf_document: default  
7   html_document: default  
8 ---  
9  
10 ````{r sum_01, echo=TRUE, fig.height=6, fig.width=5, message=FALSE, warning=FALSE}  
11 ...  
12  
13  
14  
15  
16  
17  
18
```

A red arrow points from the bottom right towards a floating "Chunk options" dialog box. This dialog box contains the following settings:

- Name: sum\_01
- Output: Show code and output
- Show warnings
- Show messages
- Use paged tables
- Use custom figure size
- Width (inches): 5
- Height (inches): 6

At the bottom of the dialog are "Chunk options", "Revert", and "Apply" buttons.

# Useful options

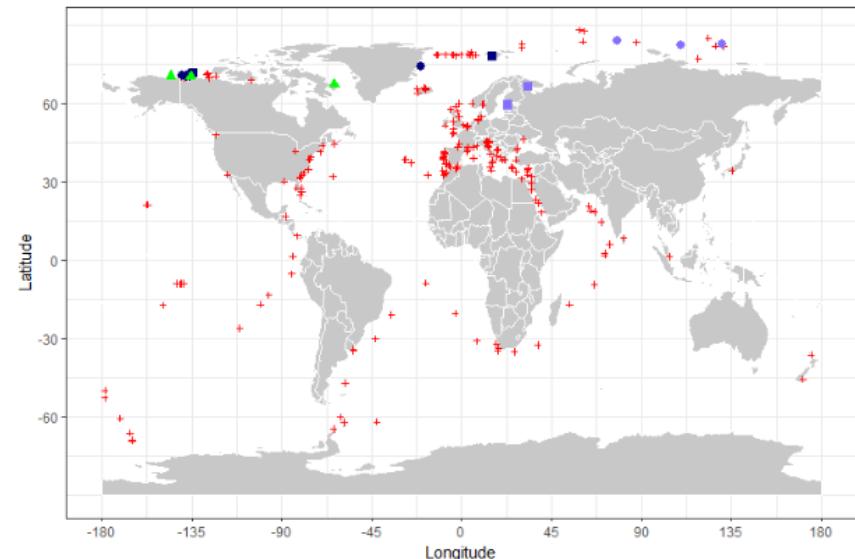
---

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)

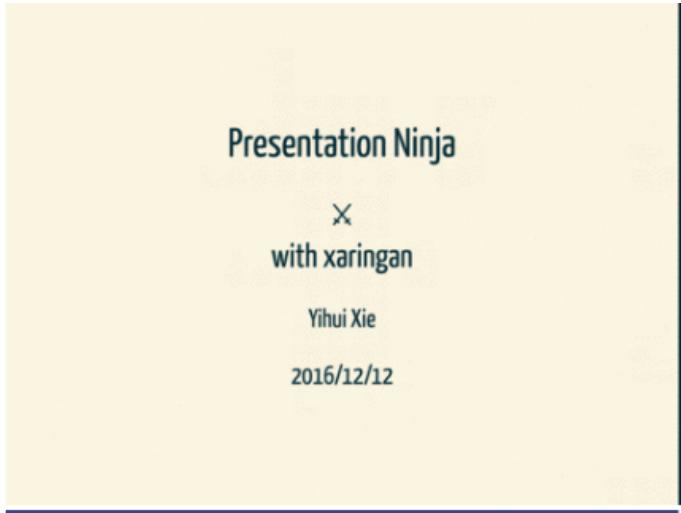
# Add the ice sequence
df_map <- dplyr::filter(genbank_species, substrate == "ice")
species_map <- species_map + geom_point(data = df_map, aes(x = longitude, y = latitude),
  color = color_ice, size = size_points, shape = 15)

# 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)

# Dispaly and save
species_map
```

# Presentation

<https://github.com/yihui/xaringan>



## Hello World

Install the `xaringan` package from [Github](#):

```
devtools::install_github("yihui/xaringan")
```

You are recommended to use the [RStudio IDE](#), but you do not have to.

- Create a new R Markdown document from the menu `File -> New File -> R Markdown -> From Template -> Ninja Presentation`<sup>[1]</sup>
- Click the `Knit` button to compile it;
- or use the [RStudio Addin](#)<sup>[2]</sup> "Infinite Moon Reader" to live preview the slides (every time you update and save the Rmd document, the slides will be automatically reloaded in RStudio Viewer).

[1] 中文用户请看[这份教程](#)  
[2] See [#2](#) if you do not see the template or addin in RStudio.

3



## Hello World

Install the `xaringan` package from [Github](#):

```
devtools::install_github("yihui/xaringan")
```

You are recommended to use the [RStudio IDE](#), but you do not have to.

- Create a new R Markdown document from the menu `File -> New File -> R Markdown -> From Template -> Ninja Presentation`<sup>[1]</sup>
- Click the `Knit` button to compile it;
- or use the [RStudio Addin](#)<sup>[2]</sup> "Infinite Moon Reader" to live preview the slides (every time you update and save the Rmd document, the slides will be automatically reloaded in RStudio Viewer).

[1] 中文用户请看[这份教程](#)  
[2] See [#2](#) if you do not see the template or addin in RStudio.

R - markdown and Quarto



# Posters

<https://github.com/brentthorne/posterdown>

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

Author One<sup>1</sup> Author Two<sup>2</sup>

<sup>1</sup>Department of Poster Layouts, University of Markdown; <sup>2</sup>Department 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 ultrices tristique nulla. Mauris vitae ultricies leo integer malesuada nunc vel risus commodo. Suspendisse potenti nullam ac tortor sit amet porttitor eget.

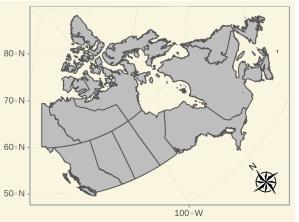


Figure 1: This is a map of Canada, the ggspatial package is great for GIS folks in R!

### Objectives

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

### 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 calculated. In posterdown this is as easy as using the kable table formatting you are probably use to as per typi-

cal RMarkdown formatting. I suggesting checking out the kableExtra package and its 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

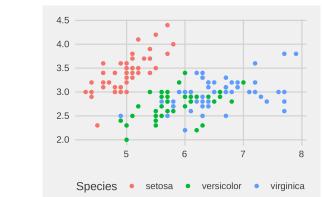


Figure 2: A typical plot using ggplot using the classic iris dataset.

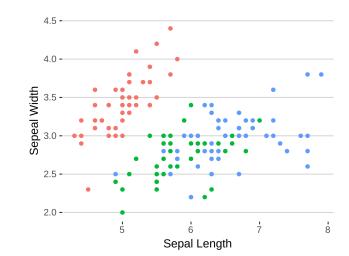


Figure 3: Another typical plot using ggplot, this time with a different theme and r code chunk options for fig.width and fig.height.

```
# 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,
           color = Species)) +
  geom_point() +
  theme_stata() +
  NULL
```

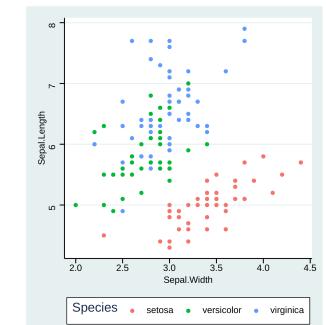


Figure 4: Another figure showing how base R plots might look on this poster!

### 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 attribute to posters as far as I have come to know.
- Figure compatibility with knitr 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] Eun-Jung Hoban et al., "Identifying structural complexity in aeromagnetic data: An image analysis approach to predict gold exploration", *In: Geology Review*, 40 (Aug. 2012), pp. 47–55. issn: 10591330. doi: <https://doi.org/10.1016/j.grrev.2012.06.001>
- [2] Mounir Matouk, Thierry Schaeffer, and Peter Sepehr-Ward, "GEOLOGICAL LINEAMENT INTERPRETATION USING THE OBJECT-BASED IMAGE ANALYSIS APPROACH: RESULTS OF SEMI-AUTOMATED AND COMPUTERIZED VISUAL INTERPRETATION", *In: Geological Review*, 40 (Aug. 2012), pp. 56–65. issn: 10591330. doi: <https://doi.org/10.1016/j.grrev.2012.06.002>



# 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

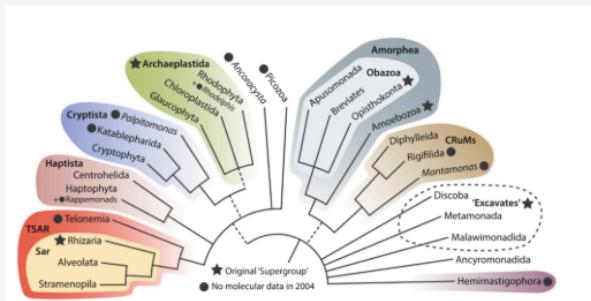
R - markdown and Quarto

# Website

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

The screenshot shows the PR<sup>2</sup> database homepage. At the top, there's a navigation bar with links to About, Download, Using PR<sup>2</sup>, Annotation, Workshops, Papers, and News. Below the navigation is a search bar and a logo featuring a blue DNA helix with the text "PR<sup>2</sup>". The main content area is titled "PR<sup>2</sup> database" and describes it as "A reference 18S rRNA sequence database". It lists features: "expert curated taxonomy", "metadata such as geo-localisation", and "use to annotate metabarcodes". Below this, there's a GitHub link ("PR2 is on GitHub | 32"), release information ("release 4.12.0 date 08 August 2019 downloads 5.2k"), and a Twitter link ("Follow @PR2database"). A prominent button at the bottom says "Download PR<sup>2</sup> version 4.12.0".

## About PR2



Current version : 4.12.0

Last update : 8 August 2019

DOI : [10.6084/m9.figshare.5913181](https://doi.org/10.6084/m9.figshare.5913181)

R - markdown and Quarto



# 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



Quarto 1.6 released! Download | Read More

X

# 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

1

```
## 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")  
```
```

2

### ggplot2 demo

Norah Jones  
May 22nd, 2021

### Air Quality

[Figure 1](#) further explores the impact of temperature on ozone level.

▶ Code

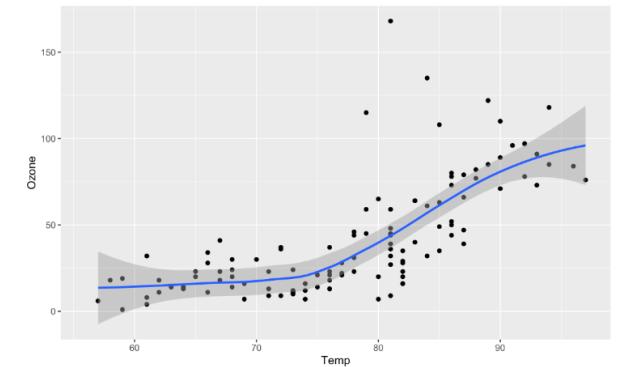


Figure 1: Temperature and ozone level.

R - markdown and Quarto

47

# Interactive documents (Shiny)

```
---
```

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

```
---
```

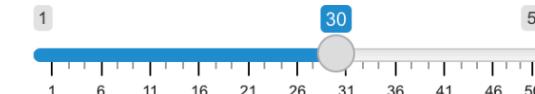
```
```{r}
sliderInput("bins", "Number of bins:",
            min = 1, max = 50, value = 30)
plotOutput("distPlot")
```
```

```
```{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')
})
```

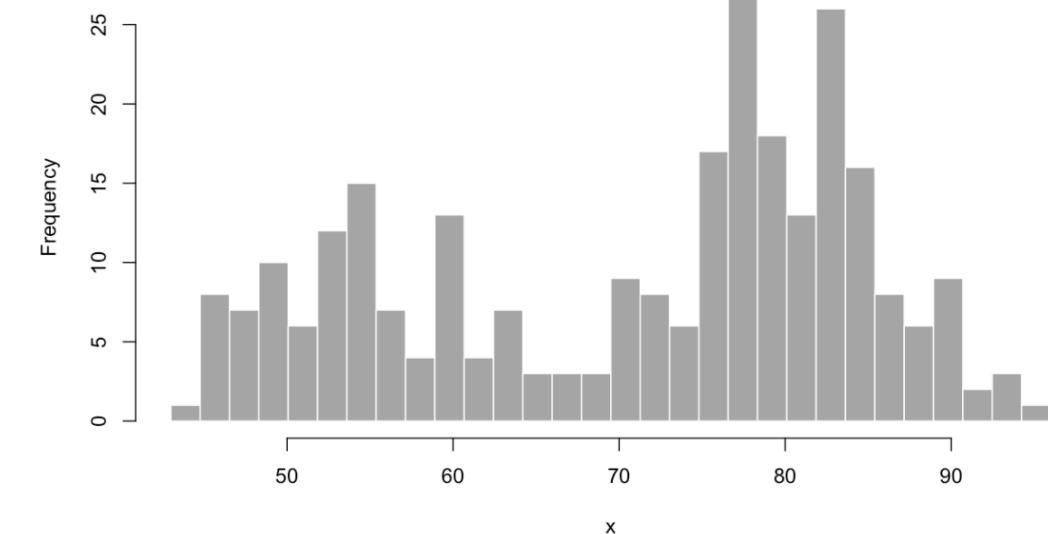
```
```
```

Old Faithful

Number of bins:



Histogram of x



# 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

```
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 consectetur vel gravida pretium. Suspendisse ut dui eu ante cursus gravida non sed sem. Nullam sapien tellus commodo id velit id, eleifend volutpat quam. Phasellus mauris velit, dapibus finibus elementum vel.
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

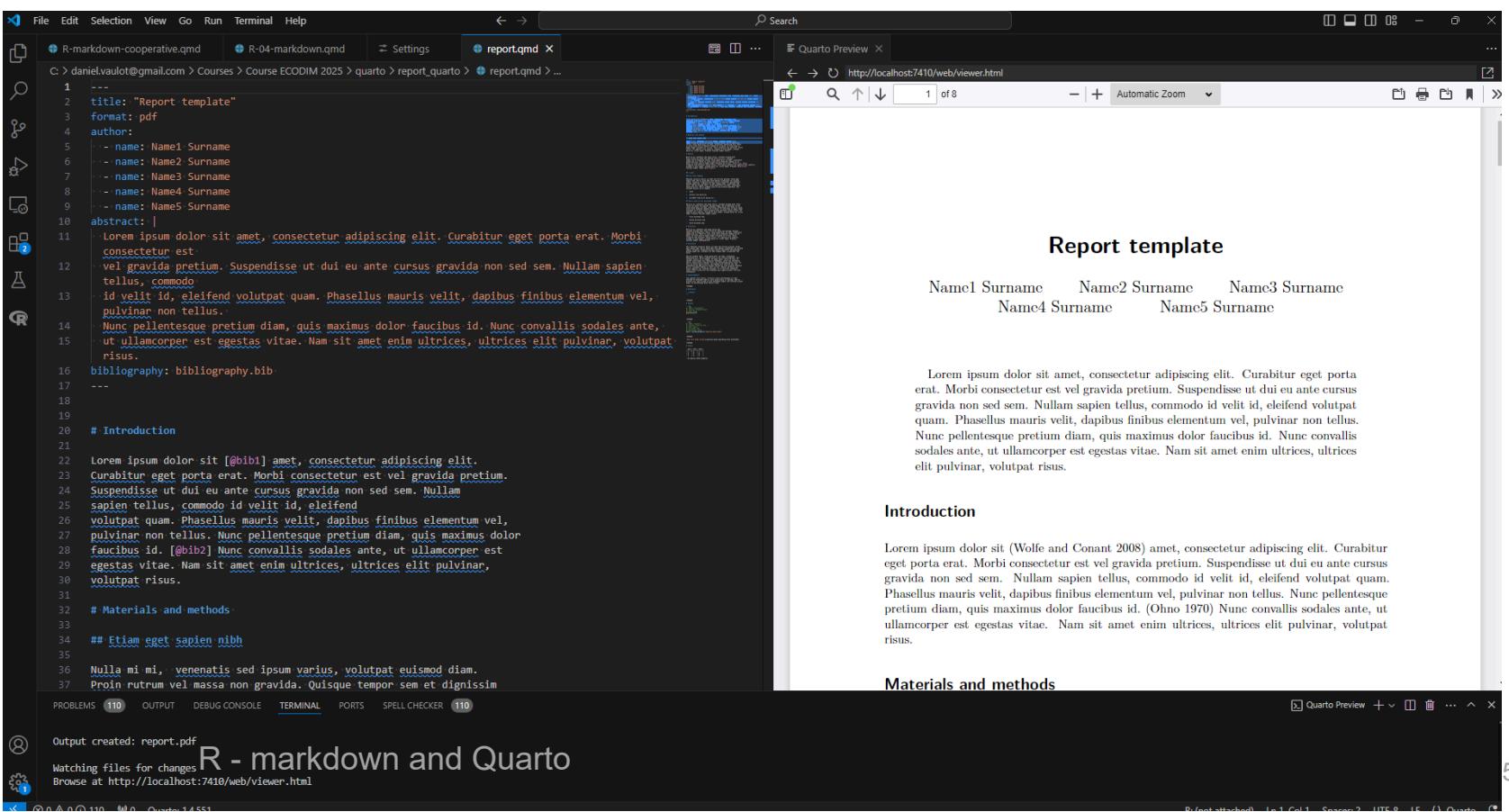
```
# Results  
  
massa. In vitae diam ac augue semper tincidunt eu ut eros (@fig-tara). Fusce
```

### 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**

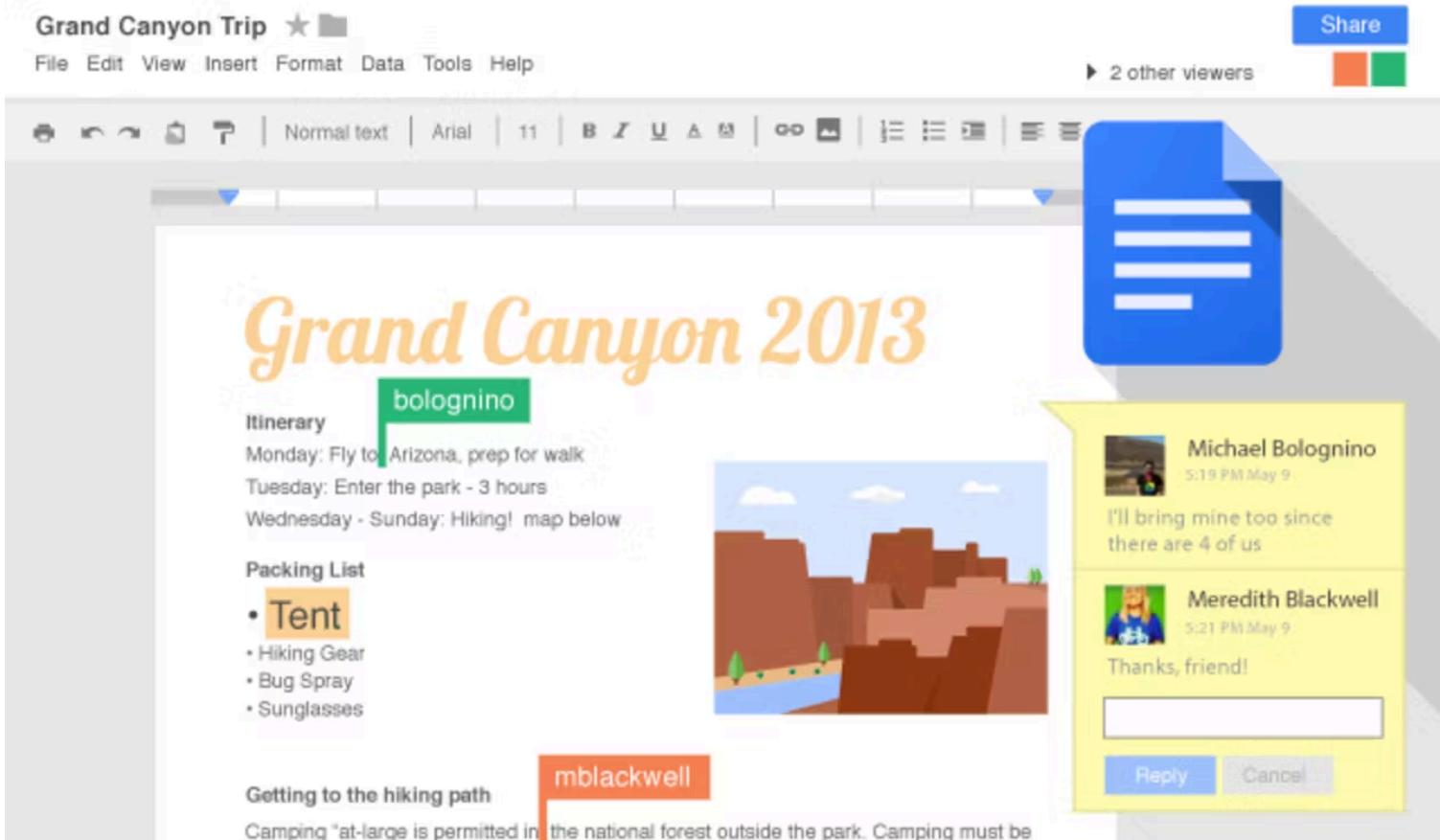
# Word / Google doc

## Advantages

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

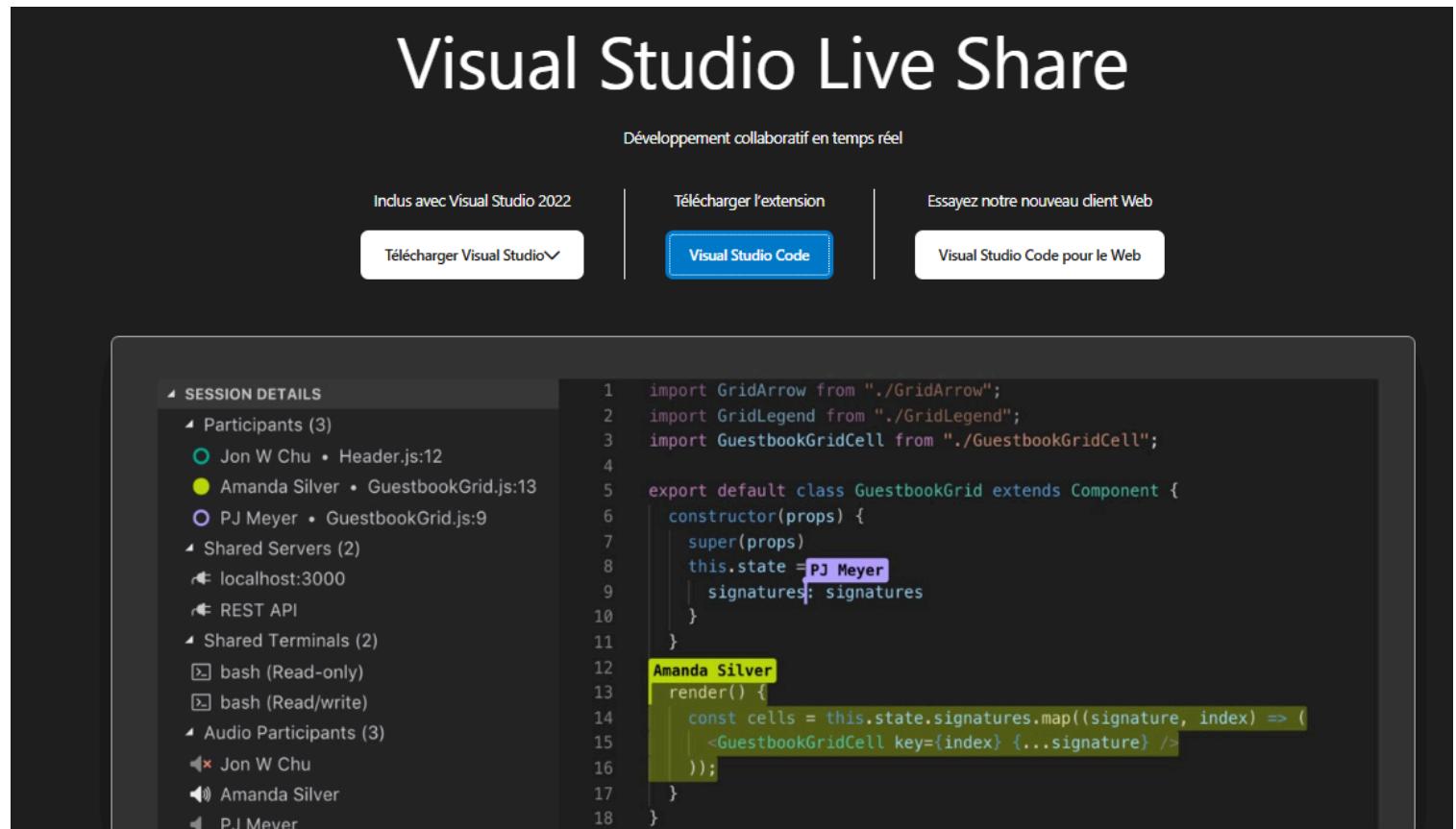
## Disadvantages

- 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

The screenshot shows the Overleaf web interface. On the left, the 'Code Editor' displays a LaTeX document with several sections and subsections, each containing code snippets and labels like 'Nicolae', 'Henrietta', and 'Galileo'. On the right, the 'Visual Editor' shows the generated PDF output. The PDF title is 'Exploring the Nexus of Astronomy and Computing' by 'Dr. Aurora Celestia Starlight' from 'Department of Astrophysics, Stellar University'. The abstract discusses the relationship between astronomy and computing. The document includes a section on image analysis of galactic structures, featuring a processed image of the Milky Way Galaxy. A caption for Figure 1 states: 'Figure 1: View of the Milky Way Galaxy'. The image processing algorithms section describes how techniques like edge detection and feature extraction were used to highlight key features in the processed image. The case study section presents an analysis of galactic structures using advanced image processing algorithms. The footer of the PDF indicates it was submitted to 'Journal of Computational Astrophysics and Data Science' on 'July 1, 2024'.

- Really good for papers

The screenshot shows the Overleaf interface with a LaTeX document titled "Paper - 2018 Trefault Dynamics euks Antarctica". The left panel displays the file structure and a file outline. The main panel shows the LaTeX code and its corresponding PDF preview. The PDF preview is titled "Annual phytoplankton dynamics in coastal waters from Fildes Bay, Western Antarctic Peninsula." It lists the authors: Nicole Trefault<sup>1,\*</sup>, Rodrigo De la Iglesia<sup>2†</sup>, Mario Moreno-Pino<sup>1</sup>, Adriana Lopes dos Santos<sup>3</sup>, Catherine Gérikas Ribeiro<sup>1</sup>, Génesis Parada-Pozo<sup>1</sup>, Antonia Cristi<sup>1</sup>, Dominique Marie<sup>4</sup>, and Daniel Vaulot<sup>4,3\*</sup>. It also includes author affiliations and ORCID numbers.

**Paper - 2018 Trefault Dynamics euks Antarctica**

**Code Editor** Visual Editor Normal text B I **Recompile** Review Share Submit History Layout Chat

1 / 41 99%

File outline

- Abstract
- Introduction
- Results
  - Phytoplankton dynamics
  - Overall composition of the phytoplankt...
  - Community size structure
  - Annual dynamics
- Discussion
  - Phytoplankton annual succession in An...
  - Antarctic *textit{vs.}* Arctic phytoplankt...
  - Final considerations
- Methods
  - Study site and sampling
  - Nutrients
  - Chlorophyll *textit{a}* determination
  - Phytoplankton cell counts by flow cyto...
  - Sorting by flow cytometry
  - Biomass collection and DNA extraction
  - Metabarcoding of filtered samples
  - Metabarcoding of sorted samples
  - Amplicon sequencing
  - Ecological succession

1 \documentclass[12pt]{wlscrep}  
2 \usepackage{utf8}{}  
3 \usepackage[T1]{fontenc}  
4 \usepackage[setspace]{lipspace} % for spacing of paragraphs  
5 \usepackage{listings} % for line numbers  
6 \usepackage{gensymb} % for degree \degree  
7 \usepackage{tocloft} % for customizing list of figure and table  
8 \usepackage{lscape}  
9 \usepackage{ soul} % == For highlighting  
10 \usepackage{longtable} % For the species table  
11  
12 \usepackage{hyperref}  
13 \hypersetup{colorlinks = true, citecolor = blue, linkcolor = blue, uricolor = blue} % remove color for links  
14  
% \usepackage{url}  
15  
% To change the labels of the figures in the Supplementary  
16 \newcommand{\beginsupplement}{  
17 \setcounter{table}{0}  
18 \renewcommand{\thetable}{\S\arabic{table}}  
19 \setcounter{figure}{0}  
20 \renewcommand{\thefigure}{\S\arabic{figure}}  
21 }  
22  
23 % To visualize the references - For final submission (but maybe not necessary)  
24 % 1. This Block need to be removed to be commented out  
25 % 2. Replace everywhere \parancite by \cite  
26 % 3. Comment out \printbiblio at the end of the file  
27  
28  
29  
30 %\usepackage[backend=biber, style=nature,  
31 %isbn=false, doi=false, url=false,  
32 %maxnames=1, maxcitenames=2, uniquelist=false,  
33 %maxbibnames=20,  
34 %uniquename=false, giveninits=true,  
35 %date=year,  
36 %citestyle=authoryear-comp, bibstyle=authoryear-comp]{biblatex}  
37  
38 %\addbibresource{antarctic.bib}  
39 %\renewbibmacro{in}{} % To remove "In: " before the title  
40 %\addbibresource{medley\_v2.bib}  
41 %-----  
42  
43 \title{Annual phytoplankton dynamics in coastal waters from Fildes Bay, Western Antarctic Peninsula.}  
44  
45 \author[1+]{Nicole Trefault}  
46 \author[2+]{Rodrigo De la Iglesia}  
47 \author[1]{Mario Moreno-Pino}  
48 \author[1]{Adriana Lopes dos Santos}  
49 \author[1]{Catherine Gérikas Ribeiro}  
50 \author[1]{Génesis Parada-Pozo}  
51 \author[1]{Antonia Cristi}  
52 \author[4]{Dominique Marie}  
53 \author[4, 3]{Daniel Vaulot}  
54 \affil[1]{GEMA Center for Genomics, Ecology & Environment, Faculty of Sciences, Universidad Mayor, Santiago, 8580745, Chile}  
55 \affil[2]{Department of Molecular Genetics and Microbiology, Pontificia Universidad Católica de Chile, Alameda 340, Santiago, 8331150, Chile}  
56 \affil[3]{Asian School of the Environment, Nanyang Technological University, 50 Nanyang Avenue, Singapore 639798}  
57 \affil[4]{Sorbonne Université, CNRS, UMR7144, Ecology of Marine Plankton team, Station Biologique de Roscoff, 29680 Roscoff, France}  
58 %\affil[] {Corresponding authors: nicole.trefault@umayor.cl, vaulot@gmail.com}  
59 %\affil[] {These authors contributed equally to this work}

**Annual phytoplankton dynamics in coastal waters from Fildes Bay, Western Antarctic Peninsula.**

Nicole Trefault<sup>1,\*</sup>, Rodrigo De la Iglesia<sup>2†</sup>, Mario Moreno-Pino<sup>1</sup>, Adriana Lopes dos Santos<sup>3</sup>, Catherine Gérikas Ribeiro<sup>1</sup>, Génesis Parada-Pozo<sup>1</sup>, Antonia Cristi<sup>1</sup>, Dominique Marie<sup>4</sup>, and Daniel Vaulot<sup>4,3\*</sup>

<sup>1</sup>GEMA Center for Genomics, Ecology & Environment, Faculty of Sciences, Universidad Mayor, Santiago, 8580745, Chile  
<sup>2</sup>Department of Molecular Genetics and Microbiology, Pontificia Universidad Católica de Chile, Alameda 340, Santiago, 8331150, Chile  
<sup>3</sup>Asian School of the Environment, Nanyang Technological University, 50 Nanyang Avenue, Singapore 639798  
<sup>4</sup>Sorbonne Université, CNRS, UMR7144, Ecology of Marine Plankton team, Station Biologique de Roscoff, 29680 Roscoff, France

\*Corresponding authors: nicole.trefault@umayor.cl, vaulot@gmail.com

†These authors contributed equally to this work

**ORCID Numbers**

- Adriana Lopes dos Santos: 0000-0002-0736-4937
- Daniel Vaulot: 0000-0002-0717-5685
- Catherine Gérikas Ribeiro: 0000-0003-0531-2313
- Antonia Cristi: 0000-0003-1381-8170
- Rodrigo De la Iglesia: 0000-0002-2000-8697

# Typst

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

The figure shows a screenshot of the Typst application interface. The top menu bar includes 'Typst', 'File', 'Edit', 'View', and 'Help'. The toolbar below has icons for bold (B), italic (I), underline (U), horizontal (H), list (L), sigma (Σ), code (C), and email (@). The main editor area contains a code-based document structure:

```
1 #import "template.typ": *
2 #show: paper.with(
3   title: [Towards Swifter Interstellar Mail Delivery],
4   date: [May 17th, 2022],
5   // ...
6 )

7 = Introduction To A-Mail Delivery
8 Our concept suggests three ways that A-Mail can be best utilized.
9
10 - First is to reduce the probability of the failure of a space mission. This
11 problem is known as the Mars problem and suggests problems with human
12 communication.
13 - High round-trip times seen on long-distance communication between Mars and Earth
14 inhibits successful human developments on the planet. In contrast, the delivery
15 speed of an A-Mail can be determined through this simple formula:
16 $ v(t) = lim_(t -> oo) integral_t^oo c dot.op sqrt(t^2) dif t $
17
18 #figure(
19   image("a-mail.svg"),
20   caption: [FTL Earth-to-Mars communication enabled by Typst.], [Egon]
21 )
```

The right side of the interface shows the rendered document titled 'Towards Swifter Interstellar Mail Delivery' with authors Johanna Swift, Egon Stellaris, and Oliver Liam from their respective institutes. The date is May 17th, 2022. The abstract discusses the challenges of interplanetary mail delivery and proposes a new approach. A formula for the velocity of A-Mail is shown, followed by a diagram illustrating FTL communication between Earth and Mars.

# 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