



Open Methodology in practice: Reproduzierbare Forschung mit R

Dr. Tobias Heycke
27.06.2019

Part 2: R Markdown

Schedule

- Basic rules of Markdown
- The YAML Header
- R Markdown
- Papaja
- Citation
- Tables

Introduction

Course material

All materials can be found in the folder: material

Markdown

- Simple Markup Language
- Written in text files and translated to final output format
- To make it easier, we will also use RStudio as IDE (which is not necessary)
- R Markdown = Markdown + R

Writing in R Markdown (.Rmd)

- Easier than \LaTeX
- Reproducible and commented R Code/Manuscript
- Less flexible than \LaTeX

Basic Rules of Markdown

Line break I

- One line per sentence (helps also with version control)
- Use empty line as line break

Line break II

This is an example sentence.

This is another example sentence.

This is an example sentence.

This is another example sentence.

This is an example sentence. This is another example sentence.

This is an example sentence.

This is another example sentence.

Header

- Use '#' to write headers
- Add empty line above and below the header
- The more '#' the lower the level of the header

Header II

```
# Level 1 Header
```

```
## Level 2 Header
```

```
### Level 3 Header
```

Level 1 Header

Level 2 Header

Level 3 Header

Bold and Italic I

To write text in bold or in italic, just add *'s around the word(s)

- one * = italic
- two ** = bold

Bold and Italic II

You can print one word **bold** and another *italic*.

Or *multiple words* can **be altered**.

You can print one word **bold** and another word *italic*.

Or *multiple words* can **be altered**.

Lists I

- Use a dash for lists (or numbers)
- Make sure there is an empty line above and below the list

Lists II

- This
- Is
- A
- List

- This
- Is
- A
- List

Lists III

1. This
2. Is
3. Another
4. List

- 1 This
- 2 Is
- 3 Another
- 4 List

Overview rules (in RStudio)

For more see: Help > Cheatsheets > R Markdown Reference Guide

Task I



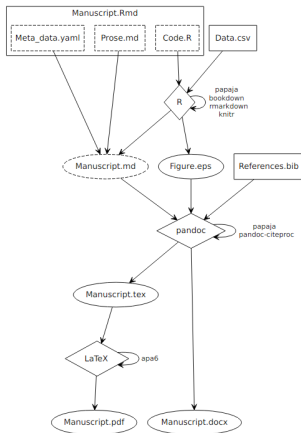
Go to hackmd.io > Click on 'Use for free' > Write Markdown!

R Markdown

What is possible?

- Scientific papers (which we will do later)
- Slides
- HTML sites
- CVs
- ...

From Rmd to PDF



YAML header

Info YAML

- YAML = “YAML Ain’t Markup Language”
- Human readable configuration information
- At the top of each markdown document
- starts and ends with: ---

Simple YAML

```
---
title: "My first Markdown"
author: "My name"
output: pdf_document
---
```

Extended YAML

```

---
title: "GESIS Panel Wave Report"
output:
  pdf_document:
    keep_tex: yes
    includes:
      in_header: style/my_style.sty
    bibliography: literature.bib
fontsize: 11pt
params:
  wave: fe
  wrauthor: David Bretschi, Tobias Heycke
  date: September 2018
---

```

R Markdown

Your first Markdown (with the help of RStudio)

- R Studio is making it easier to knit a final document
- use UTF-8 encoding
- Let us take a look at a Rmd template by R Studio

Your first Markdown: general information

- A new environment is created when R markdown is knitted
- The working directory is always set to the folder of the .Rmd file
- You can knit Markdown documents by clicking on the knit button or pressing `Ctrl + Shift + k`.

Task II



Open the file: task02.Rmd and write some content and knit the file (and save the Rmd file)!

R Markdown

R and Markdown

- Change from prose to R code (and back)
- Easy to read and spot where results come from
- Many useful functions

Code chunks

R code chunks

- Code chunks include code (mostly R but python is possible)
- Code is executed when knitting a R Markdown file
- In R Studio you can use the shortcut `Ctrl + alt + i` to inset a code block
- No underscore in chunk name
- No name twice

```
```${r name, options=...}
...
```
```

Chunk options

- Useful options that will be used by `knitr`
- See handout for all options
- Check this for more details: <https://yihui.name/knitr/options/>

Useful chunk options

- eval = FALSE
- echo = FALSE (see next slide)
- warnings = FALSE
- cache = TRUE
- dependson = “chunkname”
- child = “rmdfilename.Rmd”

Global chunk options

Adjust all chunk options in a Rmd file with the following command:

```
knitr::opts_chunk$set(echo = TRUE)
```

In line R code

- Code can be run in the text
- Makes most sense to 'print' R output in the Text
- Result = Dynamic document
- In the text just write:

```
`r 2 + 2`
```

Task III



Open the file: task03.Rmd

- add a chunk calculating the sd the speed of cars (and save it to a new object)
- Print the results in a sentence below the chunk
- Knit the PDF
- Not happy with result? Round it!

Task IIIb



Add the task02.Rmd as a child to task03.Rmd and knit!

Try out cache and dependson!

L^AT_EX

L^AT_EX I

You can add L^AT_EX code to your text.

- Use math mode for formulas etc.

You can simply add a formular: `\frac{SD}{\sqrt{N}}`

Result:

You can simply add a formula: $\frac{SD}{\sqrt{N}}$

L^AT_EX II

Things I often use:

```
\newpage
\includegraphics
\begin{center}
\end{center}
```

If you want to use a L^AT_EX package, load it in the YAML header
(see later)

Math mode and R code

You can use R within math mode

```
sd.1 <- 15
n.1 <- 5
```

```
$\frac{\texttt{`r sd.1`}}{\sqrt{\texttt{`r n.1`}}}=
```

$$\texttt{`r round(sd.1/(sqrt(n.1)), 2)`$}$$

$$\frac{15}{\sqrt{5}} = 6.71$$

Task IV



Add some \LaTeX to your Rmd file!

For help with formulas, check out:

[codecogs.com/latex/eqneditor.php](https://www.codecogs.com/latex/eqneditor.php) and mathpix.com/

L^AT_EX in YAML

```
header-includes:
```

- \usepackage{tikz}
- \usepackage{graphicx}
- \usepackage{titlesec}
- \usepackage{xcolor}

papaja

papaja

- Template + filters + functions
- Helps writing APA6 articles
- Still in developement
- More information: <https://github.com/crsh/papaja>

Installing papaja

In the R console run the following:

- `install.packages("devtools")`
- `devtools::install_github("crsh/papaja", ref = "devel")`

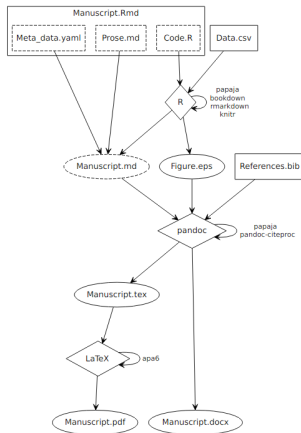
File > New File > R Markdown > From Template > APA article

Task V



- Set up a folder structure for one of your projects!
- Add some (not all) of your R code into a papaja document!
- Adjust the code, to standardize everything
- Knit the document!

From Rmd to PDF



apa_print

Print statistical results

```
toller_t_test <- t.test(1:10, y = c(7:20))
```

Das Ergebnis war toll,

```
`apa_print(toller_t_test)$full_result`.
```

Das Ergebnis war toll, $\Delta M = -8.00$, 95 % CI $[-11.05, -4.95]$,
 $t(21.98) = -5.43$, $p < .001$.

apa_print

Works with:

- htest
- lm and summary.lm
- aov, aovlist, summary.aov, and summary.aovlist
- anova and Anova.mlm

Sources and citing

What you need to cite

- A biblatex file of your references (e.g., from Zotero)
- Add .bib file name to YAML
`bibliography: nameoffile.bib`
- One way: Look up citation key and insert to text with @ in front

Citr

Another way is using citr

- Save bib file and add to YAML
- Install citr (RStudio plug-in)
- Set citr shortcut
- More information: github.com/crsh/citr

(Even better: citr + better BibTeX; see link above)

Task VI



Add sources from the `markdown_course.bib` file to your text in the Rmd file!

(If you have your own bib files, you can use these)

Task VIb



Change the citation style to a style of your choosing!

Tables & Figures

Figures

- `apa_barplot` & `apa_beeplot`
- Very handy if you have a factorial design (compare to `afex`)
- In `papaja`, figures can be in text or below (see `YAML`)

Figure reference and caption

```
```{r some-fig, fig.cap = "Some text here. \\label{fig:figure1}"}
papaja::apa_barplot(
 data = npk
 , id = "block"
 , dv = "yield"
 , factors = c("N")
)
```
```

As can be seen in Figure \@ref(fig:figure1).

Tables: general information

- Tables can be produced with R code in R chunks (e.g., with `kable` or `apa_table`)
- Tables can be written in Markdown directly

apa_table

- Important: add results='asis' to chunk options

References to tables

```

'''{r some-table, results='asis'}
my_table <- t(apply(cars, 2, function(x) # Create data
  round(c(Mean = mean(x), SD = sd(x), Min = min(x), Max = max(x)), 2)
))

apa_table(
  my_table
  , align = c("l", rep("r", 3))
  , caption = "\\label{tab:table1}A summary table of the cars dataset."
  , escape = FALSE
)
...

```

As can be seen in Table \@ref(tab:table1).

Task VII



Add a table and a figure to your Markdown document!

Don't forget to refer to it in the text!

More papaja / markdown

Comments

You can add comments that will not be displayed in final PDF (or html)

```
<!-- this is a comment -->
```

Also useful for collaborating!

R Studio features

- Show document outline
- Shortcut to Chunks

Read data from git

From: https://gist.githubusercontent.com/crsh/bd4d1f62d300462ea0c0f44b9ad38616/raw/edd9c74e24b68f42433c2526cafc888509b1b8bc/batch_download_github.R

- Benefit: Folders not needed, sharing RMD alone can be enough
- Downside: Max 1000 files can be read from github (with this method)
- Downside: Might take a while

papaja to MS Word

You can change output: `papaja::apa6_pdf` to output:
`papaja::apa6_word` to create MS word files from Rmd
but:

- \LaTeX does not work (e.g., math mode or `\@ref`)
- Tables will look different
- Generally not as pretty

For the future: Redoc

- Convert Rmd to Word and back
- Idea: also convert track changes and comments back
- More information: <https://github.com/noamross/redoc>
- Still in development

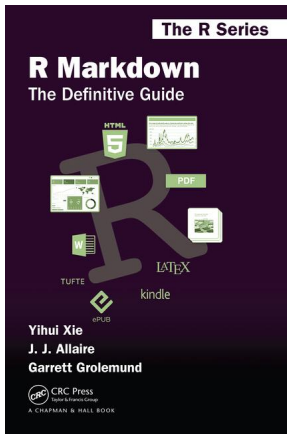
Task



Depending on time: Work on your Rmd file

Feel free to work on your Rmd at home tonight (not necessary)

R Markdown Guide



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

End of day 1