

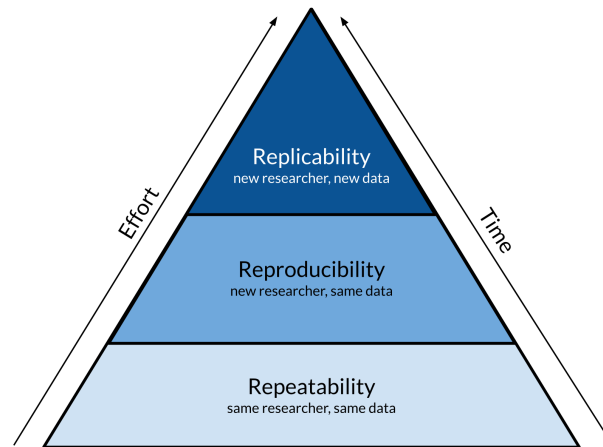
Reproducibility

Reproducibility

What's reproducibility?

A different analyst re-performs the analysis with the same code and the same data and obtains the same result.

Reproducibility vs Repeatability vs Replicability



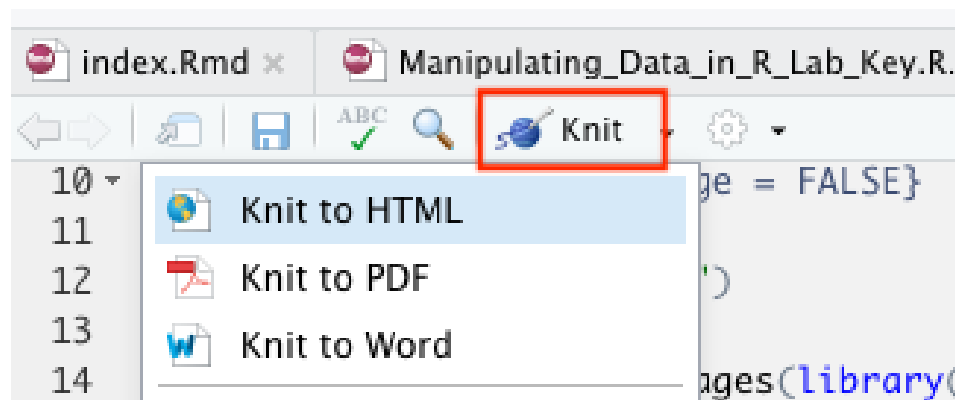
Based off of a figure from Essawy et al, 2020 <https://doi.org/10.1016/j.envsoft.2020.104753>

Reproducibility

- Clean your environment regularly
- Use RMarkdown
- Check the knit of your RMarkdown regularly
- Tell your future self and others what you did!
- Print session info!

RMarkdown

Clicking the knit button, will knit your document to create different types of reports. The default is html.



Code Chunks

```

```{r, echo = FALSE}
x<-2
```

```{r, eval = FALSE}
x<-2
```

```{r, message = FALSE}
x<-2
```

```

After knitting:

- 1) **echo** - determines if your code should be shown or not
 - TRUE = code is **shown** (default)
 - FALSE = code is not shown (but might be run...depends on eval)
- 2) **eval** - determines if your code should be evaluated (run) or not
 - TRUE = code is **run** (default)
 - FALSE = code is not run (but might be shown...depends on echo)
- 3) **message** = FALSE - suppresses messages when you run your code

RMarkdown syntax

Before:

```

# Header - biggest font created by hashtag and space
## SubHeader Second Biggest created by 2 hashtags and space

bold text
italicized text

`code` referenced outside of a chunk needs backticks

```

After knit:

Header - biggest font created by hashtag and space

SubHeader Second Biggest created by 2 hashtags and space

bold text *italicized* text

`code` referenced outside of a chunk needs backticks

RMarkdown syntax

Go to File > Help > Cheatsheets > R Markdown Cheatsheet

Final Project

Specific guidelines and example on website

Turn in through CoursePlus:

- 1) RMarkdown file
- 2) html file

Session Info

Ruby's session info print out

R version 4.0.2 vs 4.0.5

Different operating systems!

rmarkdown 2.4 vs 2.10

Avi's session info print out

If Avi and Ruby have discrepancies in their results, the session info print out gives a record which may have clues to why that might be!



Session info helps

```
sessionInfo()
```

R version 4.2.0 (2022-04-22)

Platform: x86_64-pc-linux-gnu (64-bit)

Running under: Ubuntu 20.04.4 LTS

Matrix products: default

BLAS: /usr/lib/x86_64-linux-gnu/openblas-pthread/libblas.so.3

LAPACK: /usr/lib/x86_64-linux-gnu/openblas-pthread/liblapack.so.3

locale:

```
[1] LC_CTYPE=en_US.UTF-8      LC_NUMERIC=C
[3] LC_TIME=en_US.UTF-8      LC_COLLATE=en_US.UTF-8
[5] LC_MONETARY=en_US.UTF-8  LC_MESSAGES=en_US.UTF-8
[7] LC_PAPER=en_US.UTF-8     LC_NAME=C
[9] LC_ADDRESS=C             LC_TELEPHONE=C
[11] LC_MEASUREMENT=en_US.UTF-8 LC_IDENTIFICATION=C
```

attached base packages:

```
[1] stats      graphics  grDevices  utils      datasets  methods    base
```

other attached packages:

```
[1] emo_0.0.0.9000      patchwork_1.1.1      here_1.0.1
[4] plotly_4.10.0       directlabels_2021.1.13 scales_1.2.0
[7] knitr_1.39          esquisse_1.1.1       readxl_1.4.0
[10] naniar_0.6.1        broom_0.8.0          jhur_0.2.1
[13] lubridate_1.8.0     forcats_0.5.1        stringr_1.4.0
[16] dplyr_1.0.9         purrr_0.3.4          tidyr_1.2.0
[19] tibble_3.1.7        ggplot2_3.3.6        tidyverse_1.3.1
[22] readr_2.1.2
```

loaded via a namespace (and not attached):

```
[1] fs_1.5.2            bit64_4.0.5          httr_1.4.3
[4] rprojroot_2.0.3     phosphoricons_0.1.2  tools_4.2.0
[7] backports_1.4.1     bslib_0.3.1          utf8_1.2.2
[10] R6_2.5.1            lazyeval_0.2.2       DBI_1.1.2
[13] colorspace_2.0-3    withr_2.5.0          tidyselect_1.1.2
[16] bit_4.0.4           curl_4.3.2           compiler_4.2.0
[19] cli_3.3.0           rvest_1.0.2          xml2_1.3.3
[22] labeling_0.4.2      sass_0.4.1           quadprog_1.5-8
[25] digest_0.6.29       foreign_0.8-82       rmarkdown_2.14
[28] rio_0.5.29          pkgconfig_2.0.3      htmltools_0.5.2
[31] dbplyr_2.1.1        fastmap_1.1.0        highr_0.9
[34] htmlwidgets_1.5.4   rlang_1.0.2          rstudioapi_0.13
[37] shiny_1.7.1         jquerylib_0.1.4      farver_2.1.0
[40] generics_0.1.2      jsonlite_1.8.0       crosstalk_1.2.0
[43] vroom_1.5.7         zip_2.2.0            magrittr_2.0.3
[46] Rcpp_1.0.8.3        munsell_0.5.0        fansi_1.0.3
[49] lifecycle_1.0.1     visdat_0.5.3         stringi_1.7.6
[52] yaml_2.3.5          grid_4.2.0           parallel_4.2.0
[55] datamods_1.3.2      promises_1.2.0.1     crayon_1.5.1
[58] haven_2.5.0         hms_1.1.1            pillar_1.7.0
[61] clisymbols_1.2.0    reprex_2.0.1         glue_1.6.2
[64] evaluate_0.15       data.table_1.14.2    modelr_0.1.8
[67] vctr_0.4.1          tzdb_0.3.0           httpuv_1.6.5
[70] cellranger_1.1.0    gtable_0.3.0         assertthat_0.2.1
[73] xfun_0.31           openxlsx_4.2.5       mime_0.12
[76] xtable_1.8-4        later_1.3.0          viridisLite_0.4.0
[79] shinywidgets_0.7.0  ellipsis_0.3.2
```

DRY code

DRY

(https://web.archive.org/web/20131204221336/http://programmer.97things.oreilly.com/wiki/index.php/Don't_Repeat_Yourself) is an acronym: “Don’t repeat yourself” [@Smith2013].

“I hate code, and I want as little of it as possible in our product.” - Jack Diedrich

More resources

These are just some quick tips, for more information:

- The RMarkdown book (<https://bookdown.org/yihui/rmarkdown/>)
- Jenny Bryan’s organizational strategies (https://www.stat.ubc.ca/~jenny/STAT545A/block19_codeFormattingOrganization.html).
- Write efficient R code for science (<https://www.earthdatascience.org/courses/earth-analytics/automate-science-workflows/write-efficient-code-for-science-r/>).
- Reproducibility in Cancer Informatics course (https://jhudatascience.org/Reproducibility_in_Cancer_Informatics/introduction.html)