R-eproducible-science

Rick Gilmore

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## R-eproducible psychological science

## Themes

1. What is reproducible psychological science?
2. How can R make my science more transparent, open, and reproducible?

## Is there a crisis?

[Baker 2016](http://doi.org/10.1038/533452a)

## Not just in psychology

## If so, why?

[Baker 2016](http://doi.org/10.1038/533452a)

Here are the data from the Nature survey.

## [(Munafò et al. 2017)](http://doi.org/10.1038/s41562-016-0021) manifesto

## What am I trying to reproduce?

* My own workflow
  + Data collection
  + Cleaning
  + Visualization
  + Analysis
* "Hit by a truck" scenario

## Reproducible workflows

* Scripted, automated = minimize human-dependent steps.
* Well-documented
* Transparent to me & colleagues == transparent to others

## Using R for reproducible workflows

* Mix R code, output, comments, tables using R Markdown
* R Markdown files = text files
* One input file, multiple outputs to
  + PDF, Word (.docx)
  + HTML for web pages, slides

## Example 1

* James' R commands from Day 1
* [Raw R script (.R)](R-Workshop-James.R)
* Converted to [R Markdown](R-Workshop-James.R.Rmd)
* Output as | [HTML notebook](R-Workshop-James.nb.html) | [HTML Slides](R-Workshop-James.html) | [PDF](R-Workshop-James.pdf) | [DOCX](R-Workshop-James.docx) |

## How to

* Add header info in [YAML Ain't Markup Language (YAML) format](http://www.yaml.org/start.html)
* Wrap R code "chunks" with triple backticks and {r}
* Separate segments with --- and/or ## or ###
* Render via knit button or `rmarkdown::render(file="my-file.Rmd")

## How to

* Create new R Markdown file: New/New File/R Markdown...
* Specify default, alternative output formats:
  + pdf\_document
  + word\_document
  + ioslides\_document: HTML slides
  + github\_document: renders nicely on GitHub
* Create your document
  + Use an "outline" with Header\_1, Header\_2, Header\_3, etc.
  + Header\_1 text starts with # This is a top level header
  + Header\_2 text starts with ## This is a 2nd level header
  + Header\_3 text starts with ### This is a 3rd level header
* Surround R code with triple back-ticks
* Sections that start with Header\_1, Header\_2, and --- will start new slides in ioslides\_presentation mode.
* **Bold text**: \*\*This is bold\*\*; *Italicized text*: \*Italics\*
* Start lists with hyphens - Item 1 or numbers 1. Item 1.

## Let's try it

* <bootcamp-survey.Rmd>
* <bootcamp-survey.md>

## Key points

* Use R Markdown files for documents, reports, presentations.
  + One or more output formats from the same file.
  + Analysis/lab notebook.
* Use R scripts to automate different pieces of the pipeline.
* Make README files to explain how to put pieces together.

## Toward a reproducible psychological science...

* Transparent, reproducible, open workflows pre-publication
* Openly shared materials + data + code
* [(Munafò et al. 2017)](http://doi.org/10.1038/s41562-016-0021)
* [(Gilmore and Adolph 2017)](http://dx.doi.org/10.1038/s41562-017-0128)

## Advanced topics

* Write papers in R Markdown using [papaja](https://github.com/crsh/papaja)
* Use R Studio [projects](https://support.rstudio.com/hc/en-us/articles/200526207-Using-Projects)
* Version control with git and [GitHub](http://github.com)
* [Web sites](http://rmarkdown.rstudio.com/rmarkdown_websites.html), [blogs](https://bookdown.org/yihui/blogdown/), (even [books](https://bookdown.org/)) with R Markdown
* Scriptable analysis workflows
  + Reports for each participant
  + Example: [PEEP-II project](https://github.com/gilmore-lab/peep-II-ratings-analysis)

## My GitHub workflow

1. Create a repo on GitHub
2. Copy repo URL
3. File/New Project.../
4. Version Control, Git
5. Paste repo URL
6. Select local name for repo and directory where it lives.
7. Open project within R Studio File/Open Project...
8. Commit early & often

## Learn from my mistakes

* Script **everything** you possibly can
  + If you have to repeat something, make a function or write a parameterized script
* Document **all the time**
  + Comments in code
  + Update README files
* Don't be afraid to ask
* Don't be afraid to work in the open
* Learn from others
* Just do it!

## References

Gilmore, Rick O, and Karen E Adolph. 2017. “Video Can Make Behavioural Science More Reproducible.” *Nature Human Behavior* 1 (12~jun). doi:[10.1038/s41562-017-0128](https://doi.org/10.1038/s41562-017-0128).

Munafò, Marcus R, Brian A Nosek, Dorothy V M Bishop, Katherine S Button, Christopher D Chambers, Nathalie Percie du Sert, Uri Simonsohn, Eric-Jan Wagenmakers, Jennifer J Ware, and John P A Ioannidis. 2017. “A Manifesto for Reproducible Science.” *Nature Human Behaviour* 1 (10~jan): 0021. doi:[10.1038/s41562-016-0021](https://doi.org/10.1038/s41562-016-0021).