

# Reproducible Research: The R Ecosystem, Github, Etc.

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# Introduction

## The practice of research (I)

### What is research?

- In short, writting papers

### Many processes involved

- Code development
- Dataset collection
- Scripts for everything
- Figures creation
- Statistics and analysis

### The review comes, after 6 months

- ... you must repeat an experiment
- ... or change a figure or ...

# Introduction

## The practice of research (I)

### What is research?

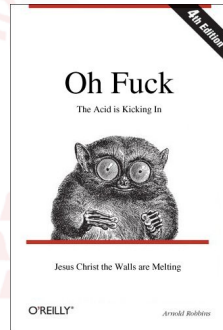
- In short, writting papers

### Many processes involved

- Code development
- Dataset collection
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### The review comes, after 6 months

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# Introduction

## The practice of research (II)

Even worse: Imagine you need to reproduce other's experiments

- Or any one else reproduce your experiments ... **in teams**

Need of many assets

- Experiment run
- Data analysis
- Experiment documentation
- Paper authoring
- **On-line publication**

Need of procedures and tools to handle this

### Our objective

Formalize the whole publishing *collaborative* process

# Introduction

## Reproducible research

### Two types of experiments

- Repetible
- Reproducible

“Reproducible research is the idea that data analyses, and more generally, scientific claims, are published with their data and software code so that others may verify the findings and build upon them.”

<http://reproducibleresearch.net/>

Reproducible research is a cornerstone of research

- Science **must** be reproducible

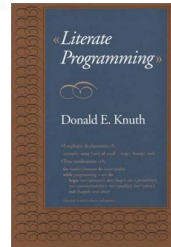
# Introduction

## Components of reproducible research

Task	Tool
Collaborative code development	Git, GitHub
Experiment run	Python
Statistical analysis	R
Process documentation	Markdown
Results writting	Bookdown, Knitr, Swave
Assets publishing	GitHub

# Literate Programming

Literate programming is an approach to programming introduced by D. Knuth in which a program is given as an explanation of the program logic in a natural language, such as English, interspersed with snippets of macros and traditional source code, from which a compilable source code can be generated.



- [https://en.wikipedia.org/wiki/Literate\\_programming](https://en.wikipedia.org/wiki/Literate_programming)



# Tex

$\text{T}_{\text{E}}\text{X}$ (= tau epsilon chi, and pronounced similar to "blecch", not to the state known for 'Tex-Mex' chili) is a computer language designed for use in typesetting; in particular, for typesetting math and other technical (from Greek "techne" = art/craft, the stem of 'technology') material.

[tug.org/whatis.html](http://tug.org/whatis.html)

- It has been around for many years...
-

# Tex and Latex

$\text{\LaTeX}$ , which is pronounced «Lah-tech» or «Lay-tech» (to rhyme with «blech» or «Bertolt Brecht»), is a document preparation system for high-quality typesetting. It is most often used for medium-to-large technical or scientific documents but it can be used for almost any form of publishing.

<http://www.latex-project.org/about/>

- It also has been around for many years...
-

# What is R?

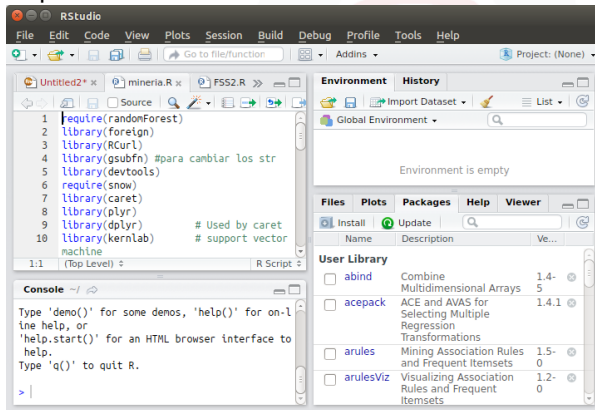
R is a programming language and software environment for statistical computing and graphics supported by the R Foundation for Statistical Computing. The R language is widely used among statisticians and data miners for developing statistical software and data analysis.

Wikipedia:

[https://en.wikipedia.org/wiki/R\\_\(programming\\_language\)](https://en.wikipedia.org/wiki/R_(programming_language))

# What is RStudio?

## Popular IDE for R.



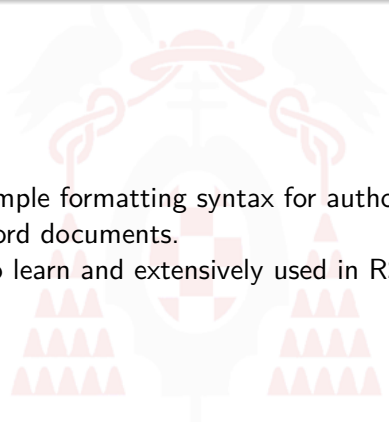
<https://www.rstudio.com/>

# RStudio?

Well known package authors work for RStudio.



# Markdown



Markdown is a simple formatting syntax for authoring HTML, PDF, and MS Word documents.  
Extremely easy to learn and extensively used in RStudio.

# knitr

knitr is an engine for dynamic report generation with R. It is a package in the statistical programming language R that enables integration of R code into LaTeX, LyX, HTML, Markdown, AsciiDoc, and reStructuredText documents.

<https://en.wikipedia.org/wiki/Knitr>

knitr extracts R code in the input document, evaluates it and writes the results to the output document

Rnw, Markdown, HTML and LaTeX

<http://yihui.name/knitr/>

<http://yihui.name/knitr/demo/minimal/>

# Bookdown

It is way of authoring books with RMarkdown generating PDF, handouts and slides automatically.

<https://www.rstudio.com/resources/webinars/introducing-bookdown/>



# Rnw

Inserts R into Latex documents.

## Git and GitHub



# Git

Git

[https://en.wikipedia.org/wiki/R\\_\(programming\\_language\)](https://en.wikipedia.org/wiki/R_(programming_language))

# GitHub

GitHub

[www.github.com](https://www.github.com)

Publish Websites, etc.



# Conclusions

- Learn Bash and other tools for it: awk, make, sort,
- Learn Git, R or Python.
- If you use R/Python for your research automate as much as possible. It is much easier to modify.
- Try to stick to Open/libre software GNU/Linux, R, Python, etc.