Intro to This Course; Getting Started with R

Enrico Toffalini

Why becoming an R user?

- **Mainstream in academia** for statistical computing and data science, increasingly used in business. *Job market advantage!*
- **Free & open-source**: wherever you go, R will be with you at no costs (unlike *MATLAB*, *MPLUS*, *SPSS*, etc.)
- **Real programming language**: difficult at the beginning, but: 1) gives you lots of flexibility; 2) has transfer on other programming languages (e.g., ***Python***).
- **Vast community support** thanks to a large and active community (plus *chatGPT*, *Gemini*, *Lucrez-IA*, etc., know it pretty well!).
- **Huge ecosystem**, >23,000 packages on CRAN, more from other sources (e.g., GitHub), to do amazing stuff with statistical data analysis, machine learning, data visualization, developing webapps [*shiny*], writing reports and even entire books [*bookdown*, *rmarkdown*]); also, can integrate with *Quarto*, *GitHub*.
- Facilitates **reproducible scientific research** by sharing code and workflows.

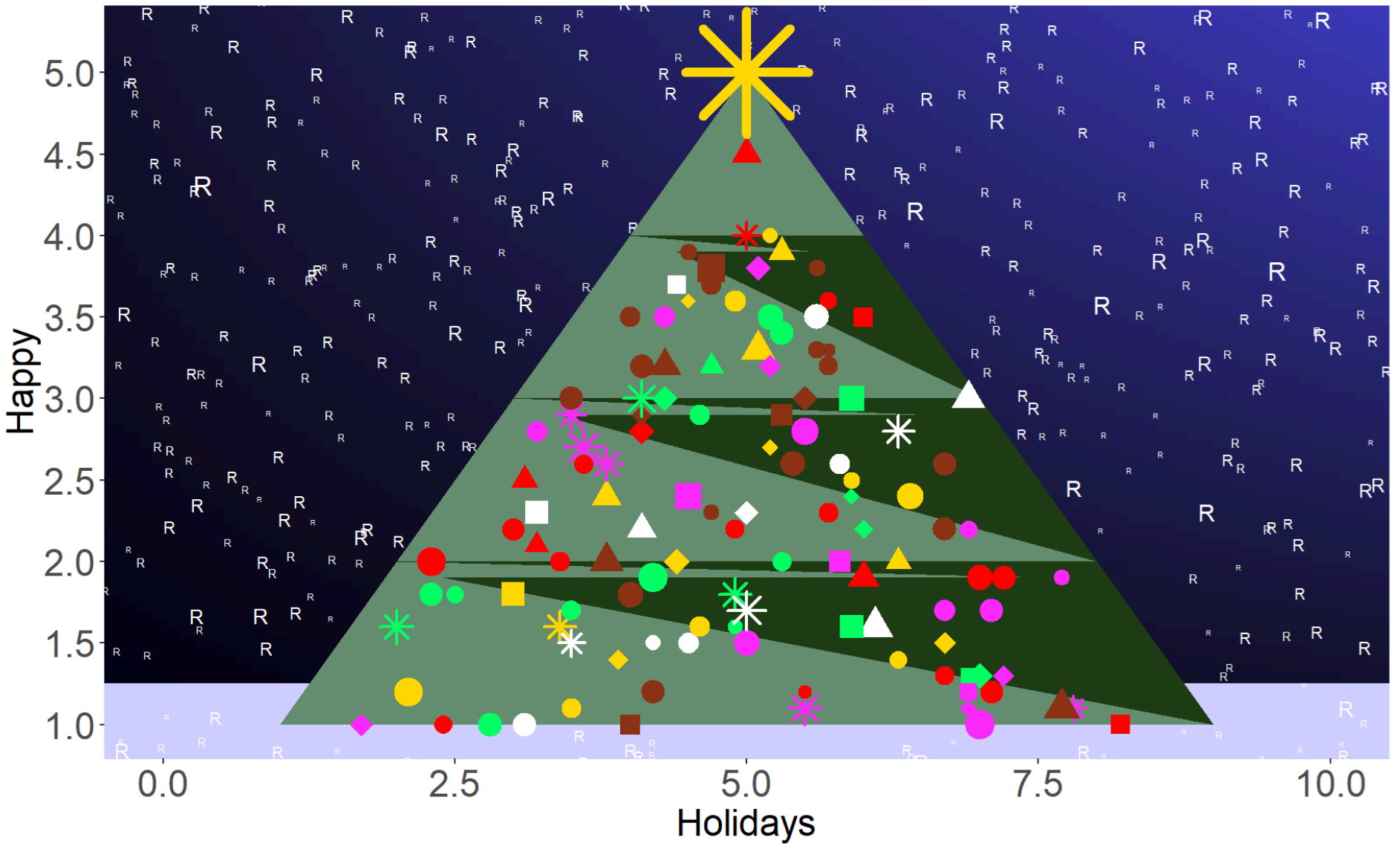
What you may expect to learn in this course:

- Executing fundamental operations and using basic functions;
- Working with essential data types and structures;
- Gaining some proficiency in managing and manipulating data with vectors and dataframes;
- Understanding some fundamental concepts of programming.

Over the next two years, following this PhD program, you will or may have the opportunity to use R to perform at least some fundamentals about:

- Core **statistical inference** methods;
- **LM/LMM/GLMM**: (Generalized) linear (mixed-effects) models;
- **Data visualization** using *ggplot2*;
- Power analysis & more via **data simulation**;
- **SEM**: Structural Equation Modeling;
- Conducting **meta-analysis**.

you may even create greeting cards



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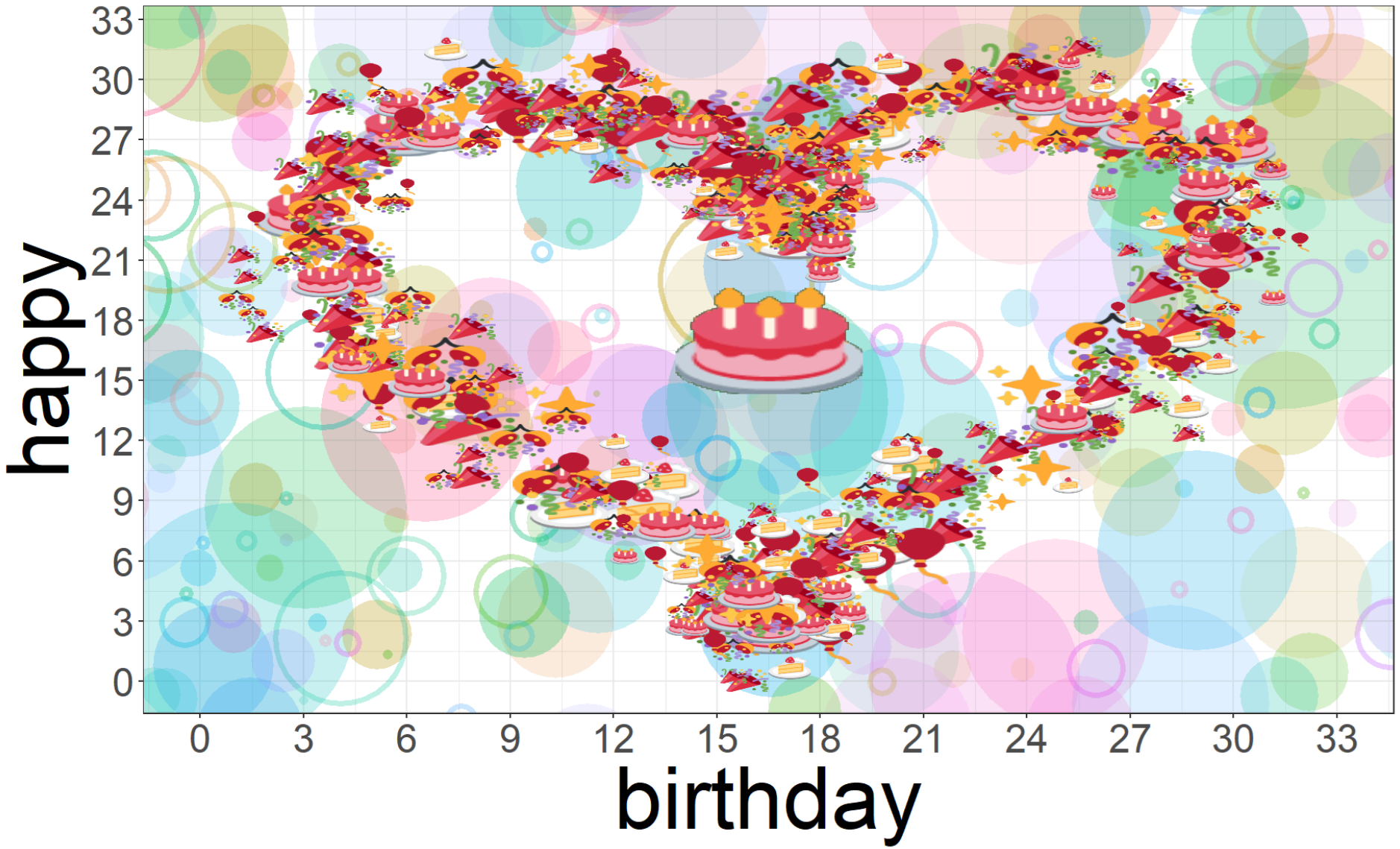
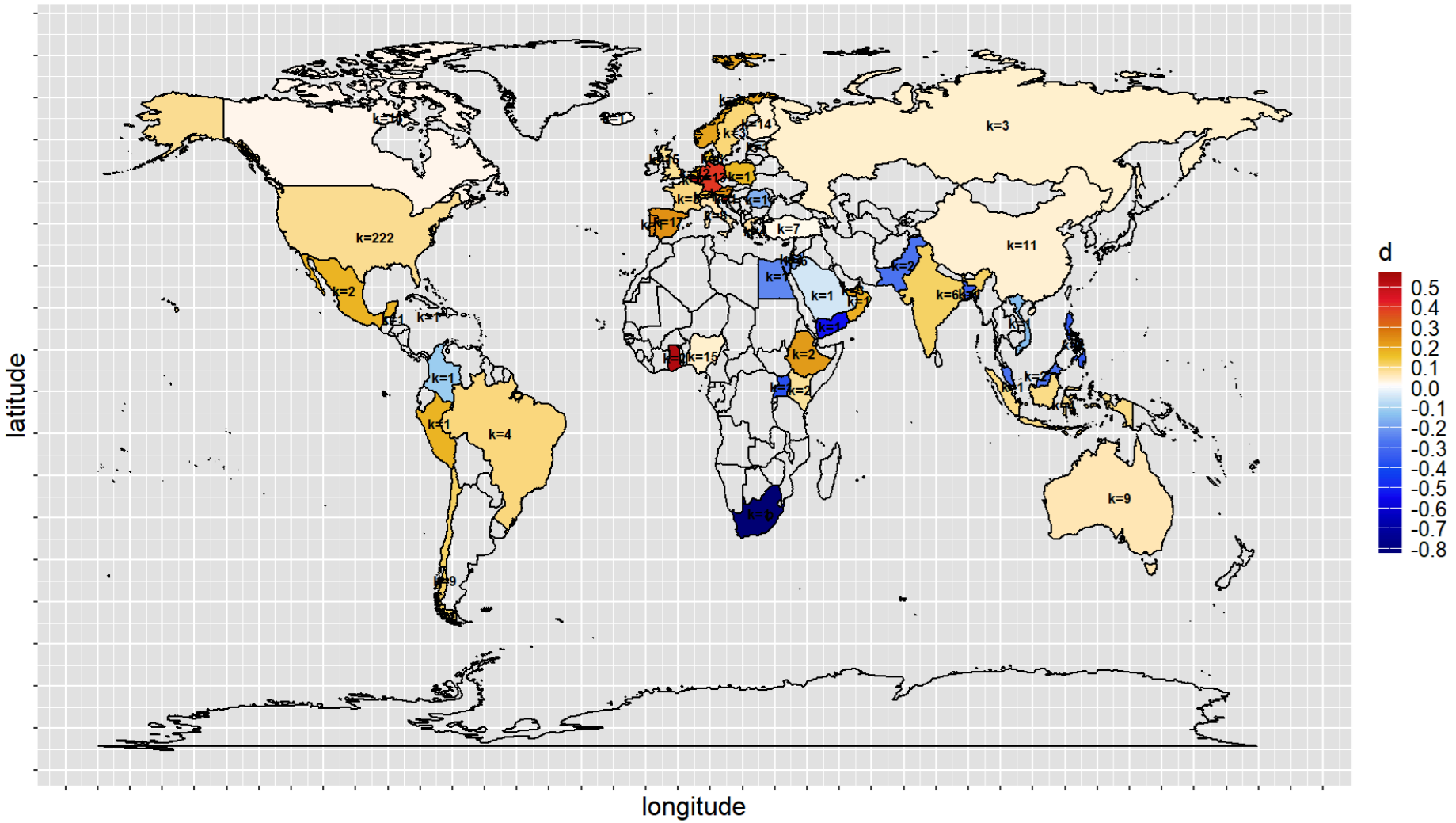


or like fancy infographics



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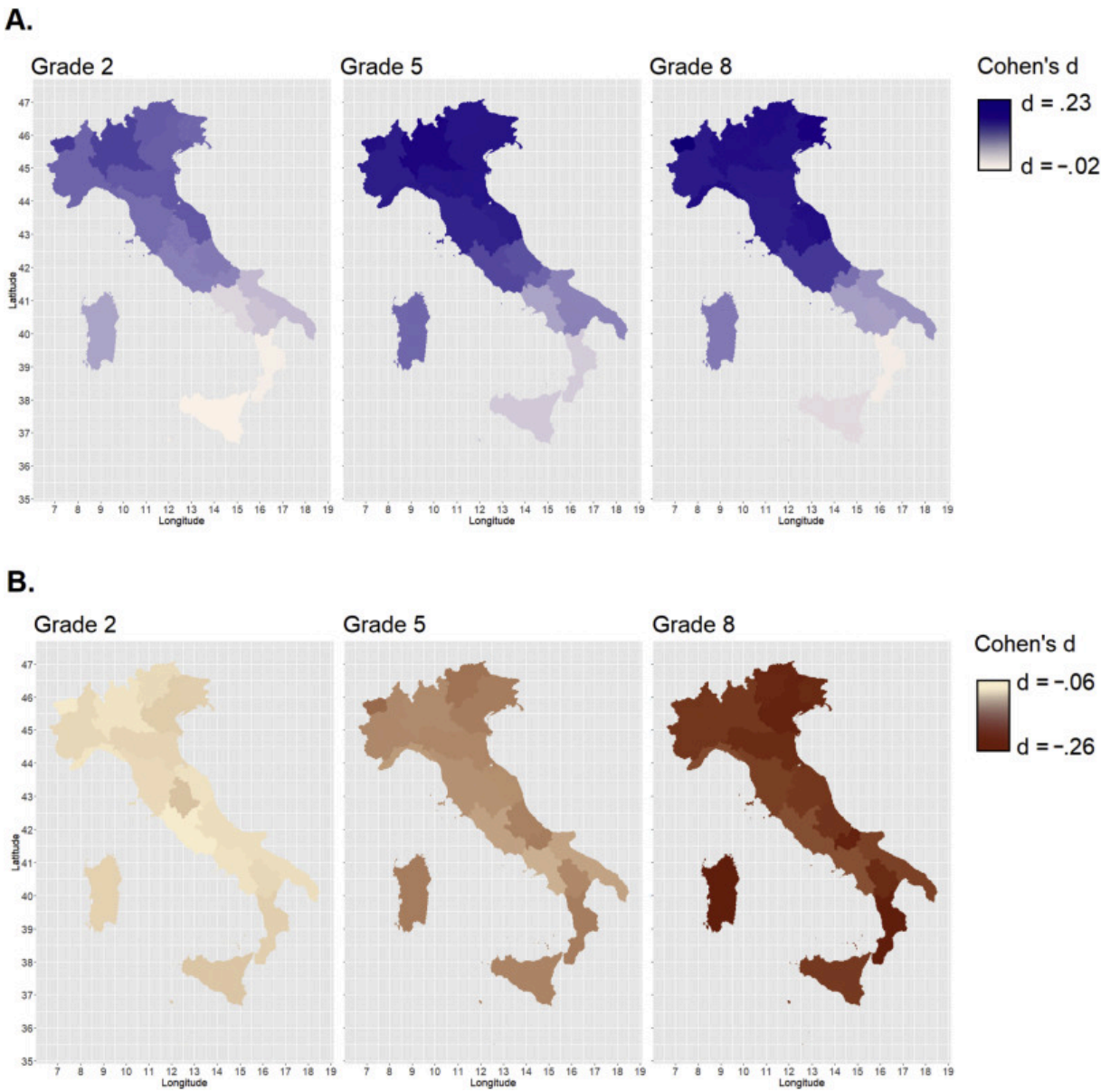
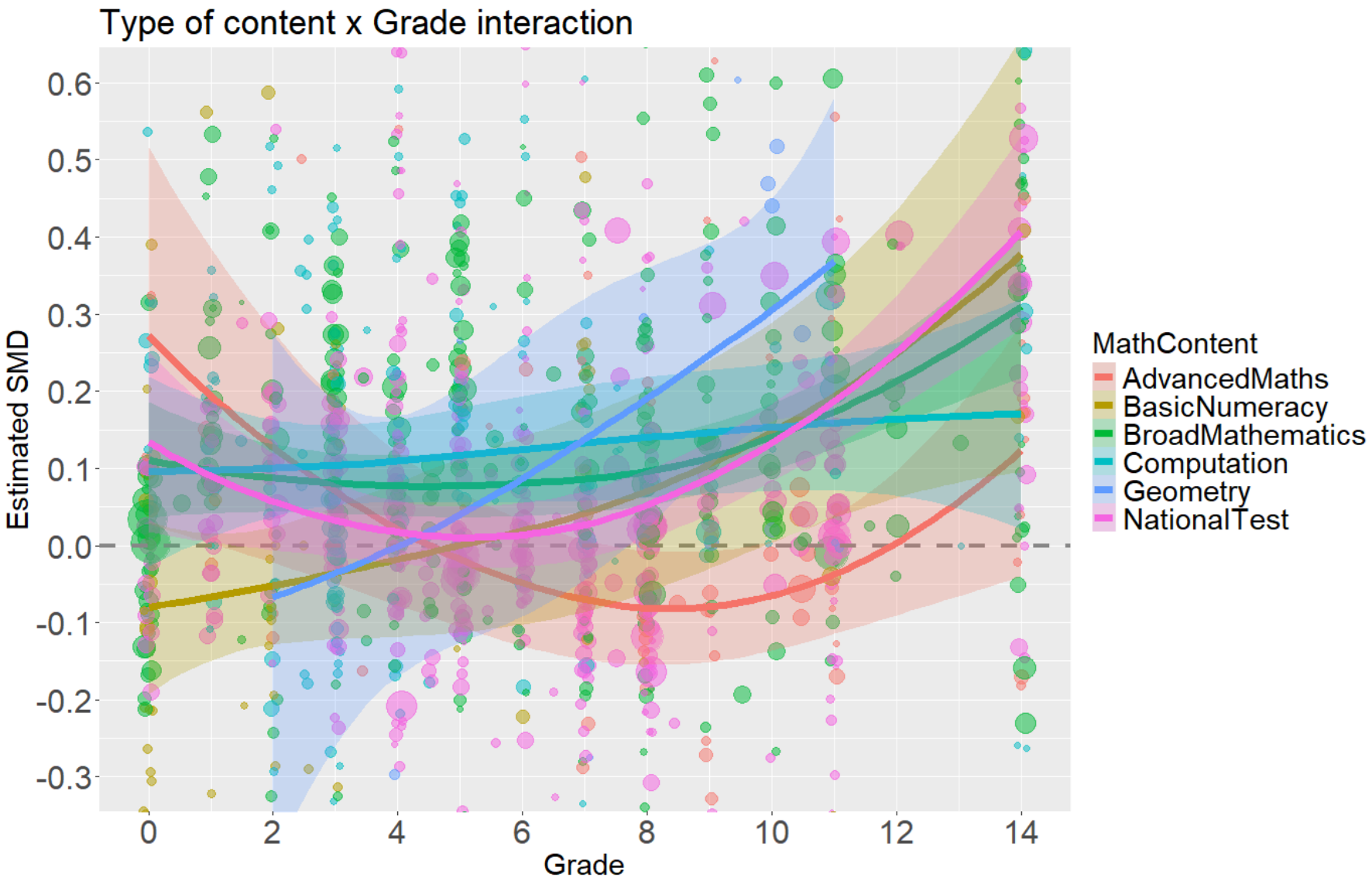


perform fancy moderated meta-analyses



you may create interactive webapps with Shiny

see **Shiny gallery**

here's a couple of recent real examples from **Psicostat** members:

- this game-like shiny app developed for the science4all event in Padova; see here some explanation in Italian
- practical ad-hoc shiny app for scoring experimental data collected by students

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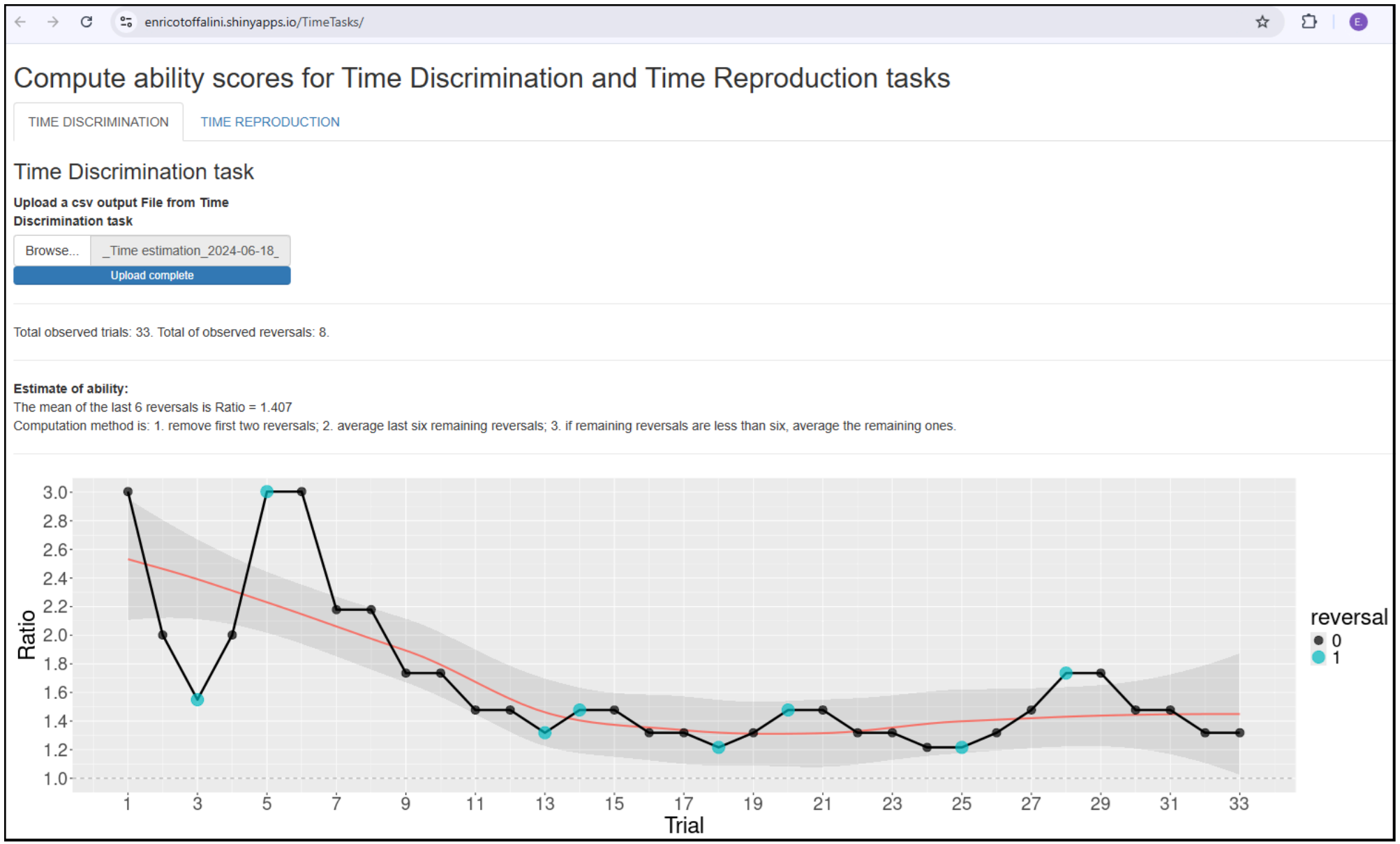


or entire websites and books

examples of other resources that can be **created within the R ecosystem**, integrating other tools such as *GitHub* and *Quarto*:

- this very course support material is a website in its own right
- this very course textbook is a book/website
- this book by Daniël Lakens explaining Statistical Inference

R + *Integrated Development Environment*(s)

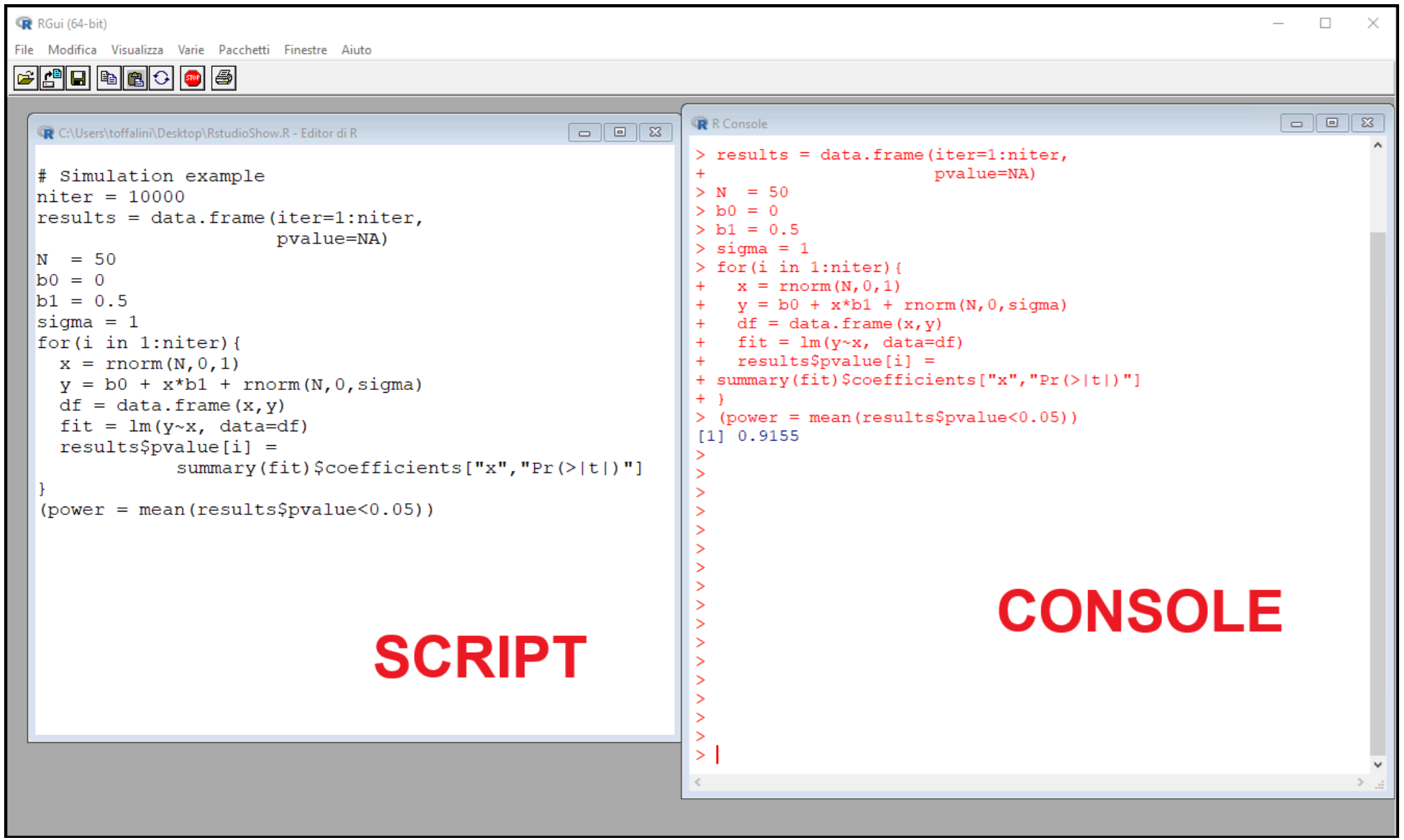
Make sure you install:

- **R** as the programming language interpreter and the basic environment and packages
- **RStudio** is the IDE of election to make writing R code easy

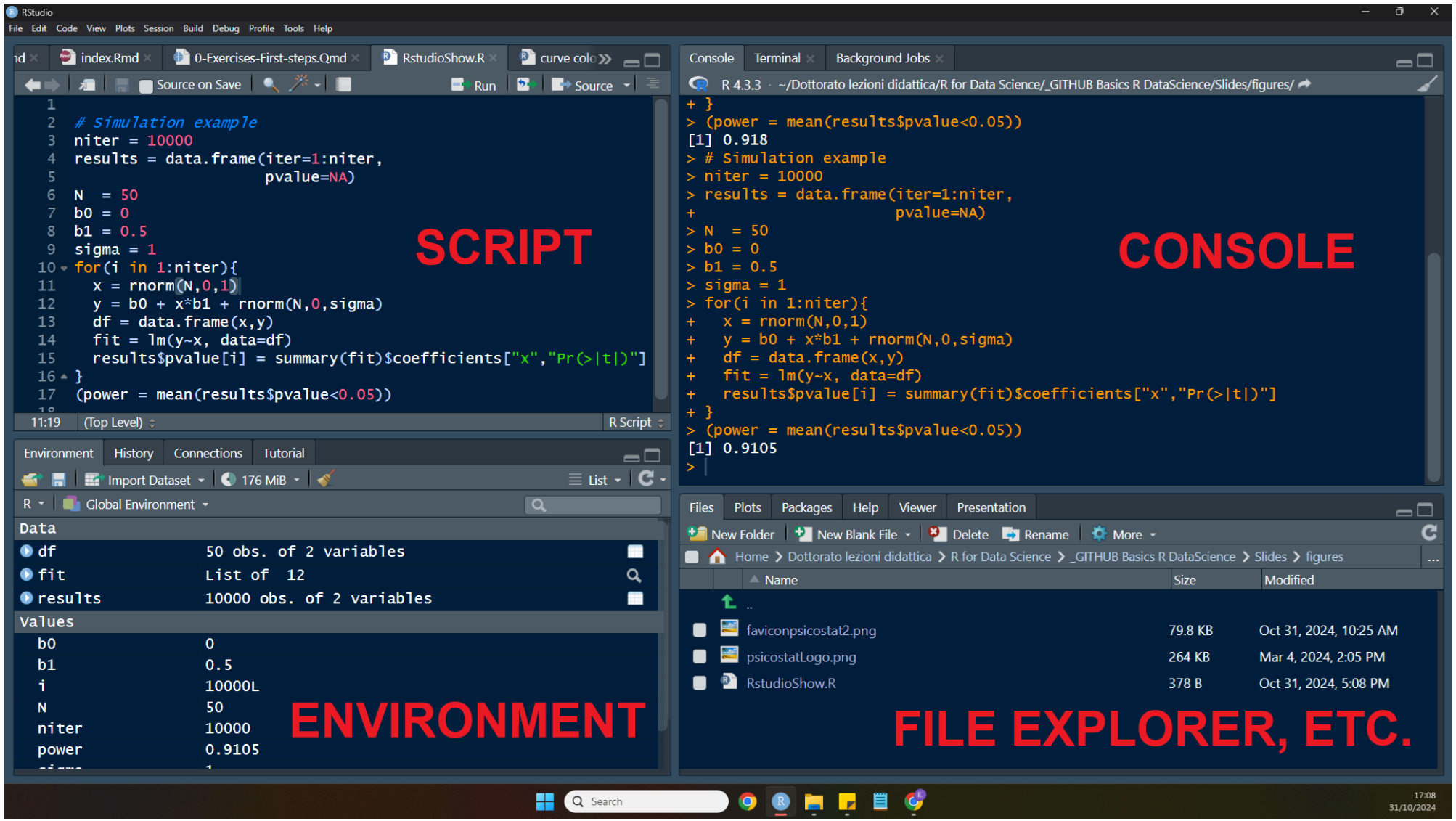
Interesting alternatives to installing RStudio:

- **Positron** (based on MS Visual Studio)
- **Posit.cloud** (fully online, actually RStudio)
- **Google Colab** (fully online, make sure to set *R runtime type*; actually a Jupyter notebook)

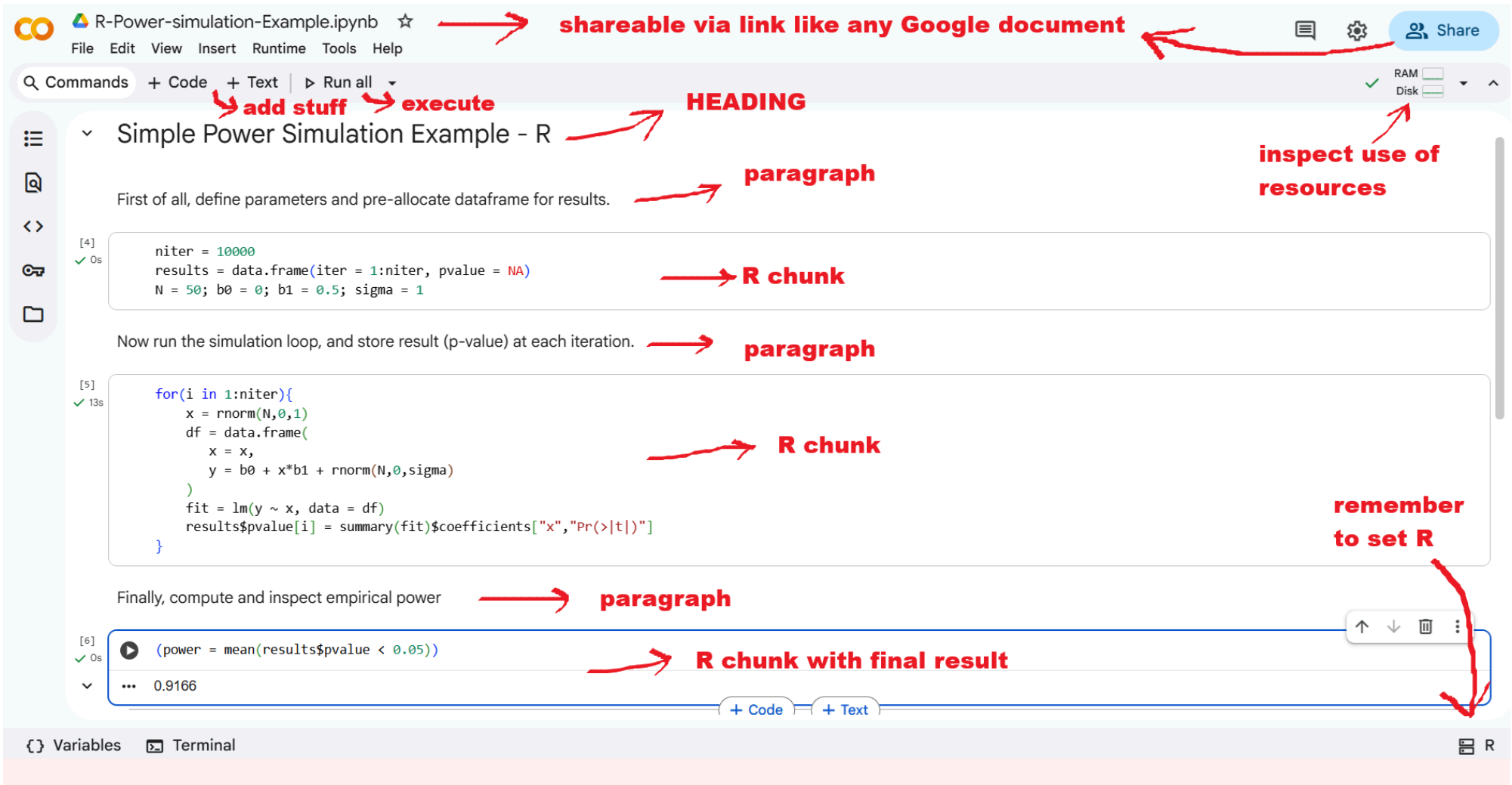
R Console (just base R)



R Studio (full IDE)



Google Colab (online notebook)



Let’s Test the Environment!

Let’s run a few commands in RStudio to familiarize with its console and see if the installation works properly

```
rnorm(10) # draw 10 random values from a Standard Normal distribution
```

```
 [1]  2.1893126 -0.3920248  0.6233079 -0.3044554  1.0206581 -0.8628790
 [7]  0.9408118  1.1756534  0.6488329 -0.9160198
```

```
?rnorm # open the help tab for the "rnorm" function
```

```
round( rnorm(10, mean=100, sd=15) ) # draw 10 values from IQ distribution, round them
```

```
 [1]  89  89  75 104  84  59 111  92  94  77
```

```
install.packages("psych") # install a package from CRAN
```

```
library(psych) # load the newly installed package

fisherz(rho=0.5) # use it to transform a correlation into a Fisher's z
```

```
[1] 0.5493061
```