Creating Economic Tutorials with R and `learnr`

Vanguard Scientific Instruments in Management' 2023

Lyuben Ivanov, PhD

September 10, 2023

Faculty of Economics and Business, Sofia University

Introduction to R

What is R?

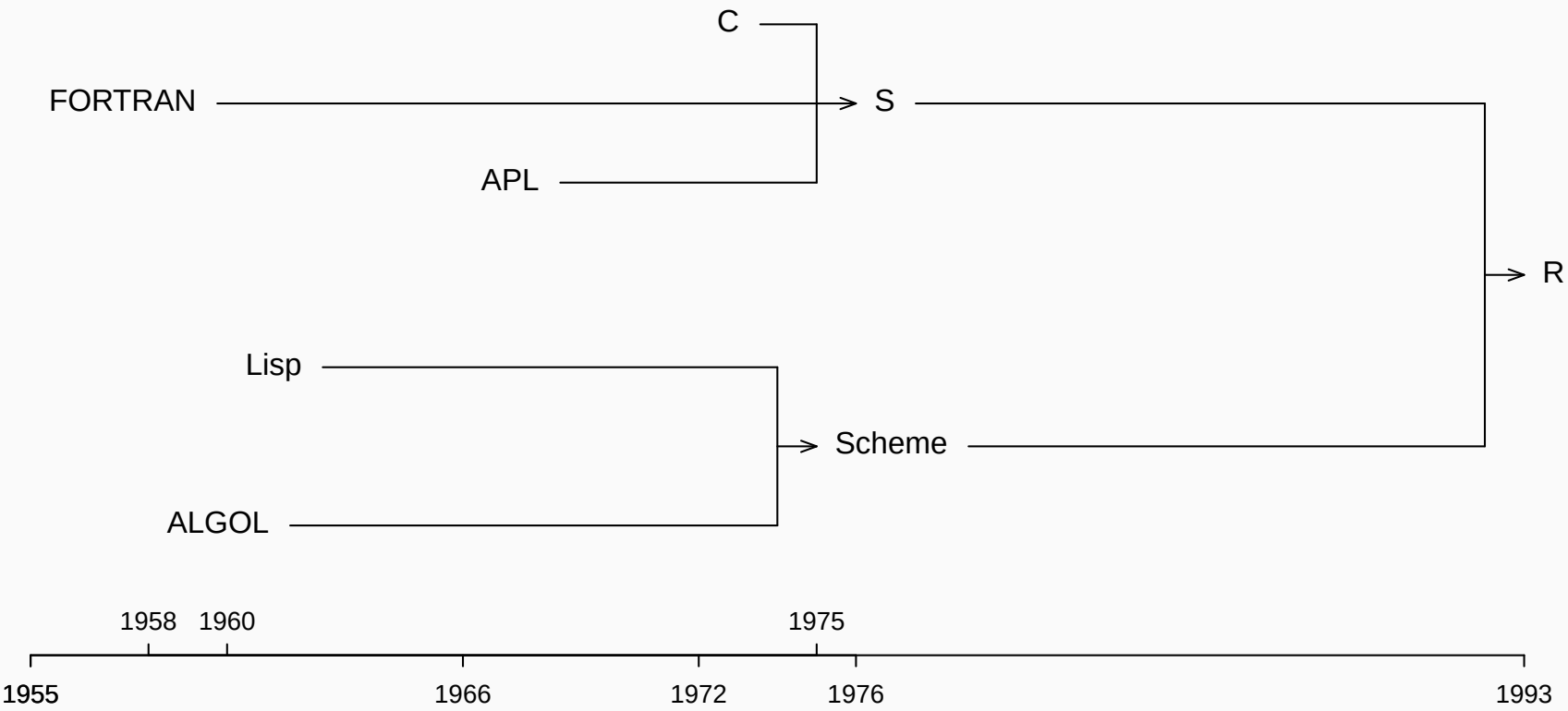
R *is a system for statistical computation and graphics.*

R Core Team

R provides, among other things:

- a programming language;
- high level graphics;
- interfaces to other languages;
- debugging facilities.

R Genealogy


C
FORTRAN
S
APL
R
Lisp
Scheme
ALGOL
1958
1960
1975
1955
1966
1972
1976
1993

The Birth of Scheme

Scheme, the dialect of Lisp that we use, is an attempt to bring together the power and elegance of Lisp and Algol. From Lisp we take the metalinguistic power that derives from the simple syntax, the uniform representation of programs as data objects, and the garbage-collected heap-allocation data. From Algol we take lexical scoping and block structure, which are gifts from the pioneers of programming language design...

Abelson and Sussman.

Design Principles of R

Everything that exists in R *is an object.*

John M. Chambers

Everything that happens in R *is a function call.*

John M. Chambers

Interfaces to other languages are a part of R*.*

John M. Chambers

Introduction to `learnr`

What is `learnr`?

`learnr` is an `R` package created and maintained by employees of Posit (formerly RStudio).

It creates interactive tutorials using `R Markdown` and `Shiny`.

`learnr` uses a combination of:

- narrative,
- figures,
- videos,
- exercises,
- and quizzes

to create self-paced tutorials for learning about `R` and `R` packages.

RStudio/Posit: The Company Behind `learnr`!

Table 1: Top 5 most downloaded packages in August 2023

rank	package	maintainer
1	ragg	thomas.pedersen@posit.co
2	textshaping	thomas.pedersen@rstudio.com
3	ggplot2	thomas.pedersen@posit.co
4	pkgdown	hadley@rstudio.com
5	devtools	jenny@rstudio.com

Source: https://cran.rstudio.com

The Pillars of `learnr`

Developer interface (`R Studio` + `knitr` + `pandoc`):

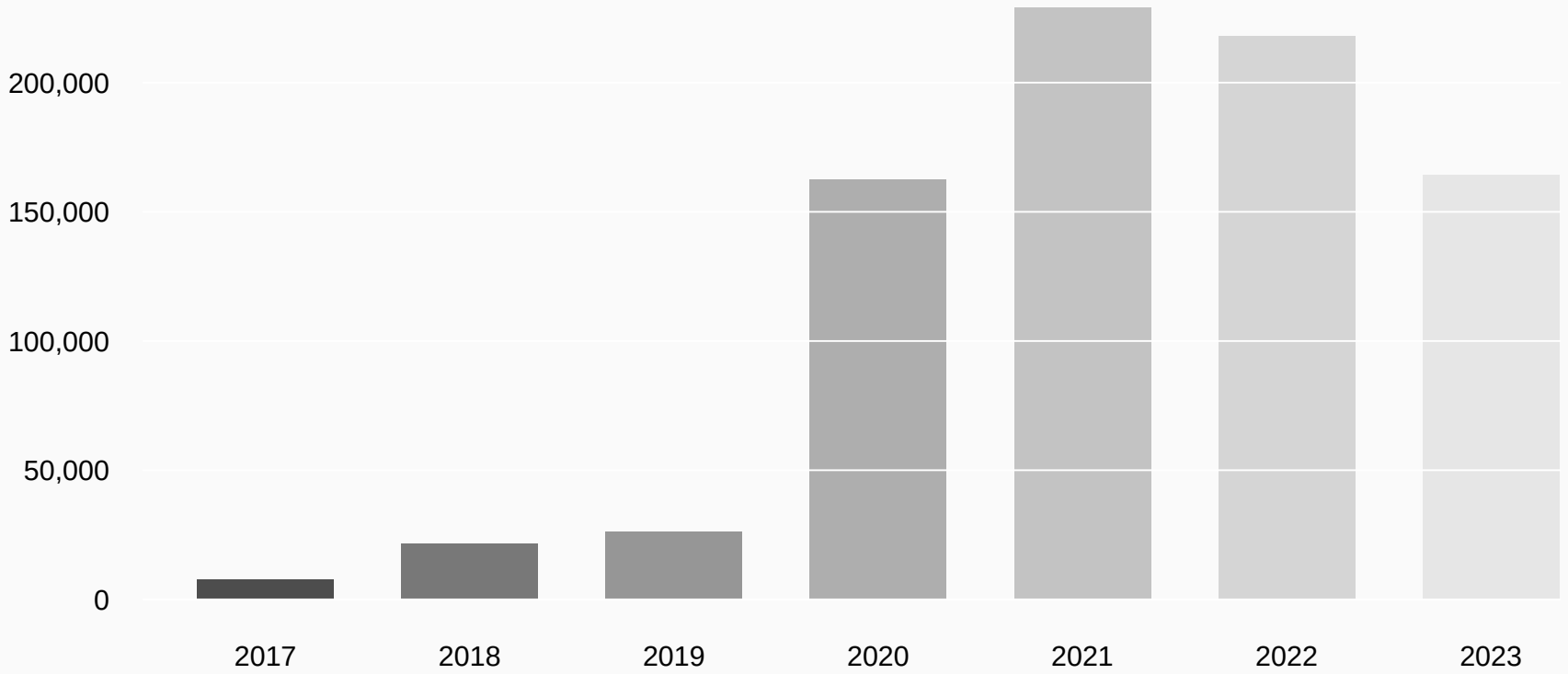
- `learnr` tutorials are built around R Markdown documents;
- `shiny` inputs and outputs are components of HTML-based Rmd documents;
- `shiny` apps are easily embedded in HTML-based Rmd documents;
- `shiny` apps published on the web can also be included with `knitr::include_app()`.

Web interface (`shiny`):

- use `R` functions to create HTML and CSS code;
- publish tutorials on `https://shinyapps.io`, Shiny Server or Posit Connect.

The Use of `learnr` Tutorials

The Growing Use of `learnr` (Downloads per Year)



`learnr` Tutorials Hosted in the Cloud

Posit Cloud Primers

Twenty six `learnr` tutorials divided into 6 topics:

- The Basics;
- Work with Data;
- Visualize Data;
- Tidy Your Data;
- Iterate;
- Write Functions.

`learnr` Tutorials Hosted in the Cloud

R *was written for statisticians, by statisticians.*

Marek Gagolewski

OpenIntro::Introduction to Modern Statistics

Six `learnr` tutorials, each of them corresponding to one part of the book and comprised of multiple lessons for a total of 35 lessons that cover the entire content of the book.

`learnr` Tutorials Distrubuted as R Packages

When assigned 'R for Data Science'tudents should read the book and type in all the associated R commands themselves. Sadly, that never happens. These tutorials allow students to demonstrate (and their instructors to be sure) that all work has been completed.

David Kane

`learnr` Tutorials Distrubuted as R Packages

Kane, D. (2023) r4ds.tutorials: Tutorials for 'R for Data Science'

Kane, D. (2023) tidymodel.tutorials: Tutorials for 'Tidy Modeling with R'

Kane, D. (2023) primer.tutorials: Tutorials for 'Primer for Bayesian Data Science'

Kane D (2023) tidycensus.tutorials: Tutorials for Analyzing US Census Data.

A Hands-on Experience with a Demo Tutorial

Demo Tutorial

You can see a demo tutorial directly by visiting

`https://lyubenivanov.shinyapps.io/VSIM23demo`

or by installing the package `vsim23` from GitHub (`https://github.com/lyuben-ivanov/vsim23`)

and loading the tutorial with:

```
learnr::run_tutorial(
  name = "demo",
  package = "vsim23"
  )
```

Key Takeaways

Advantages of using `learnr` to create learning resources

- easy to create multiple similar questions by programming
- uses R's powerful graphic and computation engines
- facilitates cooperation due to strong GitHub integration
- easy to reuse own code and other people's code

Disadvantages of using `learnr` to create learning resources

- not very mature (current version is 0.11.4)
- much more suitable for formative rather than for summative assessment
- not a learning management system (yet?)