Doing

A (very) short introduction to R

in the interactive swirl environment

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1 Introduction

R is a powerful language and environment for statistical computing and graphics. It is a public domain (a so called "GNU") project which is similar to the commercial S language and environment which was developed at Bell Laboratories (formerly AT&T, now Lucent Technologies) by John Chambers and colleagues. R can be considered as a different implementation of S, and is widely used as an educational language and research tool.

The main advantages of R are the fact that R is freeware and that there is a lot of help available online. It is quite similar to other programming packages such as MatLab (not freeware), but more user-friendly than programming languages such as C++ or Fortran. You can use R as it is, but for educational purposes we prefer to use R in combination with the RStudio interface (also freeware), which has an organized layout and several extra options.

The tutorial "A (very) short introduction to R" (Torfs and Brauer, 2017) contains explanations, examples and exercises, which can also be understood (hopefully) by people without any programming experience. Going through all text and exercises takes about 1 or 2 hours. A list with examples of frequently used commands and error messages on the last two pages of that document can be used as a reference.

Instead of reading the pdf and doing the ToDo exercises, you can also go through the text and exercises in an interactive environment called swirl. Swirl "teaches you R programming and data science interactively, at your own pace, and right in the R console" (Swirlstats, 2017a). Swirl was developed in 2013 by the Biostatistics department of Johns Hopkins School of Public Health. Since then, many others have contributed with new courses.

This document explains how to access the swirl version of "A (very) short introduction to R". The contents are the same (with a few exceptions), so you can open the pdf version alongside to look up how to do something you learned before or browse through the references on the last two pages.

2 Getting started

2.1 Install R

To install R on your computer (legally for free!), go to the home website of R[1]:

`www.r-project.org`

and do the following (assuming you work on a windows computer):

1. click `download CRAN` in the left bar
2. choose a download site
3. choose `Windows` as target operation system
4. click `base`
5. choose `Download R 3.4.1 for Windows`[2] and choose default answers for all questions

It is also possible to run R and RStudio from a USB stick instead of installing them. This is useful when you don't have administrator rights on your computer. See our separate note "How to use portable versions of R and RStudio" for help on this topic.

[1] On the R-website you can also find an older version of "A (very) short introduction to R" : `cran.r-project.org/doc/contrib/Torfs+Brauer-Short-R-Intro.pdf`. The last version of this document is always published on `www.github.com/ClaudiaBrauer/A-very-short-introduction-to-R`.

[2] At the moment of writing 3.4.1 was the latest version. Choose the most recent one.

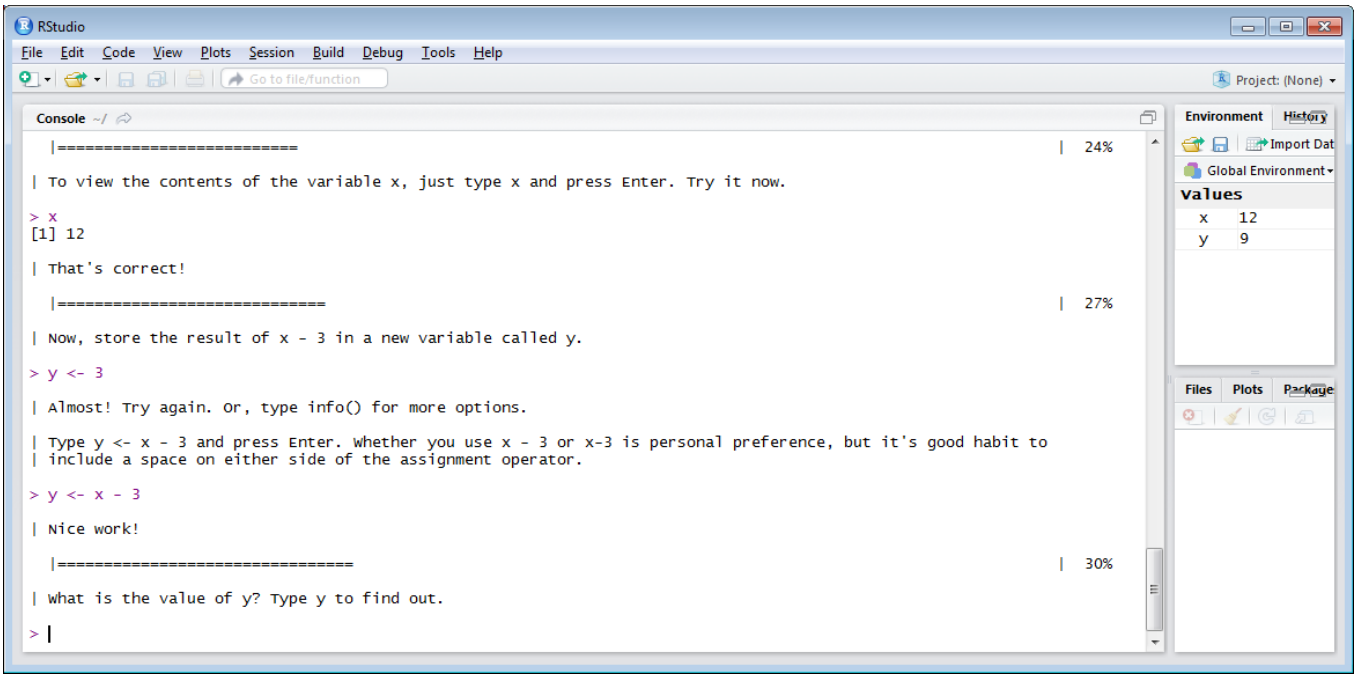

Figure 1: Swirl asks questions and responds to your answer in the command window.

2.2 Install RStudio

After finishing this setup, you should see an "R" icon on you desktop. Clicking on this would start up the standard interface. We recommend, however, to use the RStudio interface.[3] To install RStudio, go to:

`www.rstudio.com`

and do the following:

1. under `Download RStudio`, click `Download`
2. below `RStudio Desktop` (free), click `Download`
3. click the version for your operating system
4. download the `.exe` file and run it (choose default answers for all questions)

2.3 Starting swirl

On the swirl website `www.swirlstats.com`, on the tab "Learn", you'll find the steps you'll have to take to get swirl. You have already installed R and RStudio, so you can skip the first steps and:

1. Open RStudio.
2. Install the `swirl` package by typing `install.packages("swirl")`
3. Load the package by typing `library(swirl)`
4. Start swirl by typing `swirl()`

[3]There are many other (freeware) interfaces, such as Tinn-R.

2.4 Installing the course

After entering `swirl()`, the program will ask you (interactively) which course you want. If you want a new course, you have to install it first.

1. Go to `github.com/ClaudiaBrauer/A-very-short-introduction-to-R`
2. Download the swc file with the `swirl` course (see item 2 on the website) and store it on a logical location on your computer.
3. To install the course, you have to tell R exactly where the file is located. For example, if the swc file is stored in a folder called swirl on your E drive, type `install_course(swc_path="E:/swirl/A_(very)_short_introduction_to_R.swc")`.

internet[4]. "A (very) short introduction" is divided into 3 modules, corresponding to Sections 2–3, 5–7 and 8–11 in the pdf version.

2.5 Using swirl

Swirl will explain things and ask you questions in the command window (bottom left). Using swirl is quite straightforward: just do what it tells you (Fig. 1).

[4]GitHub is a web hosting service, used for publishing and sharing code. You'll find many R packages developed by users (see for example Brauer, 2017) – some very sophisticated, others unfinished or badly documented.

Swirl gives feedback, both after correct and wrong answers. Of course there are many wrong answers possible, so sometimes the feedback is not very specific. Swirl also shows your progress through the module.

3 Follow-up courses

In the (very) short introduction to R, you learn the very basics of programming in R. That document is useful for the very first beginning and as a reference, when you forgot how to install a package or get a column from a matrix. However, to really master the programming language, you'll have to practice more. There are many interactive (using swirl or something else) and non-interactive tutorials to practice (google e.g. "R tutorial").

3.1 Other swirl courses

When swirl asks you which course you want, you can choose either "A (very) short introduction to R" or "Take me to the swirl course repository!". Choosing the second opens the GitHub site with the list of swirl courses in a browser (Swirlstats, 2017b). You can look at the options, for example:

1. R Programming
2. Data Analysis
3. Open Intro (statistics, data visualisation)
4. Getting and Cleaning Data
5. ...

Once you've found a nice course, you can install it by typing `install_from_swirl("R Programming")` in the command window. When you open swirl (by typing `swirl()`), this course is added to the list.

3.2 R Programming

The swirl course "R Programming" is a good start because it is the same level as the (very) short introduction to R. It contains the following modules:

1. Basic Building Blocks
2. Workspace and Files
3. Sequences of Numbers
4. Vectors
5. Missing Values
6. Subsetting Vectors
7. Matrices and Data Frames
8. Logic
9. Functions
10. lapply and sapply
11. vapply and tapply
12. Looking at Data
13. Simulation
14. Dates and Times
15. Base Graphics

These modules are ordered logically, but you can change the order or skip modules if you want to learn something specific.

3.3 Final remarks

Different programmers have different styles. For example, in the (very) short introduction, we use = to assign variables (e.g. `x = 3`), while in "R programming" swirl really wants you to use <-. This may be annoying at first, but it may turn out to be helpful, because it makes it easier for you to read other people's code in the future.

Acknowledgements

We thank the developers of swirl and swirlstats for their time and effort to make this interactive environment which makes learning easier and more fun. Apart from "A (very) short introduction to R", we didn't design and program any swirl courses (such as R Programming) ourselves – we only recommend them. All credit goes to the people who contributed to those swirl projects.

References

Brauer, C. C., 2017. Home page for WALRUS.
URL `github.com/ClaudiaBrauer/WALRUS`

Swirlstats, 2017a. The official swirl website.
URL `swirlstats.com`

Swirlstats, 2017b. Swirl courses on GitHub.
URL `github.com/swirldev/swirl_courses`

Torfs, P. J. J. F., Brauer, C. C., 2017. A (very) short introduction to R.
URL `www.github.com/ClaudiaBrauer/A-very-short-introduction-to-R`