Binder for fully reproducible research in R (data, code, and computational environment).

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www.software.ac.uk

Inspired by The Turing Way
https://github.com/alan-turing-institute/the-turing-way

Open and Reproducible Research

- Shared Data - we already know this is important for reproducibility.

- Shared Code - we already know this is important for reproducibility.

- Shared Computational environment - why is this important and how do we do it?

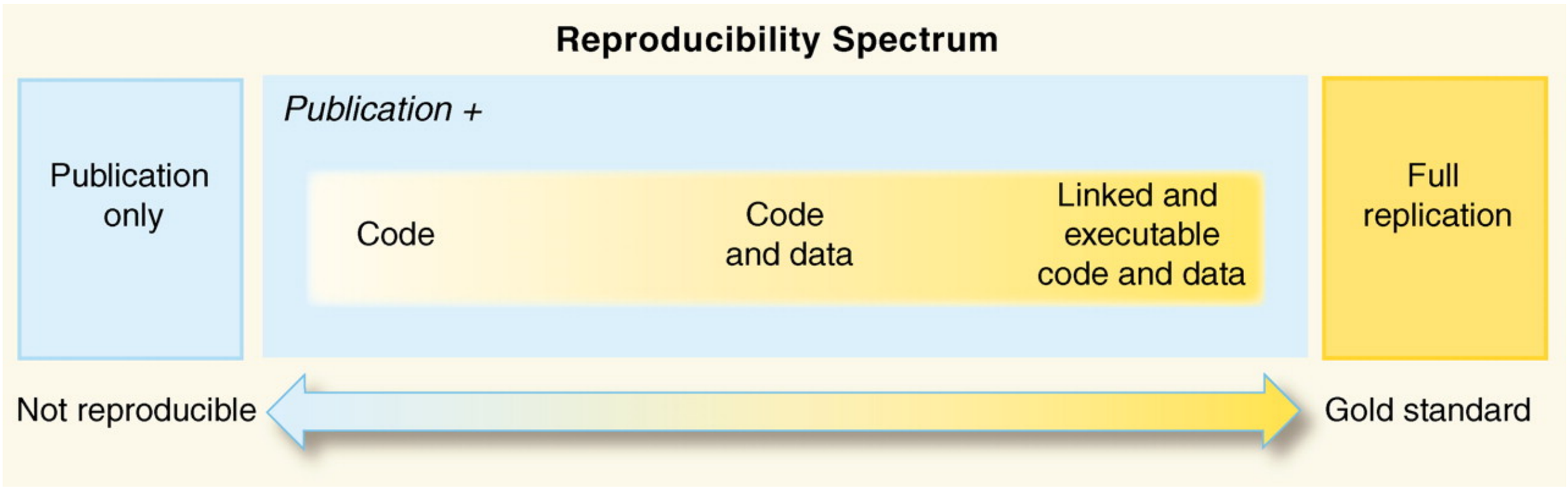
PERSPECTIVE

Reproducible Research in Computational Science

Roger D. Peng

+ See all authors and affiliations

Science 02 Dec 2011:
Vol. 334, Issue 6060, pp. 1226-1227
DOI: 10.1126/science.1213847



Why do we need to reproduce the computational environment?

- Quite often analysis code ‘breaks’ - often in one of two ways:

- Code that worked previously now doesn’t - maybe a function in an R package was updated (e.g., `lsmeans` became `emmeans` so old code using `lsmeans` wouldn’t now run).

- Code that worked previously still works - but produces a slightly different result or now throws a warning where it didn’t previousy (e.g., convergence/singular fit warnings in `lme4` version 1.1-19 vs. version 1.1-20).

Capturing your local computational environment

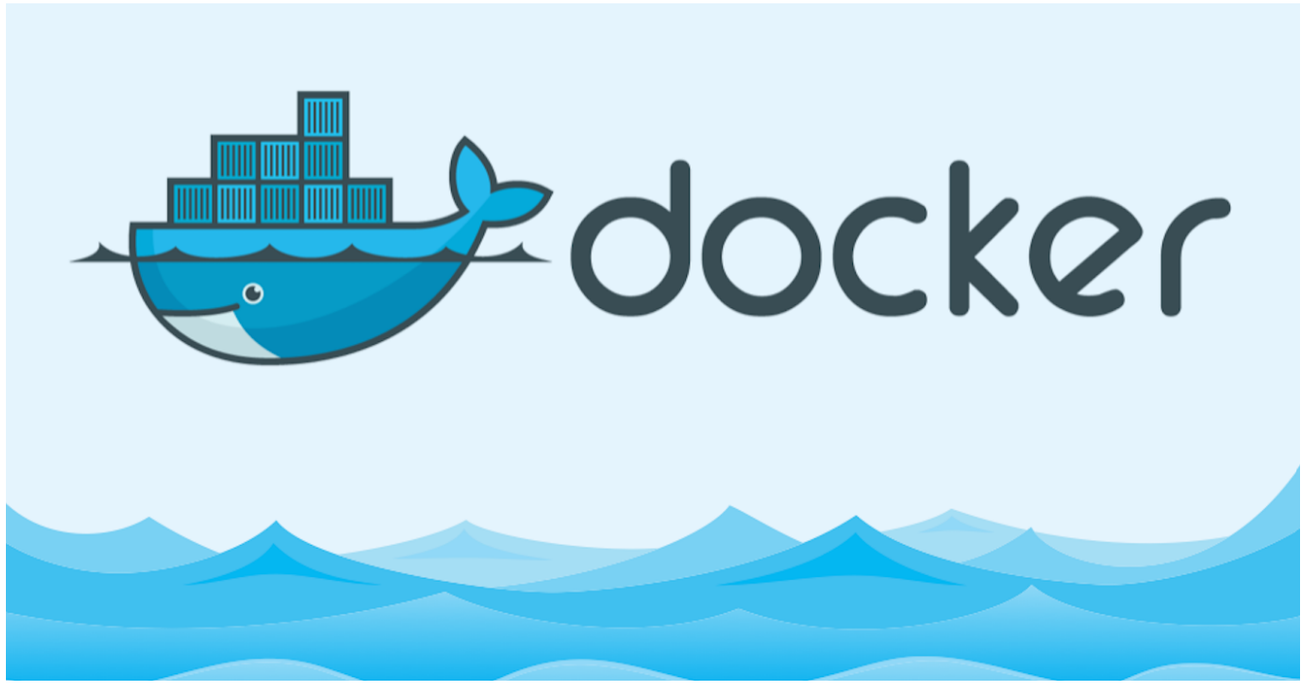
- You need to capture the versions of the different R packages (plus their dependencies).

- May sound trivial but trying running some old R code and be amazed at how many things now don’t work as they once did!

Docker for beginners

Docker packages your data, code and all its dependencies in the form called a docker container to ensure that your application works seamlessly in any environment.

When you run a docker container it's like running your analysis on a virtual computer that has the same configuration as our own one at the point in time when you ran the analysis.



https://medium.com/the-andela-way/docker-for-beginners-61e8e0ce6a19

So what's Binder?

- Binder is powered by BinderHub, which is an open-source tool that deploys the Binder service in the cloud.

- Binder works by pulling information from a repository that you set up on GitHub.

- Think of a repository as a folder containing your R code, your data, and a few other small bits and pieces - but it sits in the cloud rather than on your computer.

github.com/ajstewartlang/Turing_way2

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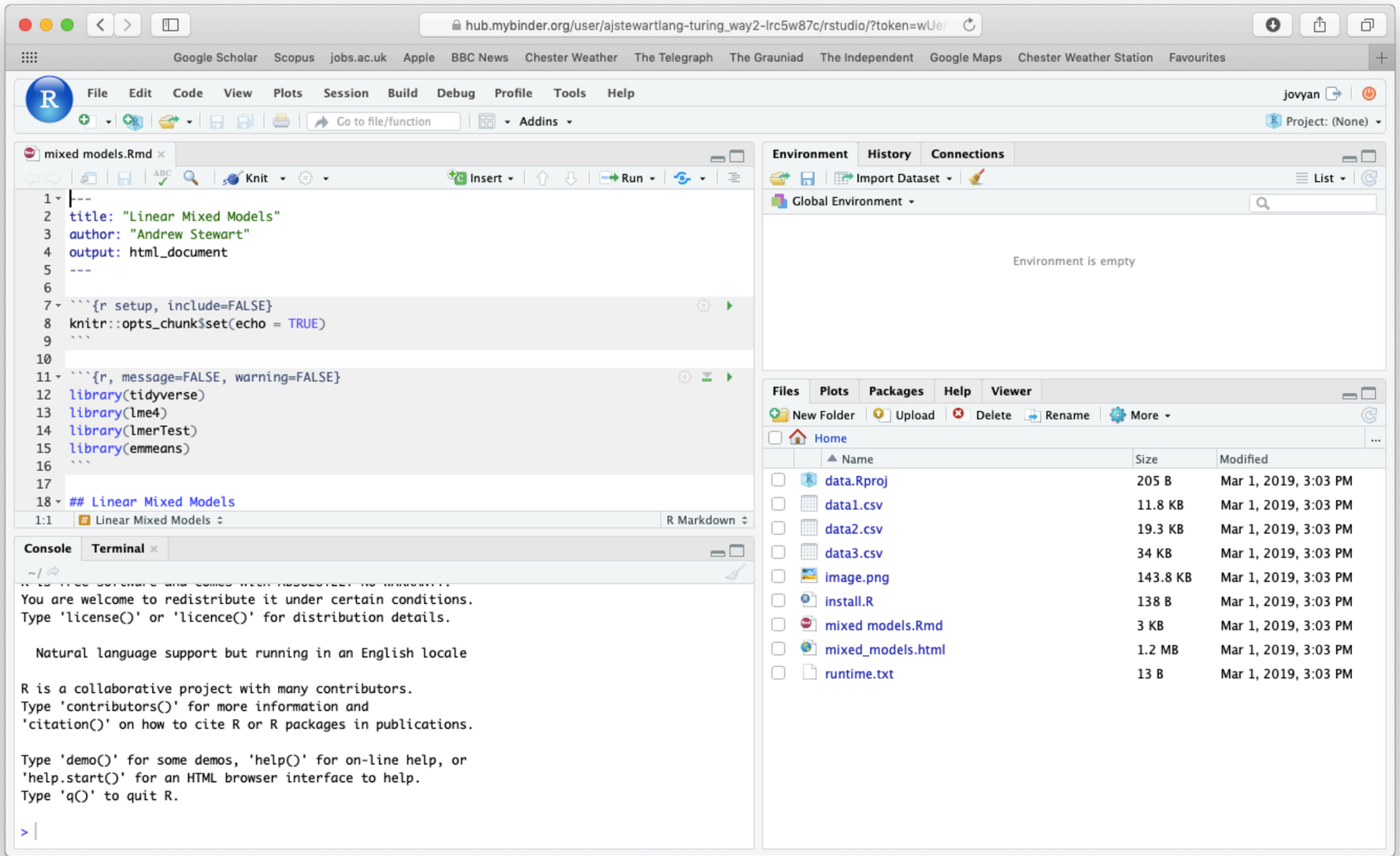
ajstewartlang Create install.R Latest commit 36d3181 2 hours ago

.Rproj.user	commit	2 hours ago
data.Rproj	first commit	3 hours ago
data1.csv	first commit	3 hours ago
data2.csv	first commit	3 hours ago
data3.csv	first commit	3 hours ago
image.png	first commit	3 hours ago
install.R	Create install.R	2 hours ago
mixed models.Rmd	commit	2 hours ago
mixed_models.html	first commit	3 hours ago
runtime.txt	Update runtime.txt	2 hours ago

GitHub Desktop

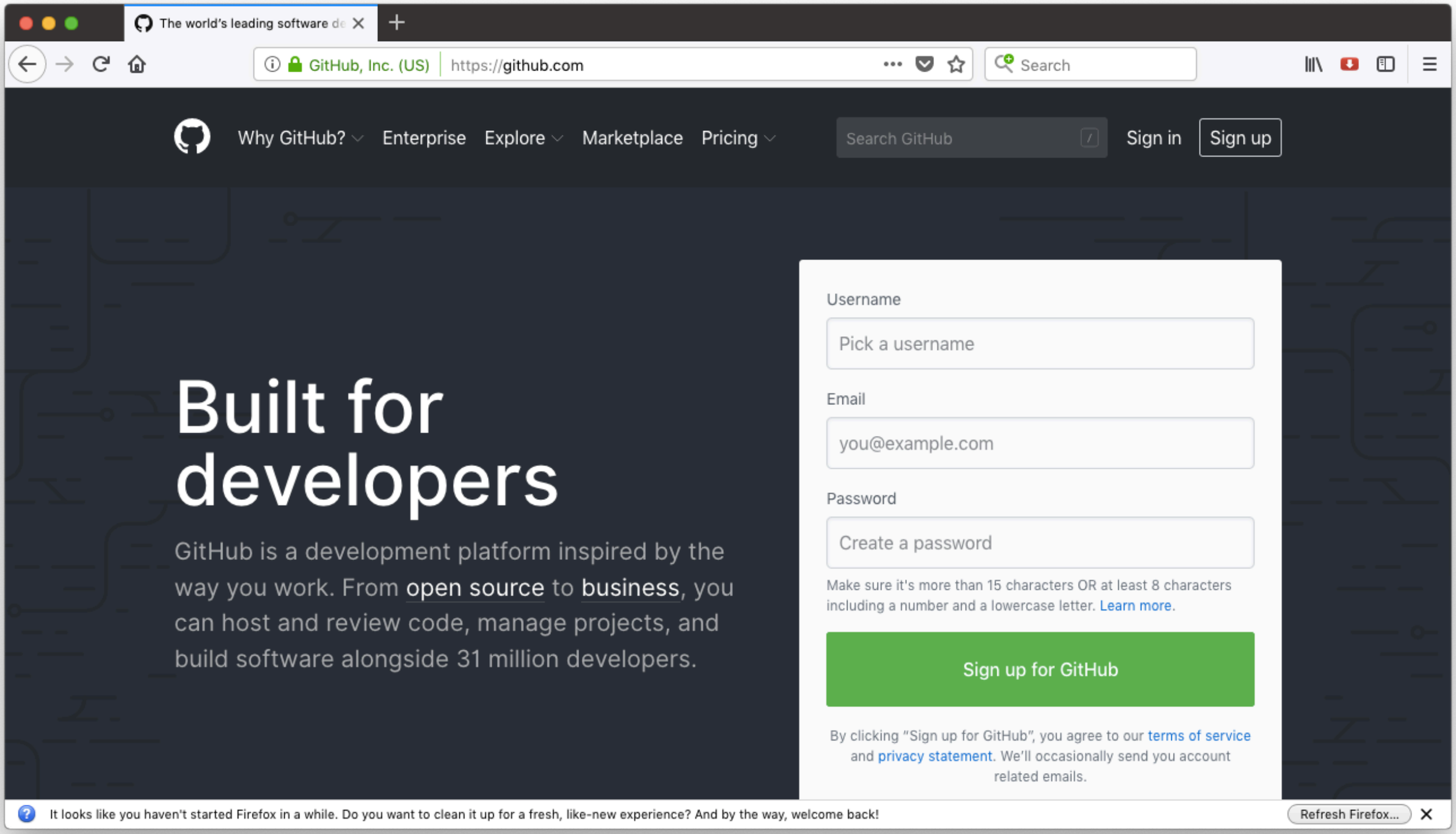
My R code and data files.

- When I link my GitHub repository to Binder and launch it I then get the following in my web browser.
- This is RStudio running the cloud using my code, my data and the appropriate versions of the packages that I was using when I did the analysis originally!

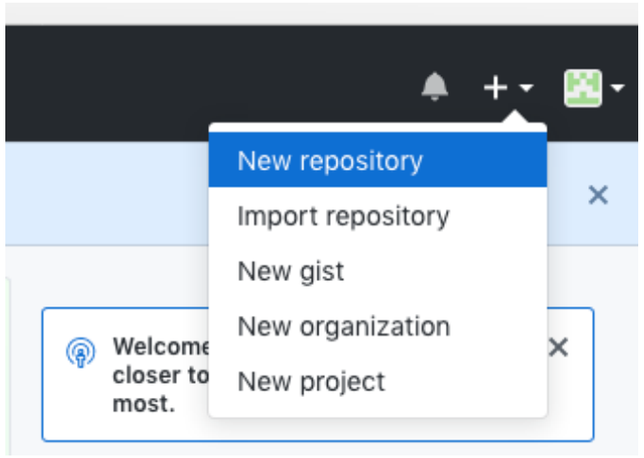


https://mybinder.org/v2/gh/ajstewartlang/Turing_way2/master?urlpath=rstudio

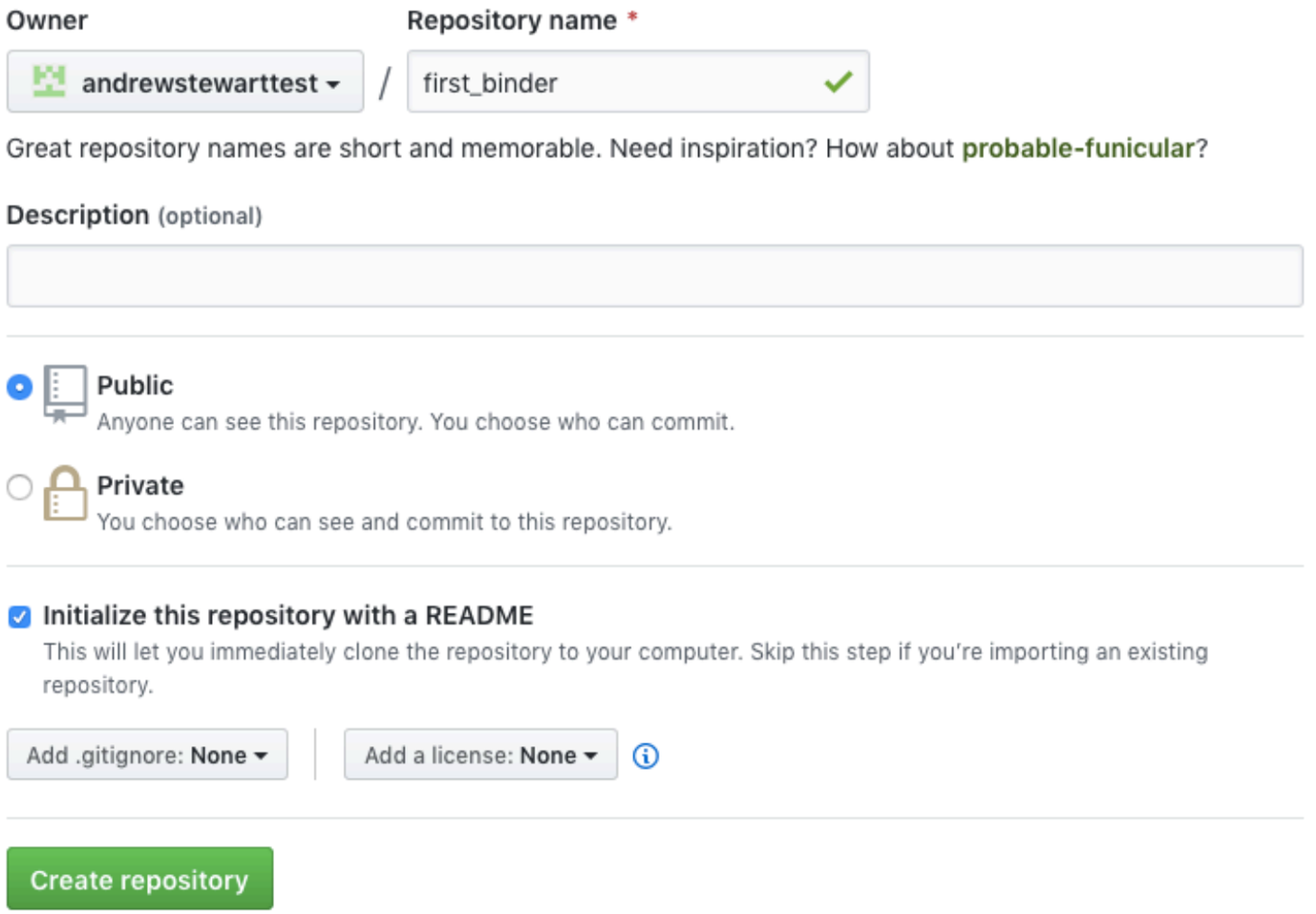
Step 1 - Set up a GitHub account



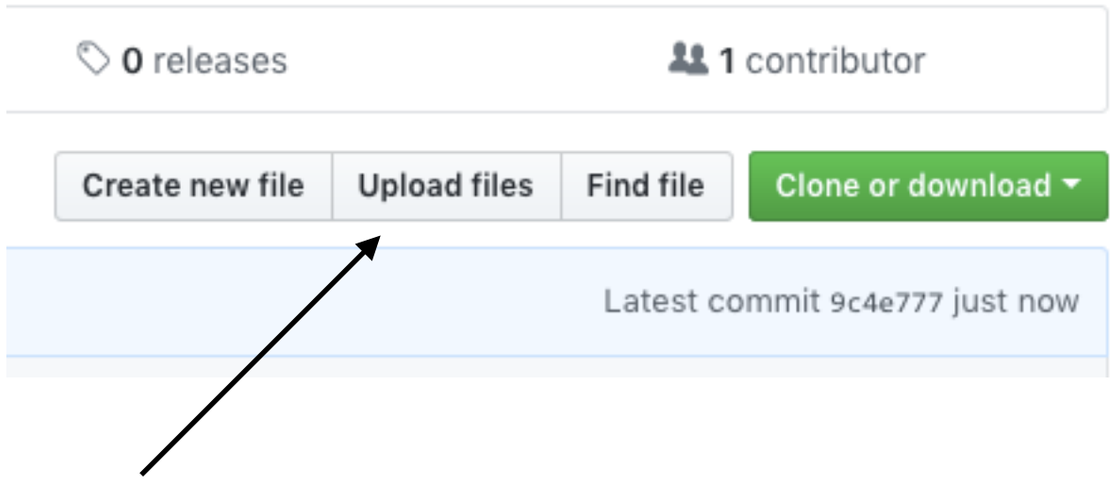
Step 2 - Create a new repository



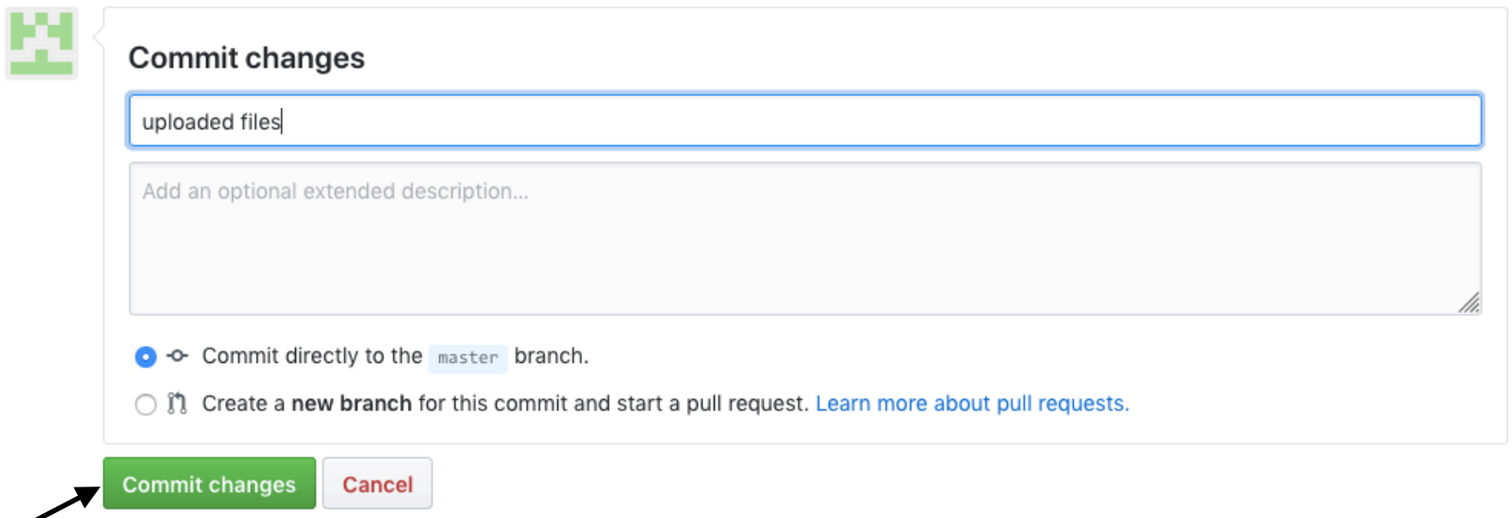
Give it a name, set it to public and tick “Initialise this repository with a README”.



Step 3 - Upload your R script and data and make your first “Commit”



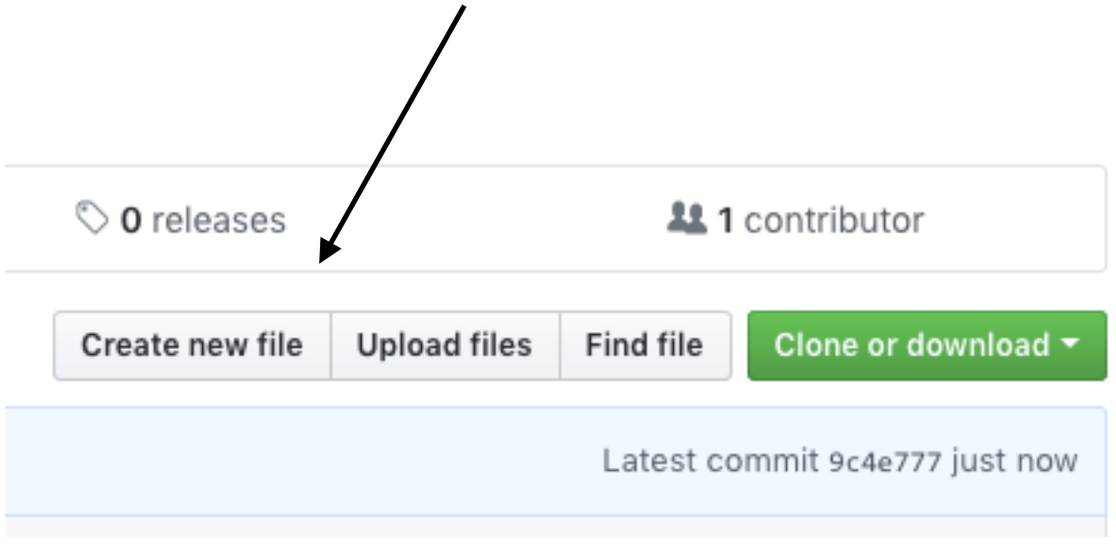
Click here to upload



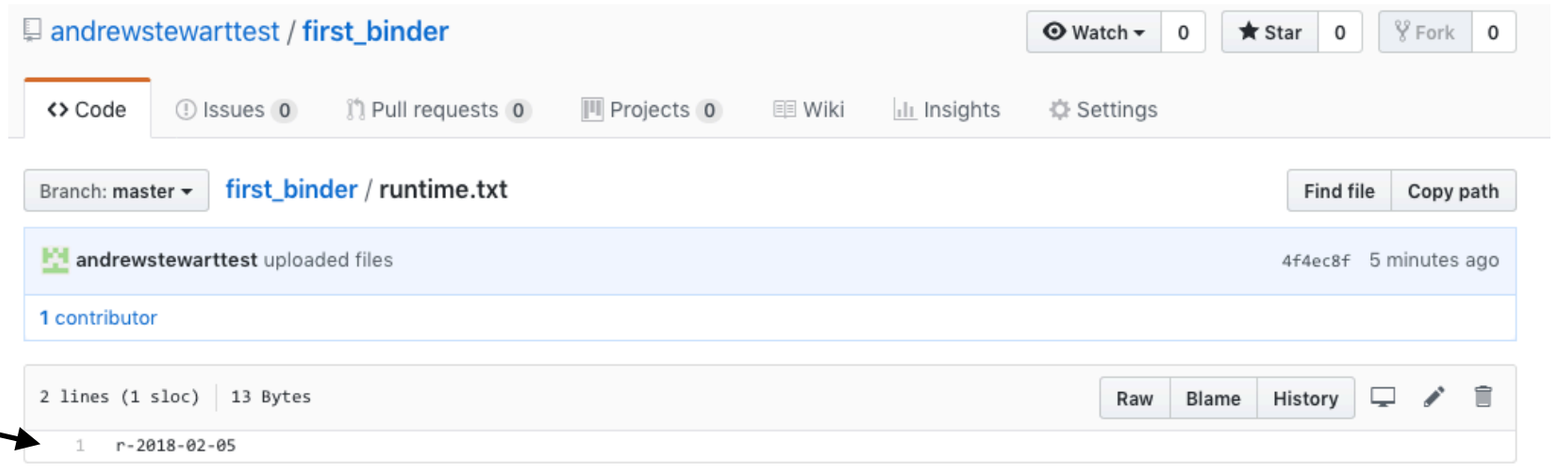
Click here to Commit

Step 3 - Upload your R script and data and make your first “Commit”

- We need two other files at this point - one is called “runtime.txt” and contains the date of R and its associated packages that you want to simulate.
- The other is called “install.R” and contains the list of R packages that need to be installed in order for your script to run.
- To create a new file select “Create new file”

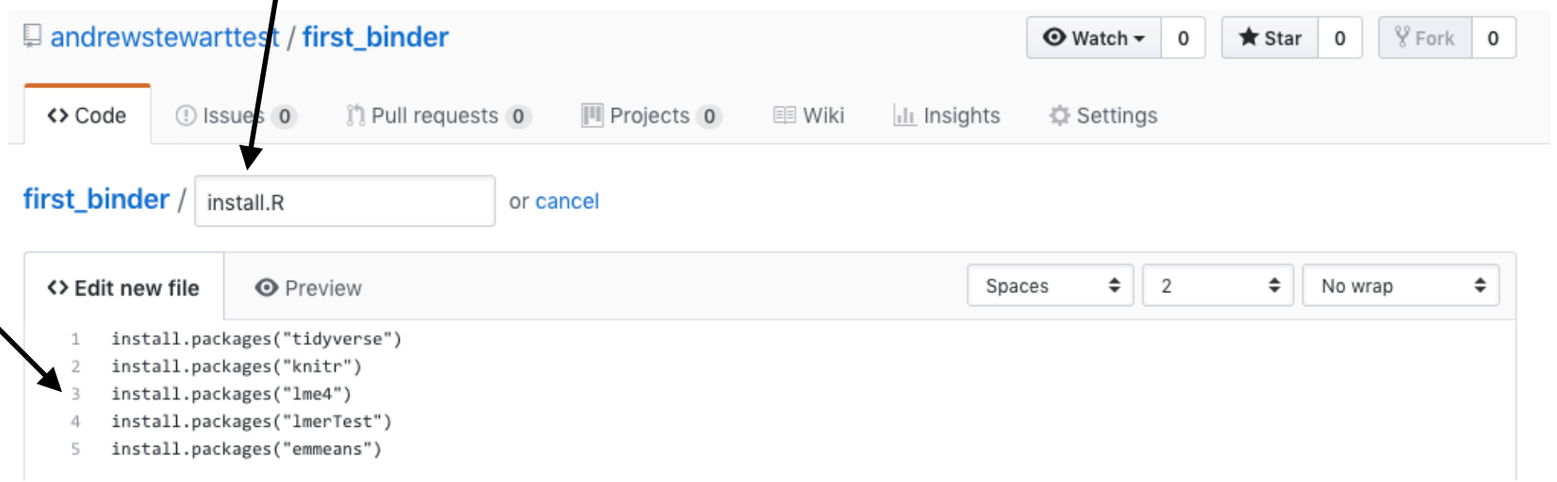


In the runtime.txt file type the date you want in the format r-YYYY-MM-DD



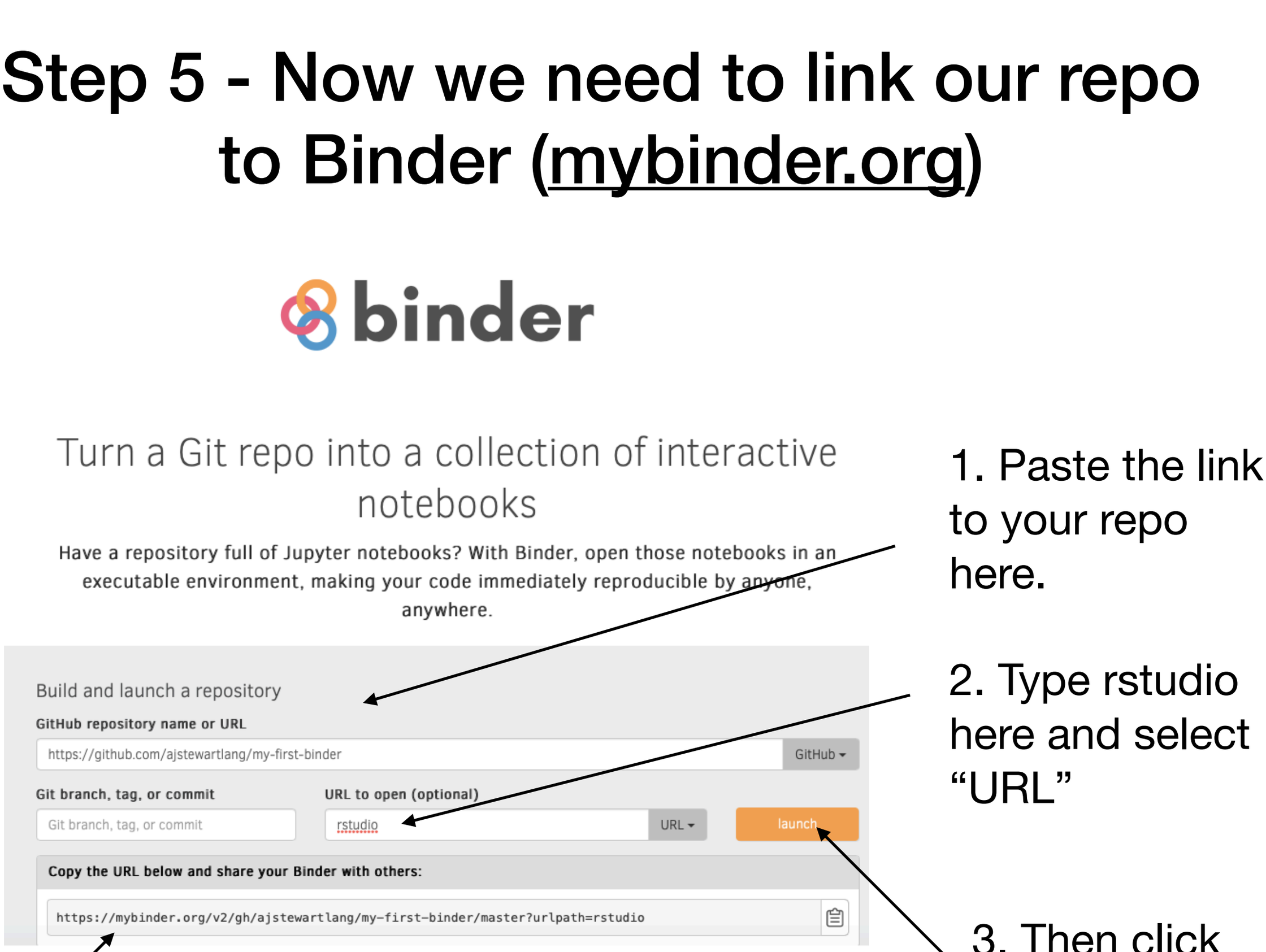
Name your file

List your packages like this in the install.R file



Don’t forget to click “Commit” after you’ve created each file!

Step 5 - Now we need to link our repo to Binder (mybinder.org)



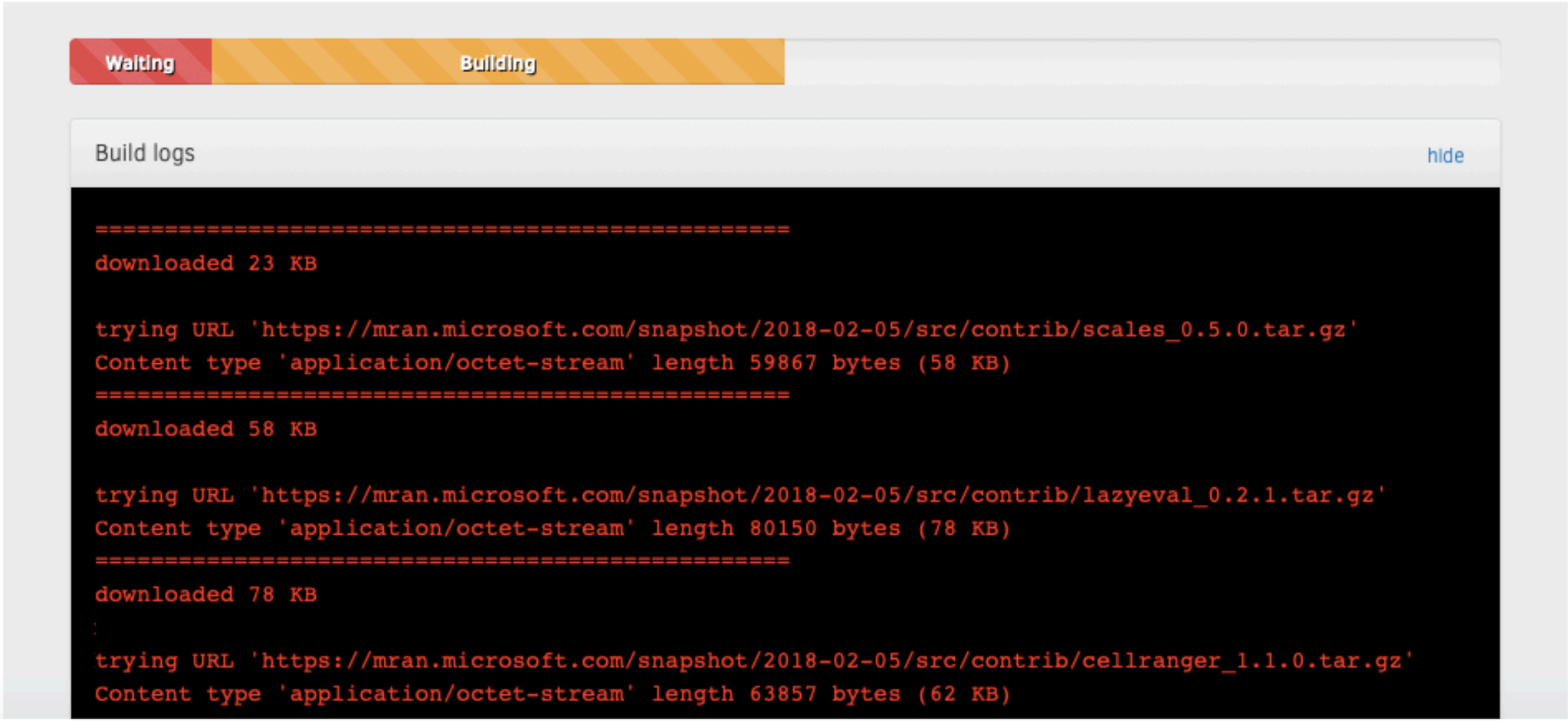
1. Paste the link to your repo here.

2. Type rstudio here and select "URL"

3. Then click on "launch"

4. This is the URL to share with others.

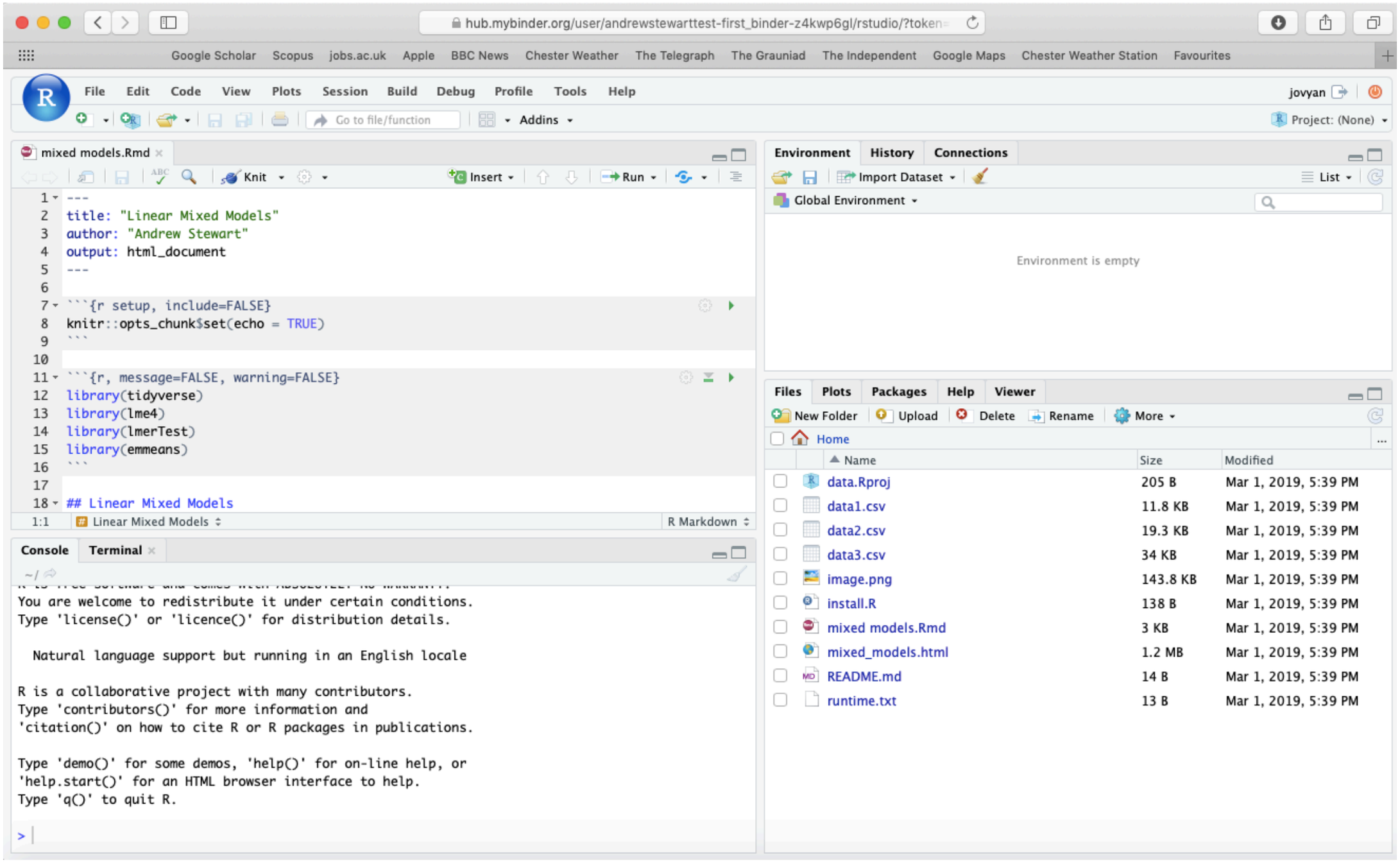
And wait…



You can check the progress of the build by clicking on the “Build logs” bar.

And wait…

And then...


hub.mybinder.org/user/andrewstewarttest-first_binder-z4kwp6gl/rstudio/?token=
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File Edit Code View Plots Session Build Debug Profile Tools Help
jovyan
Go to file/function
Addins
Project: (None)
mixed models.Rmd
Knit
Insert
Run
1 ---
2 title: "Linear Mixed Models"
3 author: "Andrew Stewart"
4 output: html_document
5 ---
6
7 ```{r setup, include=FALSE}
8 knitr::opts_chunk$set(echo = TRUE)
9 ```
10
11 ```{r, message=FALSE, warning=FALSE}
12 library(tidyverse)
13 library(lme4)
14 library(lmerTest)
15 library(emmeans)
16 ```
17
18 ## Linear Mixed Models
1:1
Linear Mixed Models
R Markdown
Console
Terminal
~/
You are welcome to redistribute it under certain conditions.
Type 'license()' or 'licence()' for distribution details.
Natural language support but running in an English locale
R is a collaborative project with many contributors.
Type 'contributors()' for more information and
'citation()' on how to cite R or R packages in publications.
Type 'demo()' for some demos, 'help()' for on-line help, or
'help.start()' for an HTML browser interface to help.
Type 'q()' to quit R.
>
Environment
History
Connections
Import Dataset
List
Global Environment
Environment is empty
Files
Plots
Packages
Help
Viewer
New Folder
Upload
Delete
Rename
More
Home
Name
Size
Modified
data.Rproj 205 B Mar 1, 2019, 5:39 PM
data1.csv 11.8 KB Mar 1, 2019, 5:39 PM
data2.csv 19.3 KB Mar 1, 2019, 5:39 PM
data3.csv 34 KB Mar 1, 2019, 5:39 PM
image.png 143.8 KB Mar 1, 2019, 5:39 PM
install.R 138 B Mar 1, 2019, 5:39 PM
mixed models.Rmd 3 KB Mar 1, 2019, 5:39 PM
mixed_models.html 1.2 MB Mar 1, 2019, 5:39 PM
README.md 14 B Mar 1, 2019, 5:39 PM
runtime.txt 13 B Mar 1, 2019, 5:39 PM