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

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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?

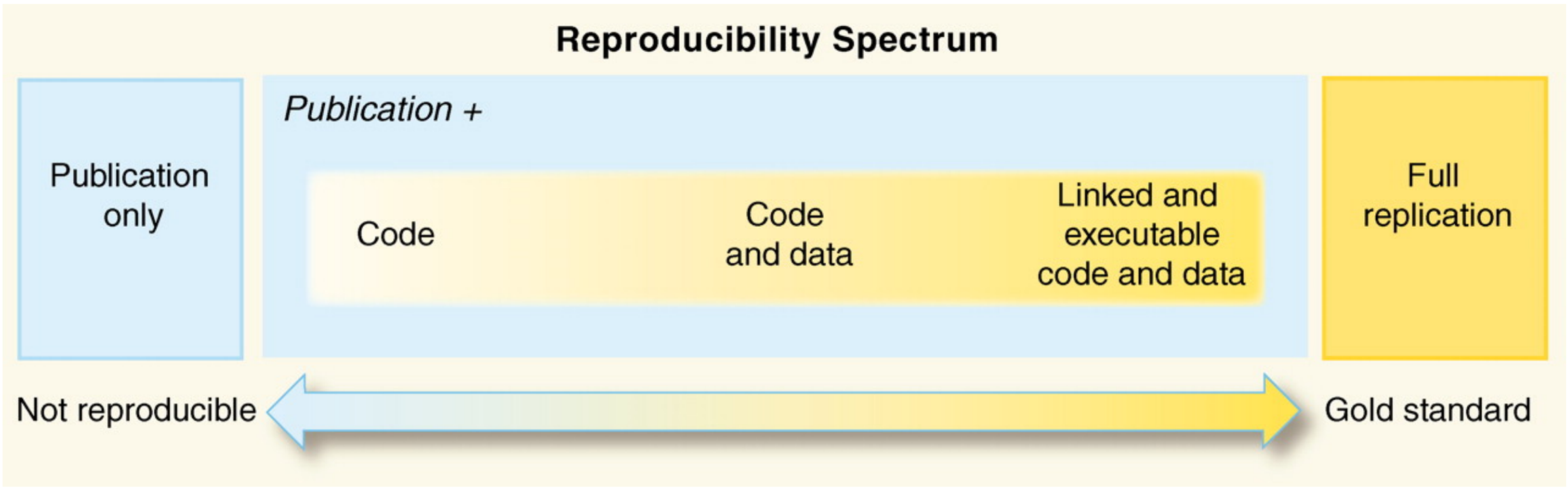
PERSPECTIVE

# 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

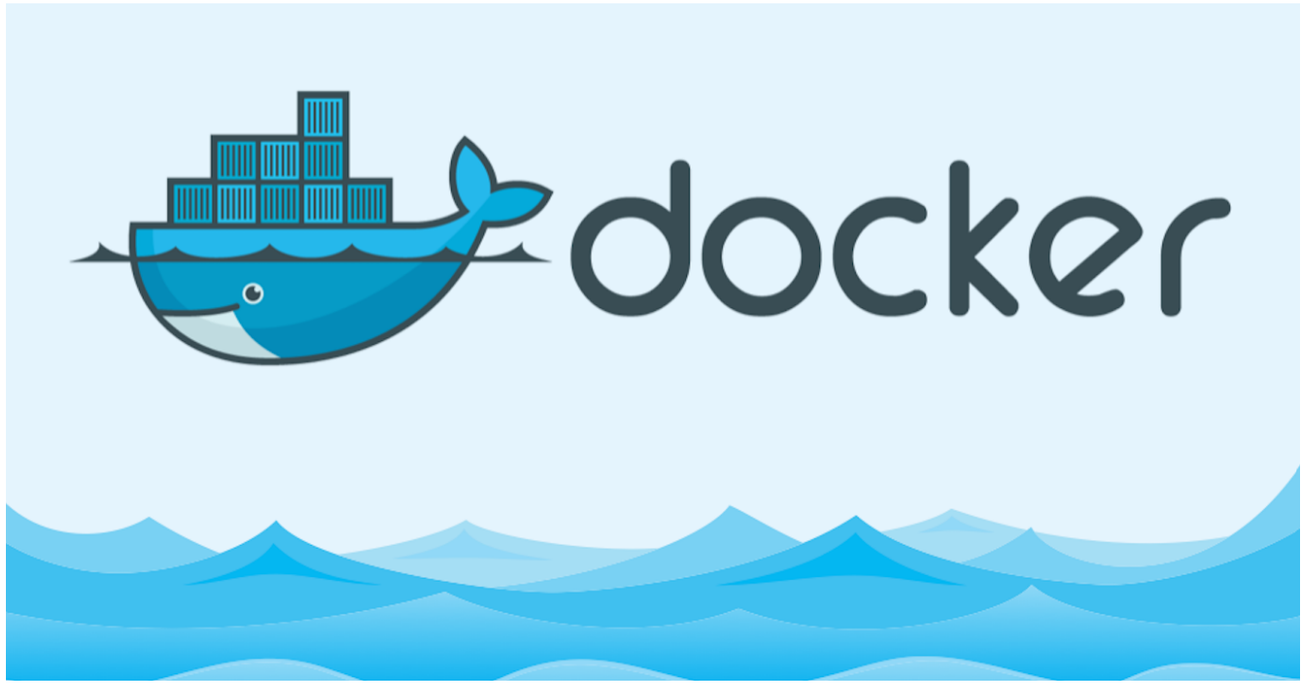
- You need to capture the versions of the different R packages (plus their dependencies).

- 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 allows you to create custom computing environments (a Docker image) and share them to be used by others anywhere in the world.

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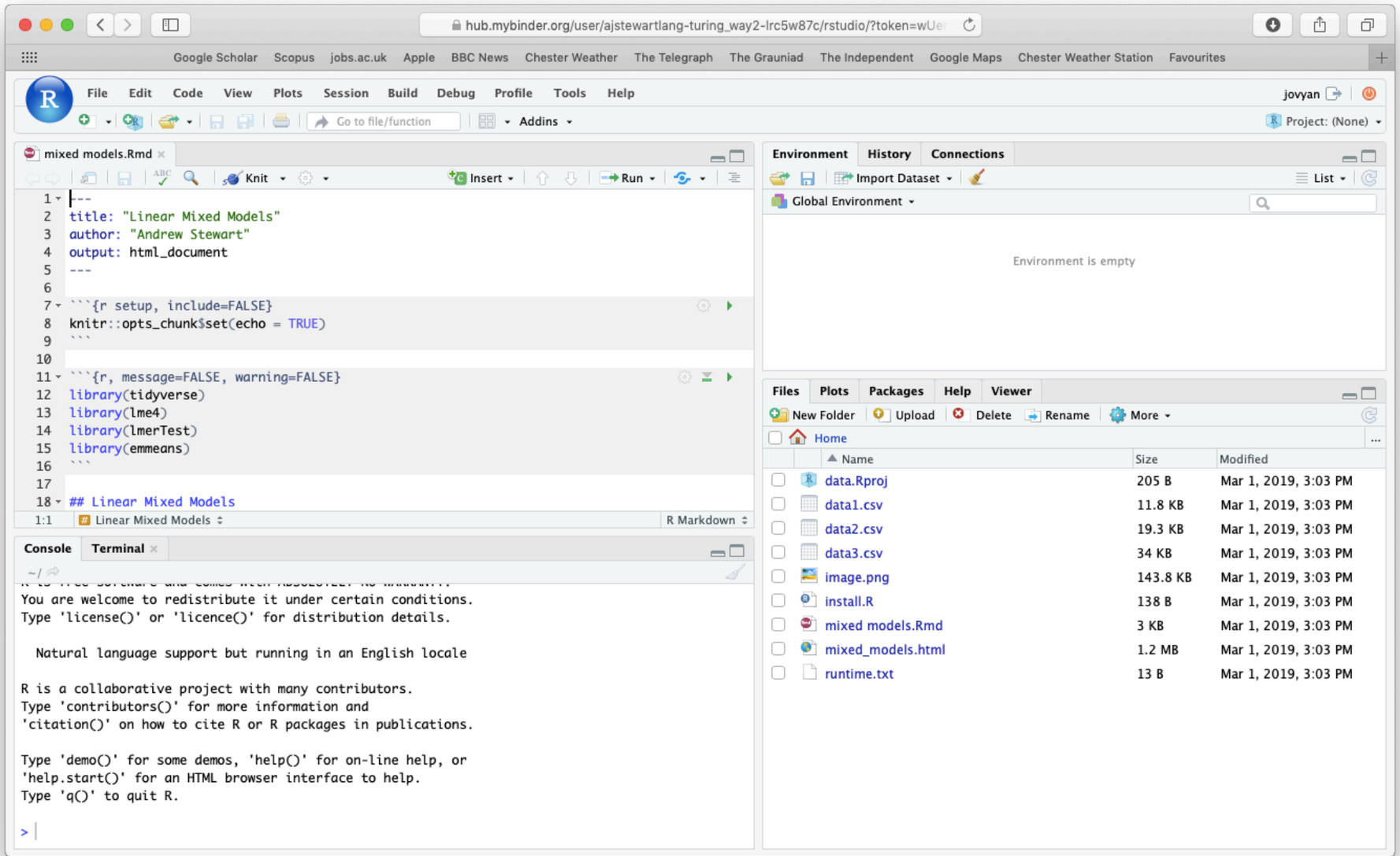
ajstewartlang Create install.R Latest commit 36d3181 2 hours ago

| | | |
|---|---|---|
| .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

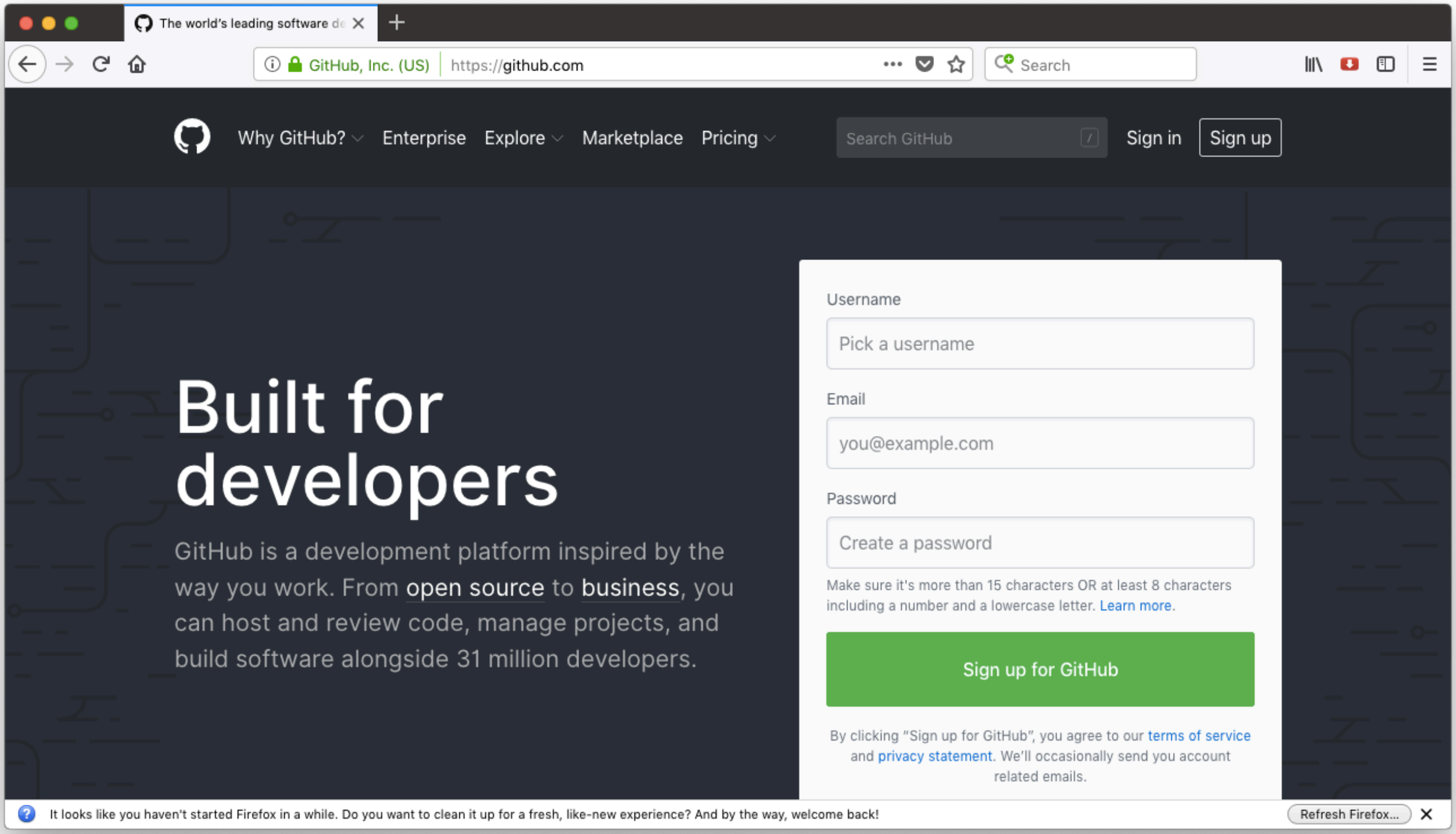
My R code and data files.

- 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!

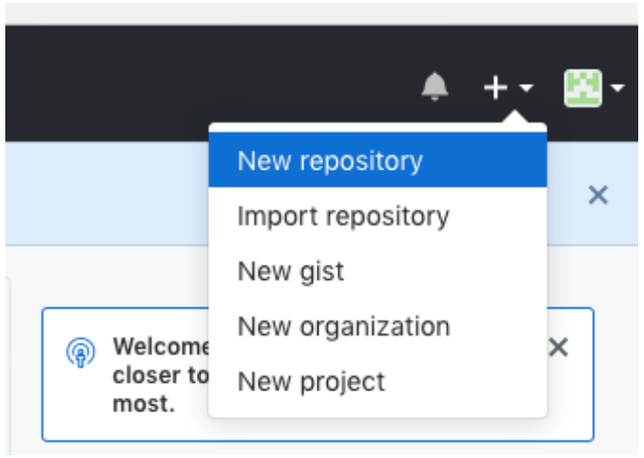



https://mybinder.org/v2/gh/ajstewartlang/Turing_way2/master?urlpath=rstudio

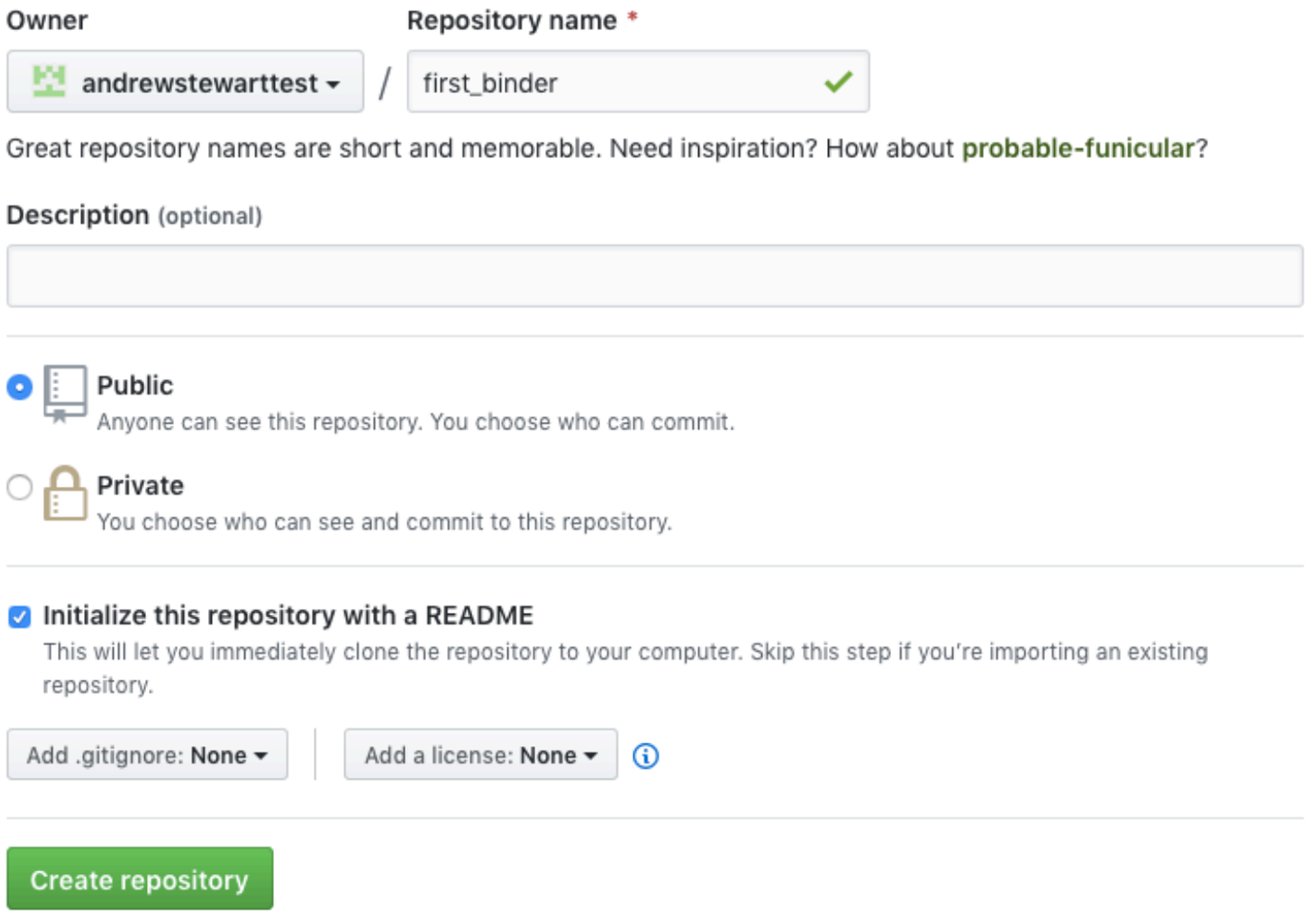
# Step 1 - Set up a GitHub account



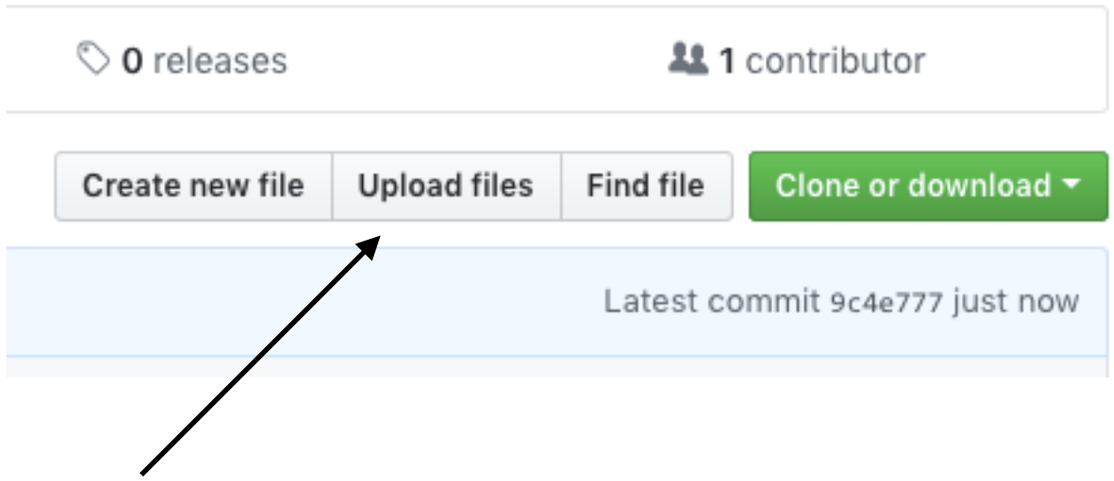
# Step 2 - Create a new repository



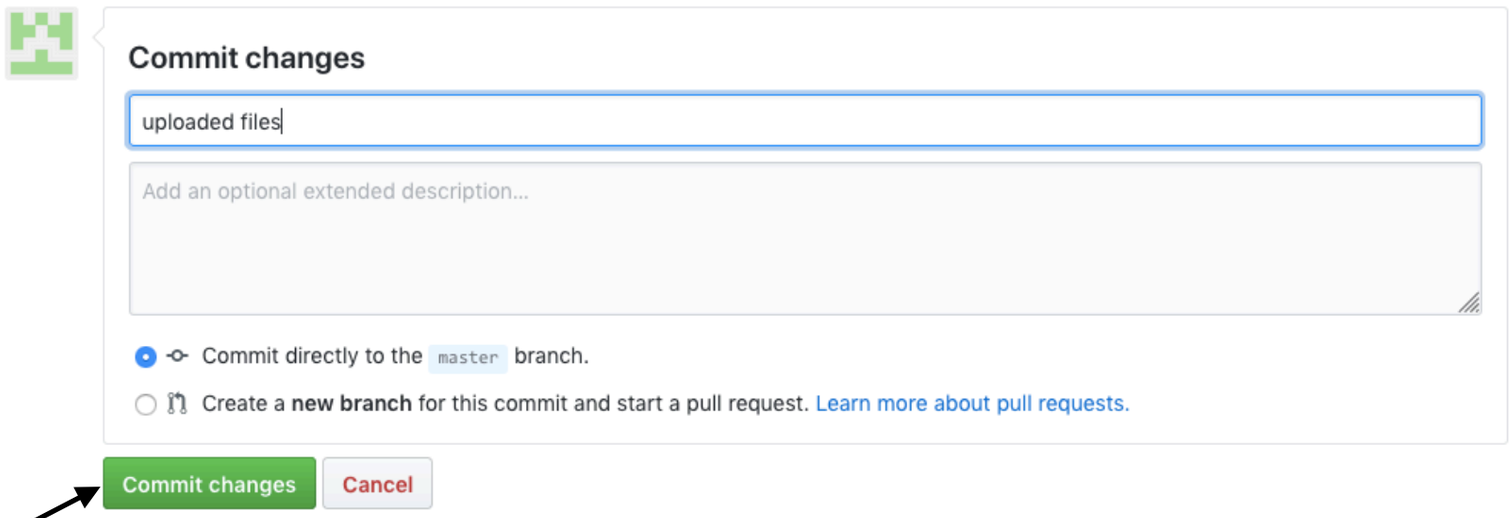

Give it a name, set it to public and tick “Initialise this repository with a README”.



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



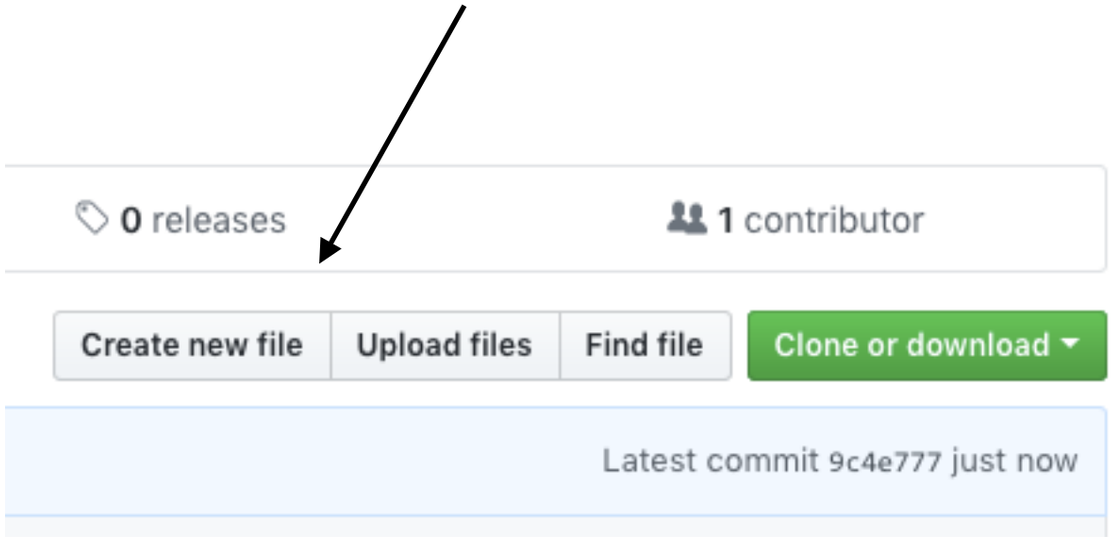

Click here to upload



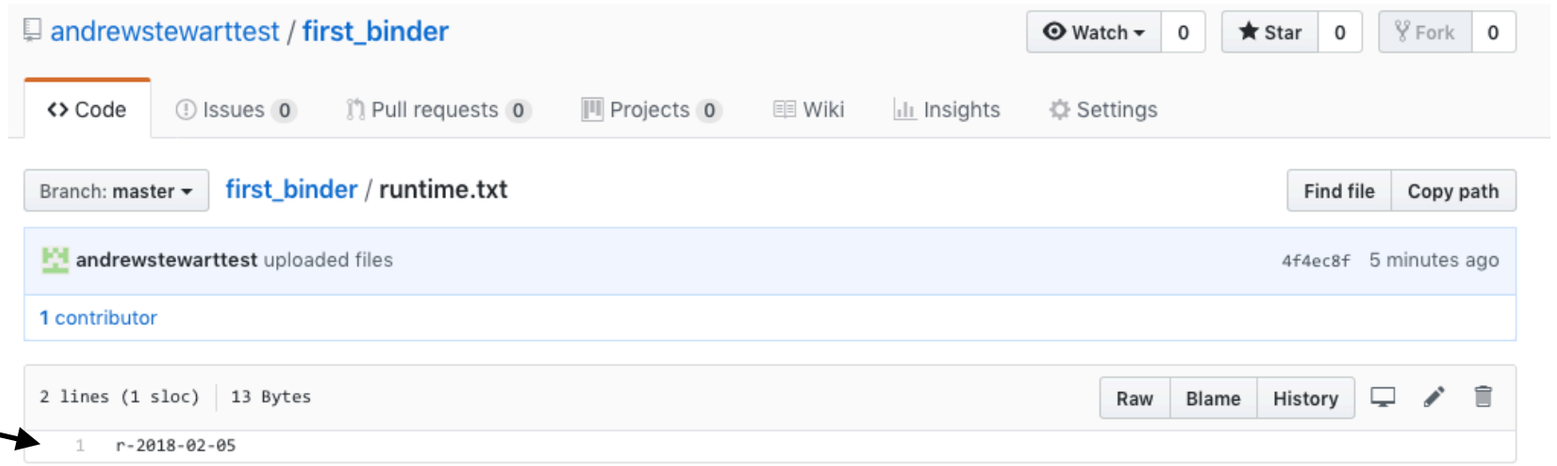

Click here to Commit

# 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”

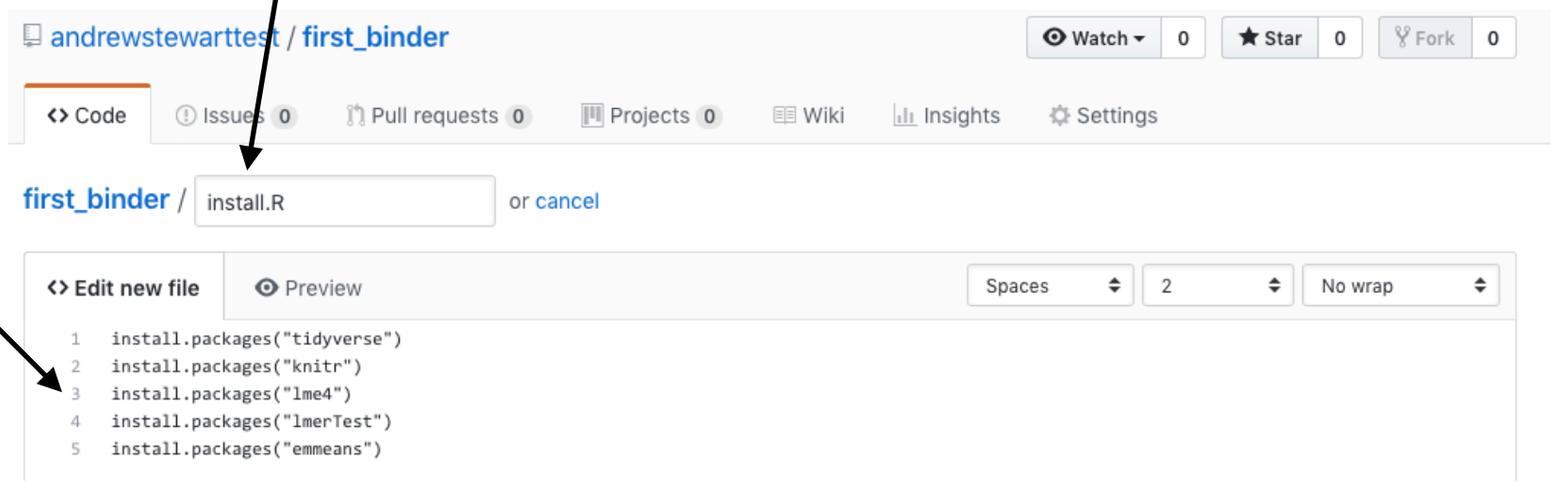


In the runtime.txt file type the date you want in the format r-YYYY-MM-DD




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)

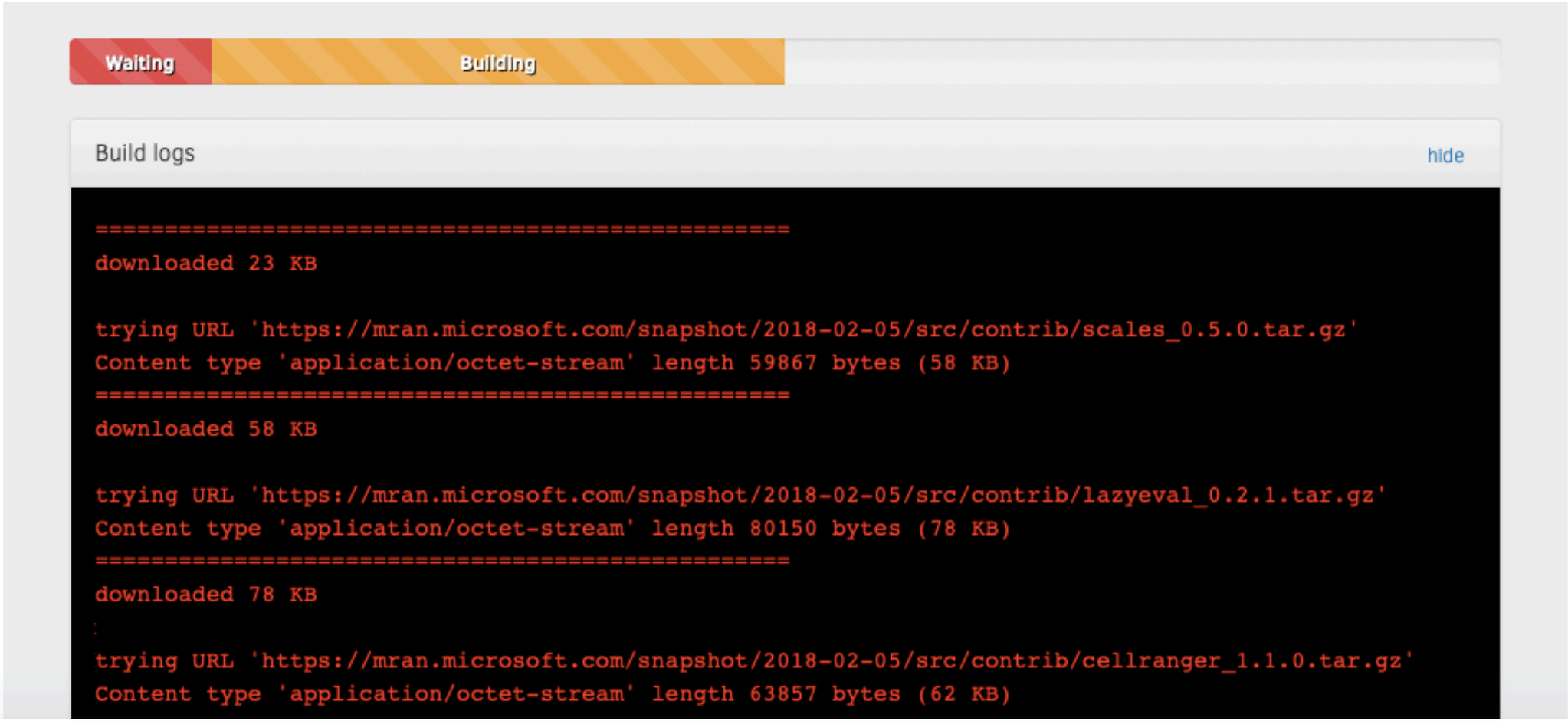

1. Paste the link to your repo here.

2. Add “rstudio” here with the URL option selected.

3. Then click on “launch”

4. This is the URL to share with others.

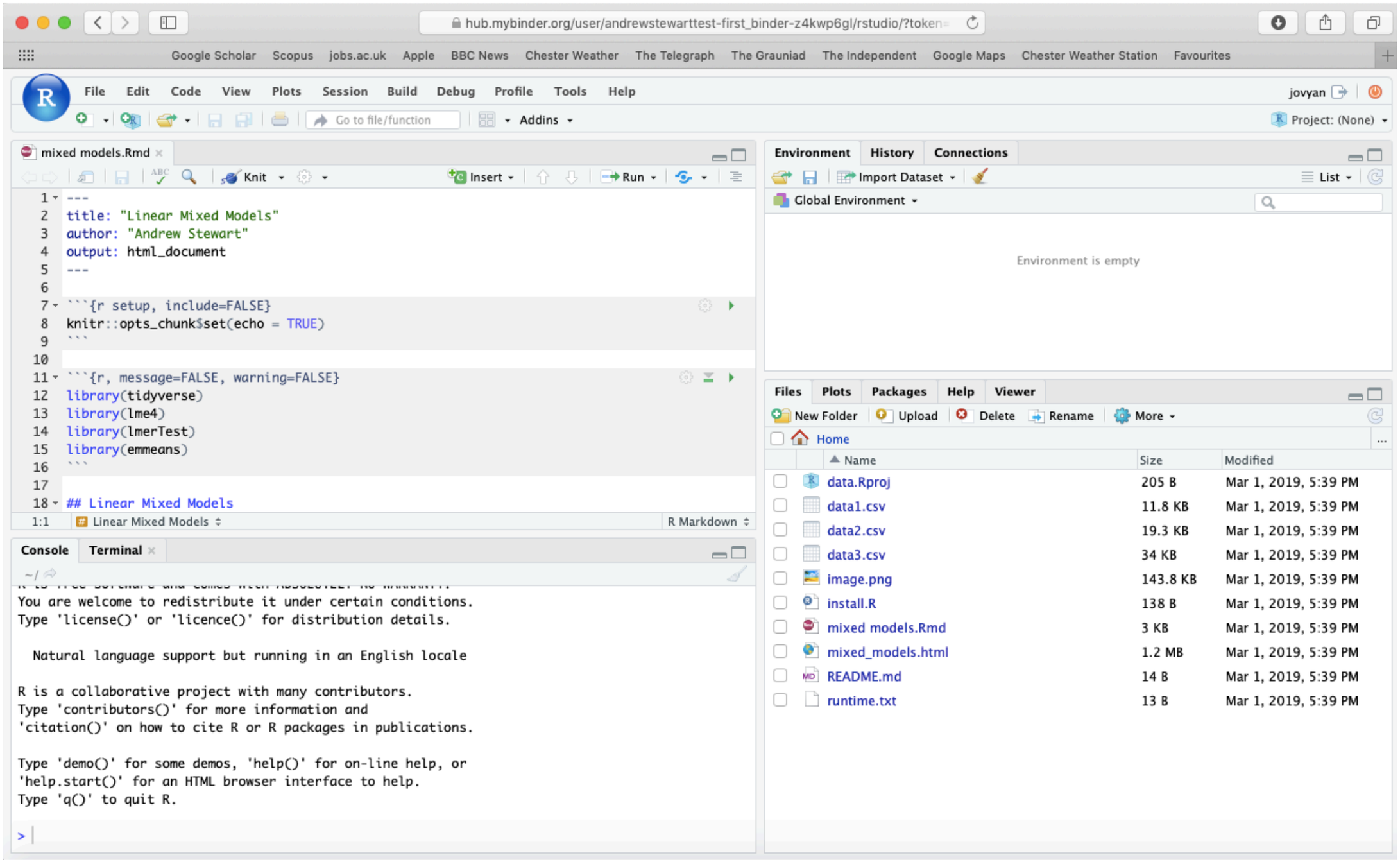
# And wait…




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=
Google Scholar Scopus jobs.ac.uk Apple BBC News Chester Weather The Telegraph The Grauniad The Independent Google Maps Chester Weather Station Favourites
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.
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'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
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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