

# Introduction to the `{targets}` package

## Reproducible Scientific Workflows in R

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Masons, when they start upon a building,  
Are careful to test out the scaffolding;

Make sure that planks won't slip at busy points,  
Secure all ladders, tighten bolted joints.

And yet all this comes down when the job's done  
Showing off walls of sure and solid stone.

So if, my dear, there sometimes seem to be  
Old bridges breaking between you and me

Never fear. We may let the scaffolds fall  
Confident that we have built our wall.

- "Scaffolding" by Seamus Heaney, 1939-2013

# Outline

- Concepts on scientific workflows
- The `{targets}` package
- Practical session

# Concepts on scientific workflows

**Concept #1: Reproducibility, reproducibility,  
reproducibility!**



**Karl Broman**

@kwbroman · [Follow](#)



Keith Baggerly: Most important tool for [#ReproducibleResearch](#) is the *\*mindset\**, when starting, that the end product will be reproducible.

4:07 PM · Nov 20, 2015



Keith Baggerly, via @kwbroman tweet

# Concept #2: Organisation

**File organization and naming are powerful weapons against chaos.**

@JennyBryan



Analysis

Back/Forward View Group Action Share Edit Tags Dropbox Search

Name	Date Modified	Size	Kind
▶ Africa_SHP	28 Oct 2021 at 21:19	--	Folder
↳ bfscore.r	24 Mar 2012 at 15:43	Zero bytes	Rez so..
↳ boot.r	3 Feb 2013 at 22:21	Zero bytes	Rez so..
↳ bootBW.r	20 Nov 2012 at 09:16	Zero bytes	Rez so..
▶ BUF_outline_SHP	28 Oct 2021 at 21:44	--	Folder
↳ coverageData.txt	4 May 2012 at 00:01	Zero bytes	text
↳ coverageDataDosso.csv	1 May 2012 at 10:58	Zero bytes	comma.
↳ coverageDataOld.txt	24 Feb 2012 at 05:17	Zero bytes	text
↳ coverageDataTillaberi.csv	2 May 2012 at 09:00	Zero bytes	comma.
▶ data	28 Oct 2021 at 21:46	--	Folder
↳ dietaryDiversityClasses.r	18 Feb 2012 at 14:36	Zero bytes	Rez so..
↳ dietaryDiversityEstimates.r	24 Mar 2012 at 19:24	Zero bytes	Rez so..
↳ districtData.csv	18 Feb 2012 at 02:05	Zero bytes	comma.
↳ districts.csv	26 Nov 2012 at 11:38	Zero bytes	comma.
↳ dossoGPS.csv	18 Jan 2013 at 21:37	Zero bytes	comma.
↳ ebfNiger.pdf	28 Oct 2013 at 02:53	Zero bytes	PDF Doc
↳ ebfNiger.png	3 Sep 2014 at 13:35	Zero bytes	PNG ima
↳ estimates.r	5 Feb 2013 at 07:17	Zero bytes	Rez so..

Favourites: Dropbox, Downloads, Pictures, Music, ernest, Applications, AirDrop, Movies

iCloud: Desktop, Documents, iCloud Drive

Locations

**Concept #3: DRY - Don't repeat yourself**

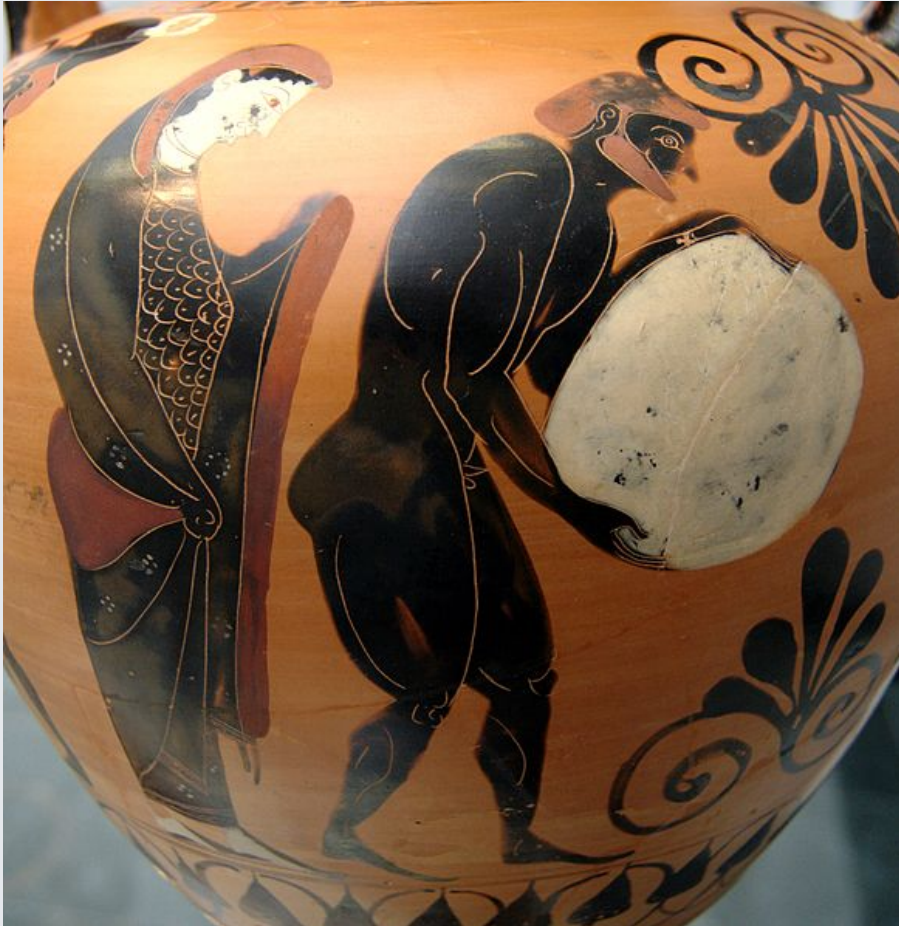
**Don't repeat yourself. It's not only repetitive,  
it's redundant, and people have heard it before.**

Lemony Snicket

**"You should consider writing a function whenever you've copied and pasted a block of code more than twice (i.e. you now have three copies of the same code)"**

# Challenges with scientific workflows

# Sisyphean loop



1. Launch the code.
2. Wait while it runs.
3. Discover an issue.
4. Restart from scratch.

# The {targets} package



- a pipeline toolkit for Statistics and data science in R
- maintain a reproducible workflow without repeating yourself
- learns how your workflow fits together
- skips costly runtime for tasks that are already up-to-date
- runs only the necessary computation
- supports implicit parallel computing
- abstracts files as R objects
- shows tangible evidence that the results match the underlying code and data

# {targets} file organisation

ernestguevarra update README

File/Folder	Description	Commit Time
.git-crypt	Add 1 git-crypt collaborator	5 days ago
.github/workflows	rename workflows	2 days ago
R	complete data review and anthro review	8 hours ago
auth	encrypt and authenticate with drive	3 days ago
data	add .gitkeep	3 days ago
images	update README	12 minutes ago
outputs	Create .gitkeep	2 days ago
renv	Initial commit	5 days ago
reports	add notes to data review	7 hours ago
.Rprofile	encrypt and authenticate with drive	3 days ago
.env	encrypt and authenticate with drive	3 days ago
.gitattributes	encrypt and authenticate with drive	3 days ago
.gitignore	encrypt and authenticate with drive	3 days ago
README.Rmd	update README	12 minutes ago
README.md	update README	12 minutes ago
<b>_targets.R</b>	complete data review and anthro review	8 hours ago
mozambique-baseline-review.Rproj	encrypt and authenticate with drive	3 days ago
packages.R	complete data review and anthro review	8 hours ago
renv.lock	complete data review and anthro review	8 hours ago

**Improving nutrition status for under 5 children in Zambezia and Nampula baseline survey data review workflow**

repo status Active test review workflow passing run review workflow passing

This repository is a template for a `docker`-containerised, `{targets}`-based, `{renv}`-enabled R workflow for the baseline survey data review of the improving nutrition status for under 5 children in Zambezia and Nampula

- this is a typical file structure with user-defined components of any project-oriented workflow
- the `_targets.R` file, however, is special and specific to a `{targets}` workflow - it is the target script file
- the target script file should be in the project's root directory

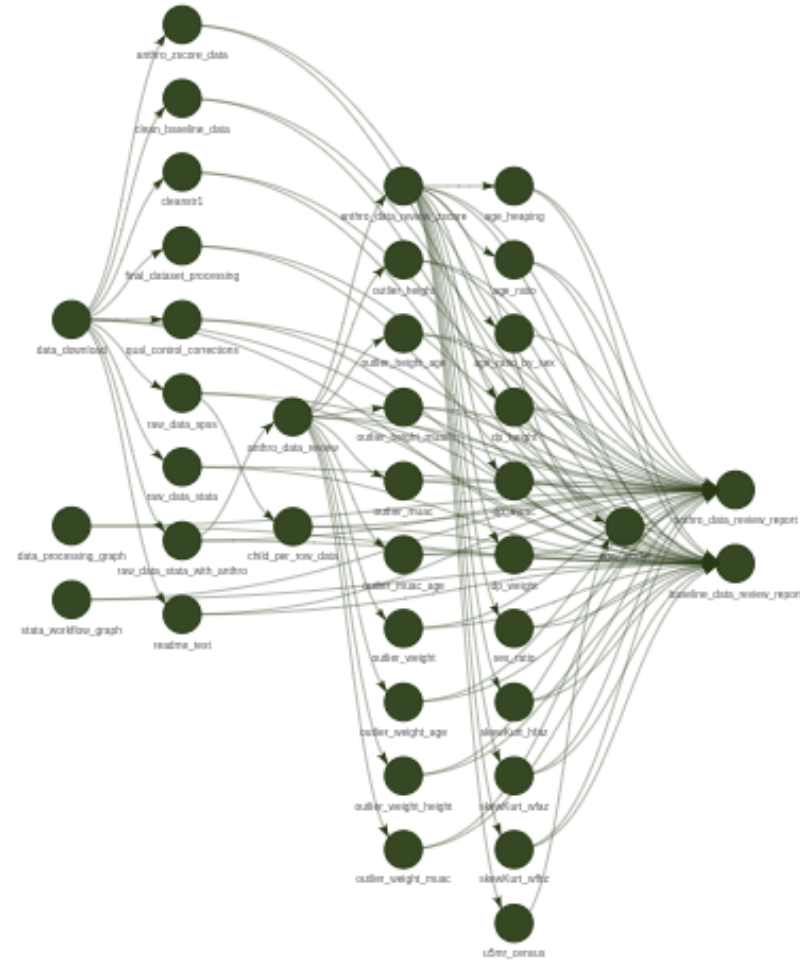


# {targets} script file

```
1 #####
2 #
3 # Project build script
4 #
5 #####
6
7 # Load packages (in packages.R) and load project-specific functions in R folder
8 suppressPackageStartupMessages(source("packages.R"))
9 for (f in list.files(here::here("R"), full.names = TRUE)) source (f)
10
11
12 # Set build options -----
13
14
15
16 # Groups of targets -----
17
18 ## Read raw data
19 raw_data <- tar_plan(
20   data_download = download_all_baseline_data(overwrite = TRUE),
21   raw_data_spss = read_spss_data(file_list = data_download),
22   raw_data_stata = read_stata_data(
23     file_list = data_download,
24     filename = "survey_fin.dta"
25   ),
26   anthro_zscore_data = read_csv_data(
27     file_list = data_download, filename = "who_anthrofin_zscore.csv"
28   ),
29   raw_data_stata_with_anthro = read_stata_data(
30     file_list = data_download,
31     filename = "survey_plus_who_fin.dta"
32   ),
33   clean_baseline_data = read_csv_data(
34     file_list = data_download,
35     filename = "Zambia and Namputa baseline survey dataset.csv",
36     fileEncoding = "latin1"
37   )
38 )
39
40 ## Read associated text and code information
41 text_data <- tar_plan(
42   readme_text = read_text_data(file_list = data_download, filename = ".txt"),
43   cleanstr1 = read_text_data(
44     file_list = data_download, filename = "cleanstr1", widths = 150),
45   qual_control_corrections = read_text_data(
```

- Load the packages required (1)
- Load custom functions (1)
- Define individual targets - intermediate step of the workflow (2)
- End with a list of targets objects

# {targets} workflow



Up to date

Stem

**Questions?**

# Practical session

We will all continue to go through Exercise #1 in the **Practical R for Epidemiologists** book

**Questions?**

# Thank you!

Slides can be viewed at <https://oxford-ihtm.io/open-reproducible-science/session8.html>

PDF version of slides can be downloaded at <https://oxford-ihtm.io/open-reproducible-science/pdf/session8-reproducible-scientific-workflows.pdf>

R scripts for slides available [here](#)