

Open Science, Reproducible Research, and R

An Overview

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Tell me, and I will forget

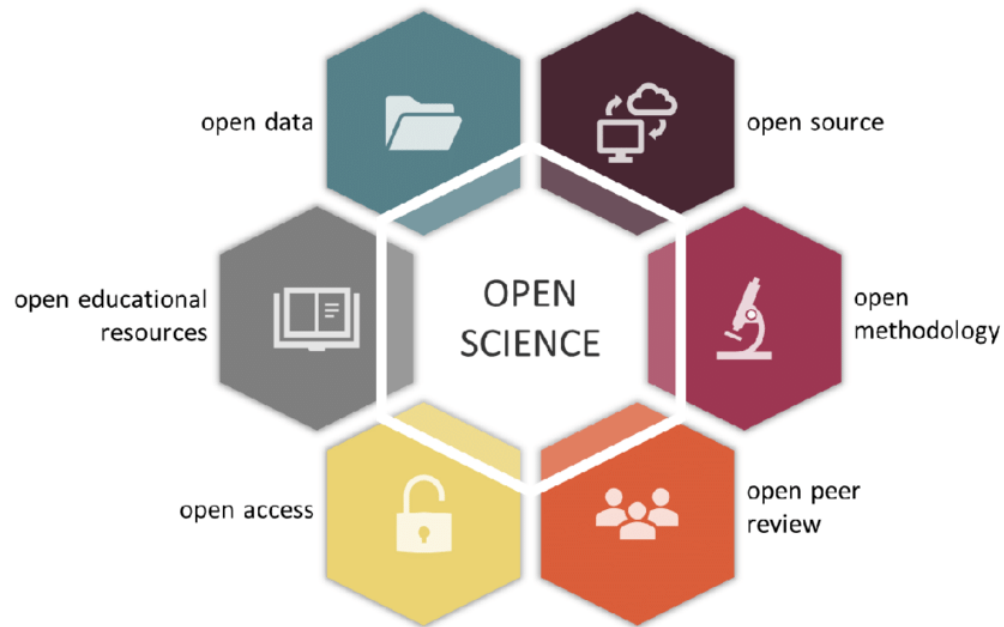
Show me, and I will remember

Involve me, and I will understand

Outline

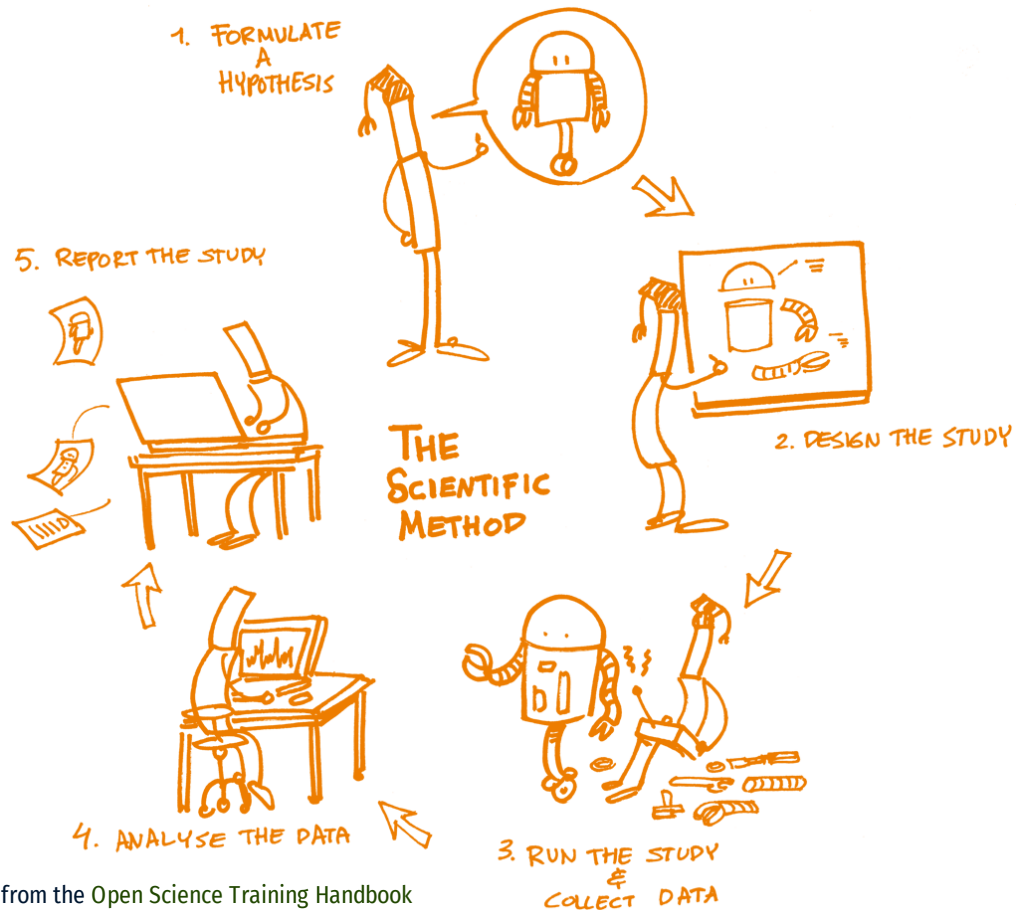
1. What is Open Science?
2. What is Reproducible Research?
3. Why Reproducible Research?
4. How to do Reproducible Research?
5. Why R?

What is Open Science?



- movement to make scientific research and dissemination accessible to anyone
- aims for greater transparency in research and removes barriers for sharing outputs, resources, methods or tools at any stage of the research process

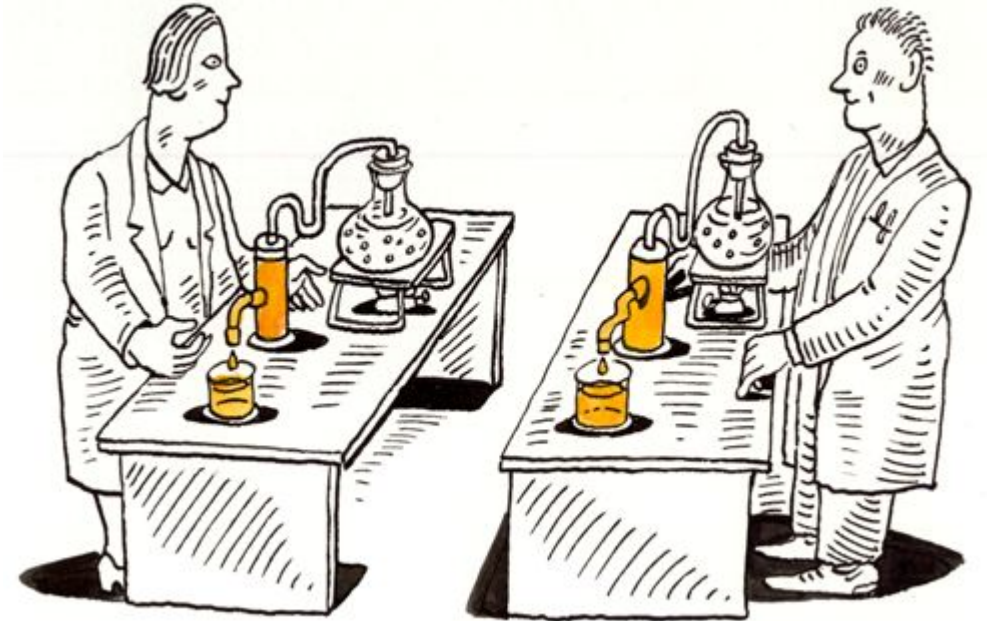
What is Reproducible Research?



- The concept of reproducibility is directly linked to the scientific method
 1. Formulating a hypothesis
 2. Designing the study
 3. Running the study and collecting the data
 4. Analyzing the data
 5. Reporting the study
- Each of these steps should be clearly reported by providing clear and open documentation, and thus making the study transparent and reproducible.

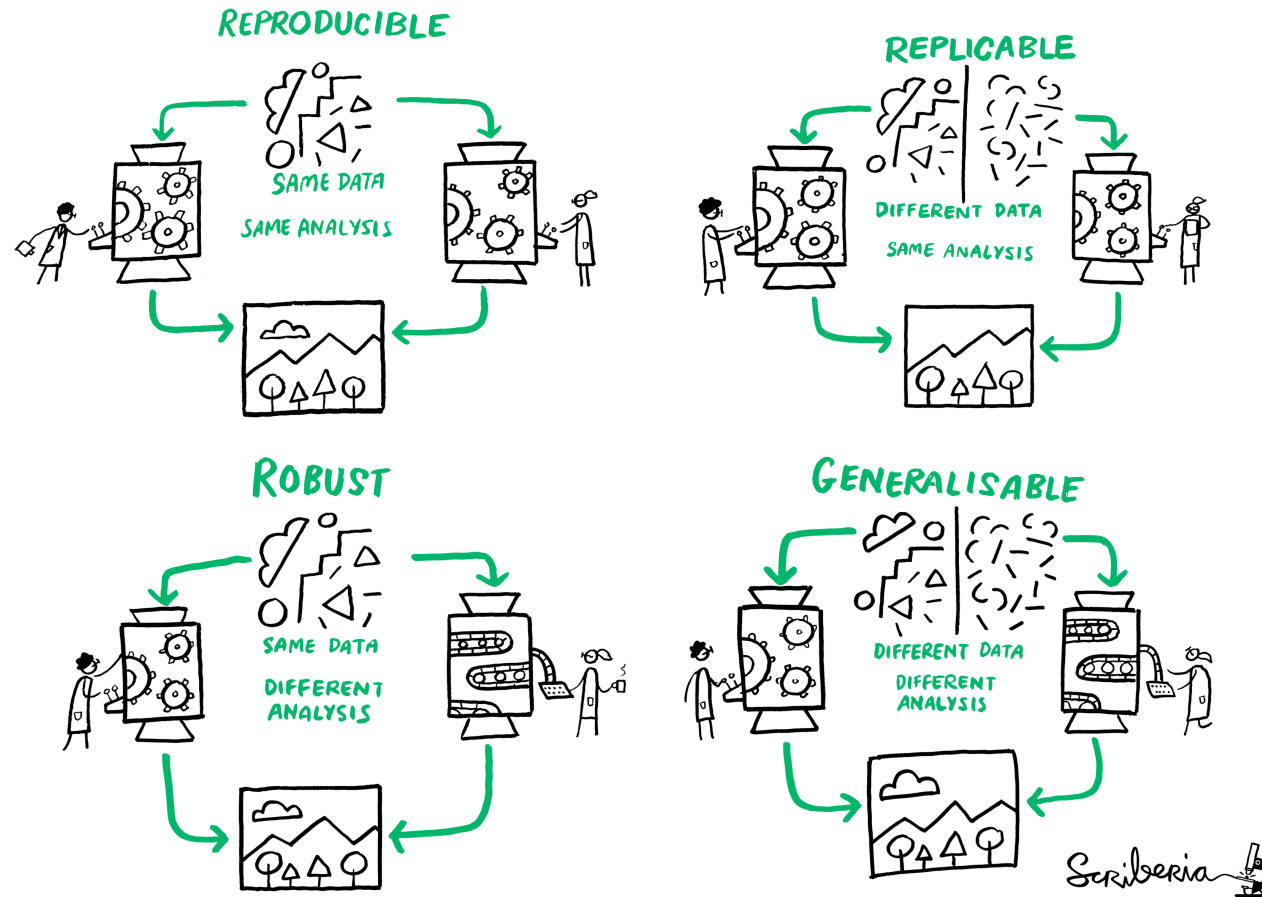
What is Reproducible Research?

- Research papers with accompanying software tools that allow the reader to directly reproduce the results and employ the methods that are presented in the research paper (Gentleman and Lang, 2004)
- Research data and code are made available so that others are able to reach the same results as are claimed in scientific outputs (Open Science Training Handbook)
- The standard of reproducibility calls for the data and the computer code used to analyze the data be made available to others (Peng, 2012)



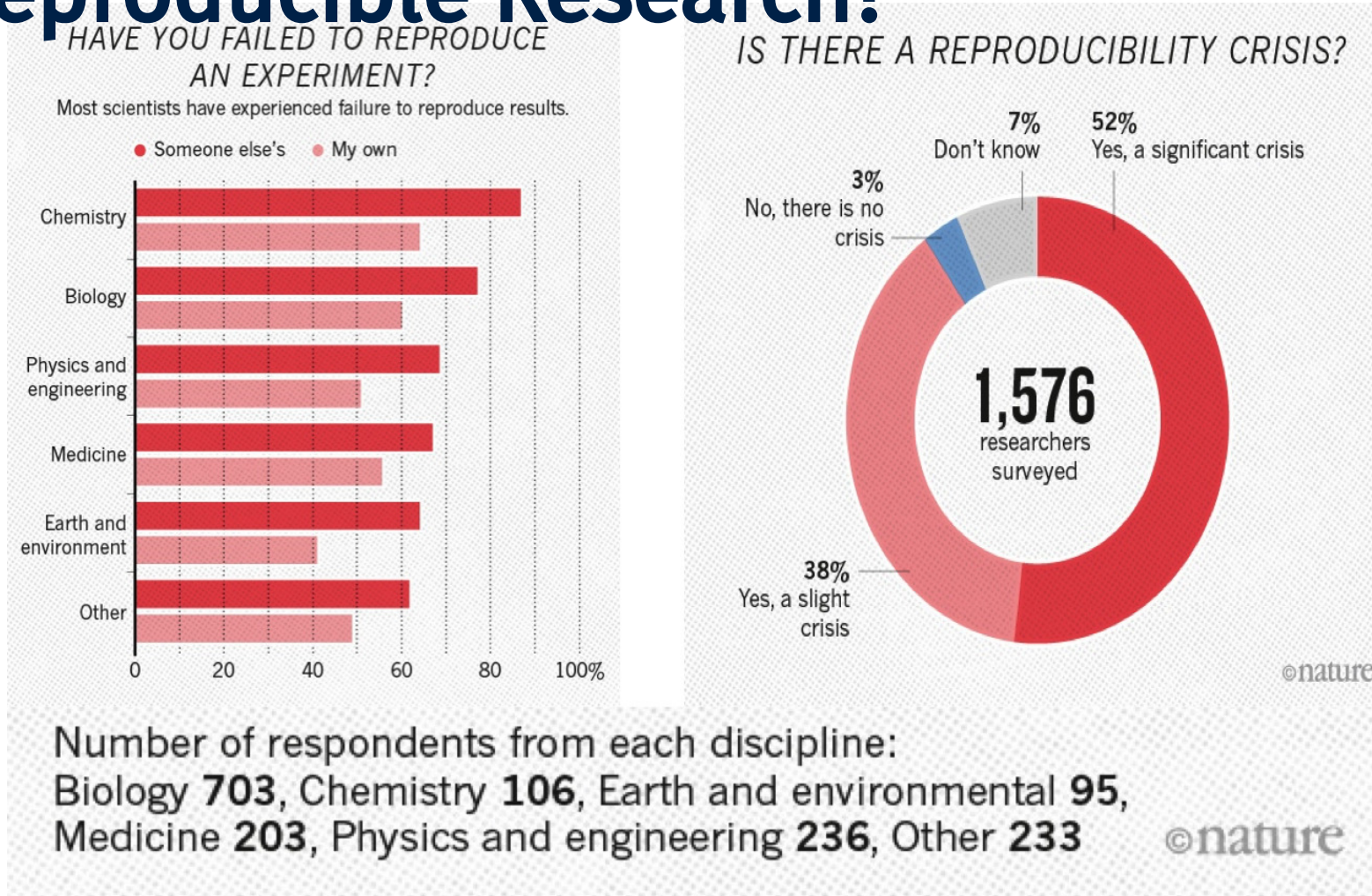
from <https://www.displayr.com/what-is-reproducible-research>

Differentiating Reproducible Research



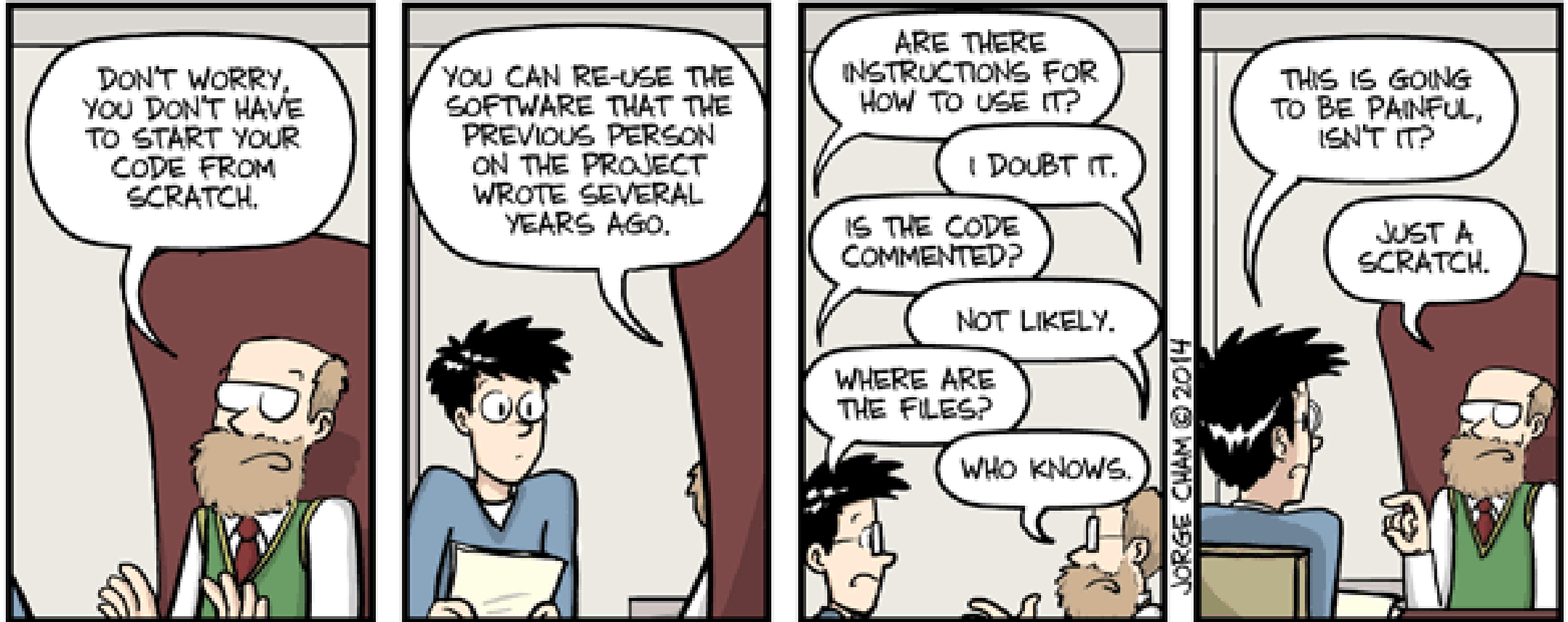
This image was created by Scriberia for The Turing Way community and is used under a CC-BY licence.

Why Reproducible Research?



Baker, M. 1,500 scientists lift the lid on reproducibility. Nature 533, 452–454 (2016). <https://doi.org/10.1038/533452a>

Factors in irreproducible research



WWW.PHDCOMICS.COM

Factors in irreproducible research

- Not enough documentation on how experiment is conducted and data is generated
- Data used to generate original results unavailable
- Software used to generate original results unavailable
- Difficult to recreate software environment (libraries, versions) used to generate original results
- Difficult to rerun the computational steps

How to do Reproducible Research?

The reproducibility spectrum

Data Replication & Reproducibility

PERSPECTIVE

Reproducible Research in Computational Science

Roger D. Peng

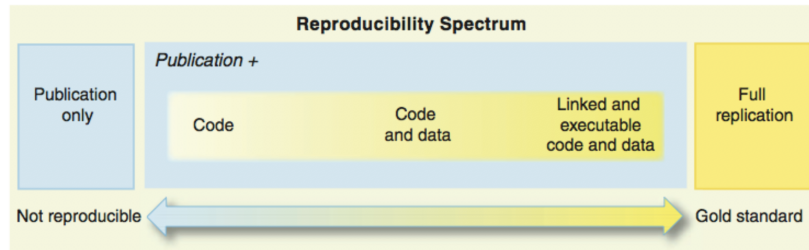


Fig. 1. The spectrum of reproducibility.

Steps in reproducible research

- Record the project's provenance
- Data and metadata curation
- Establish a testing/analysis workflow
- Test, document, and publish your code
- Share

Why R for Reproducible Research?

- freely available
- huge user and developer community
- has a robust set of user- and community-developed packages that support reproducible research



Questions?

Go to the people. Live with them. Learn from them. Love them.

Start with what they know. Build with what they have.

But with the best leaders, when the work is done, the task accomplished, the people will say "We have done it ourselves".

Lao Tzu

Thank you!

Slides can be viewed at <https://oxford-ihtm.io/open-reproducible-science/session6.html>

PDF version of slides can be downloaded at <https://oxford-ihtm.io/open-reproducible-science/pdf/session6-open-reproducible-science.pdf>

R scripts for slides available [here](#)