Reproducible Research

MSL, Durham, 2016

Tuomas Eerola

Updated: 12/12/2016

Reproducible_Research

Durham University

Overview

1. What is Reproducible Research?
2. How to Achieve Reproducible Research?
3. Analysis
4. Sharing Data

References

What is Reproducible Research?

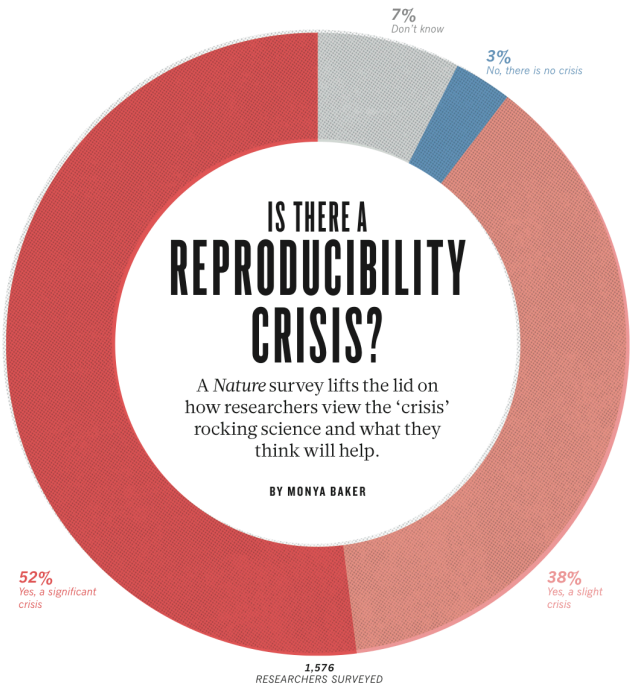
What is Reproducible Research?

"A study is reproducible if there is a specific set of computational functions/analyses that exactly reproduce all of the numbers and data visualizations in a published paper from raw data. Reproducibility does not require independent data collection and instead uses the methods and data collected by the original investigator." (Marwick, 2016, p. 4)

Why Reproducible Research?

Replication Crisis

Crisis on replication and transparency in empirical research



Nature (26 May 2016), doi:10.1038/533452a

Why Abundance of Irreproducible Research?

- We don't know better
- We have pressure to publish
- There is no incentive to produce reproducible research
- We do selective reporting (data subsets, p-value fishing, pos. results only)
- It keeps us artificially in the business (we are the only ones who know how to make sense of the data, etc.)

Benefits of Reproducibility (1)

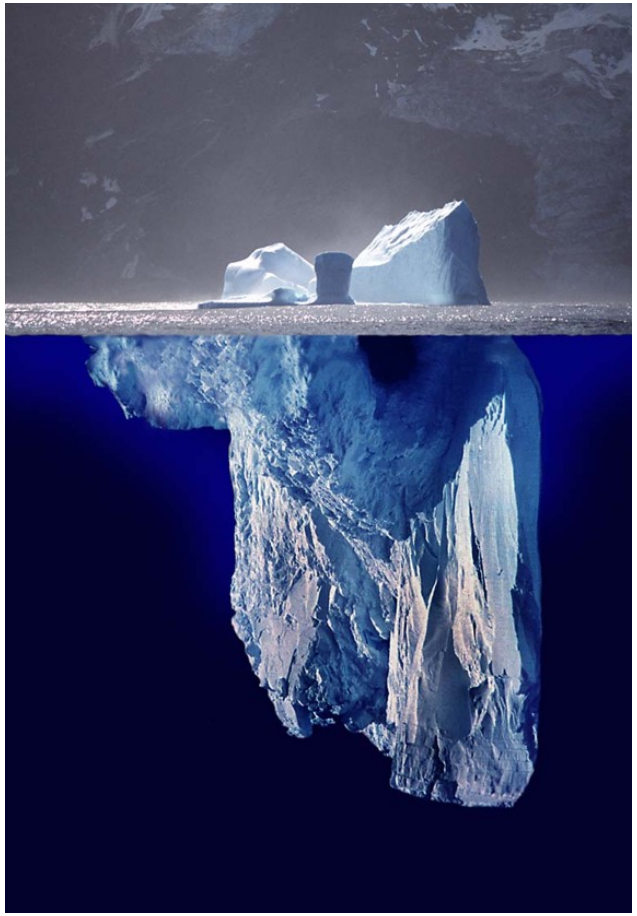
- Comply with the demands for transparency
  - first in computer sciences and biosciences
  - recently in social sciences (Asendorpf et al., 2013)
  - Note: Open Access Data is required by all RCUK funding
  - some journals promote reproducible research and data release (PLOS One, Nature, PNAS, a growing host of others)

Benefits of Reproducibility (2)

- To collaborate more easily and effectively
  - spot mistakes
  - encourage learning & exploration (Sandve, Nekrutenko, Taylor, & Hovig, 2013)
- Communicate research more clearly
  - workflows that integrate analysis and reporting
  - share data, figures, analysis and gain visibility (Piwowar, Day, & Fridsma, 2007)

Reproducible Research

Article – is just a tip of the iceberg. Reproducible Research makes the whole workflow accessible.



Types of Reproducible Research

3 kinds of reproducibility (Stodden, Leisch, & Peng, 2014):

- Computational reproducibility: code, software, hardware and implementation details.
- Empirical reproducibility: detailed information about non-computational empirical scientific experiments and observations. Basically the data.
- Statistical reproducibility: detailed information is provided about the choice of statistical tests.

Reproducible Music Research?

Music Research is interdisciplinary, and some disciplines are closer to demands of reproducibility than others

- Music Information Retrieval (MIR) has started this (e.g., soundsoftware.ac.uk)
- Music Psychology follows the path (interest in replication)
- Music Intervention research (has to register study protocols)
- Music analysis using corpus studies (rare but increasing: Jazzomat project, Huron's Humdrum, JAMS proposal by Humphrey et al., 2014)

How to Achieve Reproducible Research?

How to Achieve Reproducible Research?

- Workflows that are reproducible and transparent
  - Designs (sometimes requiring pre-registration)
  - Sharing data (data, analysis pipelines, etc.)
  - Analysis (using tools that allow reproduction)
  - Reporting (linking data and analysis, + additional information)

Analysis

Analysis

Analysis tools that facilitate reproducibility

- Statistics: R

ASK YOURSELF

Can you easily replicate a complex analysis in SPSS? No!

R Is Excellent Because It...

- is accessible, free, open source, available for all OS
- is completely programming driven (ie fully transparent)
- has excellent coverage of statistical modelling tools
- is pedagogical in many of its functionalities
- has good support for producing reports (R Markdown, knitr, Sweave) or interactive websites (Shiny).

See my Reproducible Research using R - A template for analysing behavioural experiments (separate pdf document)

Sharing Data

Sharing Data

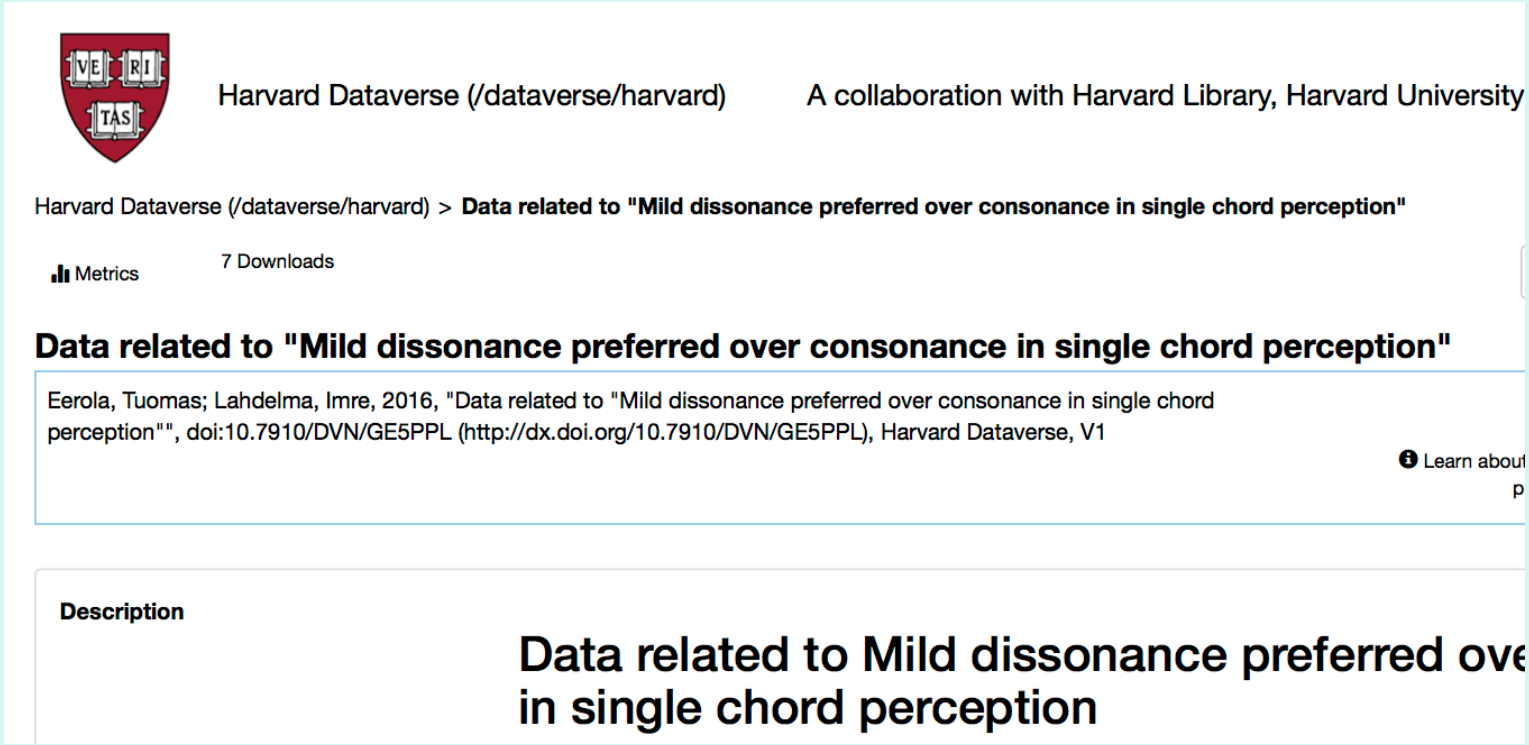
Requirement for UK Research Council Funded Projects.

- UK Data Reshare (http://reshare.ukdataservice.ac.uk)
- Harvard Dataverse (https://dataverse.harvard.edu)
- FigShare (http://figshare.com/)
- OpenScience (https://osf.io)
- Zenodo (https://zenodo.org)
- Researchcompendia (http://researchcompendia.org/compendia/)

Better than institutional repositories, keep track of the usage, ensure long-term storage

EXAMPLE: Data Share

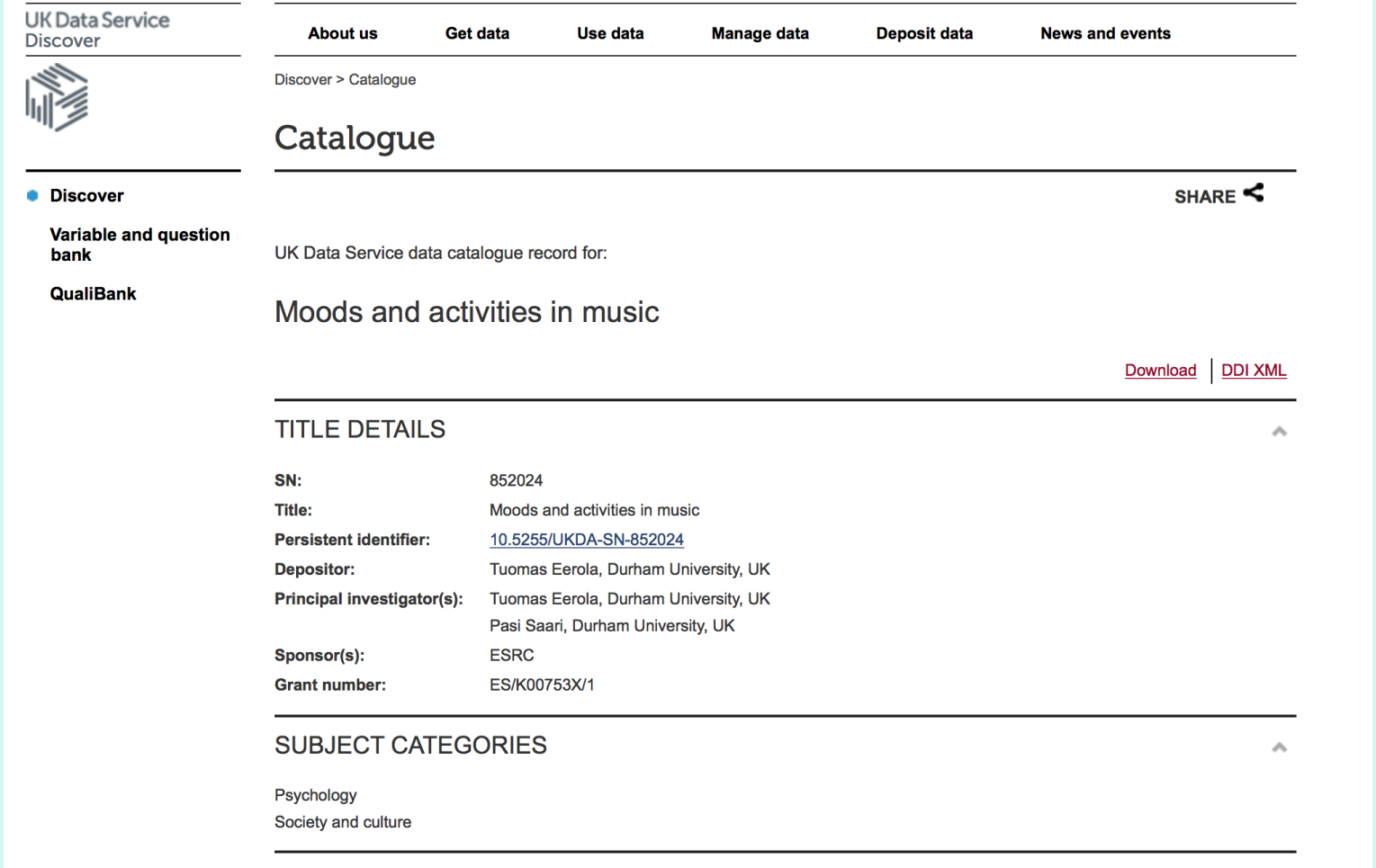
Dataverse



Eerola & Lahdelma, 2016, doi:10.1038/533452a

EXAMPLE: UK Datareshare

UK Datareshare



UK Data Service
Discover

About us | Get data | Use data | Manage data | Deposit data | News and events

Discover > Catalogue

- Discover
- Variable and question bank
- QualiBank

Catalogue

SHARE

UK Data Service data catalogue record for:

Moods and activities in music

Download | DDI XML

TITLE DETAILS

SN:	852024
Title:	Moods and activities in music
Persistent identifier:	10.5255/UKDA-SN-852024
Depositor:	Tuomas Eerola, Durham University, UK
Principal investigator(s):	Tuomas Eerola, Durham University, UK Pasi Saari, Durham University, UK
Sponsor(s):	ESRC
Grant number:	ES/K00753X/1

SUBJECT CATEGORIES

Psychology
Society and culture

Good Ways to Promote Reproducibility

- Require reproducibility from PhD students
- Run replication studies in UG teaching
- Make it one of your themes in lab meetings
- Take up the challenge of reproducibility in collaborations

> "Reproducibility is like brushing your teeth. It is good for you, but it takes time and effort. Once you learn it, it becomes a habit." (Baker, 2016)

References

Asendorpf, J. B., Conner, M., De Fruyt, F., De Houwer, J., Denissen, J. J., Fiedler, K., … others (2013). Recommendations for increasing replicability in psychology. European Journal of Personality, 27(2), 108–119.

Baker, M. (2016). 1,500 scientists lift the lid on reproducibility. Nature, 533(7604), 452–454.

Marwick, B. (2016). Computational reproducibility in archaeological research: Basic principles and a case study of their implementation. Journal of Archaeological Method and Theory, 1–27.

Piwowar, H. A., Day, R. S., & Fridsma, D. B. (2007). Sharing detailed research data is associated with increased citation rate. Plos One, 2(3), e308.