The R Dimensions

reproducible repeatable replicable reusable
referenceable retrievable reviewable rerunnable
replayable re-interpretable reprocessable
recomposable reconstructable repurposeable
reliable respectful reputable revealable
recoverable restorable reparable refreshable
The PRIMAD Model

Elements of an experiment:

- Research goal
- Method
- Implementation
- Platform
- Data
- Actor
PRIMAD Example

- **Research goal:** an efficient sorting algorithm
- **Method:** Quicksort
- **Implementation:** C++
- **Platform:** gcc 5.4, Windows 10.1, HP xyz
- **Data**
  - **Input:** data to be sorted
  - **Parameter:** position of the pivot
- **Actor:** The user executing the experiment
Reproducibility

Which elements of the PRIMAD model are changed when reproducing an experiment?

- R → R': new research goal
- M → M': new method (algorithm)
- I → I': new implementation
- P → P': different platform
- D → D': different data/parameters
- A → A': other experimenter

Note: Changes of components are not independent of each other
R → R': New Research Goal

- **Repurposing** some of the components of an experiment for another research question
- **Method** and **Implementation** usually are different, other components possibly as well
M → M': New Method

- Developing a new algorithm for the same research goal
- I → I' (new implementation) is implied
- Platform and Data should be the same, to allow for comparisons
I → I': New Implementation

Re-Coding

• Possible goals:
  − verification of previous implementation
  − Increase efficiency
  − broader set of execution platform
P → P': Different Platform

Portability

• wider adoption
• higher stability
D → D': Different Data/Parameters

Rerun

• Different parameters → robustness
• Different input data → generality
A → A': Other Experimenter

Experimenter-independence:

• verify that reproducibility information is complete

• (experimenter may have an effect on test subjects)
Further issues

• **Consistency:**
  Success or failure of a reproducibility experiment is evaluated wrt. consistency of outcomes
Further issues (2)

• Transparency:
  ability to look into all necessary components to verify that
  the experiment does what it claims
  (vs. running a black box)
Enabling Reproducibility

- **Research goal**, **Method**: Publications
- **Implementation**: Open Source (e.g. Github)
- **Platform**: Virtual Machines, Docker
- **Data**: Sharing Data (trustworthy repositories)