Reproducibility is hard: case studies

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What do mean by reproducibility again?

- Re-do the same thing

Computational ←——————————→ Conceptual

Conceptual reproducibility

What needs to be documented in a manuscript and in order for the findings to be reproducible?

- Experimental design
- Demographic/animal information
- Material
- Analysis details
- Code?
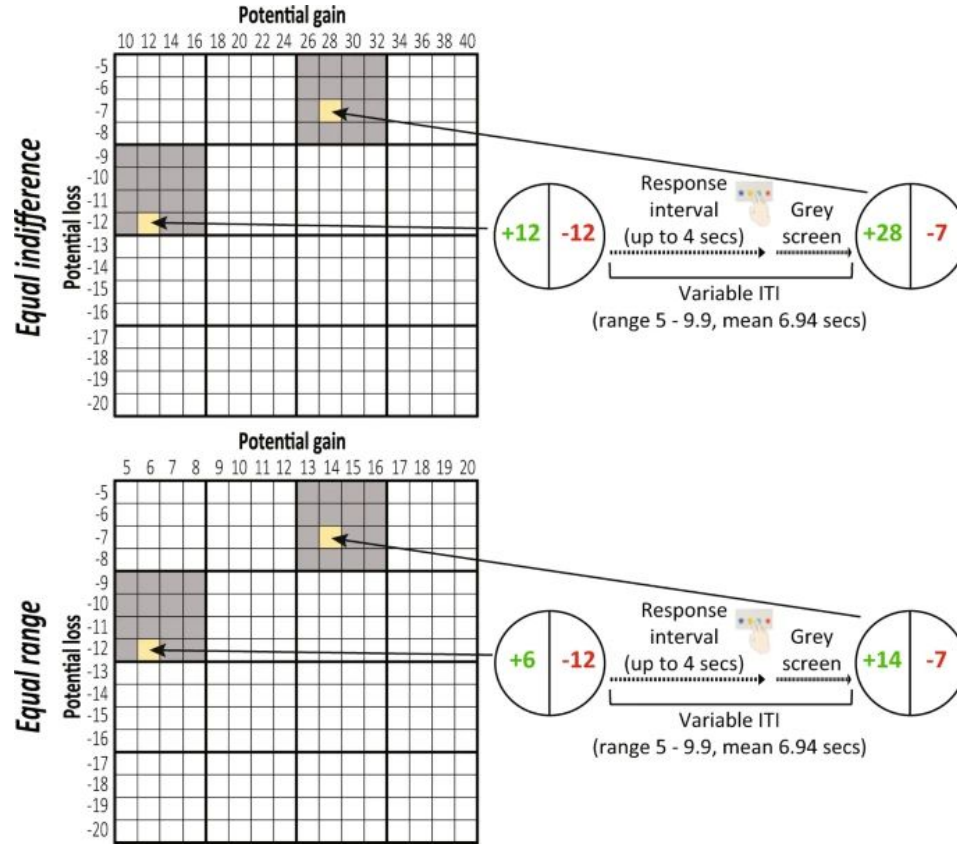- Data?

Computational and Conceptual

Neuroimaging Analysis Replication and Prediction Study https://www.narps.info/

estimate the variability of neuroimaging results across analysis teams

examine the neural basis of decision-making under risk using fMRI → choice between options that yield different known outcomes with known probabilities

https://www.nature.com/articles/s41586-020-2314-9

Computational and Conceptual

Participants choose to accept or not the gamble - they can win real life cash

Computational and Conceptual

Seventy teams (69 of whom had previous fMRI publications) were provided with the raw data, and an optional preprocessed version of the dataset. They were asked to analyse the data to test nine ex-ante hypotheses, each consisting of a description of activity in a specific brain region in relation to a particular feature of the task.

4/9 hypotheses were consistent across teams: 1 hyp. showed a 84.3% rate of significant findings, and 3 hyp. showed a 94.3% rate of non-significant findings across teams. The remaining 5/9 hyp, show variables results (21.4% to 37.1% of teams reporting a significant result)

Is it a good or bad result?

Just like with the reproducibility in psychology project, if we take the effect sizes (here brain wide statistical maps) we can see a very good correlation (the negative ones are just the same maps reversed)

→ focusing on effect sizes and sharing underlying results (e.g. the files behind figures) allows quantitative comparisons - how much variations? Rather than binary differences leading to meaningless arguments

Six factors affecting reproducibility

A lack of access to methodological details, raw data, and research materials

Use of misidentified, cross-contaminated materials (chemicals, cell lines, animals, human diagnostic)

Inability to manage complex datasets

Poor research practices, experimental design, statistical power

Cognitive bias

A competitive culture that rewards novel findings and undervalues negative results

https://www.nature.com/articles/d42473-019-00004-y

Case Studies on Reproducibility

Case study (choose a high level one)

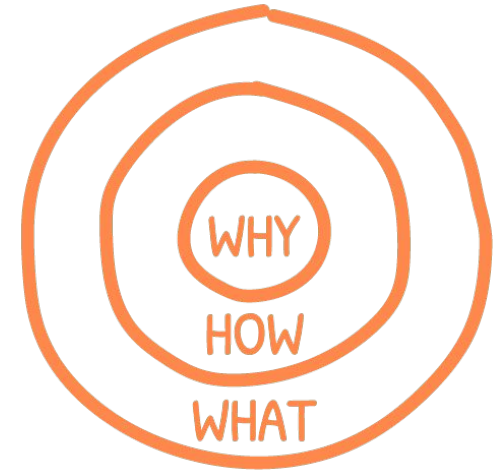http://www.practicereproducibleresearch.org/TOC.html

Focus on the why and how, not on the what

Why: vision, goals
How: strategy
What: concrete actions taken
Critique: what could still be improved

Let's do an example

(1) Quickly summarize

Research in brain imaging, collecting the data from the same people several times, changing some details about the scanner and using 2 different models

Let's do an example

(2) Why:

"MRI is expensive"
"Many of these practices evolved out of laziness."
"The level of confidence that I have in my results is quite high. That helps me sleep well at night."

(3) How:

Open access publishing, data sharing, scripting (so that it can be shared) and testing, code sharing, preprint, versioning, listing dependencies

Let's do an example

(4) Some critiques:

Subject consent is not specified

We cannot find data for subject 3-6

Dependencies list Python packages, not versions

Code is shared on a commercial (github/microsoft) platform and not persistent (although good that it is on the vistalab/organisation, not on arokem/personal)

No pre-registration (although there is versioning of notebooks, you can see that he only versioned after writing the first draft of the paper)

Precomputed parameter files were not made publicly available

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