# Day 2: Introduction to R for reproducible science

By David Souto

# Worksheet 4

[Intro].

## Understanding challenges to reproducibility

### Dance of p-values

Geoff Cumming pointed to a fundamental misunderstanding about p-values. While the language we use to report p-values suggests strength of evidence (e.g., “very significant”), a p-value tells little about how likely we are to see the same finding or the strength of the evidence. Cumming’s solution is to stop focusing on p-values but the precision of our measures, while others advocate improving p-value interpretation.

Use the shiny app to understand what results we can predict under different situations: [**https://shiny.ieis.tue.nl/d\_p\_power/**](https://shiny.ieis.tue.nl/d_p_power/)

### P-hacking challenge

We will be simulating data collection by using this Shiny app: <https://shinyapps.org/apps/p-hacker/>

We are going to start with entering the name of your favourite effect. A number of observations of XX is assumed. We are measuring 4 dependent variables to start with and the true effect is 0 (no effect).

Add participants by 5 and note save significant p-values.

### Plot results from many analysts project

[This can be used to illustrate importance of accounting for analytical choices / we can introduce an example of multiverse analyses as well]

### FORT project on replicability in R

**References**

**Shiny app:** [**https://shiny.ieis.tue.nl/d\_p\_power/**](https://shiny.ieis.tue.nl/d_p_power/)

**Lakens – Improving your statistical inference Misconceptions about p-values:** [**https://lakens.github.io/statistical\_inferences/01-pvalue.html#sec-lindley**](https://lakens.github.io/statistical_inferences/01-pvalue.html#sec-lindley)[**https://lakens.github.io/statistical\_inferences/**](https://lakens.github.io/statistical_inferences/)

The dance of p-values - [https://dx.doi.org/10.1111/j.1745-6924.2008.00079.x /](https://dx.doi.org/10.1111/j.1745-6924.2008.00079.x%20/) Video: <https://youtu.be/5OL1RqHrZQ8>

Definitions of reproducibility / replicability / generalizability (not universally agreed upon): [https://osf.io/cgdsn /](https://osf.io/cgdsn%20/) many analyst

On QRP: Nine circles of hell <https://journals.sagepub.com/doi/full/10.1177/1745691612459519?rss=1&ssource=mfr>

Simmons J., Nelson L. & Simonsohn U. (2011) False-Positive Psychology: Undisclosed Flexibility in Data Collection and Analysis Allow Presenting Anything as SigniFicant. Psychological Science, 22(11), 1359-1366.

Examples across disciplines: Plenty examples across Medicine, Biology even Physics

Feinstein, A.R. (1988). Scientific standards in epidemiologic studies of the menace of daily life. Science, 242, 1257-1263.

Simonsohn, U. (2015). Small telescopes: Detectability and the

evaluation of replication results.Psychological Science,26,559-569

Belief in the law of small numbers - Kahneman & Tversky

What is replication? <https://journals.plos.org/plosbiology/article?id=10.1371/journal.pbio.3000691>

Research misconduct and data fraud in clinical trials: prevalence

and causal factors <https://link.springer.com/article/10.1007/s10147-015-0887-3>