2017-01-23-manifesto

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2017-01-25 16:22:25

"A manifesto for reproducible science"

Discussion of

Munafò, M. R., Nosek, B. A., Bishop, D. V. M., Button, K. S., Chambers, C. D., Sert, N. P. du, ... Ioannidis, J. P. A. (2017). A manifesto for reproducible science. Nature Human Behaviour, 1, 0021. https://doi.org/10.1038/s41562-016-0021.

Steps in scientific method (and weaknesses)

- Generate and specify hypothesis
- Design study
- Conduct study and collect data
- Analyze data and test hypothesis
- Interpret results
- Publish and/or conduct next study

Failure to control for bias

- *Apophenia*
- Confirmation bias
- Hindsight bias
- Kahneman, D. (2011). Thinking Fast and Slow. Farrar, Straus, and Giroux.

Low statistical power

- Button, K. S., Ioannidis, J. P. A., Mokrysz, C., Nosek, B. A., Flint, J., Robinson, E. S. J., & Munafò, M. R. (2013). Power failure: why small sample size undermines the reliability of neuroscience. Nature Reviews Neuroscience, 14(5), 365–376. https://doi.org/10.1038/nrn3475
- Ioannidis, J. P. A. (2005). Why Most Published Research Findings Are False. PLOS Medicine, 2(8), e124. https://doi.org/10.1371/journal.pmed.0020124

Low statistical power

- Szucs, D., & Ioannidis, J. P. (2016). Empirical assessment of published effect sizes and power in the recent cognitive neuroscience and psychology literature. bioRxiv, 071530. https://doi.org/10.1101/071530

Poor quality control

- Goodman, S. N., Fanelli, D., & Ioannidis, J. P. A. (2016). What does research reproducibility mean? Science Translational Medicine, 8(341), 341ps12–341ps12. https://doi.org/10.1126/scitranslmed.aaf5027
- *Methods* reproducibility
  - *"... the ability to implement, as exactly as possible, the experimental and computational procedures, with the same data and tools, to obtain the same results."*

P-Hacking

- Simonsohn, U., Nelson, L. D., & Simmons, J. P. (2014). P-curve: A key to the file-drawer. Journal of Experimental Psychology: General, 143(2), 534–547. https://doi.org/10.1037/a0033242
- If an effect is *true*, the distribution of reported p values should be right-skewed (long right tail)
- http://www.p-curve.com/
- p-curve app

HARKing: hypothesizing after the results are known

- Kerr, N. L. (1998). HARKing: Hypothesizing After the Results are Known. Personality and Social Psychology Review, 2(3), 196–217. https://doi.org/10.1207/s15327957pspr0203_4
- Find an effect in data analysis
- Present effect as if it had been hypothesized

Publication bias

- Results vs. null findings
- Novel results vs. replications
- Counter-intuitive findings
- File drawer effect
  - How many unpublished failures to replicate sit in file drawers?

Overcoming these weaknesses

Performing research

- Protecting against cognitive biases
- Improving methodological training
- Implementing independent methological support
- Encouraging collaboration and team science
- Collect bigger samples

Reporting on research

- Promoting study pre-registration
  - Registered reports (Munafo et al. 2017, Box 3)
- Improving the quality of reporting
  - The Transparency and Openness Promotion (TOP) guidelines and signatories

Reporting on research

- Franco, A., Malhotra, N., & Simonovits, G. (2016). Underreporting in Psychology Experiments: Evidence From a Study Registry. Social Psychological and Personality Science, 7(1), 8–12. https://doi.org/10.1177/1948550615598377
- "*We find that about 40% of studies fail to fully report all experimental conditions and about 70% of studies do not report all outcome variables included in the questionnaire. Reported effect sizes are about twice as large as unreported effect sizes and are about 3 times more likely to be statistically significant.*"

Reporting on research

- Publish replications
- Frank, M. C., & Saxe, R. (2012). Teaching Replication. Perspectives on Psychological Science, 7(6), 600–604. https://doi.org/10.1177/1745691612460686.

Verifying research

- Promoting transparency and open science
- Open methods, materials, code sharing, data sharing,

Changing Incentives

- Higginson, A. D., & Munafò, M. R. (2016). Current Incentives for Scientists Lead to Underpowered Studies with Erroneous Conclusions. PLOS Biology, 14(11), e2000995. https://doi.org/10.1371/journal.pbio.2000995
- Claim that current publication incentive structure reinforces current practices
- OSF badge system
- Other incentives/disincentives

Status report/recommendations by stakeholder group

Source: http://www.nature.com/articles/s41562-016-0021/tables/1

Your thoughts?

Questions for discussion

- Which of the manifesto provisions would you disagree with?
- Do you agree with the assessment about progress (Table 1)
- What steps could **you** take?