

# 2017-01-23-manifesto

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## “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
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### 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](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 methodological 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

## 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?