

# How **Open Science** Can Solve (Parts of) the Replication Crisis

Parts of this presentation are inspired by presentations from Daniel Lakens, Jim Grange, Marcus Munafò, Dorothy Bishop, and Brian Nosek

This presentation is licensed under a [CC-BY 4.0 license](#). You may copy, distribute, and use the slides in your own work, as long as you give attribution to the original author at each slide that you use.



# Marketing/Story-Telling



Nice fairy tales, based on myths or selfish/commercial interests.  
No relation to reality,  
no empirical evidence.

# Science



Pursuit of knowledge that relates to reality.  
Evidence-based claims which are reproducible by other researchers.

# Marketing/Story-Telling

## Mit Backpulver (Natron) von Krebs geheilt

(Zentrum der Gesundheit) - Kann Backpulver (Natron) Krebs heilen? Vernon Johnston aus Kalifornien besiegte mit Natron, einem einfachen Haushaltmittel, das normalerweise als Backpulver in jedem Haushalt Verwendung findet, seinen weit fortgeschrittenen Prostata- und Knochenkrebs.



Nice fairy tales, based on myths or selfish/commercial interests.  
No relation to reality,  
no empirical evidence.

# Science

BMJ

BMJ 2014;348:d266 doi:10.1136/bmj.d266 (Published 11 February 2014)



Page 1 of 10

## RESEARCH

### Twenty five year follow-up for breast cancer incidence and mortality of the Canadian National Breast Screening Study: randomised screening trial

OPEN ACCESS

Anthony B Miller professor emeritus<sup>1</sup>, Claus Wall data manager<sup>1</sup>, Cornelia J Barnes professor emerita<sup>1</sup>, Ping Sun statistician<sup>1</sup>, Teresa Te senior scientist<sup>1</sup>, Steven A Narod professor<sup>1,2</sup>

Dalla Lana School of Public Health, University of Toronto, Toronto, Ontario M5T 1R7, Canada; <sup>2</sup>University College Research Institute, Women's College Hospital, Toronto, Ontario M5G 1X5, Canada; <sup>3</sup>Child Health Executive Services, The Hospital for Sick Children, Toronto, Ontario, Canada

#### Abstract

**Objective** To compare breast cancer incidence and mortality up to 25 years in women aged 40–59 who did or did not undergo mammography screening.

**Design** Follow-up of randomised screening trial by cohort-coordination. The study is central office, and linkage to cancer registries and vital statistics.

**Setting** 11 assessing centres in six Canadian provinces, 1400000 Ontario, Quebec, Ontario, Manitoba, Alberta, and British Columbia.

**Participants** 31 630 women, aged 40–59, randomly assigned to mammography (five annual mammography screening, or control (no mammography).

**Conclusion** Annual mammography in women aged 40–59 does not reduce mortality from breast cancer beyond that of physical examination.

**Effectiveness** When mammography is done every two years, it reduces mortality from breast cancer by 15% (95% confidence interval 6–26%).

**Interpretation** Mammography detected invasive breast cancers with over-diagnosis, representing one over-diagnosed invasive cancer for every 49 women who received mammography screening in the trial.

#### Introduction

Regular mammography screening is closer to reducing mortality from breast cancer. Mammograms detect non-palpable breast cancers, i.e. smaller on average than clinically palpable breast cancers. Small breast cancers confer a better prognosis than large ones. However, survival in the context of a screening

Pursuit of knowledge that relates to reality.  
Evidence-based claims which are reproducible by other researchers.

# How to be successful in academia

aka.

## Hack your way to scientific glory

# Tool I: Outcome switching

The screenshot shows the COMPARE website homepage. The header features the word "COMPARE" in large red letters, with a globe icon to its left, and the subtitle "TRACKING SWITCHED OUTCOMES IN CLINICAL TRIALS" below it. A navigation bar with links to "PROJECT", "RESULTS", "TEAM", "BLOG", and "FAQ" is visible. The main content area has a light gray background. It starts with the heading "Tracking switched outcomes in clinical trials". Below this, a subtext says "Here's what we found.". The central part of the page displays four large red numbers: 67, 9, 300, and 357, each associated with a statistic: "TRIALS CHECKED", "TRIALS WERE PERFECT", "OUTCOMES NOT REPORTED", and "NEW OUTCOMES SILENTLY ADDED". At the bottom, a summary statement reads: "On average, each trial reported just 62.1% of its specified outcomes. And on average, each trial silently added 5.3 new outcomes."

**COMPARE**  
TRACKING SWITCHED OUTCOMES IN CLINICAL TRIALS

PROJECT RESULTS TEAM BLOG FAQ

Tracking switched outcomes in clinical trials

Here's what we found.

67	9	300	357
TRIALS CHECKED	TRIALS WERE PERFECT	OUTCOMES NOT REPORTED	NEW OUTCOMES SILENTLY ADDED

On average, each trial reported just 62.1% of its specified outcomes. And on average, each trial silently added 5.3 new outcomes.

# Tool I: Outcome switching

- 2 outcome variables:

false positive rate **5% → 9.5%**

- 5 outcome variables with one-sided testing:

false positive rate **5% → 41%**

For Vohs et al. (2006), “*the authors conducted two additional money priming studies that showed no effects, the details of which were shared with us.*” and “*reported nine dependent measures that were statistically affected by the manipulation in the predicted direction (one in each experiment) but did not report 19 additional measures that were statistically unchanged*”.

# Tool 2: Many conditions, report only those that worked

**Best-practice example:**  
**Transforming a boring dissertation into a groundbreaking publication**

<https://twitter.com/JoeHilgard/status/699693258386051072>

Joe Hilgard  
@JoeHilgard

Folge Ich

Here's another spicy one: Thesis reports four conditions, 415 subjects. Manuscript reports three conditions, 140 subjects.

Übersetzung anzeigen

RETWEETS GEFÄLLT  
2 11

12:34 - 16. Feb. 2016

Antwort an @JoeHilgard

Joe Hilgard @JoeHilgard - 16. Feb.  
Figured it out: It started with a  $2 \times 2 \times 4$  design and worked its way down to the  $2 \times 3$  design that "worked."

# Tool 3: Optional stopping

## Repeated Significance Tests on Accumulating Data

By P. ARMITAGE, C. K. MCPHERSON and B. C. ROWE

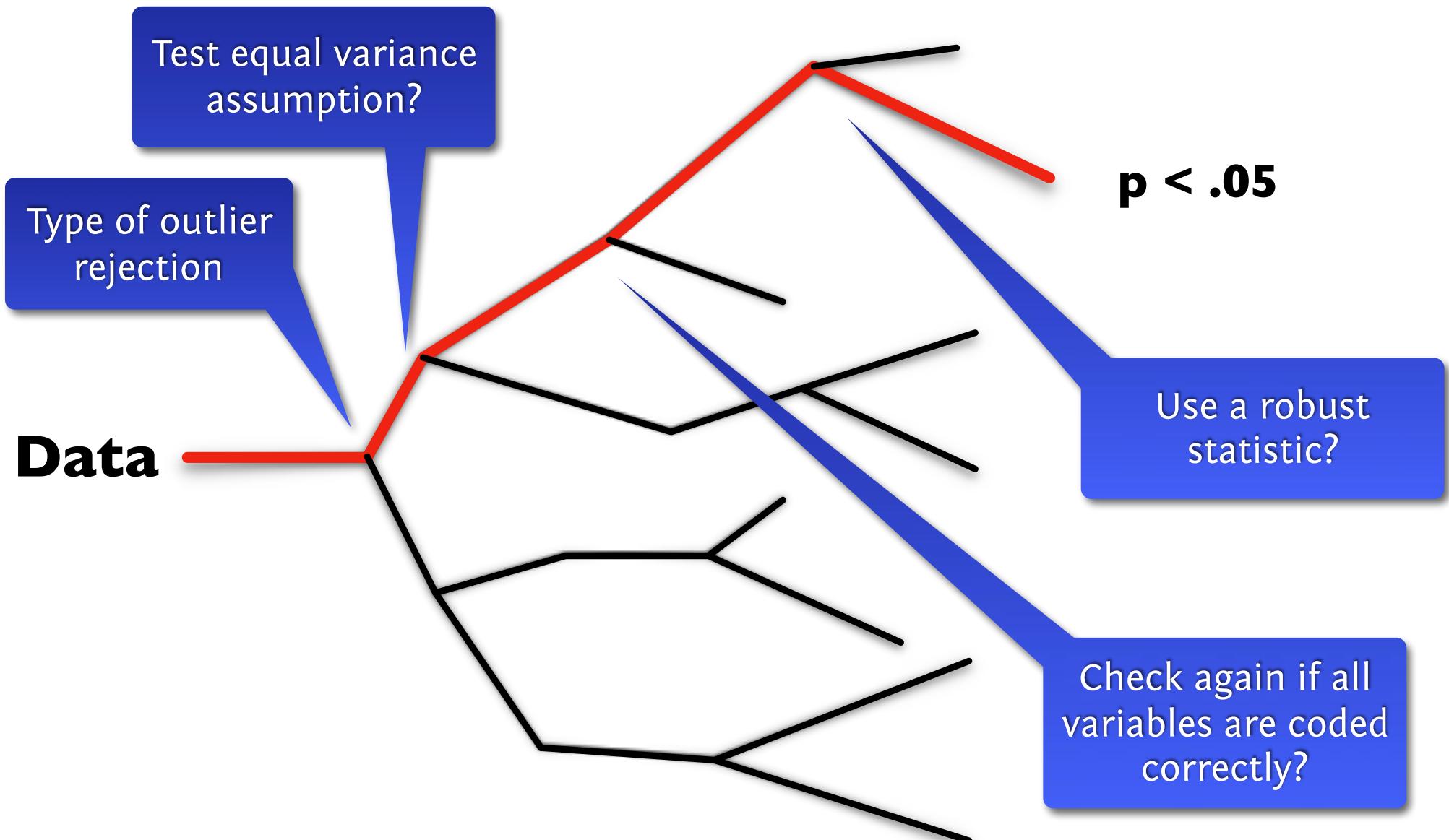
$n$	$0\cdot10$		$0\cdot05$		$0\cdot02$		$0\cdot01$		
	$k$	$Q$	$S$	$Q$	$S$	$Q$	$S$	$Q$	$S$
1		0·10000	0·0970	0·05000	0·0545	0·0200			
2		0·16015	0·1650	0·08312	0·0885	0·0345			
3		0·20207	0·1980	0·10726	0·1115	0·0456			
4		0·23399	0·2295	0·12617	0·1260	0·0545			
5		0·25963	0·2590	0·14169	0·1420	0·0620			
160		0·63315		0·40829		0·2083			
180		0·64301		0·41677		0·2135			
200		0·65165		0·42429		0·2182			
250		0·670		0·440		0·228			
500		0·720		0·487		0·250			
750		0·746		0·512		0·270			
1,000		0·763				0·288	0·164	0·172	

With long enough sampling and optional stopping, it is guaranteed to get a significant result!

100%

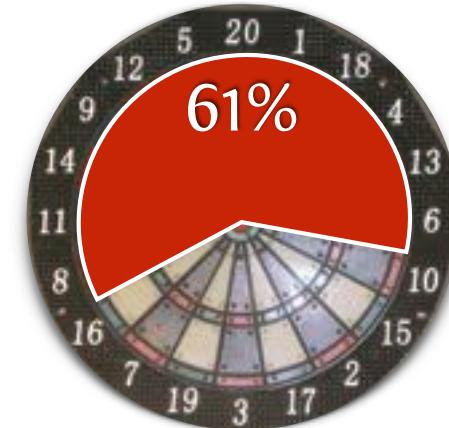
# The garden of forking paths

Andrew Gelman & Eric Loken, 2013



# How bad can it be? A bad case (but not untypical?) scenario

- Doing some of these questionable research practices (QRPs) in combination raises false positive rate from 5% to **61%**!
- QRPs corrupt the logic of the  $p$ -value and “renders the reported  $p$ -values essentially uninterpretable.”



Simmons, J. P., Nelson, L. D., & Simonsohn, U. (2011). False-positive psychology: Undisclosed flexibility in data collection and analysis allows presenting anything as significant. *Psychological Science*, 22, 1359–1366. doi:10.1177/0956797611417632

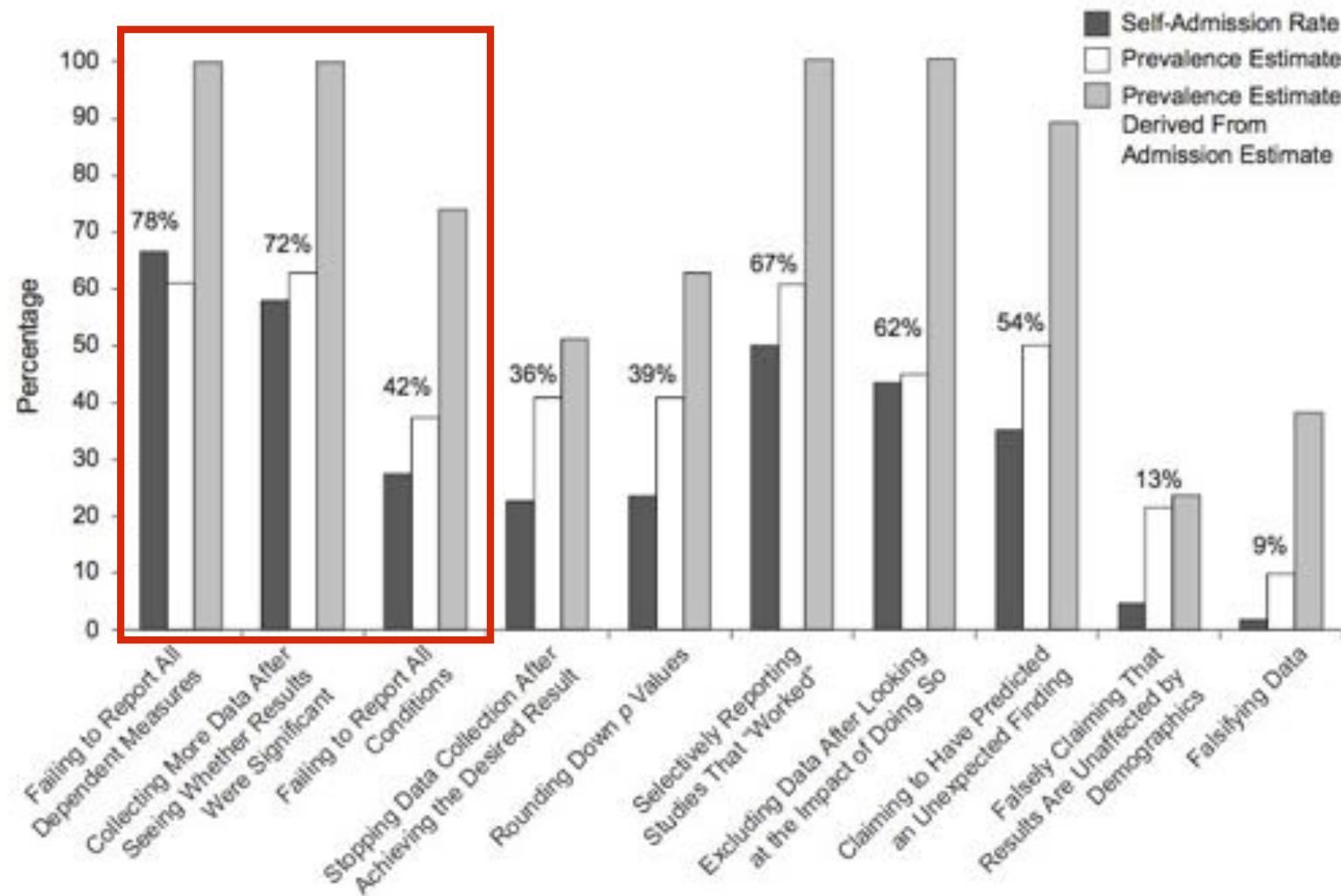
Wasserstein, R. L., & Lazar, N. A. (2016). The ASA's statement on p-values: context, process, and purpose. *American Statistician*, 00–00. <http://doi.org/10.1080/00031305.2016.1154108>

# Measuring the Prevalence of Questionable Research Practices With Incentives for Truth Telling *IN PSYCHOLOGY*

Psychological Science  
23(5) 524–532  
© The Author(s) 2012  
Reprints and permission:  
[sagepub.com/journalsPermissions.nav](http://sagepub.com/journalsPermissions.nav)  
DOI: 10.1177/0956797611430953  
<http://journals.sagepub.com>  


Leslie K. John<sup>1</sup>, George Loewenstein<sup>2</sup>, and Drazen Prelec<sup>3</sup>

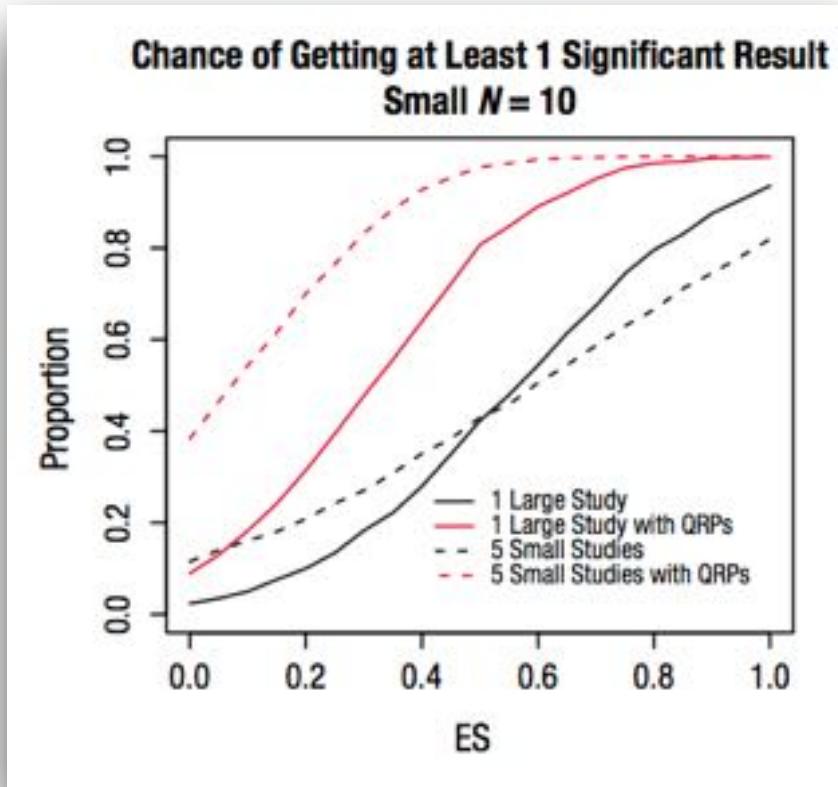
<sup>1</sup>Marketing Unit, Harvard Business School; <sup>2</sup>Department of Social & Decision Sciences, Carnegie Mellon University; and <sup>3</sup>Sloan School of Management and Departments of Economics and Brain & Cognitive Sciences, Massachusetts Institute of Technology



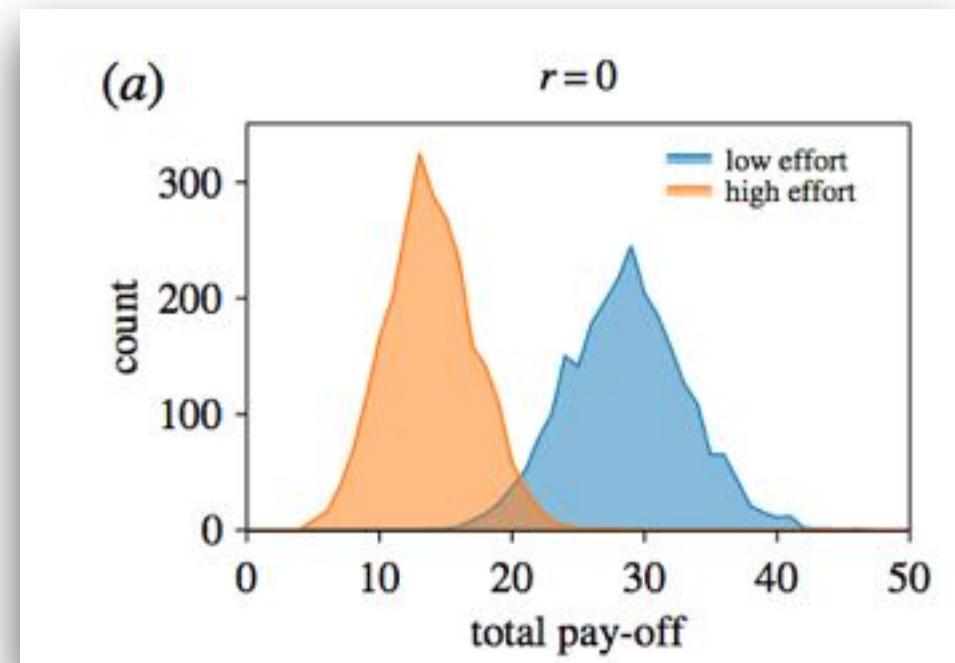
# Quantity, not quality

Actual (not desired) relevance at professorship hiring committees:	Rank
<b>Number</b> of peer-reviewed publications	1
Fit of research profile to the advertising institution	2
Quality of research talk	3
<b>Number</b> of publications	4
<b>Volume</b> of acquired third-party funding	5
<b>Number</b> of first authorships	6
...	...

## „The rules of the game“



## „Evolution of bad science“



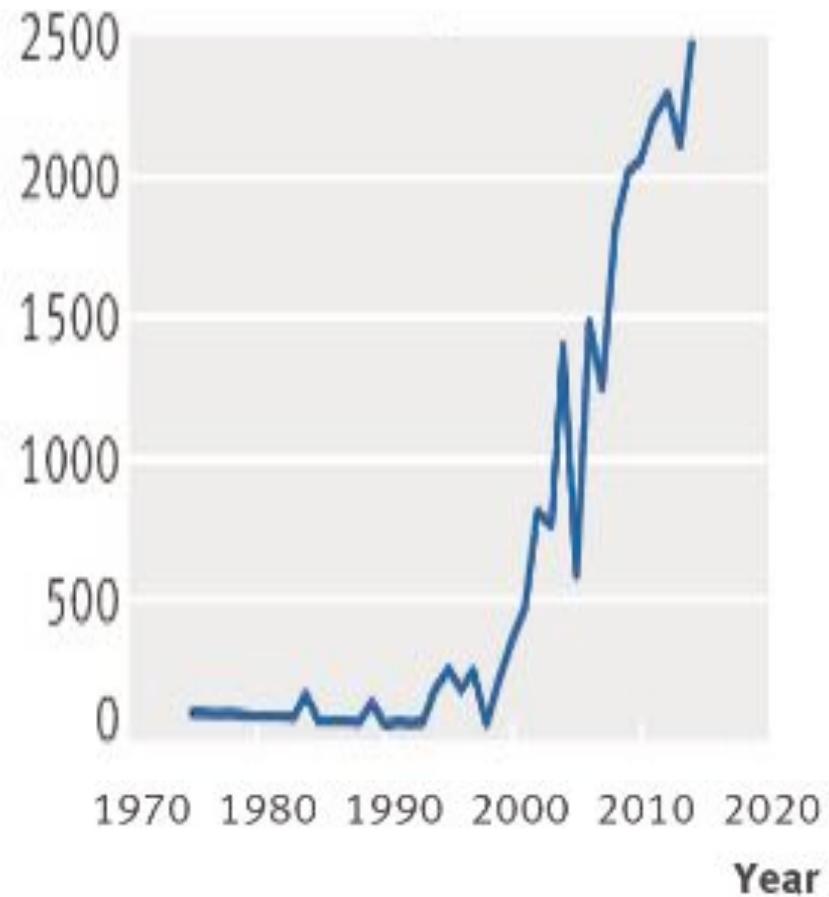
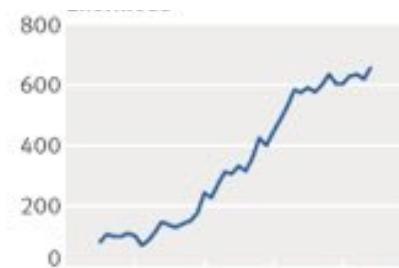
Ideal strategy for a high quantity of publications:  
small  $n$  + many studies + questionable research practices  
(QRPs), such as  $p$ -hacking

„Innovative, unprecedented, transformative!“  
**+880% from 1974- 2014**

**Groundbreaking!!!**



Enormous!!



# A dystopian view of science ...



**Mit Backpulver (Natron) von Krebs geheilt**

(Zentrum der Gesundheit) - Kann Backpulver (Natron) Krebs heilen? Vernon Johnston aus Kalifornien besiegte mit Natron, einem einfachen Hausmittel, den Krebs. Er lebt heute gesund und fit in jedem Haushalt. Verwendung findet, seinen weit fortgeschrittenen Prostata- und Knochenkrebs.

**RESEARCH**

**Twenty five year follow-up for breast cancer incidence and mortality of the Canadian National Breast Screening Study: randomised screening trial**

**OPEN ACCESS**

Anthony B Miller professor emeritus<sup>1</sup>, Claus Wall data manager<sup>1</sup>, Cornelia J Baines professor emerita<sup>1</sup>, Ping Sun statistician<sup>2</sup>, Teresa To senior scientist<sup>1</sup>, Steven A Narod professor<sup>2</sup>

Dalla Lana School of Public Health, University of Toronto, Toronto, Ontario M5T 3M7, Canada; <sup>1</sup>Women's College Research Institute, Women's College Hospital, Toronto, Ontario M5G 1N8, Canada; <sup>2</sup>Child Health Evaluative Services, The Hospital for Sick Children, Toronto, Ontario, Canada

**Abstract**

**Objective** To compare breast cancer incidence and mortality up to 25 years in women aged 40-59 who did or did not undergo mammography screening.

**Design** Follow-up of randomised screening trial by centre coordinators, the study's central office, and linkage to cancer registries and vital statistics databases.

**Setting** 15 screening centres in six Canadian provinces, 1980-85 (Nova Scotia, Quebec, Ontario, Manitoba, Alberta, and British Columbia).

**Participants** 89 835 women, aged 40-59, randomly assigned to mammography (five annual mammography screens) or control (no mammography).

**Conclusion** Annual mammography in women aged 40-59 does not reduce mortality from breast cancer beyond that of physical examination or usual care when adjuvant therapy for breast cancer is freely available. Overall, 22% (106 484) of screen-detected invasive breast cancers were over-diagnosed, representing one over-diagnosed breast cancer for every 424 women who received mammography screening in the trial.

**Introduction**

Regular mammography screening is done to reduce mortality from breast cancer. Mammogram-detected non-palpable breast cancers are smaller on average than clinically palpable breast cancers. Since breast cancers confer a better prognosis than large ones. However, survival in the context of a screening

Page 1 of 10

BEFORE AFTER

Coherent stories are made up after seeing the data.  
We publish nice fairy-tales; empirical evidence is only  
decoration that is tortured until it fits the story.

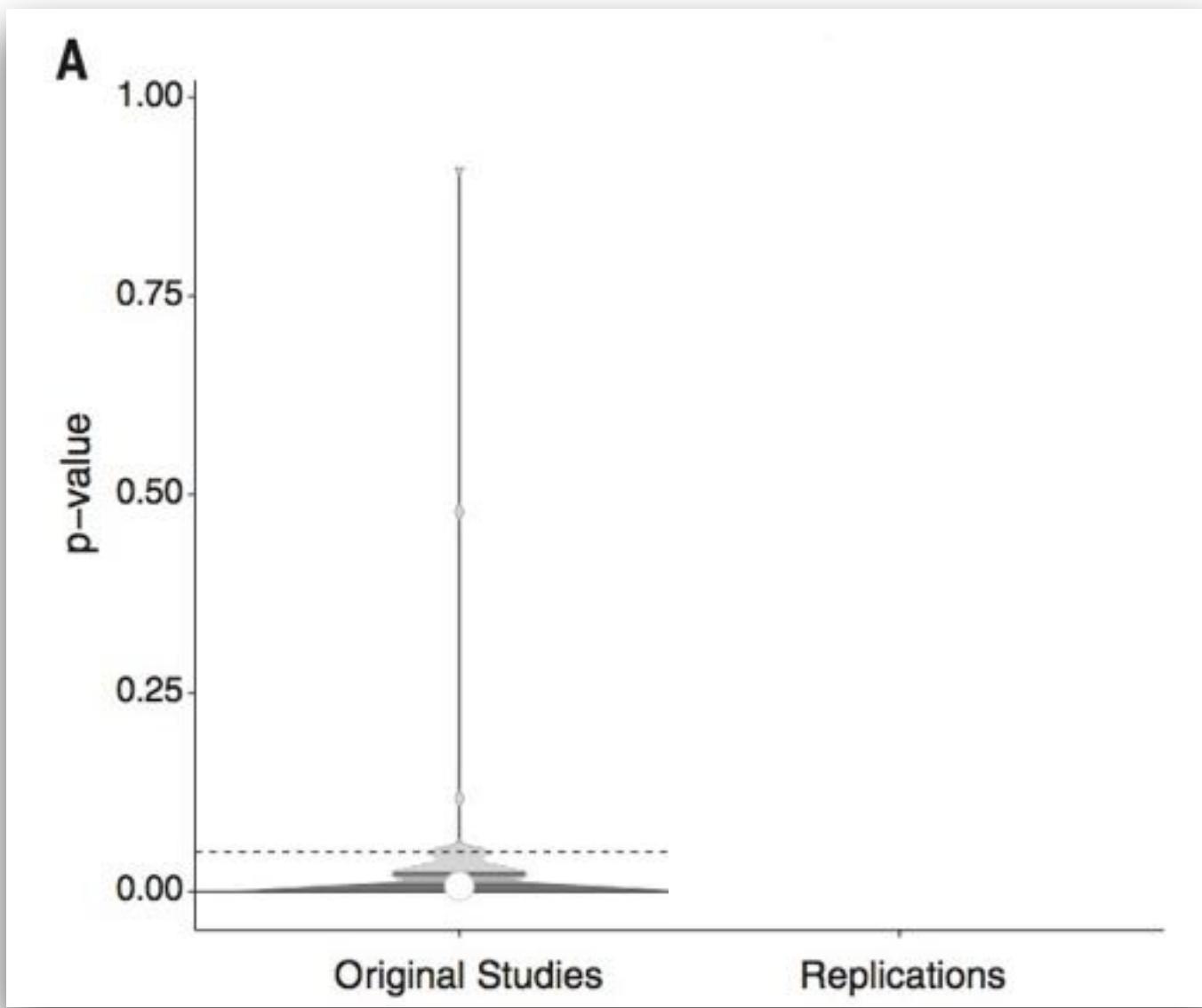
# Kahneman: Open Letter



Daniel Kahneman, Nobel prize 2002

I believe that you should  
collectively do something  
about this mess.

**I see a train wreck  
looming.**

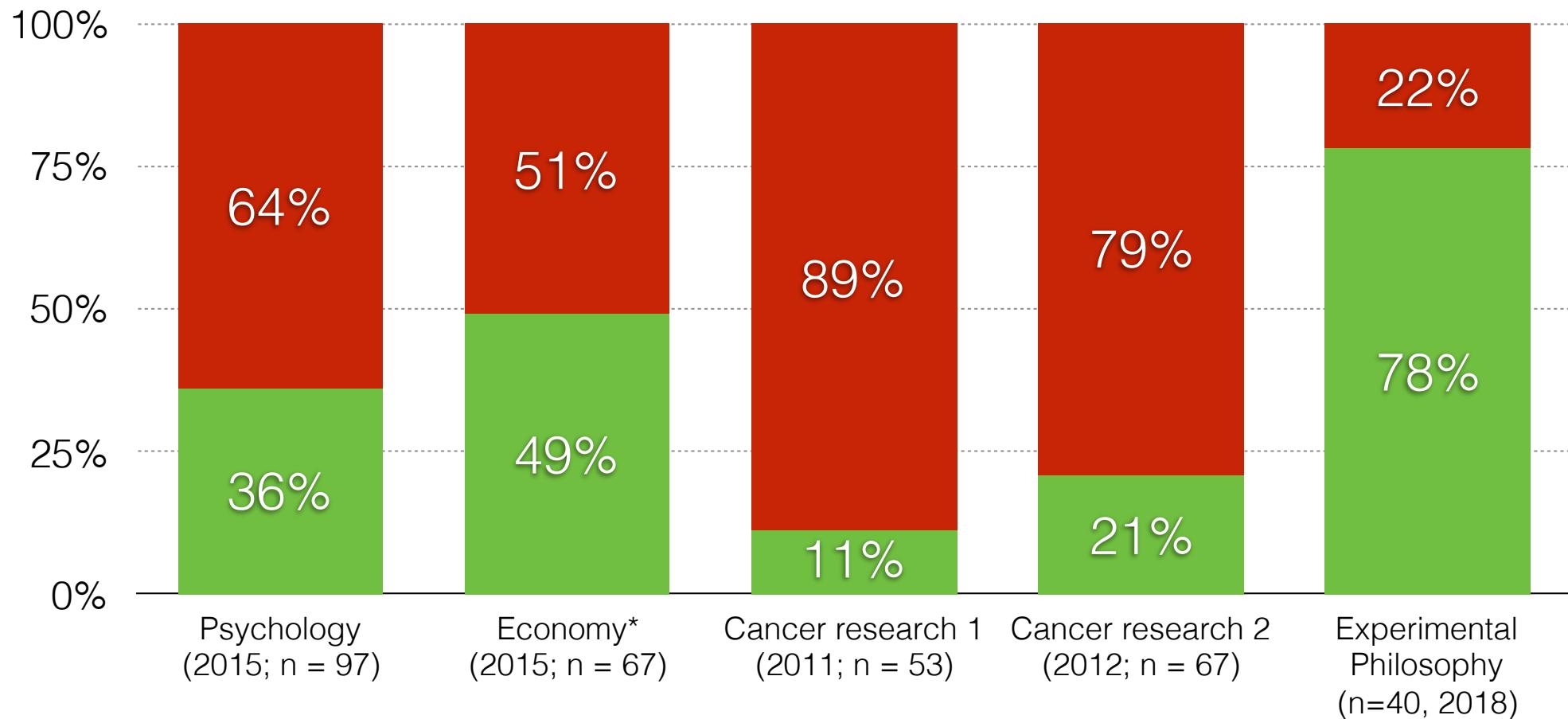


- 100 replications
- 36% of all replications were significant
  - PS - cog: 53%
  - JEP:LMC: 48%
  - PS - soc: 29%
  - JPSP - soc: 23%
- 83% of all effect sizes are smaller than the original:  
 $M_O: r = .40$   
 $M_R: r = .20$

# **Only psychology?**

An outlook to other disciplines.

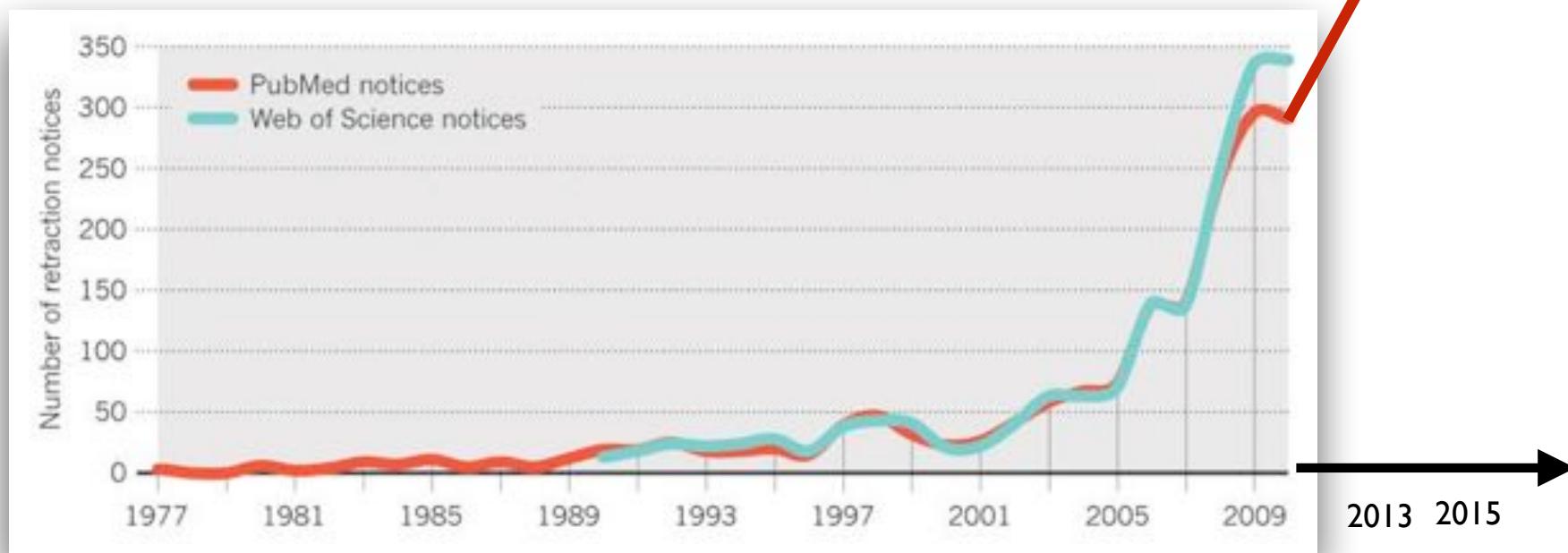
# Which part of published findings can be independently replicated?



\*The data on economics is about *reproducibility*; i.e. the attempt to get the same results if you apply the original data analysis on the original data set.

# Retractions: +1000% in 10 years

„In the past decade, the number of retraction notices has shot up 10-fold.“



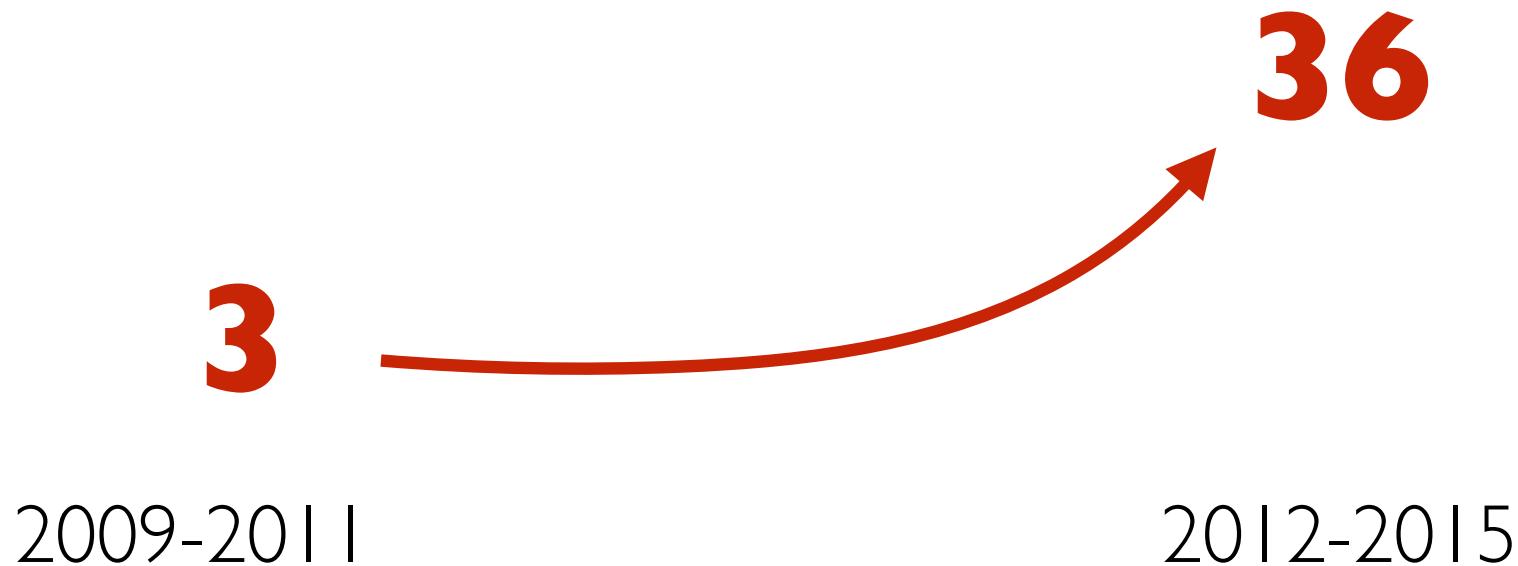
<http://www.nature.com/news/2011/111005/full/478026a/box/2.html>

<http://retractionwatch.com/2016/03/24/retractions-rise-to-nearly-700-in-fiscal-year-2015-and-psst-this-is-our-3000th-post/>

<https://www.washingtonpost.com/news/speaking-of-science/wp/2016/04/01/when-scientists-lie-about-their-research-should-they-go-to-jail/>

# Scientific misconduct: + 1200% in 4 years

U.S. Office of Research Integrity:



## Thesis:

Our current incentives foster questionable research practices, which decrease the truth value of our shared knowledge.

What is good for the individual careers of researchers leads to a collective fiasco.

Researchers who do it right (i.e., high power, no QRPs, transparency) have a clear competitive disadvantage.

## Anti-Thesis:

Society pays for us that we generate valid and robust knowledge.

Our incentives should be chosen in a way that they foster good science.

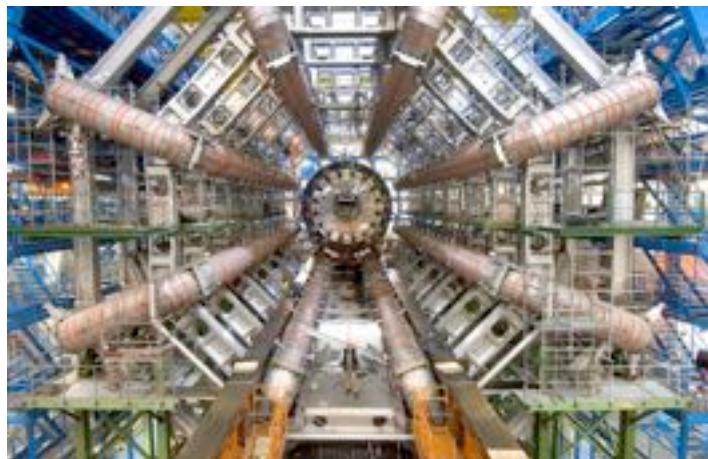
Researchers who do it right should be supported and promoted.

Best practice examples  
from other disciplines

# Physics: CERN

Built-in independent replication

ATLAS, 550 Mio €



CMS, 350 Mio €



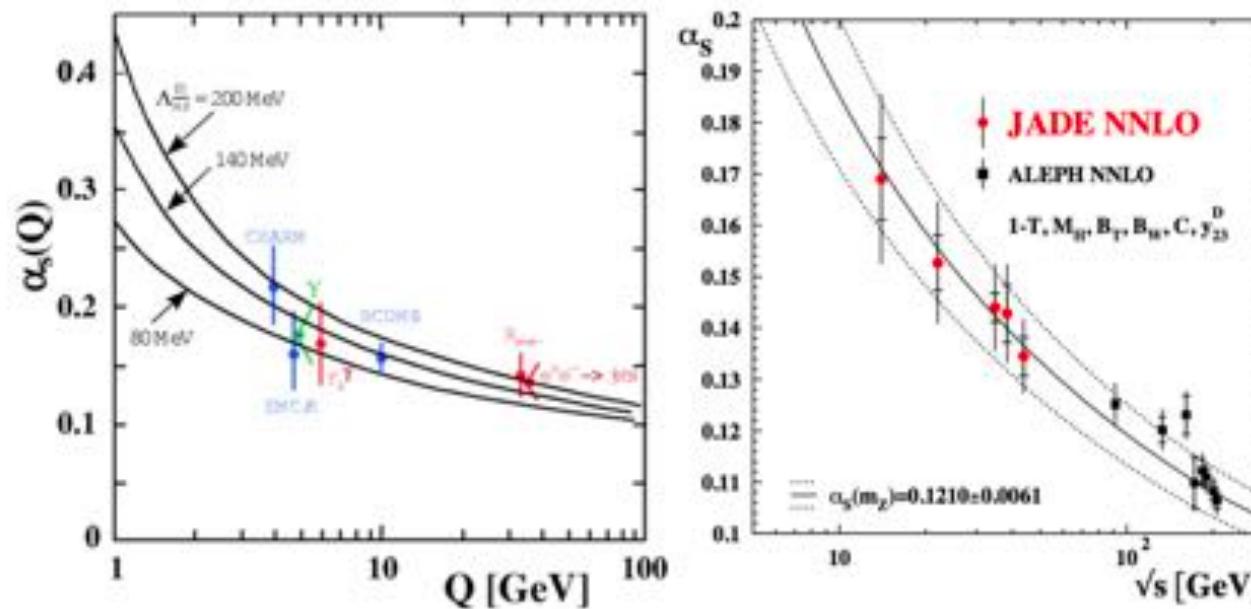
The biggest of these experiments, **ATLAS** and **CMS**, use general-purpose detectors to investigate the largest range of physics possible. Having two independently designed detectors is vital for cross-confirmation of any new discoveries made. **ALICE** and

→ Independent replication is built into the system. A „discovery“ is only declared as a discovery when it has been independently replicated

# Physics: Open Data

## Why? Uniqueness of data

- JADE experiment (1979–1986) on PETRA accelerator at DESY
- JADE data still cover unique  $e^+e^-$  energy range in 2017
- JADE data being re-analysed even  $\sim 35$  years later!



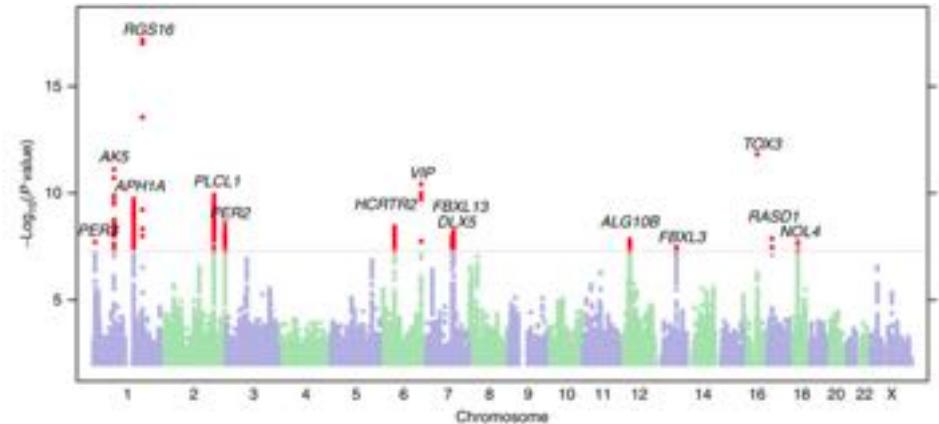
DPHEP <https://arxiv.org/abs/1205.4667>

# Chemistry

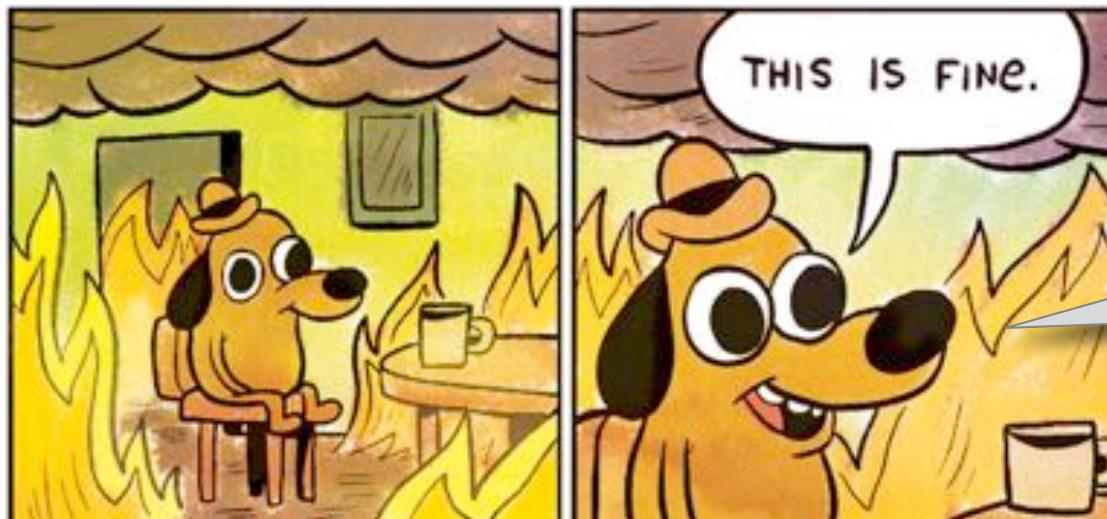
Danheiser is the editor-in-chief of the unconventional journal *Organic Syntheses* that has verified the experiments of all the papers it has published since it launched in 1921. The journal does this by having the research replicated by independent chemists before publishing them – a practice that is almost unheard of in chemistry or any other research field (the exception being a few brief instances in history). All experiments are checked for reproducibility in the lab of one of the journal's board of editors, often by graduate students and postdoctoral researchers working under the supervision of the *Organic Syntheses* editor.

Between 2010 and 2016, the journal rejected 7.5% of submissions due to irreproducibility of yield or selectivity, Danheiser notes. ‘Most chemists would consider that to be frightening,’ he adds, as papers in conventional journals are therefore less likely to be reproducible.

# Genome-wide associations studies

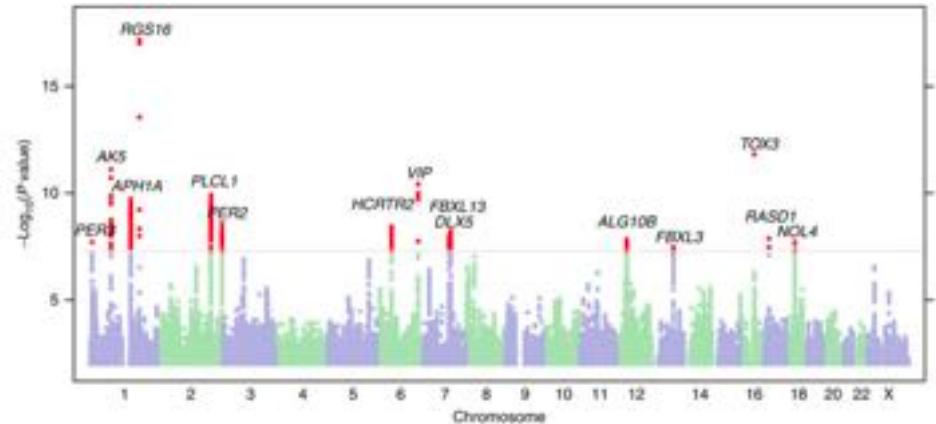


- „prior to 2005, the field was largely a scientific wasteland scattered with the embarrassing and wretched corpses of unreplicated genetic association studies“  
(Daniel MacArthur, 2009)



© KC Green

# Genome-wide associations studies



- „prior to 2005, the field was largely a scientific wasteland scattered with the embarrassing and wretched corpses of unreplicated genetic association studies“  
(Daniel MacArthur, 2009)
- But after that ...
  - ✓ new statistical standard of evidence:  $p < .0000005$
  - ✓ independent replication is standard
  - ✓ all raw data are shared openly (e.g., European Genome-phenome Archive)

The new way of doing research:

A scientific framework  
for the 21. century

Credible Science

Open Science

Open Access

Open Source  
(Software)

Open Data

Open Peer Review

Open Material

Open Educational  
Resources

# Open Science Badges



Roberta Michnick Golinkoff, Amy Pace, Paula K. S. Yust, and Katharine Suma

## The Contribution of Early Communication Quality to Low-Income Children's Language Success

Psychological Science July 2015 26: 1071-1083, first published on June 5, 2015

doi:10.1177/0956797615581493

[Abstract](#)

[Full Text](#)

[Full Text \(PDF\)](#)



[Request Permissions](#)

- Helen Colby, Jeff DeWitt, and Gretchen B. Chapman

## Grouping Promotes Equality: The Effect of Recipient Grouping on Allocation of Limited Medical Resources

Psychological Science July 2015 26: 1084-1089, first published on June 15, 2015

doi:10.1177/0956797615583978



[Abstract](#)

[Full Text](#)

[Full Text \(PDF\)](#)



[Supplemental Material](#)

[Request Permissions](#)

---

## ▲ Research Reports

- Samantha P. Fan, Zoe Liberman, Boaz Keysar, and Katherine D. Kinzler

## The Exposure Advantage: Early Exposure to a Multilingual Environment Promotes Effective Communication

Psychological Science July 2015 26: 1090-1097, first published on May 8, 2015

doi:10.1177/0956797615574699



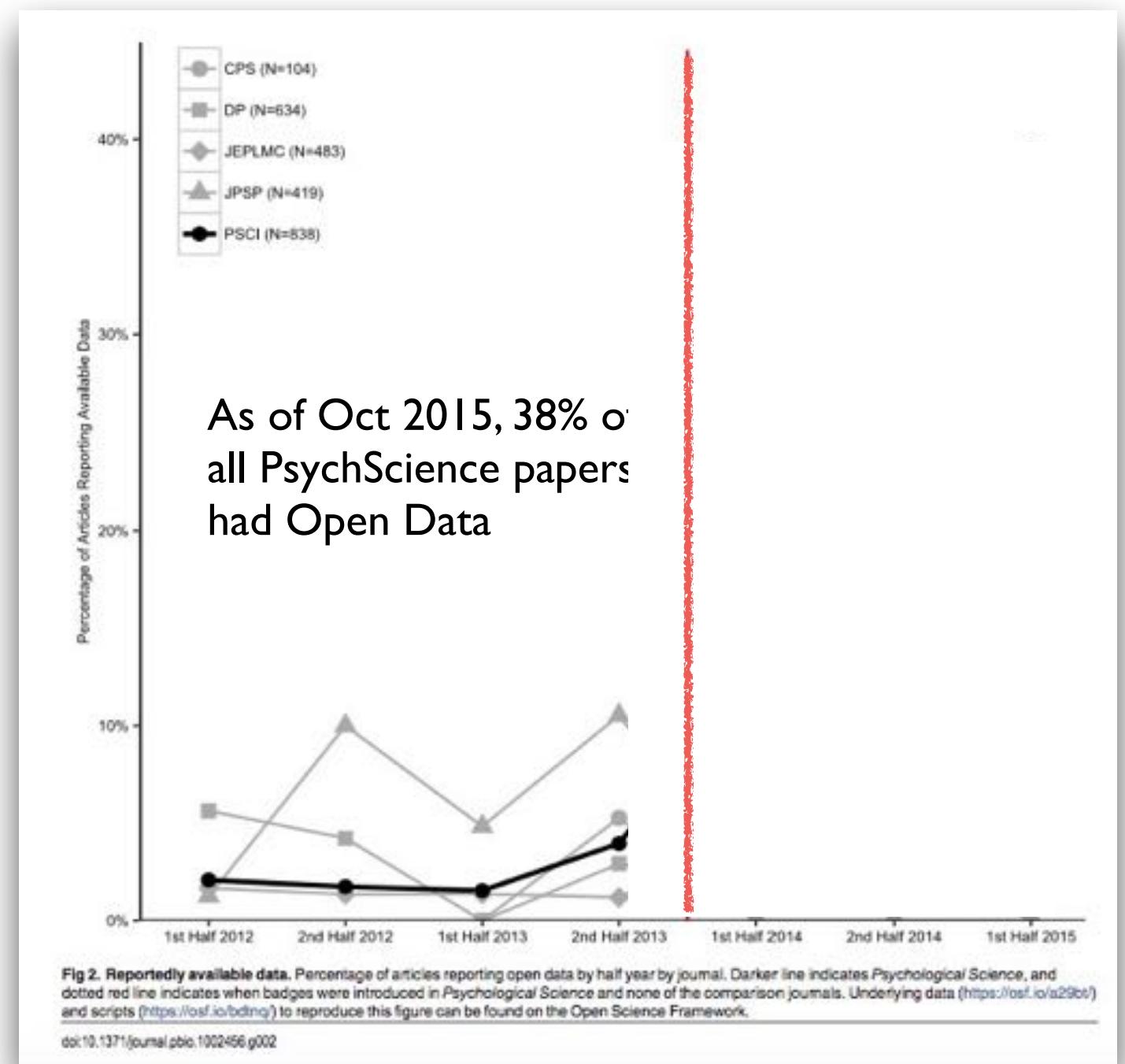


# Open Science Badges

<https://osf.io/tvyxz/wiki/home/>



Kidwell, M. C., Lazarević, L. B., Baranski, E., Hardwicke, T. E., Piechowski, S., Falkenberg, L.-S., et al. (2016). Badges to Acknowledge Open Practices: A Simple, Low-Cost, Effective Method for Increasing Transparency. PLoS Biology, 14(5), e1002456–15. <http://doi.org/10.1371/journal.pbio.1002456>

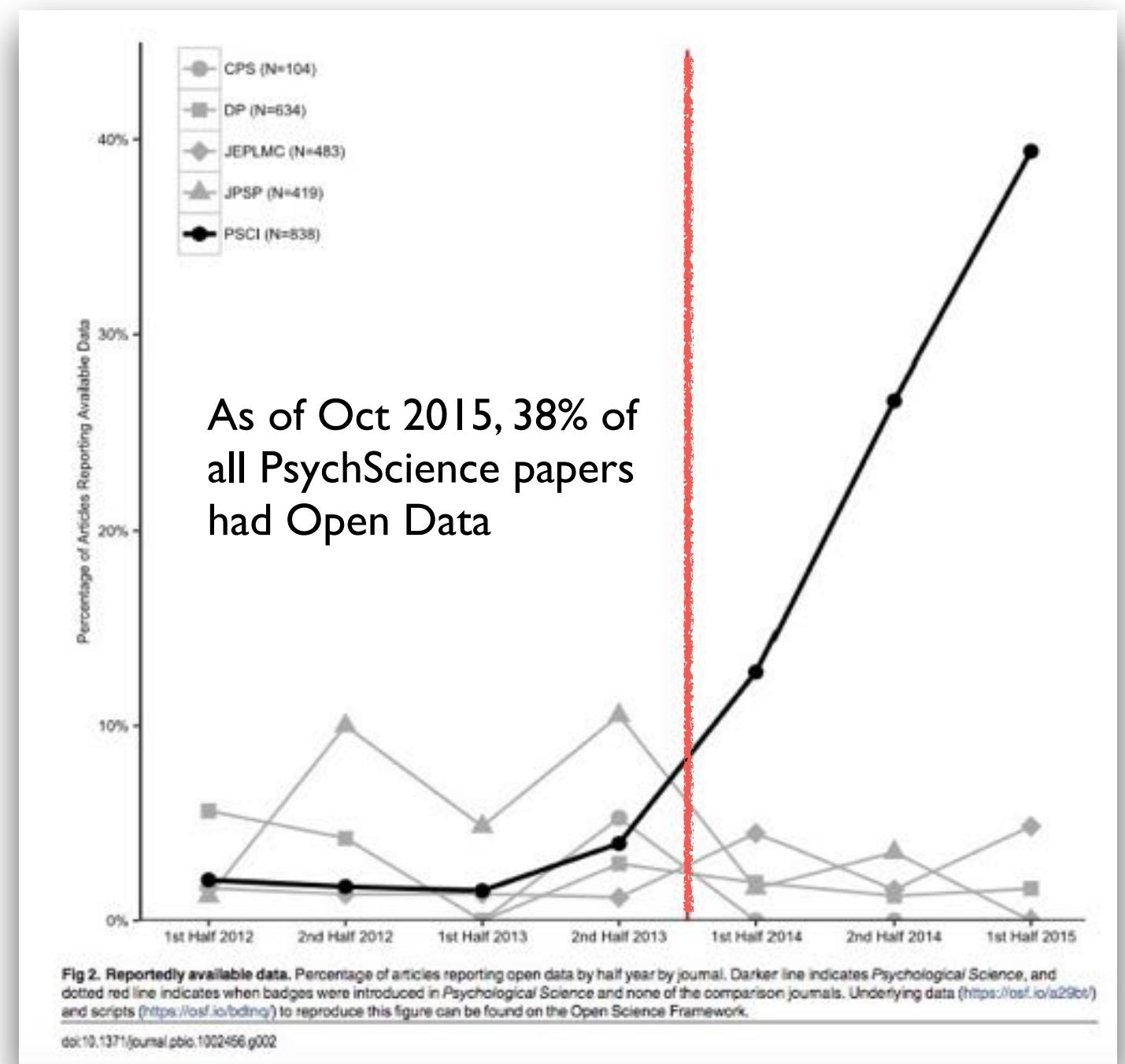


# Open Science Badges

<https://osf.io/tvyxz/wiki/home/>



Kidwell, M. C., Lazarević, L. B., Baranski, E., Hardwicke, T. E., Piechowski, S., Falkenberg, L.-S., et al. (2016). Badges to Acknowledge Open Practices: A Simple, Low-Cost, Effective Method for Increasing Transparency. PLoS Biology, 14(5), e1002456–15. <http://doi.org/10.1371/journal.pbio.1002456>



# Consider the GDPR!

see, for example, the slides for the workshop „Maintaining privacy with open data“ from Ruben Arslan: <https://osf.io/9j27d/>

The image shows a presentation slide with a teal header. In the header, the Max-Planck-Institut für Bildungsforschung logo and the text 'Max-Planck Institute for Human Development' are visible, along with icons for a person, a document, and a gear. The main title 'Maintaining privacy with open data' is centered in large, bold, black font. Below the title, the author's name 'Ruben Arslan' and the date 'Munich, February 23, 2018' are listed. At the bottom left, there is an email address 'ruben.arslan@gmail.com' and a Twitter handle '@rubenarslan'. At the bottom right, there is a link 'blog: http://the100.ci'.

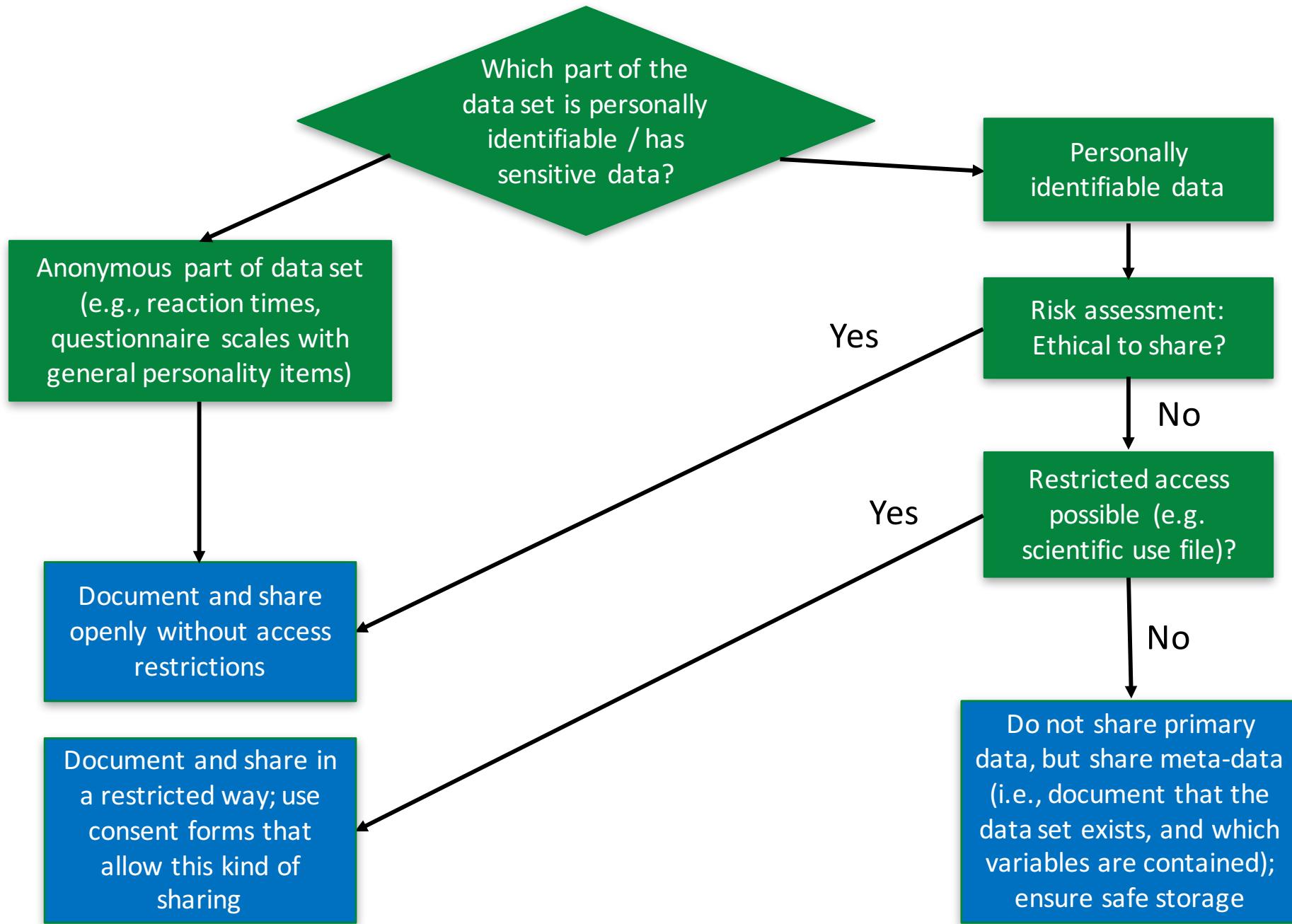
Maintaining privacy  
with open data

Ruben Arslan  
Munich, February 23, 2018

[ruben.arslan@gmail.com](mailto:ruben.arslan@gmail.com)  
[@rubenarslan](https://twitter.com/rubenarslan)

blog: <http://the100.ci>

# I have videos, so I cannot share! (?)



Open data and analytical flexibility

# Many names for the same idea . . .

- Sensitivity/ robustness analysis
- Multiverse analysis (Steegen et al., 2016)
- Specification curve (Simonsohn et al., 2015)
- Vibration of effects (Patel et al., 2015)
- Ensemble approach (e.g. climatology)
  - use a set of models with the same input data to produce a range of outcomes

# **Revisiting the Power Pose Effect: How Robust Are the Results Reported by Carney, Cuddy, and Yap (2010) to Data Analytic Decisions?**

**Marcus Credé<sup>1</sup> and Leigh A. Phillips<sup>1</sup>**

Social Psychological and Personality Science  
1-7  
© The Author(s) 2017  
Reprints and permission:  
[sagepub.com/journalsPermissions.nav](http://sagepub.com/journalsPermissions.nav)  
DOI: [10.1177/1948550617714584](https://doi.org/10.1177/1948550617714584)  
[journals.sagepub.com/home/spp](http://journals.sagepub.com/home/spp)  


- A “multiverse analysis” (Steegen, Tuerlinchx, Gelman, & Vanpaemel, 2016): Report results for all plausible analytical decisions
- Check robustness of results: Do several analytical paths lead to comparable conclusions?
- Based on open data by Carney et al. (2010)

Table I. Multiverse Analysis for the Effect of Power Posing on Testosterone.

Gender Effect	Control Variables	Outlier Identification: Entire Sample (N = 39)		Outlier Identification: Test Conditioned on Gender (N = 41)		Outlier Identification: Multivariate or No Exclusion (N = 42)	
		DV: T2 Test.	DV: Δ in Test.	DV: T2 Test.	DV: Δ in Test.	DV: T2 Test.	DV: Δ in Test.
Combined	Gender		.047 (p = .19)		.019 (p = .39)		.036 (p = .23)
Combined	Gender and TI test.	.029 (p = .31)		.042 (p = .21)		.055 (p = .15)	
Combined	Gender and TI cort.		.045 (p = .21)		.017 (p = .43)		.018 (p = .42)
Combined	Gender, TI test., and TI cort.	.037 (p = .26)		.040 (p = .23)		.043 (p = .21)	
Combined	TI cort. and T2 cort.		.089 (p = .07)		.038 (p = .23)		.037 (p = .24)
Combined	Gender, TI test., TI cort., and T2 cort.	<b>.123 (p = .04)</b>		.099 (p = .06)		.102 (p = .051)	
Men only	No controls		.192 (p = .13)		.047 (p = .44)		.096 (p = .24)
Men only	TI test.	.000 (p = .96)		.073 (p = .35)		.101 (p = .25)	
Men only	TI cort.		.184 (p = .17)		.121 (p = .22)		.063 (p = .37)
Men only	TI test. and TI cort.	.026 (p = .64)		.104 (p = .28)		.083 (p = .32)	
Men only	TI cort. and T2 cort.		.162 (p = .22)		.141 (p = .21)		.057 (p = .41)
Men only	TI test., TI cort., and T2 cort.	.026 (p = .66)		.125 (p = .26)		.086 (p = .33)	
Women only	No controls		.005 (p = .73)		.005 (p = .73)		.005 (p = .73)
Women only	TI test.	.019 (p = .51)		.019 (p = .51)		.019 (p = .51)	
Women only	TI cort.		.005 (p = .75)		.005 (p = .75)		.005 (p = .75)
Women only	TI test. and TI cort.	.023 (p = .48)		.023 (p = .48)		.023 (p = .48)	
Women only	TI cort. and T2 cort.		.077 (p = .19)		.077 (p = .19)		.077 (p = .19)
Women only	TI test., TI cort., and T2 cort.	.167 (p = .053)		.167 (p = .053)		.167 (p = .053)	

Note. Entries are partial  $\eta^2$  values and (in parentheses) the associated p value. The entry in boldface is the effect for the analyses originally reported in the Carney, Cuddy, and Yap (2010) paper. Blank entries mean that the analyses would not be recommended for reasons described in the text. The number of women was constant across the three outlier strategies. DV = dependent variable; Test. = testosterone; cort. = cortisol; TI = premanipulation; T2 = postmanipulation.

Of 54 plausible analyses exactly **one** was significant.

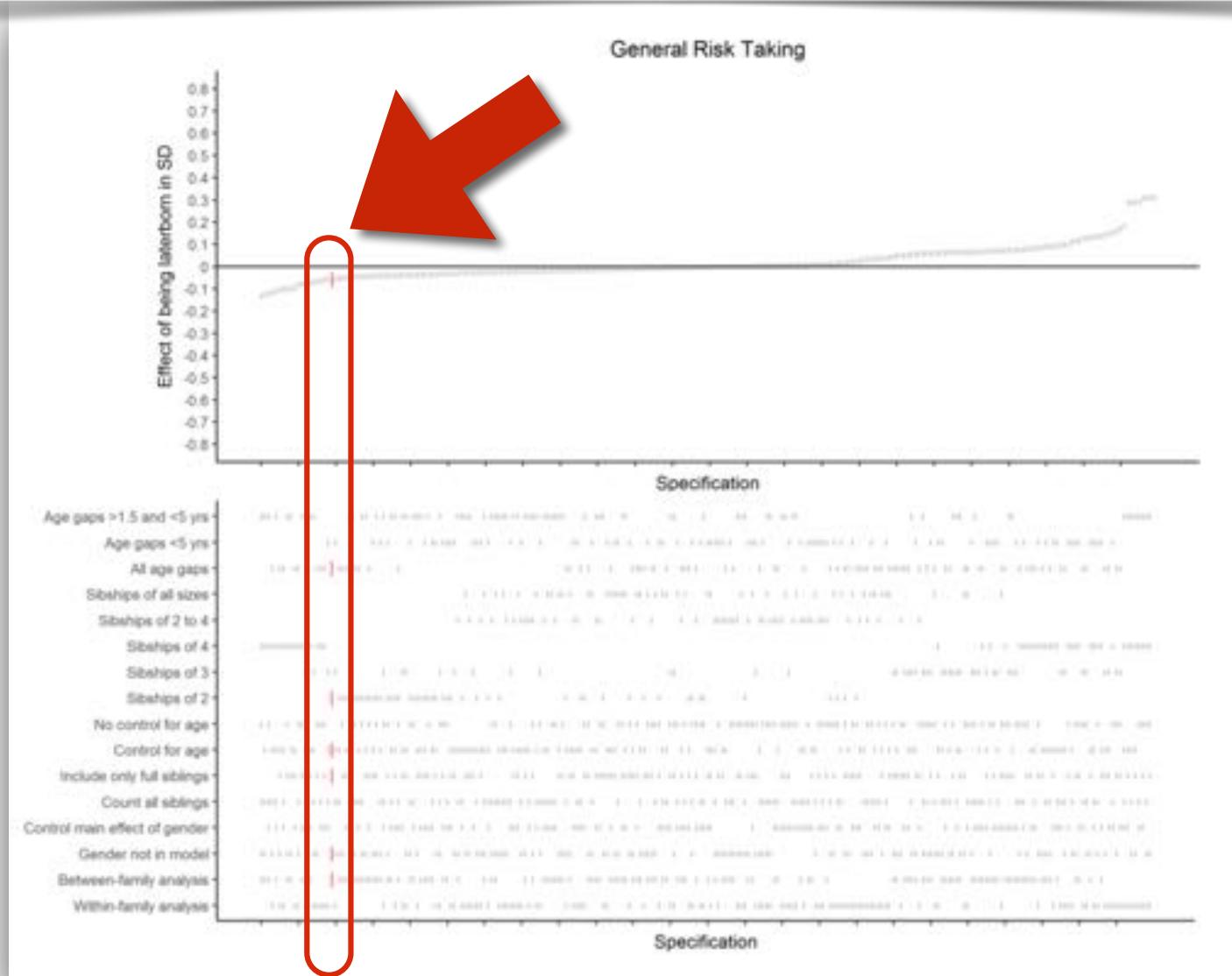
Guess which has been reported in the original paper?

# Open Letter by Dana Carney (2016)

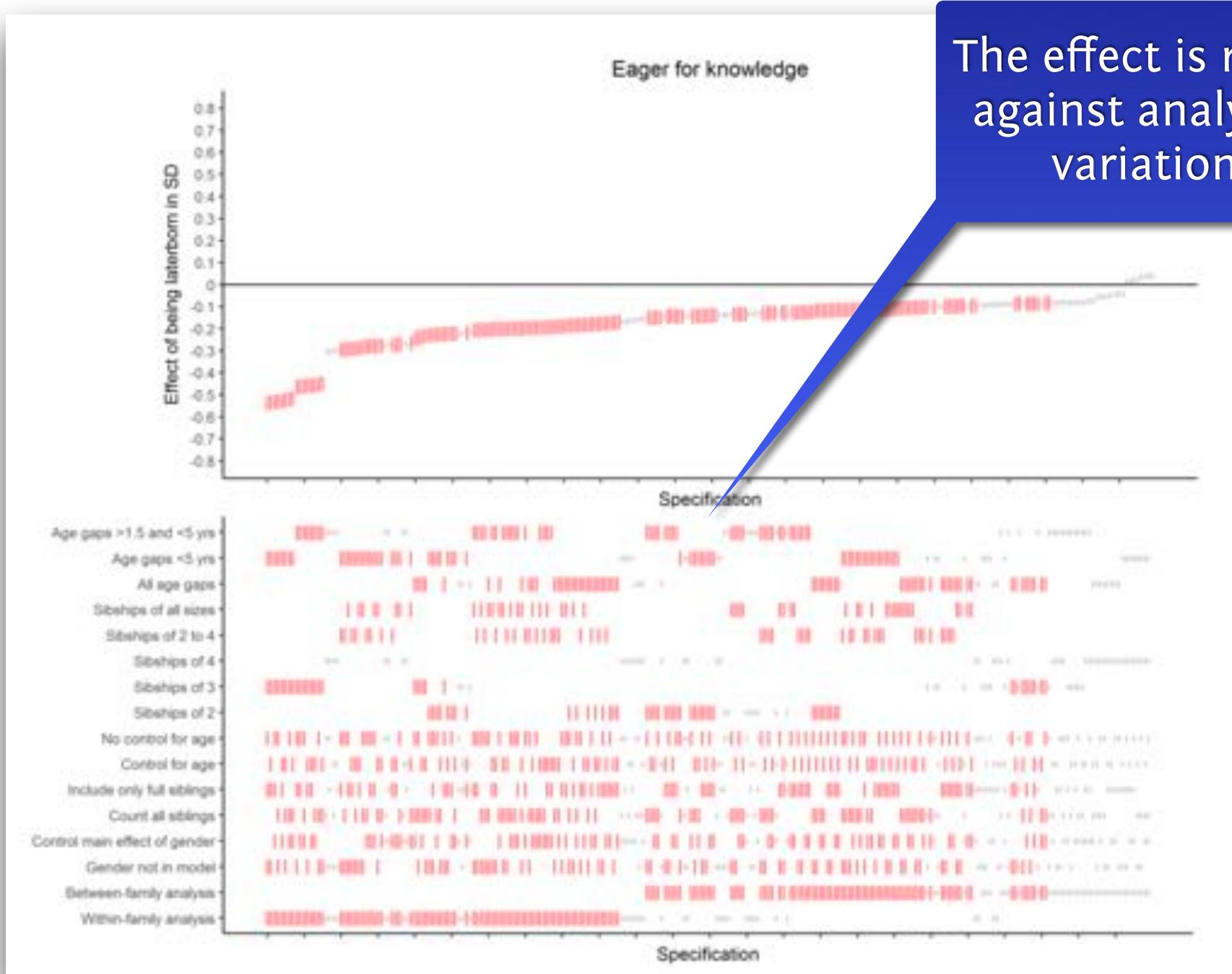
5. Initially, the primary DV of interest was risk-taking. We ran subjects in chunks and checked the effect along the way. It was something like 25 subjects run, then 10, then 7, then 5. Back then this did not seem like p-hacking. It seemed like saving money (assuming your effect size was big enough and p-value was the only issue).
6. Some subjects were excluded on bases such as "didn't follow directions." The total number of exclusions was 5. The final sample size was  $N = 42$ .
7. The cortisol and testosterone data (in saliva at that point) were sent to Salimetrics (which was in State College, PA at that time). The hormone results came back and data were analyzed.
8. For the risk-taking DV: One p-value for a Pearson chi square was .052 and for the Likelihood ratio it was .05. The smaller of the two was reported despite the Pearson being the more ubiquitously used test of significance for a
10. The self-report DV was p-hacked in that many different power questions were asked and those chosen were the ones that "worked."

# Probing Birth-Order Effects on Narrow Traits Using Specification Curve Analysis

Julia M. Rohrer<sup>1,2</sup>, Boris Egloff<sup>3</sup>, Stefan C. Schmukle<sup>2</sup>



The effect is robust  
against analytical  
variations





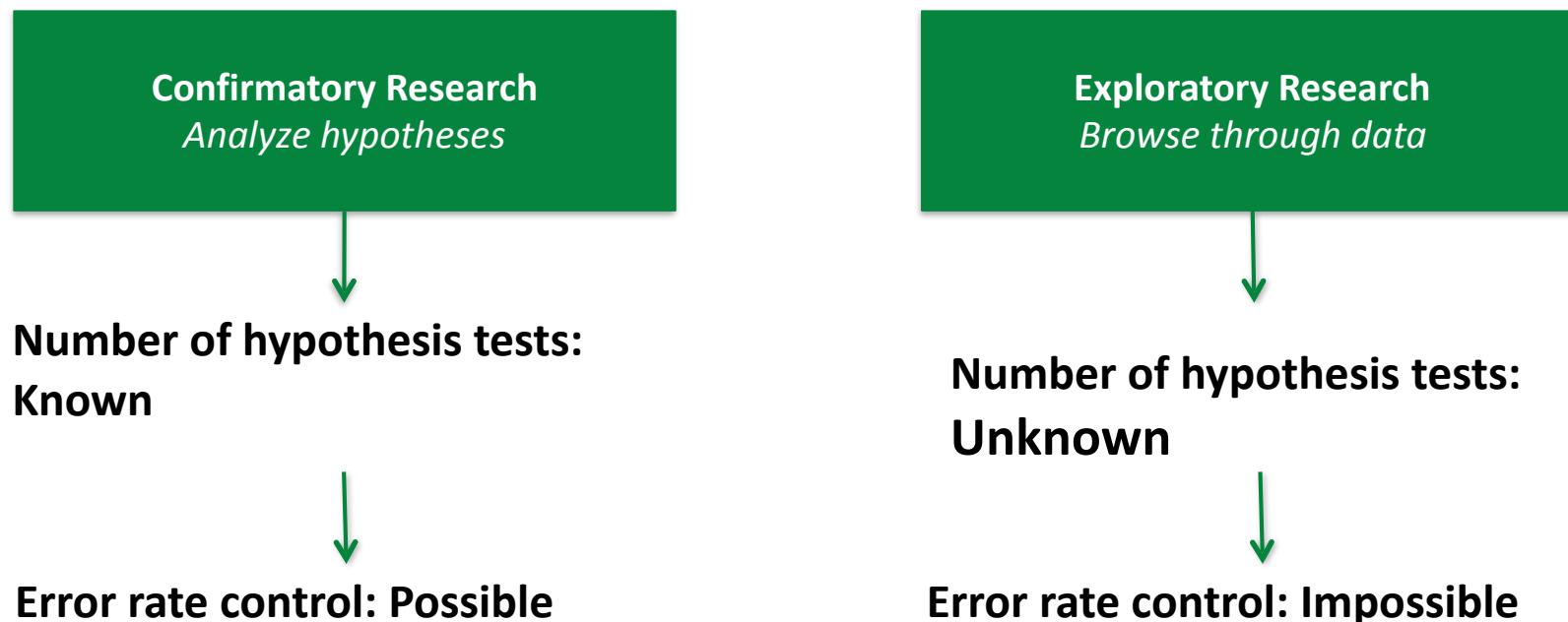
# What is a preregistration?

„The specification of a research design,  
hypotheses, and analysis plan prior to observing  
the outcomes of a study“

**Nosek & Lindsay (2018)**

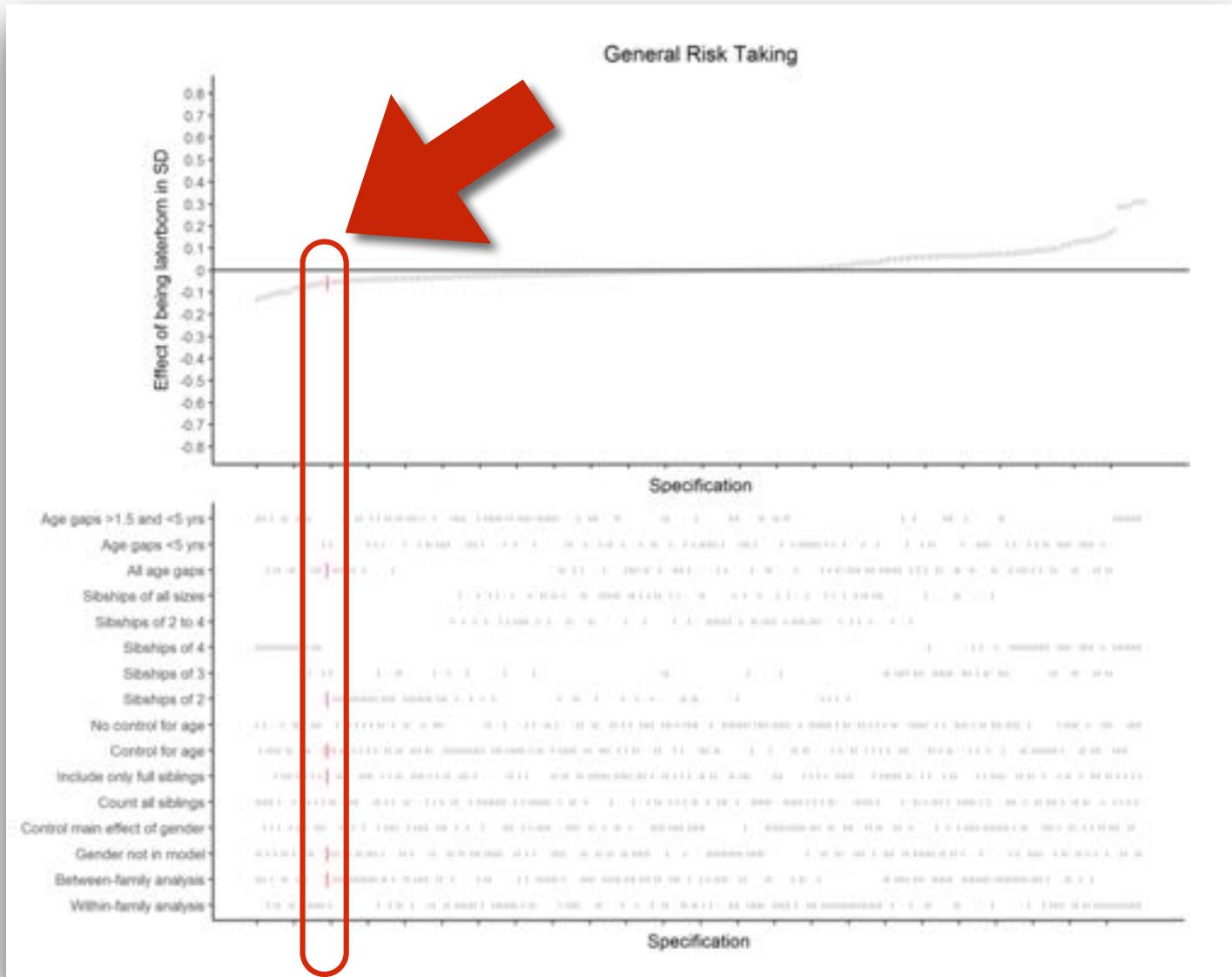
# Why preregistration?

## 1. Clear distinction between confirmatory and exploratory research



# Why preregistration?

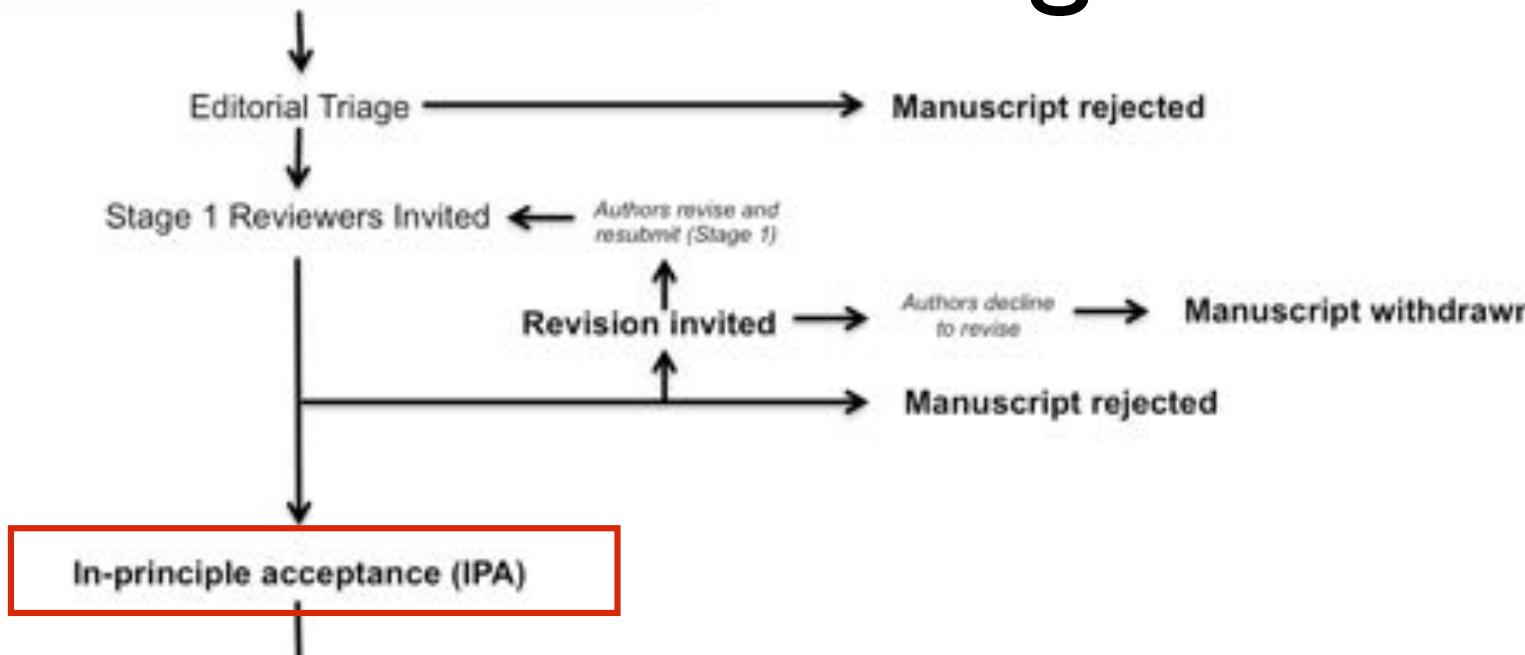
## 2. Prevent *p*-hacking and QRPs



**Stage 1 Registered Report**  
Peer review of Introduction, Method, Proposed Analyses,  
and Pilot Data (if applicable)

# Registered Reports

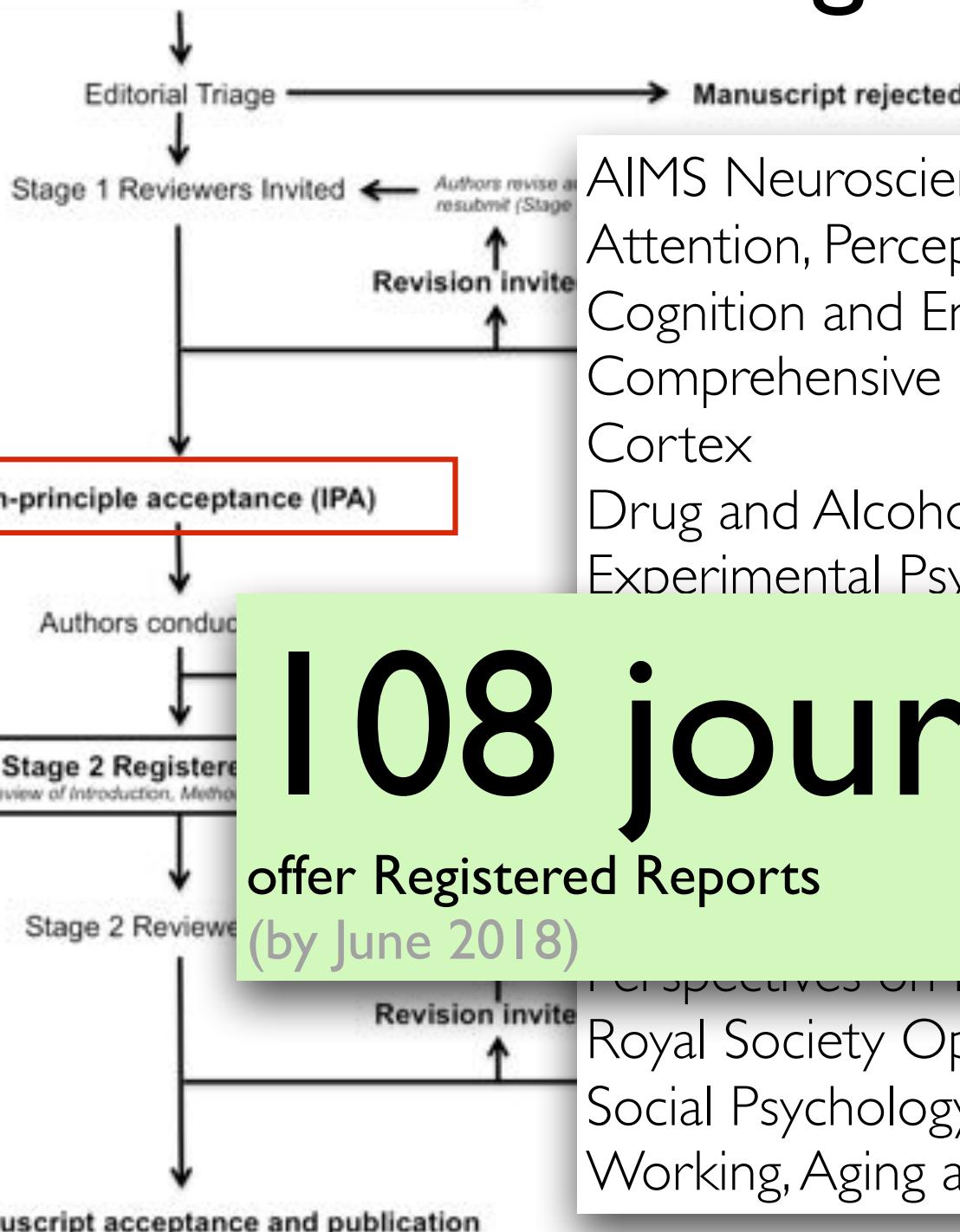
<https://cos.io/rr/>



**Stage 1 Registered Report**  
Peer review of Introduction, Method, Proposed Analyses,  
and Pilot Data (if applicable)

# Registered Reports

<https://cos.io/rr/>



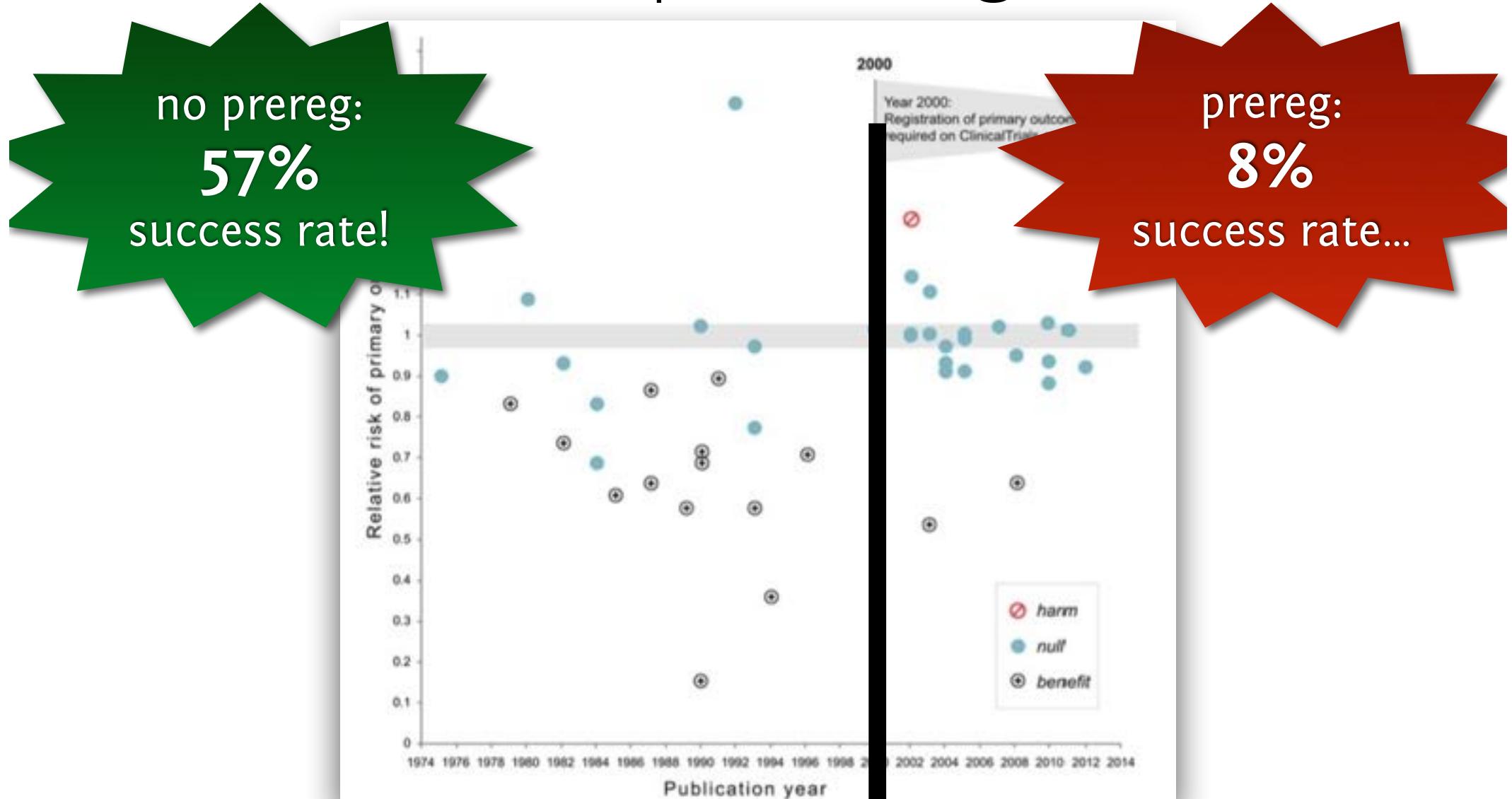
AIMS Neuroscience  
Attention, Perception, and Psychophysics  
Cognition and Emotion  
Comprehensive Results in Social Psychology  
Cortex  
Drug and Alcohol Dependence  
Experimental Psychology

108 journals

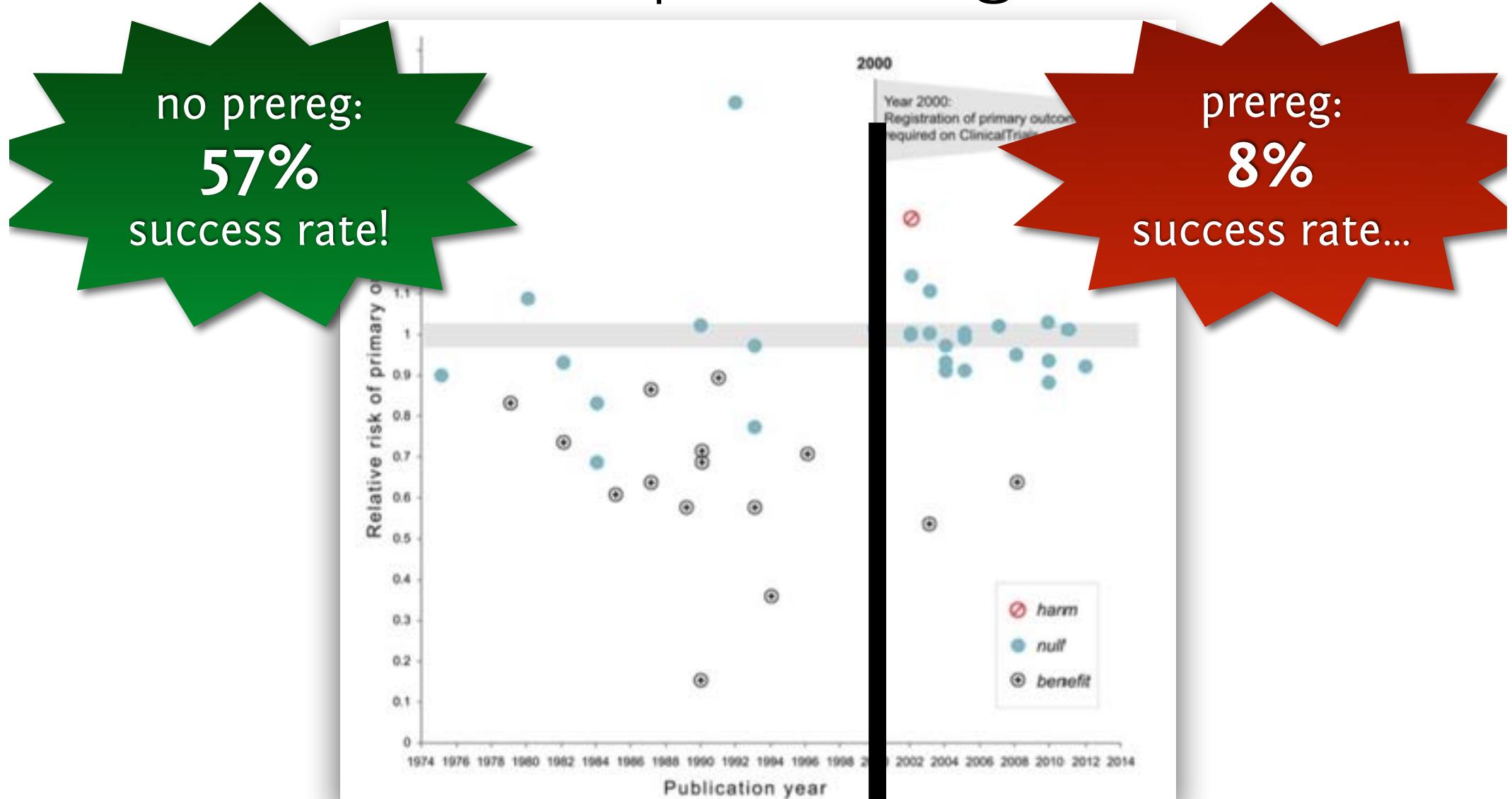
offer Registered Reports  
(by June 2018)

Frontiers in Psychological Science  
Perspectives on Psychological Science  
Royal Society Open Science  
Social Psychology  
Working, Aging and Retirement

# Pre-registration causes medicines to stop working!



# Pre-registration causes **p-hacking** medicines to stop working!



**OPEN**  **ACCESS**

# Beyond commercial publishers

Meta-Psychology, 2017, pp. 1-3  
Article type: Editorial  
Published under the CC-BY4.0 license

Pre-print doi: NA  
Paper doi:10.13628/MP2017.0001  
Review doi:NA

Edited by: Rickard Carlsson  
Reviewed by: Not peer-reviewed

## Inaugural Editorial of Meta-Psychology

Rickard Carlsson, Henrik Danielsson, Moritz Heene, Åse Innes-Ker, Daniël Lakens, Ulrich Schimmack, Felix D. Schönbrodt, Marcel van Assen, Yana Weinstein

In 1957 Robert K. Merton wondered how historians living in 2050 would look back at how the sociology of science developed, and predicted that they would see a 'spacious area of neglect' (Merton, 1957, p. 635). Sixty years later, we might safely make a similar prediction about how future historians will look back at the psychology of science. Science is a social enterprise, and psychologists are ideally suited to study the inter- and intra-individual processes that impact how science is done. One specific area within the psychology of science is the psychology of psychological science, and we refer to this as meta-psychology.

The past several years has seen increased focus on analyzing the systemic and psychological factors that threatens the validity of research in general, and

psychological research; a journal that questions the basic assumptions of research paradigms and monitors the progress of psychological science as a whole. The new journal *Meta-Psychology* aims to provide a platform for academic work on the psychology of psychological science, as well as an outlet for new types of contributions, such as high quality post-publication peer reviews, articles that empty the file-drawers of researchers, and registered reports.

**Psychology Needs a Journal Dedicated to Meta-Psychology**

Most scientific journals focus on publishing original research articles or review articles (including meta-analyses) of studies on a particular topic. So far there

- ✓ Full open access, no APCs
- ✓ Non-commercial institutional publisher (Linnaeus U library)
- ✓ Open, citable peer review (with doi)
- ✓ Well-powered null results and direct replications welcomed
- ✓ Registered Reports as option
- ✓ Mandatory open data
- ✓ Open Science badges (including a reproducibility badge)
- ✓ Special article formats, e.g. „Empty your file-drawer“

The European Open-Access Publishing Platform for Psychology

 **PsychOpen**  
publishing psychology

Browse Publications   For Editors   For Authors

Home

● ● Featured Publications



**Qualitative Content Analysis**  
by Philipp Mayring (2014). Theoretical Foundation, Basic Procedures and Software Solution. [more](#)

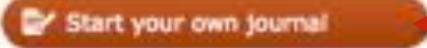


**EJOP**  
**Europe's Journal of**  
**PSYCHOLOGY**  
ISSN 1614-0309



**JNC**  
**Journal of**  
**Numerical Cognition**  
ISSN 2296-471X

Search publications  

 [Start your own journal](#)

 [Submit your article](#)

● ● News

12.05.2017 [Note-taking is more effective for Recall Ability than Doodling](#)

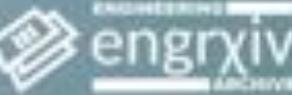
 An article in the latest issue of Psychological Thought discusses the question whether doodling has...

Red arrow pointing from the "Submit your article" button towards the "PsychOpen publishing psychology" logo.

# COS launches branded preprint servers

Preprint Services

Leading preprint service providers use this open source infrastructure to support their communities:

**AgriXiv**  Earth  ArXiv  FocusUS Archive 

Create your own branded preprint servers backed by the OSF.

Check out the [open source code](#) and the [requirements and road map](#). Input welcome!

[Contact us](#)

16 preprint services with > 2 million searchable preprints.

# Open Science as a strategic benefit

McKiernan, E. C., Bourne, P. E., Brown, C. T., Buck, S., Kenall, A., Lin, J., et al. (2016). How open science helps researchers succeed. *eLife*, 5, e16800. <http://doi.org/10.7554/eLife.16800>

# Journals with mandatory open data (or justification why not)

- Advances in Methods and Practices in Psychological Science (AMPPS)
- Archives of Scientific Psychology
- BMC Psychology
- Collabra: Psychology
- Cognition
- Comprehensive Results in Social Psychology
- European Journal of Personality (EJP)
- European Journal of Social Psychology (EJSP)
- Evolution and Human Behavior
- Experimental Psychology
- Journal of Economic Psychology
- Journal of Open Psychology Data (JOPD)
- Journal of Research in Personality
- Judgment and Decision Making
- Journal of Cognition
- Meta-Psychology
- PLOS ONE
- Royal Society Open Science
- Science

For a continuously updated list, see here: <https://osf.io/tbkzh/wiki/Psychology%20journals%20with%20mandatory%20open%20data/> 57

“dass die Daten unmittelbar nach Abschluss der Forschungen oder nach wenigen Monaten **der Öffentlichkeit frei zur Verfügung gestellt werden.**“

Das Engagement [ ... ] von Wissenschaftlern und Wissenschaftlerinnen um die Verfügbarmachung von Forschungsdaten sollten bei der **Würdigung von wissenschaftlichen [ ... ] Leistungen** zukünftig stärker berücksichtigt werden.

## Der Umgang mit Forschungsdaten im Fach Psychologie: Konkretisierung der DFG-Leitlinien

Im Auftrag des DGPs Vorstands (17.09.2016)

Felix Schönbrodt, Mario Gollwitzer und Andrea Abele-Brehm

Die vorliegenden Empfehlungen sollen – als einer von mehreren Bausteinen – zur Qualitätssicherung der psychologischen Forschung beitragen. Sie sind getragen von der Idee einer offenen und transparenten Wissenschaft,

en zur disziplinspezifischen Nutzung und Bereitstellung von Forschungsdaten zu entwickeln<sup>4</sup>. Die Deutsche Gesellschaft für Psychologie (DGPs) schließt sich den Zielen der DFG und der Allianz der Wissenschaftsorganisationen an



Felix Schönbrodt

@nicebread303

Next funding scheme of EU is called "Horizon Europe", with 100.000.000.000 € (2021-2027). You want funding? Then consider:

"The principle of 'open science' will become the modus operandi of Horizon Europe, requiring open access to publications and data"

[europa.eu/rapid/press-rele...](http://europa.eu/rapid/press-rele...)

Tweet übersetzen

23:09 - 25. Juni 2018

[http://europa.eu/rapid/press-release\\_IP-18-4041\\_en.htm](http://europa.eu/rapid/press-release_IP-18-4041_en.htm)



An der Fakultät für Psychologie und Pädagogik der Ludwig-Maximilians-Universität München ist zum Wintersemester 2016/2017 eine

## Professur (W3) für Sozialpsychologie (Lehrstuhl)

Das Department Psychologie legt Wert auf transparente und replizierbare Forschung und unterstützt diese Ziele durch Open Data, Open Material und Präregistrierungen. Bewerber/innen werden daher gebeten, in ihrem Anschreiben darzulegen, auf welche Art und Weise sie diese Ziele bereits verfolgt haben und in Zukunft verfolgen möchten.



Am Fachbereich 07 - Psychologie und Sportwissenschaft, Institut für Psychologie - der Westfälischen Wilhelms-Universität Münster ist zum nächstmöglichen Zeitpunkt eine

## Professur (W 2 BBesO) für Pädagogische Psychologie

zu besetzen.

Das Fach Psychologie in Münster legt Wert auf transparente und replizierbare Forschung und unterstützt Open Science Praktiken. Bewerber/-innen werden gebeten, in ihren Bewerbungsunterlagen darzulegen, auf welche Art und Weise sie diese Praktiken bereits verfolgt haben und/oder in Zukunft verfolgen möchten.

+ 3 additional professorship job descriptions

The Department of Psychology at the Faculty of Human Sciences of the University of Cologne (UoC) seeks to appoint a

## Full Professor (W3) of Social Psychology

to be filled as soon as possible.

The Department of Psychology aims for transparent and reproducible research (including Open Data, Open Materials, and Preregistrations). Applicants are asked to illustrate how they have pursued these goals in the past and/or how they plan to do so in the future.



Google™ benutzerdefinierte SU



www.lmu.de Sitemap

Startseite • Psychologie • Open-Science-Committee • Recognizing Open Research Practices in Our Hiring Policy

 drucken

FAKULTÄT

STUDIUM

FORSCHUNG

PSYCHOLOGIE

Studium und Lehre

Forschung

Open-Science-Committee

About our OSC

Recognizing Open Research Practices in Our Hiring Policy

Workshops and Talks

Lehr- und Forschungseinheiten

Ambulanzen und Testlab

## Recognizing Open Research Practices in Our Hiring Policy

In December 2015, the Department Psychology of the LMU Munich added a paragraph to a [professorship announcement](#) which emphasized the department's commitment to responsible research and asked applicants to write a short statement about their open science practices:

*"Our department embraces the values of open science and strives for replicable and reproducible research. For this goal we support transparent research with open data, open materials, and study pre-registration. Candidates are asked to describe in what way they already pursued and plan to pursue these goals."*

Since then, all further professorship job advertisements of our department had this requirement.

**In May 2018, the department's steering committee unanimously voted for an explicit policy to always include this (or a similar) statement to all future professorship job advertisements.** It is the task of the appointment committee to value the existing open science activities as well as future commitments of applicants appropriately. By including this statement, our department aims to communicate core values of good scientific practice and to attract excellent researchers who aim for transparent and credible research.

Journals should really ... ....

It's the task of granting agencies to ... ....

University boards have to ... ....

Journals, I'll really .....

It's the task of funding agencies to .....

University, have to .....



I want you for  
Open Science!

# Spend your valuable reviewer's time on research that is worthy to be reviewed



<https://opennessinitiative.org/>

The screenshot shows the Royal Society Open Science homepage with a search bar and navigation links for Home, Content, Information for, About us, Sign up, and Submit. Below the navigation is a featured article summary:

**The Peer Reviewers' Openness Initiative: incentivizing open research practices through peer review**

Richard D. Morey, Christopher D. Chambers, Peter J. Etchells, Christine R. Harris, Rink Hoekstra, Daniël Lakens, Stephan Lewandowsky, Candice Coker Morey, Daniel P. Newman, Felix D. Schönbrodt, Wolf Vanpaemel, Eric-Jan Wagenmakers, Rolf A. Zwaan

Published 13 January 2016. DOI: 10.1098/rsos.150547

We suggest that beginning January 1, 2017, **reviewers make open practices a pre-condition for more comprehensive review.**

This is already in reviewers' power; to drive the change, all that is needed is for reviewers to collectively agree that the time for change has come.

# Consider to sign our voluntary commitment to research transparency

The screenshot shows the homepage of the Research Transparency website. At the top center is a blue hexagonal logo containing a white icon of a document with horizontal lines and a circular chart below it. To the right of the logo is a dark grey ribbon banner with the text "COMMITMENT TO RESEARCH TRANSPARENCY" in white capital letters. Below the header, there is a navigation bar with links: "Our Commitment" (highlighted in red), "Signatories", "Sign the Commitment", "FAQ", "Discussion", "Who we are", and "Links & Media". The main content area features a large, bold, black title: "Our Commitment to Research Transparency and Open Science". Below the title is a paragraph of text: "We embrace the values of openness and transparency in science. We believe that such research practices increase the informational value and impact of our research, as the data can be reanalyzed and synthesized in future studies. Furthermore, they increase".

<http://www.researchtransparency.org/>

<http://www.nicebread.de/a-voluntary-commitment-to-research-transparency/>

# Consider to sign our voluntary commitment to research transparency

<http://www.researchtransparency.org/>

- 161 signatories from >50 international universities (by June 2018)

**Jeremy R. Winget** from Loyola University Chicago  
signed on 2018-02-12

**Daniel Nüst** from University of Münster  
signed on 2018-01-25

**Brice Beffara** from The Walden III Slowpen Science Laboratory  
signed on 2018-01-19

**Peter Edelsbrunner** from ETH Zürich  
signed on 2018-01-17

**Chuan-Peng Hu** from Johannes Gutenberg University Medical Center  
signed on 2018-01-16

**Caroline A. Larson** from University of Wisconsin-Madison  
signed on 2017-12-14

# At LMU Munich's psychology department ...

- ... we have an „Open Science Committee“ with 40 members, all chairs are represented
- ... all „Empirische Praktika“ have a core curriculum which consists of:
  - Power analysis
  - Pre-registration
  - Open Data + Codebook
  - Reproducible scripts
- ... money is partly distributed based open science bonus points
  - a „triple-badger“ (open data, open material, preregistered) equals 0.5 additional papers
- ... professorship positions are advertised with an „open science statement“

Schönbrodt, F.D., Maier, M., Heene, M., & Bühner, M. (2018). Forschungstransparenz als hohes wissenschaftliches Gut stärken: Konkrete Ansatzmöglichkeiten für Psychologische Institute. *Psychologische Rundschau*, 69, 37–44. doi:10.1026/0033-3042/a000386

[http://www.fak11.lmu.de/dep\\_psychologie/studium/lehrelounge/kerncurriculum\\_empra/index.html](http://www.fak11.lmu.de/dep_psychologie/studium/lehrelounge/kerncurriculum_empra/index.html)

[http://www.fak11.lmu.de/dep\\_psychologie/osc/open-science-hiring-policy/index.html](http://www.fak11.lmu.de/dep_psychologie/osc/open-science-hiring-policy/index.html)

# Netzwerk der Open Science Initiativen: <https://osf.io/tbkzh/> 12 Standorte





## LMU Open Science Center

- 32 individual members of 11 disciplines:  
*Psychology, sociology, computer science, statistics, geography, medicine, veterinary medicine, economics, philosophy of science, ...*
- 7 institutional members:  
*Faculty of Medicine, Faculty of Veterinary Medicine, Faculty of Psychology and Educational Science, Department Psychology, LMU-ifo Economics & Business Data Center (EBDC), University Library, Leibniz Supercomputing Centre*
- Mission Statement:
  - Education (from PhD students to professors)
  - Meta-science research
  - Change the incentive structure
- <http://www.osc.lmu.de>

A screenshot of the LMU OSC website's "Individual Members" page. The page has a header with the LMU logo, the text "OPEN SCIENCE CENTER", and the OSC logo. Below the header is a navigation bar with links for "NEWS", "ABOUT THE LMU-OSC", "MEMBERS", "Individual Members", "Institutional Members", "Join the OSC", and "NEWSLETTER &amp; CONTACT". The main content area is titled "Individual Members" and contains four profiles of individual members, each with a photo, name, and a brief bio. The profiles are: Prof. Dr. Kathrin Asenjurg, Prof. Dr. Bernd Bischl, Prof. Dr. Anne-Laure Boulesteix, and Prof. Dr. Hans-Bernd Brodin.

# 10 easy steps to increase your openness

1. **Create an account on OSF** (<http://osf.io/>)
2. **Upload the material for an existing study** (e.g., questionnaires, protocols, maybe reproducible analysis scripts) to an OSF project.
3. Prior to publication, **add an open license to all of your figures** (so that you can reuse them in later publications, blog posts,, or presentations: „Figure available under a CC-BY4.0 license at osf.io/XXXX.“)
4. For the next project: **Change the consent forms** in a way that **open data** would be possible for that project (see <https://osf.io/mgwk8/wiki/Consent%20form%20templates%20for%20open%20data/>). **Never promise to destroy data!**
5. **Sign the PRO initiative** and expect openness (or a justification why not) if you review another paper (<https://opennessinitiative.org/>)
6. For the next data analysis: Practice to create **scripts for reproducible data analysis** (e.g., SPSS syntax, R scripts). All analytic steps that lead from raw data to the final results should be reproducible.
7. **Let a master student preregister his/her thesis.** Can be either a „local preregistration“, or a proper preregistration at OSF or at <https://aspredicted.org/>. See this workshop material for how to do a preregistration: <https://osf.io/yd487/>, <https://osf.io/mx7yp/>
8. **Do you own first preregistration;** enter the Prereg challenge and get 1000\$: <https://cos.io/prereg/>
9. **Publish your first open data set:** Ensure anonymity, provide a codebook. See here for details: <http://econtent.hogrefe.com/doi/pdf/10.1026/0033-3042/a000341>
10. **Establish/join your local open science initiative**

# The future of science ...

- is **open**: open access, open data, open material
- is **collaborative**: Less “superstars”,  
more (ad hoc) large scale research teams for more power  
(see ManyLabs & RP:P; ‘Team up!', Back & Vazire, 2015)
- uses new technology, such as the  
**Open Science Framework**
- provides incentives for the **quality of the process**,  
not for the outcome  
(and definitely not for sheer quantity)