

Open Science

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Today we will talk about

Problems in Psychology

What is Open Science (OS)?

How OS can help these problems?

Why you shouldn't be afraid of OS!

What is Science?

Good Science (Norms)

Communality → Open sharing

Universalism → Evaluate research on own merit

Disinterestedness → Motivated by knowledge and discovery

Organized Skepticism → Consider all new evidence, even against one's prior work

Quality

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Quality

Bad Science (Counternorms)

Secrecy → No sharing

Particularism → Evaluate research by reputation

Self-interestedness → Treat science as a competition

Organized dogmatism → Invest career promoting one's own theories and findings

Quantity

Current Problems in Psychological Science

File Drawer Problem

- Only publishing studies that find significance

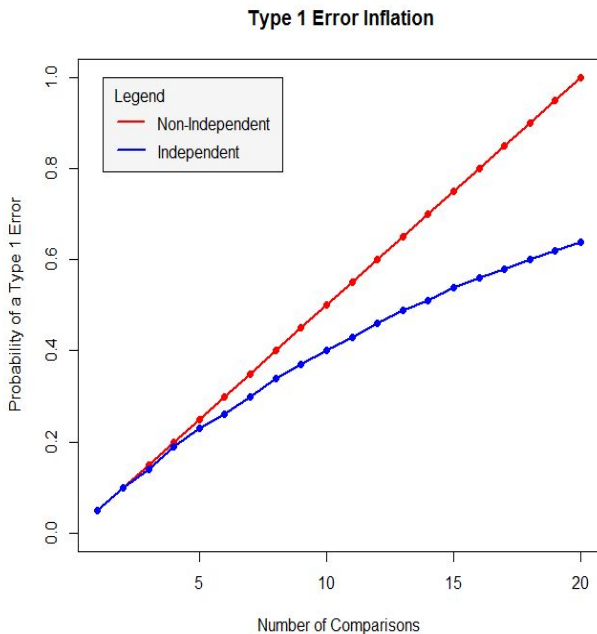
Current Problems in Psychological Science

File Drawer Problem

- Only publishing studies that find significance

Multiple Comparisons

- P-hacking or “fishing” for significance



Current Problems in Psychological Science

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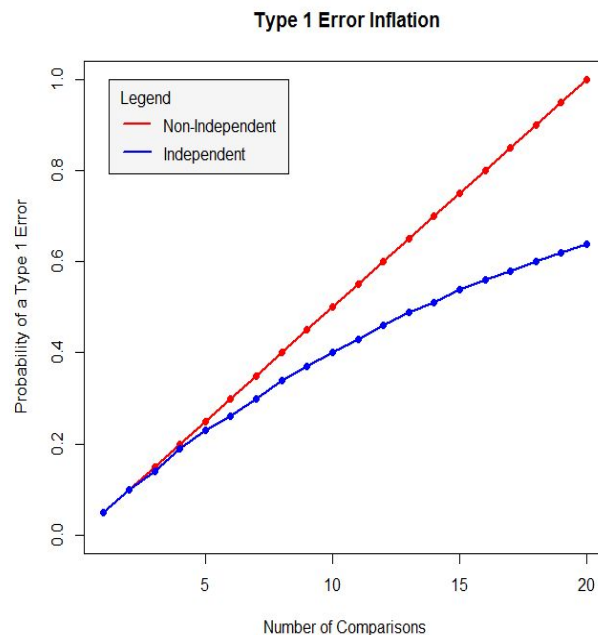
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Replication Problem

- Replicating work (is it real or a “false positive”)



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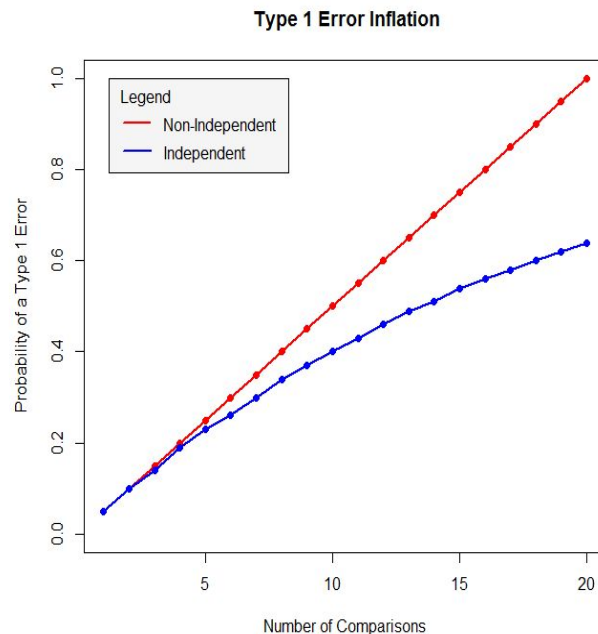
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Replication Problem

- Replicating work (is it real or a “false positive”)

Access Problem

- Being able to access science



What is Open Science?



Tell us what you're going to do.



Show us the data you analyzed.



Share the materials you used.



What is Open Science?: Pre-registration

Preregistration



- Register data collection, analyses, and other plans of the research study ahead of data collection/analyses.
- Used to prevent “p-hacking”
- Get feedback from peers before study begins
- Use as documentation later for decisions
- Useful for reviewers
- Get rewarded!

What is Open Science?: Open Data

Open Data



- Make data available online for post-publication review
- Also used for subsequent analyses by other researchers
- Help ameliorate issues in developmental (and other fields) psychology such as small sample sizes, longitudinal studies, etc.

What is Open Science?: Open Materials

Open Materials



- Saves time for other researchers not to reinvent the wheel
- Creates comparable methodologies to be used to juxtapose findings of different studies
- Saves your time when you get an email 4 years after publication asking about a specific detail about a particular procedure you used...

What is Open Science?: Open Access

Open Access



- Promotes scientific literacy
- Ethical
- Researchers don't get paid to publish, reviewers don't get paid to review

What is Open Science?: Open Access

Open Access



sci-hub.hk
sci-hub.la
sci-hub.mn
sci-hub.name
sci-hub.tw
sci-hub.tv

Other Open Science Practices

Replication

Registered Reports

RESEARCH ARTICLE SUMMARY

PSYCHOLOGY

Estimating the reproducibility of psychological science

Open Science Collaboration*

INTRODUCTION: Reproducibility is a defining feature of science, but the extent to which it characterizes current research is unknown. Scientific claims should not gain credence because of the status or authority of their originator but by the replicability of their supporting evidence. Even research of exemplary quality may have irreproducible empirical findings because of random or systematic error.

RATIONALE: There is concern about the rate and predictors of reproducibility, but limited evidence. Potentially problematic practices include selective reporting, selective analysis, and insufficient specification of the conditions necessary or sufficient to obtain the results. Direct replication is the attempt to recreate the conditions believed sufficient for obtaining a pre-

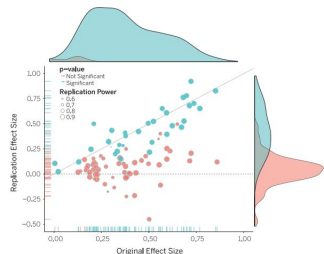
viously observed finding and is the means of establishing reproducibility of a finding with new data. We conducted a large-scale, collaborative effort to obtain an initial estimate of the reproducibility of psychological science.

RESULTS: We conducted replications of 100 experimental and correlational studies published in three psychology journals using high-powered designs and original materials when available. There is no single standard for evaluating replication success. Here, we evaluated reproducibility using significance and P values, effect size, subjective assessments of replication teams, and meta-analysis of effect sizes. The mean effect size (η) of the replication effects ($M = 0.197$, $SD = 0.207$) was half the magnitude of the mean effect size of the original effects ($M = 0.403$, $SD = 0.188$), representing a

substantial decline. Ninety-seven percent of original studies had significant results ($P < .05$). Thirty-six percent of replications had significant results; 47% of original effect sizes were in the 90% confidence interval of the replication effect size; 50% of effects were subjectively rated to have replicated the original results; and if no bias to original results is assumed, combining original and replication results left 69% with statistically significant effects. Correlational tests suggest that replication success was better predicted by the strength of original evidence than by characteristics of the original and replication teams.

CONCLUSION: No single indicator sufficiently describes replication success, and the five indicators examined here are not the only ways to evaluate reproducibility. Nonetheless, collectively these results offer a clear conclusion: A large portion of replications produced weaker evidence for the original findings despite using materials provided by the original authors, review in advance for methodological fidelity, and high statistical power to detect the original effect sizes. Moreover, correlational evidence is consistent with the conclusion that variation in the strength of initial evidence (such as original P value) was more predictive of replication success than variation in the characteristics of the teams conducting the research (such as experience and expertise). The latter factors certainly can influence replication success, but they did not appear to do so here.

Reproducibility is not well understood because the incentives for individual scientists prioritize novelty over replication. Innovation is the engine of discovery and is vital for a productive, effective scientific enterprise. However, innovative ideas become old news fast. Journal reviewers and editors may dismiss a new test of a published idea as unoriginal. The claim that “we already know this” belies the uncertainty of scientific evidence. Innovation points out paths that are possible; replication points out paths that are likely; progress relies on both. Replication can increase certainty when findings are reproduced and promote innovation when they are not. This project provides accumulating evidence for many findings in psychological research and suggests that there is still more work to do to verify whether we know what we think we know. ■



Original study effect size versus replication effect size (correlation coefficients). Diagonal line represents replication effect size equal to original effect size. Dotted line represents replication effect size of 0. Points below the dotted line were effects in the opposite direction of the original. Density plots are separated by significant (blue) and nonsignificant (red) effects.



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*Corresponding author: E-mail: replicability@oscience.org
Cite this article as: Open Science Collaboration, Science 348, no.6229 (2015), DOI: 10.1126/science.1260061

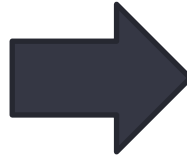
Quick Note: People Fear Replication

For better science, call off the revolutionaries



ASSOCIATED PRESS

By **Pardis Sabeti** JANUARY 21, 2018



SCIENCE

For Better Science, Bring on the Revolutionaries

In defense of the replication movement.

By **DANIEL ENGBER**

JAN 23, 2018 • 5:22 PM

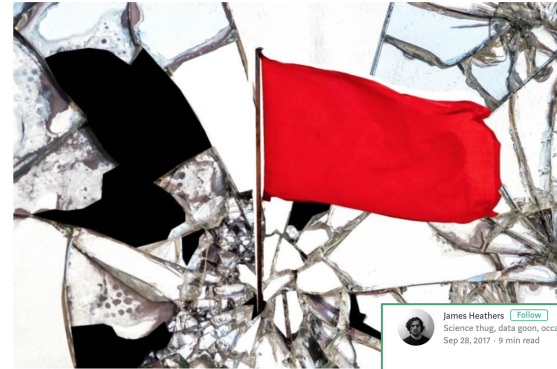


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James Heathers [Follow](#)

Science thug, data goon, occasional writer, fallen meathard.
Sep 28, 2017 • 9 min read

Why We Find And Expose Bad Science

(It isn't because we're mean.)

Curious day. Just found out I was in a BuzzFeed article (who, in the absolute opposite of many news organisations, appear to be in fully-fledged flight towards rather than away from legitimacy).

It's here. It's also excellent, by the way.

Emails Show How An Ivy League Prof Tried To Do Damage Control For His Bogus Food Science

The Smarter Lunchrooms Movement, a \$22 million federally funded program that pushes healthy-eating strategies in almost...

www.buzzfeed.com



Confronting Fears of OS



- “I might get scooped!”
 - You can set your preregistration to become public at anytime, even after publication.
 - No one cares about your research (Knoll et al., 2015, *Psych Science* [example](#))
 - If you get scooped, that means your research is important.
 - Actually might prevent scooping (timestamp showing you came up with the idea first)
- “I don’t want to be locked into any of my analysis plans-- things change!”
 - It’s okay, there are no preregistration police.
 - Most important is that your hypotheses are documented to prevent cherry-picking hypotheses/HARKing.
 - Preregistrations often ask for back-up analysis plans for if your data violate assumptions. This can be helpful to think about before collecting data.
- “But preregistration takes such a long time!”
 - Pain now or pain later, and pain now comes with a badge!

Confronting Fears of OS

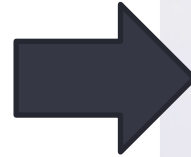
PRESIDENTIAL COLUMN

Why Preregistration Makes Me Nervous

SUSAN GOLDIN-MEADOW

TAGS: CLINICAL PSYCHOLOGICAL SCIENCE | DATA | OPEN PRACTICES | PREREGISTRATION | PSYCHOLOGICAL SCIENCE | SUSAN GOLDIN-MEADOW COLUMNS

I must admit that when I first heard of the effort to get psychological scientists to preregister their studies (that is, to submit to a journal a study's hypotheses and a plan for how the data will be analyzed before that study has been run), I had a moment of panic. It seemed, on the surface, entirely too regulated for my tastes. I have since calmed down and now see the usefulness of preregistration — indeed, APS has been at the forefront of encouraging preregistration to make our science more transparent and reliable. Manuscripts accepted for publication in *Psychological Science* are eligible to earn three separate badges designed to promote open science (Eich, 2014). (Editor's Note: *Clinical Psychological Science* now offers badges as well. See story on p. 13.) These are



Research Preregistration 101

D. STEPHEN LINDSAY, DANIEL J. SIMONS, SCOTT O. LILIENFELD

TAGS: DATA | EXPERIMENTAL PSYCHOLOGY | METHODOLOGY | PREREGISTRATION | STATISTICAL ANALYSIS

APS President Susan Goldin-Meadow recently published an *Observer* column titled “Why Preregistration Makes Me Nervous.” We suspect that many psychological scientists share Goldin-Meadow’s uncertainties about preregistration. In this article, we attempt to allay those concerns by explaining the rationale for and benefits of preregistration for researchers and for the field of psychology at large. We also include some explanations of different [types of preregistration](#) and [answers to frequently asked questions](#).

Confronting Fears of OS



- “But people might find mistakes!”
 - Yep. (double, triple, & quadruple check your work)
 - Culture of science is changing (“This stuff is really hard!”) → More accepting and tolerant of mistakes
 - Makes our collective science more accurate, makes you a better researcher in the long-run
 - Resources available → Center for Open Science FREE statistical consulting.
- “What if someone tries to tarnish my reputation using my own data?”
 - Difference between tarnishing and healthy debate. The latter is really good for science & OS facilitates it
 - It’ll be pretty clear whether someone is intentionally drag your name through the mud
 - Variety of ways to tarnish reps -- if someone is set on it, they’ll do it (regardless of whether your data/materials are publicly available)

Confronting Fears of OS



- “Why should I give away my materials when I spent so much time making them?”
 - Sharing is caring (remember communality vs. secrecy)
 - You don’t have to share all of your materials.
 - If you created novel materials, researchers will have an easier time finding it if you make it open. This means you might be more likely to have your materials used and cited for it(maybe even authorship?)!
 - Helping establish this kind of culture will benefit you in the long run.

Q: So What?

So what? Why should I go out of my way
to practice it?

A: It's Good For YOU

Incentive structures are changing

- Berkeley Initiative for Transparency in Social Science (BITSS)
 - Gives out \$\$\$ for transparent social scientists (up to 10K)
- Hiring committees will begin valuing job candidates who practice OS
 - Example: Stanford Psych Dept.
- Journals care
 - Badges in *Psychological Science*
 - Work may be more likely to be published if hypotheses are pre-reg'ed & data/materials open
- Show off!
 - Put it on your CV -- links to data/materials, list of pre-registrations, etc. Other people might use your data and cite you / give you authorship!
- Data publications
 - [GigaScience](#), [Scientific Data](#), [Journal of Open Psychology Data](#), [Advances in Methods & Practices in Psychological Science](#)

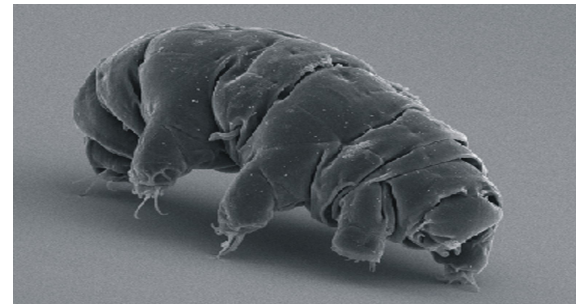
A: It's Imminent

- Science, American Journal of Political Science, Journal of the American Statistical Association, and Psych Science* all made deposition of data and code mandatory in the past two years (Science, 1.1.17; JASA, 9.1.16).
- It's already required in a number of other journals.
- Now is the perfect time to learn how to share data, incrementally at your own pace, before it becomes imposed all at once (That was Aug-2016; Things have picked up!)

*Sort of

Limitations of OS

- It will deter and reduce, but not *eliminate*, fraud. People will still do it.
- It's also not a guarantee that mistakes will be discovered (or at least when it matters most).
- Some argue this shouldn't be the 'Gold Standard'
- It won't completely "fix" science
 - Repeatability, efficiency, and collaboration will benefit; Science overall will be bettered, but OS won't completely fix it
 - It's "fixed" by, well, doing *better* Science--better knowledge of appropriate statistical tests to run, better designed experiments, better theory, etc.



How You Can Get Started

- Start slow...
 - Pre-register something--an analysis plan, hypothesis, sample size justification, stoppage rule
 - Make a little material available--survey measures, experimental tasks, syntax files, training instructions, recruitment scripts
 - Deposit some of your data--final dataset, data used for to make a figure, statistical maps (fMRI)
- ...Work your way up
 - Pre-register the entire study (hypotheses, analysis plan, etc)
 - Make all raw data, analysis scripts, and other materials available
- Have it your way--choose your favorite platform
 - [Lab websites](#), [Personal websites](#)
 - [OpenfMRI](#), [NeuroVault](#), [OpenNeuro](#)
 - [OSF](#), [Figshare](#), [Github](#), [DropBox](#)

Useful Resources

- Papers & Blogs

- [Gorgolewski & Poldrack, 2016](#) & [OHBM Best Practices in Data Sharing](#) (for the neuroimaging crowd)
- [Manuscript Checklist](#) (Peelle blog, 3.23.16)
- [Reproducibility Starts at Home](#) (Zelner blog, 5.31.16)
- [Data Sharing Policy Types](#) (*Springer Nature* Blog, 7.5.2016)
- [20% Statistician](#) (has a lot of good practices for statistical analyses, multiple comparisons, etc.)

- Tools/Code/Programs

- [R-Markdown](#); [MatLab Live Scripts](#)
- [Born Open Data](#)
- Reproducible analyses via VM: an [example](#)
- OSF Framework ([OSF.io](#))

People to Follow on Twitter!





taissa ;)
@taissavila

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“and at PLOS Biology, we consider that two papers from two groups independently identifying the same phenomenon in parallel increase the confidence in the results of the work.” EXACTLY!!! Great job **@PLOS Biology** !

Hannah Hope @hjhope

Great to see #PLOS Biology supporting publication of scooped or complementary (far nicer term) articles. Hope more journals will follow. "The importance of being second" [dx.plos.org/10.1371/journa...](https://doi.org/10.1371/journal.plos.101371)

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