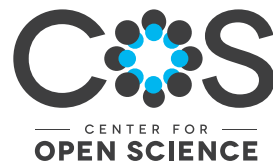


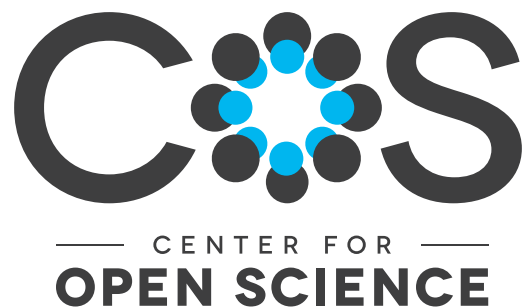
# Improving Openness of Scientific Research

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# Mission

Improve Openness, Integrity, and  
Reproducibility of Scientific Research

# Central issue

Incentives for individual success are focused on getting it published, not getting it right

# Why Most Published Research Findings Are False

John P. A. Ioannidis

## Summary

There is increasing concern that most current published research findings are false. The probability that a research claim is true may depend on study power and bias, the number of other studies on the same question, and, importantly, the ratio of true to no relationships among the relationships probed in each scientific field. In this framework, a research finding is less likely to be true when the studies conducted in a field are smaller; when effect sizes are smaller; when there is a greater number and lesser preselection of tested relationships; where there is greater flexibility in designs, definitions, outcomes, and analytical modes; when there is greater financial and other interest and prejudice; and when more teams are involved in a scientific field in chase of statistical significance. Simulations show that for most study designs and settings, it is more likely for a research claim to be false than true.

Moreover, for many current scientific

factors that influence this problem and some corollaries thereof.

## Modeling the Framework for False Positive Findings

Several methodologists have pointed out [9–11] that the high rate of nonreplication (lack of confirmation) of research discoveries is a consequence of the convenient, yet ill-founded strategy of claiming conclusive research findings solely on the basis of a single study assessed by formal statistical significance, typically for a  $p$ -value less than 0.05. Research is not most appropriately represented and summarized by  $p$ -values, but, unfortunately, there is a widespread notion that medical research articles

**It can be proven that most claimed research findings are false.**

should be interpreted based only on

is characteristic of the field and can vary a lot depending on whether the field targets highly likely relationships or searches for only one or a few true relationships among thousands and millions of hypotheses that may be postulated. Let us also consider, for computational simplicity, circumscribed fields where either there is only one true relationship (among many that can be hypothesized) or the power is similar to find any of the several existing true relationships. The pre-study probability of a relationship being true is  $R/(R + 1)$ . The probability of a study finding a true relationship reflects the power  $1 - \beta$  (one minus the Type II error rate). The probability of claiming a relationship when none truly exists reflects the Type I error rate,  $\alpha$ . Assuming that  $c$  relationships are being probed in the field, the expected values of the  $2 \times 2$  table are given in Table 1. After a research finding has been claimed based on achieving formal statistical significance,

# Barriers

- **Perceived norms** (Anderson, Martinson, & DeVries, 2007)
- **Temporal construal** (Trope & Liberman, 2003)
- **Motivated reasoning** (Kunda, 1990)
- **Minimal accountability** (Lerner & Tetlock, 1999)
- **I am busy** (Me & You, 2013)

# Two Strategies

(1) Work with existing incentives

(2) Nudge the incentives

# Incentives for openness

## Top-down – fast, but narrow

- Funders: require disclosure of grantees
- Journals: badges for openness and registration

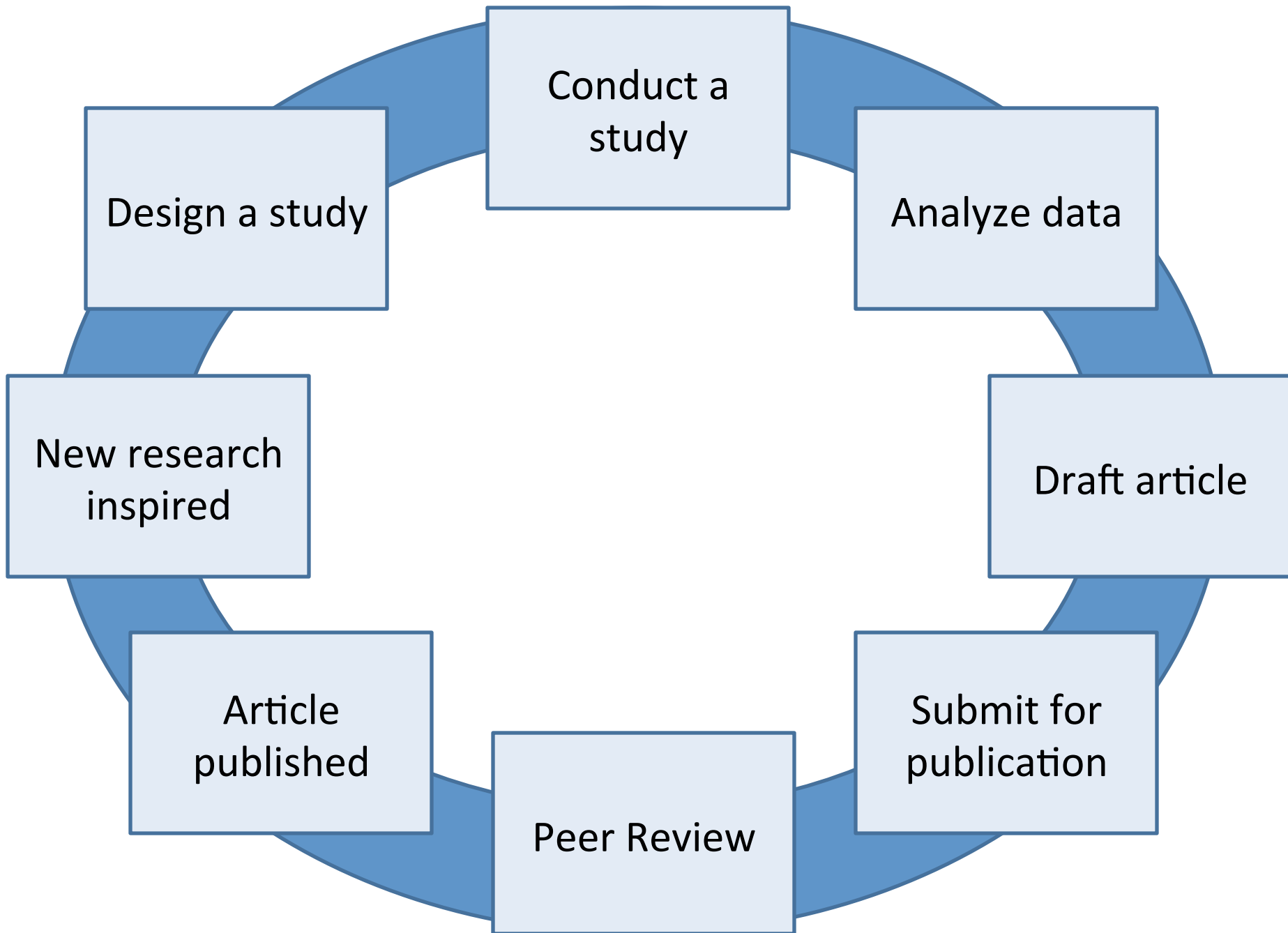
## Bottom-up – slow, but comprehensive

- Researcher's entire workflow part of the cumulative record
- Leverage norms rather than requirements
- Methods of reputation building with openness

# Implementation Principles

- Meet present needs
- Leverage existing values
- Lower barrier to entry
- Incentivize openness and other good practices
- Support workflow across entire lifecycle





Design a study

Conduct a study

Analyze data

New research inspired

Draft article

Article published

Submit for publication

Peer Review

# Open Science Framework

Jeff Spies



# Open Science Framework (OSF)

- Web app for collaboration, documentation, archiving, sharing, registration
- Respects and integrates workflow
- Replaces *ad hoc* archiving with shared solution
- Merges private and public workflows
- Incentivizes openness
- Single framework for top-down and bottom-up solutions

Grant applications  
IRB submission  
Creating materials  
Personal file-system  
Collaboration  
Scripting  
Data collection  
Analysis tools  
Figure creation  
Data storage  
Manuscript preparation  
Review/publishing system  
Article and material discovery



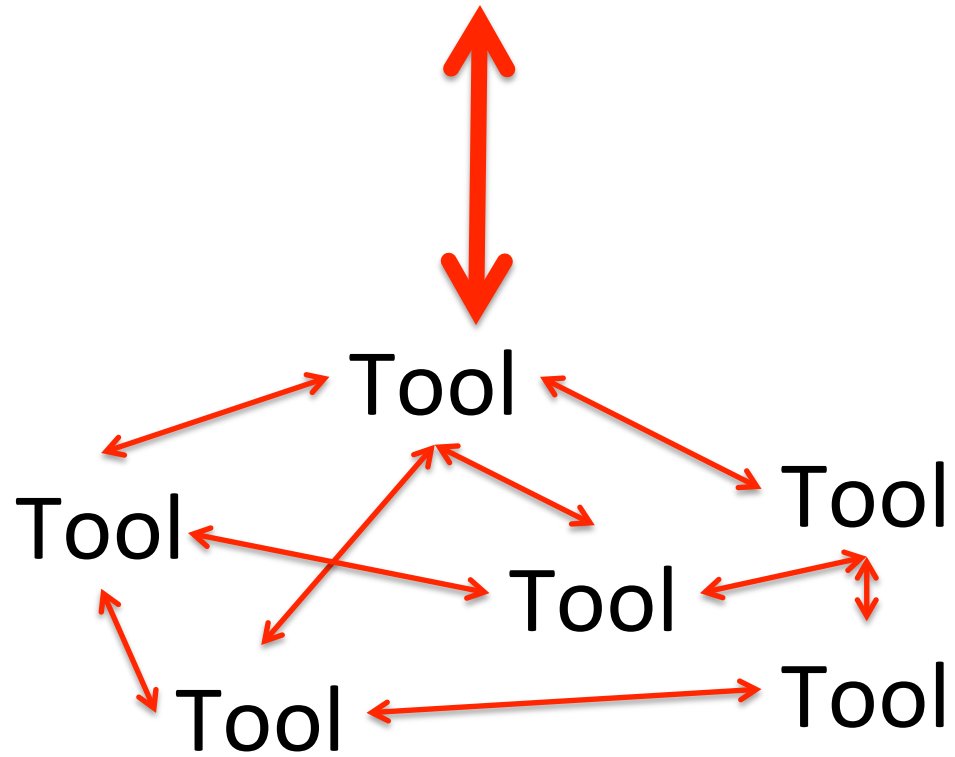
Google Drive

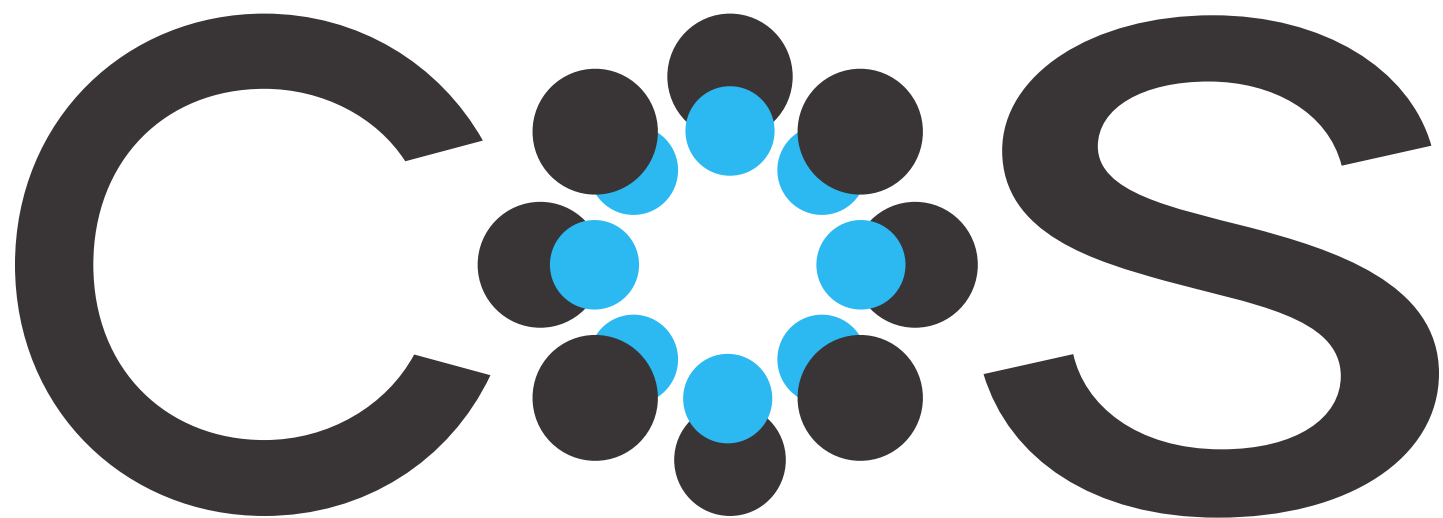


IP[y]: IPython  
Interactive Computing



Scientists





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# POTENTIAL INTERVENTION POINTS

Government policy and regulation

Funders

Scientific Societies

Universities/Libraries

Journals

Community

Individual Researchers