Responsible and Robust Research

OPEN SCIENCE BOOTCAMP

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Outline

- Understanding Questionable Research Practices (QRPs)
- The Impact of Questionable Research Practices
- Identifying Questionable Research Practices
- Maintaining Research Integrity
- Q&A

Questionable Research Practices

Questionable Research Practices

- A range of actions or decisions taken by researchers that, while not necessarily crossing the line into outright misconduct, can still introduce biases, skew results, and compromise the rigor and reliability of scientific findings.

- These practices often arise from subconscious motivations, pressures to publish, or the desire to obtain "significant" or "positive" results.

What are examples of QRPs?

1. **Hypothesizing After Results are Known (HARKing)**: This occurs when researchers retroactively develop a hypothesis that aligns with their obtained results, giving the illusion of a more robust theory than what was initially proposed.

2. **Selective Reporting**: The act of reporting only the results that support the desired conclusion while leaving out inconclusive or contradictory findings.

What are examples of QRPs?

3. **P-Hacking**: Involves the repeated testing of multiple statistical analyses until a significant result is found, without appropriately adjusting for multiple comparisons.

4. **Publication Bias**: The tendency to publish only studies with "positive" or "statistically significant" results, leaving out studies with null or nonsignificant findings, leading to an incomplete and potentially skewed body of literature.

What are examples of QRPs?

5. **Data Dredging (or Fishing)**: Exploring data in an ad hoc manner to find patterns or relationships without a predefined hypothesis, which can lead to false discoveries or spurious correlations.

6. **Inadequate Sample Size**: Conducting studies with small sample sizes, which can reduce statistical power and increase the likelihood of obtaining false-positive results.

What are examples of QRPs?

7. **Undisclosed Conflicts of Interest**: Failure to declare financial or non-financial interests that could potentially influence the research findings or the researcher's objectivity.

8. **Outliers Handling**: The improper treatment of outliers in data analysis, which can significantly impact the results and conclusions.

The Impact of Questionable Research Practices

1. Consequences for scientific knowledge and the research community

2. Implications for policy and decision-making

3. Erosion of public trust in science

The Impact of Questionable Research Practices

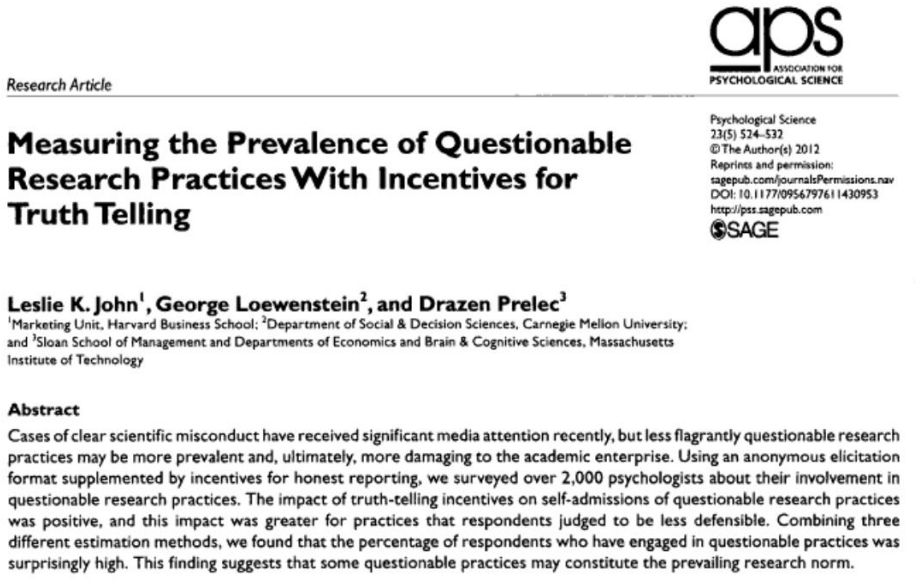
Consequences for scientific knowledge and the research community:

- Erosion of scientific integrity
- Misleading conclusions
- Reproducibility crisis
- Wasted resources
- Stifles innovation
- Increases distrust in science
- Impacts real world outcomes, including policy and decision making

Identifying Questionable Research Practices

John et al. (2012), examples include:

1. In a paper, failing to report all of a study's outcomes
2. Deciding whether to collect more data after looking to see whether the results were significant
3. In a paper, failing to report all of a study's conditions



Research Article

aps ASSOCIATION FOR PSYCHOLOGICAL SCIENCE

Measuring the Prevalence of Questionable Research Practices With Incentives for Truth Telling

Psychological Science
23(5) 524–532

DOI: 10.1177/0956797611430953
http://pss.sagepub.com
SAGE

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

Abstract

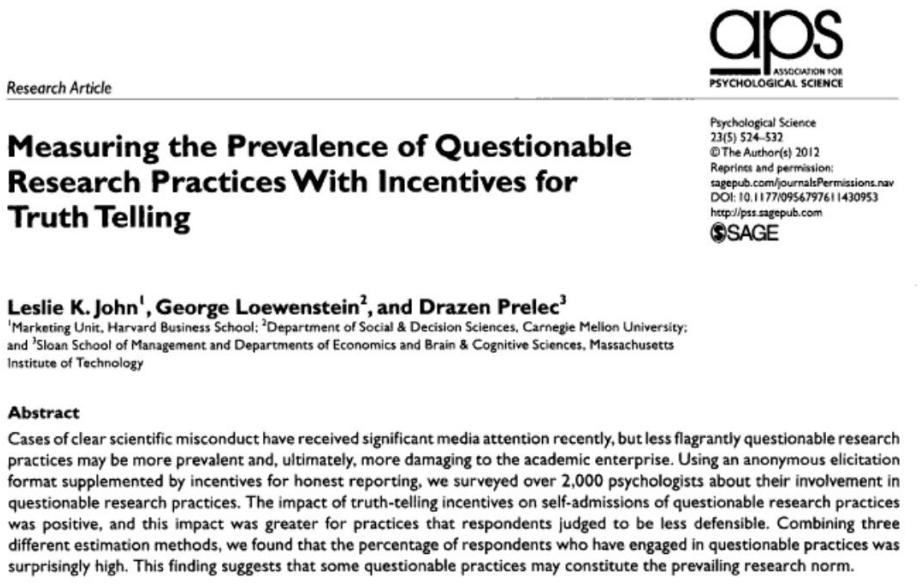
Cases of clear scientific misconduct have received significant media attention recently, but less flagrantly questionable research practices may be more prevalent and, ultimately, more damaging to the academic enterprise. Using an anonymous elicitation format supplemented by incentives for honest reporting, we surveyed over 2,000 psychologists about their involvement in questionable research practices. The impact of truth-telling incentives on self-admissions of questionable research practices was positive, and this impact was greater for practices that respondents judged to be less defensible. Combining three different estimation methods, we found that the percentage of respondents who have engaged in questionable practices was surprisingly high. This finding suggests that some questionable practices may constitute the prevailing research norm.

John et al. (2012), examples include:

4. Stopping collecting data earlier than planned because one found the result that one had been looking for

5. In a paper, rounding off a p-value (e.g. reporting a p-value of 0.054 as “p<0.05”)

6. In a paper, selectively reporting studies that “worked”



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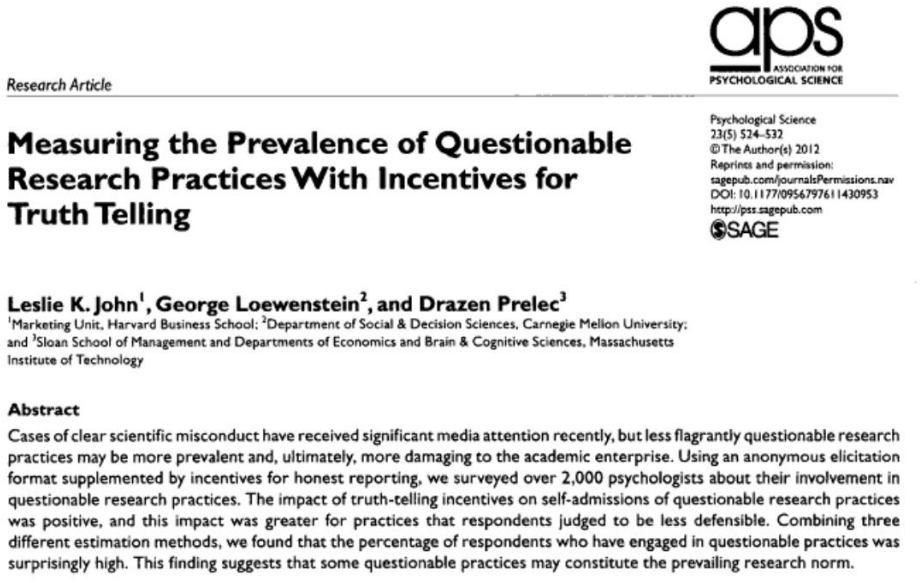
John et al. (2012), examples include:

7. Deciding whether to exclude data after looking at the impact of doing so on the results
8. In a paper, reporting an unexpected finding as having been predicted from the start
9. In a paper, claiming that results are unaffected by demographic variables when one is actually unsure
10. Falsifying data



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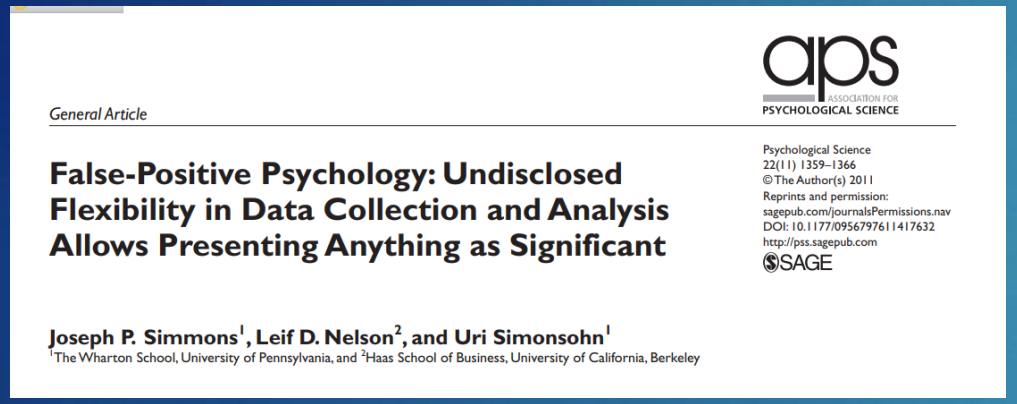
- According to John et al. (2012) self-reports of these practices (and assessments of how common they are in social science in general) range from around 60% (for #1 and #2), to under 2% (for #10).

- **All of** the practices except the last are generally seen as “defensible.”

Example (Simmons et al. 2011)



General Article

False-Positive Psychology: Undisclosed Flexibility in Data Collection and Analysis Allows Presenting Anything as Significant

Joseph P. Simmons[1], Leif D. Nelson[2], and Uri Simonsohn[1]
[1]The Wharton School, University of Pennsylvania, and [2]Haas School of Business, University of California, Berkeley

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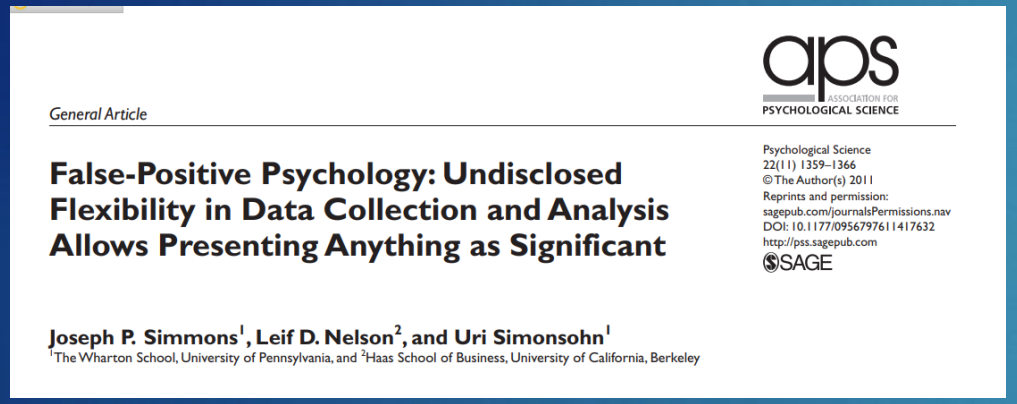
- Using common analysis paths and strategies in psychology (and many other fields), Simmons et al. found the following:
  - Study 1 (n=30 undergraduates): students were randomly assigned to listen to an instrumental song (control condition) or a children's song (experimental condition). Students felt older after listening to the children's song than after listening to the control song (based on ANCOVA, using father's age as a covariate; p=0.033).
  - Study 2 (n=20 undergraduates): "conceptual replication" and extension of Study 1. Students were randomly assigned to listen to the same instrumental song as in Study 1, or to "When I'm Sixty-Four" by the Beatles. Students were nearly a year and a half younger after listening to the Beatles' song, compared to the control song (ANCOVA, father's age as a covariate; p=0.04).
  - Further simulation study shows that by exercising "flexibility" in analysis (but still in line with how many researchers actually conduct their statistical analysis), false positive rates can be highly inflated.

Recommendations



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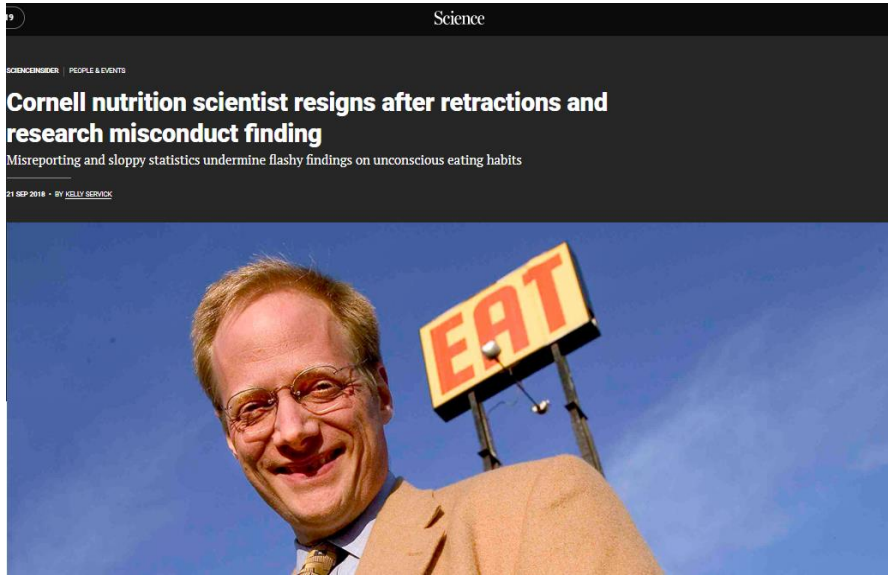
1. Authors must decide the rule for terminating data collection before data collection begins, and report this rule in the article
2. Authors must collect sufficient observations per cell, or providing a compelling explanation for why this is not possible (e.g. cost)
3. Authors must list all variables collected in a study
4. Authors must report all experimental conditions, including failed manipulations
5. If observations are eliminated, authors must also report what the statistical results are if those observations are included
6. If an analysis includes a covariate, authors should report the results of the analysis without the covariate

Case Study #1
Brian Wansink, Cornell Food Lab

- Wansink's research focused on various aspects of food consumption, including portion sizes, food psychology, and factors influencing eating behaviors.
- Numerous studies were published, and the lab gained media attention for its findings.
- In 2017, researchers attempting to replicate Wansink's studies encountered difficulty obtaining similar outcomes.
- Concerns were raised about potential data inconsistencies and statistical errors in Wansink's published papers.



Case Study #1
Brian Wansink, Cornell Food Lab

Cornell University launched an investigation into Wansink's research practices and found a number of QRPs

1. **Data P-hacking:** Wansink and his team reportedly engaged in p-hacking, which undermines the credibility of the findings.

2. **Inadequate Data Reporting:** There were instances of selectively reporting data, cherry-picking results that supported their hypotheses while excluding results that did not show significant effects.

3. **Duplicate Publication:** Some of Wansink's studies were found to have been published multiple times with minor variations, potentially inflating his publication record.

4. **Sloppy Research Practices:** The investigation revealed issues with data collection, management, and record-keeping, which raised concerns about the overall rigor of the research.

Case Study #2
Marc Tessier-Lavigne, President of Stanford

- An investigation commissioned by Stanford's Board of Trustees found that members of Tessier-Lavigne's lab had manipulated data in at least five published manuscripts dating back to 1999 that listed Tessier-Lavigne as the principal investigator.
- Lab leaders should prioritize data review and respond to allegations of impropriety promptly to prevent misconduct.
- Creating a lab culture that embraces failure and encourages openness about unexpected results can help prevent data manipulation and foster a healthy scientific environment.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NEWS | 27 July 2023

What the Stanford president's resignation can teach lab leaders

Marc Tessier-Lavigne's departure makes overworked researchers ponder: how do we prevent misconduct in our own labs?

Max Kozlov

Maintaining Research Integrity

1. Adhere to Ethical Guidelines
   - Familiarize yourself with ethical principles and guidelines, such as those outlined by professional organizations and institutional review boards.
   - Ensure voluntary and informed consent from participants and maintain confidentiality.

2. Transparent Research Design
   - Pre-register studies to avoid HARKing (Hypothesizing After Results are Known) and prevent p-hacking.
   - Clearly outline research objectives, methods, and data analysis plans before data collection.

Maintaining Research Integrity

3. Rigorous Data Collection
   - Use appropriate sample sizes to achieve sufficient statistical power.
   - Implement robust experimental design and data collection procedures.
   - Minimize bias and ensure data reliability.

4. Responsible Reporting
   - Present all findings, including null or inconclusive results, to avoid selective reporting.
   - Distinguish between exploratory and confirmatory analyses in publications.

Maintaining Research Integrity

5. Collaborative Approach
   - Foster an open and collaborative research environment.
   - Engage in peer review and welcome feedback from colleagues.

6. Data Sharing
   - Promote data sharing to enable replication and enhance transparency.
   - Utilize trusted repositories to store and share data securely.

Maintaining Research Integrity

7. Declare Conflicts of Interest
   - Disclose any financial or non-financial conflicts of interest that could influence research outcomes.
   - Uphold objectivity and independence in research.

8. Replication and Validation
   - Encourage replication studies to validate results.
   - Acknowledge and address discrepancies in replication attempts.

Maintaining Research Integrity

9. Peer Review Process
   - Participate in unbiased peer review to ensure quality control.
   - Respect confidentiality and provide constructive feedback.

10. Accountability and Responsible Conduct
   - Take responsibility for one's actions and research outcomes.
   - Foster a culture of research integrity within the academic and scientific community.

Why Open Science?

- Movement for more transparency and openness in reporting; sharing of code, data, research outputs (e.g. papers).
- Aims to improve reproducibility and replicability of science, reduce fraud.
- Statistical reform - move away from “statistical significance” or other thresholds of statistical quantities.

Questions?