
How the Reproducibility Crisis Can Lead to a Credibility Revolution in Scientific Research

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Objectives



- Understand the “Reproducibility Crisis” in scientific research
- Reproducibility vs Replicability
- Why Research Fails to Replicate
- Modes of Change
 - Structural Changes
 - Procedural Changes
 - Community Changes
- Outlook for the Future

The Story of Diederik Stapel



A Dutch professor of social psychology at Tilburg University



Rising star in field of human attitudes and behavior



Read more about his story [here](#)



Shinano-railway-Oya-station-platform-20110907-160756.jpg
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Questions

- How extensive is this type of fraud?
- What can be done to increase confidence in the results of scientific experiments?



What is the Reproducibility Crisis?

- One of the pathways by which the scientific community confirms the validity of a new scientific discovery is by repeating the research that produced it.
 - – National Academies of Sciences, Engineering, and Medicine

If data cannot be reproduced, it cannot be validated.



Survey Results: *Nature* 2016

Over 1500 scientists surveyed



70% reported failure to reproduce a peer's study

50% reported failure to reproduce their own study!



Baker, M. 1,500 scientists lift the lid on reproducibility. *Nature* 533, 452–454 (2016).

<https://doi.org/10.1038/533452a>

Reproducibility vs. Replicability

Reproducibility: The ability of a researcher to duplicate the results of a prior study using the same materials and procedures that were used by the original investigator.

Example: A second researcher can use the same raw data as the original researcher and perform the same statistical analysis to determine whether they yield the same results.

Helps assess the accuracy of claims based on the original researcher's data

Does not guarantee the quality or validity of published results though

Replicability: The ability of a researcher to duplicate the results of a prior study if the same procedures are followed but NEW data is collected.

Sometimes terms are used interchangeably in different fields.

Why Research Fails to Replicate



Questionable Research Practices

- Selective data use when analyzing data

Academic System

- Publish or Perish pressures

Publication Bias

- Negative findings not published



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**Can Open Science lead to a
Credibility Revolution?**

Structural Changes – Institutional Level

- Educate students
- Advance field of replications

New incentives for Open Science practices

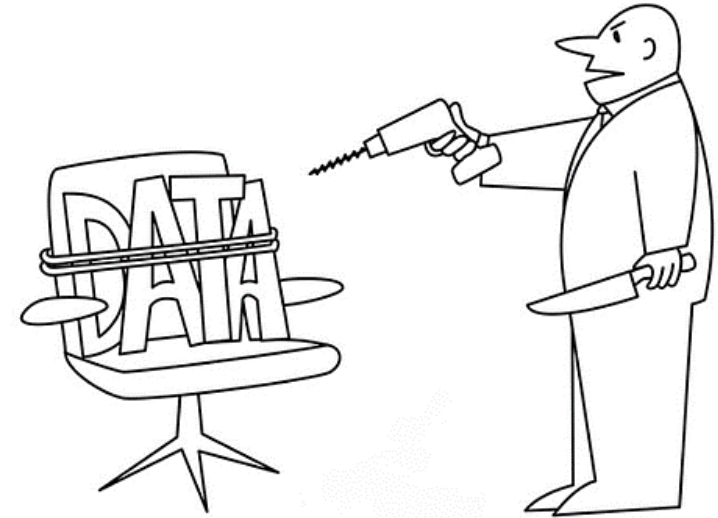
- *Registered Reports*
 - Protocols submitted prior to data collection
 - Provisional acceptance for publication
 - Reduces publication bias



Procedural Changes – Behavioral

Statistical Assessment Tools

- p-value < 0.05 threshold
- p-hacking
 - Manipulate data until 0.05 achieved
- p-curving
 - Look for manipulation of p-values



“If you don't reveal some insights soon, I'm going to be forced to slice, dice, and drill!”

Source: [Atoz Markets](#)

Community Changes

Scientific Community

- Adversarial Collaborations
 - Consensus based solutions
 - Reduced bias

Outlook for the Future

- Failed replicability tests should not be the entire focus in resolving reproducibility crisis.
- Striving to maximize transparency, rigor, and high quality throughout the research process are important.
- Open Science is going to be key in translating these ideas into practice.



References



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- Webb, G. P. (2017, March 21) Diederik Stapel – eminent “pop star” psychologist and blatant fraudster. *Dr. Geoff: Behind the headlines*. <https://drgeoffnutrition.wordpress.com/2017/03/21/diederik-stapel-eminant-pop-star-psychologist-and-blatant-fraudster/>

Thank you!

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