Embracing open science as an early-career researcher

Dr William Ngiam
Lecturer at the University of Adelaide

PGR Career Series, University of Warwick
16th February 2025

A brief introduction to me

- **Lecturer** in the School of Psychology at the University of Adelaide
  - My research is on how we represent information in the mind and brain
  - We can focus on surprisingly little – attention is a precious resource, and so we need to be attending to the right things!
- **An active advocate** for early-career researchers and Open Science
  - I served on the steering committee of *ReproducibiliTea* for three years
- I think **a lot is at stake**
  - I worry about an anti-science society – one where scientific research is no longer considered ***credible***
  - I think the Open Science movement has a major role in ensuring science continues so that it can bring positive changes to society

My background

Born in Australia to Malaysian immigrants

Both parents did not have tertiary education

Grew up in a low-income family

Both parents were non-native English speakers

Minority ethnicity

First-generation college graduate

First-generation PhD

First-generation scientist

Recently became a Lecturer (early-career)

International researcher as a postdoc

My goal for this talk is to inspire *you* to **take action and improve science**

- Provide an overview of the reproducibility crisis (from the lens of psychological science)
- Share my journey as an early-career researcher in the Open Science movement
- Convince you that you can lead the movement to bring transparency and rigour to science

Why do we need open science?

The reproducibility crisis / replication crisis

The recent collective concern that many scientific studies do not replicate

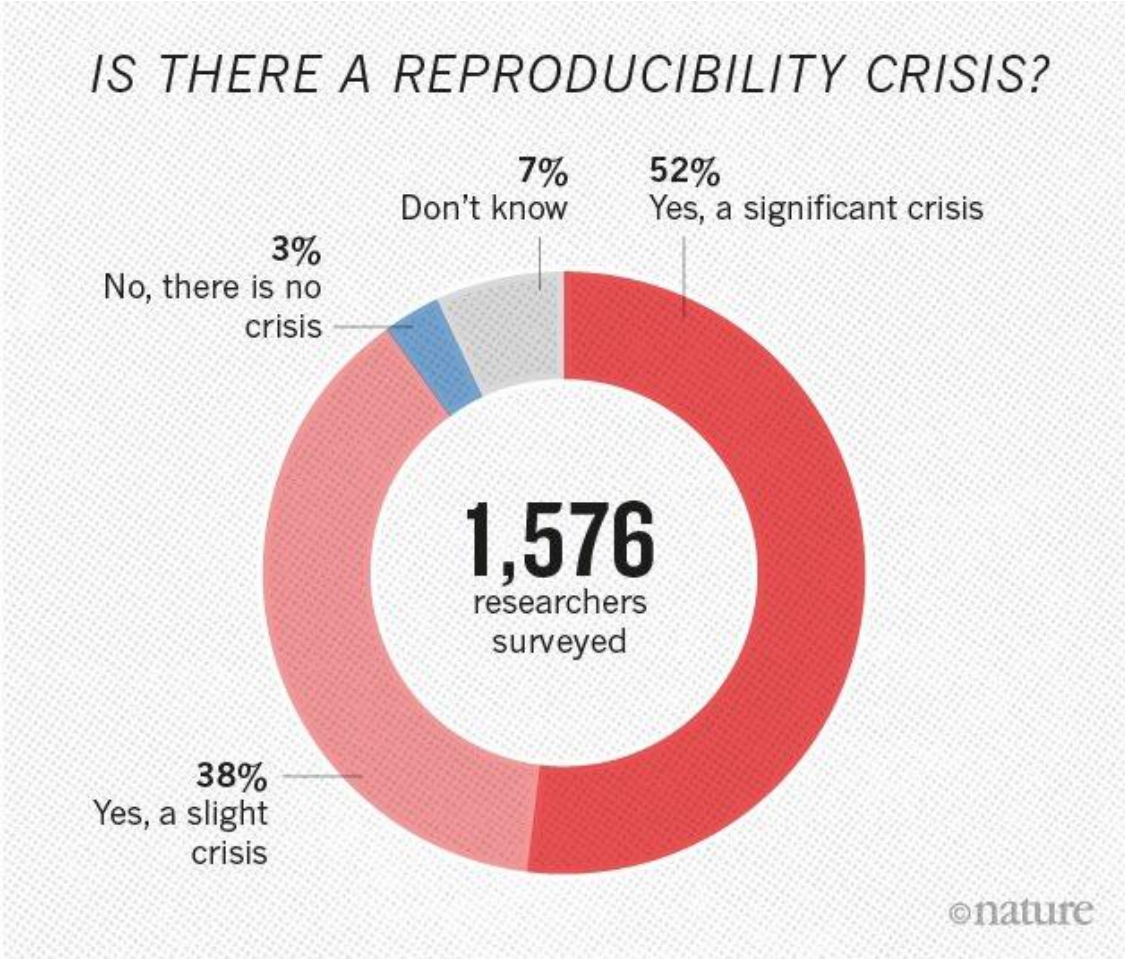


Figure taken from Baker, M. (2016). 1,500 scientists lift the lid on reproducibility. *Nature*, *533*(7604).

The reproducibility crisis

- Also known as the replicability crisis
  - Sometimes the generalizability crisis, or the methodological crisis

- The **current** collective concern that many scientific studies are difficult to reproduce or do not replicate
  - The psychological sciences (and biomedical sciences) have high-profile controversies at the start of the 2010s
  - There have been concerns about the lack of replications in the past!
    - e.g. Paul Meehl, Jacob Cohen and others were sounding the alarm in the 1970s

Romero, F. (2019). Philosophy of science and the replicability crisis. *Philosophy Compass*, *14*(11), e12633.

Notable examples of failed replications

- Priming people with elderly stereotypes leads to slower walking (Bargh, 1996) (almost 6000 citations!)
  - Multiple failures to replicate
  - Recent evidence suggesting that any walking speed effect was due to experimenters' expectations of what would happen
- Daryl Bem, a well-known and respected social psychologist and professor at the time, publishes positive evidence for precognition and premonition
  - **9** experiments, **1000** participants
  - Standard statistical analyses
  - Published in the *Journal of Personality and Social Psychology* (a highly prestigious journal) after peer review!
  - A pre-registered replication failed to find any of the reported effects in three attempts (Ritchie, Wiseman and French, 2012)

Bargh, J. A., Chen, M., & Burrows, L. (1996). Automaticity of social behavior: Direct effects of trait construct and stereotype activation on action. Journal of personality and social psychology, 71(2), 230.
Bem, D. J. (2011). Feeling the future: experimental evidence for anomalous retroactive influences on cognition and affect. Journal of personality and social psychology, 100(3), 407.
Ritchie, S. J., Wiseman, R., & French, C. C. (2012). Failing the future: Three unsuccessful attempts to replicate Bem's 'Retroactive Facilitation of Recall' Effect. PloS one, 7(3).
https://www.theguardian.com/science/2012/mar/15/precognition-studies-curse-failed-replications

Failures to replicate in psychology

- 39% of studies (36 of 97 that had positive findings) published in high-ranking psychology journals replicated (*Reproducibility Project: Psychology*; Open Science Collaboration, 2015)
- 14 of 28 psychology findings replicated with massive sample sizes (*Many Labs 2*; Klein, 2018)
- 3 of 10 psychology findings replicated across many participant pools (*Many Labs 3*; Ebersole et al., 2016)
- 13 of 21 social science experiments in *Nature* and *Science* between 2010 and 2015 replicated (Camerer, et al., 2018)

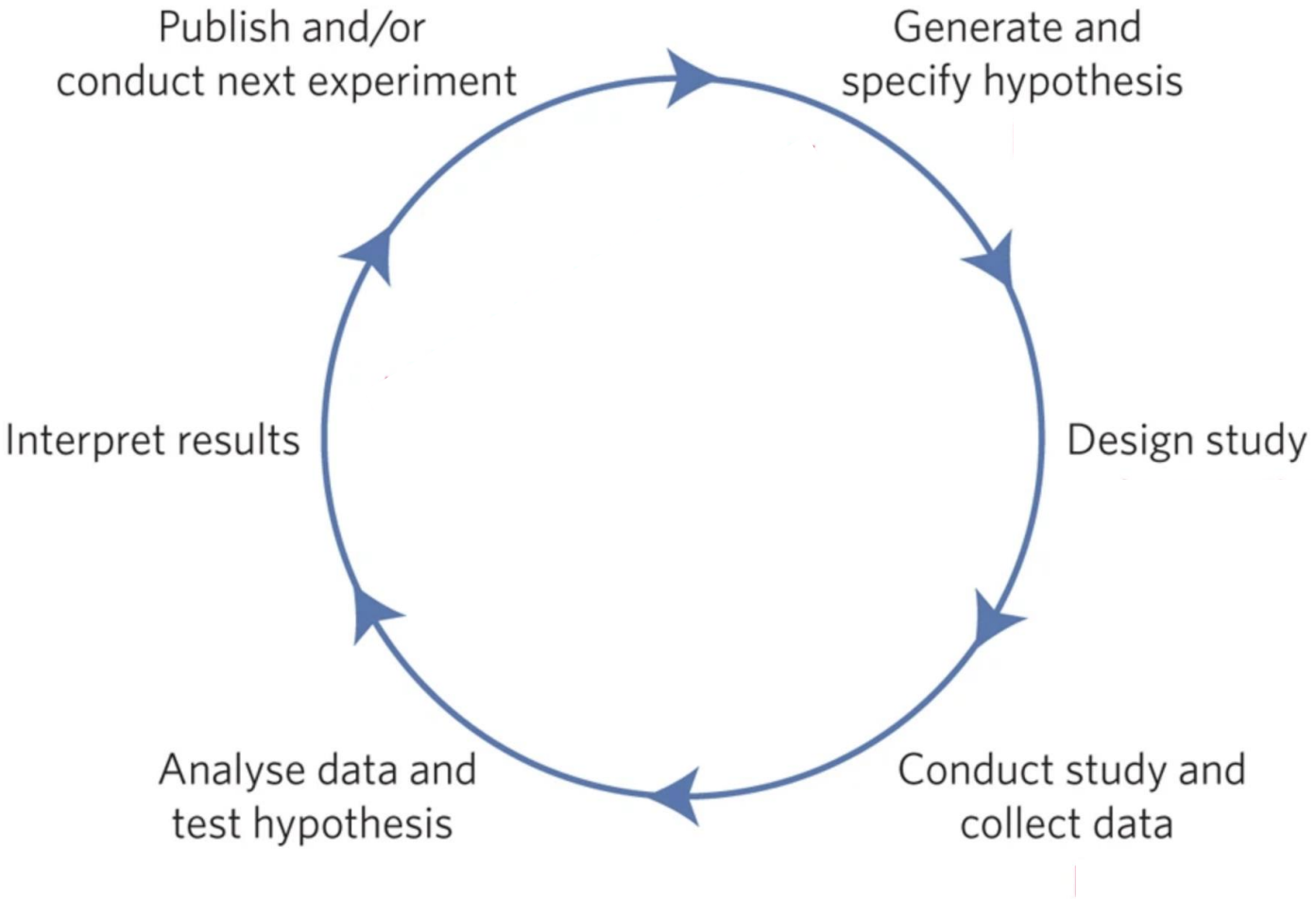
Open Science Collaboration. (2015). Reproducibility Project: Psychology. OSF. doi:10.17605/OSF.IO/EZCUJ

Klein, R. A., Vianello, M., Hasselman, F., Adams, B. G., Adams Jr, R. B., Alper, S., ... & Batra, R. (2018). Many Labs 2: Investigating variation in replicability across samples and settings. *Advances in Methods and Practices in Psychological Science*, *1*(4), 443-490

Ebersole, C. R., Atherton, O. E., PhD, Belanger, A. L., Skulborstad, H. M., Allen, J., Banks, J. B., … Nosek, B. A. (2016, August 17). Many Labs 3: Evaluating participant pool quality across the academic semester via replication. https://doi.org/10.31234/osf.io/q4emc.

Camerer, C. F., Dreber, A., Holzmeister, F., Ho, T. H., Huber, J., Johannesson, M., ... & Wu, H. (2018). Evaluating the replicability of social science experiments in Nature and Science between 2010 and 2015. Nature Human Behaviour, 2(9), 637-644.

Threats to reproducible science



Munafò, M. R., Nosek, B. A., Bishop, D. V., Button, K. S., Chambers, C. D., Du Sert, N. P., ... & Ioannidis, J. P. (2017). A manifesto for reproducible science. *Nature human behaviour*, *1*(1), 1-9.

Exponential growth of scientific publications

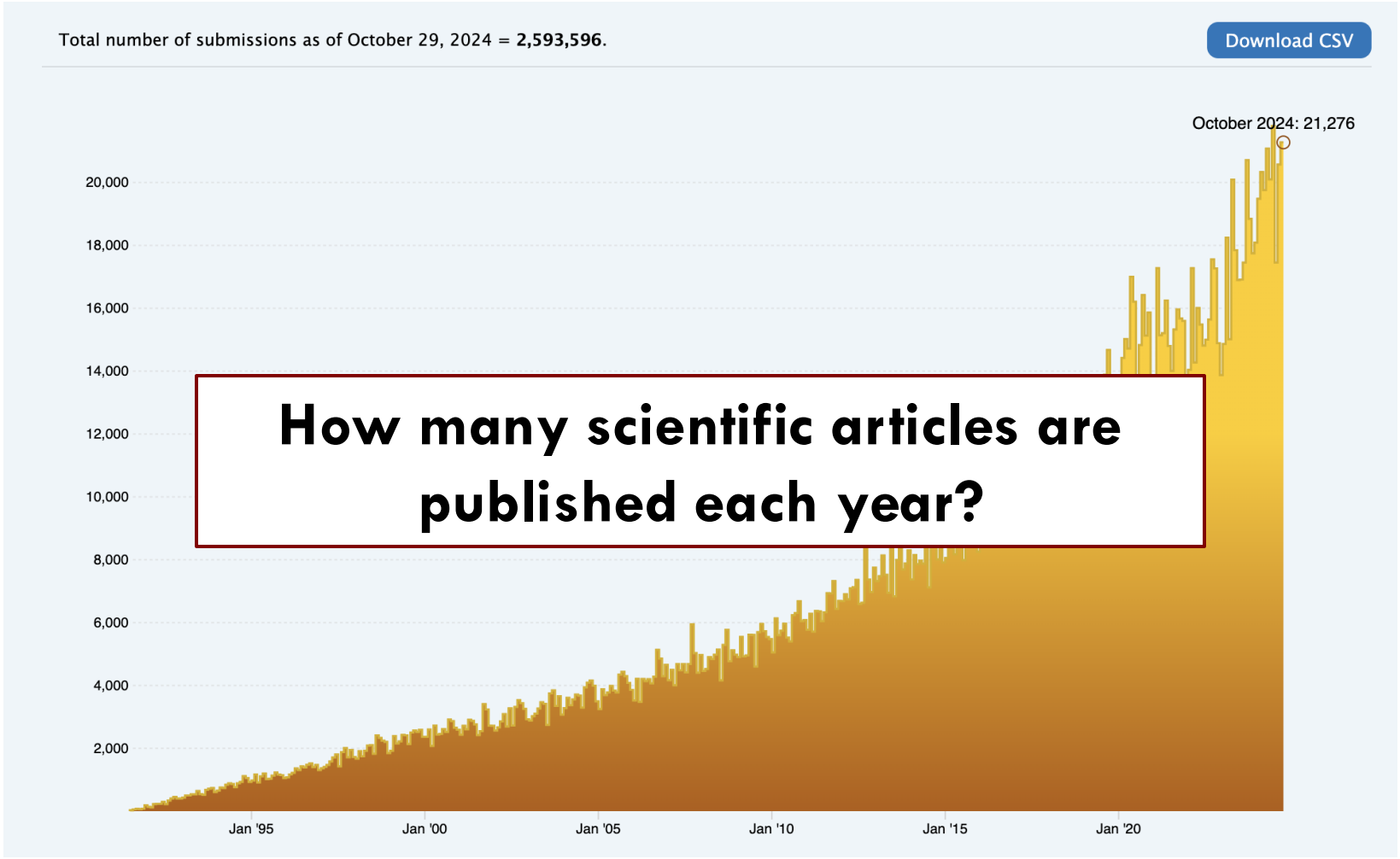


Figure taken from arxiv.org on the number of submissions over time. https://arxiv.org/stats/monthly_submissions

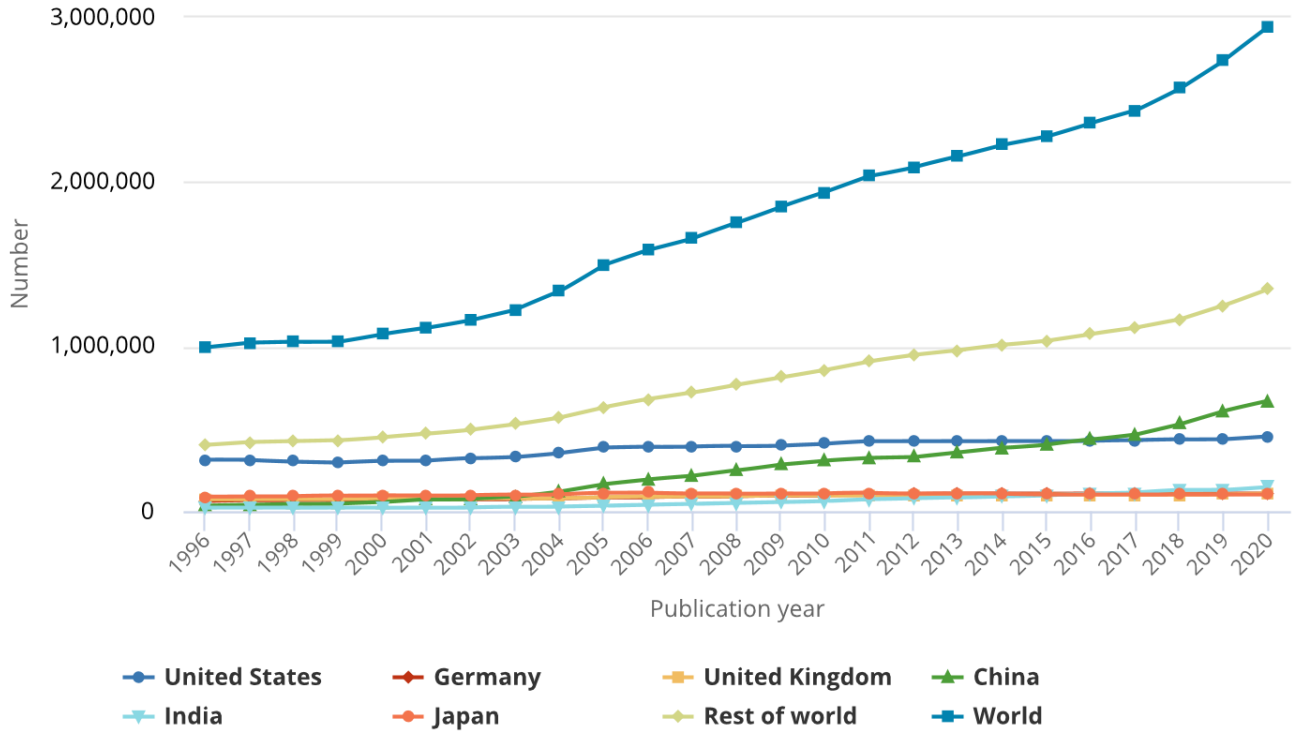
Exponential growth of scientific publications

- Estimated to have reached 2.9 million articles in 2020 (National Science Board, National Science Foundation)
- Increasing by approximately 4% each year (Pan, Petersen, Pammolli and Fortunato, 2016)

National Center for Science and Engineering Statistics | NSB-2021-4

Figure PBS-2

S&E articles, by selected region, country, or economy and rest of world: 1996–2020



Review by National Center for Science and Engineering Statistics. https://ncses.nsf.gov/pubs/nsb20214/publication-output-by-country-region-or-economy-and-scientific-field

Pan, R. K., Petersen, A. M., Pammolli, F., & Fortunato, S. (2018). The memory of science: Inflation, myopia, and the knowledge network. *Journal of Informetrics*, *12*(3), 656-678. https://arxiv.org/abs/1607.05606

Is the goal of science just to publish?

2024-8-13

The AI Scientist: Towards Fully Automated Open-Ended Scientific Discovery

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[*]Equal Contribution, [1]Sakana AI, [2]FLAIR, University of Oxford, [3]University of British Columbia, [4]Vector Institute, [5]Canada CIFAR AI Chair, [†]Equal Advising

One of the grand challenges of artificial general intelligence is developing agents capable of conducting scientific research and discovering new knowledge. While frontier models have already been used as aids to human scientists, e.g. for brainstorming ideas, writing code, or prediction tasks, they still conduct only a small part of the scientific process. This paper presents the first comprehensive framework for fully *automatic scientific discovery*, enabling frontier large language models (LLMs) to perform research independently and communicate their findings. We introduce THE AI SCIENTIST, which generates novel research ideas, writes code, executes experiments, visualizes results, describes its findings by writing a full scientific paper, and then runs a simulated review process for evaluation. In principle, this process can be repeated to iteratively develop ideas in an open-ended fashion and add them to a growing archive of knowledge, acting like the human scientific community. We demonstrate the versatility of this approach by applying it to three distinct subfields of machine learning: diffusion modeling, transformer-based language modeling, and learning dynamics. Each idea is implemented and developed into a full paper at a meager cost of less than $15 per paper, illustrating the potential for our framework to democratize research and significantly accelerate scientific progress. To evaluate the generated papers, we design and validate an automated reviewer, which we show achieves near-human performance in evaluating paper scores. THE AI SCIENTIST can produce papers that exceed the acceptance threshold at a top machine learning conference as judged by our automated reviewer. This approach signifies the beginning of a new era in scientific discovery in machine learning: bringing the transformative benefits of AI agents to the *entire* research process of AI itself, and taking us closer to a world where *endless affordable creativity and innovation* can be unleashed on the world's most challenging problems. Our code is open-sourced at https://github.com/SakanaAI/AI-Scientist.

My impression is that their attention is misplaced on the incentives, and lacks a considered philosophy of science.

Does producing more papers lead to more knowledge? Solutions to world's problems? Progress in society?

The decline of negative results

- The proportion of papers reporting a positive result has been increasing from

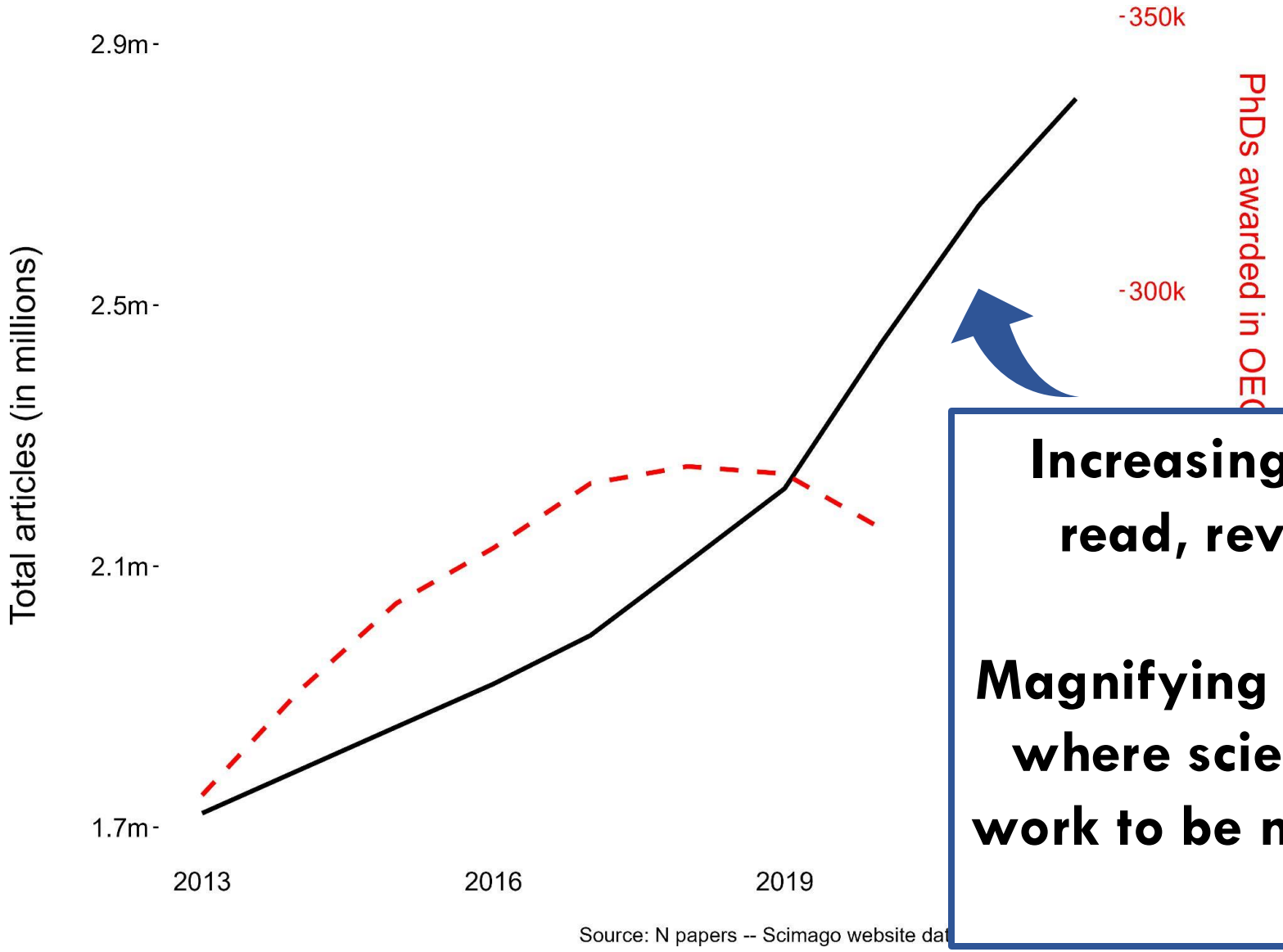
Does having more papers (mostly with positive findings) mean faster scientific progress?

I say not really.

- In the recent psychology literature, this proportion is estimated to be ~95% (Scheel, Schijen and Lakens, 2021)

Figure from Fanelli, D. (2012). Negative results are disappearing from most disciplines and countries. *Scientometrics*, *90*(3), 891-904.

Scheel, A. M., Schijen, M. R., & Lakens, D. (2021). An excess of positive results: Comparing the standard Psychology literature with Registered Reports. Advances in Methods and Practices in Psychological Science, 4(2), 25152459211007467.



Increasing strain on scientists to read, review and co-ordinate.

Magnifying an "attention economy" where scientists compete for their work to be noticed and have impact.

Figure copied from https://bsky.app/profile/hansonmark.bsky.social/post/3kajeqzv3nt2b
Hanson, Barreiro, Crosetto and Brockington (2023). The strain on scientific publishing. *ArXiv.* https://arxiv.org/abs/2309.15884

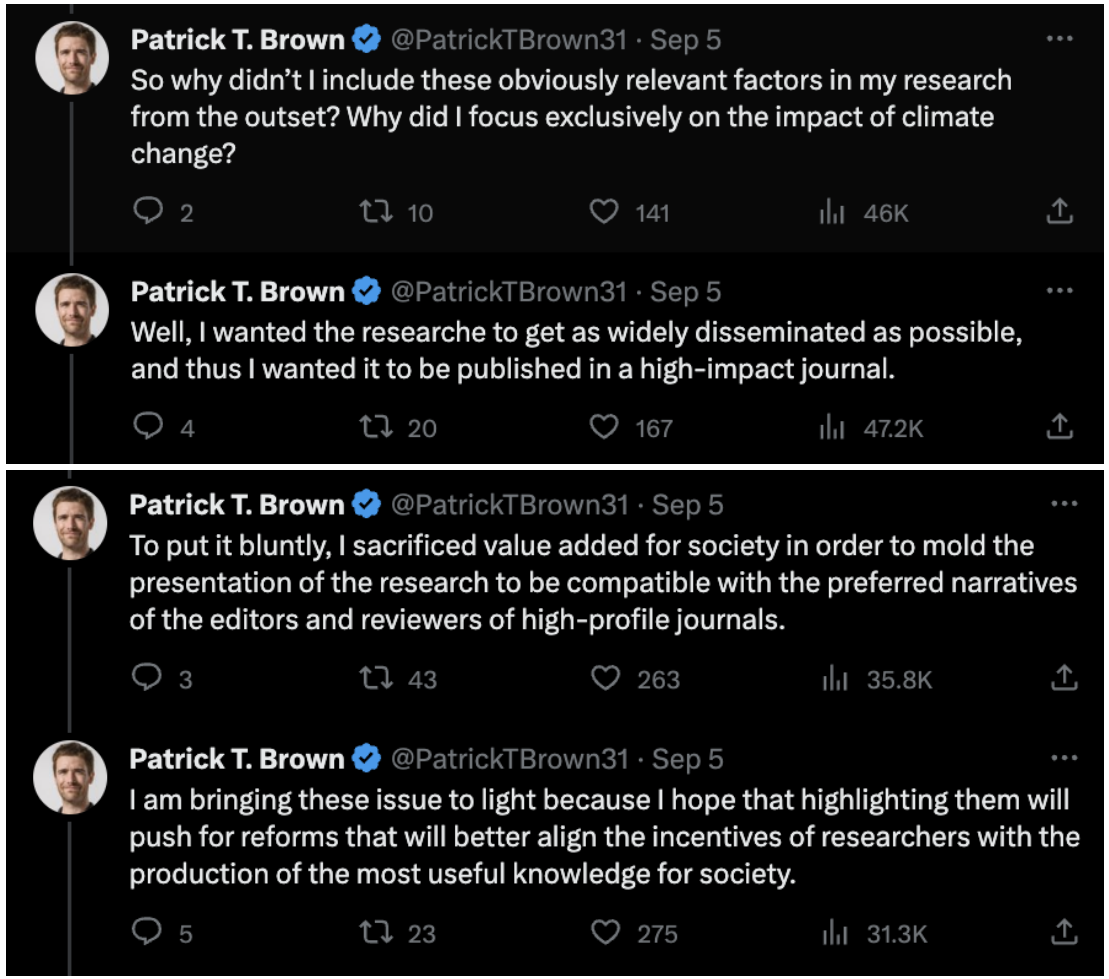
What comes at the cost of scientific rigor

Climate warming increases extreme daily wildfire growth risk in California

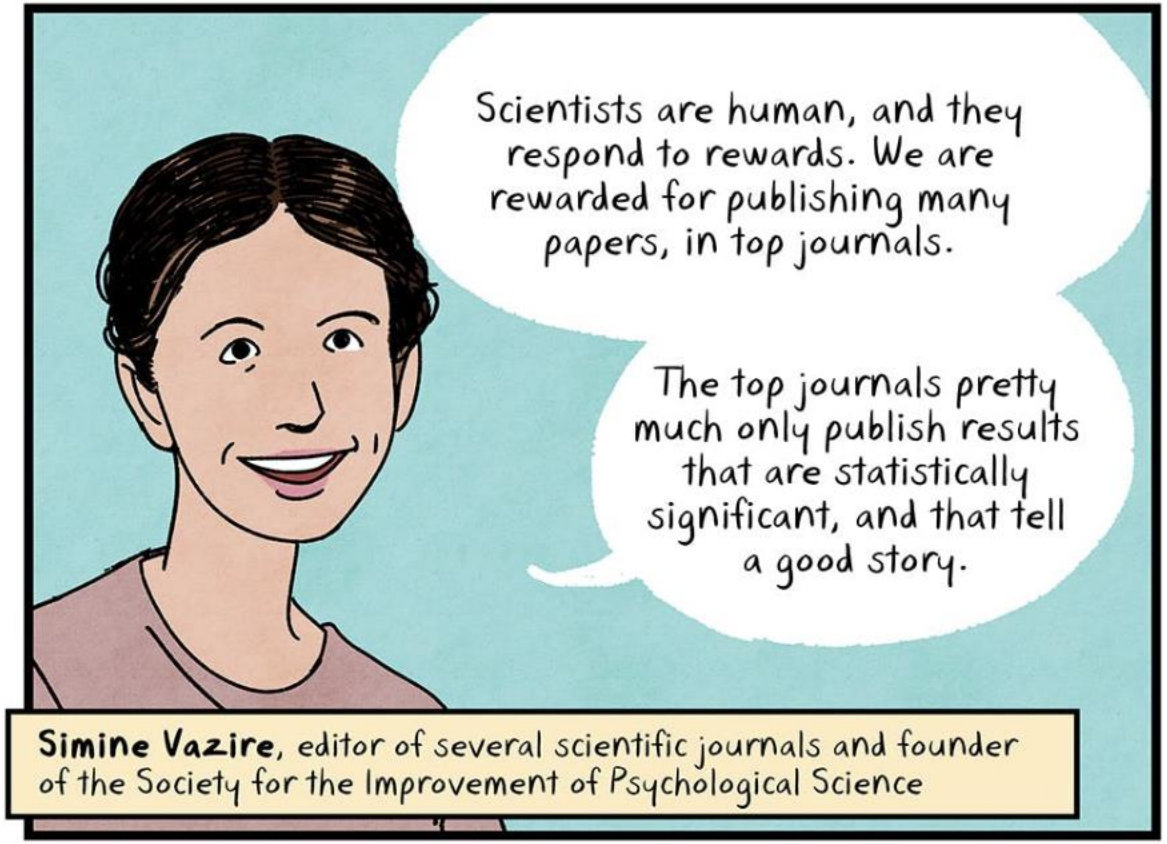
Patrick T. Brown, Holt Hanley, Ankur Mahesh, Colorado Reed, Scott J. Strenfel, Steven J. Davis, Adam K. Kochanski & Craig B. Clements

Nature **621**, 760–766 (2023) | Cite this article

Is this appropriate scientific communication?



Screenshots from https://twitter.com/PatrickTBrown31/status/1699016555844035045



Current academic structures have lead to more papers, but with incentives and research assessment being broken, it has not meant more rigorous science.

Taken from Repeat After Me by Maki Naro. Published by The Nib. https://thenib.com/repeat-after-me/

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The **Open Science** movement

- "An umbrella term used to refer to the concepts of **openness, transparency, rigor, reproducibility, replicability, and accumulation of knowledge**, which are considered fundamental features of science" (Crüwell et al., 2018)

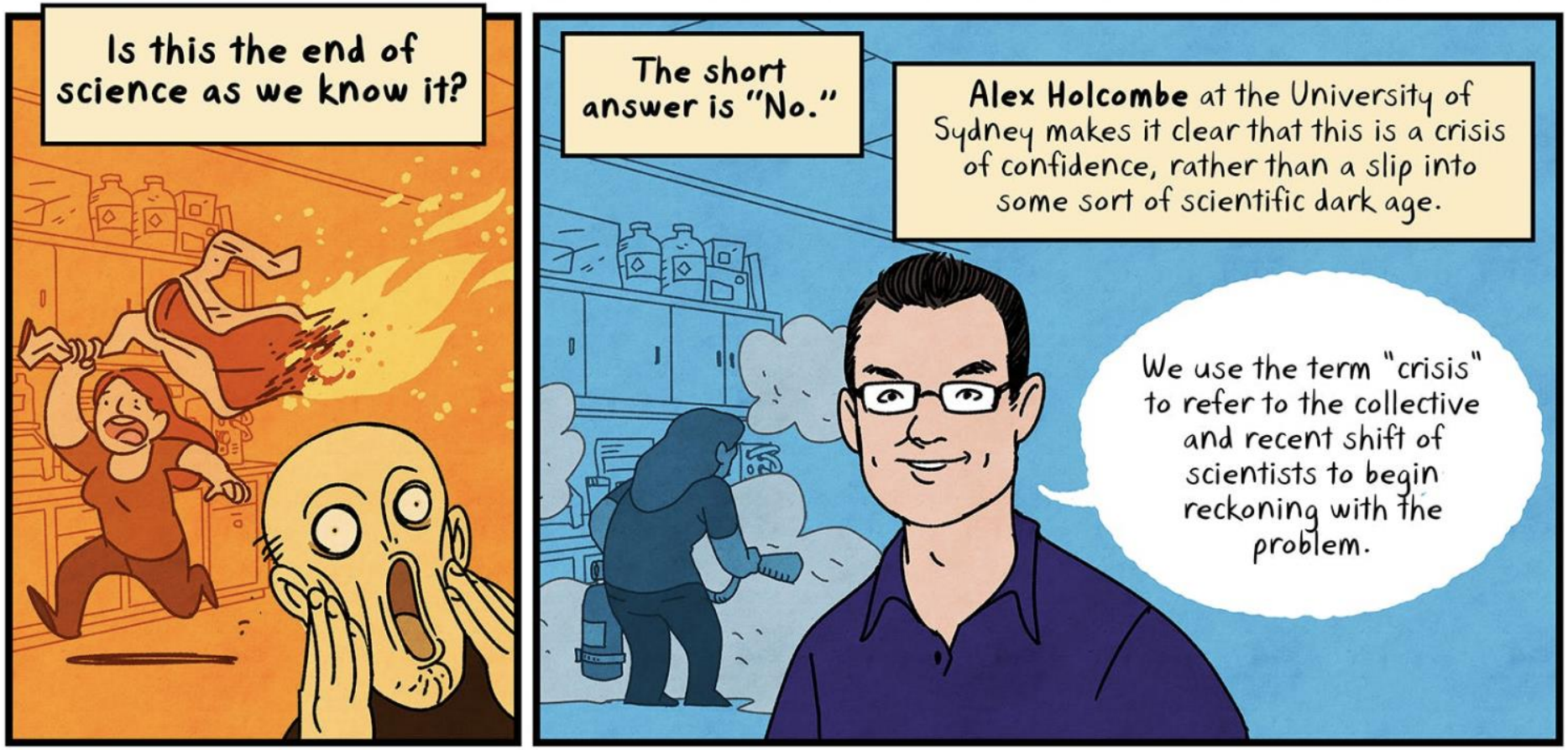
- A rapidly growing and evolving movement that has had (and continues to have) a long-lasting effect on how science is being done!

Crüwell, S., van Doorn, J., Etz, A., Makel, M. C., Moshontz, H., Niebaum, J. C., Orben, A., Parsons, S., & Schulte-Mecklenbeck, M. (2018). 7 Easy Steps to Open Science: An Annotated Reading List. https://doi.org/10.31234/osf.io/cfzyx

My journey in Open Science

My journey in Open Science

- Learnt about open science from my PhD supervisor, Alex Holcombe
  - Participated in the *Reproducibility Project: Psychology* as a research assistant



Early-career researchers leading the way with ReproducibiliTea

- An initiative founded by early-career researchers in 2018 that now spans 119 institutions across 29 countries
- Creating open scholarship communities at research institutions, especially empowering early-career researchers

Check out https://reproducibilitea.org/

My journey in Open Science

- I got involved with **ReproducibiliTea** a grassroots initiative started by early-career researchers to form Open Science journal clubs at local institutions.
  - Started a journal club chapter at the University of Chicago in my first year as a postdoc
  - Became a steering committee member in the second year of my postdoc and served for three years
  - Started a journal club chapter at the University of Adelaide in my first year as a lecturer

- Created introductory reading lists on Open Science, preregistration and theory in psychological science – hosted at https://rpt-rl.netlify.app

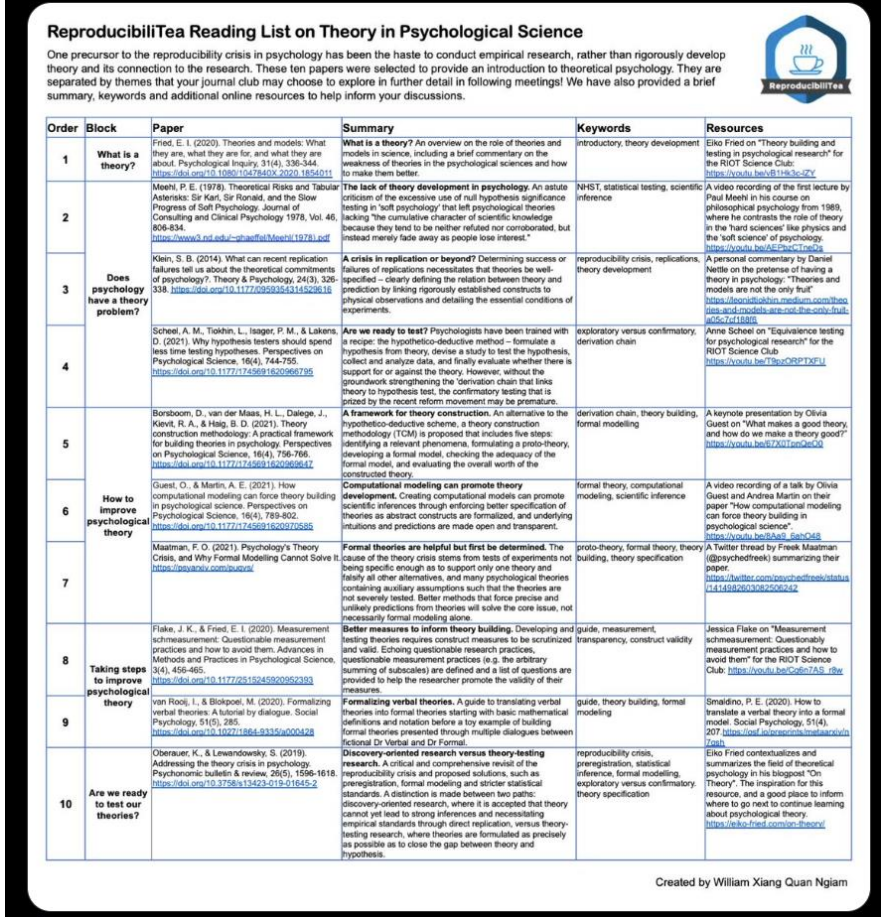
ReproducibiliTea Introductory Reading List

These are our recommendations for the papers to cover in the first term of your new ReproducibiliTea journal club! These ten papers were selected to provide an overview of the reproducibility crisis and introduction to the many aspects of Open Science. They are separated by themes that your journal club may choose to explore in further detail in following meetings! We have also provided a summary, keywords and online resources to help inform your discussions.

Order	Block	Paper	Summary	Keywords	Resources
1	The 'issues' that lead to the reproducibility crisis	Ioannidis JPA (2005). Why most published research findings are false. PLoS Med 2(8): e124. https://doi.org/10.1371/journal.pmed.0020124	**Defining the issue.** By simulating at various levels of statistical power, across different pre-study odds, the accumulation of significant results is shown to be potentially false positives predominantly. The paper introduces concepts like the positive predictive value and how it is related to the *p*-value, and how important having high statistical power is for the rigor of research.	*p*-values, positive predictive values, false positives, statistical power	Summary video (by William Ngiam): https://www.youtube.com/watch?v=C7N_-XanpTI
2		Smaldino, P. E., & McElreath, R. (2016). The natural selection of bad science. Royal Society open science, 3(9), 160384. https://doi.org/10.1098/rsos.160384	**The myth of self-correction.** Estimates of statistical power historically in science appears to be extremely low. In addition to that, due to publication bias (the view that positive results are more likely to be published) and the incentives to publish, simulations suggest that a high false-discovery rate is 'naturally selected' for and that replications are ineffective at correcting that rate.	statistical power, replication	Summary video (by William Ngiam): https://www.youtube.com/watch?v=EdLDE2Y4exM
3		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(11), 1359–1366. https://doi.org/10.1177/0956797611417632	**The problem of analytic flexibility.** A demonstration of how decisions made by researchers in statistical analysis, such as dropping conditions or adding observations after a non-significant test, can easily produce a false positive result.	analytic flexibility, researcher degrees of freedom, questionable research practices	Summary video (by William Ngiam): https://www.youtube.com/watch?v=bf3GqyBRgzY
4	The extent of the 'issues'	John, L. K., Loewenstein, G., & Prelec, D. (2012). Measuring the Prevalence of Questionable Research Practices With Incentives for Truth Telling. Psychological Science, 23(5), 524–532. https://doi.org/10.1177/0956797611430953	**The prevalence of questionable research practices.** With an incentive for honest reporting, psychologists were surveyed about engaging in questionable research practices and the proportion that admitted to doing so may be surprisingly high.	questionable research practices	
5		Open Science Collaboration. (2015). Estimating the reproducibility of psychological science. Science, 349(6251). https://doi.org/10.1126/science.aac4716	**The Reproducibility Project: Psychology.** A large-scale, collaborative replication effort of 100 published psychological findings showed the majority of findings did not reproduce, and those that do replicate mostly produced a smaller effect-size. This project provided an initial estimate of the reproducibility in science and brought attention for the need of methodological reform.	reproducibility, replication	Brian Nosek in an interview about the results and implications of the Reproducibility Project: Psychology https://www.youtube.com/watch?v=iD1MWkDghLM
6	Perspectives on the reproducibility crisis	Vazire, S. (2018). Implications of the credibility revolution for productivity, creativity, and progress. Perspectives on Psychological Science, 13(4), 411-417. https://doi-org/10.1177%2F1745691617751884	**The credibility revolution.** A reframing of the 'reproducibility crisis' that highlights the scientific reforms that have occurred with the Open Science movement, and their potential impacts on the productivity, creativity and progress of scientists.	credibility revolution, commentary, summary	Presentation by Simine Vazire at OSC 2019: https://www.youtube.com/watch?v=Yf1Ovx-OixE
7		Yarkoni, T. (2018), Not its not The Incentives - it's you. Yarkoni Blog - [citation needed]: https://www.talyarkoni.org/blog/2018/10/02/no-its-not-the-incentives-its-you/	**Dealing with the Incentives.** A blogpost arguing that the responsibility for reproducible science rests with the individual, and that the Incentives are not a good reason to be absolved of that responsibility	incentives, commentary	
8	Getting started with Open Science	Kathawalla, U. K., Silverstein, P., & Syed, M. (2021). Easing into open science: A guide for graduate students and their advisors. Collabra: Psychology, 7(1). https://doi.org/10.1525/collabra.18684	**Easing into Open Science.** A very accessible guide for graduate students (and their advisors) on some of the different ways to engage with the reproducibility movement. They are given difficulty ratings (easy, medium or difficult) and potential worries are also addressed.	early-career researchers, guide, introductory, pre-registration	Presentation by Priya Silverstein at RIOT Science Club: https://www.youtube.com/watch?v=owJaD3UiseQ
9		Munafò, M. R., Nosek, B. A., Bishop, D. V. M., Button, K. S., Chambers, C. D., Percie Du Sert, N., Simonsohn, U., Wagenmakers, E. J., Ware, J. J., & Ioannidis, J. P. A. (2017). A manifesto for reproducible science. Nature Human Behaviour, 1(1), 1–9. https://doi.org/10.1038/s41562-016-0021	**A manifesto for reproducible science.** A general overview of the goals of various reproducibility measures and how they can be implemented.	guide, reproducibility	
10		Crüwell, S., van Doorn, J., Etz, A., Makel, M. C., Moshontz, H., Niebaum, J. C., ... & Schulte-Mecklenbeck, M. (2019). Seven easy steps to open science. Zeitschrift für Psychologie. http://dx.doi.org/10.1027/2151-2604/a000387	**Where to next?** An annotated reading list of papers from seven topics: open access, open data, preregistration, reproducible analyses, replications and teaching open science in an attempt to make those practices more understandable and actionable for readers	transparency, meta-science	

Will Ngiam | https://fediscience.org/@will_ngiam
@will_ngiam

A critical component that is often missing from psychology graduate research training is a course on *theory in psychological science*. I created this introductory reading list of ten relevant articles, including a brief summary and a link to a supplemental online resource!



ReproducibiliTea Reading List on Theory in Psychological Science

One precursor to the reproducibility crisis in psychology has been the haste to conduct empirical research, rather than rigorously develop theory and its connection to the research. These ten papers were selected to provide an introduction to theoretical psychology. They are separated by themes that your journal club may choose to explore in further detail in following meetings! We have also provided a brief summary, keywords and additional online resources to help inform your discussions.

Order	Block	Paper	Summary	Keywords	Resources
1	What is a theory?	Fried, E. I. (2020). Theories and models: What they are, what they are for, and what they are about. Psychological Inquiry, 31(4), 336-344. https://doi.org/10.1080/1047840X.2020.1854011	**What is a theory?** An overview on the role of theories and models in science, including a brief commentary on the weakness of theories in the psychological sciences and how to make them better.	introductory, theory development	Eiko Fried on "Theory building and testing in psychological research" for the RIOT Science Club: https://youtu.be/vB1Hp3c-IZY
2	Does psychology have a theory problem?	Meehl, P. E. (1978). Theoretical Risks and Tabular Asterisks: Sir Karl, Sir Ronald, and the Slow Progress of Soft Psychology. Journal of Consulting and Clinical Psychology 1978, Vol. 46, 806-834. https://www3.nd.edu/~ghaeffel/Meehl(1978).pdf	**The lack of theory development in psychology.** An astute criticism of the excessive use of null hypothesis significance testing in 'soft psychology' that left psychological theories lacking "the cumulative character of scientific knowledge because they tend to be neither refuted nor corroborated, but instead merely fade away as people lose interest."	NHST, statistical testing, scientific inference	A video recording of the first lecture by Paul Meehl in his course on philosophical psychology from 1989, where he contrasts the role of theory in the 'hard sciences' like physics and the 'soft science' of psychology. https://youtu.be/AEPtxcCTqqDs
3		Klein, S. B. (2014). What can recent replication failures tell us about the theoretical commitments of psychology?. Theory & Psychology, 24(3), 326-338. https://doi.org/10.1177/0959354314529616	**A crisis in replication or beyond?** Determining success or failures of replications necessitates that theories be well-specified – clearly defining the relation between theory and prediction by linking rigorously established constructs to physical observations and detailing the essential conditions of experiments.	reproducibility crisis, replications, theory development	A personal commentary by Daniel Nettle on the pretense of having a theory in psychology: "Theories and models are not the only fruit" https://doingdarwin.medium.com/theories-and-models-are-not-the-only-fruit-a05c7cf188f6
4		Scheel, A. M., Tiokhin, L., Isager, P. M., & Lakens, D. (2021). Why hypothesis testers should spend less time testing hypotheses. Perspectives on Psychological Science, 16(4), 744-755. https://doi.org/10.1177/1745691620966795	**Are we ready to test?** Psychologists have been trained with a recipe: the hypothetico-deductive method – formulate a hypothesis from theory, devise a study to test the hypothesis, collect and analyze data, and finally evaluate whether there is support for or against the theory. However, without the groundwork strengthening the 'derivation chain that links theory to hypothesis test, the confirmatory testing that is prized by the recent reform movement may be premature.	exploratory versus confirmatory, derivation chain	Anne Scheel on "Equivalence testing for psychological research" for the RIOT Science Club https://youtu.be/T9pxORPTXFU
5	How to improve psychological theory	Borsboom, D., van der Maas, H. L., Dalege, J., Kievit, R. A., & Haig, B. D. (2021). Theory construction methodology: A practical framework for building theories in psychology. Perspectives on Psychological Science, 16(4), 756-766. https://doi.org/10.1177/1745691620969647	**A framework for theory construction.** An alternative to the hypothetico-deductive scheme, a theory construction methodology (TCM) is proposed that includes five steps: identifying a relevant phenomena, formulating a proto-theory, developing a formal model, checking the adequacy of the formal model, and evaluating the overall worth of the constructed theory.	derivation chain, theory building, formal modelling	A keynote presentation by Olivia Guest on "What makes a good theory, and how do we make a theory good?" https://youtu.be/E7X0TpnQeD0
6		Guest, O., & Martin, A. E. (2021). How computational modeling can force theory building in psychological science. Perspectives on Psychological Science, 16(4), 789-802. https://doi.org/10.1177/1745691620970585	**Computational modeling can promote theory development.** Creating computational models can promote scientific inferences through enforcing better specification of theories as abstract constructs are formalized, and underlying intuitions and predictions are made open and transparent.	formal theory, computational modeling, scientific inference	A video recording of a talk by Olivia Guest and Andrea Martin on their paper "How computational modeling can force theory building in psychological science" https://youtu.be/8Aa9_5ehO48
7		Maatman, F. O. (2021). Psychology's Theory Crisis, and Why Formal Modelling Cannot Solve It. https://psyarxiv.com/puqvy/	**Formal theories are helpful but first be determined.** The cause of the theory crisis stems from tests of experiments not being specific enough as to support only one theory and falsify all other alternatives, and many psychological theories containing auxiliary assumptions such that the theories are not severely tested. Better methods that force precise and unlikely predictions from theories will solve the core issue, not necessarily formal modeling alone.	proto-theory, formal theory, theory building, theory specification	A Twitter thread by Freek Maatman (@psychedfreek) summarizing their paper. https://twitter.com/psychedfreek/status/1414982603082506242
8	Taking steps to improve psychological theory	Flake, J. K., & Fried, E. I. (2020). Measurement schmeasurement: Questionable measurement practices and how to avoid them. Advances in Methods and Practices in Psychological Science, 3(4), 456-465. https://doi.org/10.1177/2515245920952393	**Better measures to inform theory building.** Developing and testing theories requires construct measures to be scrutinized and valid. Echoing questionable research practices, questionable measurement practices (e.g. the arbitrary summing of subscales) are defined and a list of questions are provided to help the researcher promote the validity of their measures.	guide, measurement, transparency, construct validity	Jessica Flake on "Measurement schmeasurement: Questionably measurement practices and how to avoid them" for the RIOT Science Club: https://youtu.be/Cq6n7AS_r8w
9		van Rooij, I., & Blokpoel, M. (2020). Formalizing verbal theories: A tutorial by dialogue. Social Psychology, 51(5), 285. https://doi.org/10.1027/1864-9335/a000428	**Formalizing verbal theories.** A guide to translating verbal theories into formal theories starting with basic mathematical definitions and notation before a toy example of building formal theories presented through multiple dialogues between fictional Dr Verbal and Dr Formal.	guide, theory building, formal modeling	Smaldino, P. E. (2020). How to translate a verbal theory into a formal model. Social Psychology, 51(4), 207 https://osf.io/preprints/metaarxiv/n2qsh
10	Are we ready to test our theories?	Oberauer, K., & Lewandowsky, S. (2019). Addressing the theory crisis in psychology. Psychonomic bulletin & review, 26(5), 1596-1618. https://doi.org/10.3758/s13423-019-01645-2	**Discovery-oriented research versus theory-testing research.** A critical and comprehensive revisit of the reproducibility crisis and proposed solutions, such as preregistration, formal modeling and stricter statistical standards. A distinction is made between two paths: discovery-oriented research, where it is accepted that theory cannot yet lead to strong inferences and necessitating empirical standards through direct replication, versus theory-testing research, where theories are formulated as precisely as possible as to close the gap between theory and hypothesis.	reproducibility crisis, preregistration, statistical inference, formal modelling, exploratory versus confirmatory, theory specification	Eiko Fried contextualizes and summarizes the field of theoretical psychology in his blogpost "On Theory". The inspiration for this resource, and a good place to inform where to go next to continue learning about psychological theory. https://eiko-fried.com/on-theory/

Created by William Xiang Quan Ngiam

ReproducibiliTea

6:45 PM · Oct 1, 2022

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S3E7: Invisible Workload

ReproducibiliTea Podcast

Today, Sarah and Will discuss the invisible workload of making open science. The paper on invisible workload: https://journal.trialanderror.org/pub/the-invisible-workload/release/1...

E 21 June 2023 • 37 min 52 sec left

S3E13: From Crisis To FORRTsitive Change

ReproducibiliTea Podcast

Today, Will sits down with Max Korbmacher, Thomas Rhys Evans, and Flavio Azevedo, some of the authors of the paper "The replication crisis has led to positive structural, procedural,...

E 1 Sept 2023 • Finished ✓

S4E1: Reproducibility Training with Repro4Everyone with Nafisa Jadavji and Nele Haelterman

ReproducibiliTea Podcast

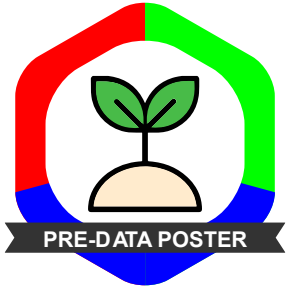
We welcome back the ReproducibiliTea Podcast with Will and Helena chatting to Nafisa Jadavji and Nele Haelterman about Reproducibility for Everyone (R4E), a community-led...

E 6 Sept 2024 • Finished ✓

WORKING MEMORY SYMPOSIUM

- Organized a free virtual conference for early-career researchers to present their work when in-person conferences shut down due to the pandemic

OPEN SCIENCE: A VISION FOR A FAIR AND EQUITABLE SCIENCE
William X. Q. Ngiam, PH.D.
Postdoctoral Researcher, University of Chicago



Pre-Data-Collection Poster Session

2022 Open Science Workshop on Preregistration

NEUROSCIENCE
2023

Doing Our Part to Change the Culture of Science: Becoming a Champion for Rigor

Organizer/Moderator: Devon Crawford
Speaker: Lique Coolen, Sandra Hewett, Brielle Ferguson, Nafisa Jadavji, Michael Dougherty, Shai Silberberg, William Ngiam
Date & Time: Saturday, November 11, noon–2 p.m.
Location: WCC 207B
Track: Research Skills

Framework for Open and Reproducible Research Training

FORRT

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Comment | Published: 21 February 2022

A community-sourced glossary of open scholarship terms

Home > Research Integrity and Peer Review > Article

A guide for social science journal editors on easing into open science

Commentary | Open access | Published: 16 February 2024

Volume 9, article number 2, (2024) Cite this article

Research Integrity and Peer Review

aps | ASSOCIATION FOR PSYCHOLOGICAL SCIENCE

Observer > 2022 > January/February > Fully Credited: Making Publishing More Equitable

FEATURED

Fully Credited: Making Publishing More Equitable

A new model of "contributorship" addresses the marginalization of early-career researchers in scientific publications.

William X.Q. Ngiam

December 29, 2021

TAGS: APS JOURNALS | CAREER | CAREER PATH | FEATURE | INCLUSIVITY | PUBLISHING | WRITING

BRAIN COMMUNICATIONS

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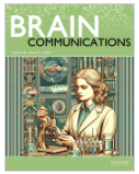


Volume 6, Issue 3
2024

JOURNAL ARTICLE

Catalyzing communities of research rigour champions

Audrey C Brumback, William X Q Ngiam, Dana M Lapato, David B Allison, Christin L Daniels, Michael Dougherty, Haley F Hazlett, Kara L Kerr, Susan Pusek, Melissa L Rethlefsen ... Show more

Brain Communications, Volume 6, Issue 3, 2024, fcae120, https://doi.org/10.1093/braincomms/fcae120

I am the inaugural *Open Practices Editor* at *Attention, Perception, and Psychophysics*

- I check each submission's open materials – preregistration, open data and open code – checking for ways to enhance their usability

I am building a free-to-use, open-source software for qualitative analysis

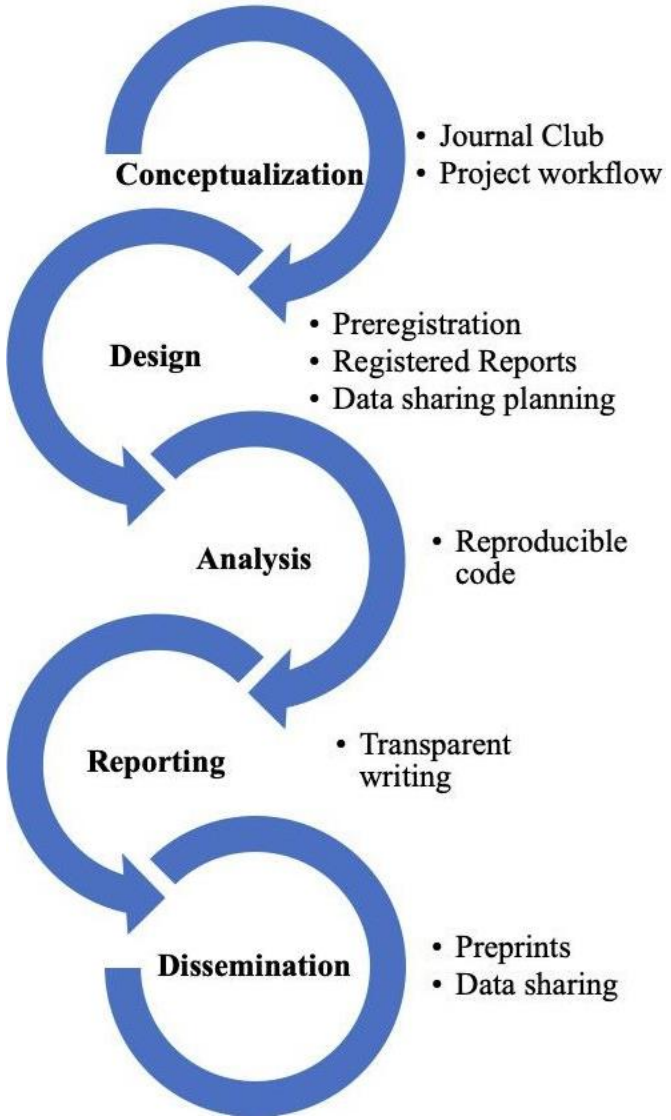
- It's called *quokka*, and it works in-browser at https://palm-lab.github.io/QualCA
- Most existing software require expensive subscriptions and have fairly clunky interfaces

Benefits of doing Open Science

Where to begin?

- Open Science is not all or nothing – treat it like a "buffet" (coined by Christina Bergmann)
  - These are research skills that take time to develop!

- Some easy Open Science practices to adopt:
  - Open sharing of code, data and research materials
  - More replications and re-analyses
  - Preprints and open access publishing
  - Preregistration and registered reports



Kathawalla, U. K., Silverstein, P., & Syed, M. (2021). Easing into open science: A guide for graduate students and their advisors. *Collabra: Psychology*, *7*(1).
McKiernan, E. C., Bourne, P. E., Brown, C. T., Buck, S., Kenall, A., Lin, J., ... & Yarkoni, T. (2016). Point of view: How open science helps researchers succeed. elife, 5, e16800.

Personal benefits of Open Science

- Improve the quality and reliability of your scientific research
  - For example, preregistrations prompt theory development, justifications of sample sizes and analyses, and statistical power considerations to protect against researcher bias
- Increases the impact of your scientific research
  - Increase reviewers' quality of feedback if they reproduce your results and analyses
  - Increase citations from re-analysis and re-use of open datasets
- Can become part of your academic brand
  - Increasingly considered in grants and job applications

Markowetz, F. (2015). Five selfish reasons to work reproducibly. Genome biology, 16(1), 1-4.
Piwowar, H. A., & Vision, T. J. (2013). Data reuse and the open data citation advantage. *PeerJ*, *1*, e175.

ORIGINAL ARTICLE

PSYCHOPHYSIOLOGY SPR WILEY

Estimating the statistical power to detect set-size effects in contralateral delay activity

William X. Q. Ngiam[1] | Kirsten C. S. Adam[2] | Colin Quirk[1] | Edward K. Vogel[1] | Edward Awh[1]

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Mapping visual working memory models to a theoretical framework

AUTHORS
William X. Q. Ngiam

It's not either/or – your goals can include improving science while conducting empirical research.

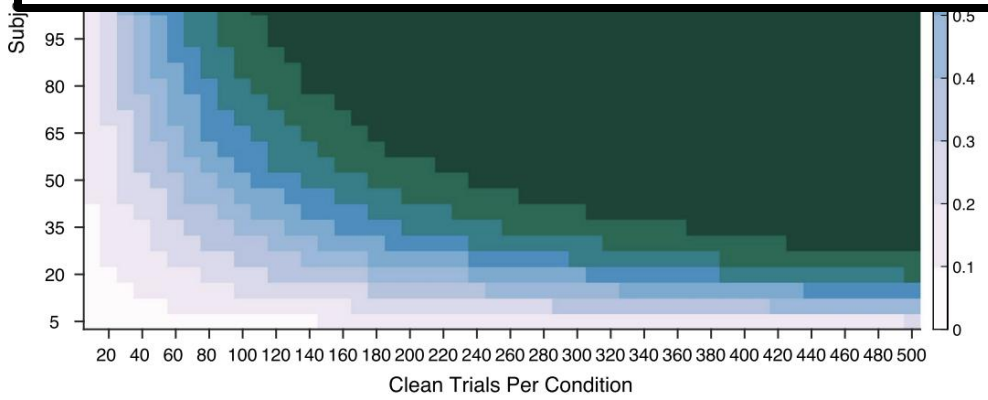


FIGURE 6 Simulated statistical power for observing a significant difference in CDA amplitude between set sizes 2 and 4 beyond the bounds of the Hakim et al. (2019) dataset

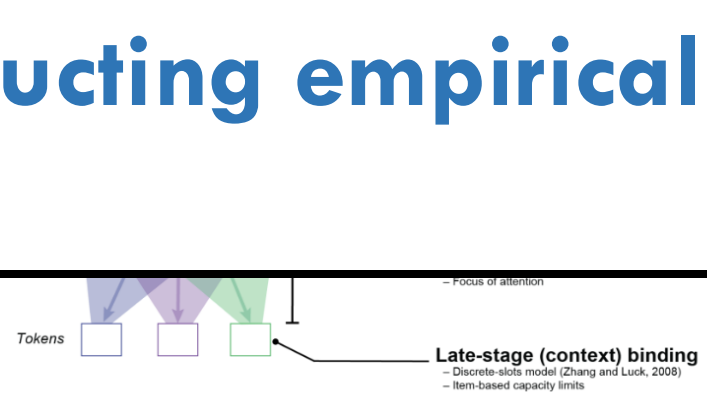
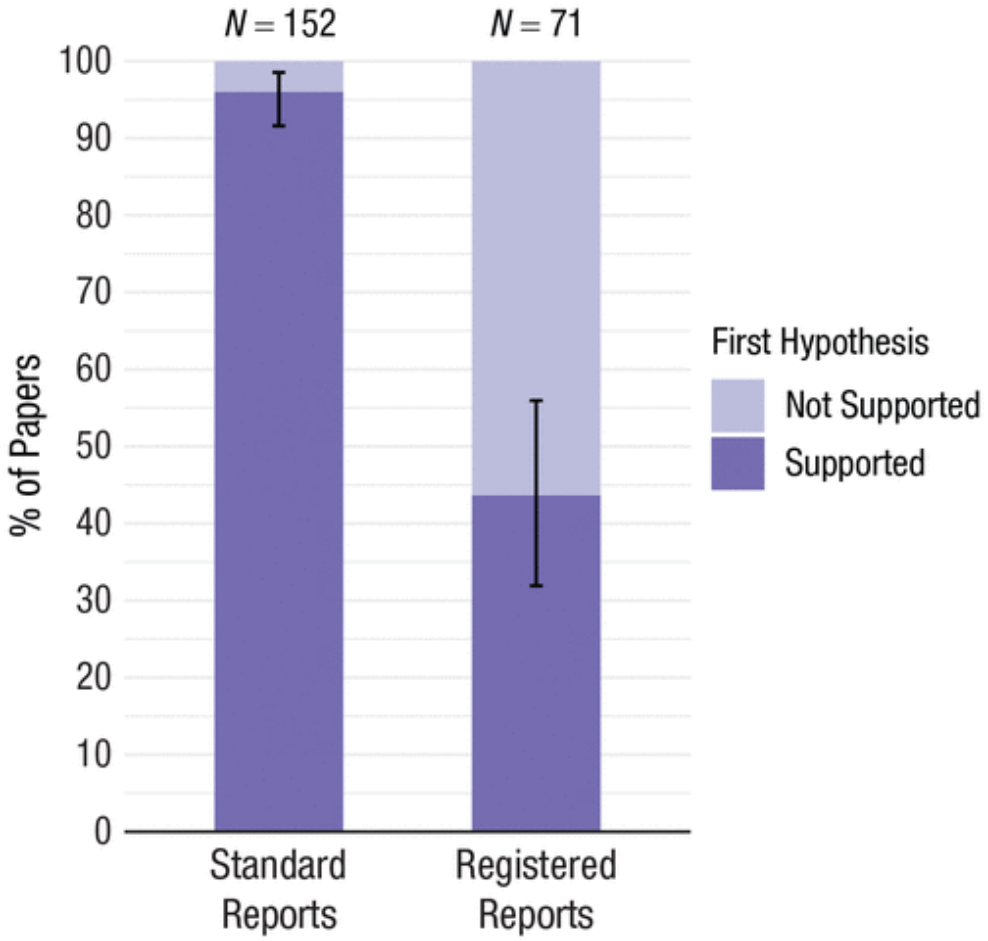


Figure 1. A simplified schematic of the Memory for Latent Representations (MLR) model architecture (Hedayati et al., 2022) with visual working memory phenomena and current models mapped on to its components: the variational autoencoder (VAE), the binding pool, and the tokens. This theory map aims to provide a coherent framework within which to organize visual working memory phenomena and discuss the relevant explanatory models. As such, the compatibility or inconsistencies between models can be better identified, and subsequently tested. For example, one could use a working definition for the noisy representation in VWM as the noise held in the pattern of neuron activity in the binding pool that follows a summation of information from various perceptual sources.

It is working!

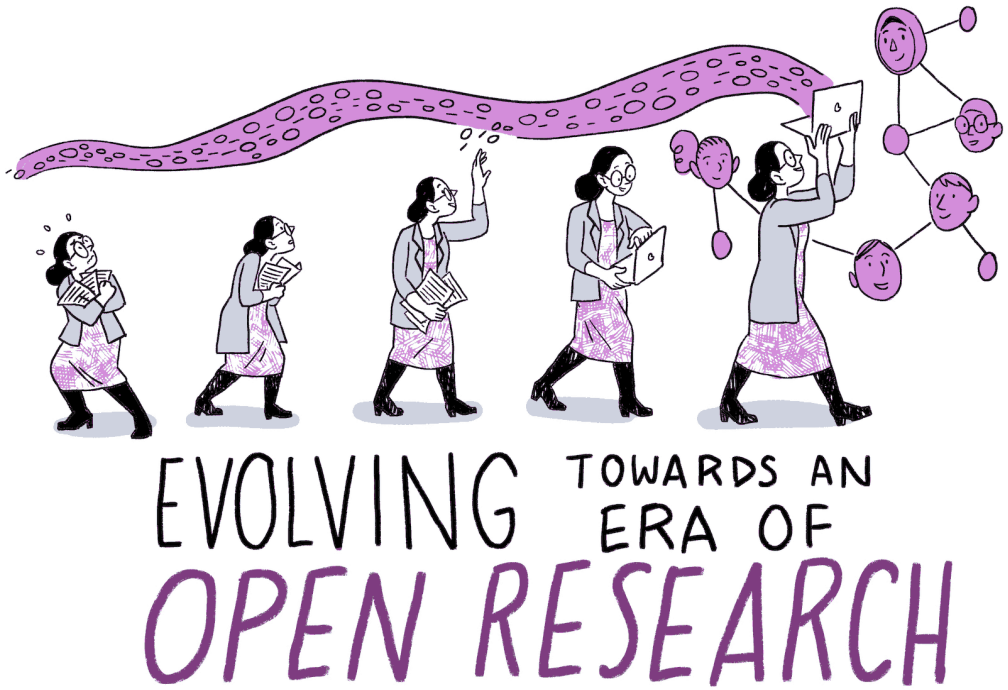
- Registered Reports have substantially fewer positive results than the standard literature (Scheel, Schijen and Lakens, 2021)
  - Likely due to a reduction in publication bias and error inflation!



Scheel, A. M., Schijen, M. R., & Lakens, D. (2021). An excess of positive results: Comparing the standard Psychology literature with Registered Reports. *Advances in Methods and Practices in Psychological Science*, *4*(2), 251524592110074*67*.

Research rigor needs to be a priority…

and that starts with you



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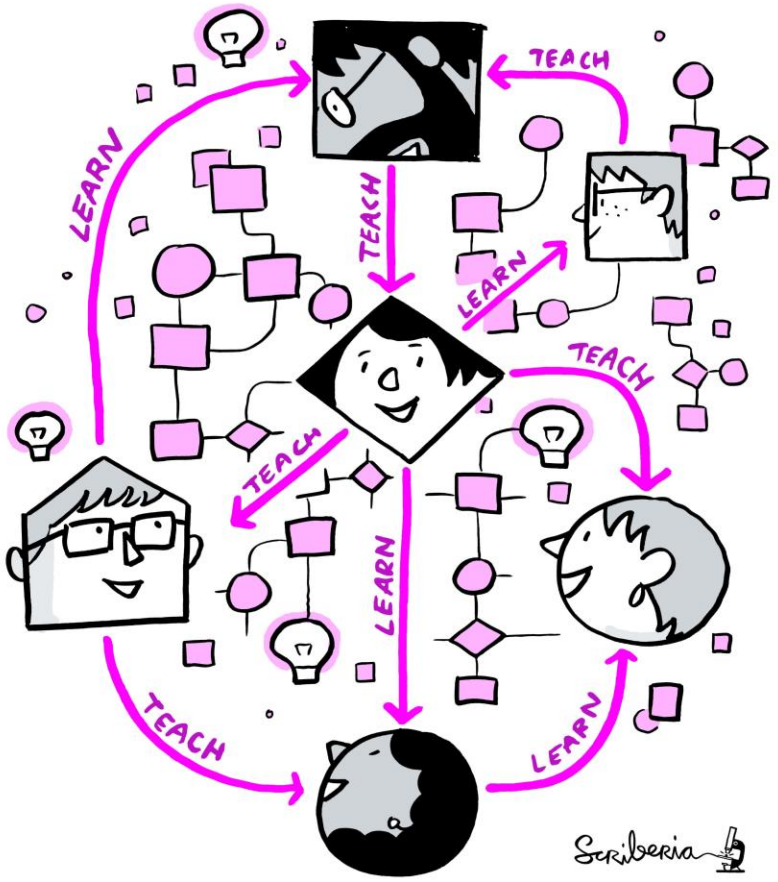


Fig. 1 Modes of change towards scientific credibility. This figure presents an overview of the three modes of change proposed in this article: structural change is often evoked at the institutional level and expressed by new norms and rules; procedural change refers to behaviours and sets of commonly used practices in the research process; community change encompasses how work and collaboration within the scientific community evolves.

Korbmacher, M., Azevedo, F., Pennington, C., Hartmann, H., Pownall, M., Schmidt, K., ... & Evans, T. (2023). The replication crisis has led to positive structural, procedural, and community changes. *Communications Psychology*.

Communication network for sharing, learning and teaching. *The Turing Way* project illustration by Scriberia. Used under a CC-BY 4.0 licence. DOI: 10.5281/zenodo.3332807.

The **Open Science** movement

- There are a lot of ideas and initiatives in the reform movement – too many to list:
  - Experiment design/collaboration: *AsPredicted, ManyLabs, Psychological Science Accelerator…*
  - Data and Code: *Open Science Framework, OpenNeuro, BIDS…*
  - Publishing: *The Unjournal, ASAPBio, DORA, CRediT*
  - Education: *FORRT, Repro4Everyone, The Carpentries*
  - Global and National Projects: *OSIRIS, Community4Rigor, ABRIR, UKRN and other national RNs*
- Perhaps not a coherent or cohesive movement in improving science
- Not too many of these initiatives have the next-generation of scientists as their direct focus

The credibility revolution in science can only succeed if ***we take action together***.

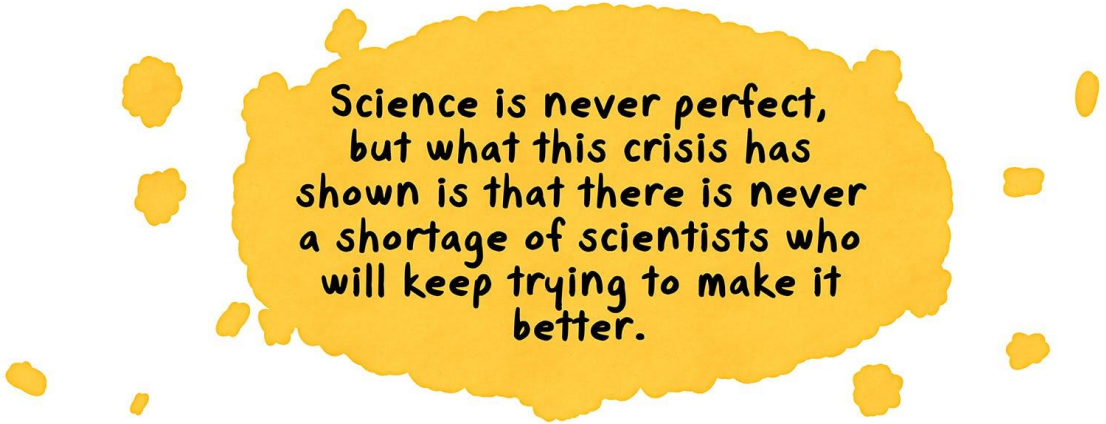
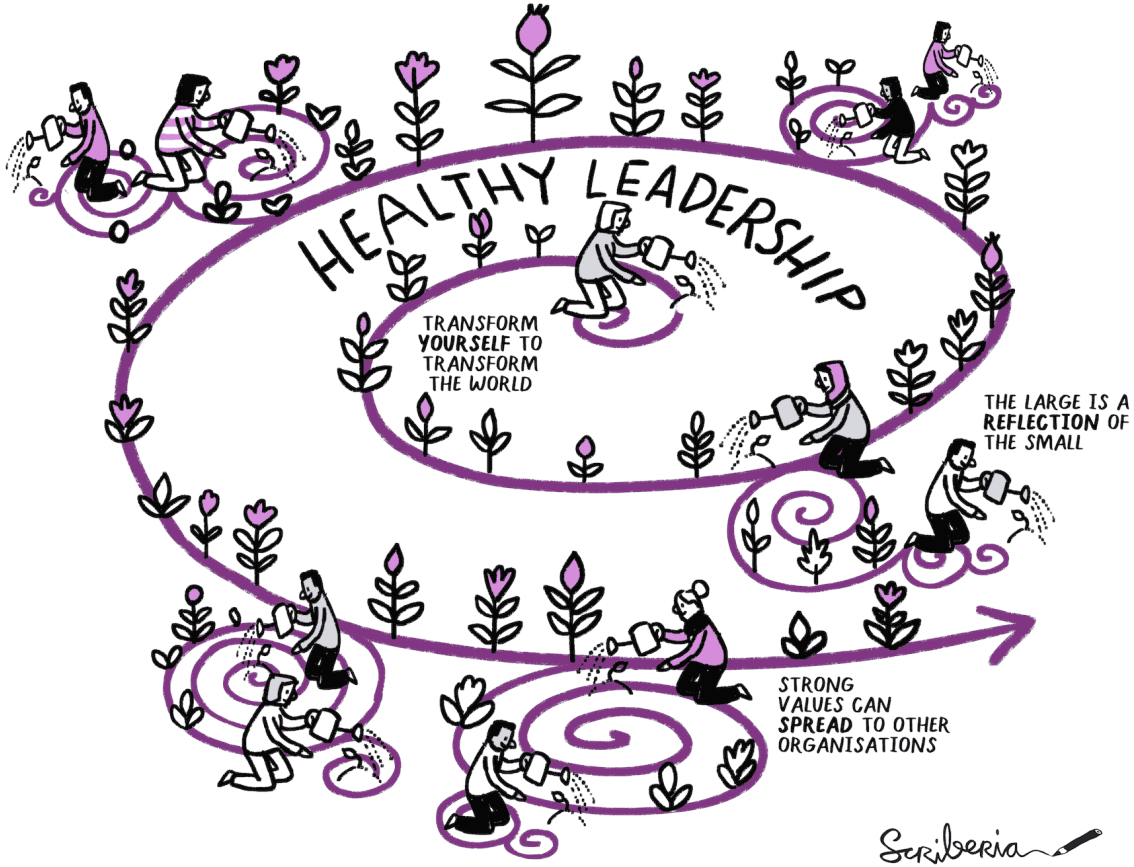


Illustration from Repeat After Me by Maki Naro
https://thenib.com/repeat-after-me/



Dr William Xiang Quan Ngiam *williamngiam.github.io* *william.ngiam@adelaide.edu.au*