

Open Science



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HIRAKU Consortium Researchers Event

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Open Science

What went wrong?

Maybe it's not that bad?...

Good to know

Final thoughts



Open Science



- Global approach to science.

OPEN



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- It is a philosophy of behavior more than anything else.



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- Make research findings available, **free of charge**.



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- Make research findings available, **free of charge**.
- Emphasis on **openness, reproducibility, replicability, transparency, integrity**.
- Several OS principles are now mandatory at major funding boards:
 - ▶ EU's Horizon 2020 ([here](#), [here](#)).
 - ▶ U.S.'s National Institutes of Health (NIH; [here](#), [here](#)).
 - ▶ U.S.'s National Science Foundation (NSF; [here](#)).
 - ▶ JSPS and MEXT over open access ([here](#), [here](#)).

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- Contribute to **robust** and **speedy** scientific discovery.
- Sharing materials allows getting constructive feedback.
- Improve quality of published research.
- Increase societal relevance, maximize public benefit, avoid resource waste.
- Meet expectations from funders.

Background: By [Markus Winkler](#) at [Unsplash](#), [license](#).



See [Crüwell et al. \(2019\)](#), also [here](#).

- Open data (FAIR principles; [Wilkinson et al., 2016](#)).
- Open materials, code.
- Open methodology (preregistration, registered reports).
- Open access.
- Reproducibility, replicability ([Penders, Holbrook, & de Rijcke, 2019](#)).
- Open review.
- Open educational resources.

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- Misconduct.
- *Questionable research practices*, including p -hacking, HARKing.
- Vague methods section, leading to virtually non-reproducible results.
- ...

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Maybe it's not that bad?...



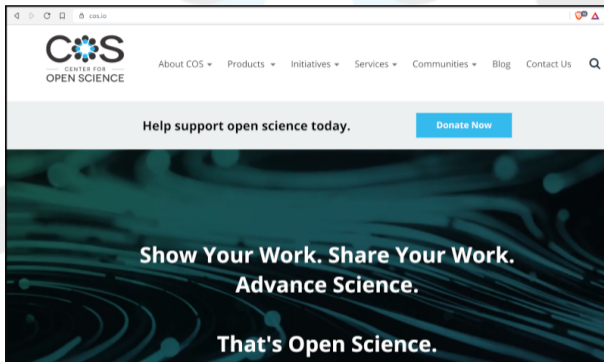
Unfortunately, it really is.

And the scenario applies across a broad spectrum:

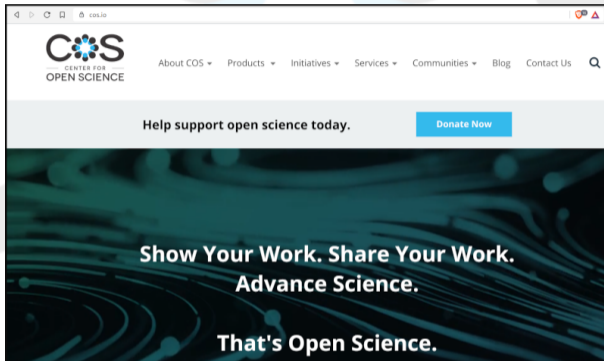
- *Medicine:*
Ioannidis (2005), Begley and Ellis (2012), Errington et al. (2014), Prinz, Schlange, and Asadullah (2011).
- *Economics:*
See Camerer et al. (2016), Chang and Li (2021), Duvendack, Palmer-Jones, and Reed (2017).
- *Social Sciences:*
See Camerer et al. (2018), Klein et al. (2018), OSC (2015).
- *Many other fields:*
See Baker (2016).

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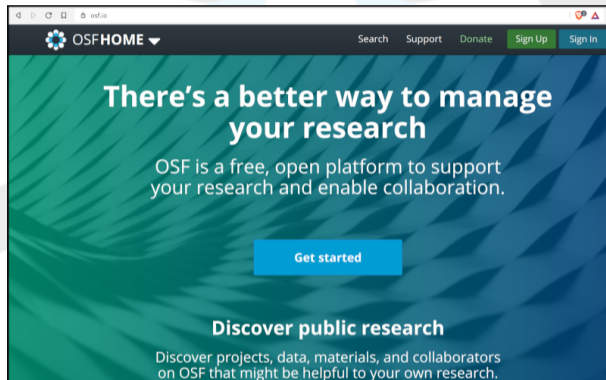
Good to know



- See [Center for Open Science](https://cos.io).

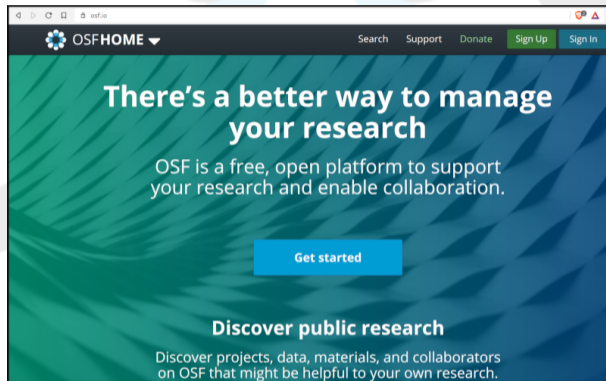


- See [Center for Open Science](#).
- Offers many services:
 - ▶ [Open Science Framework](#) (OSF) for collaborative projects, share data, preprints. . .
 - ▶ [Preregistrations](#).
 - ▶ [Registered reports](#).
 - ▶ [Open Science badges](#).
 - ▶ . . .

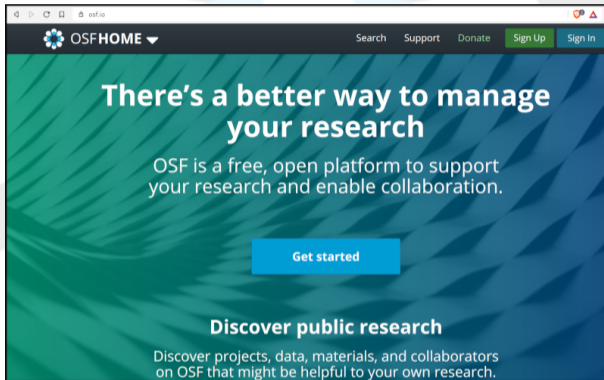


- See [Open Science Framework](#).

OPEN SCIENCE

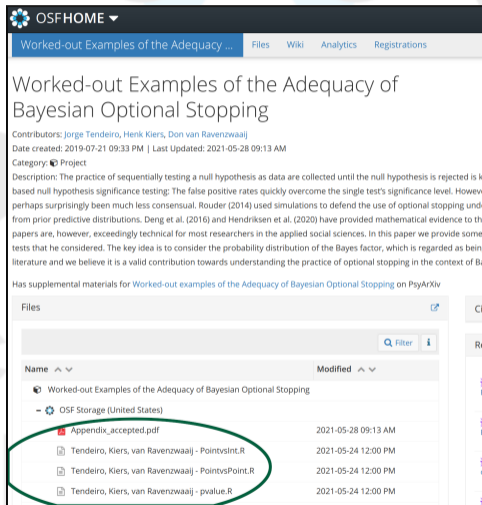


- See [Open Science Framework](#).
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- See [Open Science Framework](#).
- Allows sharing of data, study materials, research proposals.
- Easy access to preprints and effectively bypass publisher's unacceptably expensive paywalls (please see [this movie!!](#)).

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The screenshot shows the OSFHOME interface for a project titled "Worked-out Examples of the Adequacy of Bayesian Optional Stopping". The page includes a header with the OSFHOME logo and navigation tabs for "Files", "Wiki", "Analytics", and "Registrations". The main content area displays the project title, contributors (Jorge Tendeiro, Henk Kiers, Don van Ravenzwaaj), creation date (2019-07-21 09:33 PM), and last update date (2021-05-28 09:13 AM). A description follows, discussing sequential testing and optional stopping. Below the description, there is a section for "Files" with a search filter and a table of files. The table lists the project name, a folder for OSF Storage (United States), and three files: "Appendix_accepted.pdf", "Tendeiro, Kiers, van Ravenzwaaj - PointvsInt.R", "Tendeiro, Kiers, van Ravenzwaaj - PointvsPoint.R", and "Tendeiro, Kiers, van Ravenzwaaj - pvalue.R". The first three items are circled in green.

OSFHOME

Worked-out Examples of the Adequacy ... Files Wiki Analytics Registrations

Worked-out Examples of the Adequacy of Bayesian Optional Stopping

Contributors: [Jorge Tendeiro](#), [Henk Kiers](#), [Don van Ravenzwaaj](#)
Date created: 2019-07-21 09:33 PM | Last Updated: 2021-05-28 09:13 AM
Category: Project

Description: The practice of sequentially testing a null hypothesis as data are collected until the null hypothesis is rejected is known as sequential hypothesis testing. The false positive rates quickly overcome the single test's significance level. However, perhaps surprisingly, it has been much less consensual. Rouder (2014) used simulations to defend the use of optional stopping under the null hypothesis. Deng et al. (2016) and Hendriksen et al. (2020) have provided mathematical evidence to the contrary. The papers are, however, exceedingly technical for most researchers in the applied social sciences. In this paper we provide some results that he considered. The key idea is to consider the probability distribution of the Bayes factor, which is regarded as being a valid contribution towards understanding the practice of optional stopping in the context of Bayesian optional stopping.

Has supplemental materials for [Worked-out examples of the Adequacy of Bayesian Optional Stopping](#) on PsyArXiv

Files

Name	Modified
Worked-out Examples of the Adequacy of Bayesian Optional Stopping	
OSF Storage (United States)	
Appendix_accepted.pdf	2021-05-28 09:13 AM
Tendeiro, Kiers, van Ravenzwaaj - PointvsInt.R	2021-05-24 12:00 PM
Tendeiro, Kiers, van Ravenzwaaj - PointvsPoint.R	2021-05-24 12:00 PM
Tendeiro, Kiers, van Ravenzwaaj - pvalue.R	2021-05-24 12:00 PM

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- Upload manuscripts, pre- and/or post-reviewed.
- Free access for everyone to read.
- Common in some fields for years, but still new to many others.

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Examples (besides OSF already mentioned):

[arXiv](#) (since 1991!), [bioRxiv](#) (2013), [ChemRxiv](#) (2017), [PsyArXiv](#) (2016), [PeerJ](#) (2013),...

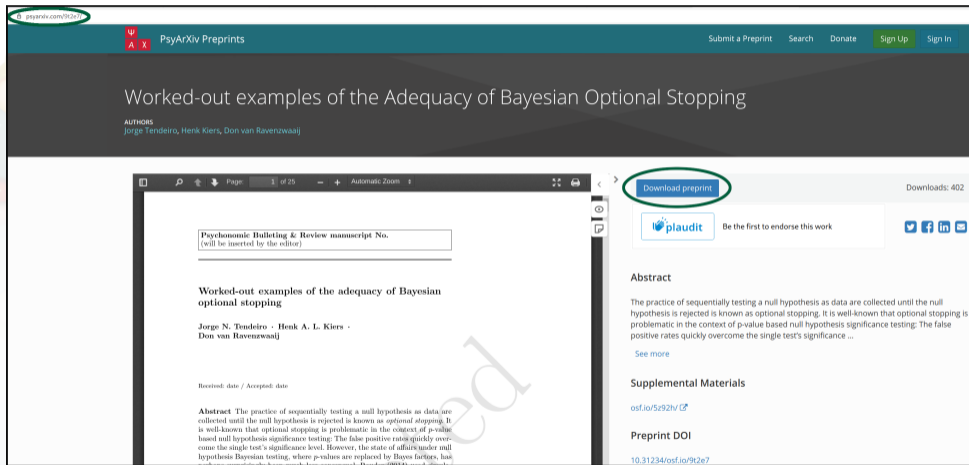
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Do share preprints!



The screenshot shows the PsyArXiv preprint interface. At the top, the URL psyarxiv.com/9t2e7 is circled in green. The page title is "Worked-out examples of the Adequacy of Bayesian Optional Stopping" by Jorge Tendeiro, Henk Kiers, and Don van Ravenzwaaj. A "Download preprint" button is circled in green. The abstract text is partially visible, starting with "The practice of sequentially testing a null hypothesis as data are collected until the null hypothesis is rejected is known as optional stopping. It is well-known that optional stopping is problematic in the context of p-value based null hypothesis significance testing: The false positive rates quickly overcome the single test's significance level. However, the state of affairs under null hypothesis Bayesian testing, where p-values are replaced by Bayes factors, has..."

Background: By [B S K](#) at [Freelimages](#), [license](#).

See Nosek, Ebersole, DeHaven, and Mellor (2018).

Document your research plan online:

- read-only
- time-stamped
- with pre-analysis plan
- (include as much detail as possible).

See Nosek et al. (2018).

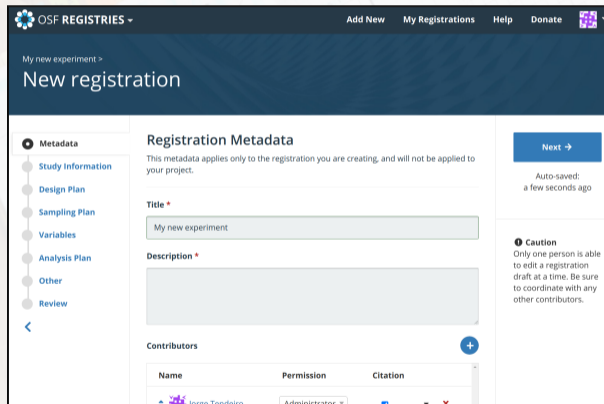
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Advantages:

- Distinguish exploratory from confirmatory research.
- Reduce researcher df's.
- No *p*-hacking, HARKing.
- **Not** a waste of time, just a time-reversed heurisitc.

Examples: [OSF](#), [AsPredicted](#), [ClinicalTrials](#)
(and various options for clinical trials, where this is done for years).



The screenshot shows the 'New registration' page on the OSF Registries website. The page has a dark blue header with the OSF logo and navigation links: 'Add New', 'My Registrations', 'Help', and 'Donate'. Below the header, the breadcrumb 'My new experiment >' is followed by the title 'New registration'. A left sidebar contains a 'Metadata' section with a list of steps: 'Study Information', 'Design Plan', 'Sampling Plan', 'Variables', 'Analysis Plan', 'Other', and 'Review'. The main content area is titled 'Registration Metadata' and includes a note: 'This metadata applies only to the registration you are creating, and will not be applied to your project.' There are two text input fields: 'Title *' containing 'My new experiment' and 'Description *'. Below these is a 'Contributors' section with a table. The table has columns for 'Name', 'Permission', and 'Citation'. One contributor is listed: 'Jorge Tendeiro' with the role of 'Administrator'. A blue 'Next' button is located on the right side of the form. Below the button, a status message says 'Auto-saved: a few seconds ago'. A 'Caution' icon and text are also present on the right, warning that only one person can edit a registration draft at a time.

Name	Permission	Citation
Jorge Tendeiro	Administrator	

Background: By [Bich Tran](#) at [Pexels](#), [license](#).

See Nosek and Lakens (2014).



Main ideas:

- Peer review the RQs and methodology **before** collecting data:
Stage 1 Peer Review.
- Upon *in-principle acceptance*, complete the study by following the protocol.
- Publication is **assured** upon ascertaining adherence to the registered protocol (or providing compelling reasons to deviate from it):
Stage 2 Peer Review.

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Major advantage on top of those for preregistrations:

- Avoid **publication bias**.
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Q: How popular are Registered Reports these days?

A: At the moment, about 300 journals (!) already offered this possibility (see [here](#) for a full list).

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Final thoughts

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So now what?



For me, it's all about taking little steps.
Trying to do all of it at once is just crazy.
Adapt things to your field and needs.

Background: By [Bruno Scramgnon](#) at [Pexels](#), [license](#).

A selection of extra resources you can consider looking at, complementing what was shown before (Robson et al., 2021):

- Check if your journal is/offers open access: [Sherpa/Romeo](#).
- [Database](#) of Open Access journals.
- [FAIR](#) data principles.
- Data repositories: [Nature](#), [Zenodo](#).
- Request a [paywalled article](#) (legally!).
- Peer reviewers' [Openness Initiative](#).

Background: By [Bruno Scramgnon](#) at [Pexels](#), [license](#).

I still don't know much. This is what I found:

- <https://openscience.jp/>. But it seems outdated.
- Research Center for Open Science and Data Platform ([RCOS](#)) for research data management.
- [JST](#) also has some directives for a few years now.
- A [Twitter Open Access](#) account, but it seems inactive.
- [JUSTICE](#) (is the name a homage to the Knight Rider?)
Includes an Open Access roadmap.

Background: By [Tomáš Malík](#) at [Pexels](#), [license](#).



Embrace Open Science!

- Baker, M. (2016). 1,500 scientists lift the lid on reproducibility. *Nature*, 533(7604), 452–454.
- Begley, C. G., & Ellis, L. M. (2012). Raise standards for preclinical cancer research. *Nature*, 483(7391), 531–533.
- Camerer, C. F., Dreber, A., Forsell, E., Ho, T.-H., Huber, J., Johannesson, M., . . . Wu, H. (2016). Evaluating replicability of laboratory experiments in economics. *Science*, 351(6280), 1433–1436.
- 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.
- Chang, A. C., & Li, P. (2021). Is Economics Research Replicable? sixty Published Papers FromThirteen Journals Say “Often Not”. *Critical Finance Review*, 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: An Annotated Reading List. *Zeitschrift für Psychologie*, 227(4), 237–248.
- Duvendack, M., Palmer-Jones, R., & Reed, W. R. (2017). What Is Meant by “Replication” and Why Does It Encounter Resistance in Economics? *American Economic Review*, 107(5), 46–51.
- Errington, T. M., Iorns, E., Gunn, W., Tan, F. E., Lomax, J., & Nosek, B. A. (2014). An open investigation of the reproducibility of cancer biology research. *eLife*, 3, e04333.
- Ioannidis, J. P. A. (2005). Contradicted and Initially Stronger Effects in Highly Cited Clinical Research. *JAMA*, 294(2), 218.
- Klein, R. A., Vianello, M., Hasselman, F., Adams, B. G., Adams, R. B., Alper, S., . . . Nosek, B. A. (2018). Many Labs 2: Investigating Variation in Replicability Across Samples and Settings. *Advances in Methods and Practices in Psychological Science*, 1(4), 443–490.
- Nosek, B. A., Ebersole, C. R., DeHaven, A. C., & Mellor, D. T. (2018). The preregistration revolution. *Proceedings of the National Academy of Sciences*, 115(11), 2600–2606.

- Nosek, B. A., & Lakens, D. (2014). Registered reports: A method to increase the credibility of published results. *Social Psychology*, 45(3), 137–141.
- OSC. (2015). Estimating the reproducibility of psychological science. *Science*, 349(6251), aac4716.
- Penders, B., Holbrook, J. B., & de Rijcke, S. (2019). Rinse and Repeat: Understanding the Value of Replication across Different Ways of Knowing. *Publications*, 7(3), 52.
- Prinz, F., Schlange, T., & Asadullah, K. (2011). Believe it or not: How much can we rely on published data on potential drug targets? *Nature Reviews Drug Discovery*, 10(9), 712–712.
- Robson, S. G., Baum, M. A., Beaudry, J. L., Beitner, J., Brohmer, H., Chin, J., . . . Tangen, J. M. (2021). *Nudging Open Science* (Preprint). PsyArXiv.
- Wilkinson, M. D., Dumontier, M., Aalbersberg, I. J., Appleton, G., Axton, M., Baak, A., . . . Mons, B. (2016). The FAIR Guiding Principles for scientific data management and stewardship. *Scientific Data*, 3(1), 160018.