

Open Science

Open Science Movement

Sometimes labelled "**the reform movement**" --
(psychological) scientists trying to address problems in the field identified as part of the replication crisis.

(Note, these are not distinct periods of history, nor are either of them considered over.)

Within psychology, much of the force behind this movement has been driven by social and personality psychologists.

- **Open** because one of the primary problems of the replication crisis was the lack of transparency. Everyone did work in private; kept data secret; buried, hid, lost key aspects of research. Opaque was normal.

Dates

2011-2012 -- Bem ESP paper, False Positive Psychology paper, Diederik Stapel fraud case, Hauser fraud case, Sanna fraud case, Smeesters fraud case.

2013 -- Center for Open Science is founded

2016 -- Innagural meeting of the Society for the Improvement of Psychological Science.

Goals of open science

- Change incentive structure
- Improve training and research practices of the next generation (YOU)
- Empirically test the state of the field (meta-science)
- Develop new tools to enable better scientific research

Open science values

Tal Yarkoni (July 13, 2019)

I hate open science

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I hate open science

Now that I've got your attention: what I hate—and maybe *dislike* is a better term than *hate*—isn't the open science *community*, or open science *initiatives*, or open science *practices*, or open *scientists*... it's the *term*. I fundamentally dislike the term *open science*. For the last few years, I've deliberately tried to avoid using it. I don't call myself an open scientist, I don't advocate publicly for open science (per se), and when people use the term around me, I often make a point of asking them to clarify what they mean.

- **Reproducibility** -- are other people able to obtain your same result with your same data?
- **Accessibility** -- is work publicly available?
- **Incentive alignment** -- do the policies of the field encourage good science or something else entirely?
- **Openness of opinion** -- is criticism of work distinguished from criticism of people?
- **Diversity, equity, and inclusion** -- Are there barriers to being a scientist, reading science, being helped by science?
- **Meta-science and informatics.** -- How are we diagnosing the field? How do we determine the quality of a study?

Reproducibility vs Replicability

Condon, Graham, & Mroczek, 2018; psyarxiv.com/2fn5x

	Same Data	Different Data
Same Methods	Reproducibility	Generalizability
Different Methods	Sensitivity	Full Generalizability / Conceptual Replicability / Other Research

(New) tools

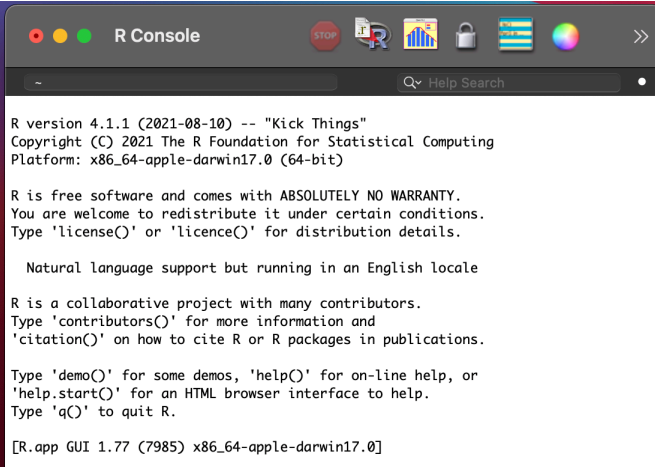
This is an exciting time to be a psychological researcher, because new tools for making work reproducible, accessible, open, and inclusive are being developed every day.

It's just a lot easier to meet these standards today than it was 10 years ago.

Let's discuss some new(ish) tools for ensuring your work is reproducible and robust.

R (not new)

- Use of scripts -- data analysis is **reproducible**
 - Don't be your own worst collaborator
- Software is open-source
 - **Equity** in terms of who can use the software
 - **Equity** in terms of who can build the software!
 - Available right away



```
R version 4.1.1 (2021-08-10) -- "Kick Things"
Copyright (C) 2021 The R Foundation for Statistical Computing
Platform: x86_64-apple-darwin17.0 (64-bit)

R is free software and comes with ABSOLUTELY NO WARRANTY.
You are welcome to redistribute it under certain conditions.
Type 'license()' or 'licence()' for distribution details.

Natural language support but running in an English locale

R is a collaborative project with many contributors.
Type 'contributors()' for more information and
'citation()' on how to cite R or R packages in publications.

Type 'demo()' for some demos, 'help()' for on-line help, or
'help.start()' for an HTML browser interface to help.
Type 'q()' to quit R.

[R.app GUI 1.77 (7985) x86_64-apple-darwin17.0]
```

RMarkdown (Not that new)

Combination of two languages: **R** and Markdown.

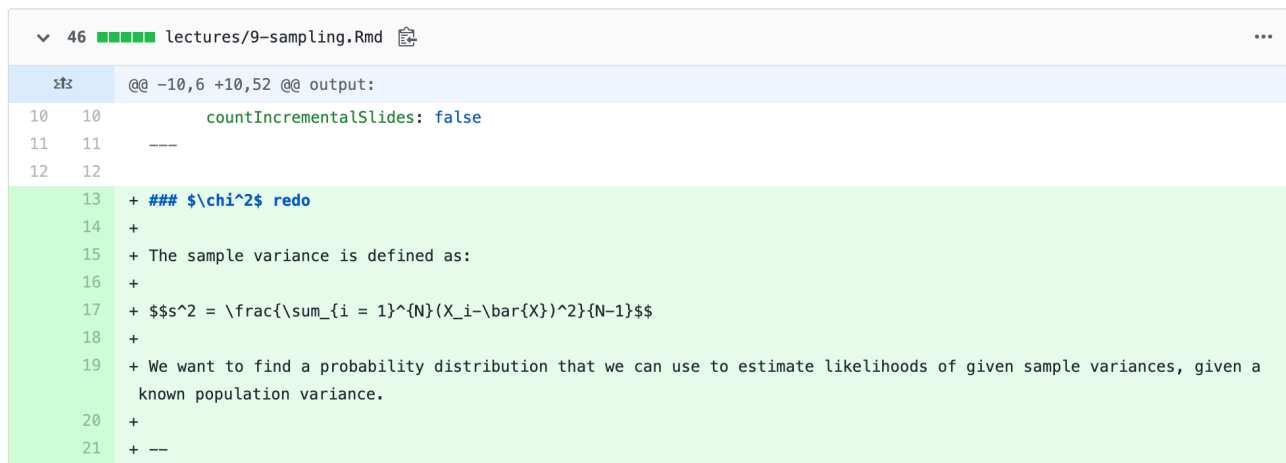
Markdown is a way of writing without a WYSIWYG editor -- instead, little bits of code tell the text editor how to format the document.

Increased flexibility: Markdown can be used to create

- presentations (this one!)
- manuscripts
- CVs
- books
- websites

Git (not new)

Git is a version control system. Think Microsoft Track Changes for your code.



```
46 lectures/9-sampling.Rmd
@@ -10,6 +10,52 @@ output:
10 10      countIncrementalSlides: false
11 11      ---
12 12
13 13 + ### $\chi^2$ redo
14 14 +
15 15 + The sample variance is defined as:
16 16 +
17 17 + $$s^2 = \frac{\sum_{i = 1}^N (X_i - \bar{X})^2}{N-1}$$
18 18 +
19 19 + We want to find a probability distribution that we can use to estimate likelihoods of given sample variances, given a
    known population variance.
20 20 +
21 21 + ---
```

- Allows multiple collaborators to contribute code to the same project
- If you want to go into industry, you 100% need to know this
- Want to learn more? **Oh Shit, Git**

GitHub (also not new)

- GitHub is one site that facilitates the use of Git
- Repositories can be private or public -- allow you to share your work with others (reproducible)
- GitHub also plays well with the Markdown language, which is what you're using for your homework assignments.
 - You can [link GitHub repositories to R Projects](#) for near seamless integration.
 - Pair GitHub and R to make websites!

(Interested? Have 4 hours to kill? I recommend looking through [Alison Hill's workshop on blogdown](#) and the [tutorial prepared by Dani Cosme and Sam Chavez](#)).

Open Science Framework (OSF.io)

- Another repository, also includes version control
 - Reproducibility
- Doesn't use code/terminal to update files
 - Drag and drop, or linked with other repository (Dropbox, Box, Google Drive, etc)
- Also great for collaborations
- Easy to navigate
- Can be paired with applications you (should) already use

PsyArXiv



- preprint = the pre-copied version of your manuscript
- journals have different policies regarding what you can post. It's always a good idea to **check**.

OSF connects to PsyArXiv, which is the primary preprint server for psychology

- Make your work available to the public (equity and inclusion)
- Post reports of work that can't get published (avoid the file drawer, improve everyone's work)
- Even citable in journals

Preregistration

OSF also allows you to preregister a project.

Preregistration is creating a time-stamped, publicly available, frozen document of your research plan prior to executing that plan.

The screenshot shows the OSF Preregistration interface. The top navigation bar includes 'Public registration' and icons for profile, bookmark, and share. The left sidebar contains navigation links: Overview (selected), Files, Wiki, Components (0), Links (0), Analytics, and Comments (0). The main content area is titled 'Study Information' and includes a hamburger menu icon. It contains sections for Title, Authors, and Research Questions. The right sidebar lists metadata: Contributors (Cory Costello and Sanjay Srivastava), Registration type (Prereg Challenge), Date registered (October 6, 2016), Date created (January 20, 2016), Registered from (osf.io/65wfu), Category (Project), and Citation (osf.io/kfcmt).

Public registration ▾

Overview

Files

Wiki

Components 0

Links 0

Analytics

Comments 0

Study Information

Title

Provide the working title of your study. It is helpful if this is the same title that you submit for publication of your final manuscript, but it is not a requirement.

Accuracy and Consensus in Hearsay Reputations (Study 2)

Authors

The author who submits the preregistration is the recipient of the award money and must also be an author of the published manuscript. Additional authors may be added or removed at any time.

Cory Costello, Sanjay Srivastava

Research Questions

Please list each research question included in this study.

This is a follow-up to a previous study which investigated accuracy and consensus in hearsay or discursive reputation. As such, we have two aims: re-examine the research questions posed in the previous study (see Pre-registration study: 10.21203/rs.2016.02.02.000000).

Contributors

Cory Costello and Sanjay Srivastava

Registration type

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Goal: deter *p*-hacking and harking

- Did the researcher preregister 3 outcome variables and only report one?
- Did the research *actually* believe this correlation would be significant?

Goal: distinguish data-driven choices from theory based choices

- Was some other variable included because of theory or based on descriptives?

Goal: correctly identify confirmatory and exploratory research

- Exploratory research should be OK!
- Protection against editors and reviewers

Preregistration

Misconception: Preregistration does **not** tie your hands

1. Encourage researchers to plan out analysis and choices before they see the data, and
2. Create a verifiable record of when analytic decisions were made, which will
3. Allow researchers to calibrate their confidence in results accordingly.

Preregistration also provides a check on the file-drawer problem.

Enhances the reproducibility, replicability, and transparency of research.

Preregistration

Preregistration is great. But it's not a blanket protection. **Crappy science can still be preregistered.** Really good science doesn't have to be preregistered. It's a tool in your toolbelt.

The most important aspect is **TRANSPARENCY**. That's it. It can come in the form of any of the tools we've just talked about, ideally some combination of those. It can also be a well-maintained lab notebook. As long as you are transparent, you're doing your best.

Registered reports

Registered reports (RR) are a special kind of journal article

Classic publishing



Registered reports



image credit: [Dorothy Bishop](#)

Registered reports

Goal: uncouple incentive (publication) from study result

- New incentive is now doing a high-quality study

Changes the researcher's goal; also changes the reviewer's focus

- No longer evaluate whether or not result was "statistically significant" -- instead, evaluate whether this is a good test of the research question.

Many journals now allow RRs, and even RRR (registered **replication** reports)

Challenges

Some challenges with preregistration and registered reports:

- Difficult to do with longitudinal data
- Controversy over pre-existing data (secondary data analysis)
- Preregistration needs to be specific, otherwise it doesn't work

Meta-science tools

New methods of conducting science on science -- often developed to find fraud, but super useful for detecting errors

- **Granularity-related inconsistency of means (GRIM)** test -- is the mean mathematically possible given the sample size?
- **Sample Parameter Reconstruction via Iterative TEchniques (SPRITE)** -- given a set of parameters and constraints, **generate** lots of possible samples and examine for common sense.
- **StatCheck** -- upload pdfs and word documents to look for inconsistencies (e.g., statistic, df)

Science is becoming more collaborative

MIND

✓ FACT CHECKED

The Psychological Science Accelerator: Building A “CERN For Psychology”

By: Chris Chartier, Nicholas Coles and Hans IJzerman | February 5, 2019





Traditional status hierarchies are being upset. Many early career researchers have contributed to open science, even as graduate students.

Criticisms

Some argue that open science methods are broadly harmful: stifle creativity, slow down research, incentivize *ad hominem* attacks and "methodological terrorists", and encourage data parasites.

It is worth admitting that, unless incentive structures don't change, there can be harm done with adoption of these methods. But part of the goal is to change the overall system.

More legit concern: adoption of these methods can fool researchers into believing that all research using these methods is "good" and all research not using them are "bad."

Example: "Preregistration is redundant, at best." (Oct 31, 2019) Szollosi et al

Next time...

All that being said, we're still going to use NHST for most of this sequence and most of your stats journey will include NHST. 🙄

Chi-squared tests