Doing Open Science

How Local Groups Can React to the Replication Crisis

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Agenda

1. The Replication Crisis & Open Science
2. Working in a Local Initiative Using the Example of GOSSIP
3. Open Science Resources & References

transparency

reproducibility

false positives

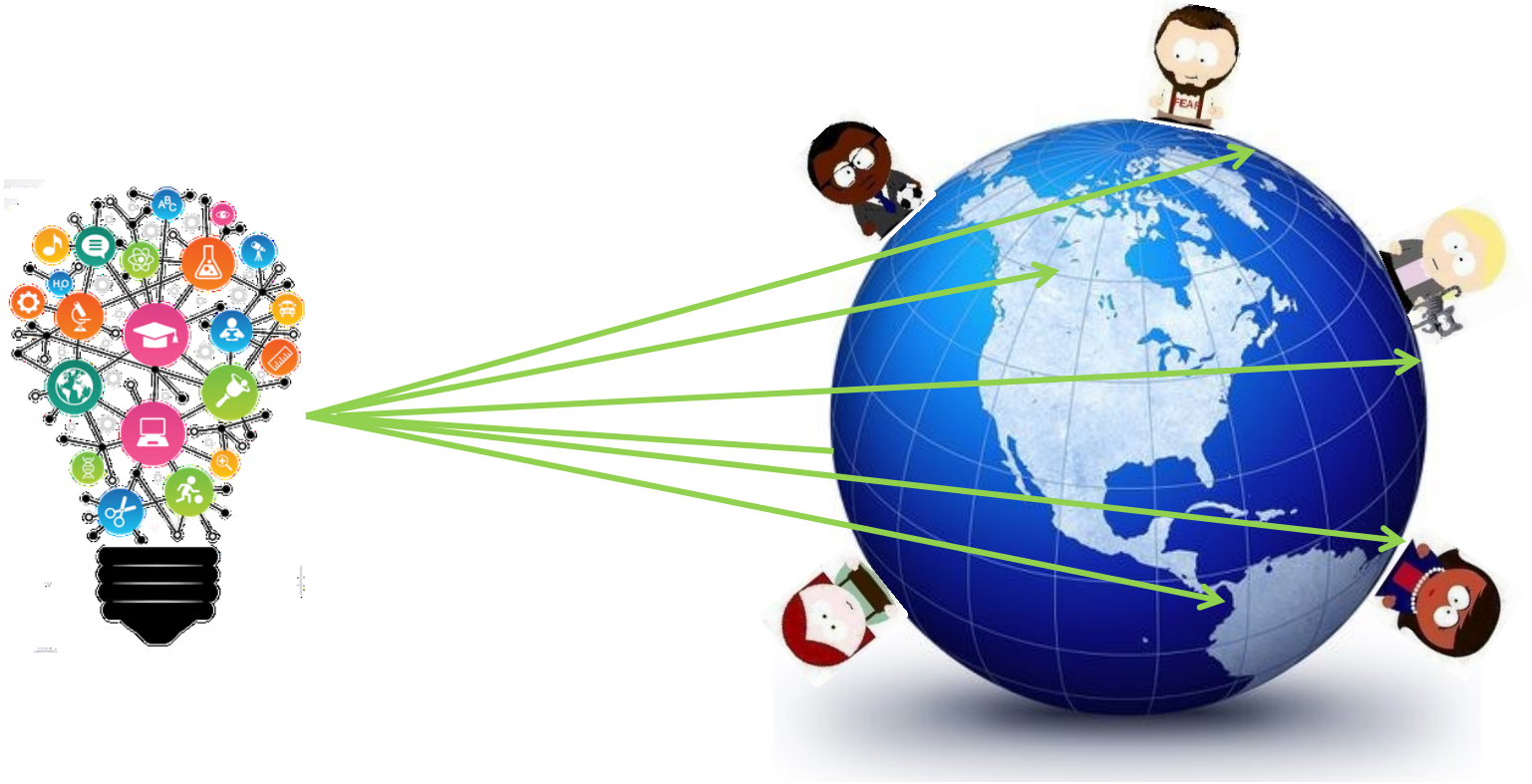
p-hacking

preregistration

1 The Replication Crisis and Open Science

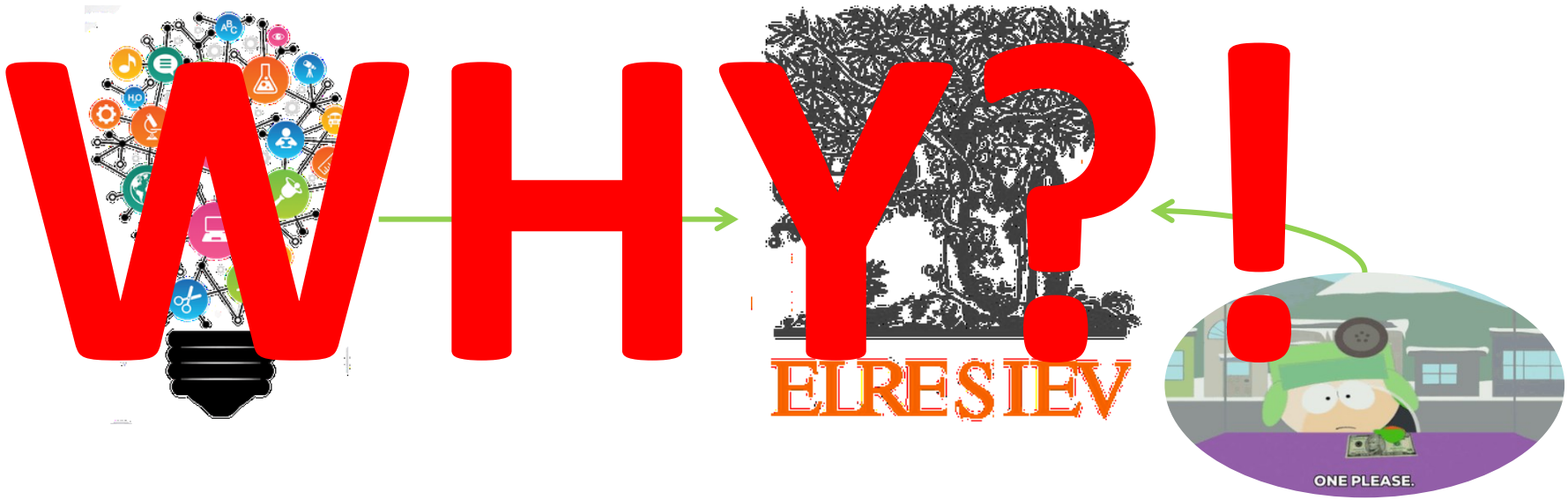
The Goal of Research

Find *truth* and make it *public*

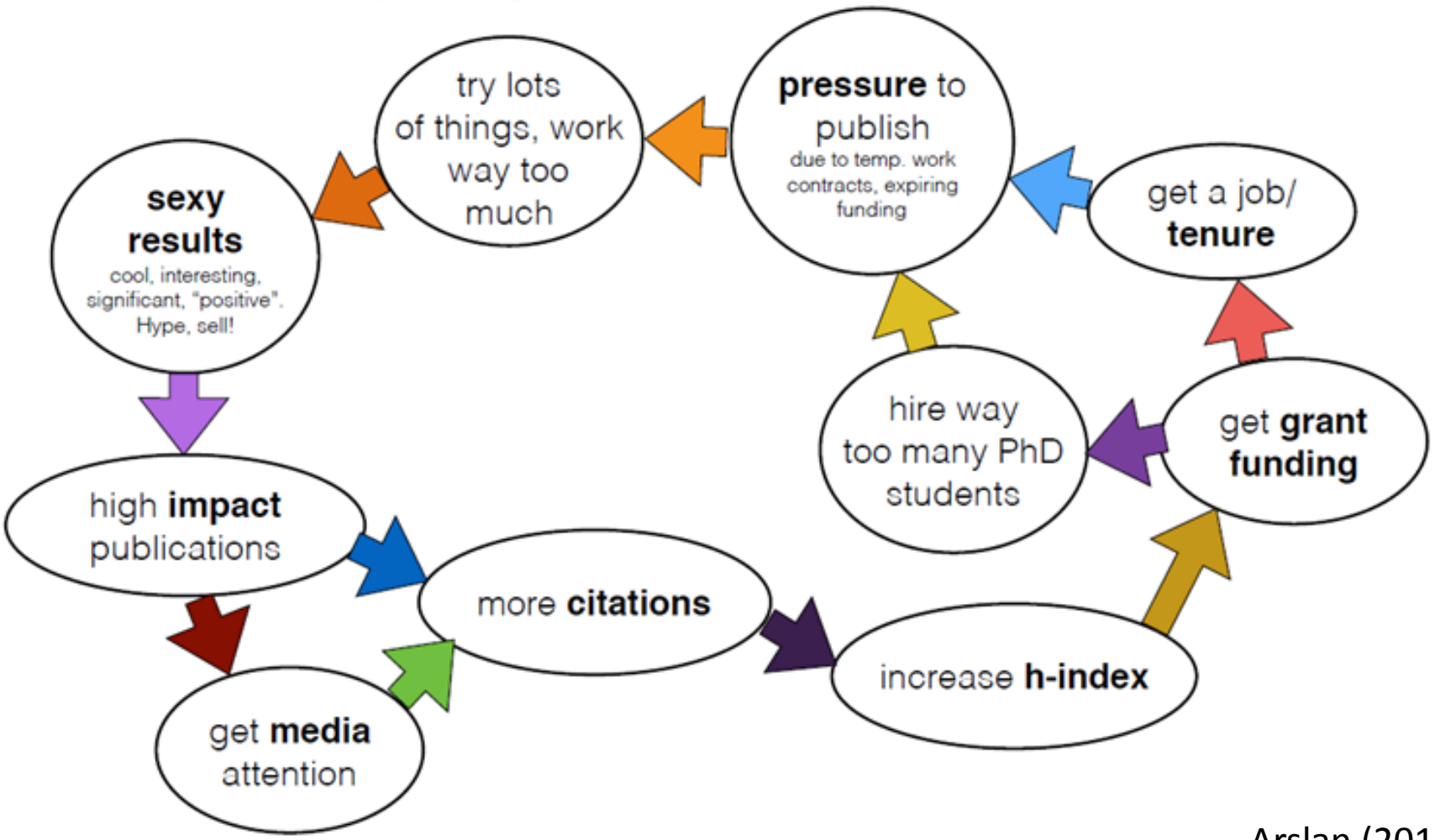


A Common Goal of Researchers

Find as many *exciting effects* as possible and publish them in a *high impact journal* where people have to *buy* the article

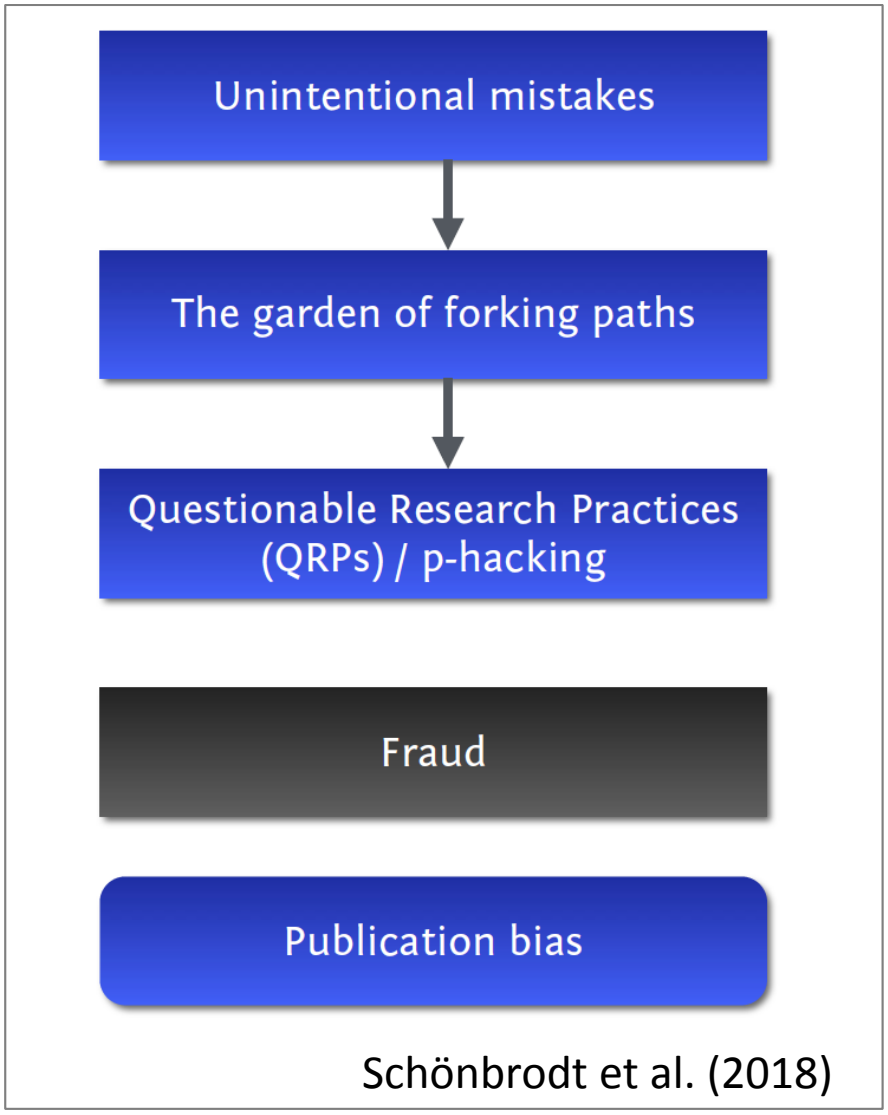


Science as a System



Arslan (2018)

Processes Leading to an Inflation of False-Positives



+ underpowered studies

Experiment: People feel younger after listening to “When I’m Sixty-Four” by The Beatles instead of “Kalimba”

→ Paper demonstrates how *easy* it is to find and report statistically significant *evidence* for *false hypotheses*

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

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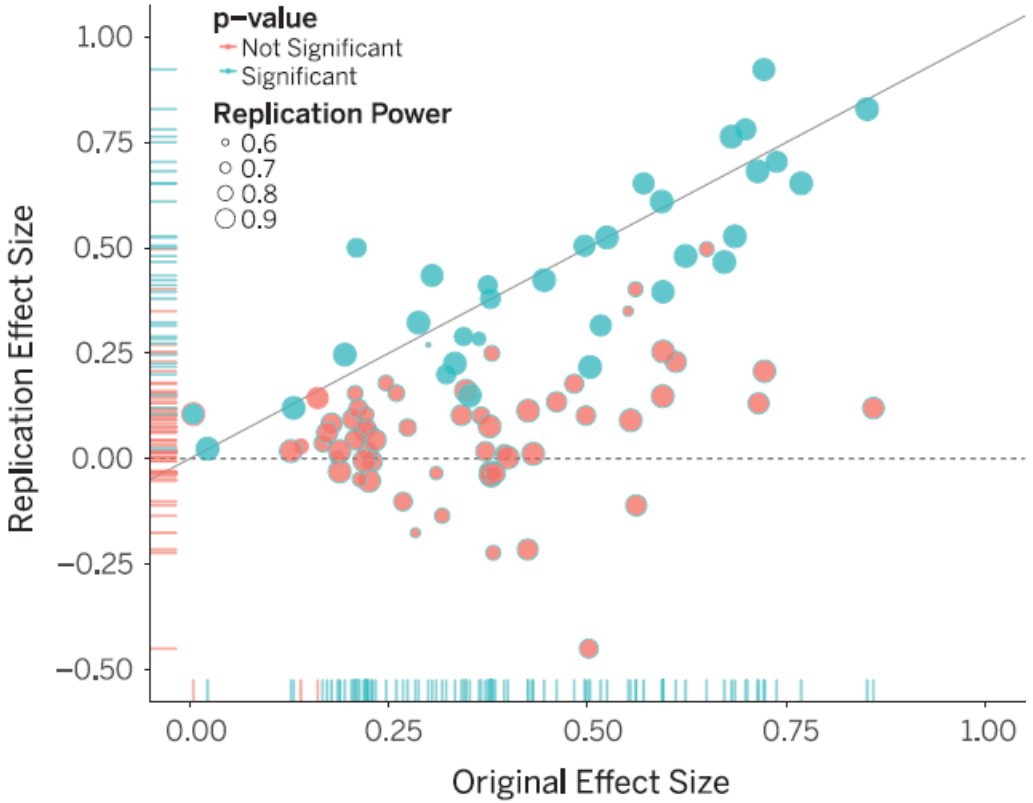
[1]The Wharton School, University of Pennsylvania, and [2]Haas School of Business, University of California, Berkeley

Abstract

In this article, we accomplish two things. First, we show that despite empirical psychologists’ nominal endorsement of a low rate of false-positive findings (≤ .05), flexibility in data collection, analysis, and reporting dramatically increases actual false-positive rates. In many cases, a researcher is more likely to falsely find evidence that an effect exists than to correctly find evidence that it does not. We present computer simulations and a pair of actual experiments that demonstrate how unacceptably easy it is to accumulate (and report) statistically significant evidence for a false hypothesis. Second, we suggest a simple, low-cost, and straightforwardly effective disclosure-based solution to this problem. The solution involves six concrete requirements for authors and four guidelines for reviewers, all of which impose a minimal burden on the publication process.

Simmons et al. (2011)

Replication Crisis in Psychology



Reproducibility Project (Open Science Collaboration, 2015):

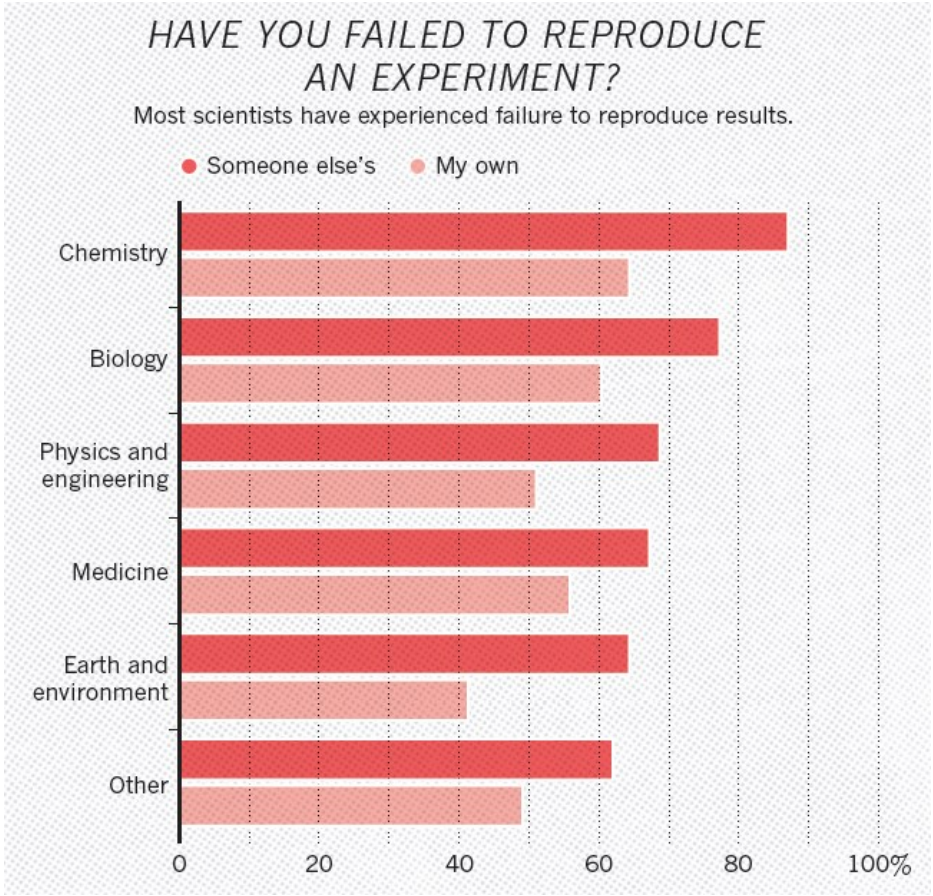
Only 36% of 97 psychological studies were replicable.

Mean replicated effect sizes were half the magnitude of the original effects.

This was termed Replication Crisis.

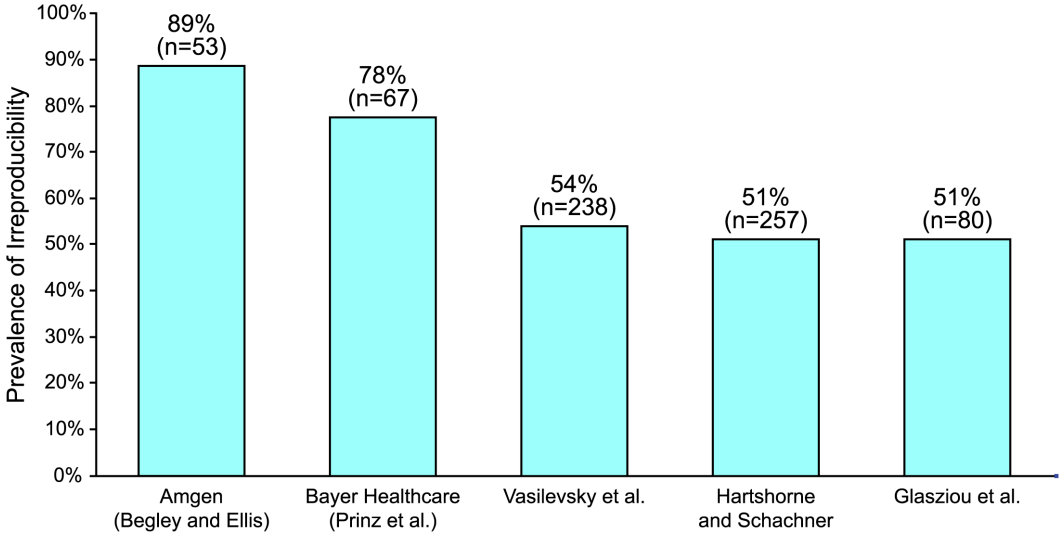
Replication Crisis Outside Psychology

Irreproducibility reported by researchers from different fields of science



Baker, 2016

Irreproducibility in preclinical research



Freedman et al. (2015): Prevalence of irreproducible preclinical research exceeds 50%

What is Open Science?

Open Definition by Open Knowledge International (2019):

> *Knowledge is open if anyone is free to access, use, modify, and share it.*

(One) Definition of **Open Science** (de la Fuente, n.d.):

> Open Science is about **extending the principles of openness to the whole research cycle**, fostering sharing and collaboration as early as possible thus entailing a systemic change to the way science and research is done

Components of Open Science

Open Access: Make research results available

Open Data: Publish the raw data

Open Source: Make software available that permits anyone to use, change, improve, or derive from existing source code

Open Methodology: Share the methodological details of the study provided and the tools used for data collection and analysis

Accessibility and Transparency

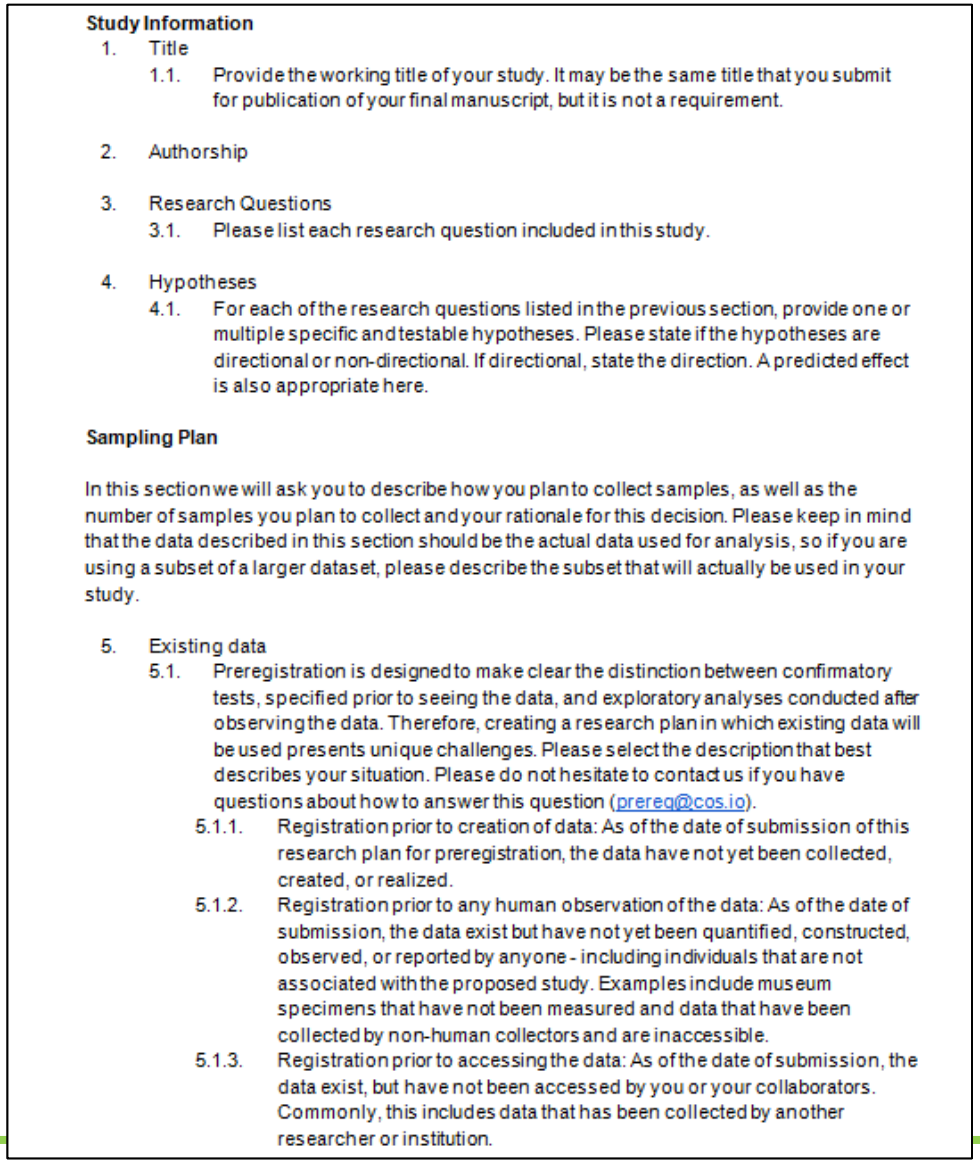
Kraker et al. (2011)

Preregistration Within the Open Science Framework

Sections:

- Study Information, incl. Hypotheses
- Sampling Plan
- Variables
- Design Plan
- Analysis Plan
- Optional: Analysis Script

Center for Open Science (2019)



Study Information

1. Title
   - 1.1. Provide the working title of your study. It may be the same title that you submit for publication of your final manuscript, but it is not a requirement.
2. Authorship
3. Research Questions
   - 3.1. Please list each research question included in this study.
4. Hypotheses
   - 4.1. For each of the research questions listed in the previous section, provide one or multiple specific and testable hypotheses. Please state if the hypotheses are directional or non-directional. If directional, state the direction. A predicted effect is also appropriate here.

Sampling Plan

In this section we will ask you to describe how you plan to collect samples, as well as the number of samples you plan to collect and your rationale for this decision. Please keep in mind that the data described in this section should be the actual data used for analysis, so if you are using a subset of a larger dataset, please describe the subset that will actually be used in your study.

5. Existing data
   - 5.1. Preregistration is designed to make clear the distinction between confirmatory tests, specified prior to seeing the data, and exploratory analyses conducted after observing the data. Therefore, creating a research plan in which existing data will be used presents unique challenges. Please select the description that best describes your situation. Please do not hesitate to contact us if you have questions about how to answer this question (prereg@cos.io).
     - 5.1.1. Registration prior to creation of data: As of the date of submission of this research plan for preregistration, the data have not yet been collected, created, or realized.
     - 5.1.2. Registration prior to any human observation of the data: As of the date of submission, the data exist but have not yet been quantified, constructed, observed, or reported by anyone - including individuals that are not associated with the proposed study. Examples include museum specimens that have not been measured and data that have been collected by non-human collectors and are inaccessible.
     - 5.1.3. Registration prior to accessing the data: As of the date of submission, the data exist, but have not been accessed by you or your collaborators. Commonly, this includes data that has been collected by another researcher or institution.

Why Preregister?

- Having a plan: Especially in complex studies, preregistrations help researchers to orient themselves and to consider difficulties early on
- Transparency: Readers and reviewers can observe which thoughts and hypotheses existed at the beginning of a study
- Prevention of the hindsight bias = Confusion of *prediction* and *postdiction* („I knew it all along“)
- Reduced risk of p-hacking and reduced number of researcher degrees of freedom
- Reduction of the publication bias: Null results can have a higher chance to be published
  – particularly with *registered reports* = journal accepts an article based on the proposal of theory, hypotheses, and design instead of (significance of) results

Myths About Preregistrations

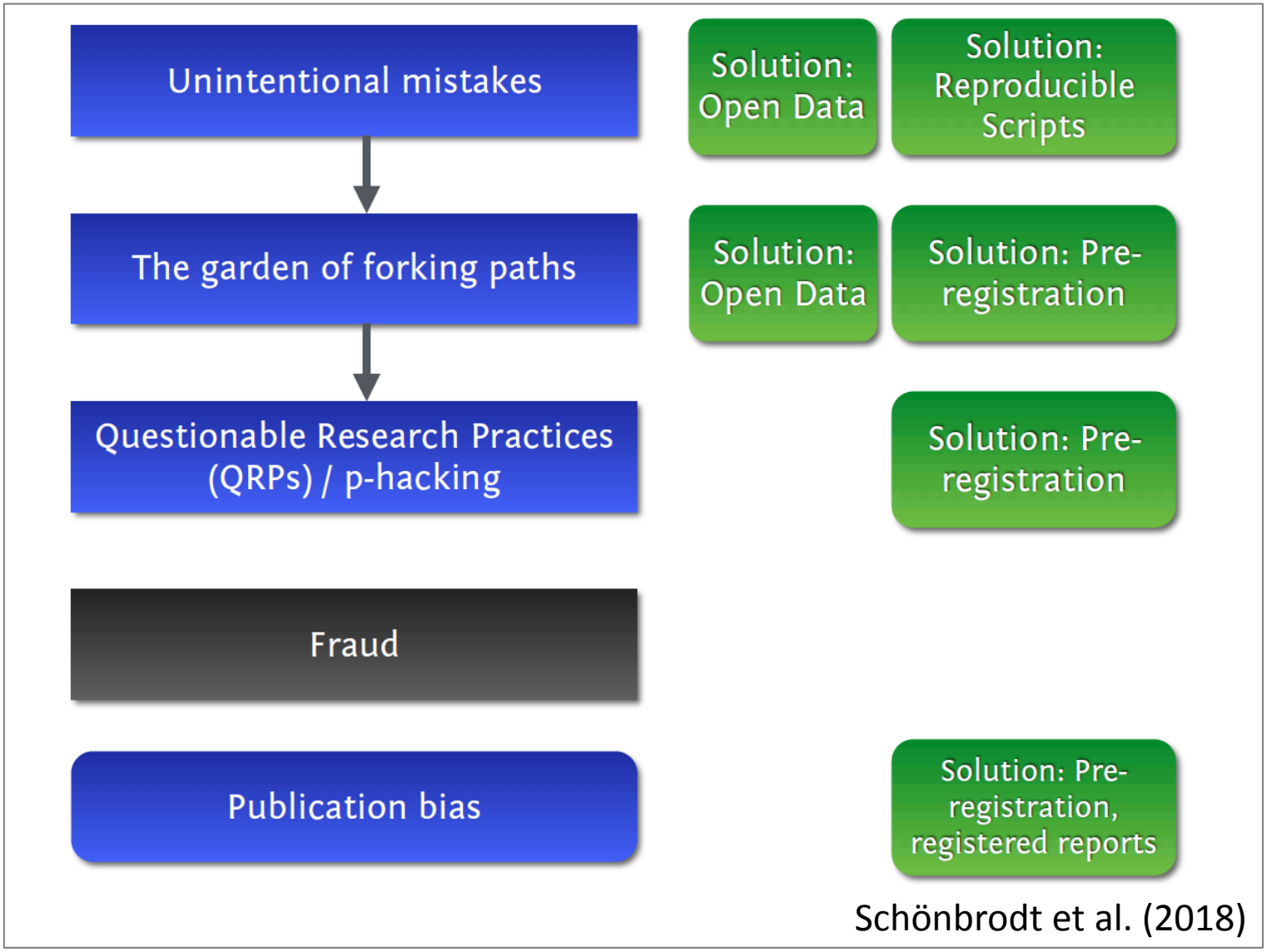
- „After preregistration, others can steal my ideas“

Preregistrations document by whom and when research ideas were generated and the researcher can decide when a preregistration becomes public (within a certain embargo).

- „Preregistration is a prison for researchers“

Preregistrations do not forbid changes of the research plan during an ongoing study (e.g. observation of an additional important control variable). It only requires to make such changes transparent!

Open Science Offers *Solutions*



+ Preprints

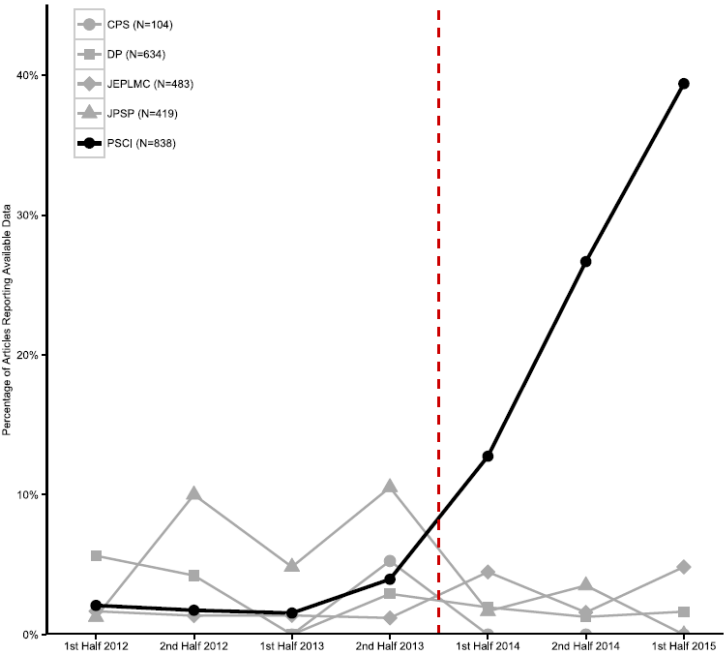
Good News: The System Changes!

OS Badges

- Transparency guidelines (e.g. Schulz et al. 2010, for randomized trials; Keil et al., 2014, for psychophysiology)
- Since 2014, *Psychological Science* established badges for open data and materials. In 2015 open data have risen from 3% - 39% (Kidwell et al., 2016)
- The Preregistration Challenge (ended 2019; https://cos.io/our-services/prereg-more-information/)
- High powered many labs replication projects (e.g. Many Labs 2; Klein et al., 2018)
- Nelson et al. (2017): The crisis caused the field to improve and increase the integrity of our discipline, practices such as replications, disclosure, preregistration became more common

→ New incentives have been added to the system and a new awareness has developed

Good News: The System Changes!



Kidwell et al. (2016)

Leaderboard for the Preregistration Challenge

University	Rank*	Number of Researchers
University of Queensland	1	36
University of Oxford	2	32
Stanford University	3	28
University College London	3	28
University of Pennsylvania	5	22
University of Toronto	6	21
Duke University	6	21
University of Michigan	8	20
University of Göttingen	9	19
University of Edinburgh	9	19
University of Chicago	9	19

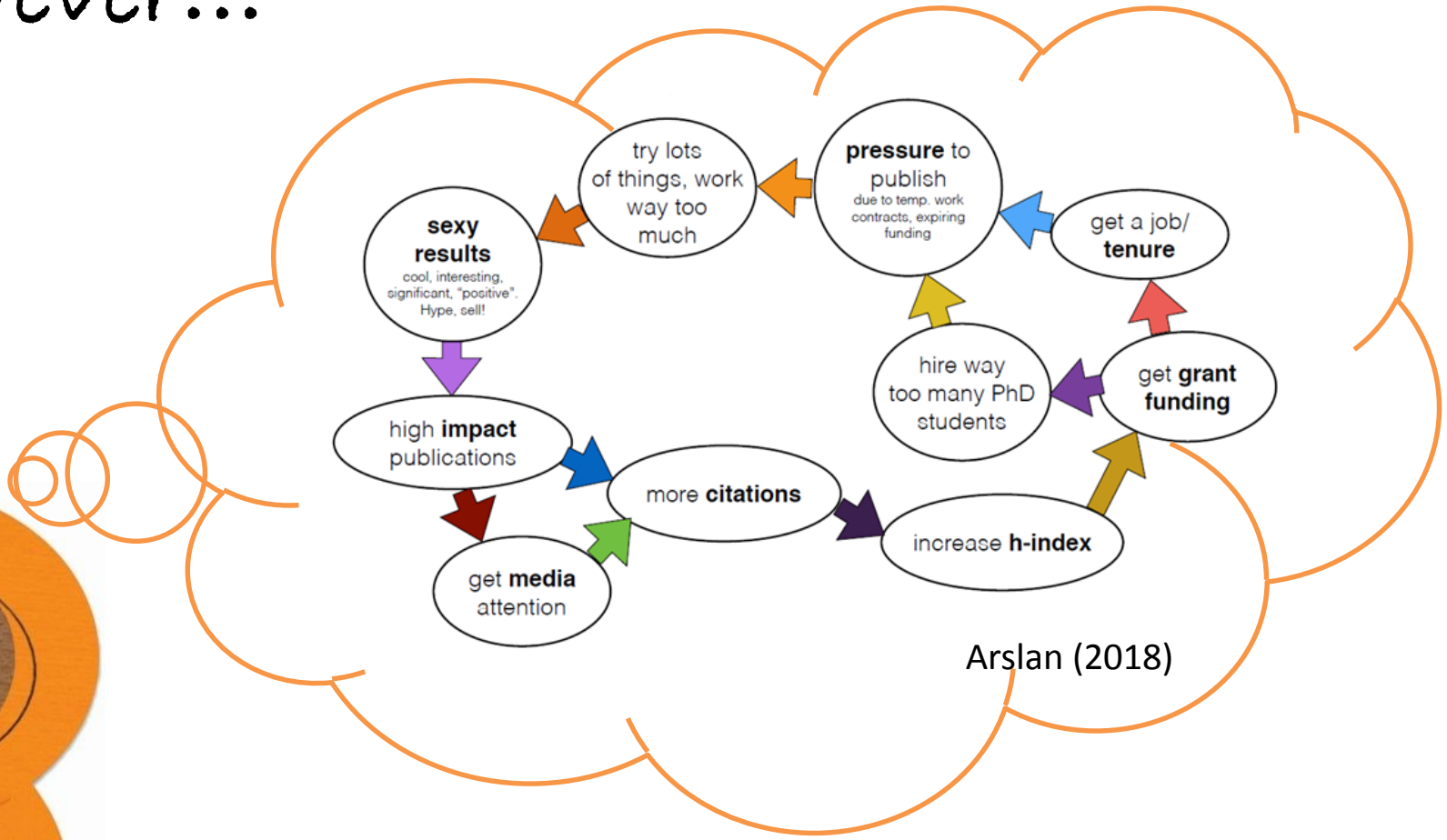
Mellor et al. (2019)

How can I do Open Science?

How can I do Open Science?

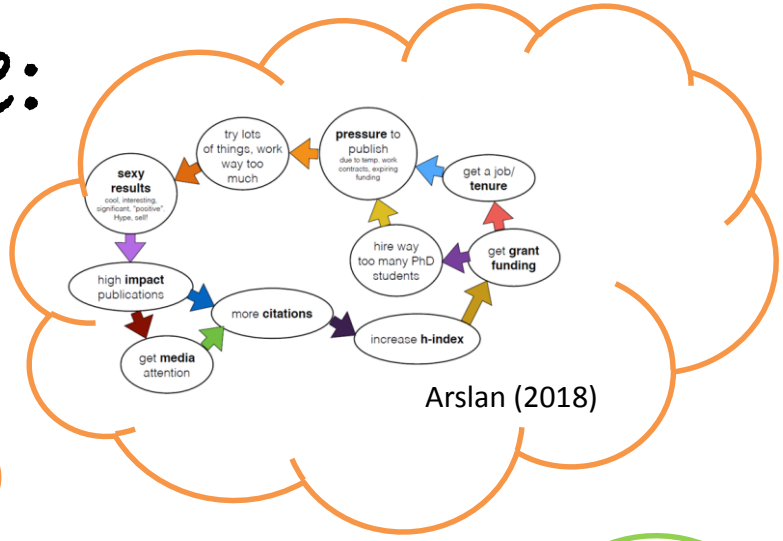
- Learn about OS: Follow OS experts on twitter, join Facebook groups, read blogs, etc
- Preregister your studies
- Make your data, scripts, and materials open
- Cooperate with journals that support open access
- Publish preprints
- …

However...

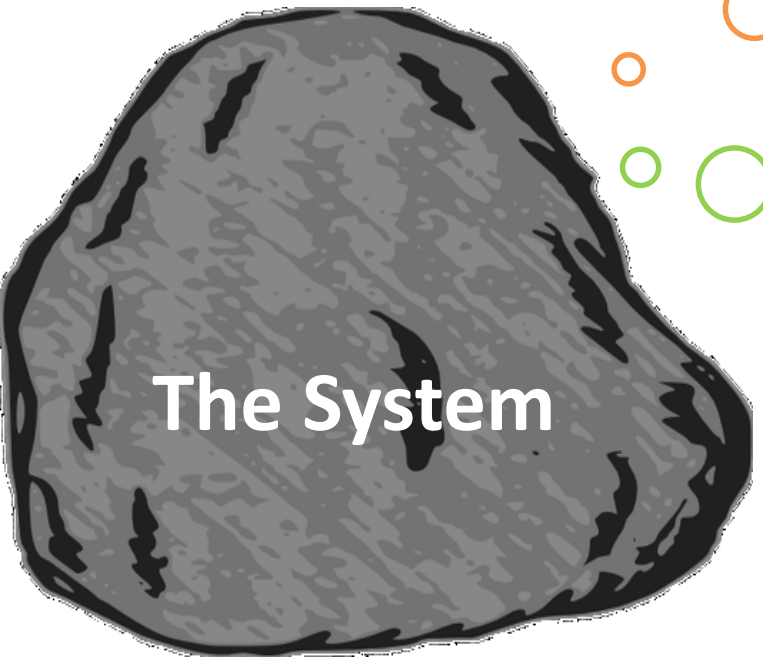


Arslan (2018)

… it can feel like:



Arslan (2018)



- Learn about OS: Follow OS experts on twitter, join facebook groups, read blogs, etc
- Preregister your studies
- Make your data and materials open
- Cooperate with journals that support open access
- Publish preprints

Team up with your (Open Science) friends and change the system together!

How can we do Open Science?

As a group, we can …

… share knowledge and support each other

… influence the incentives of the (local) system

… build larger networks (e.g. for high-powered many lab replication studies)

2 Working in a Local Open Science Initiative …

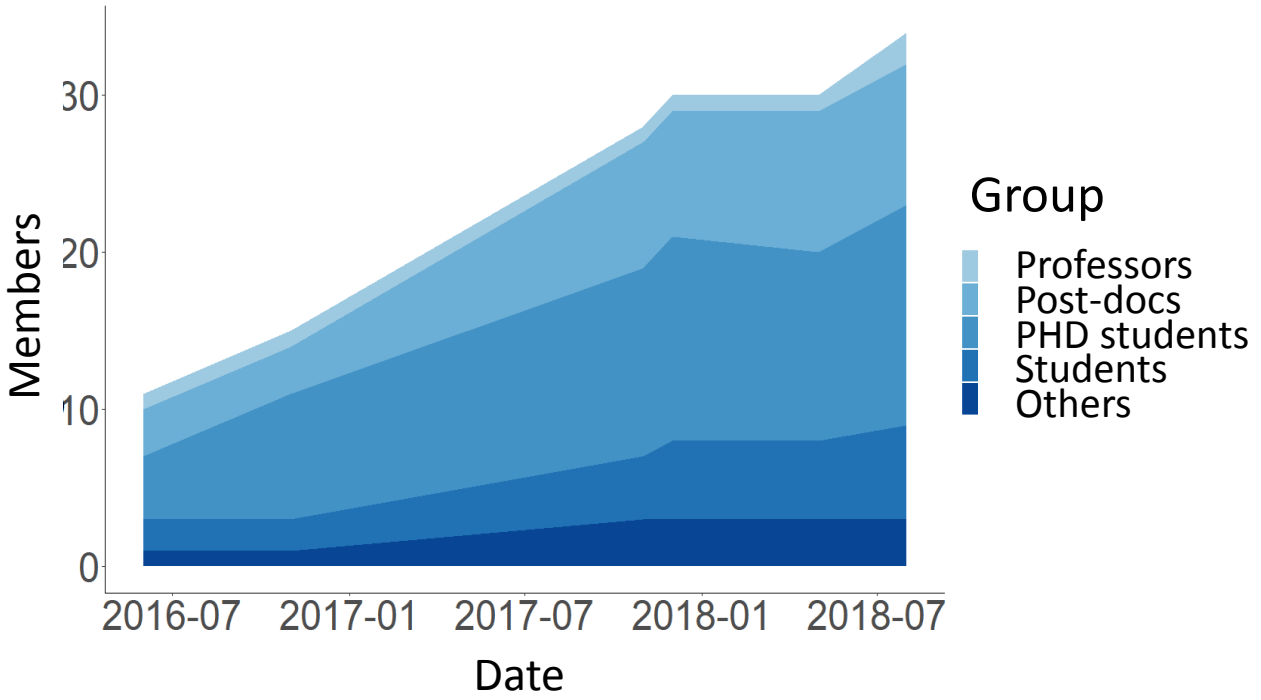
… Using the Example of GOSSIP

GOSSIP

Göttingen Open Source & Science Initiative of Psychology

The History of GOSSIP

- 2016: Some institute members decided to form a group and support Open Science at their work space
- Since then more than 40 members joined and most departments are represented

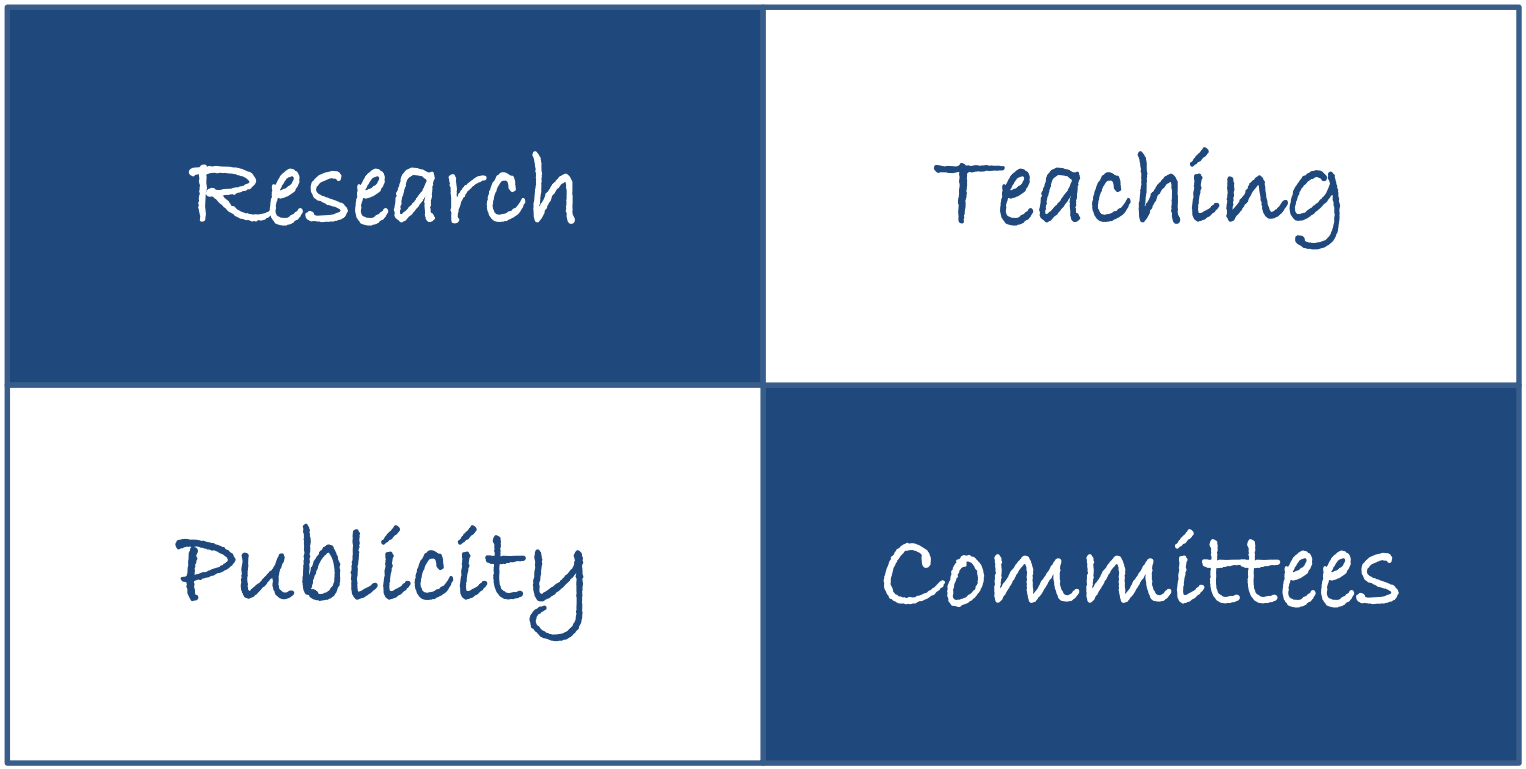


GOSSIP, 2018

Organizational Structure

- Flat hierarchy
- Everyone can join
- 2 meetings per semester (plus meetings in project groups)
- Communication via e-mail mailing list
- Task segregation/ responsibilities, e.g. newsletter team

GOSSIP's Fields of Commitment



GOSSIP's Commitment

Research

→ Motivate and support researchers in doing open science

- Workshops about preregistration and the use of OS software
- Invitation of OS experts for talks
- Use of the OSF platform for knowledge exchange and connection with others
- Listing of OS publications on the institute's website

GOSSIP, 2018

GOSSIP's Commitment

- Preregistration and OS badges at the experimental practicum course (3rd semester Bachelor)
- Courses about the replication crisis and OS (Bachelor + Master)
- Support of OS practices and preregistration in students' theses
- Cooperation with the student's council

Teaching

→ Teach best practices and increase sensitivity for non-optimal practices in published literature

GOSSIP, 2018

GOSSIP‘s Commitment

→Make OS visible to the public and enlarge our network

Publicity

- Website with news and OS resources: www.psych.uni-goettingen.de/gossip (German only)
- Newsletter (distributed via mailing list, see archive on GOSSIP website)
- Presence at OS events, e.g. OS run, conferences, etc.

GOSSIP, 2018

GOSSIP's Commitment

- OS as a criterion in job announcements and for recruitment
- Seeking funding for OS activities
- Anchoring OS in shared projects with other institutions and research infrastructures
- Support and initiation of a student's petition for more OS at universities

→ Build a system that rewards OS practices

Committees

GOSSIP, 2018

What helps "opening the door" for OS?

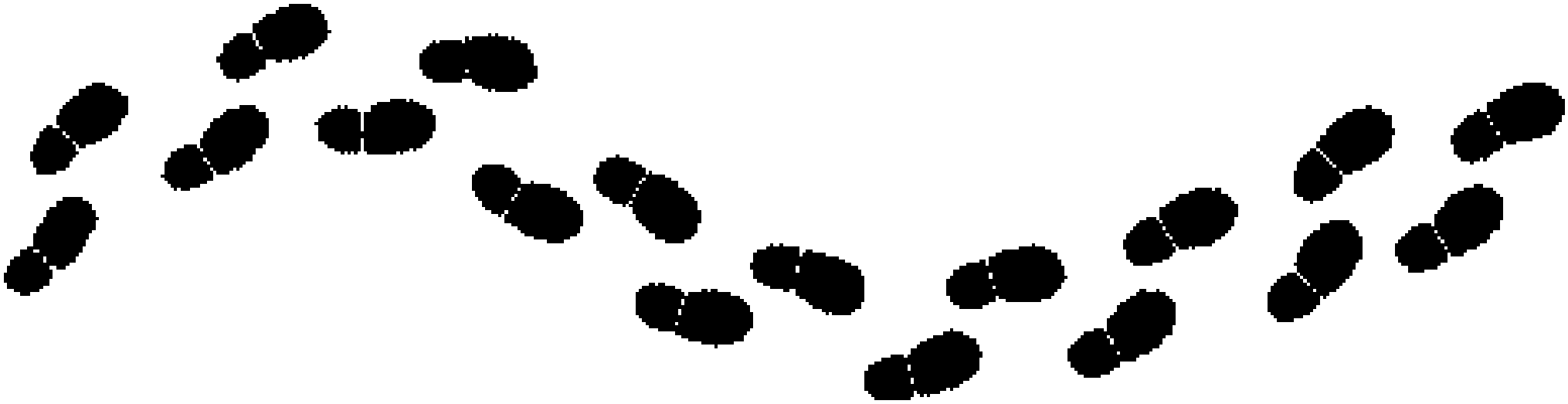
Recommendations by Tanja M. Gerlach (spokeswoman of GOSSIP)

When getting involved as department …

- Do not be afraid of the overwhelming amount of information!
  - Just get started with small steps towards OS
- Usually you do not need to invent everything completely new
  - Ask the OS community for templates and materials
  - Talk to colleagues who do similar research to find solutions together
- When following the improvement of OS practices in the media, it can feel as if you can never do it right
  - Treat your own OS work as a continuous learning process (shifting standards = always room for improvement ☺)
  - In the past, reviewers and editors usually have valued OS efforts and gave helpful tips and pragmatic advice

When founding an initiative …

- It might take a while to convince others to join
  - Be persistent in bringing the topic to the agenda and do not give up
- Respect other people's concerns and the local possibilities (especially when trying to convince people in key positions)
  - Encourage big AND small efforts
  - „Foot in the door" instead of „door in the face": Try to jointly seek out new ways and offer help instead of acting like a know-it-all



Every little bit helps!

3

Resources and References

Some Resources to Learn About Open Science (there are *many* more!)

- OS framework: https://osf.io/
- Society for the Improvement of Psychological Science: http://improvingpsych.org/
- FB group: https://www.facebook.com/groups/psychmap
- Tutorials: http://spsp.org/resources/videos/openscience
- Blog: http://datacolada.org/
- Platform labeling articles regarding OS: http://curatescience.org/
- Preprints: https://psyarxiv.com/
- Twitter: @BrianNosek, @nicebread303, @LorneJCampbell, @lakens, ...
- Take online courses and earn badges: https://www.fosteropenscience.eu/

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