Anne Gärtner
Faculty of Psychology

Workshop Open Science Practices
Part 1

Preregistration

Overview

Time	Topic
13:00 – 13:10	Welcome
13:10 – 13:40	Power (Alex)
13:40 – 13:55	Discussion
13:55 – 14:40	Data Collection (Anne)
14:40 – 14:55	Break
14:55 – 15:40	*P*-hacking (Anne)
15:40 – 16:10	Publication Bias (Alex)
16:10 – 16:25	Discussion
16:25 – 16:40	Break
16:40 – 17:25	Preregistration (Anne)
17:25 – 17:40	Discussion
17:40 – 18:00	Wrap Up, Evaluation

Workshop material

Zoom Poll

Outline

What is a preregistration?
- Reasons for conducting preregs
- Essential elements

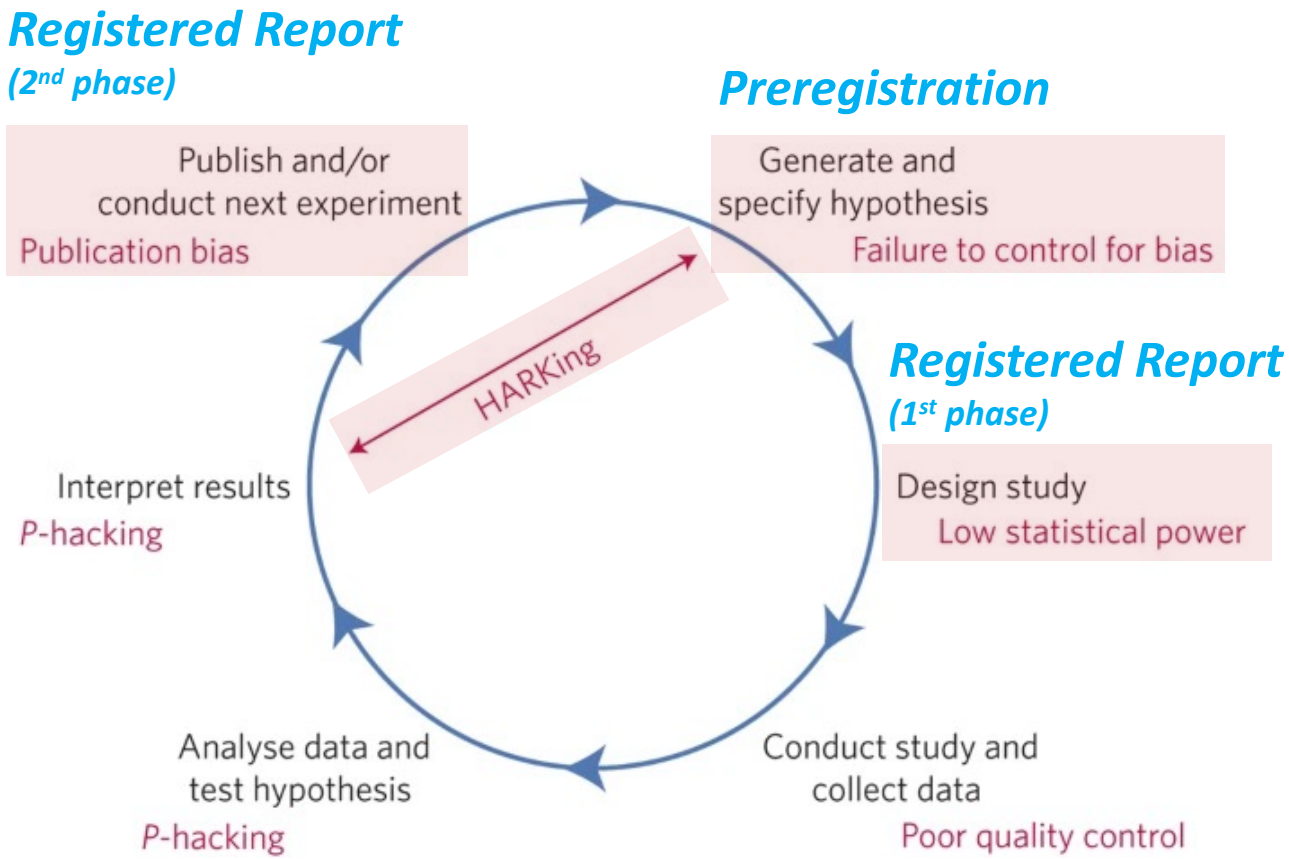
How to practically conduct a prereg
- Templates and platforms

Registered Reports

Advocatus Diaboli
- But…

Exercise

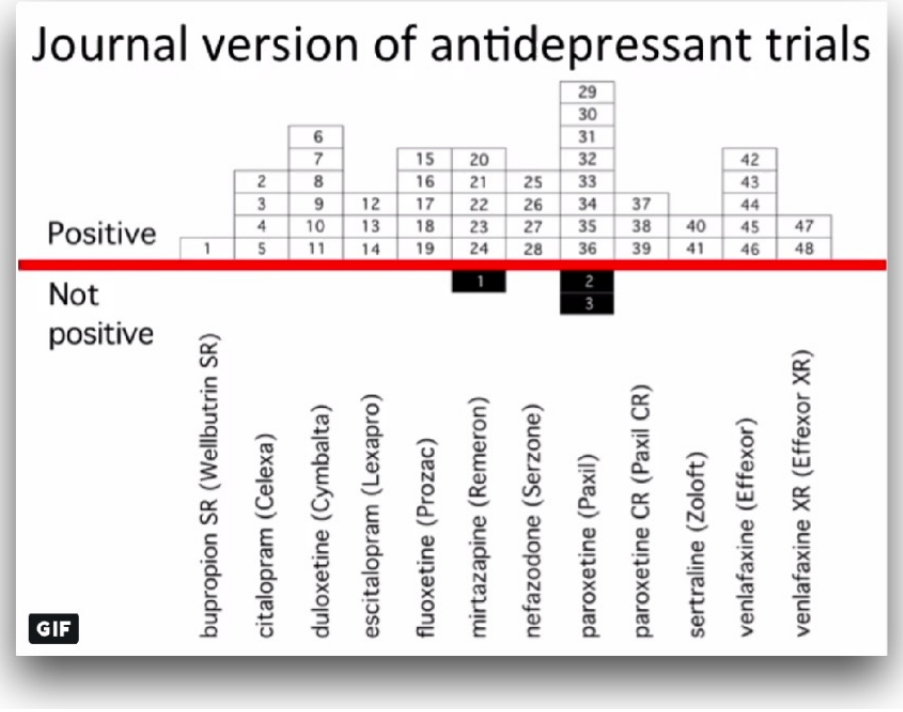
Summary and further recommendations



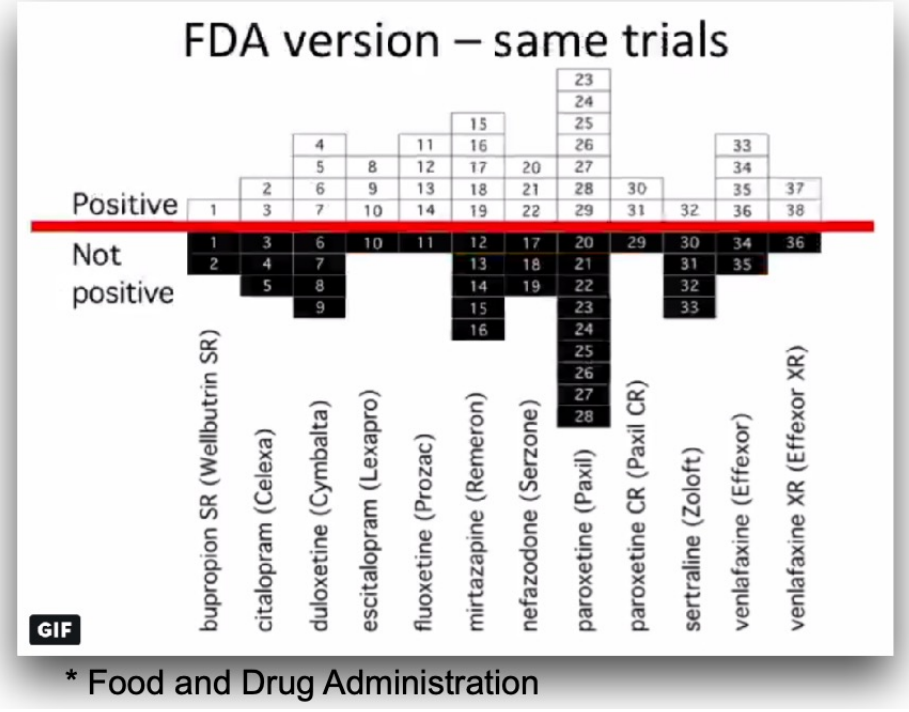
Introduction

Efficacy of anti-depressants (Turner et al., 2008)

Trials published in journals
48 positive, 3 negative



Trials preregistered at FDA*
38 positive, 36 negative



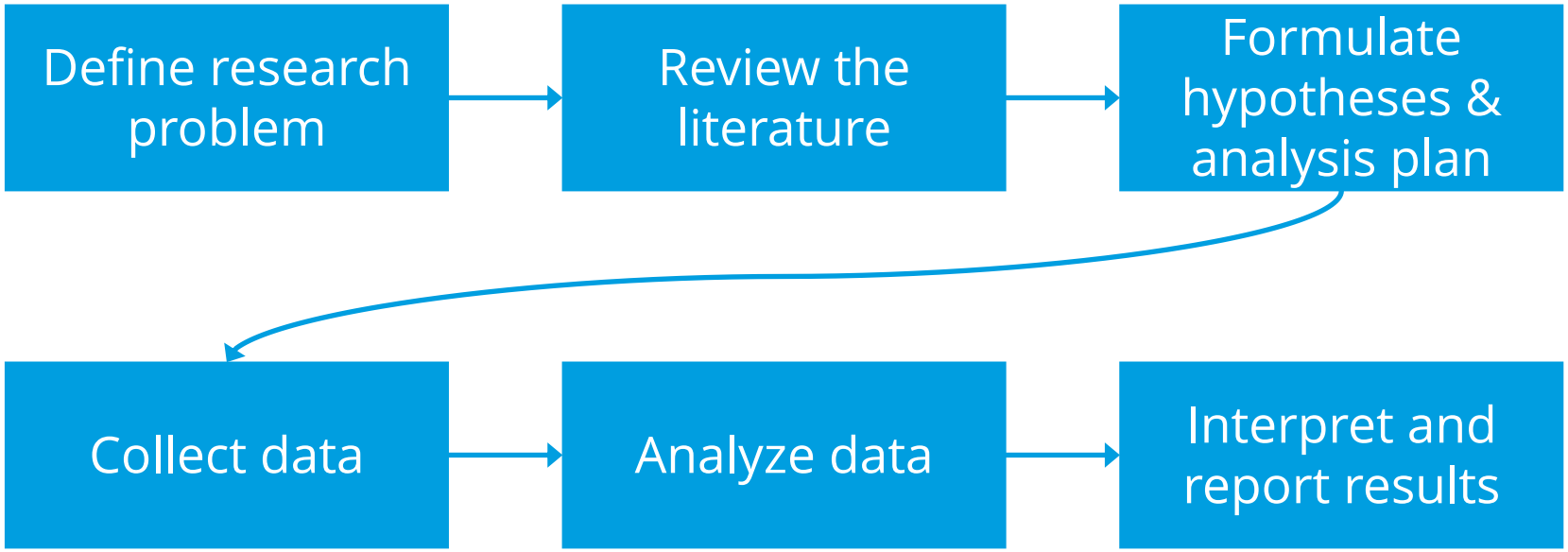
* Food and Drug Administration

Turner et al. (2008). *N Engl J Med, 358*(3):252-60

What is a preregistration?

What is a preregistration?
Reasons for conducting preregs

A prototypical research process

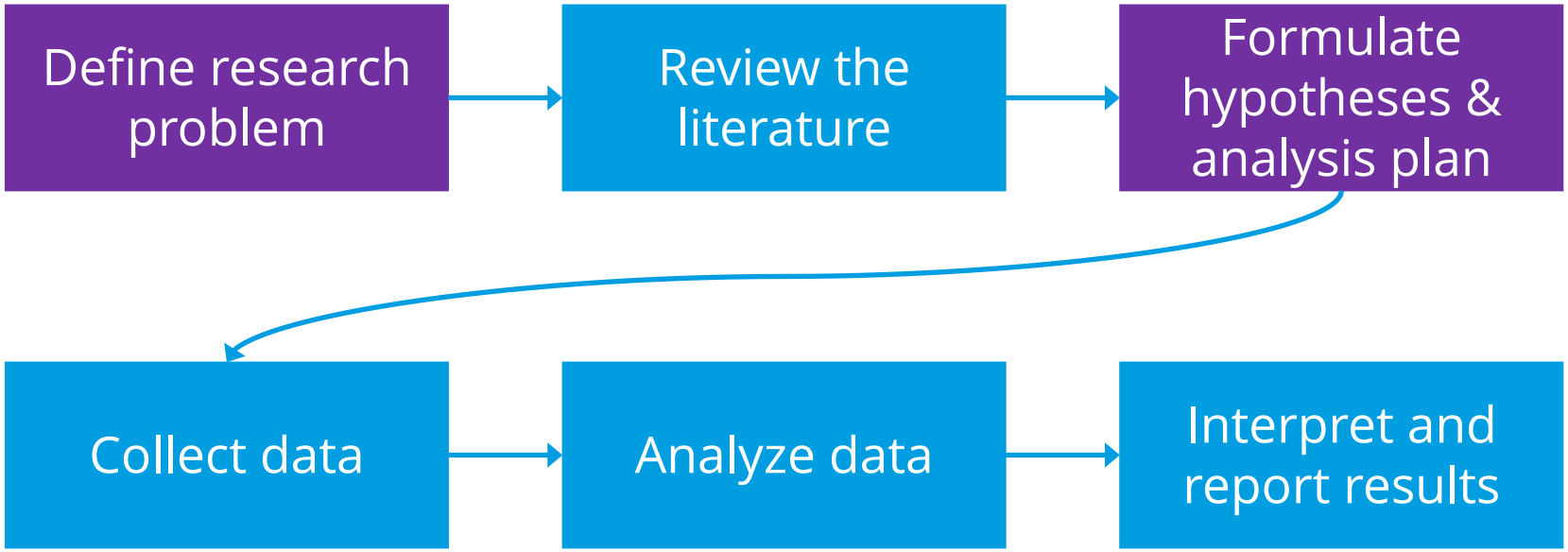


Kothari (2004). Research methodology: Methods and techniques. (2nd ed.)

What is a preregistration?
Reasons for conducting preregs

A prototypical research process

A preregistration makes these steps explicit



Kothari (2004). Research methodology: Methods and techniques. (2nd ed.)

What is a preregistration?
Reasons for conducting preregs

Definition

„The specification of a research design, hypotheses, and analysis plan prior to observing the outcomes of a study.“

Nosek & Lindsay (2018)

Nosek & Lindsay (2010). *APS Observer*, 31(3).

What is a preregistration?
Reasons for conducting preregs

1. Clear distinction between confirmatory and exploratory research

Confirmatory Research
Analyze hypotheses

↓

Number of hypothesis tests: known

↓

Error rate control: possible
p-value: meaningful

Exploratory Research
Browse through data

↓

Number of hypothesis tests: unknown

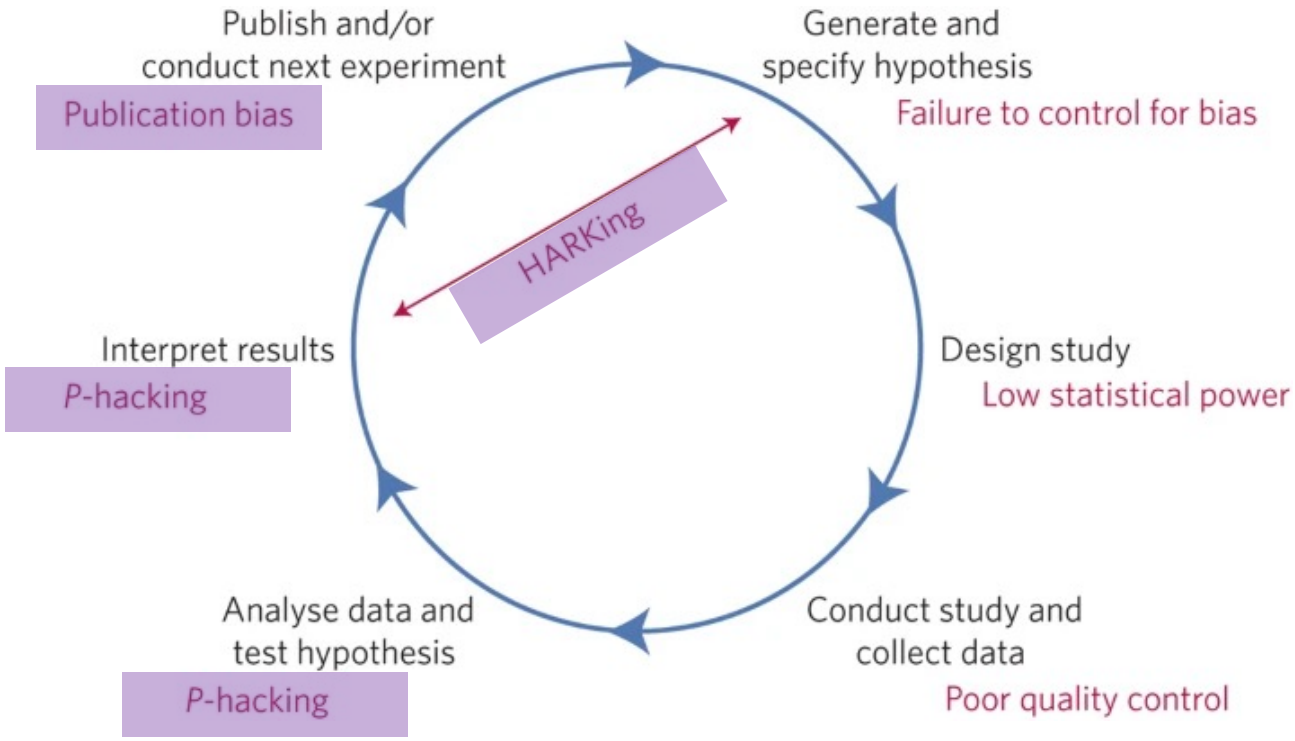
↓

Error rate control: impossible
p-value: „essentially uninterpretable“

Wagenmakers et al. (2012), *Perspectives on Psychological Science, 7*(6).

What is a preregistration?
Reasons for conducting preregs

2. Mitigate questionable research practices

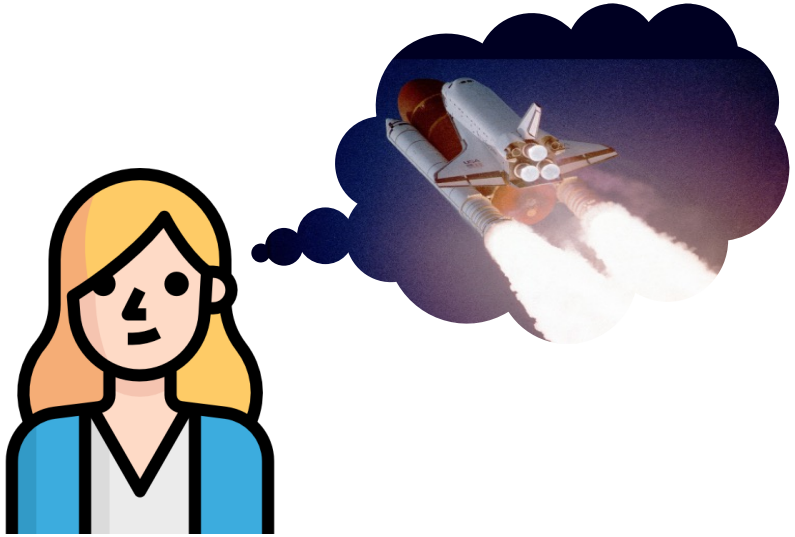


Munafó et al. (2017), *Nature Human Behaviour, 1*(21).

What is a preregistration?
Reasons for conducting preregs

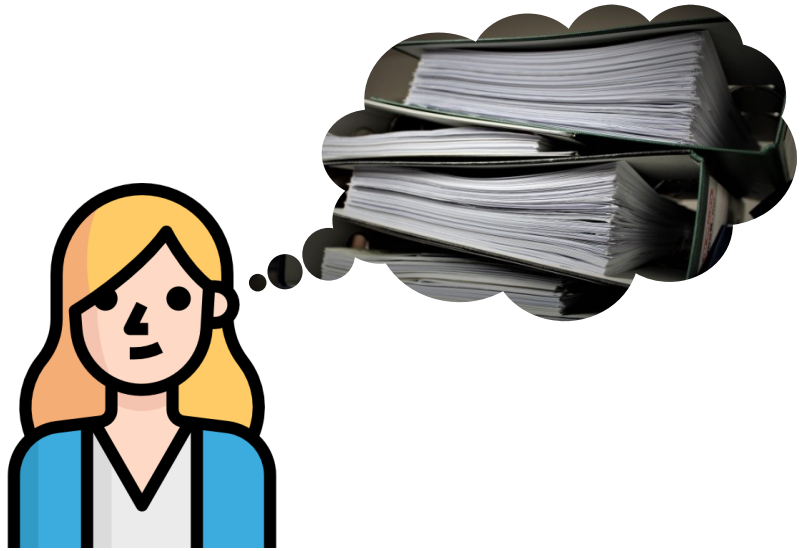
3. Get your head around your research designs

Before you conduct the study...



„This is gonna be rocket science!“

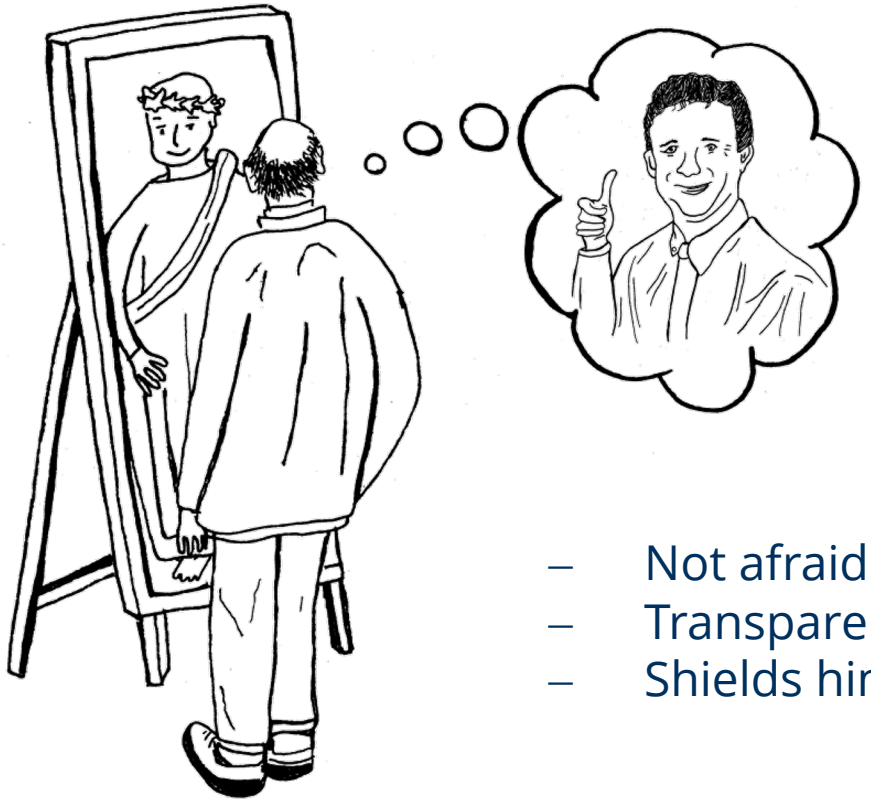
When you look at your data...



„How should I ever analyze this mess?“

What is a preregistration?
Reasons for conducting preregs

4. Build your reputation

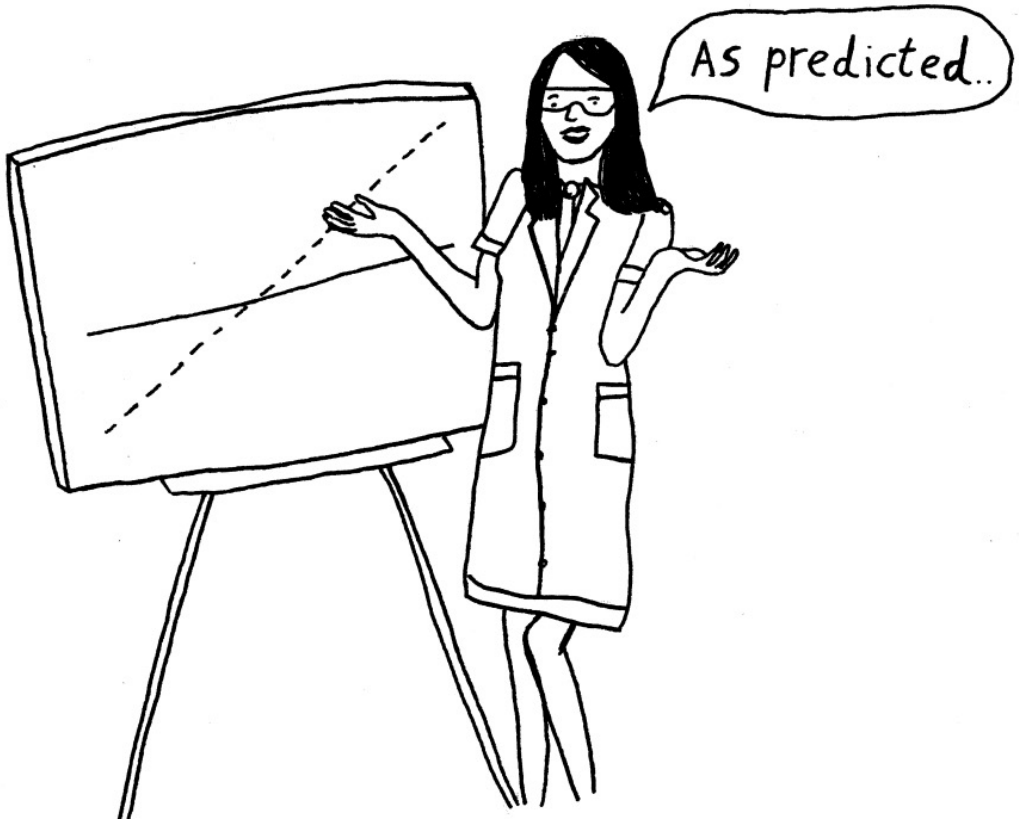


- Not afraid of falsification
- Transparent scientist
- Shields him/herself from bias

Wagenmakers & Dutilh (2016), *APS Observer*, *29*(9).

What is a preregistration?
Reasons for conducting preregs

5. Take credit for your ideas



Wagenmakers & Dutilh (2016), *APS Observer*, *29*(9).

What is a preregistration?
Essential elements

1. Hypotheses
2. Design
3. Planned sample
4. Exclusion criteria
5. Analysis plan
6. Additional stuff

Essential

- Describe hypotheses as relationship between variables
- Describe shape of interaction effects
- Describe manipulation checks (or why they are not included)

Recommended

- Figures / tables to describe interaction effects
- Rationales / theoretical frameworks to justify the hypotheses

van t'Veer & Giner-Sorolla (2016). *Journal of Experimental Social Psychology, 67*, 2-12.

What is a preregistration?
Essential elements

1. Hypotheses
2. Design
3. Planned sample
4. Exclusion criteria
5. Analysis plan
6. Additional stuff

Essential

- Independent variables (describe variable, all levels, between- or within-person?)
- Dependent variables
- Third variables (covariates, moderators, control variables etc.)

van t'Veer & Giner-Sorolla (2016). *Journal of Experimental Social Psychology, 67*, 2-12.

What is a preregistration?
Essential elements

1. Hypotheses
2. Design
3. Planned sample
4. Exclusion criteria
5. Analysis plan
6. Additional stuff

Essential

- Pre-selection rules (e.g., age limits)
- Where, from whom, and how will the data be collected?
- Justify planned sample size (power analysis or Bayesian design analysis)
- Describe data collection termination rule

van t'Veer & Giner-Sorolla (2016). *Journal of Experimental Social Psychology, 67*, 2-12.

What is a preregistration?
Essential elements

1. Hypotheses
2. Design
3. Planned sample
4. Exclusion criteria
5. Analysis plan
6. Additional stuff

Essential

Describe all anticipated exclusion criteria, e.g.

- Missing, erroneous, overly consistent responses
- Failing check-tests or suspicion probes
- Demographic exclusions
- Data-based outlier criteria
- Method-based outlier criteria (e.g., too long response times)

Recommended

- Set fail-save levels of exclusion at which whole study needs to be stopped, altered, and restarted

van t'Veer & Giner-Sorolla (2016). *Journal of Experimental Social Psychology, 67*, 2-12.

What is a preregistration?
Essential elements

1. Hypotheses
2. Design
3. Planned sample
4. Exclusion criteria
5. Analysis plan
6. Additional stuff

Essential

Describe statistical analyses that test hypotheses. Include:

- Relevant variables and how they are calculated
- Statistical technique
- Each variable's role in the technique (e.g., IV, DV, covariate)
- If covariates are used: Rationale for using them
- For techniques other than NHST: criteria + inputs toward making conclusions about your hypotheses

Recommended

- Multiple testing correction, missing data handling
- Anticipated data transformations
- Assumptions and assumption checks

van t'Veer & Giner-Sorolla (2016). *Journal of Experimental Social Psychology, 67*, 2-12.

What is a preregistration?
Essential elements

1. Hypotheses
2. Design
3. Planned sample
4. Exclusion criteria
5. Analysis plan
6. Additional stuff

Recommended

- For exploratory analyses: „We don‘t have any hypotheses“
- Transparency statement: How will research output be shared?
- Conditional safeguards: What will happen if…?

van t‘Veer & Giner-Sorolla (2016). *Journal of Experimental Social Psychology, 67*, 2-12.

How to practically conduct a preregistration

Registered Report
Preregistration & Publication

Preregistration templates:

- AsPredicted.org
- OSF Preregistration
- International Open Science: A Preregistration Template for Quantitative Research in Psychology
- Replication Recipe (Brandt et al., 2013): Pre-Registration
- Replication Recipe (Brandt et al., 2013): Post-Completion
- Open-Ended Registration
- Secondary Data Preregistration
- Pre-Registration in Social Psychology (van t'Veer & Giner-Sorolla, 2016)
- BAM!!!Lab Study preregistration
- Happy Lab Preregistration (quite short)
- ...

Registered Report
Preregistration & Publication

http://aspredicted.org/

Pro:
- Easy „fill-the-blanks“ concept
- timestamped

Con:
- Multiple private preregistrations possible, can remain private forever
- Not easy to find without the link

AsPredicted Questions

(version 2.00)

This **blog post** on how to answer pre-registration questions may be a useful resource.

1) Data collection. Have any data been collected for this study already?

- Yes, we already collected the data.
- No, no data have been collected for this study yet.
- It's complicated. We have already collected some data but explain in Question 8 why readers may consider this a valid pre-registration nevertheless.
  (Note: "Yes" is not an accepted answer.)

2) Hypothesis. What's the main question being asked or hypothesis being tested in this study?

Example: A month-long academic summer program for disadvantaged kids will reduce the drop in academic performance that occurs during the summer.

We **recommend** using up to about 3200 characters.

3) Dependent variable. Describe the key dependent variable(s) specifying how they will be measured.

Example: Simple average GPA across all courses during the first semester after the intervention.

4) Conditions. How many and which conditions will participants be assigned to?

Example 1: Two conditions: Offering summer program: yes vs. no. **Example 2:** 12 conditions in a mixed design lab study. Participants will be assigned to one of four conditions: math training, verbal training, memory task, or control (4 between-subject conditions). Each participant will complete a math test, a verbal test, and a memory test (3 within-subject conditions).

5) Analyses. Specify exactly which analyses you will conduct to examine the main question/hypothesis.

Example: Linear regression predicting the simple average GPA in the semester after the intervention with a dummy variable indicating whether the participant was offered the summer program or not (intention-to-treat-analysis). We will also conduct the same regression controlling for simple average GPA during the semester before the intervention, gender, & household income (an 8-point scale ranging from 1 = below $20,000 and 8 = above $150,000).

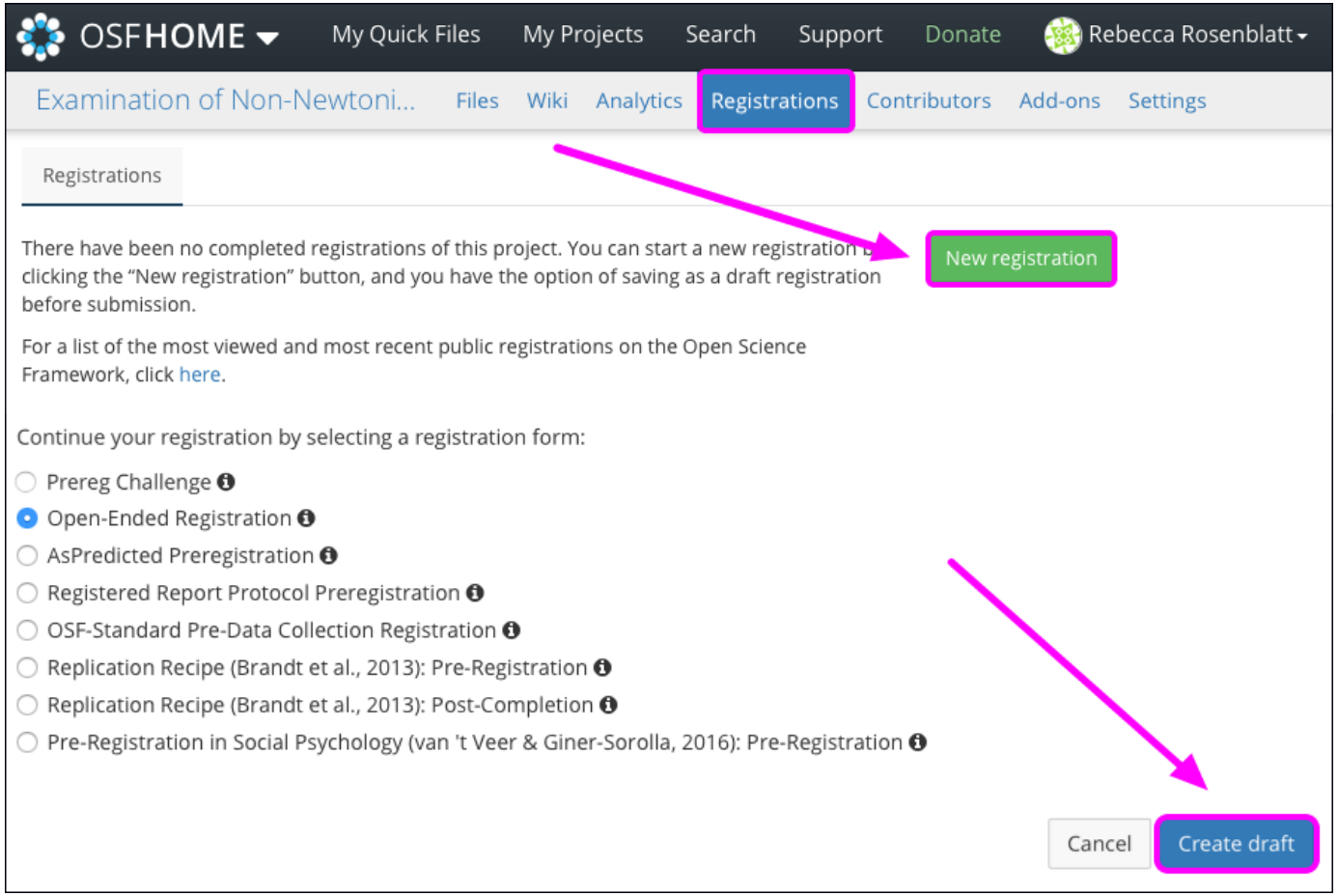
Registered Report
Preregistration & Publication

OSF.io

Pro:
- coupled to OSF project
- timestamped
- flexible templates
- no max. file size

Con:
- not 100% intuitive

Most easiest way: Write your preregistration as a PDF, upload to project, and choose „Open-ended Registration“



http://help.osf.io/m/registrations/l/524205-register-your-project#!prettyPhoto

Registered Report
Preregistration & Publication

Other platforms and institutional repositories

- GitHub.com
- Figshare.com
- Clinical Trials: clinicaltrials.gov
- American Economic Association's Registry: socialscienceregistry.org
- Evidence in Governance and Politics: egap.org/content/registration

Pro:
- coupled to GitHub account
- timestamped
- flexible templates

Con:
- Not the first place to look for preregs
- No template provided
- GitHub now is owned by Microsoft (commercial interests)

http://help.osf.io/m/registrations/l/524205-register-your-project#!prettyPhoto

Registered Report
Preregistration & Publication

Other platforms and institutional repositories

- GitHub.com
- Figshare.com
- Clinical Trials: clinicaltrials.gov
- American Economic Association's Registry: socialscienceregistry.org
- Evidence in Governance and Politics: egap.org/content/registration

Pro:
- timestamped
- flexible templates
- altmetrics provided

Con:
- Not the first place to look for preregs
- No template provided
- Commercial platform

http://help.osf.io/m/registrations/l/524205-register-your-project#!prettyPhoto

Registered Report

Registered Report
Preregistration & Publication

Definition

"Registered Reports are a format of empirical article where a study proposal is reviewed before the research is undertaken. Pre-registered proposals that meet high scientific standards are then provisionally accepted before the outcomes are known, independently of their results."

Chris Chambers (2016)

Registered Report

How does it work?

paper can be conditionally accepted **here**

final decision (not based on design / research question)

Registered Report

Availability of Registered Reports

Currently, over 300 journals use the Registered Reports publishing format

Applied Cognitive Psychology
Behavioral Neuroscience
Brain and Cognition
Brain and Neuroscience Advances
Cognition and Emotion
Collabra
Cortex
Developmental Cognitive Neuroscience
Developmental Science
eNeuro
European Journal of Neuroscience
European Journal of Personality
Experimental Psychology
Frontiers
Journal of Cognition
Journal of Experimental Psychology: Learning, Memory, and Cogni
Journal of Personality
Journal of Personality and Social Psychology
Nature Communications
Nature Human Behaviour
NeuroImage Reports
Open Psychology
Personality Science
PLOS ONE
Psychological Science
Scientific Reports
Social Psychological Bulletin

Advocatus Diaboli

Advocatus Diaboli

But…

… preregistration keeps me from conducting exploratory research!

- Improving your confirmatory research does not mean that you have to refrain from doing exploratory research
- You can also preregister your exploratory research (e.g., planned analysis methods)

Advocatus Diaboli

But…

… preregistration takes so much time!

– Actually it might even save you time during data analysis / interpretation
– Preregistration mostly changes the order of the research process (e.g., think about how to analyze your data *before / after* you collect them)

Advocatus Diaboli

But…

… someone will steal my ideas!

– On the contrary: By preregistering your ideas you mark them as yours! If anyone still dares to steal them, it will be very easy to point this out as scientific misconduct.

Advocatus Diaboli

But…

… what if I (or my students) make mistakes in the preregistration?

- Everyone makes mistakes, no need to be embarrassed!
- You can always deviate from your preregistered analysis if you give a good justification.
- If you make your preregistration open and someone finds a mistake, consider yourself lucky because this spares you finding it out when it is too late.

Advocatus Diaboli

But…

… people preregister stuff and then deviate significantly from the preregistration. What is it good for then?

- As a reviewer, it should make you vigilant about the quality of the paper → require justifications for deviations from the preregistration
- As a reader, you will be able to judge the quality of results (do they come from confirmatory or exploratory research?)
- It helps you to spot QRPs.

Exercise

Exercise
Preregistration

Discussion:

Do you think this is a good or bac
preregistration?

What would you change?

AsPredicted
Pre-Registration made easy

Sample 5 - SUMMER PROGRAMS - GPA performance, Chicago, July 2016 (#578)

Author(s)
Larry TheRobot (AsPredicted College) - larry@aspredicted.org

Created: 04/07/2016
Made public: 04/07/2016

1) What's the main question being asked or hypothesis being tested in this study?
A month-long academic summer program for disadvantaged kids will reduce the drop in academic performance that occurs during the summer.

2) Describe the key dependent variable(s) specifying how they will be measured.
Simple average GPA across all courses during the first semester after the intervention.

3) How many and which conditions will participants be assigned to?
Two conditions: Offering summer program: yes vs no.

4) Specify exactly which analyses you will conduct to examine the main question/hypothesis.
Linear regression predicting the dependent variable with a dummy indicator for having been offered the summer program vs not (intention-to-treat analysis). We will also report results when controlling for baseline levels of the dependent variable (simple GPA average semester before training), gender & household income.

5) Any secondary analyses?
The effect may be larger for boys rather than girls, and for children living with one rather than two parents/guardians.

6) How many observations will be collected or what will determine sample size? No need to justify decision, but be precise about exactly how the number will be determined.
We will offer the program until 500 people have agreed to participate in it or until June 30, 2016 (whichever comes first).

7) Anything else you would like to pre-register? (e.g., data exclusions, variables collected for exploratory purposes, unusual analyses planned?)
We include a battery of questions for exploratory purposes including happiness, videogame playing and family activity. We will also collect data on a survey with 24 questions and will report the results of those data in a separate project.

8) Have any data been collected for this study already?
No, no data have been collected for this study yet

https://osf.io/r8fwb/

Summary

Summary
Preregistration

How can you improve your OS record (almost) without effort?

1. **As a reviewer**: ask the authors which analyses are confirmatory and which exploratory
2. **As a researcher**: write down your hypotheses/expectations before you start your studies
3. **Always**: Interfere when someone wants to exploit researcher degrees of freedom to “prove” an effect

Further recommendations

Further Recommendations
Preregistration

Who to ask?

- Center for Open Science Preregistration Coaching Network: https://cos.io/blog/preregistration-coaching-network/
- Registered Reports FAQ (by Chris Chambers): https://cos.io/rr/ (see „FAQ“ tab)
- Registered Reports: Editor of your RR journal
- Ask Open Science Initiative (e.g., OSIP @TUD): https://tu-dresden.de/mn/psychologie/die-fakultaet/open-science

OPEN SCIENCE INITIATIVE

OSIP Open Science Initiative der Fakultät Psychologie der TUD

Further Ressources
Important Links

- COS (2018). *Registered Reports: Peer review before results are known to align scientific values and practices.* Available on cos.io/rr/
- Lin, W. & Green, D.P. (2016). Standard operating procedures: A safety net for pre-analysis plans. *PS: Political Science & Politics, 49*(03), 495-500. stat.berkeley.edu/~winston/sop-safety-net.pdf
- Nosek, B.A. & Lindsay, S. (2018). Preregistration becoming the norm in psychological science. *APS Observer, 31*(3). Available on psychologicalscience.org/observer/preregistration-becoming-the-norm-in-psychological-science.
- Schönbrodt, F. S., Scheel, A., & Stachl, C. (2017). *LMU workshop „pre-registration“.* Slides available on osf.io/yd487/
- van t'Veer, A.E. & Giner-Sorolla, R. (2016). Pre-registration in social psychology: A discussion and suggested template. *Journal of Experimental Social Psychology, 67,* 2-12. osf.io/56g8e/

Further Ressources
References

Chambers, C. (2016). Interview by Alice Power on the Royal Society Publishing blog. *Registered reports: What are they and why are they important?* Available on blogs.royalsociety.org/publishing/registered-reports-what-are-they-and-why-are-they-important/

Kothari, C.R. (2004). *Research methodology: Methods and techniques.* (2nd ed.) New Delhi: New Age International. Available on https://goo.gl/16aqXQ .

Lin, W. & Green, D.P. (2016). Standard operating procedures: A safety net for pre-analysis plans. *PS: Political Science & Politics, 49*(03), 495-500. stat.berkeley.edu/~winston/sop-safety-net.pdf

Munafò, M. R., Nosek, B. A., Bishop, D. V. M., Button, K. S., Chambers, C. D., Percie du Sert, N., . . . Ioannidis, J. P. A. (2017). A manifesto for reproducible science. *Nature Human Behaviour, 1*(21) doi: 10.1038/s41562-016-0021

Nosek, B.A. & Lindsay, S. (2018). Preregistration becoming the norm in psychological science. *APS Observer, 31*(3). Available on psychologicalscience.org/observer/preregistration-becoming-the-norm-in-psychological-science.

Schönbrodt, F. D. & Wagenmakers, E.-J. (2017). Bayes factor design analysis: Planning for compelling evidence. *Psychonomic Bulletin & Review.* 1-15. doi: 10.3758/s13423-017-1230-y

Schönbrodt, F. S., Scheel, A., & Stachl, C. (2017). *LMU workshop „pre-registration".* Slides available on osf.io/yd487/

Wagenmakers, E.-J. & Dutilh, G. (2016). Seven selfish reasons for preregistration. *APS Observer, 29*(9). Available on psychologicalscience.org/issue/nov-16

Wagenmakers, E.-J., Wetzels, R., Borsboom, D., Maas, H. L. J. v. d., & Kievit, R. A. (2012). An agenda for purely confirmatory research. *Perspectives on Psychological Science*, *7*(6), 632–638. doi: 10.1177/1745691612463078

van t'Veer, A.E. & Giner-Sorolla, R. (2016). Pre-registration in social psychology: A discussion and suggested template. *Journal of Experimental Social Psychology, 67*, 2-12. osf.io/56g8e/

https://www.pinterest.ch/researchugent/research-integrity/

Thank you!