03-Preregistration

June 25, 2019

1 Preregistration

2 What is preregistration?

- Specifying to your plan in advance, before you gather data.
- Preregistration separates hypothesis-generating (exploratory) from hypothesis-testing (confirmatory) research
  - Both are important.
- The same data cannot be used to generate and test a hypothesis
  - Nevertheless in reality, this appens often
  - This often happens unintentionally
  - The consequence is that it reduces the credibility of you as a scientist and your results
- Addressing this problem through planning:
  - Improves the quality and transparency of your research
  - Helps others who may wish to build on it

3 Why would I preregister a study?

- Increase reproducibility
- Increase trust in research by being transparent
- Fight against Questionable Research Practices

3.1 I am not doing anything wrong. Why should I waste my time?

- This isn't about paying a pennance for doing something wrong
- This is about taking collective action against Questionable Research Practices

Leading by example

- By voluntarily being transparant about research practices, we can:

  - Regain trust in research
  - Create a research environment that is more difficult for Questionable Research Practices to thrive in
- This is about putting the benefit of the scientific community before the ease of our current research climate

4 An example preregistration of a study of mine

Automate Formant Ceiling

5 Challenges

- Changes to procedure during study administration
- Discovery of assumption violations during analysis
- Data are pre-existing
- Longitudinal studies and large, multivariate datasets
- Many experiments
- A program of research
- Few a priori expectations
- Competing predictions
- Narritive inferences and conclusions

6 Changes to procedure during study administration

- What if you didn't account for:
  - the fact that half of your babies are falling asleep during testing
  - your mice decided to eat each other
  - your adult subjects are bored with your study
  - you made a mistake in your procedure
  - your algorithm parameters are unsuitible

Don't Panic, Document it - With transparent reporting, readers can assess the deviations and their rationale

7 Discovery of assumption violations during analysis

- What if your data violate normality assumptions or other similar situations?
  - Some studies can be preregistered in stages
    * Register study, plan a normality check
    * Register analysis type after normality checks
  - Register a decision tree
  - Establish standard operating procedures (SOPs) that accompany one or many preregistrations
- Just document any changes you make

8 Data are pre-existing

- Meta analysis?
- Analyze old data in new way?
- Came to a new lab and got given data?

A study can be preregistered at any stage before analysis

- Analysis plan must be blind to research outcomes
- If nobody has observed data, pre-registration is possible

- If someone has observed the data, it may not be possible to preregister it
  - A replication could be preregistered
- Meta analysis is allowed in pre-registration if blind to research outcomes

9 Longitudinal studies and large, multivariate datasets

What do you do if you cannot preregister the entire design and analysis plan for all future papers at project onset?

- Preregistered in stages
- Register a decision tree
- Establish standard operating procedures (SOPs) that accompany one or many preregistrations
- Document changes to procedures and deviations from original preregistration
- Analysis plan must be blind to research outcomes

10 Too Many Experiments

What do you do if you have a lab that runs lots of experiments? Preregistration takes too much time.

- Are you running a research paradigm?
  - Create a preregistration template
    - Defines the variables and parameters for the protocol
  - Change template for each new experiment
- Documenting process slowing you down because data collection is so easy?
  - First do an undocumented exploratory study
  - Then preregister a confirmatory replication

11 Program of Research

- Analysis plan must be blind to research outcomes
- All outcomes of analysis plan must be reported
  - No selective reporting!
  - No file drawers
- Does not overcome multiple comparisons

12 Few *a priori* expectations

What if you are just trying to discover something? What if you are *just* exploring?

- You probably still do have a few basic predictions.
- Run the study as an exploratory study
  - Replicate the study as a preregistered confirmatory study
  - If dataset is large enough, split in half
    - Explore in one half, confirm on other half

13 Narrative inferences and conclusions

What if only 1/10 statistical tests are significant. How to avoid focusing only on the "successful" parts of the study?

- Preregistration prevents people from reporting only those statistical inferences that fit a narrative
- Preregistration does not prevent selective attention of readers and authors to focus only on results deemed "successful" or "interesting"

Mostly adapted from: 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.f

14 Questions and Discussion

In [ ]: