Preregistering your study – a Guide

Pre-registration of experiments refers to the practice of formally documenting the design, hypotheses, and analysis plan for a research study **before** the data is collected. This is done to increase the transparency, rigor, and credibility of scientific research. Preregistration allows us to clearly separate hypothesis generating (exploratory) research from hypothesis testing (confirmatory) research.

A preregistration doesn't fail if things don't go fully as predicted or intended in the planning stage of a study – it helps authors and readers differentiate the original plan from the final resulting research.

Pre-registration minimizes various biases like confirmation bias, where researchers might unconsciously look for data that supports their hypothesis, or p-hacking (accidental or intentional), where researchers manipulate their analysis to get statistically significant results. Researchers might unintentionally or intentionally alter the study's design or data analysis approach after seeing the results, and pre-registration locks in a fixed protocol to avoid this as much as possible – or note it in a clear way when unavoidable.

By making the research design and analysis plan publicly available, pre-registration also ensures that the research process is open to scrutiny, which increases trust in the. Clear documentation of the research design and analysis plan also helps other researchers replicate the study and verify the findings.

To better understand why pre-registration is crucial, see:

- https://help.osf.io/article/145-preregistration
- https://doi.org/10.1016/j.tics.2019.07.009
- https://doi.org/10.1073/pnas.1708274114

A clear guide about the desired level of specificity and detail in a preregistration can be found in this article:

- http://datacolada.org/64

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Key Aspects of Pre-Registration

- Hypotheses: Researchers state their hypotheses or predictions about the expected outcomes of the experiment. These hypotheses are based on prior knowledge or theory, and pre-registering them helps prevent researchers from altering their hypotheses based on the data.
- Research Design: The experimental methods are clearly outlined. This includes details on participants (e.g., sample size, demographic characteristics), procedures, materials, and the specific measures or variables that will be assessed.
- Analysis Plan: Researchers specify in advance how they plan to analyze the data, including the statistical tests that will be used and any plans for handling potential outliers or missing data. This helps avoid data dredging or post hoc analyses that may lead to false-positive findings.
- Expected Outcomes: Researchers may indicate what kind of results they expect, which can help distinguish between exploratory and confirmatory research.

Common Platforms for Pre-registration

OSF (Open Science Framework):
https://osf.io/dashboard

AsPredicted:
https://aspredicted.org/

ClinicalTrials.gov: A site where researchers can pre-register clinical trials.
https://clinicaltrials.gov/data-api/api

This document includes step by step guides about using OSF and Aspredicted below.

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How to preregister your study **on OSF**

Watch this video guide made by OSF: https://www.youtube.com/watch?v=1fsqW-9MwNw

If you prefer reading, here's a Step-by-Step Guide to Pre-registering Your Study on OSF:

1. Create an OSF Account

- Visit OSF.io and sign up for a free account.
- After registration, log in to access the platform's features.

2. Initiate a New Registration

- Navigate to your dashboard and click on **"Create new project"**.
- Select **"Registration"** as the project type.
- Provide a descriptive title for your study, such as "Investigating Cognitive Processes Through Behavioral Tasks, Gaze Tracking, and fMRI".

3. Choose an Appropriate Template

- For studies involving fMRI, the fMRI Preregistration Template is highly recommended. This template integrates guidelines from the OSF preregistration challenge and best practices for neuroimaging studies.
- If your study primarily focuses on behavioral and gaze tracking aspects, consider the Open Science Framework Preregistration Template, which is more general but still suitable for your needs .

4. Fill Out the Preregistration Form

- **Study Overview**:
    - **Research Question**: Clearly state the primary research question your study aims to address.
    - **Hypotheses**: Define your hypotheses regarding the expected outcomes of the behavioral tasks, gaze patterns, and neural activity.

- **Study Design**:
    - **Participants**: Specify the number of participants, inclusion/exclusion criteria, and demographic information.
    - **Procedures**: Detail the sequence of events in your study, including the behavioral tasks, gaze tracking setup, and fMRI scanning procedures.
    - **Materials**: List the equipment and software used, such as the eye tracker model and fMRI scanner specifications.
- **Analysis Plan**:
    - **Behavioral Data**: Outline the statistical methods for analyzing task performance metrics.
    - **Gaze Data**: Describe how gaze metrics (e.g., fixation duration, saccade patterns) will be quantified and analyzed.
    - **fMRI Data**: Provide details on preprocessing steps (e.g., motion correction, spatial normalization), statistical modeling approaches (e.g., GLM), and multiple comparison correction methods (e.g., FDR).
- **Expected Outcomes**: Predict the anticipated results and their implications for your hypotheses.

5. Preview and Submit Your Registration

- Review all entries for clarity and completeness.
- Submit your preregistration for review. Once approved, it will be publicly accessible, ensuring transparency in your research process.

How to preregister your study on **AsPredicted**

1. Create an AsPredicted Account

- Visit https://aspredicted.org/ and sign up for a free account.
- After registration, log in to access the platform's features.

2. Create a new registration

- Select a Template Type: The default is the Standard 9-Question Template (widely used and accepted), you can also choose a Custom Template (if you have a specific format in mind).

3. Complete the 9-question preregistration form

Here are the 9 standard questions and what they're asking for:

1. **What's the main question being asked or hypothesis being tested in this study?**
    - Clearly state your primary hypothesis or research question.
2. **Describe the key dependent variable(s).**
    - What outcome(s) are you measuring? Be specific.
3. **How many and which conditions will participants be assigned to?**
    - List your experimental or control conditions.
4. **Specify exactly which analyses you will conduct to examine the main question/hypothesis.**
    - Describe the statistical tests (e.g., ANOVA, regression, t-tests).
5. **Any secondary analyses?**
    - Optional: Describe exploratory or additional analyses, if any.
6. **What's your sample size, and how did you determine it?**
    - Provide a number and justification (e.g., power analysis, budget constraints).
7. **What is the actual data collection stopping rule?**
    - Define: when will you stop collecting data (e.g., fixed N, time limit, sequential analysis).

8. **Any data exclusions?**
    - Describe planned exclusion criteria (e.g., failed attention checks, incomplete responses).
9. **Any manipulations, randomizations, or counterbalancing?**
    - Outline how participants are assigned to conditions, and if anything is randomized.

4. **Once submitted, you cannot edit the preregistration**. Therefore, make sure everything is final and reviewed – then, once finished, click “Submit and Register”.