Scientific Values versus Scientific Practices

Core values of science are showing your work (transparency) and independent replication (reproducibility). However, scientists must publish, and publishing success is more likely with positive and tidy results, even at the expense of transparent, reproducible research. What is good for science and what is good for scientists are not always the same. This creates a conflict-of-interest that could result in researchers inadvertently lowering the reproducibility of observed results. Common reasoning biases may lead to selective reporting of analysis and evidence biasing published reports. For example, hindsight bias can lead researchers to recall the results of exploratory analysis as reflecting the original study purpose and thus misperceive the outcomes as resulting from a confirmatory test. The potential impact is a published literature that is more beautiful, and less reproducible, than reality.

What is Preregistration?

Preregistration distinguishes confirmatory (hypothesis testing) and exploratory (hypothesis generating) analyses. Confirmatory analyses are determined in advance; Exploratory analyses are responsive to the what is observed in the data. Confirmatory analyses maximize diagnostic value of statistical inferences; Exploratory analyses provide opportunity for discovery of unexpected outcomes. Both are important. However, the same data cannot be used to generate and test a hypothesis. With preregistration, confirmatory analyses are made explicit in advance to retain their diagnosticity and avoid memory and reasoning biases. Exploratory analyses are reported as post hoc investigations that can inspire confirmatory tests in future studies.

The Preregistration Challenge

Preregistration is an unfamiliar practice to many scientists. We will give 1,000 awards of $1,000 each to promote education and experience with preregistration. Award winners will have completed a preregistration using the Open Science Framework, a free scholarly commons, and published the results in an eligible journal. See https://cos.io/prereg for details.

Resources about Preregistration (additional materials can be found at OSF.io/x5w7h)

The extent of the problem
- Why Most Published Research Findings Are False (Ioannidis, 2005)
- Estimating the reproducibility of psychological science (Open Science Collaboration, 2015)
- Scientific Utopia: Restructuring Incentives and Practices to Promote Truth Over Publishability (Nosek, Spies, & Motyl 2015)
- False-Positive Psychology, Undisclosed Flexibility in Data Collection and Analysis Allows Presenting Anything as Significant (Simmons, Nelson, & Simonsohn, 2011)
- Believe it or not: how much can we rely on published data on potential drug targets? (Prinz, Schlange, & Asadullah, 2011)

How preregistration can help
- Likelihood of Null Effects of Large NHLBI Clinical Trials Has Increased over time (Kaplan & Irvin, 2015)
- Instead of "playing the game" it is time to change the rules: Registered Reports at AIMS Neuroscience and beyond (Chambers et al., 2014)
- Registered Reports, A Method to Increase the Credibility of Published Results (Nosek & Lakens, 2014)
- An Agenda for Purely Confirmatory Research (Wagenmakers et al., 2012)
- Drug development: Raise standards for preclinical cancer research (Begley & Ellis, 2012)

Other Resources
- Templates for a Preregistration "recipe" are available as a Google doc or Word doc.