Scientific transparency

P-hacking is the process of analyzing the data in variety of ways, until a significant result has been found, which then is reported. P-hacking increases the likelihood of false positives, and thus hinders scientific progress. The solution is to make an explicit distinction between confirmatory and exploratory analyses. There are two ways to do this: preregistration and cross validation.

By means of pre-registration, which has several advantages, we completely fixate the data-analytic plan before data have been gathered. Pre-registration is possible on various websites, for example on OSF, aspredicted.org, or our own ethics committee website. Some journals even offer the possibility to submit preregistrations for review. If you want to perform additional analyses, this is completely valid, as long as you explicitly state in your paper that theses analyses are exploratory instead of confirmatory. The importance of such exploratory analyses for generating new hypotheses cannot be overstressed.

Another approach to the relationship of confirmatory and exploratory analysis is cross-validation. In such an analysis the data is split in two parts (this can be either at the level of participants or trials). The first part of the data is used for abduction/exploratory analysis, that is finding the best explanation for the observed data (Lipton, 2003). Also, this data can also be used to optimize the pre-processing and processing steps often used in computational modelling and/or the analysis of EEG and fMRI data (by using k-fold crossvalidation). Next the developed hypothesis, with the selected processing pipe-line is tested, in a confirmatory way, on the second part of the data (Yarkoni & Westfall, 2017, Pereira et al., 2009). Compared to pre-registration it provides transparency to the individual researcher about the status of the exploratory research by adding a confirmatory step, at the cost of having to acquire more data.

Lipton, P. (2003). Inference to the best explanation. Routledge.

Pereira, F., Mitchell, T., & Botvinick, M. (2009). Machine learning classifiers and fMRI: a tutorial overview. Neuroimage, 45(1), S199-S209.

Yarkoni, T., & Westfall, J. (2017). Choosing prediction over explanation in psychology: Lessons from machine learning. Perspectives on Psychological Science, 12(6), 1100-1122.