

Higher criticism statistics for fMRI: a secondary analysis of NARPS team results

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Functional magnetic resonance imaging (fMRI) is a key research method in neurosensory science and human neuroscience in general. fMRI analyses often adopt mass-univariate approaches with relatively strict thresholding for multiple comparison correction. A recent study (NARPS) has demonstrated how analytical variability can limit the reliability of results from such fMRI analyses. Here we present a re-analysis of publicly available group-level intermediate results from the NARPS study using an alternative statistical approach, higher criticism (HC): HC tests a global hypothesis that at least rare or weak effects are present within a large number of primary statistical tests by quantitatively assessing an excess of low p-values. Purpose of this analysis was to assess whether HC-based global hypothesis testing for rare/weak effects based on result maps from different NARPS teams reduces the variability of results compared with the originally reported analyses. HC-based analyses revealed at least rare or weak effects within NARPS regions of interest despite negative or ambiguous findings in the mass-univariate analyses originally reported. It thus reduced variability of conclusions in a subset of NARPS hypotheses. HC could, however, not generally solve the problem with heterogeneous results across NARPS teams. It rather shifted ambiguity of results towards hypotheses with negative results in the original analyses. The HC-based approach assessed here is a potential supplementary fMRI analysis method. While the dataset underlying the reanalyzed aggregate NARPS results is not directly related to neurosensory science, the insights appear applicable to other fields of human neuroscience including neurosensory science.