joinmeta - controlling the type-1 error in multiverse meta-analysis

Filippo Gambarota [1]

@fgambarota

filippo.gambarota@unipd.it

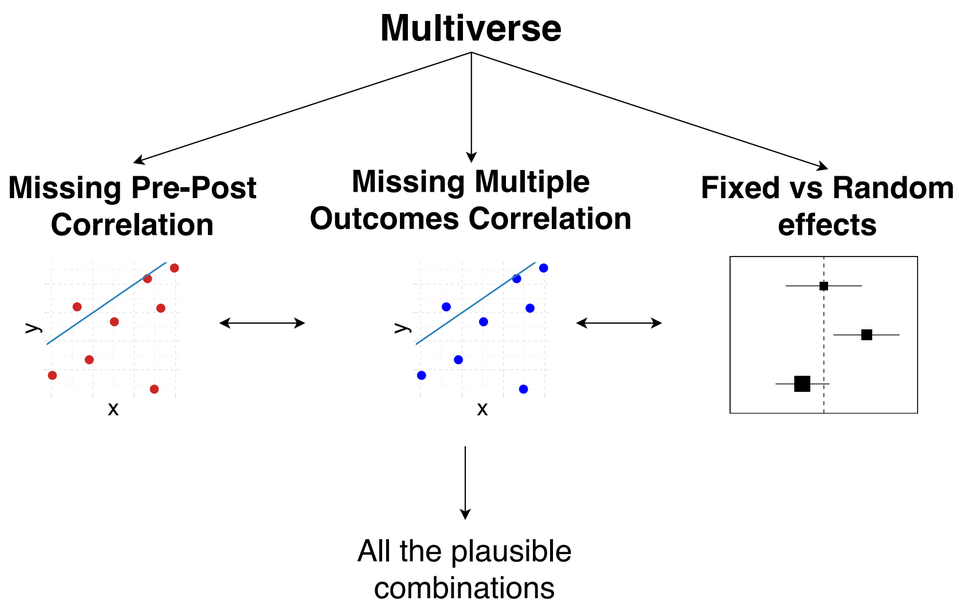
Anna Vesely[2] **Livio Finos**[3] **Gianmarco Altoè**[1]

[1] *Department of Developmental and Social Psychology, University of Padova*

[2] *Institute for Statistics, University of Bremen*

[3] *Department of Statistics, University of Padova*

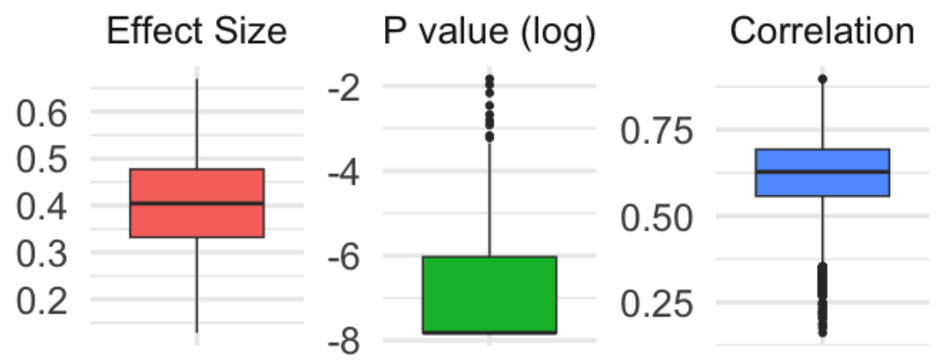
The Multiverse problem

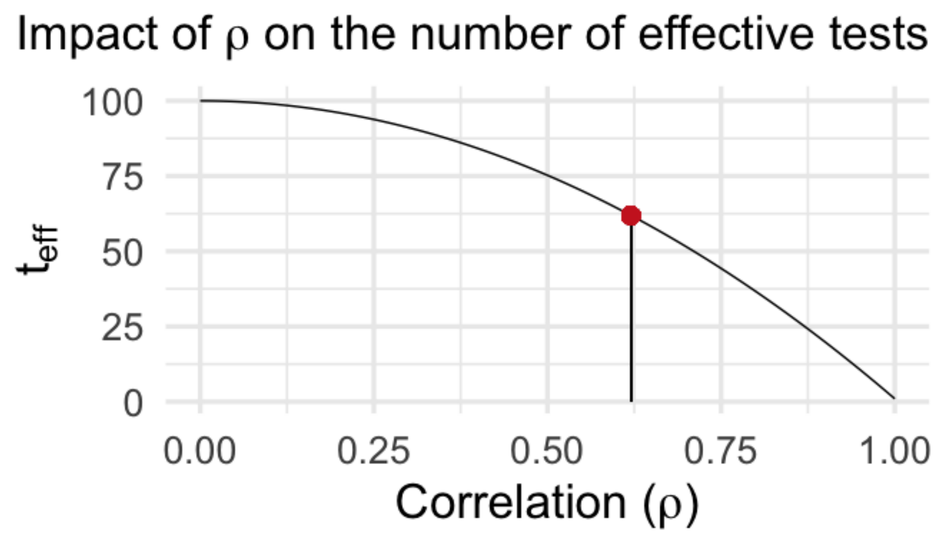


As example, we used the dataset by Daros et al. (2021) with a multivariate meta-analysis of RCTs designs with multiple measure for the same outcome. **We considered a total of 162 plausible scenarios**.

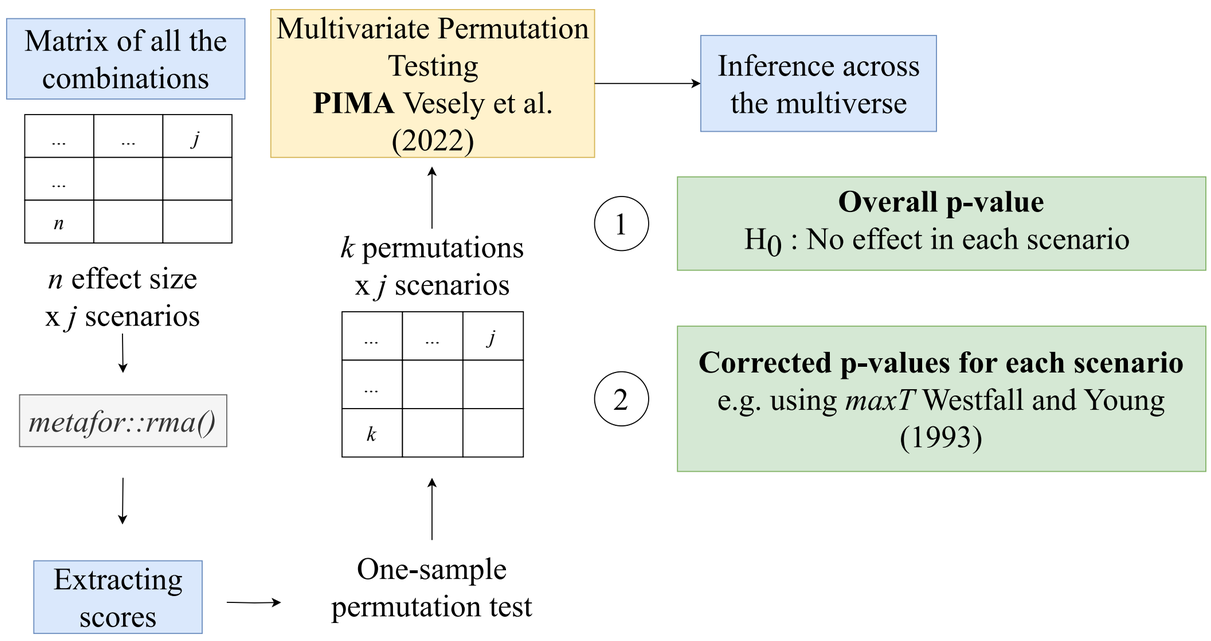
Multiverse Summary

The multiverse is a associated with an **overall p-value** < 0.001, an **average effect of** 0.403 **(**$SD = 0.112$**)** and an **average correlation of** 0.620 **(**$SD = 0.102$**)**.





The Proposed Workflow

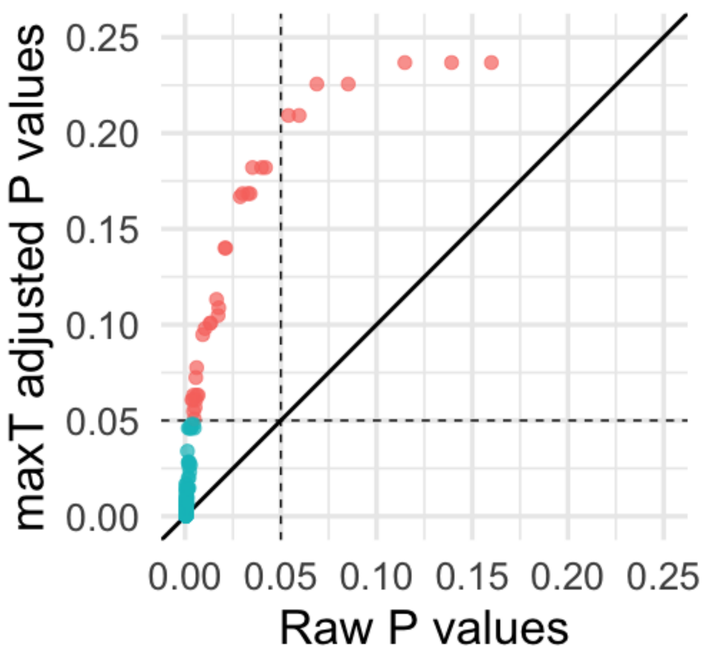


$$z_i = \frac{d_i}{\sqrt{\sigma_i^2 + \tau^2}}$$

flip::flip()

We **simulated a plausible multiverse** sampling from a multivariate normal distribution with a vector of means (i.e., the meta-analysis results) and a variance-covariance matrix for the relationship between different scenarios.

Multiverse post-hoc p-values



Conclusions and Next Steps

- **Corrected p-values for valid post-hoc inference** on specific scenarios
- The method **control the Family-wise Error Rate (FWER)** across the multiverse
- **Fast meta-analysis via permutations** using the `flip` package
- Implementing multilevel and multivariate meta-analysis