

Overview

If you have purchased a subscription to *PRIMER 8 with PERMANOVA+*, then you will have access to the **PERMANOVA+** main menu item that allows you to perform a broad range of additional analyses using a suite of routines that are not available in the basic *PRIMER 8 Lite* package. Check out our website to see a [Detailed list of all features](#).

Note also that the **PERMANOVA** routine has been expanded substantially in the leap from PRIMER 7 to PRIMER 8. For a more complete guide to all of these important improvements, please see the essential resource: '[What's new in PRIMER 8](#)'. You can also consult the historical **PERMANOVA+ user manual** for fundamental information and references regarding some of these routines and their underlying statistical details.

Here, we will run through a quick example of how to set up and run a multi-factor PERMANOVA analysis in PRIMER 8. **Permutational multivariate analysis of variance** (PERMANOVA) partitions variation in the space of a chosen dissimilarity measure in response to one or more factors in a specified sampling protocol or experimental design ([Anderson \(2001a\)](#) , [Anderson \(2017\)](#)). Tests of individual terms in a PERMANOVA model are achieved by constructing correct (pseudo-)F ratios on the basis of expectations of mean squares (EMS), and p-values are obtained using correct permutation algorithms given the full study design. *We know of no other software package that accomplishes this.*

Importantly, the PERMANOVA routine in PRIMER allows the user:

- to specify whether factors are **fixed, random, finite**, or of a type called '**whole-plot/subject**' that caters to designs lacking replication at different scales,
- to account for **heterogeneity** in multivariate dispersions when testing for differences in centroids,
- to specify whether a factor is **nested** in one or more other factors,
- to test **interaction terms**,
- to include one or more quantitative **covariates** in the analysis,
- to **group covariates** (accommodating cyclical/seasonal models),
- to **re-order, pool** or **remove** individual terms from a model,
- to handle correctly:
 - **mixed models**
 - user-specified **contrasts**
 - **BACI designs** (before-after/control-impact),
 - **asymmetrical designs** (e.g., in environmental impact studies),
 - **randomised blocks**,
 - **split plots** and **split-split-plots**,
 - **hierarchical designs**,
 - **repeated measures**,
 - **unbalanced designs** (Type I, II or III sums of squares),
 - ... and more.

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