## **Permutation Tests in Multidimensional Scaling**

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The **smacof** package [3] implements various methods of multidimensional scaling (MDS) such as metric and nonmetric MDS, spherical MDS, individual difference scaling, and unfolding for preference data [1]. MDS is a family of methods that optimally map proximity data of objects into distances between points of a multidimensional space with a given dimensionality (usually 2 or 3 dimensions). In **smacof** we use a majorization approach that minimizes the "Stress" target function.

MDS has been used heavily to model and to explore (dis)similarity data in psychology, the social sciences, and in market research. The Stress value of a p-dimensional MDS solution with n points is usually evaluated by going to tables listing the expected Stress of the "nullest of all null models" [2], i.e. the Stress value of random data for the (p,n) case. In this talk we present clearly sharper tests based on the Stress distribution that results from (matrix- or row-wise) randomly permuted dissimilarity data.

## References

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