E1-27: On the analysis of non-replicated three-way data

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The analysis of 3-way data is not straight forward when there is no replication. For convenience many researchers assume that the 3-factor interaction is absent in 3-way data and use this component to test for main effect and 2-factor interactions. This approach fails in the presence of real 3-factor interaction. With the availability of modern computer facilities, methods have emerged to separate out 3-factor interaction, if it exists, from experimental error. One such method is to first fit the usual fixed effects model without 3-factor interaction to 3-way data and then decompose the resulting 3-dimensional residual array using an extended form of the Singular Value Decomposition. Under certain situations 3-factor interaction, if it exists, can be represented by a single multiplicative term. The work discussed is based on this assumption. Often 3-factor interaction, if it exists, is caused by a few cells of 3-way data. A recently developed statistical test identifies sub-areas that are free of this interaction thus making the analysis straight forward.

In this work a computer intensive procedure is provided to obtain critical points for a wide range of values for the above test thus making it more flexible as critical points are available in tabular form only for selected cases at present. The procedure basically involves computing the traces and the largest eigen values of suitably formed normal matrices, simulating 1000 values of the test statistic in each case, and finally computing critical points for various significant levels through evaluating an incomplete beta integral. The procedure used FORTRAN 77 and can be run even on a 486 machine with 4MB memory as minimum resources.