

Tests of Additivity in Mixed and Fixed Effects Two-way ANOVA Models with Single Subclass Numbers

Dieter Rasch, Petr Šimeček, Marie Šimečková, Thomas Rusch and Klaus Kubinger

Summary

1.1 In **variety testing** usually a relative large number v (30 or more) of varieties has to be tested in b blocks with relative small number k of blocks. If $v=k$ a complete block design is used but usually with just one observation for each variety \times block combination.

Varieties can be considered as the levels of a fixed factor whereas the blocks are usually considered as randomly selected levels from a population of possible blocks.

1.2 In **psychological tests** usually a relative large number v (50 or more) of items has to be tested at b (100 or more) individuals (tестees). As the result we have just one observation for each item \times testee combination namely "correct = 1" or "wrong = 0".

Items can be considered as the levels of a fixed factor whereas the testees are usually considered as randomly selected from a population of possible testees.

Analysis in both cases is done under the assumption of missing interactions. Tests for this are known for the case of two fixed factors only. First results of some tests developed by the authors in the mixed model situation are presented.

References

Alin, A. and Kurt, S. (2006), Testing non-additivity (interaction) in two-way ANOVA tables with no replication, *Stat. Meth. in Med. Res.* **15**, 63-85

Boik, R.J. (1993a). Testing additivity in two-way classifications with no replications: the locally best invariant test, *Journal of Applied Statistics* **20**, 41–55.

Boik, R.J. (1993b). A comparison of three invariant tests of additivity in two-way classifications with no replications, *Computational Statistics and Data Analysis* **15**, 411–424.

Corsten, L.C.A. and C.A. van Eijnsbergen (1972, 1974) Multiplicative effects in two-way analysis of variance, *Statistica Neerlandica* 26, 61-68, addendum 27, 51

Ghosh, M.N. and Sharma, D. (1963), Power of Tukey's Test for Non-Additivity; *Jour. Roy. Stat. Soc. , Ser., B*, **25**, 213-219

Harter, H.L. & Lum, M.D. (1962). An interpretation and extension of Tukey's one-degree of freedom for nonadditivity, *Aeronautical Research Laboratory Technical Report, ARL*, pp. 62–313.

Johnson, D.E. & Graybill, F.A. (1972). An analysis of a two-way model with interaction and no replication, *Journal of the American Statistical Association* **67**, 862–868.

Mandel, J. (1961). Non-additivity in two-way analysis of variance, *Journal of the American Statistical Association* **56**, 878–888.

Rasch, D. (1995), *Mathematische Statistik*. Johann Ambrosius Barth, Heidelberg – Leipzig und Wiley, Berlin (851 p.).

Rasch, D., Kubinger, K.D. and Rusch, Th. (2007), *Sample Size Determination for Testing the Rasch Model in preparation*

Schabenberger, O. (1997), *Tukes's Test for Non-Additivity in Randomized Block Designs*

Tukey, J.W. (1949). One degree of freedom for nonadditivity, *Biometrics* **5**, 232–242.