A clarification of type III hypotheses in multi-factor models

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Abstract

Type III hypotheses on effects in multi-factor models are routinely tested in statistical computing packages. They are controversial in unbalanced settings. Milliken and Johnson (1984, p. 185) say, "we think that the Type III hypotheses are the worst hypotheses to consider in this situation because there seems to be no reasonable way to interpret them." A precise, mathematically explicit, general description of Type III hypotheses does not seem to be available. Instead there are murky verbal descriptions and worked-out examples. They are defined, by default, by the programs employed in statistical computing packages. Much of their appeal is their connection with definitions of effects in terms of contrasts on marginal means.

In this paper, Type III hypotheses are described in general in terms of explicitly-defined linear subspaces. A general formulation is presented for multi-factor models in terms of sets of contrasts on marginal means. The connection between hypotheses on effects in terms of marginal means, on the one hand, and Type III hypotheses, on the other, is described. In particular, it is shown that the Type III hypothesis on an effect includes all estimable marginal means hypotheses on that effect.

Keywords

ANOVA tests, Missing cells, Cell means models.

References

Milliken, G.A. and D.E. Johnson (1984). *Analysis of Messy Data, Volume I: Designed Experiments*. New York: Van Nostrand Reinhold Company.