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## Comment on article of Vidotto and Vicentini

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The *R*-average program of Vidotto and Vicentini (2007) promises good usefulness in applications of the averaging law of Information Integration Theory.

The averaging law is fundamental in human cognition, as shown by many contributors to this Padova Symposium. Unequal weighting, however, introduces multiple statistical difficulties, extensively considered in the eight-year studies of the AVERAGE program of Zalinski and Anderson (1991; page references below refer to this chapter). The *R*-average program promises valuable help with these difficulties.

One difficulty is that individual differences in group data cause bias in estimates of the weight and value parameters. A second difficulty is that the nonlinearity of the model produces intercorrelations among model predictions, as well as among parameter estimates, that violate statistical assumption of independence, vital for statistical analysis.

Both difficulties were resolved with the *replications method* of AVERAGE (pp. 357, 367, 387). The model is fitted separately to each separate replication for a single subject (or to each separate subject of a group). Repeated measurements analysis of variance is then valid and resolves both difficulties (p. 357).

This approach makes possible valid tests of goodness of fit – that is, of *deviations* between data and model predictions. This corrects the common but invalid reliance on “weak inference” (p. 357), as with residual sum of squares. Also, valid confidence intervals for parameter estimates can be had (pp. 360, 380).

A third difficulty concerned occasional nonconvergence in then-available programs for numerical analysis of nonlinear models. This problem was resolved with a *bounding method*: prior knowledge is used to set bounds on each weight and value parameter (pp. 352, 359ff, 385). Vidotto and Vincentini seem to have invoked a better program for numerical analysis to use with the bounding method.

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Other features of AVERAGE also deserve further study. First, incomplete designs (using the “delete” option) can be notably efficient (p. 375). Also, they can reduce large designs to practicable size.

Second, some parameters can be required to be equal (using the “identify” option). Equal weighting could thus be allowed for one variable, unequal weighting for another. Nearly equal weights within a given variable could also be set equal, increasing reliability (p. 373) of the estimates at the cost of minor bias.

Third, the replications method may allow notably more effective use of multiple replications (p. 367, 387). If this preliminary result can be solidified, the advantage claimed by Vidotto and Vicentini of analyzing multiple replications all at once may be a disadvantage.

Fourth, the “initial state” influences every response, causing complications not yet under good control (pp. 360, 377). Fifth, width and asymmetry of bounds also need further study (pp. 365, 386).

## References

- Vidotto, G., & Vicentini, M. (2007). A general method for parameter estimation of averaging models. *Teori & Modelli*, *12*(1-2), 211-221.
- Zalinski, J., & Anderson, N. H. (1991). Parameter estimation for averaging theory. In N. H. Anderson (Ed.), *Contributions to information integration theory. Vol. 1: Cognition* (pp. 353-394). Hillsdale, NJ: Erlbaum.

## Abstract

The *R*-average program of Vidotto and Vicentini (2007) promises valuable improvements on the AVERAGE program of Zalinski and Anderson (1991) for applying the averaging law with unequal weights. Several features of AVERAGE are noted that deserve further study. Their work promises important advances on these and other issues.

## Riassunto

Il programma *R*-average di Vidotto e Vicentini (2007) promette miglioramenti preziosi del programma AVERAGE di Zalinski e Anderson (1991) per l'applicazione

della legge della media con pesi ineguali. Vengono rilevate diverse caratteristiche di AVERAGE che meritano studio ulteriore. Il loro lavoro promette progressi importanti riguardo a queste e altre questioni.

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