

Psychometric modeling of response speed and accuracy with mixed and conditional regression.

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Abstract

Mixed (or multilevel) regression is proposed for psychometric modeling of both response speed and accuracy in cognitive testing and experiments. Mixed logistic regression of binary responses extends logistic IRT modeling to multidimensional models with covariates and interactions. Mixed linear regression of response time (RT) extends mixed ANOVA to unbalanced designs with covariates and heteroscedasticity. Conditional regression requires no normality assumption, but is limited to unidimensional models. All methods are applied to an experimental study of mental rotation. Univariate and bivariate analyses show how within-person correlation between response and RT can be distinguished from between-person correlation, and how latent traits can be detected, given careful item design or content analysis. With simple equations it is shown that estimating person and item effects from responses obtained under time pressure while ignoring RTs, can be very misleading. It is concluded that both response and RT must be recorded in cognitive testing, and that mixed or multilevel regression is a versatile method for analyzing such test data.

References

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