Factor Analysis under multimodal latent distributions: A simulation study

Friday 25 July 2025 08:30 (15 minutes)

Keywords

simulation; factor-analysis; multimodal-latent-variables; finite-mixture-models

Affiliation

1 Faculty of Psychology, Universitat de Illes Balears, Spain. 2 Faculty of Psychology, Universidad Complutense de Madrid, Spain. 3 Faculty of Psychology and Speech Therapy, Universitat de València, Spain.

Abstract

Conceptual framework: Factor analysis is one of the most popular techniques to estimate latent variables in social sciences, both in their exploratory and confirmatory branches. Among others, the factor model assumes that latent variables are unimodal and normally distributed. This assumption can be challenging when working with several populations and cultural groups due to potential multimodal distributions, which impedes fairness and generalizability of research findings.

Objectives: To investigate the impact of multimodal latent variables on factor analyses, specifically examining the potential bias in parameter estimation.

Methodology: This simulation study approaches this question by applying exploratory and confirmatory factor analyses with multimodal latent distributions. More concretely, we created several latent variables sorted in the severity of their multimodality, both in the number of modes to their distance between them.

Results: As multimodality increases, factor weights exhibit a heightened bias towards positive values, which may be an aberrant cue for researchers. Fit indices and parallel analyses showed also biases with specific patterns as multimodality gets more pronounced. Only factor scores showed up as reliable descriptors of the latent multimodality.

Implications: Latent multimodal distributions can be a relevant challenge in latent variable models, which underscore the importance of careful consideration and interpretation by researchers. We suggest more research on factor scores as potential reliable indicators of multimodal latent variables, while also the limitations and applications of these findings.

Oral presentation

Factor Analysis under multimodal latent distributions: A simulation study

Author

Guido Corradi1, Oscar Lecuona2, Víctor Ciudad3, and Jesús Alvarado2

Primary author: Dr CORRADI, Guido (Universitat de Illes Balears)

Co-authors: Dr LECUONA, Oscar (Complutense University of Madrid); Mr CIUDAD, Víctor (Universitat de València); Prof. ALVARADO, Jesús (Complutense University of Madrid)

Presenter: Dr CORRADI, Guido (Universitat de Illes Balears)

Session Classification: Session 18 : "Latent factors and errors in psychometric measurement"

Track Classification: Measurement: Measurement