

estimation. An empirical application is also provided to demonstrate the application of the proposed approach for multidimensional scales, in which we calculated the within- and between-person reliabilities for both items and subscales of a short version of the Perceived Stress Scale. Results showed that although the inter-individual reliabilities of items and subscales were high (> 0.7), there were large inter-individual differences in the intra-individual reliabilities of items and subscales. In other words, for a subset of the participants, the instrument could not reliably measure the intraindividual fluctuations in their states over time.

Keywords: within-person reliability, between-person reliability, intensive longitudinal data, two-level random dynamic measurement model, interindividual differences

错误设定与过度参数化：往复影响模型中的模型选择

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摘要 往复影响模型(reciprocal effect model)是检验不同潜在心理构念之间纵向关系的常用模型。该系列模型在结构方程模型的框架下能灵活地抽取纵向设计中的不同成分, 包括但不限于交叉滞后面板模型(CLPM)、特质-状态-误差模型(TSE)、自回归潜增长模型(ALT)等。由于简单模型在统计上嵌套在复杂模型中, 模型设定错误(misspecification, 例如, 使用错误模型或获得不适当的解)和过度参数化(over-parameterization, 例如, 所选择模型拟合良好但参数估计不合适的复杂模型)困扰着没有明确理论依据的实证研究者。此外, 近年来不少学者基于研究需要在纵向模型的构建过程中拓展出多指标模型, 丰富了纵向模型的使用情境。研究旨在基于多指标视角探究纵向模型之间的模型选择, 并为实证研究者提供切实的建议。采用模拟研究和实证研究以考察在拟合不同复杂程度数据集时, 交叉滞后和自回归参数估计的表现。模拟研究探讨了模型复杂程度、时间点和因子载荷对不同模型拟合表现的影响, 共设置 3 (真模型) \times 3 (测量时间点) \times 3 (因子载荷) = 27 个模拟条件。实证研究则基于美国青年纵向研究(Longitudinal Study of American Youth, LSAY)数据库进行。研究结果发现: (1) 不管在何真实数据的情况下, TSE 模型总体优于 CLPM 和 ALT; (2) 随着因子载荷和测量时间点的增加, 模型参数估计精度得到提升; (3) 单指标模型与多指标模型的参数估计结果比较接近。在研究者不确定数据的真实结构如何时, TSE 是更为合适的选择。该模型具有相对精确的估计结果, 并且足以检验个体间和个体内成分。此外, 通过增加时间点和因子载荷在一定程度上能够提升参数估计的精度。如果只有部分测量指标满足强载荷要求, 确保测量指标中至少有一个或两个具有代表性的测量指标对提升估计精度有所帮助。

关键词 往复影响, 交叉滞后模型, 特质-状态-误差模型, 自回归潜增长模型

Misspecification and Over-parameterization: Model Selection in Reciprocal Effect Models

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Abstract: Reciprocal effect models are popular to examine the longitudinal relationships between different latent psychological constructs. The series of models includes but is not limited to Cross-lagged Panel Model (CLPM), Trait-State-Error Model (TSE), Autoregressive Latent Trajectory Model (LV-ALT), etc. Since the simple models are statistically nested in the complex ones, model misspecification (e.g., using the wrong model or obtaining inappropriate solutions) and over-parameterization (e.g., selecting the complex model good in model fit but inappropriate in parameter estimation) confused empirical researchers without clear theoretical basis. Moreover, many researchers have added multiple indicators to longitudinal models in their empirical research and enriched the family of longitudinal models in recent years. In the present study, we aim to provide instructions for model selection between these longitudinal models based on the multiple-indicator perspective. The study performs a simulation study and empirical study to investigate the performance of the nested models with single and multiple indicators when fitting datasets with different levels of complexity. The simulation study set 3 (true data generating models) \times 3 (measurement waves) \times 3 (factor loading) = 27 simulation conditions. And the empirical study is based on the database - Longitudinal Study of American Youth (LSAY). Results indicate that (1) TSE family generally outperforms CLPM and ALT families; (2) The estimated accuracy improves as the factor loadings and measurement waves increase; (3) Single-indicator models had close estimates of parameter to the multiple-indicator ones. Irrespective of the datasets, the TSE seems to be the first choice for researchers to use. It has precise estimates and is powerful enough to detect between- and within-person components. In addition, increasing time points and factor loadings can improve the estimated accuracy of the fitted model to some extent. If not all the items have high factor loadings, ensure that there are at least one or two representative items among the indicators.

Keywords: reciprocal effect, cross-lagged panel model (CLPM), trait-state-error model (TSE), autoregressive latent trajectory model (ALT)

时间序列中早期预警信号的阈值探索——基于变点自回归模型

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摘要 精神疾病(如焦虑症等)可被视作复杂动力系统的不健康状态。基于临界减速理论的早期预警信号有助于预测从健康到精神疾病的转变,并及时实施干预。预警信号在时间序列上通常表现为自回归的突然增加,然而其阈值目前尚没有统一标准,为实际应用带来了困难。变点自回归模型(Change Point Autocorrelation Model, CPAM)通常用于识别心理状态转变的临界点。一般来说,预警信号后会紧接发生状态的转变。因此,本研究提出了一种基于CPAM确定预警信号阈值的方法。该方法主要包括三个步骤:第一,对自回归系数定义系列备选阈值(如 $1\sigma, 1.5\sigma, 2\sigma, \dots$ 等, σ 表示所有滑动窗口自相关的标准差);第二,