Panel Discussion: Increasing our Analytic Sophistication
Person-Centered Analyses
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2017 Conference on Commitment

Latent Profile Analysis

The latent variable is categorical

\[
\sigma_y^2 = \sum_{k=1}^{K} \pi_k (\mu_{yk} - \mu_y)^2 + \sum_{k=1}^{K} \pi_k \sigma_{yk}^2
\]
Focus: Mixture Modeling / Generalized Structural Equation Modeling.


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\]

BUT

Factor mixture analysis.

**Model 1**

*Model 1*: Classical latent profile analysis.
Results from the latent profiles models based on 9 factors (Model 1)

Model 3: **Factor mixture analysis** with a class invariant higher order latent factor.
Results from the factor mixture models based on 9 factors (Model 3)

BUT

The Factor Mixture approach also assumes that the mean level on the global factor is equal across all profiles, and corresponds to the sample average.
Scale Scores?

• What about measurement errors???
• Why not use factor scores:
  o Provide a partial control for measurement error
  o Forces you to demonstrate that the measurement model fits the data well.
  o Preserves the nature of the measurement model: invariance, cross loadings, method factors, etc.
  o Naturally standardized.

The World Health Organization (2014) defines psychological health as a state characterized not only by the absence of psychological distress, but also by the presence of psychological wellbeing.

**Latent Profile Model**
PURE LEVEL
Argues for a single dimension, and for the idea that wellbeing and distress are opposite ends of the same continuum.

**Factor Mixture Model**
Latent Profile Model (Bifactor)

G-Factor
BHAR
BSER
BIMP
DIRR
DANX
DDES

Class 1
Class 2
Class 3
Class 4
Class 5

Harmoniously Distanced (12%)
Normative (61%)
Stressfully Involved (14%)
Flourishing (1.38%)
Adapted (11%)

Factor Mixture Models

Can be used as a multiple-group CFA model to test for the invariance of a measure across unobserved subgroups of participants

Can be used as an overarching framework to explore the “true” underlying nature of psychological constructs as continuous, ordinal, nominal, etc.
Mixture regression analysis (MRA) identifies profiles of participants differing from one another at the level of estimated relations (regressions) between constructs.

\[ Y = a_{yx} + b_{yx} \ast X + \delta \]


Gillet, N., Morin, A.J.S., Sandrin, E., & Houle, S.A. Upcoming!
### Profile 1 - Profile 2 - Profile 3

<table>
<thead>
<tr>
<th></th>
<th>Profile 1</th>
<th>Profile 2</th>
<th>Profile 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engagement $\rightarrow$ Work-Family Conflicts</td>
<td>.041 (.086)</td>
<td>.004 (.241)</td>
<td>-.015 (.171)</td>
</tr>
<tr>
<td>Engagement $\rightarrow$ Sleeping Difficulties</td>
<td>.023 (.095)</td>
<td>.155 (.154)</td>
<td>.417 (.316)</td>
</tr>
<tr>
<td>Workaholism $\rightarrow$ Work-Family Conflicts</td>
<td>.550 (.059)**</td>
<td>.440 (.153)*</td>
<td>.582 (.097)**</td>
</tr>
<tr>
<td>Workaholism $\rightarrow$ Sleeping Difficulties</td>
<td>.244 (.121)*</td>
<td>.287 (.171)</td>
<td>-.293 (.257)</td>
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Construct Validation

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  o Heuristic Value
  o Theoretical Conformity and Value
  o Statistical adequacy

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  o Statistical adequacy
  o Shows meaningful and well-differentiated relations to key covariates:
    • Predictors
    • Correlates
    • Outcomes.
Predictors and Outcomes

Multinomial logistic regression

Indicator

This is a key advantage of mixture models, relative to cluster analyses.

But these should not change the nature of the profiles.

Always conduct the class enumeration process before adding covariates (Diallo et al., 2016).

Solution 1. Use the start values from the retained solution and turn off the random start function.
Predictors and Outcomes

Solution 2: Auxiliary functions:

- (E) For simple correlates
- (DCON) (DCAT) for outcomes
- (R3STEP) for predictors
- (DU3STEP) (DE3STEP) for continuous outcomes
- (BCH) for continuous outcomes

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- Theoretical Conformity and Value
- Statistical adequacy
- Shows meaningful and well-differentiated relations to key covariates: Predictors – Correlates – Outcomes.
- Generalizes across samples and time points.
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Testing the Generalizability of LPA Solutions:

Latent Transition Analysis


For applications, see:


http://smslabstats.weebly.com/uploads/1/0/0/6/100647486/ltasdistributional_similarity_v02.pdf
Latent Transition Analysis

• Latent transition analyses (LTA) are a very broad class of models that can be used to assess the connections between any number of latent categorical variables.
• Due to modern computer limitations, these models are typically limited to 3, sometimes 4, latent categorical variables.
• These models can be used to assess the connections between any type of latent categorical variable (LPA, MRA, growth mixtures) based on the same, or different, sets of indicators assessed at different, or similar, time points.
• The typical application of LTA is longitudinal, and assess the connection between two LPA models based on the same set of indicators measured at different time points.
• LTA can thus be used to assess the similarity of LPA solutions over time.

Growth Mixture Analyses

GMA/GMM
Individual trajectories

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**Latent curve models** allow one to synthesize individual trajectories with few latent parameters through a restricted factor model.

Random: Each individual has its own trajectory (intercept and slope variance). Model-based time-structured (trait) variability.

Residuals: Few persons follow a perfectly linear (curvilinear, etc.) trajectory. Residual state-like variability.

~ 1000 Montreal adolescents measured 5 times over a 4 year period.

**GMA Vs LCGA**

- **LCGA** (no inter-individual variability)
- **GMA** (class specific variability that can either be invariant or freely estimated)
Results: LCGA

Results: GMA, Mplus default
Results: GMA, free estimation

A simulation study


• In a series of 4 studies, we contrasted population models corresponding to the LCGA, Mplus default, or distinct latent variance-covariance matrices, while also considering presence of class-invariant or distinct residual structures.

• Overall, our results clearly show the advantages of relying on freely estimated latent variance-covariance and residual structures in each latent classes.
But this also depends on sample size and convergence

\[ N = 72 \]


741 non-smoking adolescents. Official GPA ratings obtained 8 times (beginning and end of school years).

And what about \( \varepsilon_{yikt} \)?
Organizational Research Methods: Special Issue on Person-Centered Analyses

- Confirmatory LPA
- Multilevel LPA
- Extended Capabilities through Manual Auxiliary Approaches (mediation, moderation, etc.).
- K-Centres functional clustering for longitudinal data
- Among others