Intraindividual Networks Using Autoregressive Models: Two Caveats

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Intraindividual Networks?

- Investigate how psychological variables affect themselves, and each other over time
- These relationships are likely to differ from person to person
- Networks for tailored to individuals, based on many repeated measurements
Intraindividual Networks?

C=Cheerful; E=Event; W=Worried; F=Fear; S=Sad; R=Relaxed.

Image borrowed from dr. Laura Bringmann
Bivariate autoregressive model

\[ y_{it} = \mu_i + \tilde{y}_{it} \]
Bivariate autoregressive model

\[ y_{it} = \mu_i + \tilde{y}_{it} \]
\[ \tilde{y}_{it} = \Phi_i \tilde{y}_{it-1} + \epsilon_{it} \]
\[ \epsilon_{it} \sim \text{MvN}(0, \Sigma) \]
Bivariate autoregressive model

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Bivariate multilevel autoregressive model

\[ y_{it} = \mu_i + \tilde{y}_{it} \]
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\[ \epsilon_{it} \sim \text{MvN} (0, \Sigma) \]
\[ \mu_i, \Phi_i \sim \text{MvN} (\gamma, \Psi) \]
Bivariate multilevel autoregressive model

$y_{it} = \mu_i + \tilde{y}_{it}$

$\tilde{y}_{it} = \Phi_i \tilde{y}_{it-1} + \epsilon_{it}$

$\epsilon_{it} \sim \text{MvN}(0, \Sigma)$

$\mu_i, \Phi_i \sim \text{MvN}(\gamma, \Psi)$

Implemented in Mplus v8!
Caveat 1: Comparing cross-lagged effects & standardization

Standardization

- Important for directly comparing the strength of the cross-lagged coefficients
- Important for both n=1 and multilevel VAR models
Why standardized coefficients

Unstandardized coefficients are sensitive to the measurement unit
Why standardized coefficients

Unstandardized coefficients are sensitive to the measurement unit (variable 1 multiplied by 2)
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Multilevel Standardization???

\[ \beta = b \frac{\sigma_x}{\sigma_y} \]

Can be complex (and tedious) to do (details in Schuurman, Ferrer, de Boer-Sonnenschein & Hamaker; 2016)
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Implemented in Mplus v8!
Caveat 2: Measurement error

\[ y_{it} = \mu_i + \tilde{y}_{it} \]
\[ \tilde{y}_{it} = \Phi_i \tilde{y}_{it-1} + \epsilon_{it} \]
\[ \epsilon_{it} \sim \text{MvN} (0, \Sigma) \]
\[ \mu_i, \Phi_i \sim \text{MvN} (\gamma, \Psi) \]
Caveat 2: Measurement error

\[ y_{it} = \mu_i + \tilde{y}_{it} + \nu_{it} \]
\[ \tilde{y}_{it} = \Phi_i \tilde{y}_{it-1} + \epsilon_{it} \]
\[ \nu_{it} \sim \text{MvN} \left( 0, \Omega \right) \]
\[ \epsilon_{it} \sim \text{MvN} \left( 0, \Sigma \right) \]
\[ \mu_i, \Phi_i \sim \text{MvN} \left( \gamma, \Psi \right) \]
Caveat 2: Measurement error

\[ y_{it} = \mu_i + \tilde{y}_{it} + \upsilon_{it} \]
\[ \tilde{y}_{it} = \Phi_i \tilde{y}_{it-1} + \epsilon_{it} \]
\[ \upsilon_{it} \sim \mathcal{MvN}(0, \Omega) \]
\[ \epsilon_{it} \sim \mathcal{MvN}(0, \Sigma) \]
\[ \mu_i, \Phi_i \sim \mathcal{MvN}(\gamma, \Psi) \]

Implemented in Mplus v8!
Other important ‘caveats’ and areas of development

- (Non)Stationarity
- (Dealing with/Consequences of) Unequally spaced measurements (Ad hoc solution implemented in MPlus v8)
- Differential Equation/Continuous Time Modeling
- Within/Between Unit Causality
- Variable selection/model selection
- Modeling processes on that take place at different time scales

- Theory!
Refs


Disregarding Measurement Error…
Disregarding Measurement Error...

C. True model

C. VAR(1) model
Disregarding Measurement Error...