

# Intraindividual Networks Using Autoregressive Models: Two Caveats

Noémi K. Schuurman

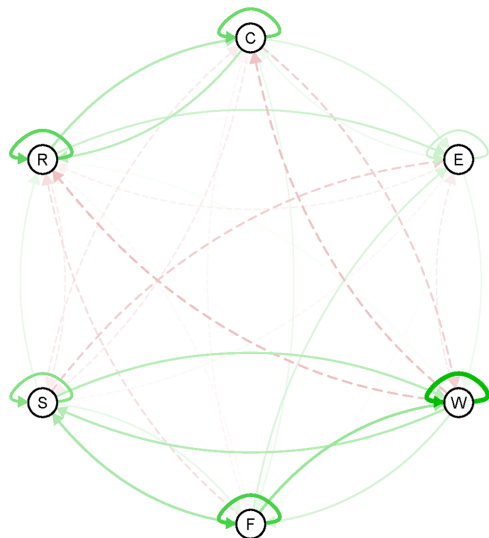
Utrecht University

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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

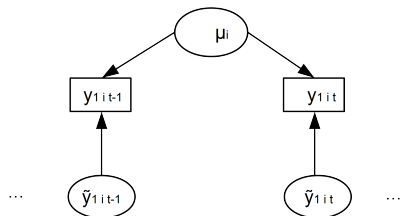
# Intraindividual Networks?



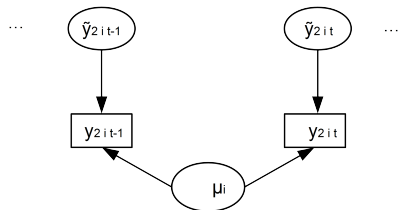
C=Cheerful; E=Event; W=Worried; F=Fear; S=Sad; R=Relaxed.

Image borrowed from dr. Laura Bringmann

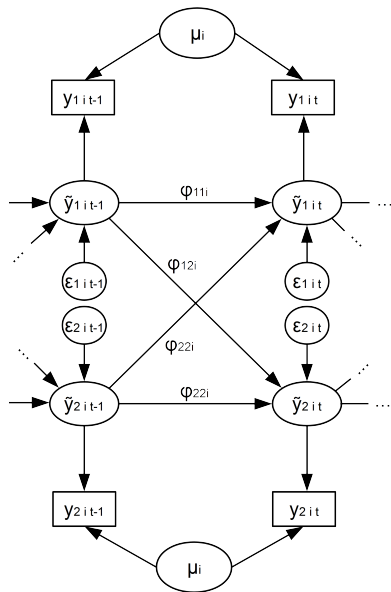
# Bivariate autoregressive model



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



# Bivariate autoregressive model

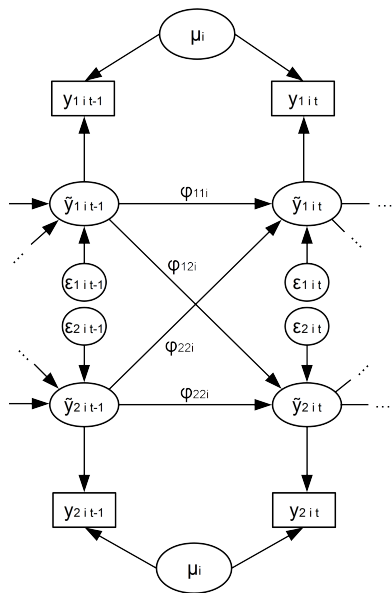


$$y_{it} = \mu_i + \tilde{y}_{it}$$

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

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

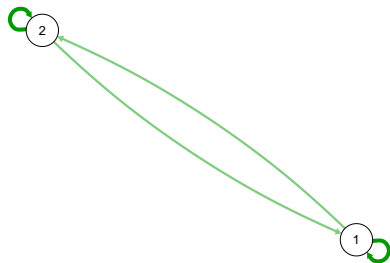
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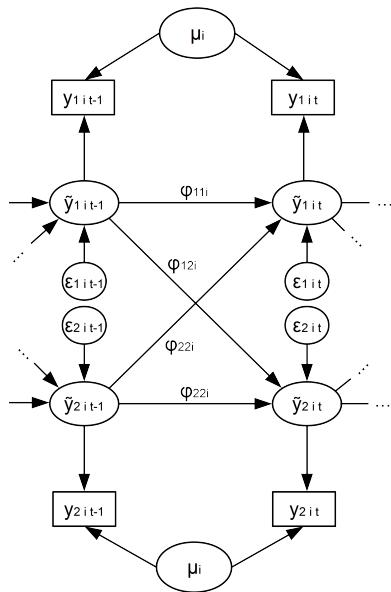
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# Bivariate multilevel autoregressive model

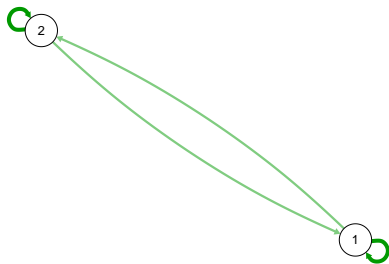


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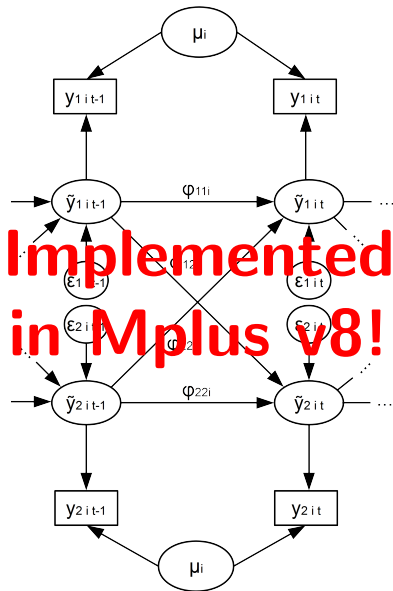
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$$\mu_i, \Phi_i \sim MvN(\gamma, \Psi)$$



# Bivariate multilevel autoregressive model



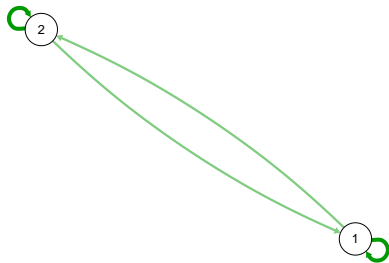
Implemented  
in Mplus v8!

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

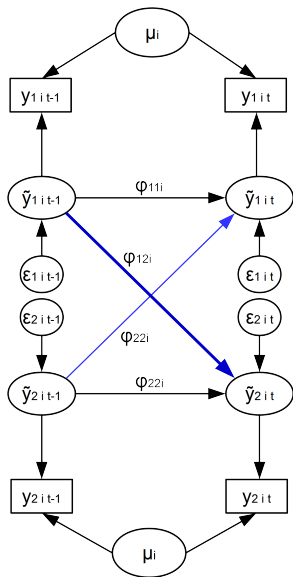
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# Caveat 1: Comparing cross-lagged effects & standardization

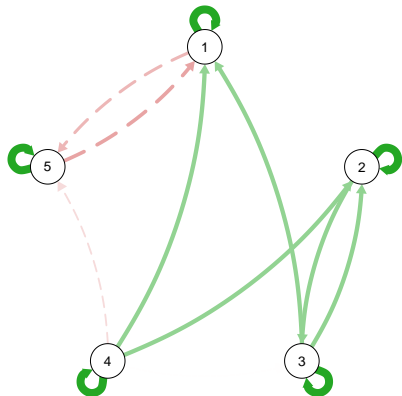


## Standardization

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

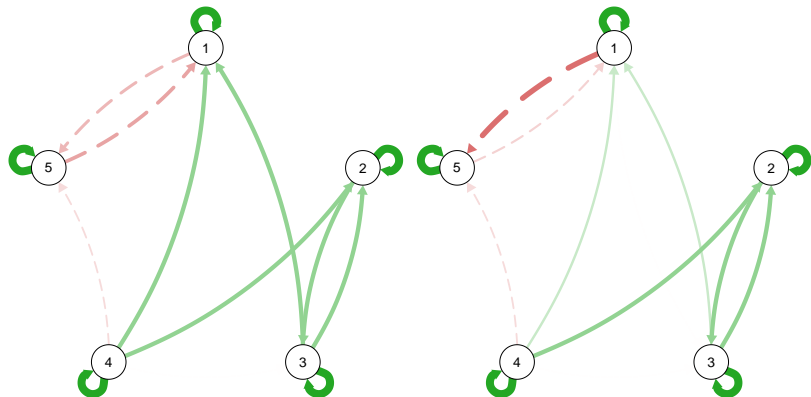
# Why standardized coefficients

Unstandardized coefficients are sensitive to the measurement unit



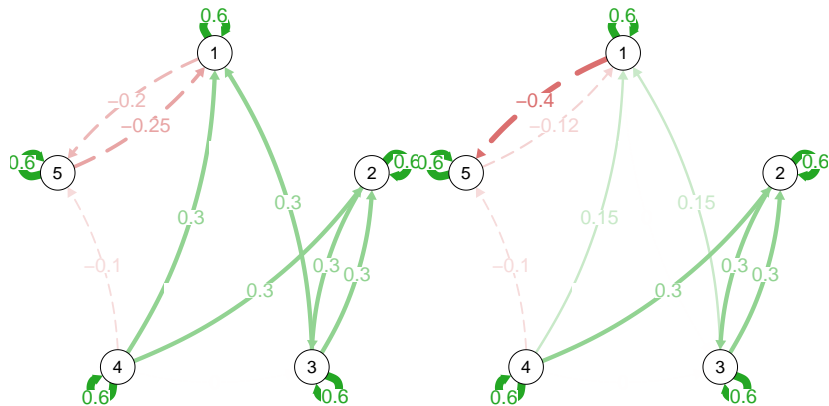
## Why standardized coefficients

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



# Why standardized coefficients

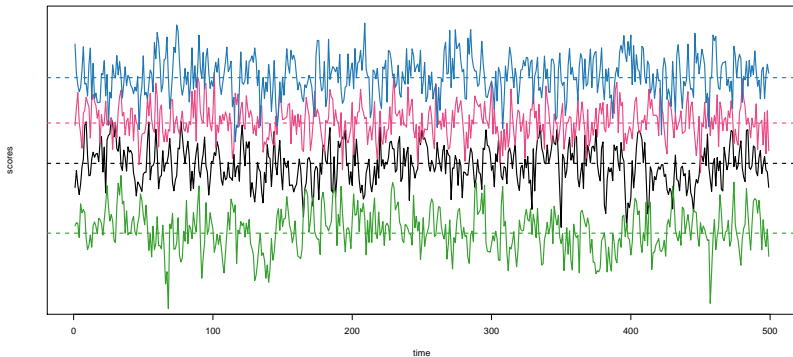
Unstandardized coefficients are sensitive to the measurement unit (variable 1 multiplied by 2)



# Multilevel Standardization???

$$\beta = b \frac{\sigma_x}{\sigma_y}$$

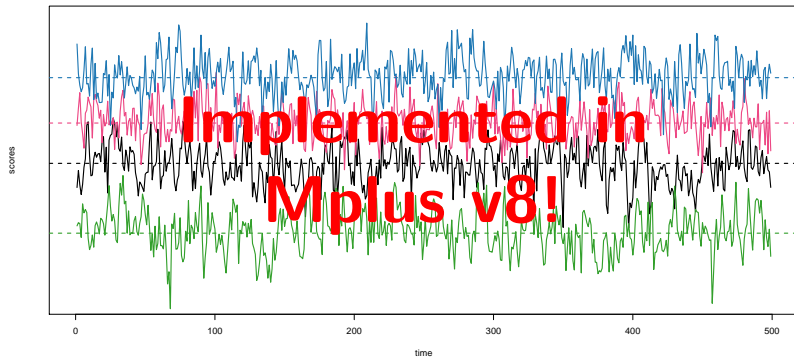
Can be complex (and tedious) to do (details in Schuurman, Ferrer, de Boer-Sonnenschein & Hamaker; 2016)



# Multilevel Standardization

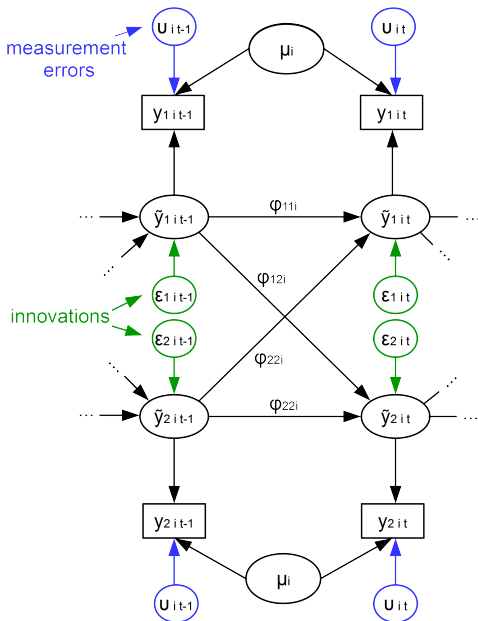
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## Caveat 2: Measurement error



Innovations  $\neq$   
Measurement errors

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

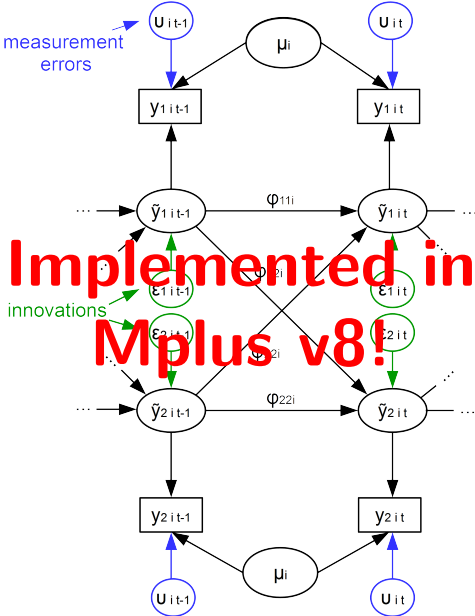
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$$v_{it} \sim \text{MvN}(0, \Omega)$$

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## Other important 'caveats' and areas of development

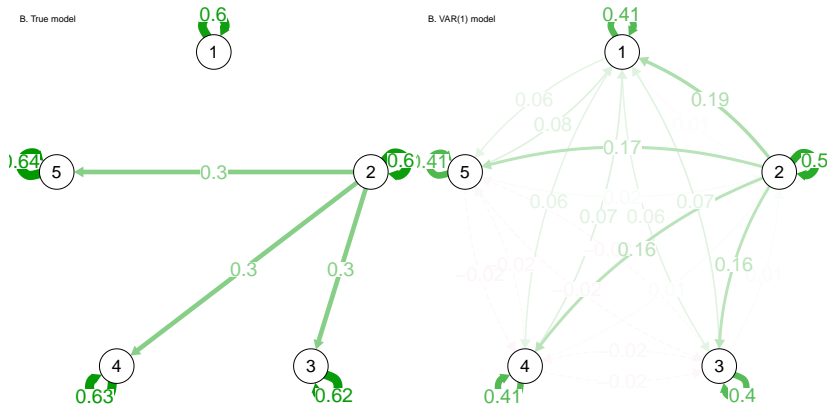
- ▶ (Non)Stationarity
- ▶ (Dealing with/Consequences of) Unequally spaced measurements (**Ad hoc solution implemented in MPlus v8**)
- ▶ Differential Equation/Continuous Time Modeling
- ▶ Within/Between Unit Causality
- ▶ Variable selection/model selection
- ▶ Modeling processes on that take place at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

## ▶ Theory!

# Refs

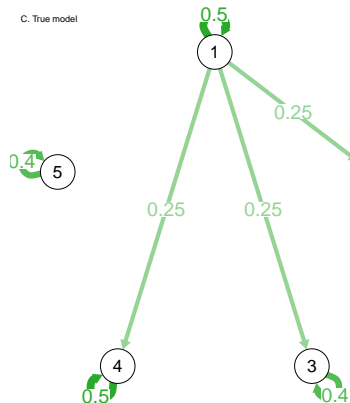
- ▶ Schuurman, N.K., Ferrer, E., de Boer-Sonnenschein, M., & Hamaker, E.L. (2016). Studying individual differences in cross-lagged associations by standardizing multilevel autoregressive models. *Psychological Methods*.
- ▶ Schuurman, N.K., Houtveen, J.H., & Hamaker, E.L. (2015). Incorporating measurement error in n=1 psychological autoregressive modeling. *Frontiers in Psychology*, 6. doi: 10.3389/fpsyg.2015.01038
- ▶ Schuurman, N.K., & Hamaker, E.L. (under review). Measurement error and person-specific reliabilities in multilevel autoregressive modeling.

# Disregarding Measurement Error...

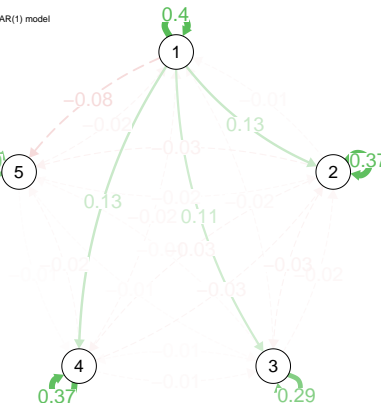


# Disregarding Measurement Error...

C. True model



C. VAR(1) model



# Disregarding Measurement Error...

