N=1 Vector Autoregressive Models

Modeling Intensive Longitudinal Data

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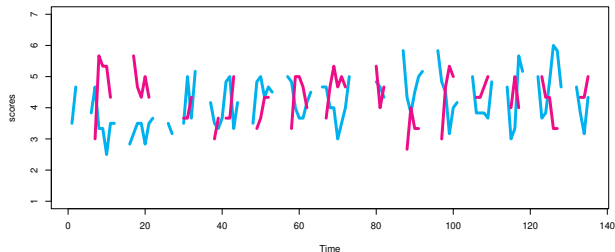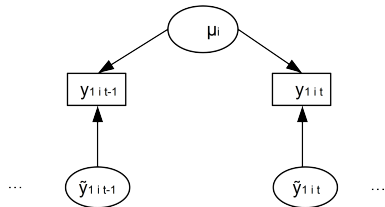
Multivariate time series: Example

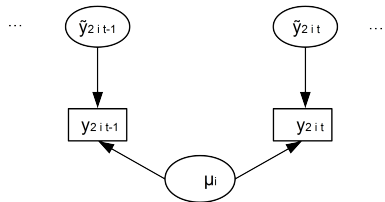**Competence and Exhaustion of people diagnosed with burnout**

- ▶ Experience Sampling study by Sonnenschein et al. (2006)
- ▶ 54 persons diagnosed with burnout
- ▶ On average 80 repeated measures for exhaustion and 40 for feeling competent

Vector Autoregressive (VAR) Model - Bivariate

$$\begin{bmatrix} y_{1t} \\ y_{2t} \end{bmatrix} = \begin{bmatrix} \mu_1 \\ \mu_2 \end{bmatrix} + \begin{bmatrix} \tilde{y}_{1t} \\ \tilde{y}_{2t} \end{bmatrix}$$
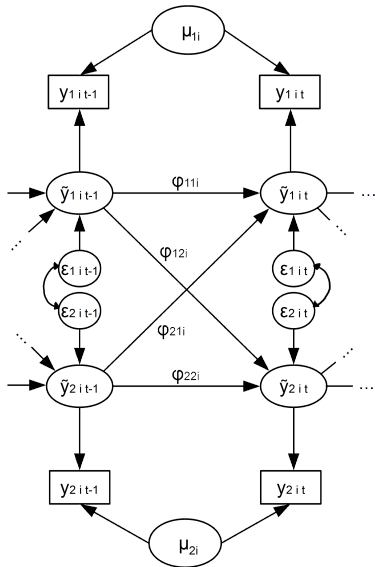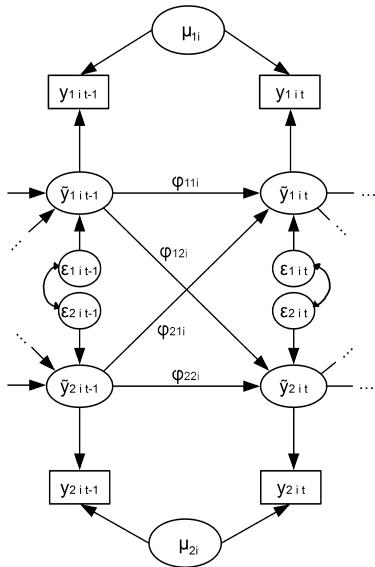
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Vector Autoregressive (VAR) Model - Bivariate

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$$\begin{bmatrix} \tilde{y}_{1t} \\ \tilde{y}_{2t} \end{bmatrix} = \begin{bmatrix} \phi_{11} & \phi_{12} \\ \phi_{21} & \phi_{22} \end{bmatrix} \begin{bmatrix} \tilde{y}_{1t-1} \\ \tilde{y}_{2t-1} \end{bmatrix} + \begin{bmatrix} \epsilon_{1t} \\ \epsilon_{2t} \end{bmatrix}$$

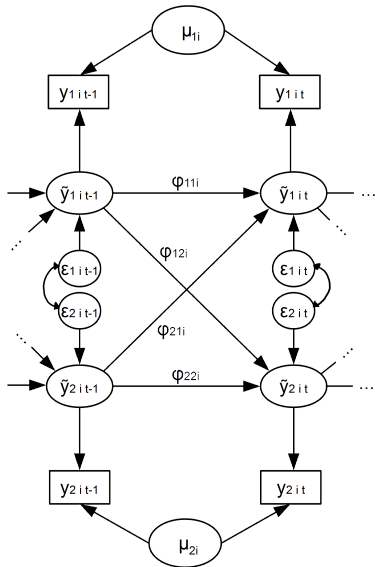# Vector Autoregressive (VAR) Model - Bivariate

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$$\begin{bmatrix} \epsilon_{1t} \\ \epsilon_{2t} \end{bmatrix} \sim MvN \left(\begin{bmatrix} 0 \\ 0 \end{bmatrix}, \begin{bmatrix} \sigma_1^2 & \sigma_{12} \\ \sigma_{12} & \sigma_2^2 \end{bmatrix} \right)$$

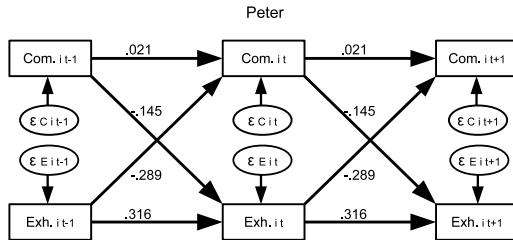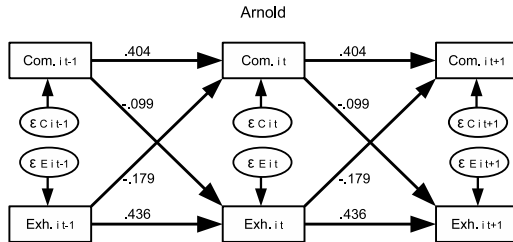# Vector Autoregressive (VAR) Model - Bivariate

$$y_t = \mu + \tilde{y}_t$$
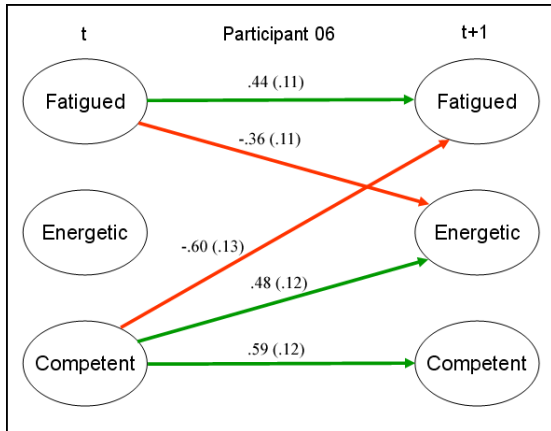$$\tilde{y}_t = \Phi\tilde{y}_{t-1} + \epsilon_t$$

$$\epsilon_t \sim MvN\left(0, \Sigma\right)$$

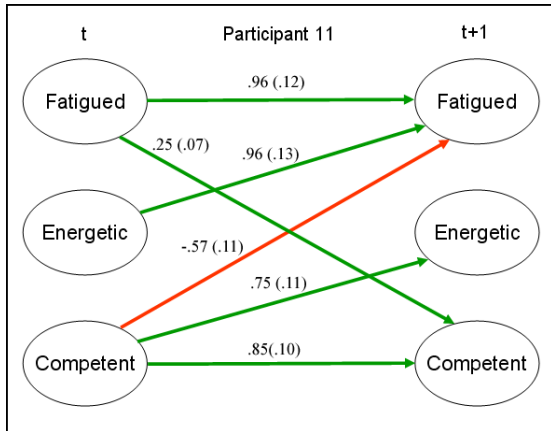Utrecht University

Bivariate VAR(1): Example

Arnold

Peter

From Schuurman, Ferrer, de Boer-Sonnenschein, & Hamaker (2016). How to compare cross-lagged associations in a multilevel autoregressive model. Psych Methods.
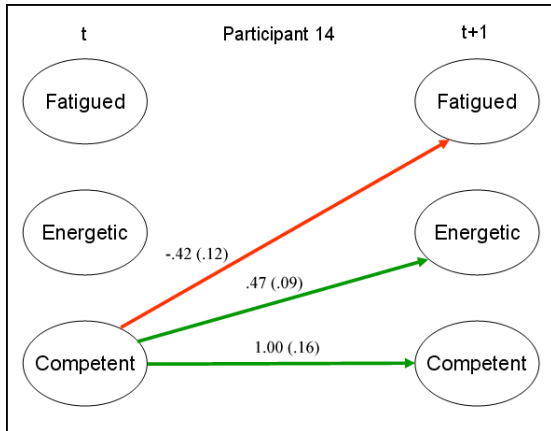
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Trivariate VAR(1): Example

From my 2010 internship report: link

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