

Dynamic networks

Modeling Intensive Longitudinal Data

Noémi K. Schuurman

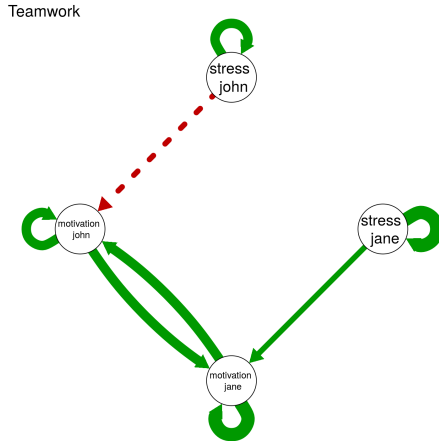


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Sharing science,
shaping tomorrow

Dynamic networks

- ▶ Visualize how variables are associated over time
- ▶ Based on statistical estimates from dynamic models



Social networks versus Psychological networks

Social networks

- ▶ Measurements: what is connected to what?
- ▶ Example: Who is collaborating with whom?
- ▶ Measured connections are plotted as network

Social networks versus Psychological networks

Social networks

- ▶ Measurements: what is connected to what?
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Psychological networks

- ▶ Measure variables
- ▶ Estimate relationships between variables
- ▶ Network visualizes estimated relationships: connections in network are estimated associations

Psychological networks

Psychometric Perspectives on Diagnostic Systems



Denny Borsboom

University of Amsterdam

The author identifies four conceptualizations of the relation between symptoms and disorders as utilized in diagnostic systems such as the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (DSM-IV; American Psychiatric Association, 1994): A constructivist perspective, which holds that disorders are conveniently grouped sets of symptoms; a diagnostic perspective, which holds that disorders are latent classes underlying the symptoms; a dimensional perspective, which holds that symptoms measure latent continua; and a causal systems perspective, which holds that disorders are causal networks consisting of symptoms and direct causal relations between them. Advantages and disadvantages of these conceptualizations are

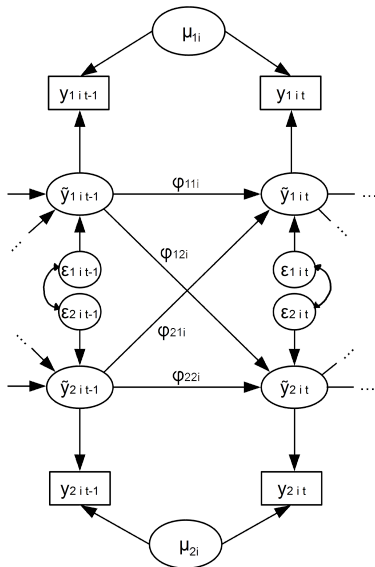
Dynamic psychological networks

- ▶ Visualize how variables are associated over time
- ▶ Based on statistical estimates from dynamic models

Dynamic psychological networks

- ▶ Visualize how variables are associated over time
- ▶ Based on statistical estimates from dynamic models
- ▶ Usually, from VAR(1) models:
 - Obtain standardized autoregressive and cross-lagged coefficients
 - pass information to package Qgraph in R to plot network (Epskamp et al., 2012)

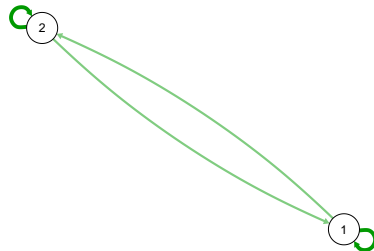
The bivariate VAR(1) model as a network



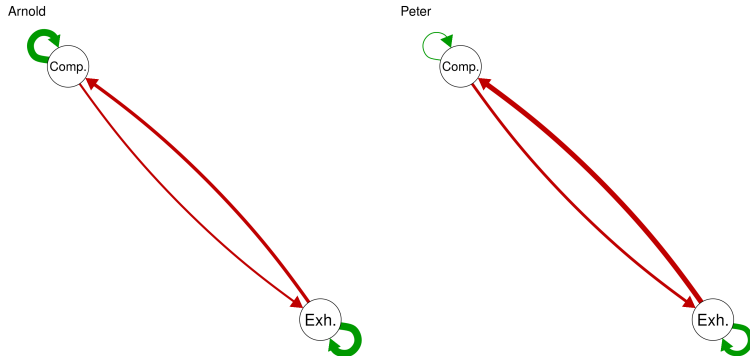
$$y_t = \mu + \tilde{y}_t$$

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

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



Nodes and edges



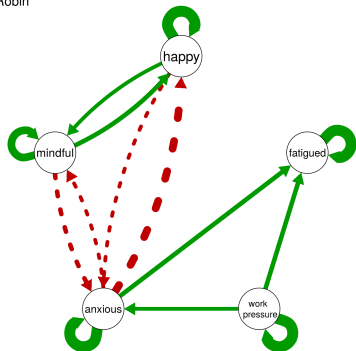
Based on results from Schuurman et al. 2016

The AR(1) model as a network



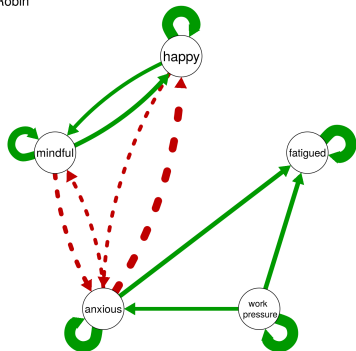
Dynamic Networks: Comparing effects within a network

Robin



Dynamic Networks: Comparing effects within a network

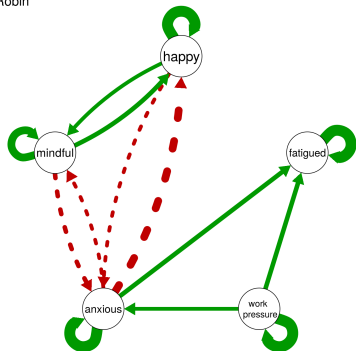
Robin



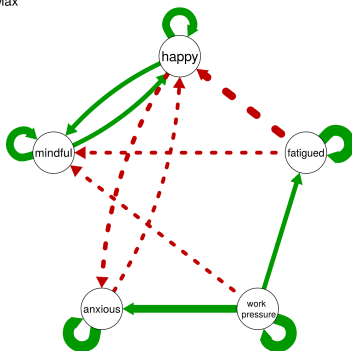
- ▶ Width of the edges represents relative strengths of the effects
- ▶ Use *standardized* coefficients for edges (or other effect size such as partial correlations)

Dynamic Networks: Comparing effects between networks

Robin



Max



- Width of the edges represents relative strengths of the effects
- Use *standardized* coefficients for edges (or other effect size such as partial correlations)

Network statistics: Beyond visualization

Network statistics

- ▶ Inference about the attributes of the network
- ▶ For example: Centrality statistics
- ▶ **Caution:** Taken from social networks, not as straightforward to apply to these kinds of dynamic networks (!).



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