Modeling Psychopathology:
From Data Models to Formal Theories

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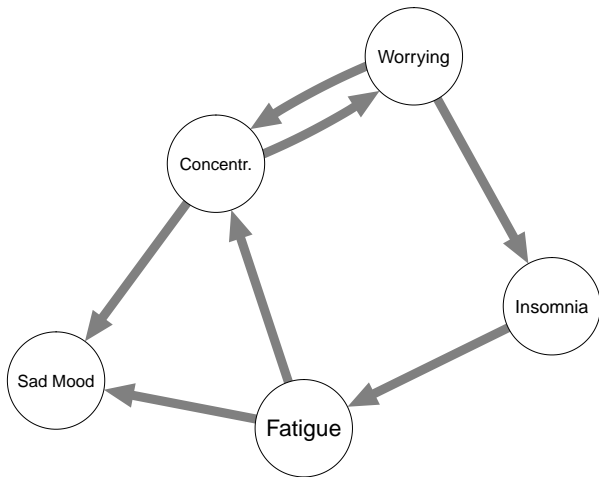*University of Amsterdam*

Oisín Ryan*
Utrecht University

Donald Robinaugh*
Harvard University

Lourens Waldorp & Denny Borsboom
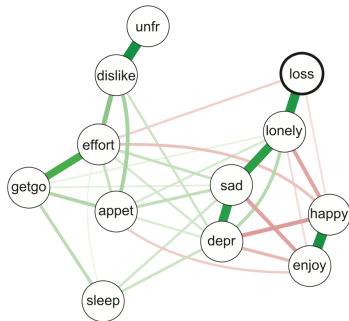*University of Amsterdam*

*Joint first authors

IOPS Summer Conference 2021

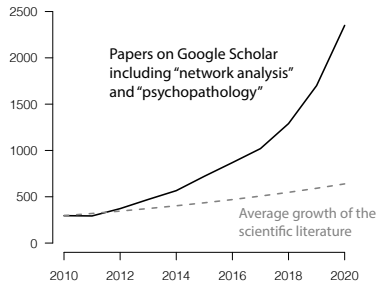# Network Approach to Psychopathology

(Cramer at al, 2010; Borsboom et al. 2013; Schmittman et al, 2013; Borsboom, 2017)
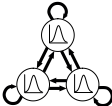
Statistical Network Analysis

(Figure from Fried et al., 2015)
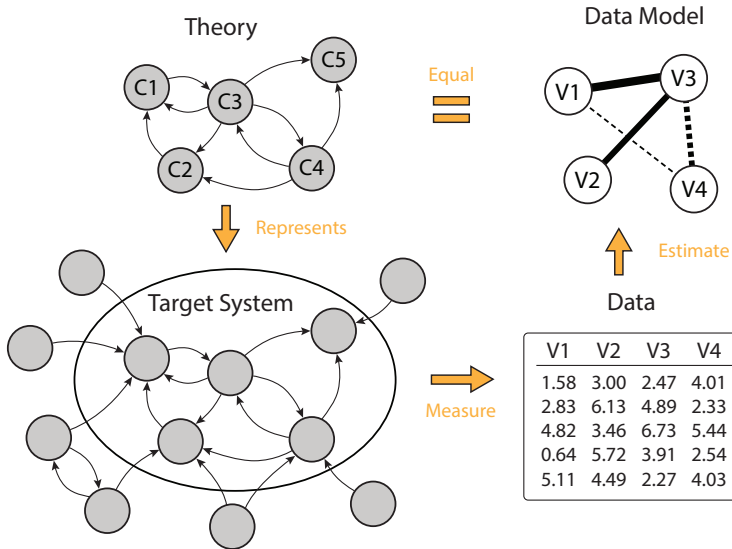
Statistical Network Models as Theories?
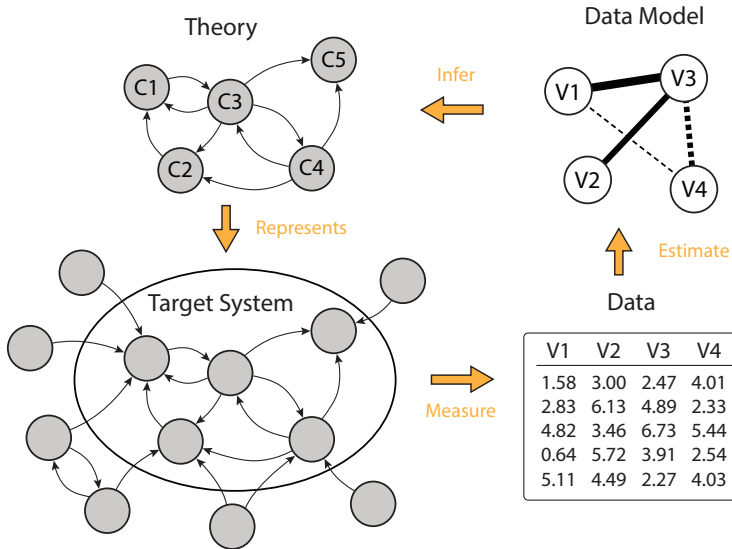

(Haslbeck*, Ryan*, Robinaugh*, et al., 2021)

Target systems, Theories, Data and Data Models
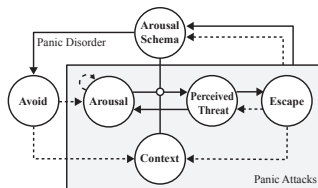

(Suárez & Pero, 2019; Haslbeck* ,Ryan* ,Robinaugh*, et al., 2021)
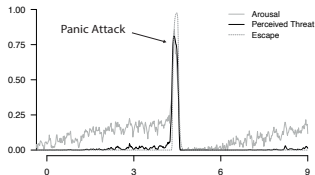
Target systems, Theories, Data and Data Models

(Suárez & Pero, 2019; Haslbeck* ,Ryan* ,Robinaugh*, et al., 2021)
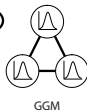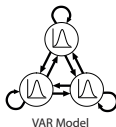
Infer Theories from Data Models?
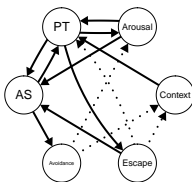

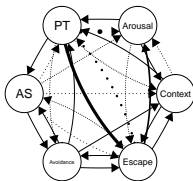(Robinaugh et al., 2020; Haslbeck*, Ryan*, Robinaugh*, et al., 2021)
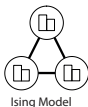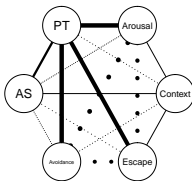
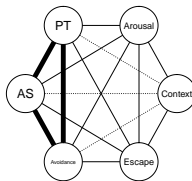# Infer Theories from Data Models?

(a) True Local Dependence

(b) VAR Model   (c) Gaussian Graphical Model   (d) Ising Model
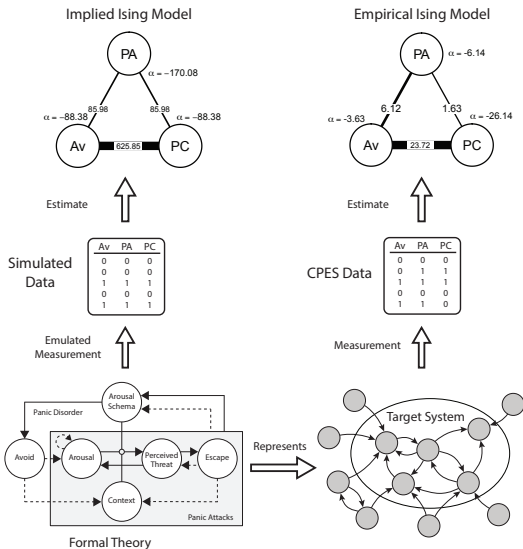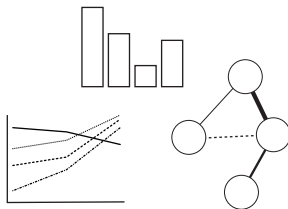
(Haslbeck*, Ryan*, Robinaugh*, et al., 2021)

Alternative: Abductive Theory Construction
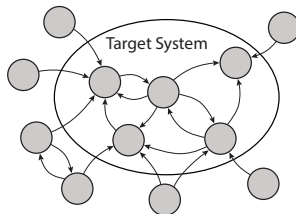

(Haslbeck*, Ryan*, Robinaugh*, et al., 2021)

How to generate an initial theory?
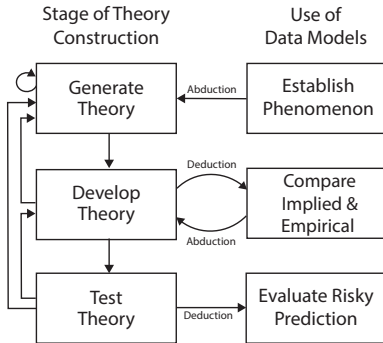
Step 1: Specify phenomenon to be explained

Step 2: Specify components and relations of target system

(Wimsat, 1987; Smaldino, 2017; Haslbeck*, Ryan*, Robinaugh*, et al., 2021)

From Data Models to Formal Theories

- ▶ Data models are unlikely to be good theories
- ▶ Naive inferences from data models to theories are highly problematic
- ▶ Abductive theory construction may be a powerful way forward

Stage of Theory Construction

Use of Data Models

Generate Theory ← Abduction ← Establish Phenomenon

Develop Theory ⇄ Deduction / Abduction ⇄ Compare Implied & Empirical

Test Theory → Deduction → Evaluate Risky Prediction

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