The Psych Systems Project

Bouncing back from adversity: Towards a dynamical conceptualization of psychological resilience

Gaby Lunansky

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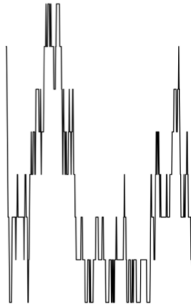
PhD supervisors: Denny Borsboom & Claudia van Borkulo



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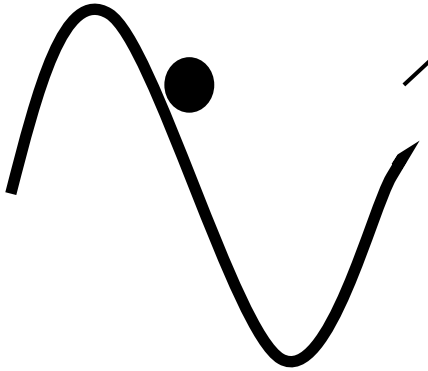

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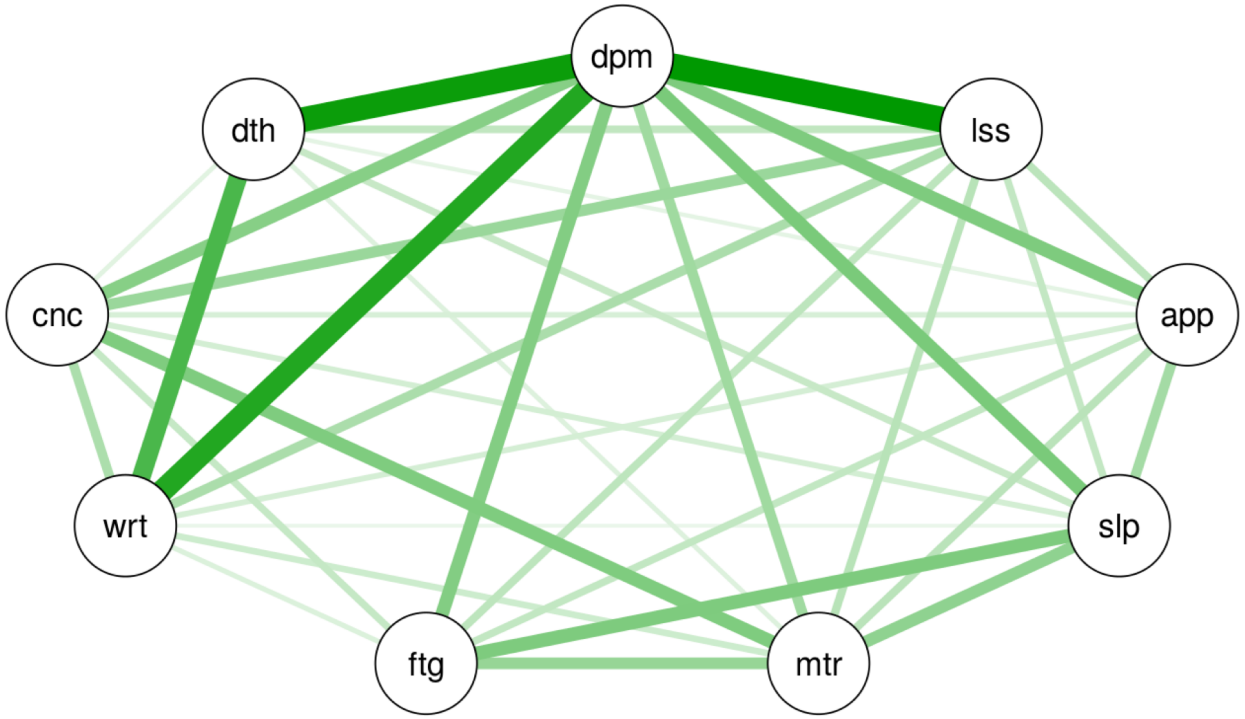
Why do we want to estimate psychological networks?



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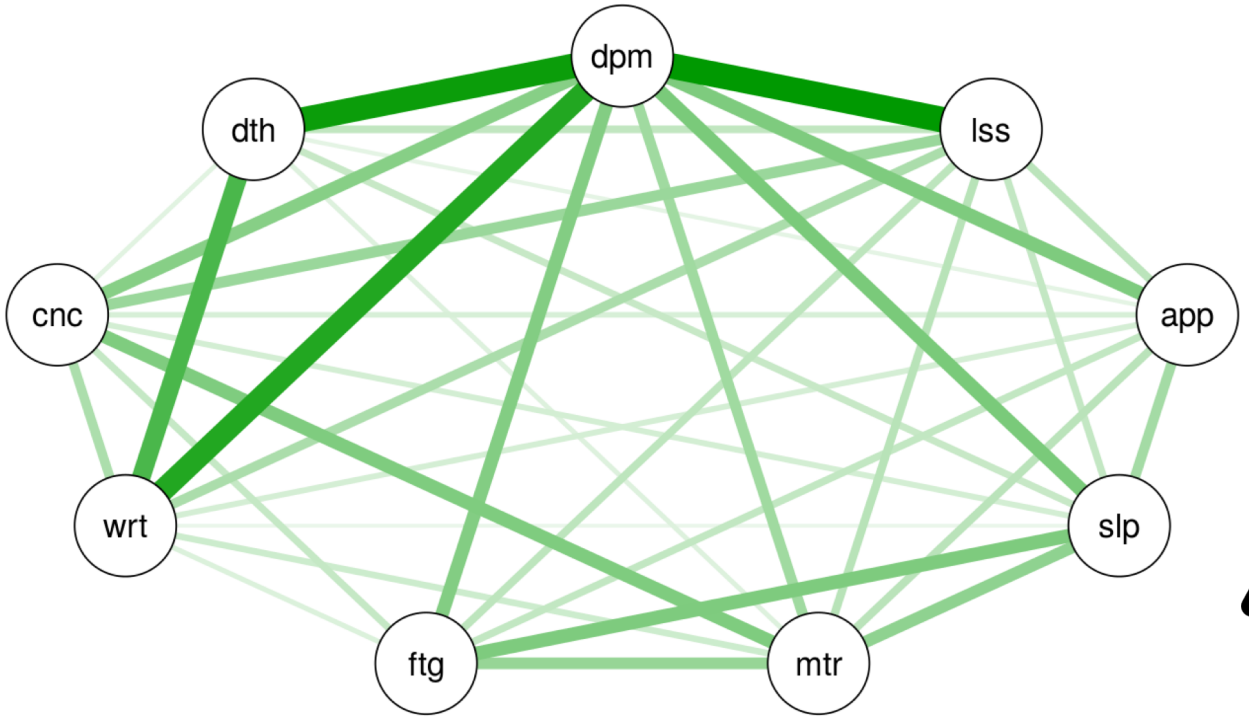

Can we evaluate the *state* of the network by looking at the *structure* of the network?

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Psychological resilience

- Why do some people collapse after a disruptive event, while others seem to take the punch and go back to their normal state quite rapidly?

- Some *ability* to cope with stressful life events

- What is this ability and how should we study it?

- New paradigm: Studying health, not disease
  - Focus on preventing illness

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Resilience as a trait vs. process

- Debate in the clinical field regarding the nature of resilience drives the field into two different directions (Jacelon, 1997)
- Some researchers look for static, protective **trait-like factors**

  E.g.: **humor** (Wagnild & Young, 1990), having a **positive outlook** (Cowen & Work,1988), having **warm & cohesive families** (Mulholland et al., 1991) or **autonomy & high self-esteem** (Masten & Garmezy, 1985)

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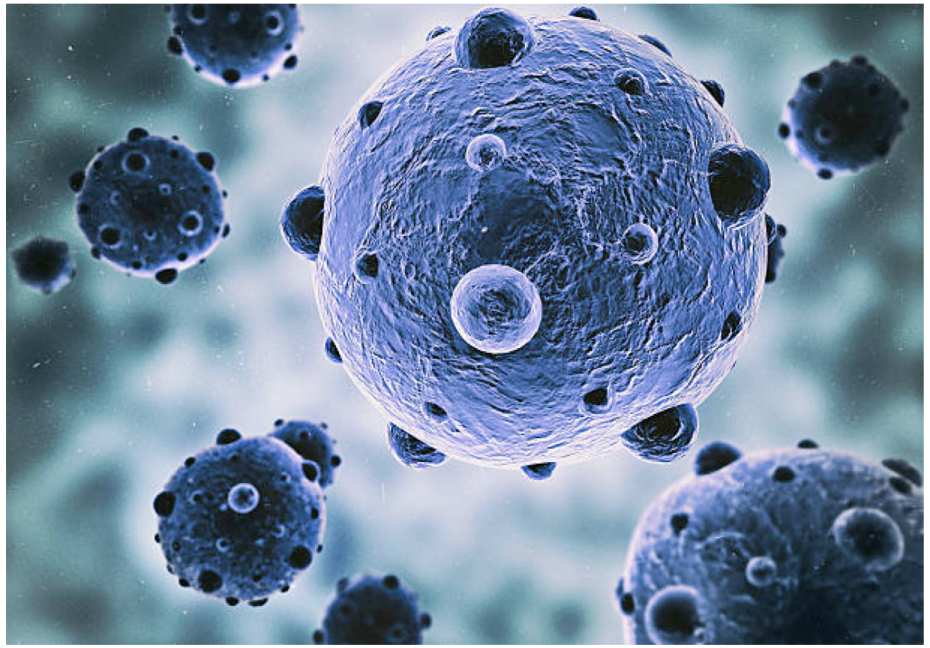
Resilience as a trait vs. process

- Other researchers conceptualize resilience as a **dynamical process**

  E.g. searching for general **underlying, causal mechanisms** of resilience (Kalisch, Muller & Tuscher, 2015)

  or studying the **'steeling effect'** (Rutter, 2012)



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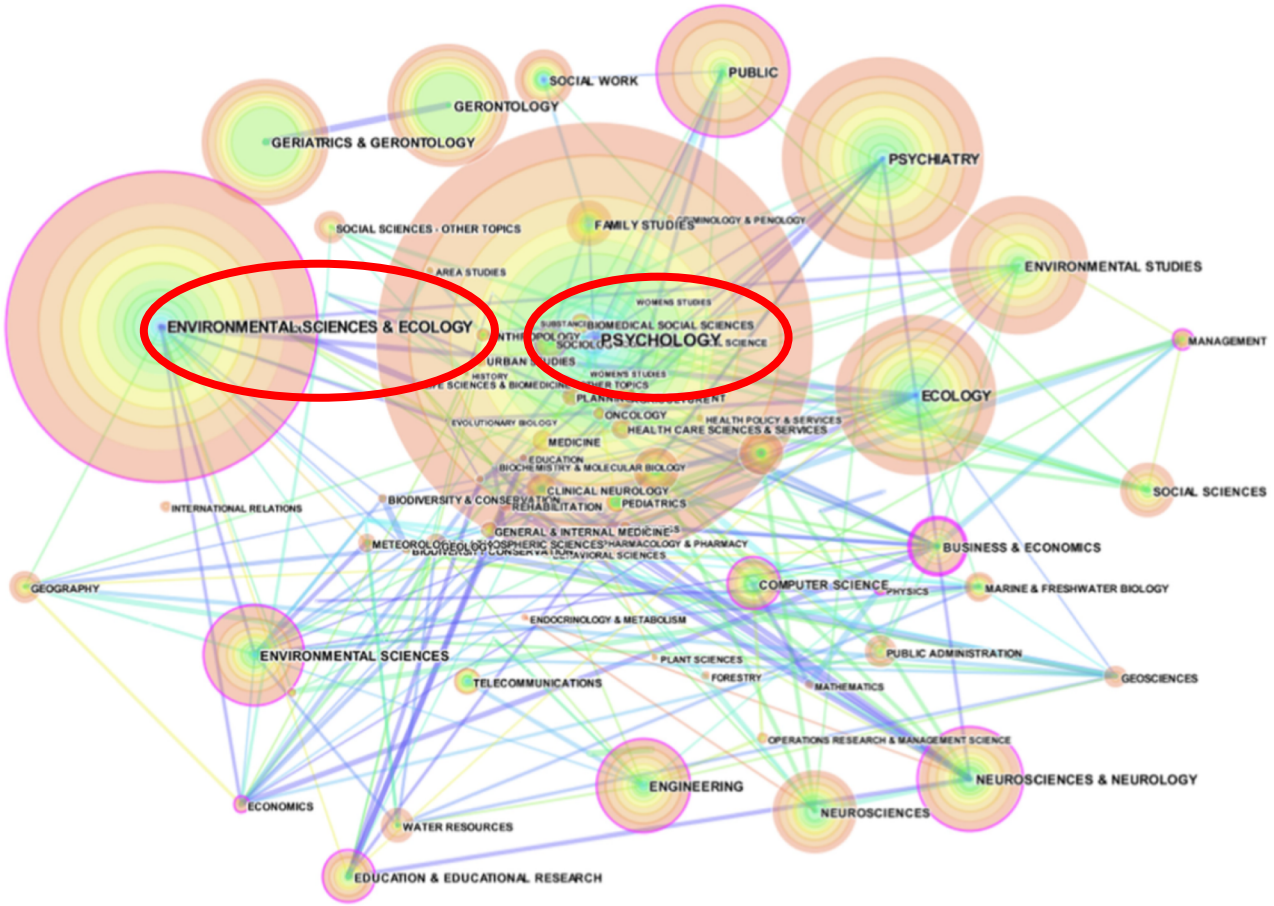
Resilience research in different fields



Hosseini et al., 2016

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How to study resilience?

Two possible operationalizations:

- **Time**: how rapidly does the system recover?
- **Intensity**: how big can the pertubation be until the state of the system shifts?

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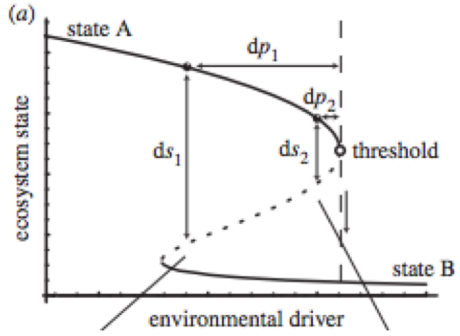
Resilience indicators in ecology

Engineering resilience

vs

Ecological resilience



(Dakos, Carpenter,

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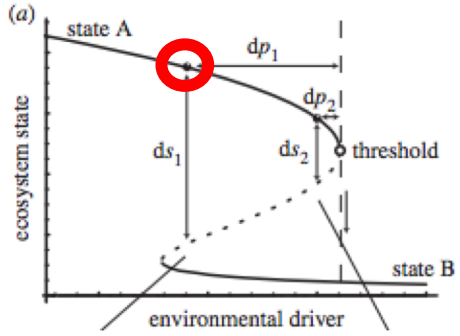

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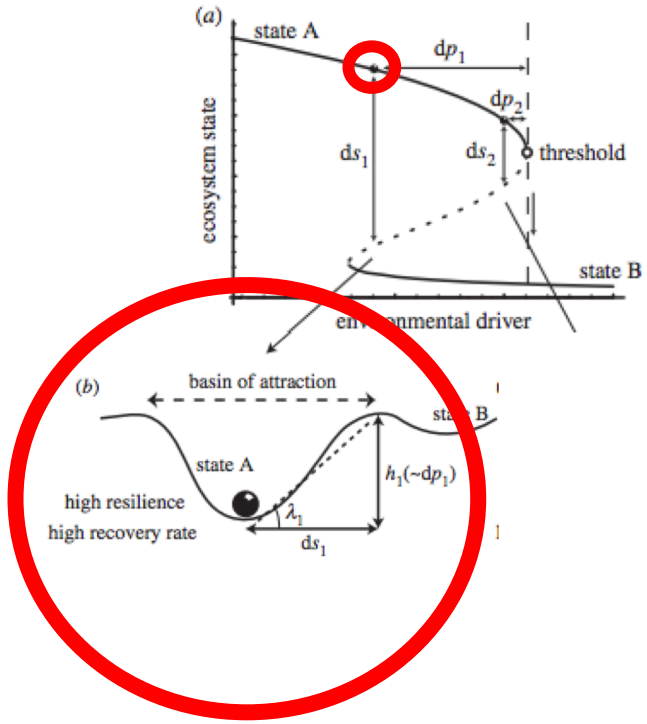

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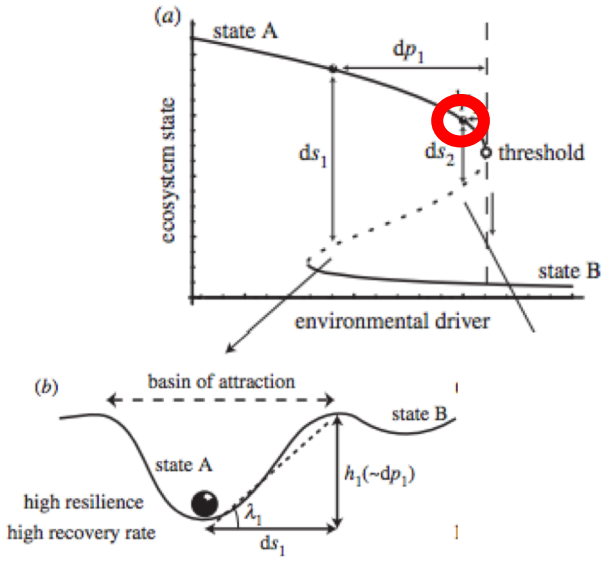

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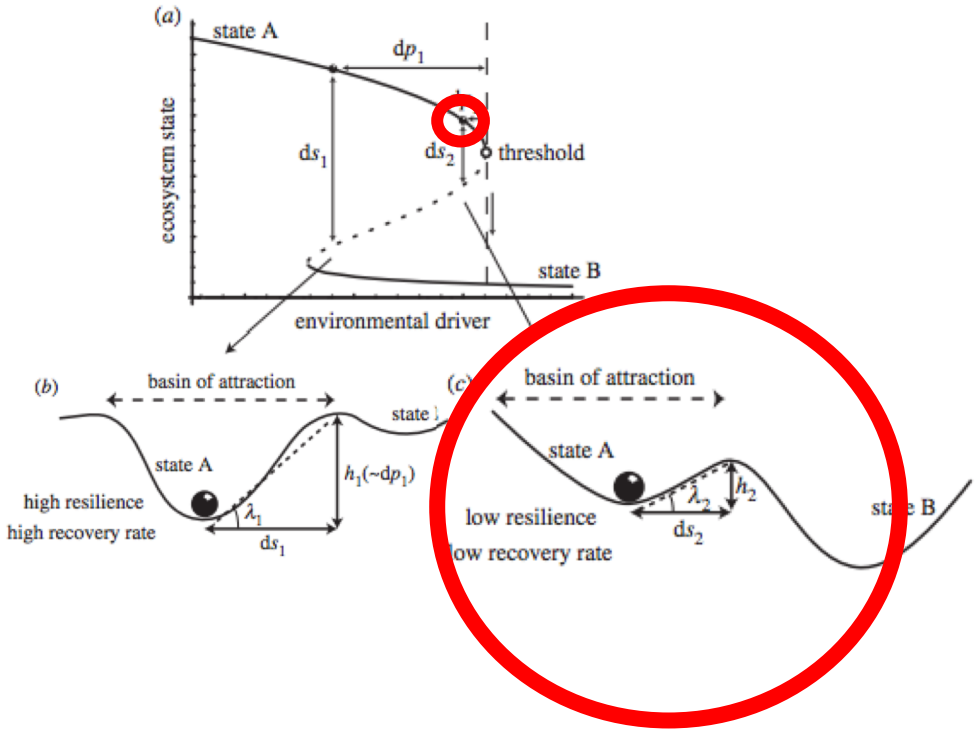

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Early warnings

- We can apply this theory to psychopathology
  - Is a person close to a 'critical transition'?

- Not possible to know the exact trajectory of a complex system like a psychiatric disorder…

  … but we can look at indicators!

- Critical slowing down

Van de Leemput et al., 2013

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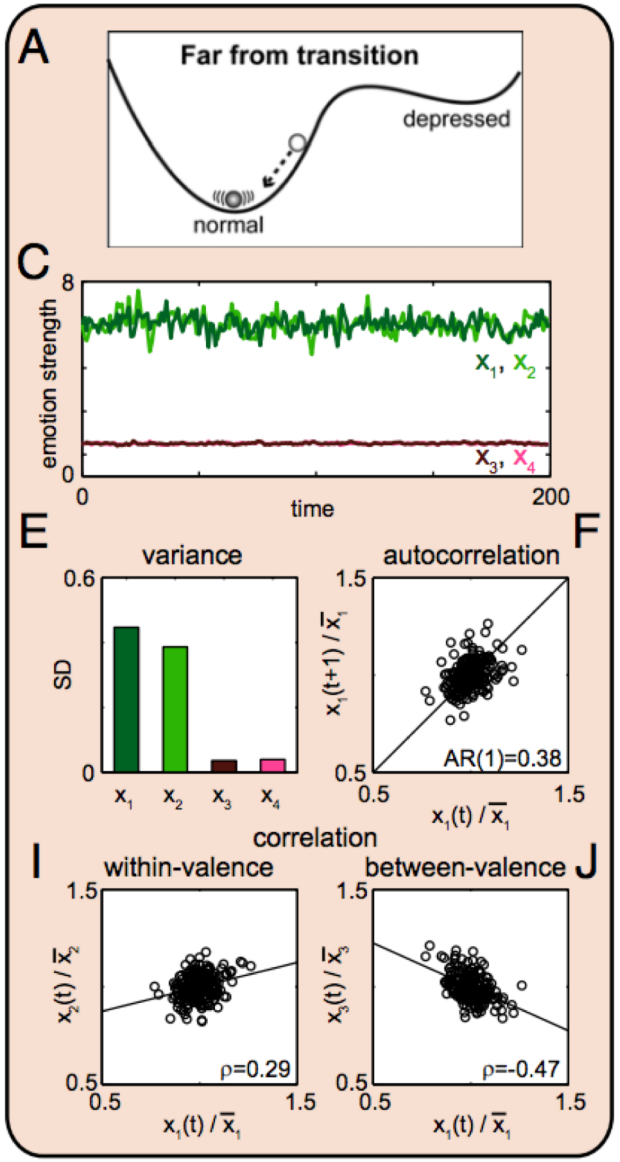

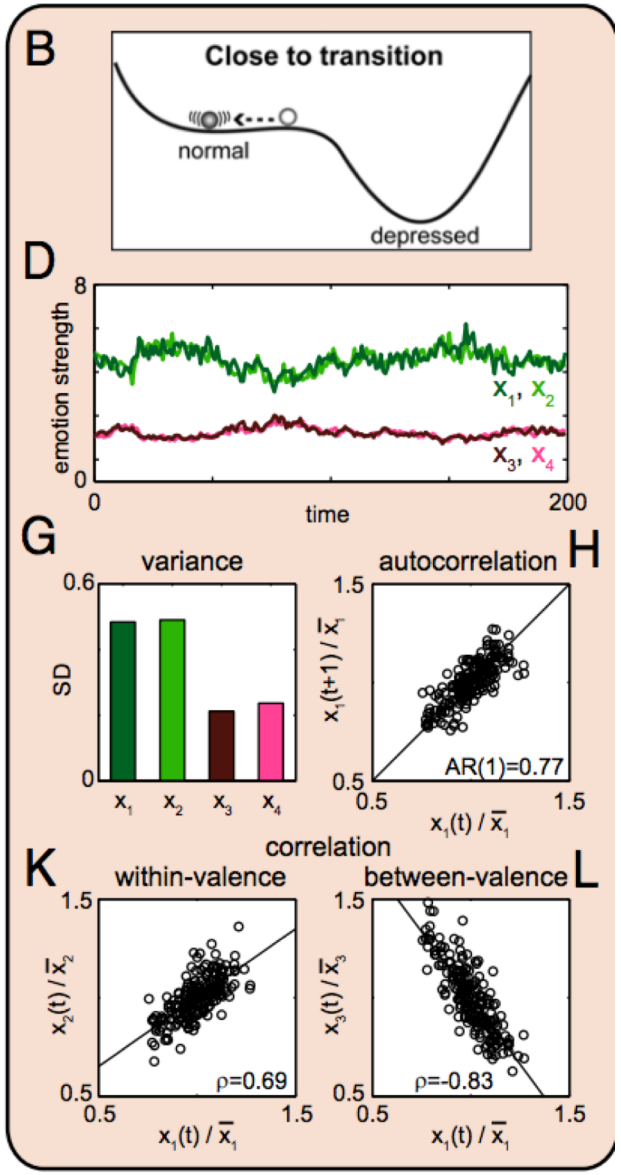

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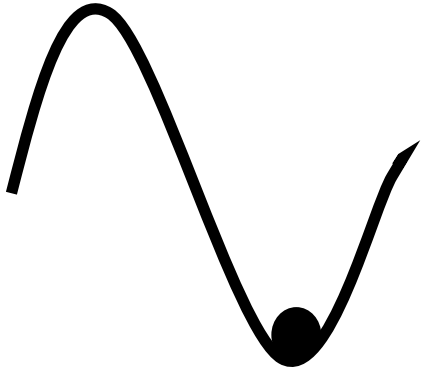
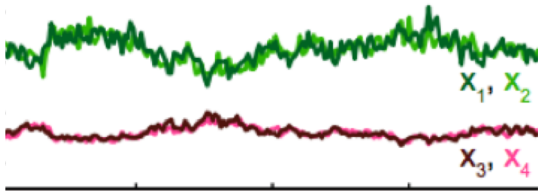
RECAP





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Resilience and Psychological Networks

- Highly relevant for the clinical practice, however, no **quantitative indicators** for resilience models in psychology

- First indicator:

  Connectivity strength of the edges (Cramer et al., 2016)

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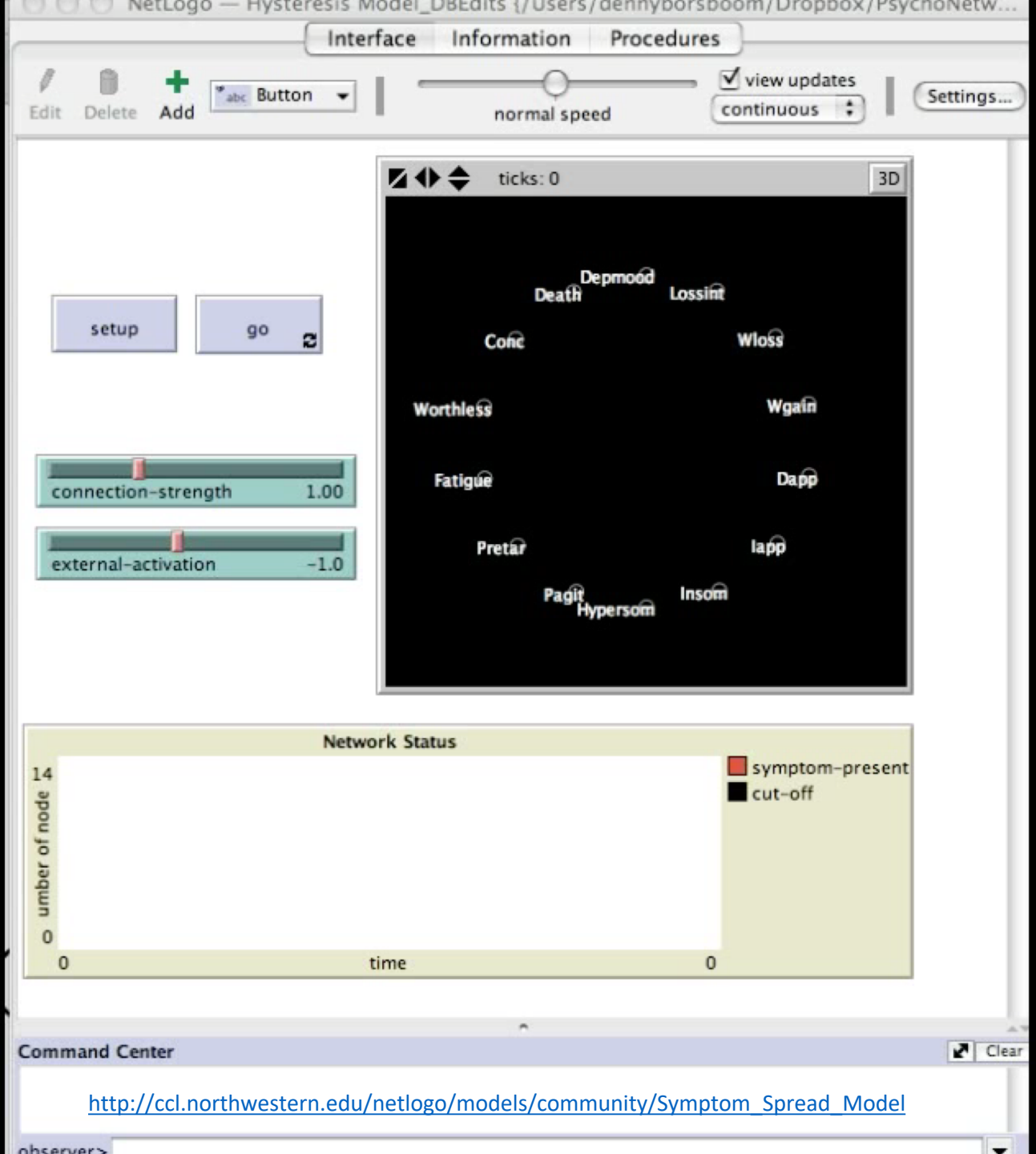
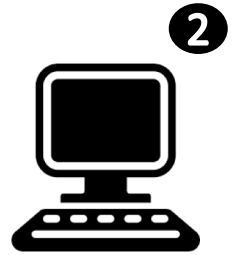
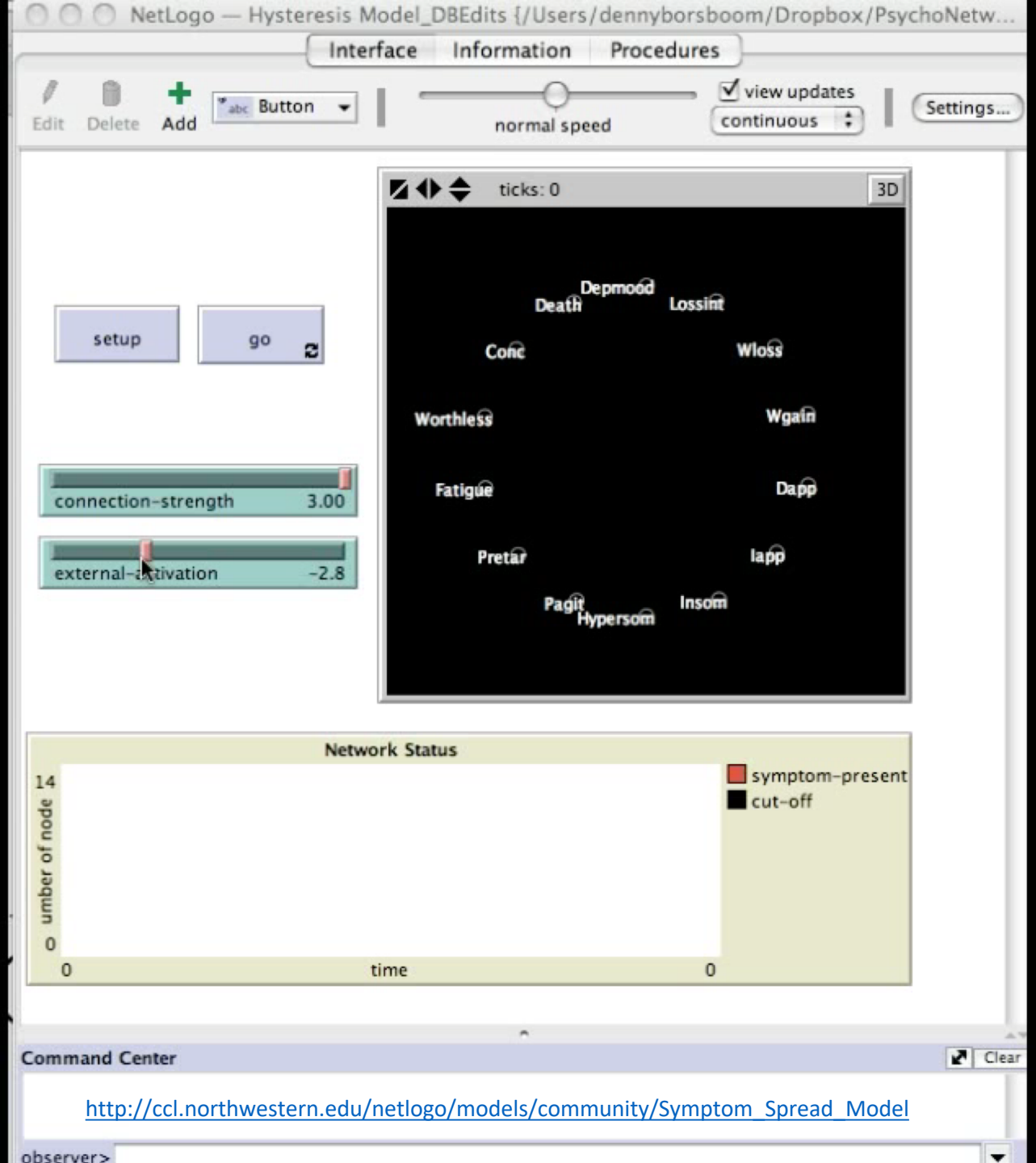
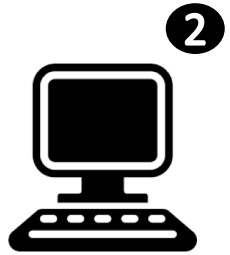


LOW Connectivity

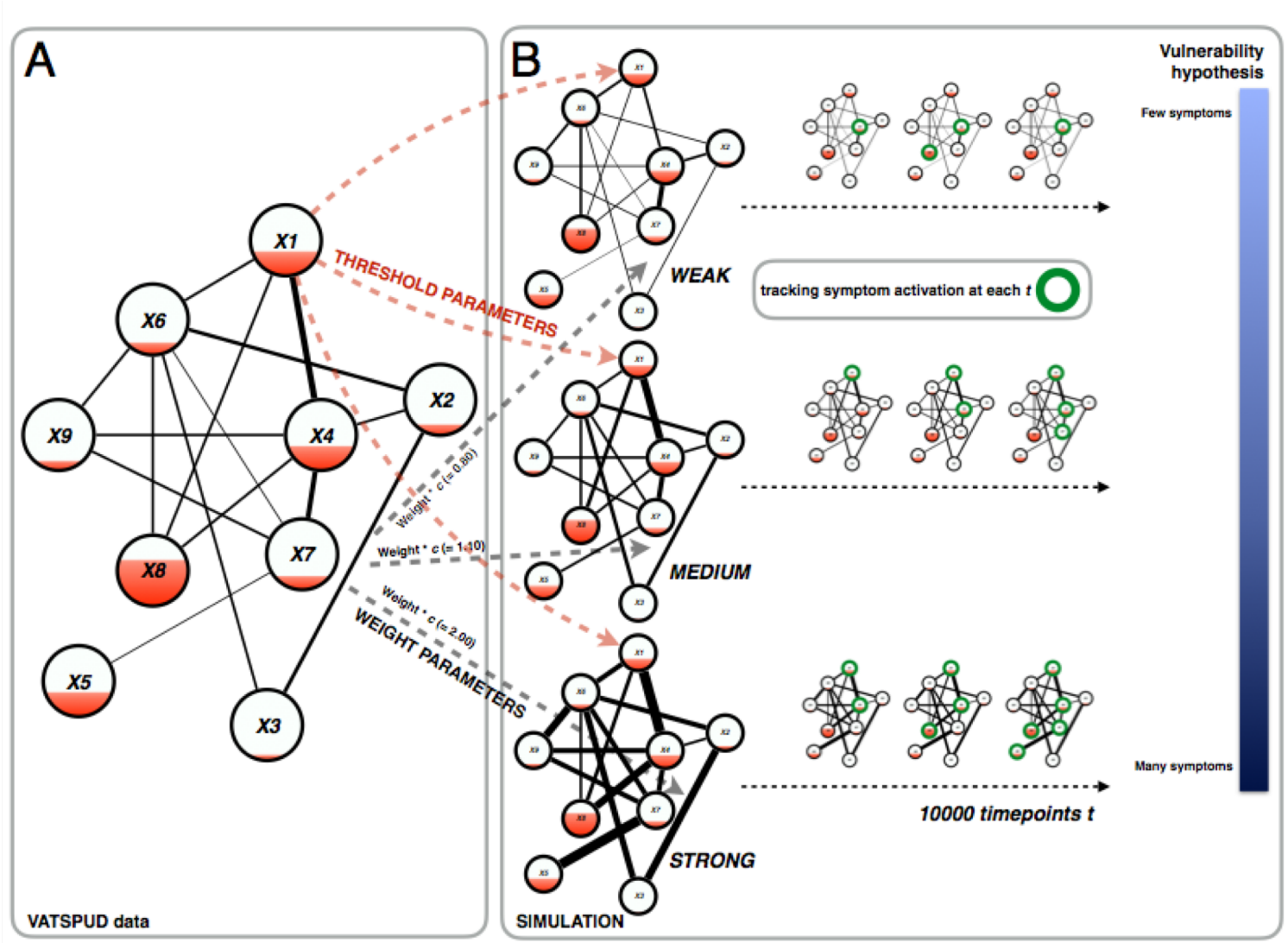




HIGH Connectivity



A simulation study: setup



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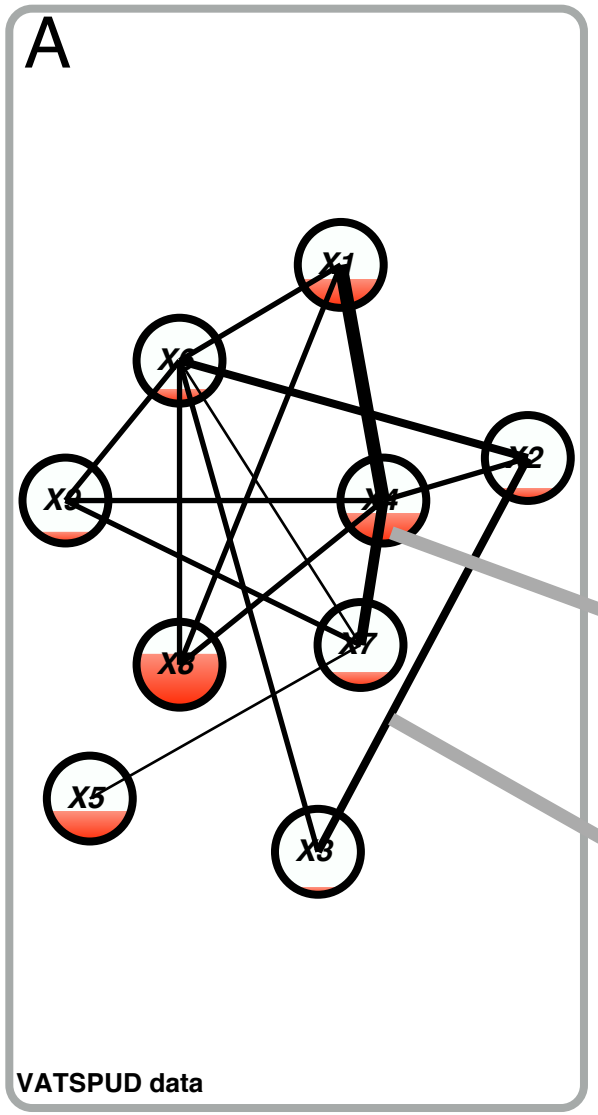
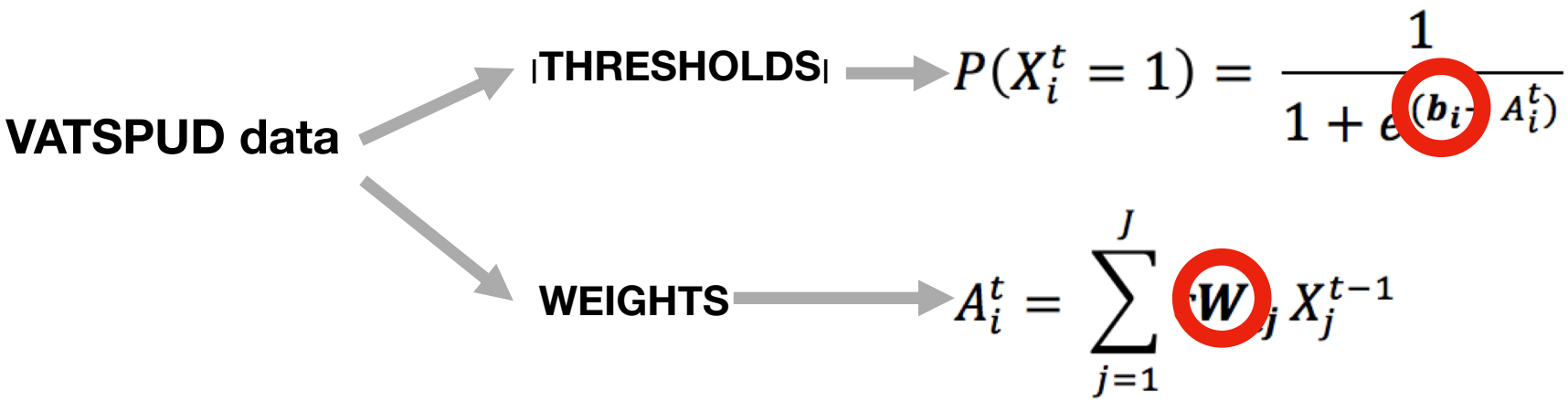


- VATSPUD data: about 8900 male and female twins, interview, prevalence MD about 17%
- Parameter estimation with *IsingFit* (van Borkulo et al., 2014)

THRESHOLD PARAMETERS

WEIGHT PARAMETERS

A simulation study: setup



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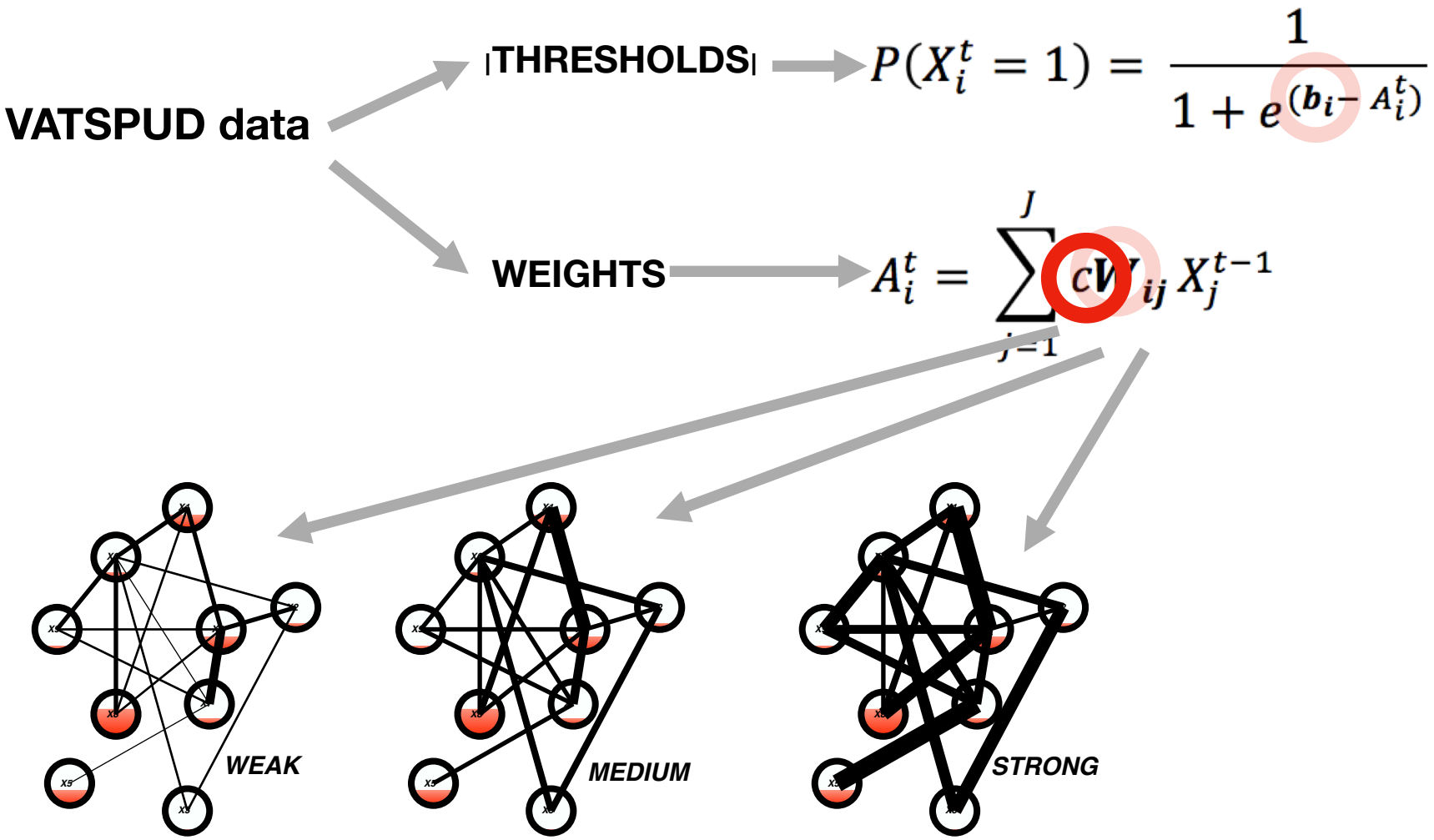

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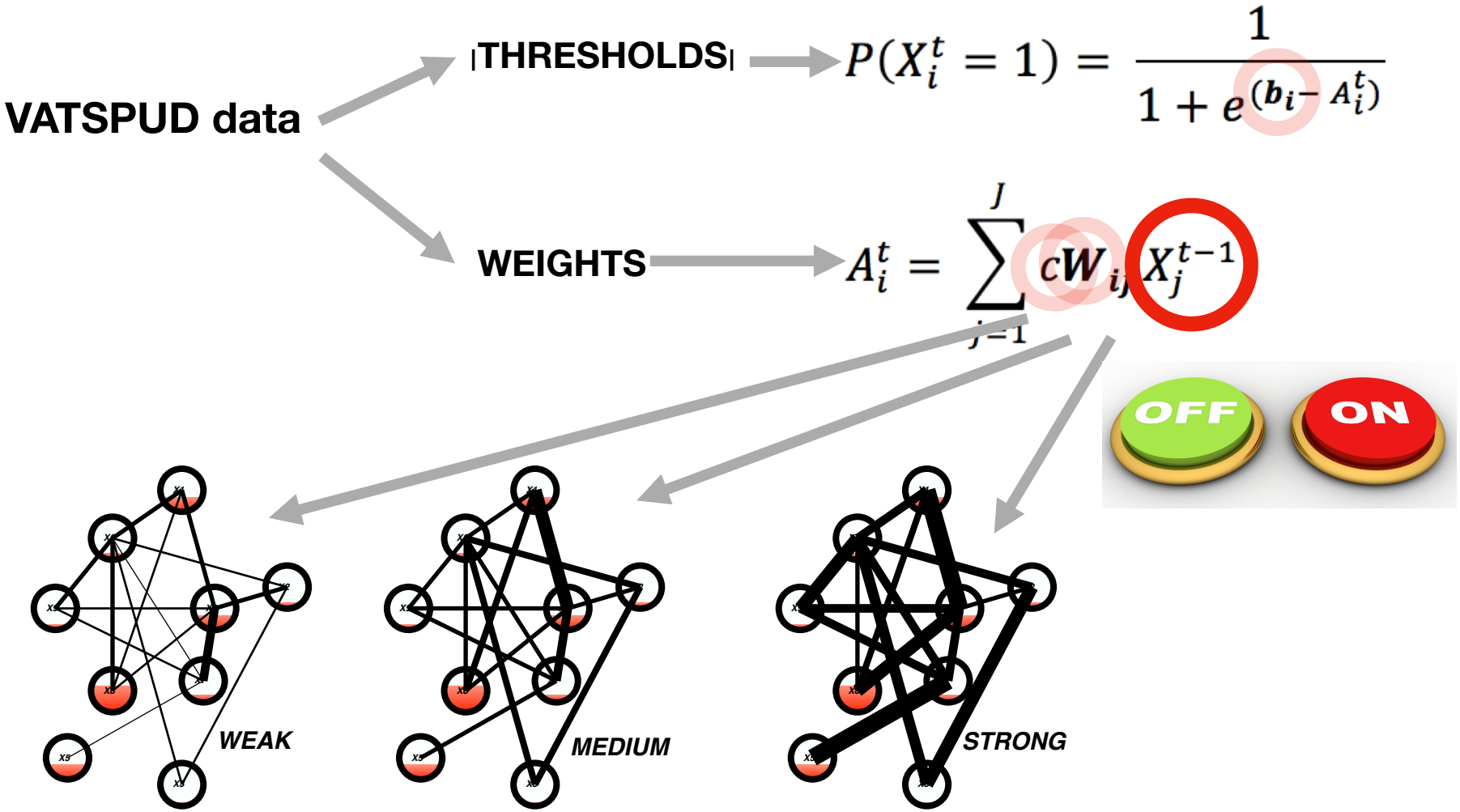
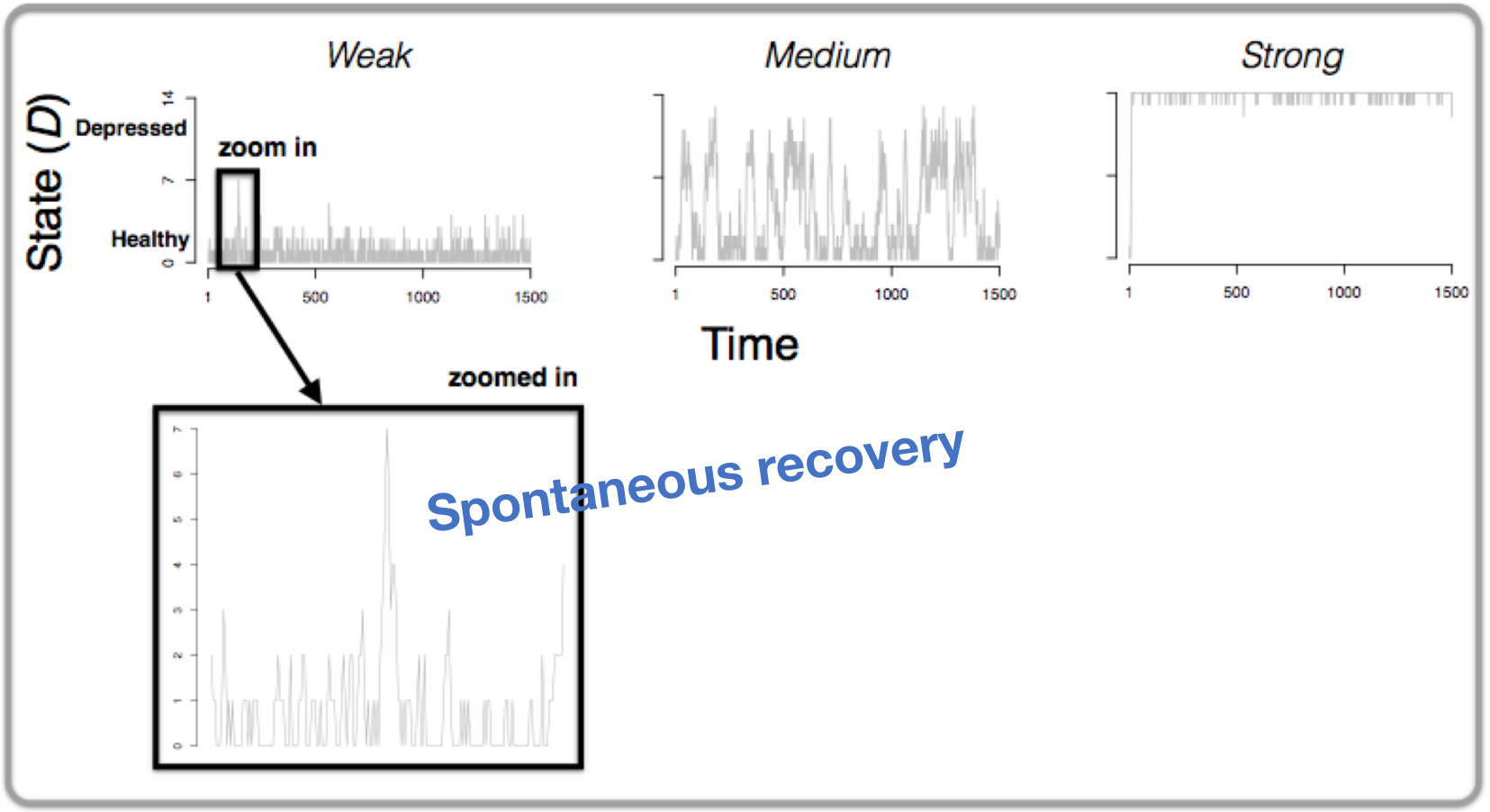


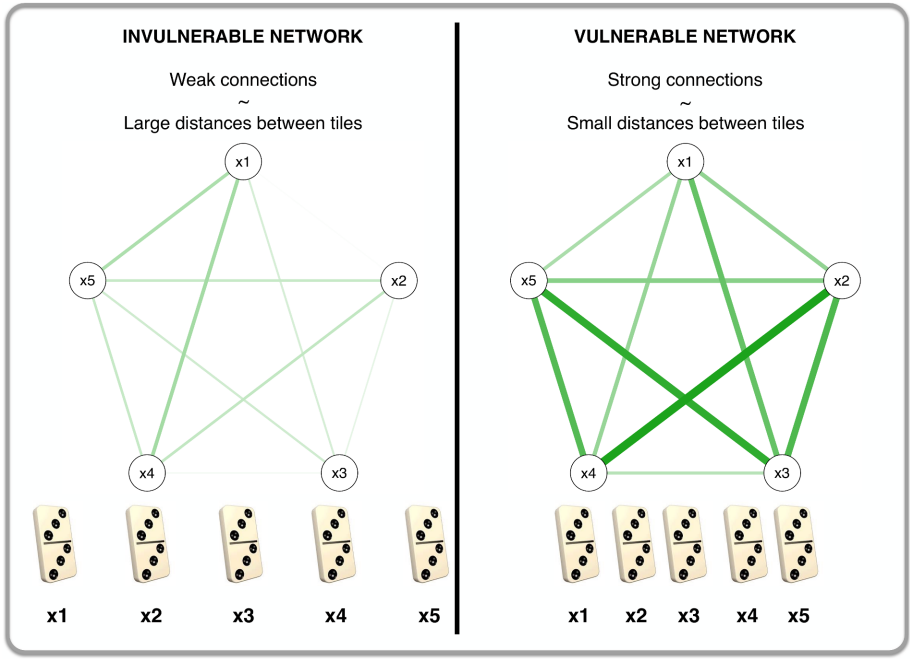
A simulation study: results



Project: Resilience Indicators for Psychological Networks

- We know the **connectivity** of the edge weights influences symptom activation spread (Cramer, van Borkulo, Giltay, van der Maas, Kendler, Scheffer & Borsboom, 2016)

- How does the **architecture** of a network influence its resilience?



Cramer et al., 2016,

Fig 1: An analogy between vulnerability in a network and spacing of domino tiles.

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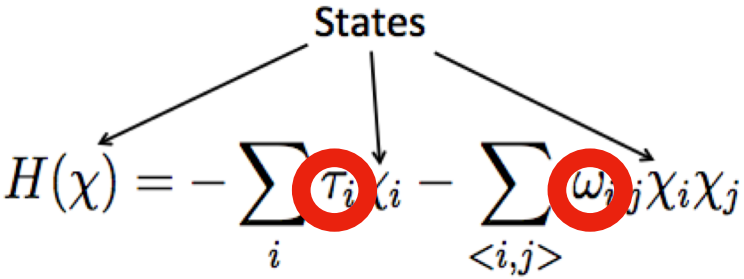
Dynamical network model of resilience

Positive and negative nodes

Ising model

Van Borkulo et al., 2014



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Dynamical network model of resilience

Glauber dynamics

Detailed Balance

$$\frac{Pr(\chi_i)}{Pr(\chi_j)} = e^{(\Delta E_{\chi i - \chi j}\beta)}$$

Flip Probability Formula

$$Pr(\chi_i \rightarrow -\chi_j) = 1/(1 + e^{(\Delta E_{\chi i - \chi j}\beta)})$$

Dalege et al. (2018)

Transformation to Y = {0,1}

$$x_i = \frac{1}{2}(y_i + 1) \text{ with inverse relation } y_i = 2x_i - 1$$

Haslbeck, Kruis & Marsman (in preparation)

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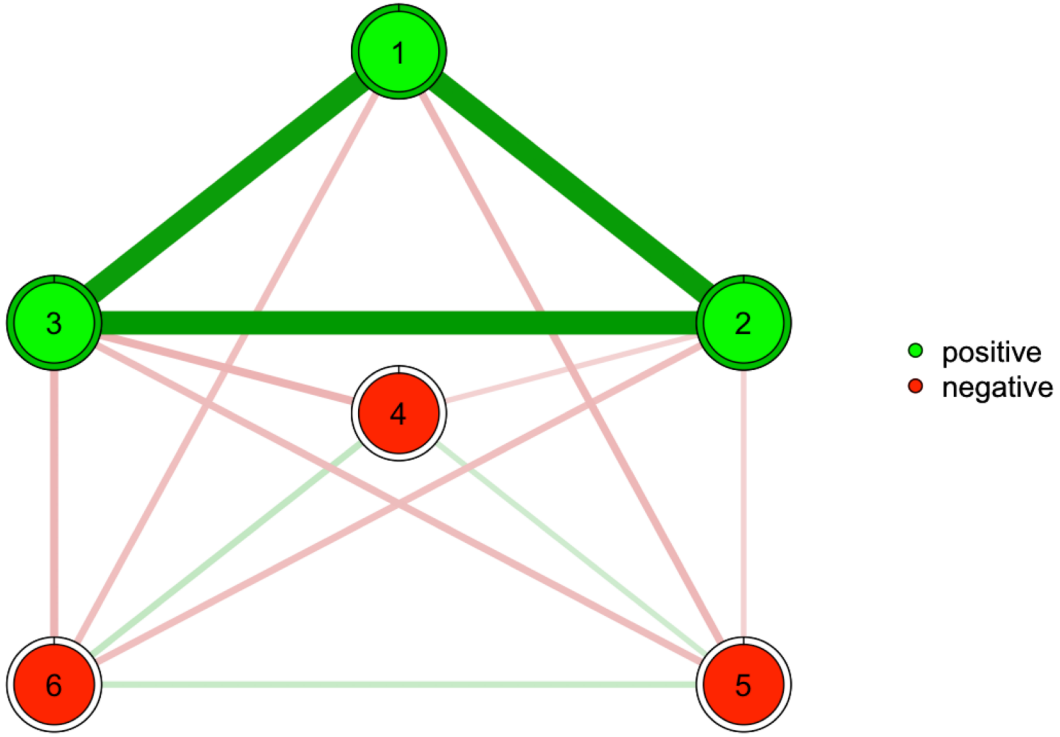
How does the architecture of a network influence its resilience?



Shiny Happy Harry

System Architecture

High thresholds of positive nodes

High connectivity between positive cluster

Low connectivity in negative cluster

Low thresholds of negative nodes

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Project: Resilience Indicators for Psychological Networks

How does the architecture of a network influence its resilience?

Miserable Mark

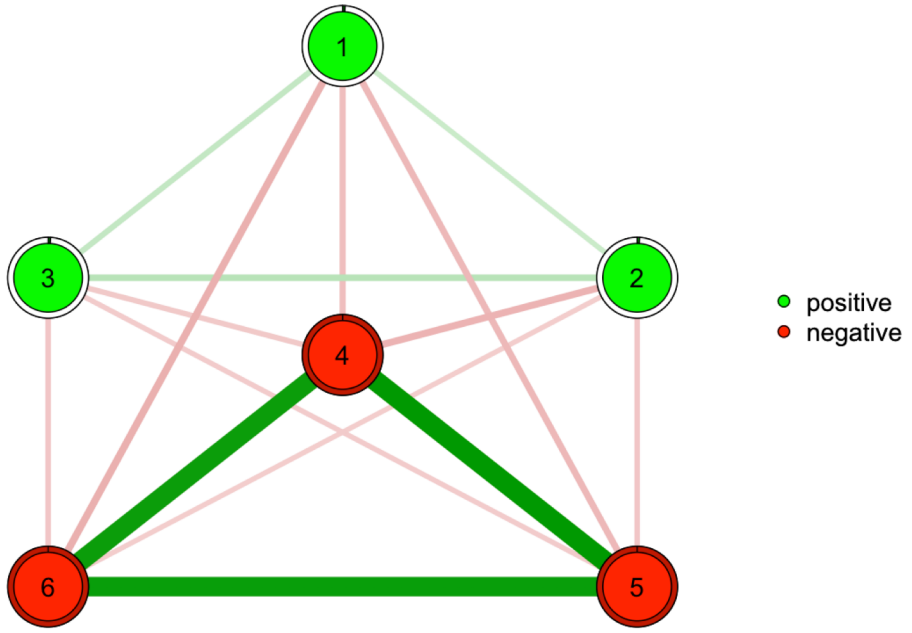
System Architecture

High thresholds of negative nodes

High connectivity in negative cluster

Low thresholds of positive nodes

Low connectivity in positive cluster



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Shiny simulation in R

https://gabylunansky.shinyapps.io/shinyappresilience/

Lunansky, van Borkulo, Bringmann, Gijzel, Hartmann, Wichers & Cramer

(in preparation)






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Conclusions

We are taking the first steps into forming a theoretical network model of resilience

Resilience indicators could help taking the next step in network psychometrics, helping to evaluate and predict the future state of the network by looking at the structure of the network

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Thank you for your attention!

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