

# **Vulnerability to develop psychopathology: A catastrophe**

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**Claudia van Borkulo  
University of Amsterdam**







# Outline

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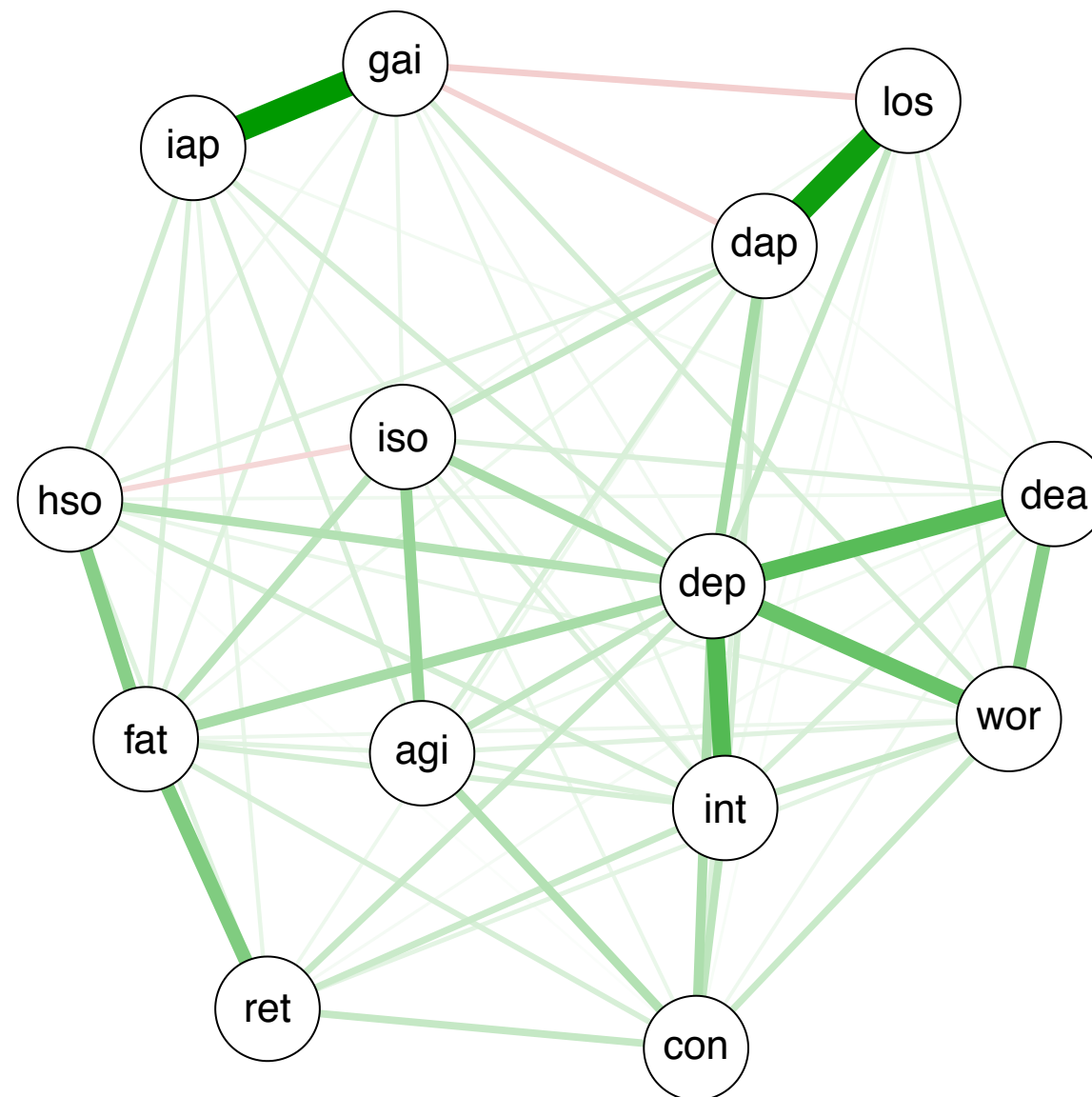
- Mental disorders as complex dynamical systems
- What is vulnerability from systems perspective?
- Simulation study
- Conclusion and discussion





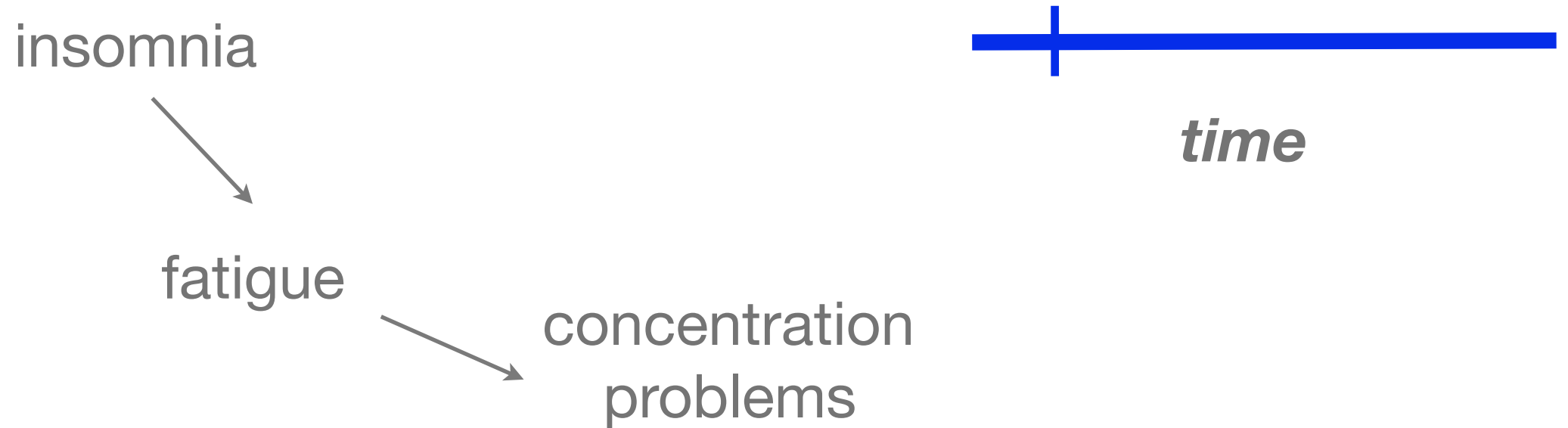
# Mental disorders as complex dynamical systems

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# Major depression: a network of symptoms

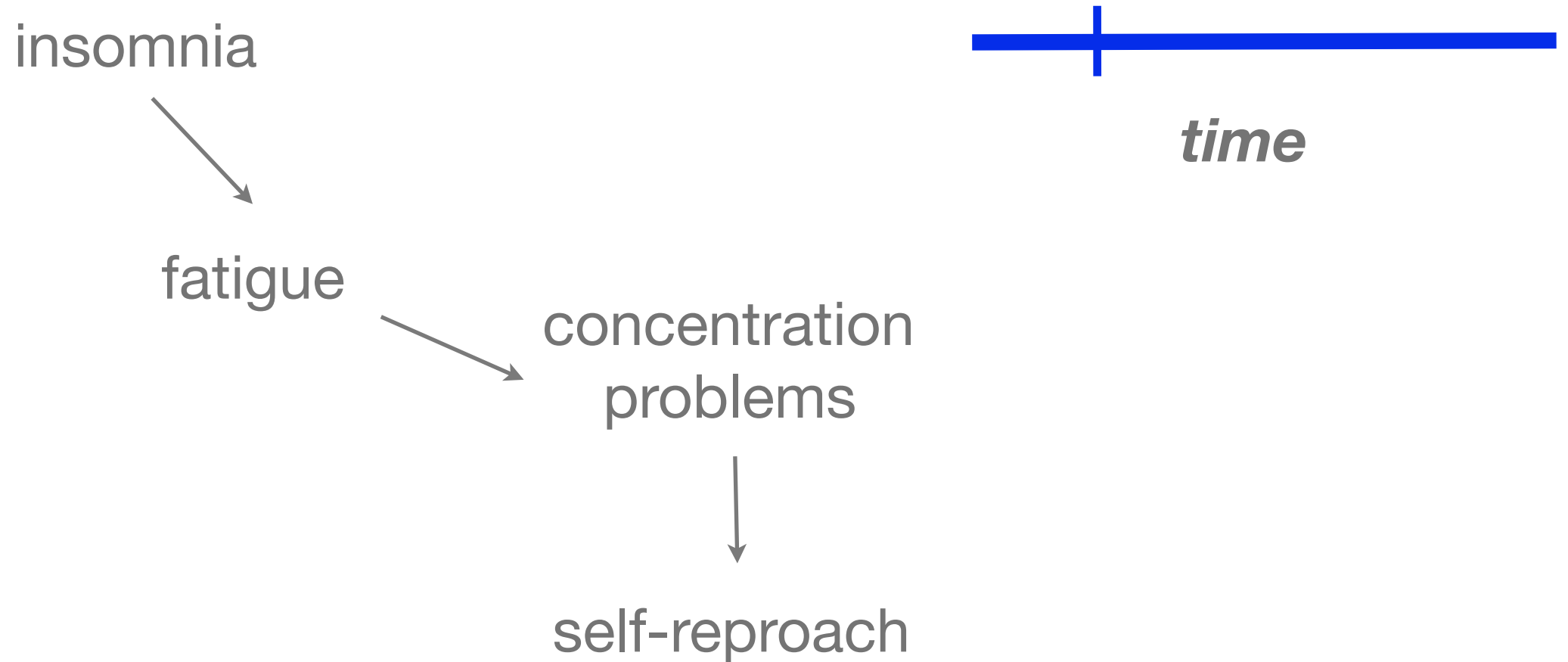
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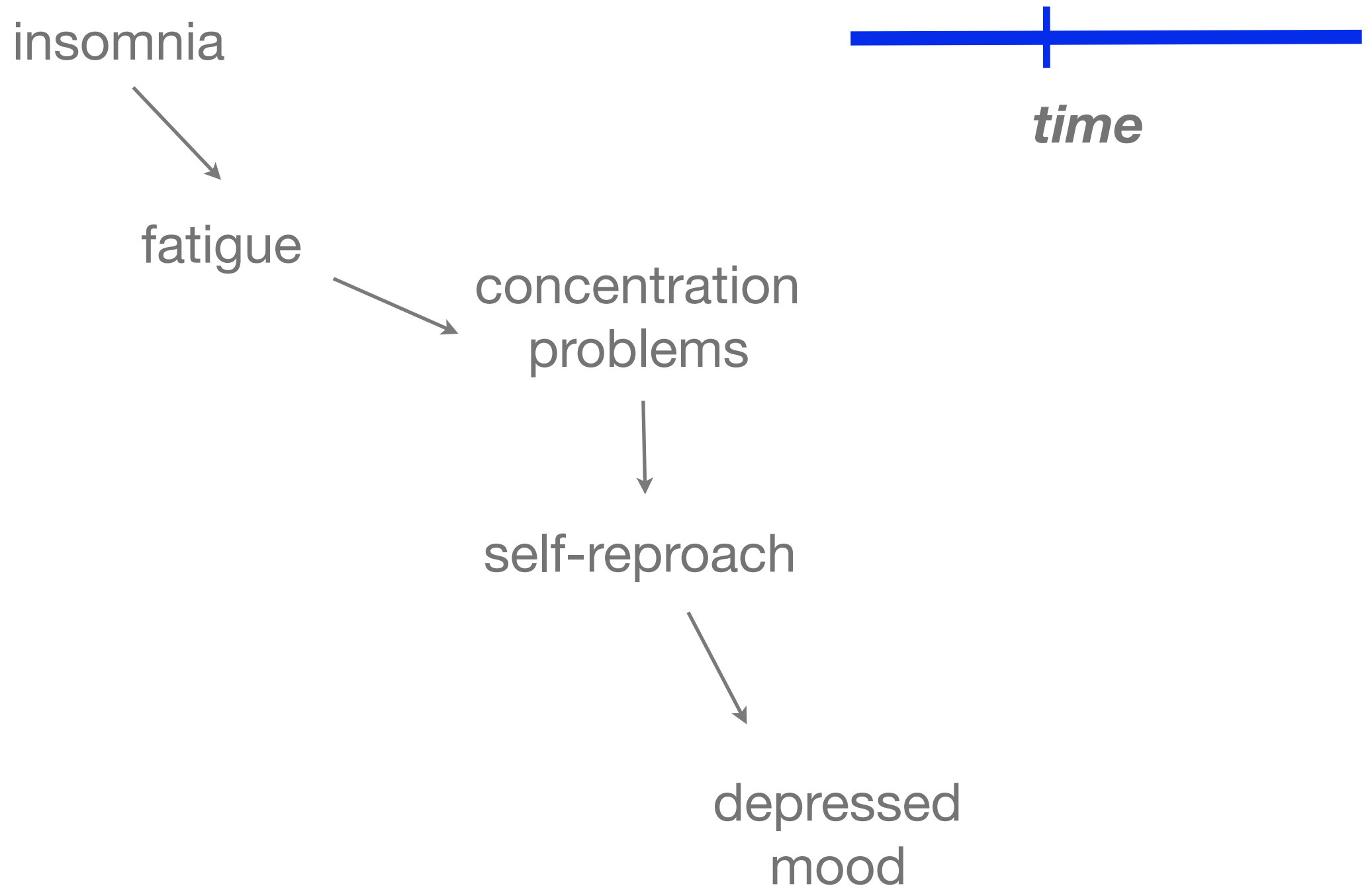
# Major depression: a network of symptoms

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# Major depression: a network of symptoms

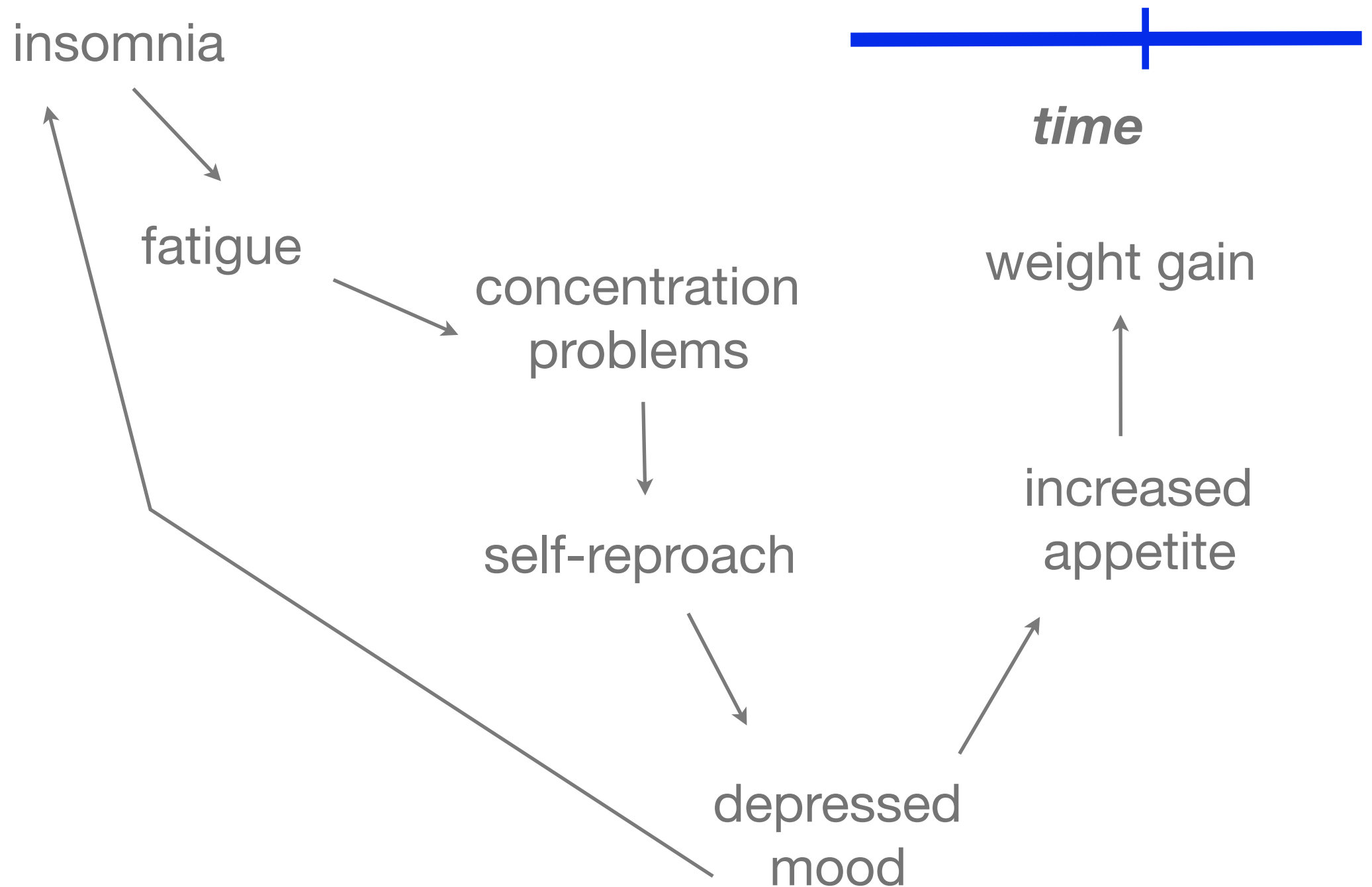
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# Major depression: a network of symptoms

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# Vulnerability in a network model

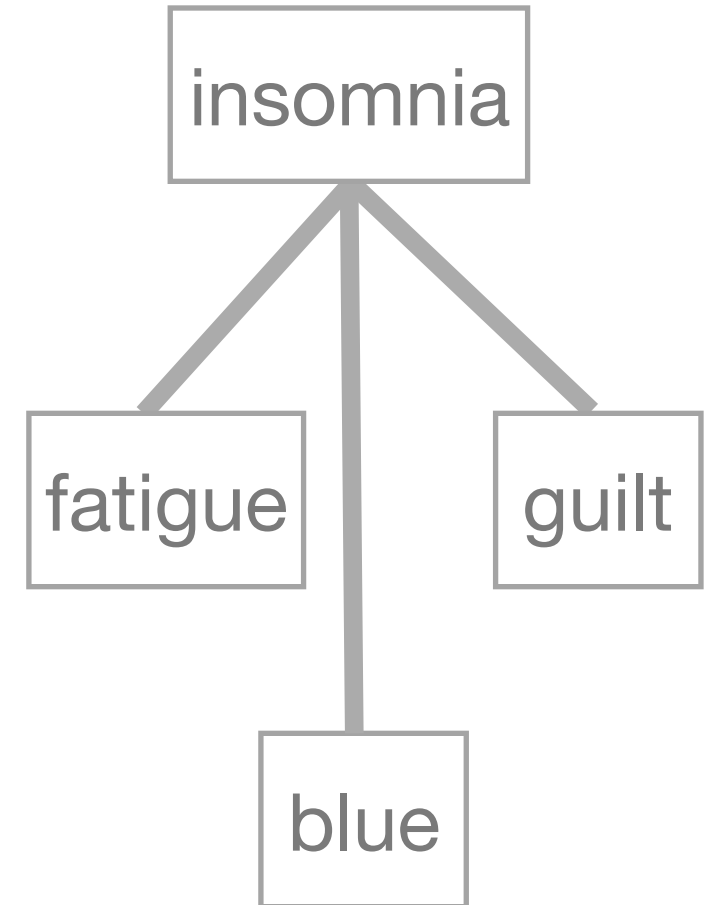
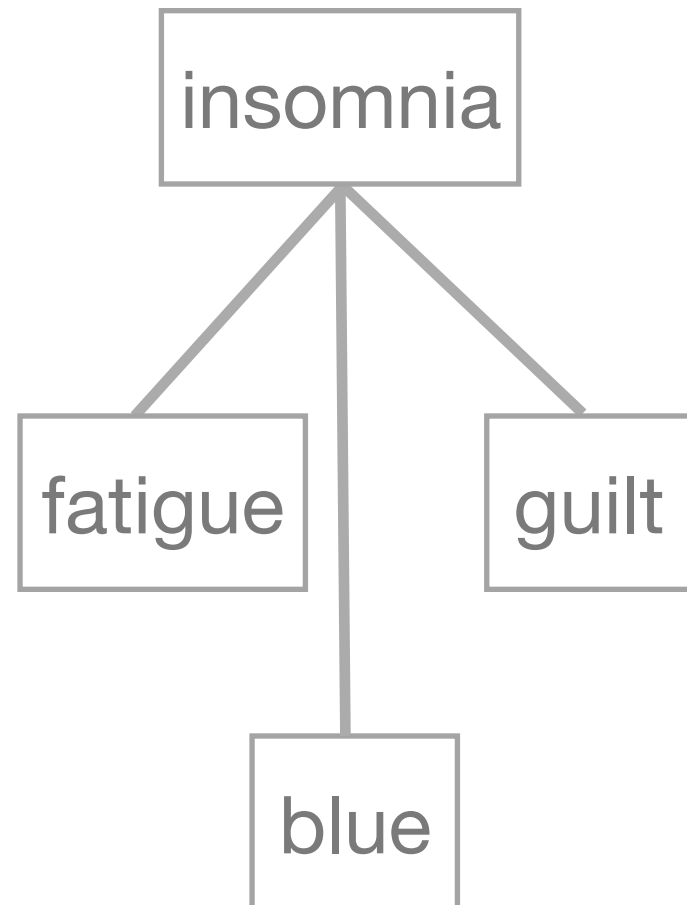
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# Vulnerability might reside in connection strength

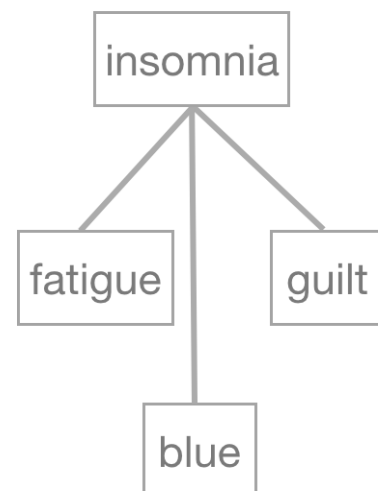
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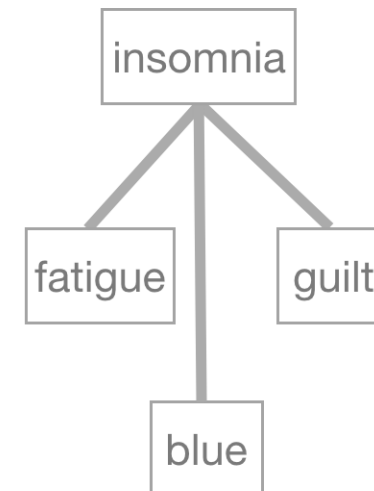
# Vulnerability might reside in connection strength

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## RESILIENT



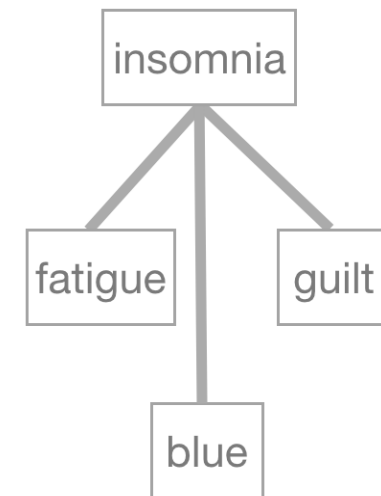
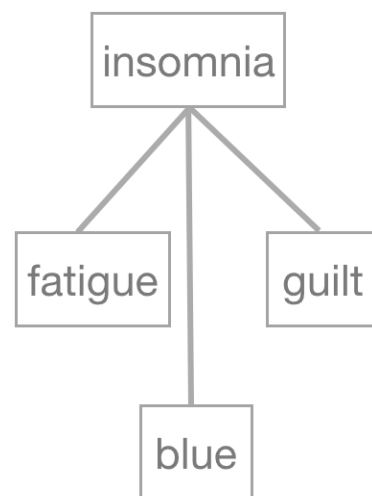
## VULNERABLE





# Vulnerability might reside in connection strength

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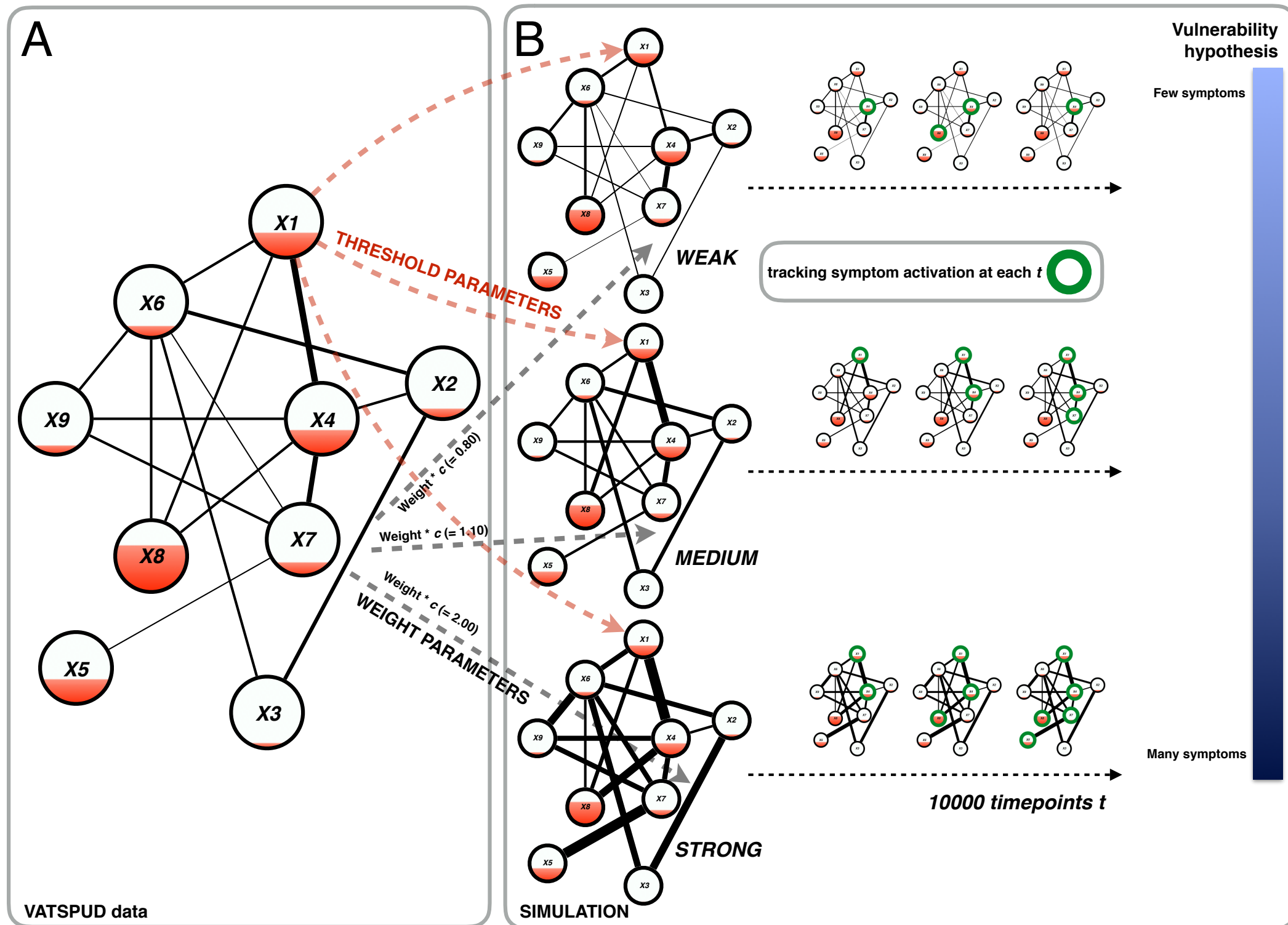
# A simulation study

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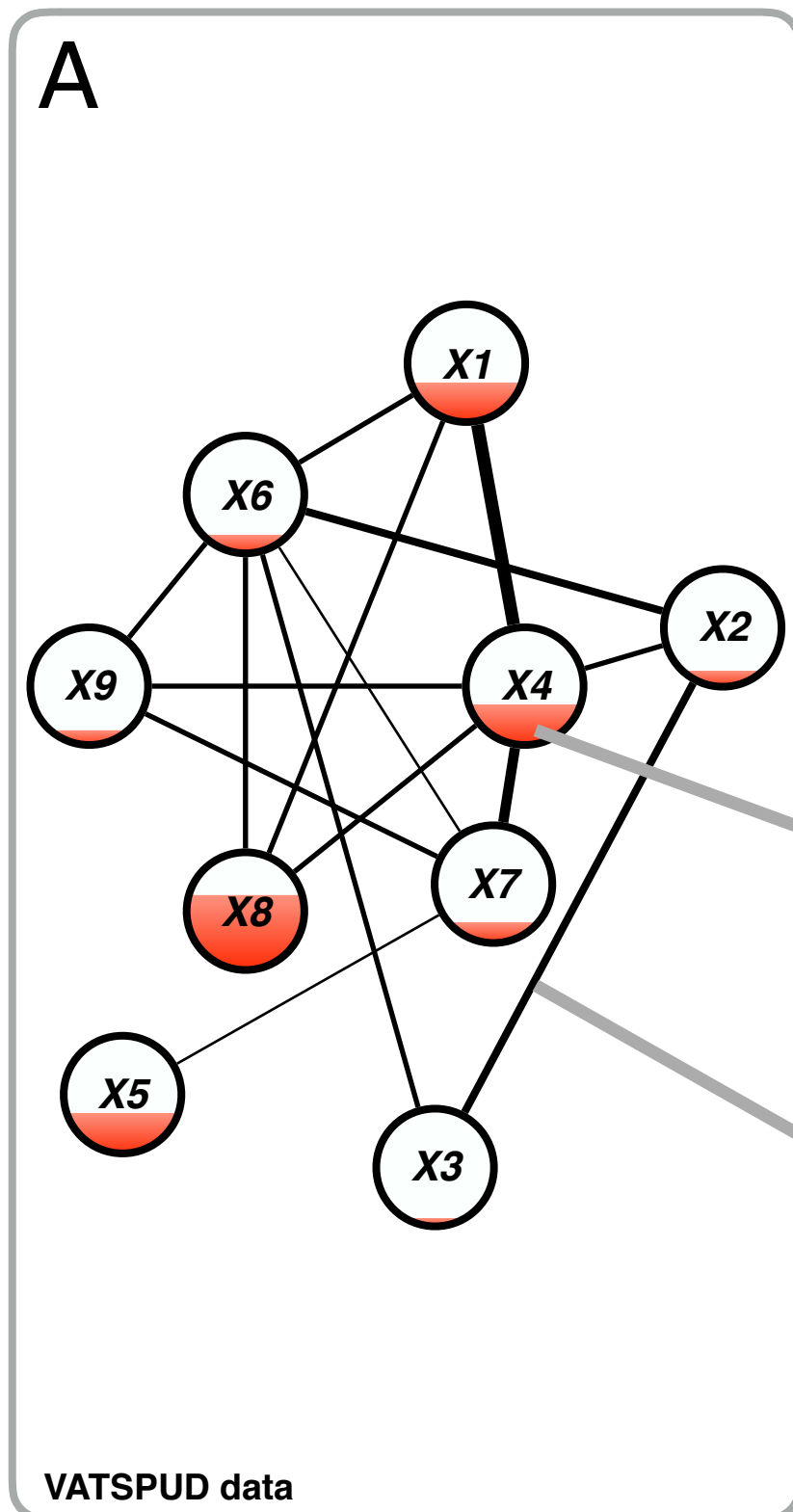




# A simulation study: setup



# A simulation study: setup



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

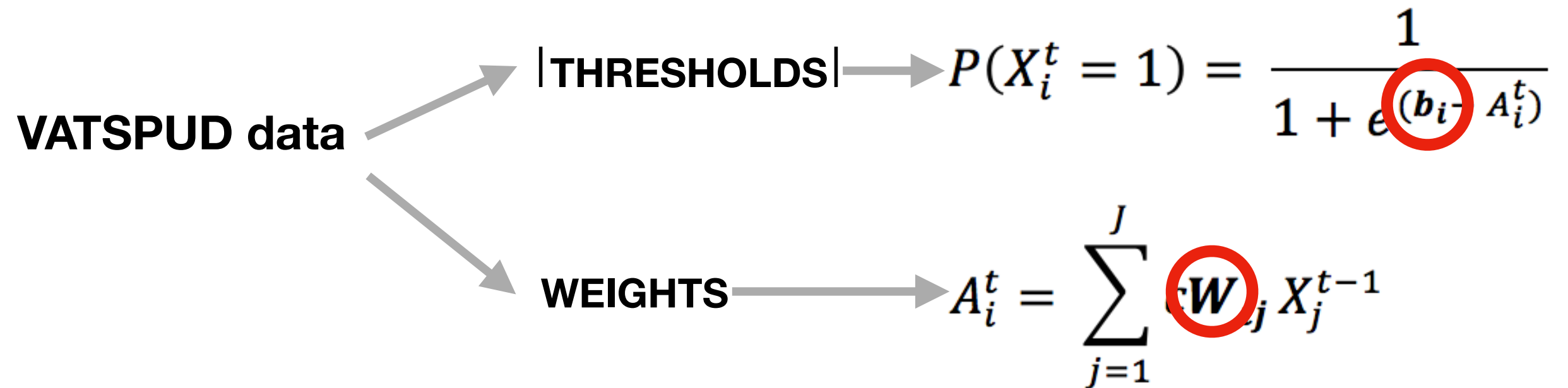
**THRESHOLD PARAMETERS**

**WEIGHT PARAMETERS**

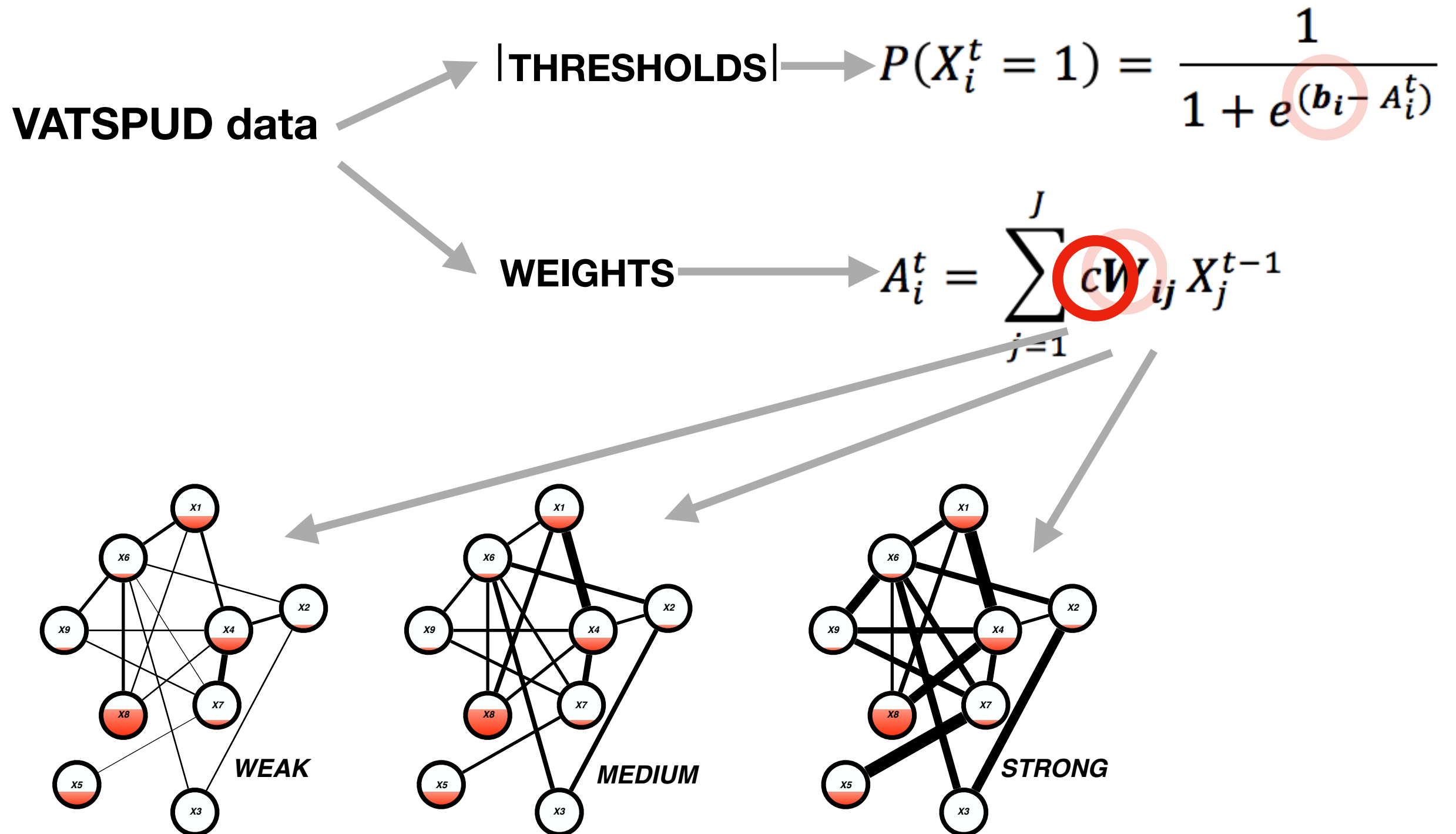


# A simulation study: setup

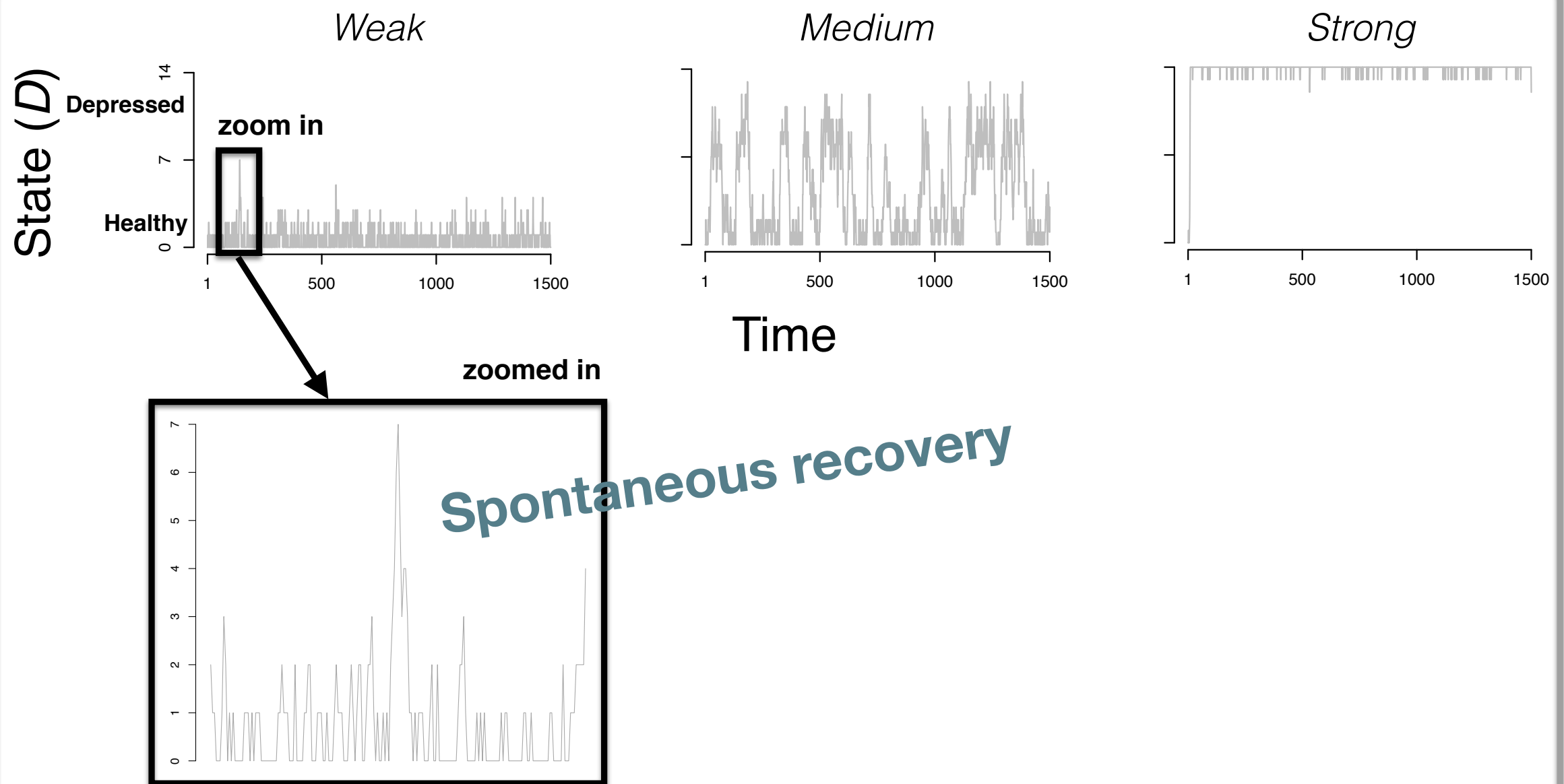
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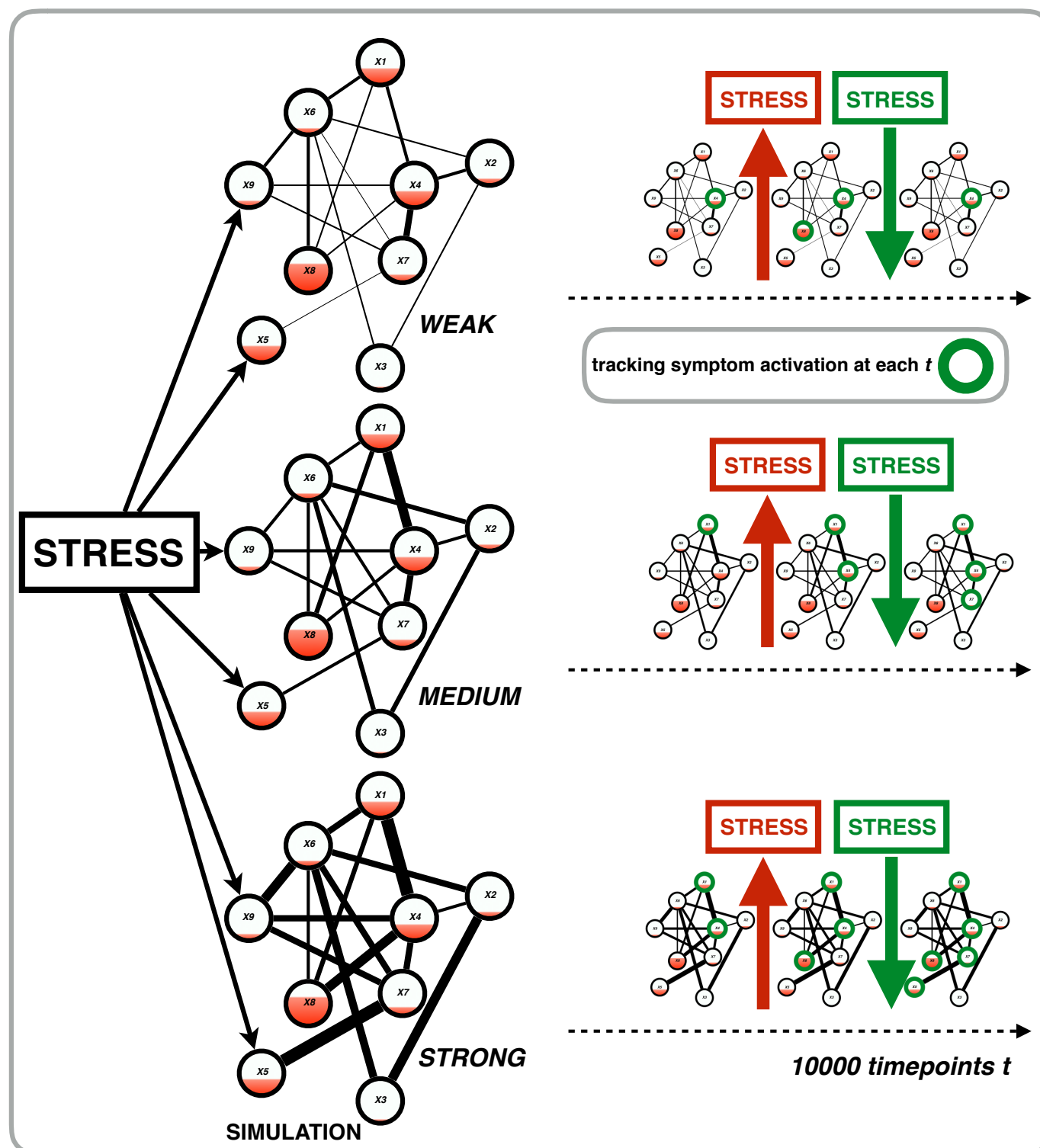
# A simulation study: setup



# A simulation study: results



# A simulation study with stress: setup



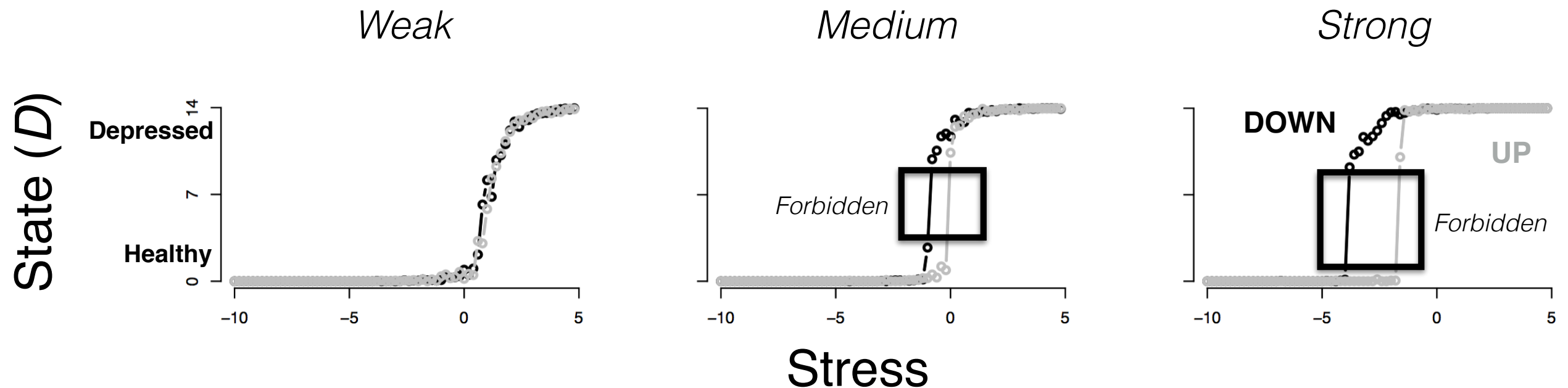
$$A_i^t = \sum_{j=1}^J cW_{ij} X_j^{t-1} + S_i^t$$

STRESS



# A simulation study with stress: results

## Continuum OR taxon depending on connectivity



**CONTINUUM**

**TAXON**

Cramer, A. O. J., Van Borkulo, C. D., Giltay, E. J., Van der Maas, H. L. J., Kendler, S. K., Scheffer, M., & Borsboom, D. (2016). Major depression as a complex dynamic system. PLoS ONE, 11(12):e0167490.

# Conclusion and discussion

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- Vulnerability in a network model seems associated with connectivity
- BUT: confirm with empirical data
- BUT: multiple ways to be vulnerable (e.g., thresholds)
- Worst case scenario is stress on a strongly connected system: discontinuity, hysteresis
- ???

# Conclusion and discussion

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There is some evidence in empirical studies:

- “...individuals with high levels of neuroticism had a denser emotion network compared with their less neurotic peers” (students; Bringmann et al., 2016)
- “individuals with MDD had a denser overall emotion network than did healthy control individuals” (healthy versus depressed; Pe et al., 2015)
- “Individuals with a clinical diagnosis had more strongly connected moment-to-moment structures” (healthy versus disordered; Wigman et al., 2015)
- “...persisters exhibited a more densely connected network at baseline than remitters” (patients; van Borkulo et al., 2015)

# Thank you!

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# References and contact info

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Cramer, A. O. J., Van Borkulo, C. D., Giltay, E. J., Van der Maas, H. L. J., Kendler, S. K., Scheffer, M., & Borsboom, D. (2016). Major depression as a complex dynamic system. *PLoS ONE*, 11(12):e0167490.

Bringmann, L. F., Pe, M. L., Vissers, N., Ceulemans, E., Borsboom, D., Vanpaemel, W., . . . Kuppens, P. (2016, August). Assessing Temporal Emotion Dynamics Using Networks. *Assessment*, 23(4), 425–435. doi: 10.1177/1073191116645909

Pe, M. L., Kircanski, K., Thompson, R. J., Bringmann, L., Tuerlinckx, F., Mestdagh, M., . . . Gotlib, I. H. (2015). Emotion-Network Density in Major Depressive Disorder. *Clinical Psychological Science*, 3(2), 292–300.

Van Borkulo, C. D., Borsboom, D., Epskamp, S., Blanken, B. W., Bosschloo, L., Schoevers, R. A., & Waldorp, L. J. (2014). A new method for constructing networks from psychometric data. *Scientific Reports* 4, 5918; DOI: 10.1038/srep05918.

Van Borkulo, C. D., Boschloo, L., Borsboom, D., Penninx, B. W. J. H., Waldorp, L. J., & Schoevers, R. A. (2015). Association of Symptom Network Structure With the Course of Depression. *JAMA Psychiatry*, 72(12), 1219–1226.

Wigman, J. T. W., van Os, J., Borsboom, D., Wardenaar, K. J., Epskamp, S., Klippel, A., . . . Wichers, M. (2015). Exploring the underlying structure of mental disorders: cross-diagnostic differences and similarities from a network perspective using both a top-down and a bottom-up approach. *Psychological Medicine*, 45(11), 2375–2387.

<http://cvborkulo.com>  
[cvborkulo@gmail.com](mailto:cvborkulo@gmail.com)