Exploratory and Confirmatory Bayesian Networks Identify the Central Role of Non-judging in Symptoms of Depression

BayesiaLab Conference 10/25/22

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Palo Alto University

No conflicts of interest to report

Overview

- Network theory in clinical psychology
- Gaussian Graphical Models
- Depression
- Mindfulness
- Bayesian Gaussian Graphical Modeling
- Methods
- Results
- Conclusion

Network Theory of Mental Health

- How do we conceptualize mental health disorders?
- Historically within the medical model as a dichotomous yes/no
- Network theory:
  - Symptoms (“nodes”)
  - Connections between nodes represent causal factors in the disorder

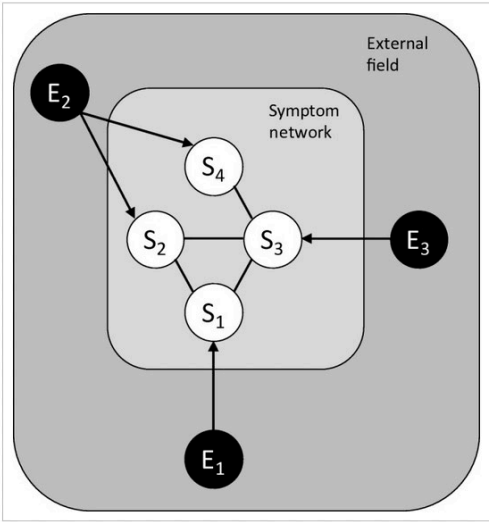
World Psychiatry
OFFICIAL JOURNAL OF THE WORLD PSYCHIATRIC ASSOCIATION (WPA)

Special Article | Free Access

A network theory of mental disorders

Denny Borsboom

First published: 26 January 2017 | https://doi.org/10.1002/wps.20375 | Citations: 862



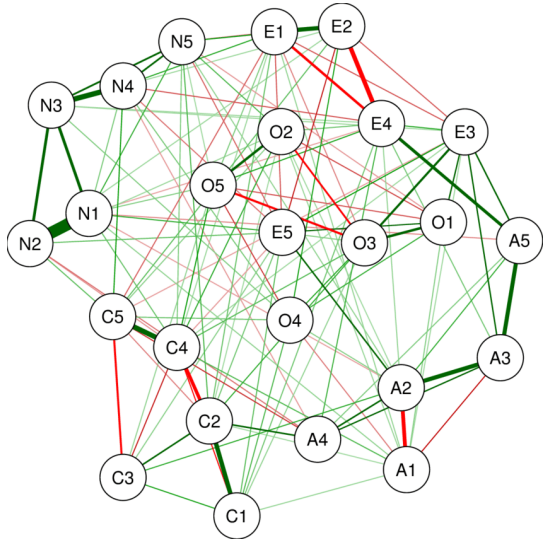
Gaussian Graphical Models

- A network of partial correlations (many ways to correct for multiple comparisons/‘tune’/regularize the network)
- Cross-sectional
- Undirected
- Where data are continuous & assumed normally distributed

Brief Report on Estimating Regularized Gaussian Networks from Continuous and Ordinal Data

January 2017

Sacha Epskamp



Network Analysis & Clinical Psychology

- Used to elucidate interconnections between symptoms within and across mental health concerns and related constructs --> rapid growth in the past decade
  - Concerns about the use of sum-scores
  - Interrelations within disorders influencing treatment efficacy

Review | Open Access | Published: 06 April 2015

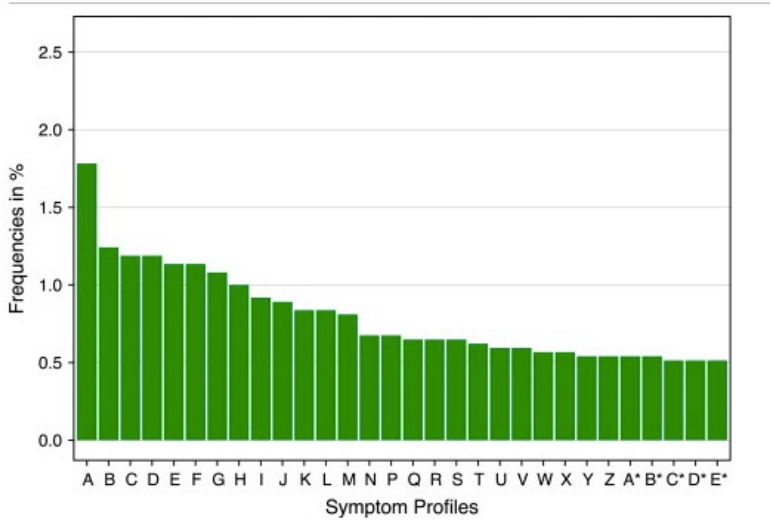
Depression sum-scores don't add up: why analyzing specific depression symptoms is essential

Eiko I Fried ✉ & Randolph M Nesse

BMC Medicine **13**, Article number: 72 (2015) | Cite this article

Depression

- Depression is a prevalent mental health concern (8.4% of U.S. Adults)
- Depression is heterogeneous, comprised of a number of symptoms
  - Depressed mood; diminished interest/pleasure; weight/appetite increase/decrease; insomnia/hypersomnia; psychomotor disturbance; fatigue or loss of energy; feelings of worthlessness or guilt' difficulty thinking or concentration; recurrent thoughts of death or suicidal ideation



Depression

- Some depression symptoms may be more central/influential

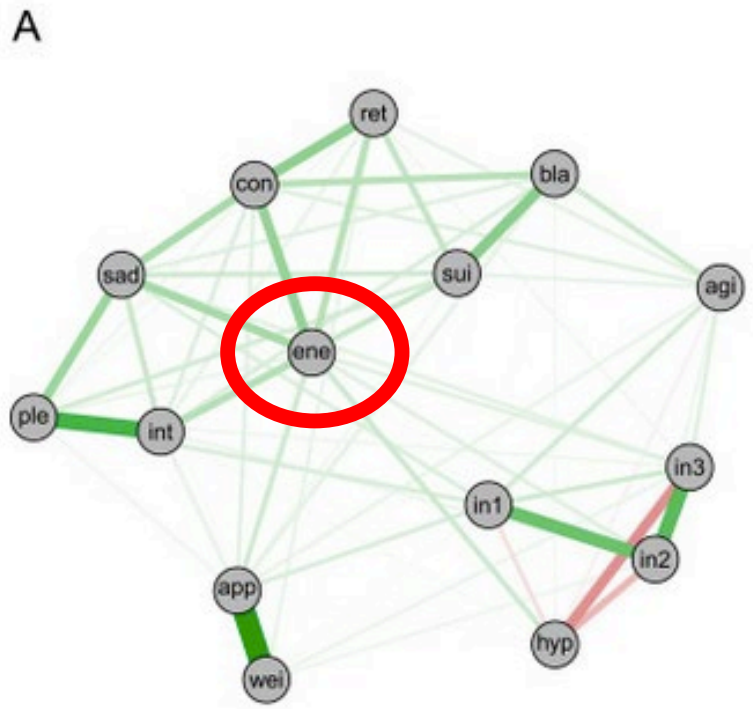
ELSEVIER

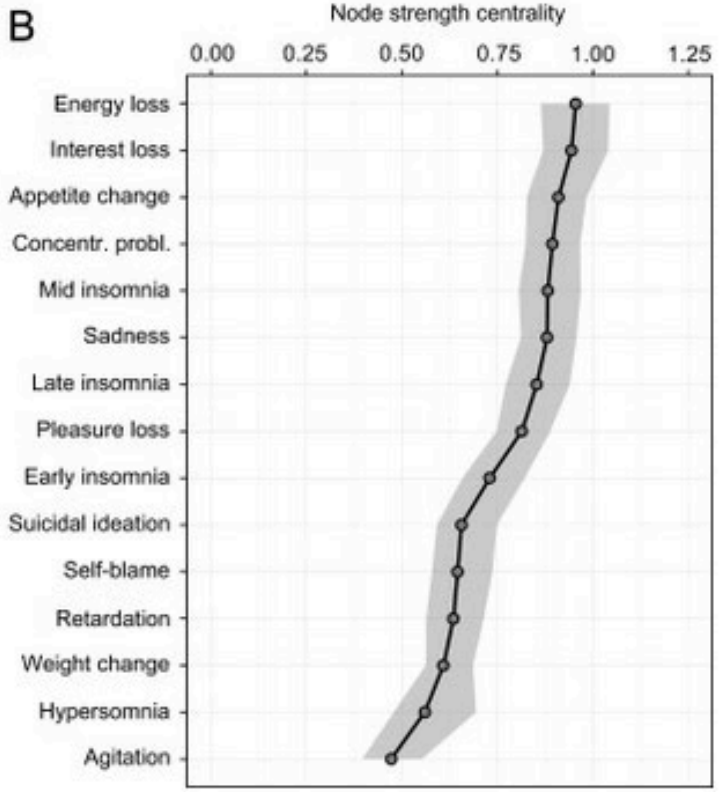
Journal of Affective Disorders
Volume 189, 1 January 2016, Pages 314-320

Research report

What are 'good' depression symptoms? Comparing the centrality of DSM and non-DSM symptoms of depression in a network analysis

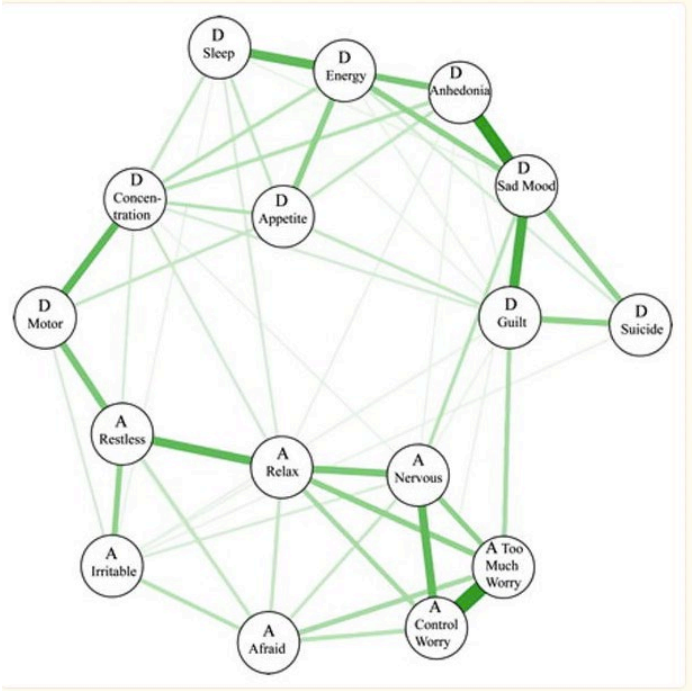
Eiko I. Fried [a], Sacha Epskamp [b], Randolph M. Nesse [c], Francis Tuerlinckx [a], Denny Borsboom [b]

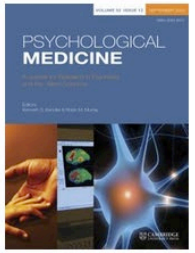




Depression + …

- Networks analysis also offers a way to examine interrelations between related psychological constructs
- Experiencing more than one mental health concern at a time *is more common* than experiencing only a single concern





Psychological Medicine

Network analysis of depression and anxiety symptom relationships in a psychiatric sample

Published online by Cambridge University Press: **14 September 2016**

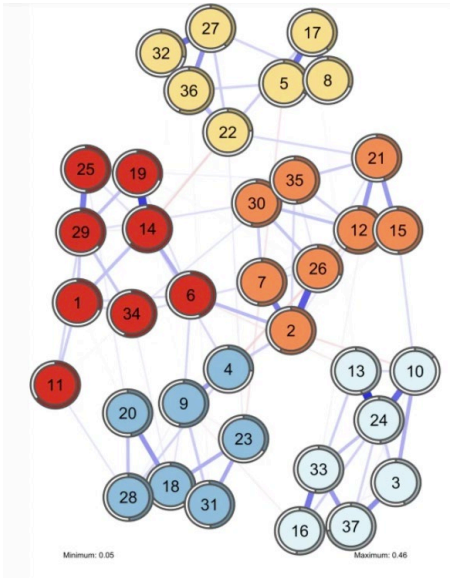
C. Beard, A. J. Millner, M. J. C. Forgeard, E. I. Fried, K. J. Hsu, M. T. Treadway, C. V. Leonard, S. J. Kertz and T. Björgvinsson

Show author details

Article | Supplementary materials | Metrics

Mindfulness

- Mindfulness is both a state of heightened awareness as well as a multi-faceted trait
- The five facets (of the FFMQ) are:
  - Observing
  - Describing
  - Acting with Awareness
  - Nonjudging (to inner experience)
  - Nonreactivity (to inner experience)



A Network Analysis of the Five Facets Mindfulness Questionnaire (FFMQ)

Oscar Lecuona, Carlos García-Rubio, Sara de Rivas, Jennifer E. Moreno-Jiménez, Rosa Marta Meda-Lara & Raquel Rodríguez-Carvajal

Mindfulness **12**, 2281–2294 (2021) | Cite this article

Mindfulness + …

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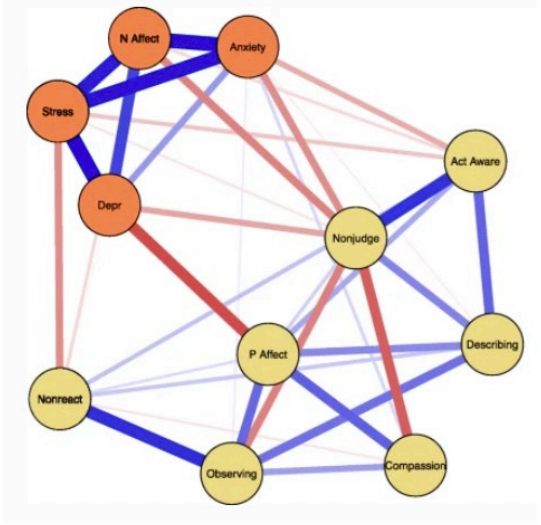

Network Analysis of Mindfulness Facets, Affect, Compassion, and Distress

Oleg N. Medvedev ✉, Matti Cervin, Barbara Barcaccia, Richard J. Siegert, Anja Roemer & Christian U. Krägeloh

Mindfulness **12**, 911–922 (2021) | Cite this article

Mindfulness + Depression

- Associations between overall mindfulness and depression

ELSEVIER

Behavior Therapy

Volume 44, Issue 3, September 2013, Pages 373-384

Mapping Mindfulness Facets Onto Dimensions of Anxiety and Depression

Alethea Desrosiers, David H. Klemanski, Susan Nolen-Hoeksema

Investigating Unique Contributions of Dispositional Mindfulness Facets to Depression, Anxiety, and Stress in General and Student Populations

Oleg N. Medvedev, Phoenix A. Norden, Christian U. Krägeloh & Richard J. Siegert

Mindfulness **9**, 1757–1767 (2018) | Cite this article

Depression & Anxiety

OFFICIAL PUBLICATION OF THE ANXIETY AND DEPRESSION ASSOCIATION OF AMERICA

ADAA

Anxiety & Depression Association of America

Research Article | Full Access

MINDFULNESS AND EMOTION REGULATION IN DEPRESSION AND ANXIETY: COMMON AND DISTINCT MECHANISMS OF ACTION

Alethea Desrosiers Ph.D., Vera Vine M.S., David H. Klemanski Psy.D., Susan Nolen-Hoeksema Ph.D.

First published: 16 April 2013 | https://doi.org/10.1002/da.22124 | Citations: 174

Mindfulness + Depression

- Mindfulness based treatments for depression are effective!

Mindfulness-based cognitive therapy for the treatment of current depressive symptoms: a meta-analysis

Simon B. Goldberg, Raymond P. Tucker, Preston A. Greene, Richard J. Davidson, David J. Kearney & Tracy L. Simpson

Pages 445-462 | Received 17 Jul 2018, Accepted 24 Nov 2018, Published online: 08 Feb 2019

Download citation https://doi.org/10.1080/16506073.2018.1556330 Check for updates

The effects of mindfulness-based stress reduction on depression, anxiety, and stress in older adults: A systematic review and meta-analysis

Simon Yat Ho Li RN (Psy), BN, Daniel Bressington RN (MH), PhD

First published: 17 January 2019 | https://doi.org/10.1111/inm.12568 | Citations: 37

ELSEVIER

Psychiatry Research

Volume 187, Issue 3, 30 May 2011, Pages 441-453

Review article

Mindfulness based cognitive therapy for psychiatric disorders: A systematic review and meta-analysis

Alberto Chiesa, Alessandro Serretti

Mindfulness + Depression

- Mindfulness based treatments for depression are effective!
- But only *on average* – some individuals do not benefit

→ an important aim for data-driven research is to figure out potential *targets* to personalize interventions and increase efficacy

Bayesian Gaussian Graphical Models

- Facilitates several important extensions for cross-sectional data:
  - Bayesian estimation (using matrix-F prior distribution)
    - Includes posterior uncertainty intervals
  - Bayesian hypothesis testing
  - Comparing GGMs


Original Articles

Bayesian Estimation for Gaussian Graphical Models: Structure Learning, Predictability, and Network Comparisons

Donald R. Williams

Pages 336-352 | Published online: 19 Mar 2021

Download citation https://doi.org/10.1080/00273171.2021.1894412 Check for updates

Exploratory and Confirmatory Bayesian Networks Identify the Central Role of Non-judging in Symptoms of Depression: Aims

- To better understand how mindfulness and depression interrelate on a *facet/symptom* level
- Develop a targeted hypothesis to test in future research
- Address heterogeneity in *measurement* of depression symptoms through replication across multiple samples/measures

Mindfulness
https://doi.org/10.1007/s12671-021-01726-1

ORIGINAL PAPER

Exploratory and Confirmatory Bayesian Networks Identify the Central Role of Non-judging in Symptoms of Depression

Mikael Rubin[1] · Santiago Papini[1] · Justin Dainer-Best[2] · Eric D. Zaizar[1] · Jasper A. J. Smits[1] · Michael J. Telch[1]

Accepted: 7 August 2021

Exploratory and Confirmatory Bayesian Networks Identify the Central Role of Non-judging in Symptoms of Depression: Methods

- *Five Facet Mindfulness Questionnaire-15 (FFMQ-15;* Baer et al., 2008). The FFMQ-15 is a 15-item self-report measure that assesses the five components of mindfulness, including: (1) Observing; (2) Describe; (3) Act with Awareness; (4) Non-judging; and (5) Non-reactivity. Participants rated the truth of each statement on a 5-point scale from “never or very rarely true” to “very often or always true”.
- *Patient Health Questionnaire – 8 (PHQ-8;* Kroenke et al., 2009). The PHQ-8 is an 8-item self-report scale assessing symptoms of depression. Participants rated how often they had been bothered by each concern within the last two weeks on a 4-point scale (0-3) from “not at all” to “nearly every day”.
- *Depression, Anxiety, and Stress Scale (DASS-21;* Henry & Crawford, 2005): The DASS-21 is a 21-item self-report questionnaire designed to measure the severity of symptoms common to both Depression and Anxiety. Responders are required to indicate the presence of a symptom over the previous week. Each item is scored from 0 (did not apply to me at all over the last week) to 3 (applied to me very much or most of the time over the past week). For the current study, only the depression subscale was administered.

Exploratory and Confirmatory Bayesian Networks Identify the Central Role of Non-judging in Symptoms of Depression: Methods

Table 1. Demographic Summary			
	Sample 1 (n=384)	Sample 2 (n=350)	Sample 3 (n=401)
	Mean (SD)		
Age	22.89 (9.92)	18.96 (1.40)	24.84 (11.06)
FFMQ-15 total	45.92 (6.87)	41.52 (7.71)	46.48 (6.99)
PHQ-8 Total Score	8.99 (6.05)	N/A	9.42 (6.37)
DASS-21 Depression subscale	N/A	25.13 (9.81)	28.56 (10.83)
	No. (%)		
Sex (female)	238 (62.0)	267 (76.3)	261 (65.1)
Ethnicity (Hispanic)	119 (31.0)	118 (33.7)	133 (33.2)
Race			
Hispanic	89 (23.2)	64 (18.3)	69 (17.2)
Black or African American	19 (4.9)	17 (4.9)	25 (6.2)
Asian	65 (16.9)	89 (25.4)	62 (15.5)
White	190 (49.5)	133 (38.0)	204 (50.9)
Multiple	44 (11.5)	47 (13.4)	39 (9.7)
American Indian or Alaska Native	0 (0)	0 (0)	1 (.2)
Native Hawaiian or Other Pacific Islander	0 (0)	0 (0)	1 (.2)
Unknown/not reported	2 (0.5)	0 (0)	0 (0)
Sample (community)	57 (14.8)	0 (0)	142 (35.1)
Possible Depression (PHQ-8 ≥ 10)	164 (42.7)	N/A	178 (44.4)
High Depression (DASS subscale ≥ 21)	N/A	198 (56.6)	279 (69.8)

Exploratory and Confirmatory Bayesian Networks Identify the Central Role of Non-judging in Symptoms of Depression: Methods

- Bayesian Gaussian Graphical Models (BGGM)

- For the exploratory analyses, the “explore” function in BGGM with specified “exhaustive” selection was used, which provides a network of positive associations and negative associations using a Bayes Factor cutoff of 3 (moderate support) to determine which associations to include.
- For the confirmatory analyses, the “confirm” function was used which tests equality constraints of the posterior probability of a given hypothesis (which were all pre-registered) and which provides a Bayes Factor value estimating the relative support for which hypothesis the results fall under (i.e., null or alternative).
- Bridge nodes are variables that are associated within a specific measure *and* across distinct measures. Bridge node centrality is a measure of the total strength of the associations of a specific variable with variables in a different community (essentially a sum of the correlation coefficients that are bridging between communities).


Original Articles

Bayesian Estimation for Gaussian Graphical Models: Structure Learning, Predictability, and Network Comparisons

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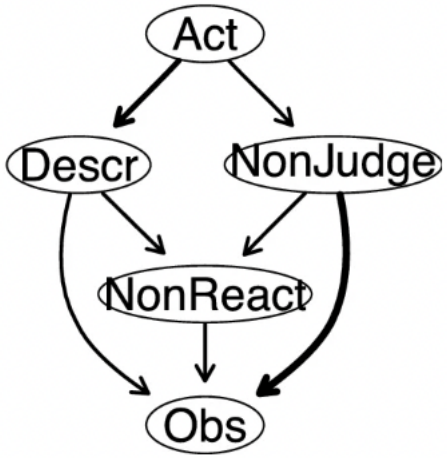
Exploratory and Confirmatory Bayesian Networks Identify the Central Role of Non-judging in Symptoms of Depression: Methods

- Why not Directed Acyclic Graphs?
- DAGs constrain the association between nodes to be unidirectional. There are challenges associated with interpreting cross-sectional psychological symptom/construct data causally, especially when the associations are unidirectional (Epskamp et al., 2018), and we chose the exploratory/confirmatory process facilitated by the BGGM package to strengthen our interpretations of cross-sectional network models.

A network approach to the five-facet model of mindfulness

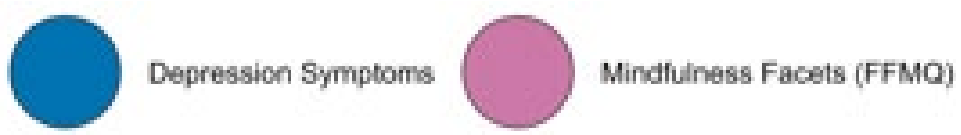
Alexandre Heeren, Séverine Lannoy, Charlotte Coussement, Yorgo Hoebeke, Alice Verschuren, M. Annelise Blanchard, Nadia Chakroun-Baggioni, Pierre Philippot & Fabien Gierski

Scientific Reports **11**, Article number: 15094 (2021) | Cite this article



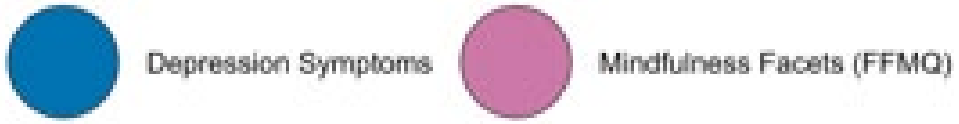
Exploratory and Confirmatory Bayesian Networks Identify the Central Role of Non-judging in Symptoms of Depression: Results

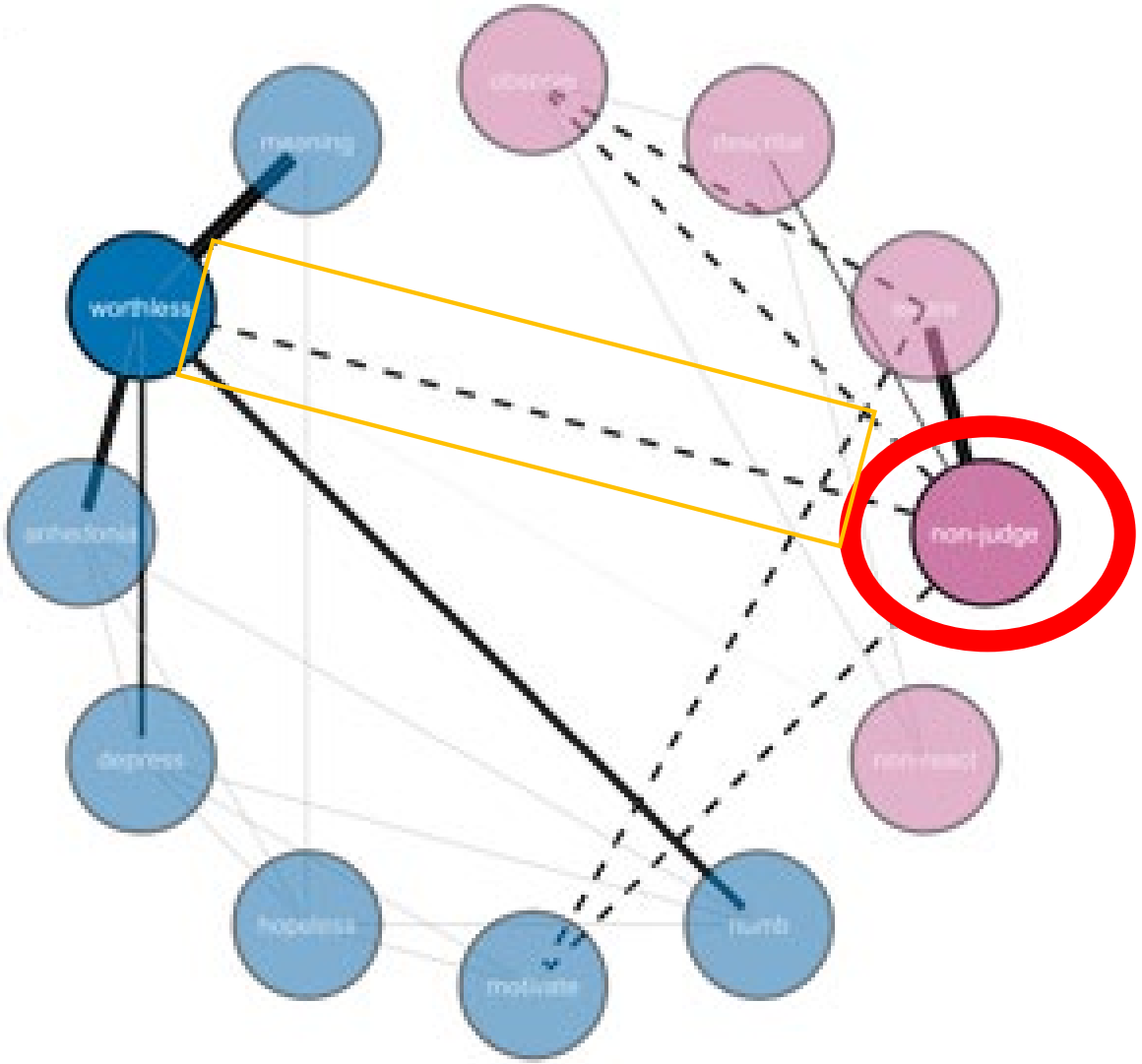
- Exploratory Network #1



Exploratory and Confirmatory Bayesian Networks Identify the Central Role of Non-judging in Symptoms of Depression: Results

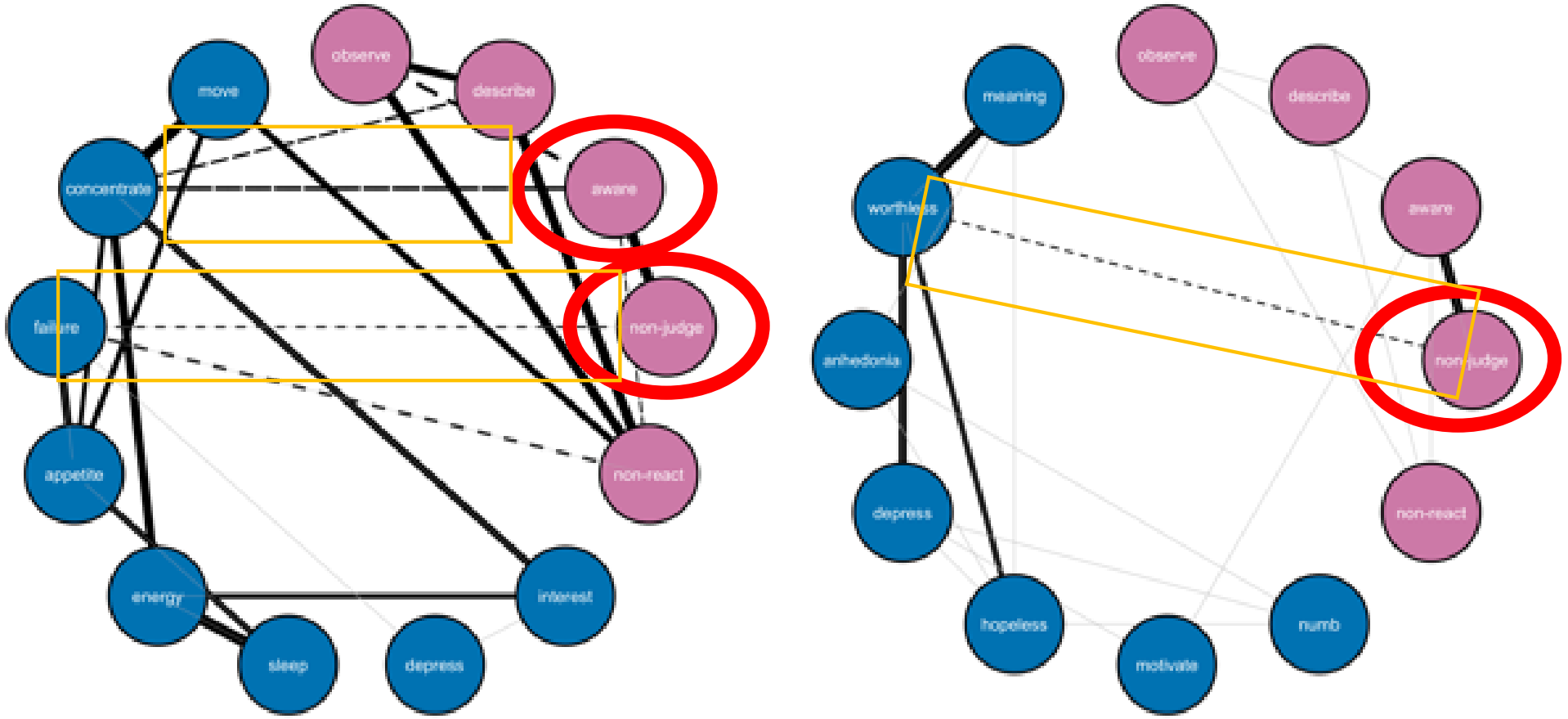
- Exploratory Network #2





Exploratory and Confirmatory Bayesian Networks Identify the Central Role of Non-judging in Symptoms of Depression: Results

- Confirmatory Networks (pre-registered)



Exploratory and Confirmatory Bayesian Networks Identify the Central Role of Non-judging in Symptoms of Depression: Discussion

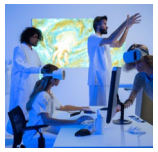
- Non-judging appeared to be central across samples and measures of depression.
  - Connection was focused with feelings of failure (PHQ-8) and worthlessness (DASS– depression subscale)
- Awareness was also a central facet connected to concentration, but was only present/replicated in relation to symptoms of depression on the PHQ-8
  - There is no ‘concentration’ symptom on the DASS-21

Exploratory and Confirmatory Bayesian Networks Identify the Central Role of Non-judging in Symptoms of Depression: Conclusions

- Non-judging represents a specific potential target for mindfulness-based treatments
- Caution needed when interpreting cross-sectional GGMs
- Bayesian GGMs offer a pathway for developing and testing hypotheses iteratively

Thank you!

- Collaborators: Santiago Papini, Eric Zaizar, Justin Dainer-Best, Jasper Smits, and Michael Telch
- University of Texas at Austin
- Palo Alto University



Translational Attention Intervention Lab Trainlab.org

mikaelrubin.com