



ANÁLISES DE REDE EM CIÊNCIAS DA SAÚDE

PROGRAMAÇÃO:

03 de Dezembro de 2018

- 09h às 12h - Redes Frequentistas

Palestrante: Dr. Wagner de Lara Machado (PUCRS)

- 14h às 17h - Redes Bayesianas

Palestrante: Dra. Carmen Moret Tatay (UCV - Espanha)

LOCAL: PUCRS - Escola da Negócios, prédio 50, 9º andar - Lab. LACE

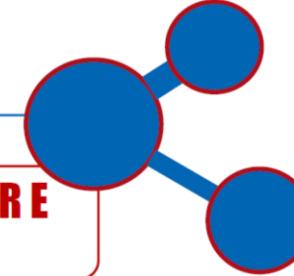
INSCRIÇÕES PELO LINK: <https://goo.gl/forms/9rAEcGiDigAykRvq1>

VAGAS LIMITADAS



GRUPO DE PESQUISA

AVALIAÇÃO EM BEM-ESTAR E
SAÚDE MENTAL



Redes Frequentistas

Prof. Dr. Wagner de Lara Machado

Escola de Ciências da Saúde – PPG Psicologia

Análise de rede aplicada à psicometria e a avaliação psicológica



Sacha Epskamp

Assistant Professor in Psychological Methods and
Psychometrics at the University of Amsterdam

Wagner de Lara Machado

Pontifícia Universidade Católica de Campinas

João Ricardo Nickenig Vissoci

Faculdade Ingá e Duke University

Sacha Epskamp

Universiteit van Amsterdam



João Vissoci

Pesquisador na divisão de Emergency Medicine do departamento de Cirurgia, e
na divisão Duke Global Neurosurgery and Neuroscience (DGNN) do departamento
de Neurocirurgia, na Duke University

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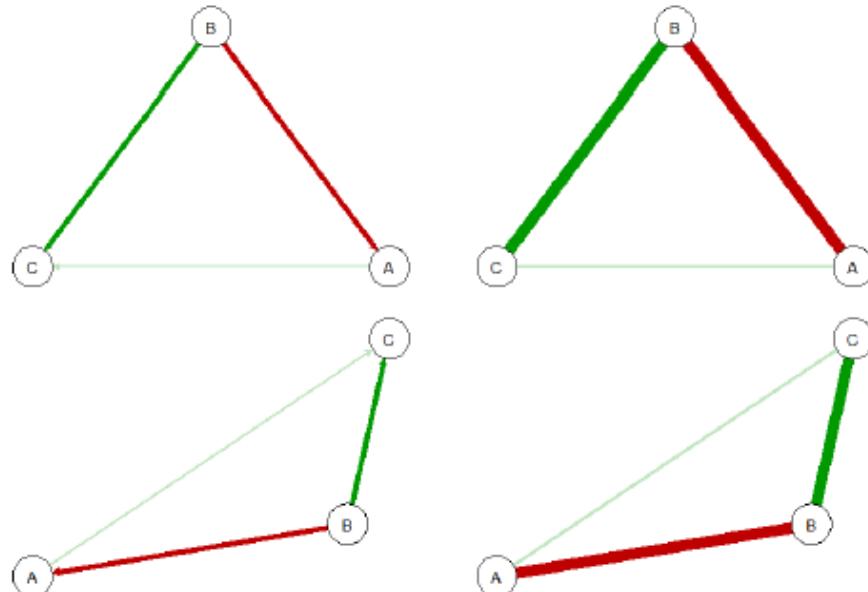


Figura 5. Redes ponderadas, direcionais e não-direcionais, sem (acima) e com (abaixo) o emprego do algoritmo de posicionamento.

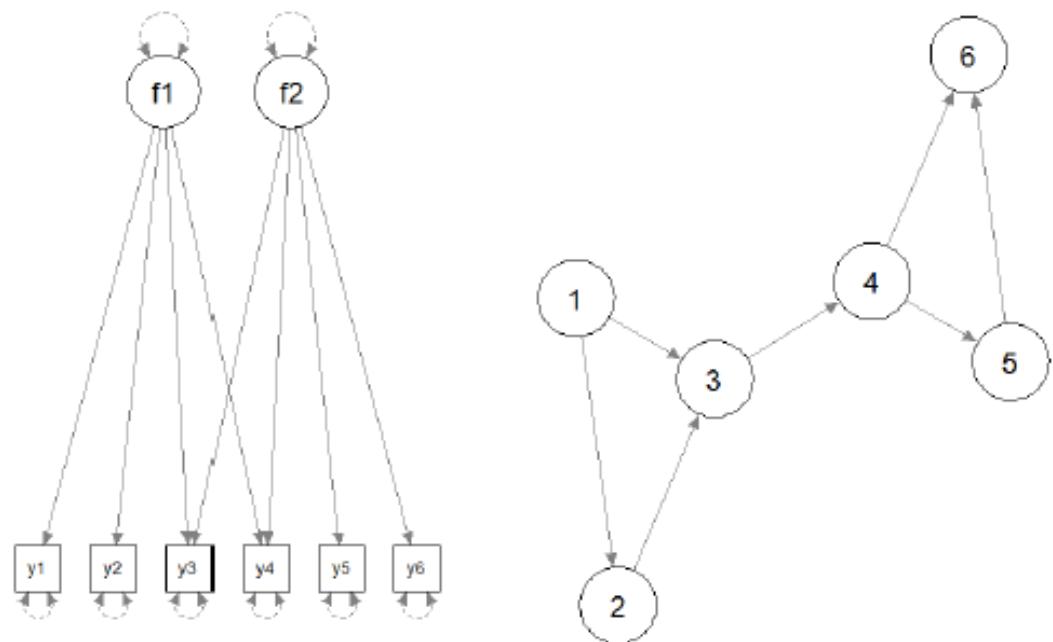


Figura 13. Modelo de traço latente (esquerda) e de rede (direita) da comorbidade.

Iniciando...

- Acesse: <https://github.com/wagnerLM>
- Selecione o curso_redes: https://github.com/wagnerLM/curso_redes
- Abra seu RStudio
- Baixe no curso_redes, o script em:
https://github.com/wagnerLM/curso_redes/blob/master/link_script_curso_redes
- Abra o arquivo de script via o RStudio

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SOFTWARE R APLICADO À PSICOMETRIA

● R

[curso_redes](#)

Curso redes frequentistas PUCRS

● R

← → C GitHub, Inc. [US] | https://github.com/wagnerLM/curso_redes

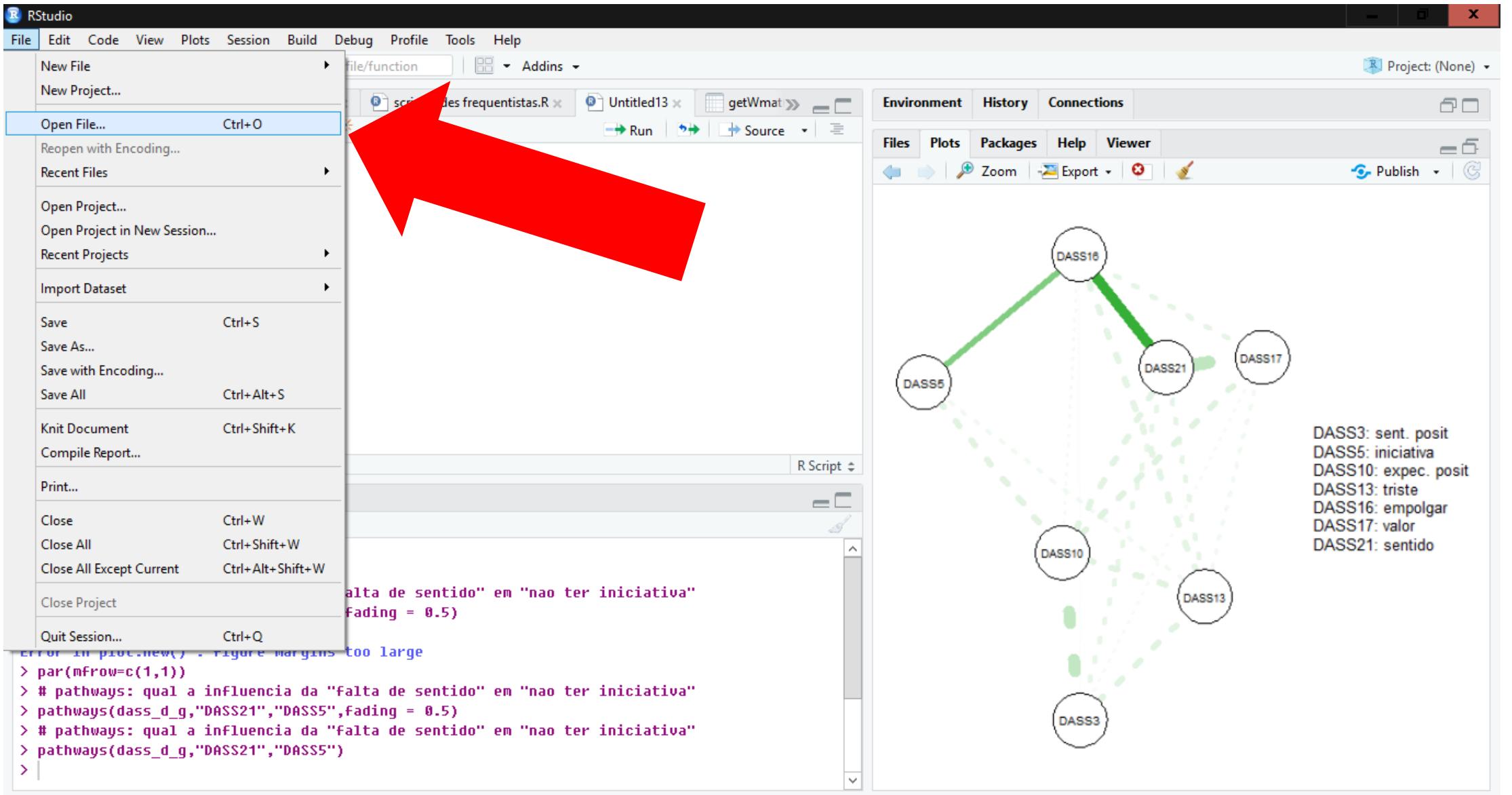
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curso_redes

https://github.com/wagnerLM/curso_redes/blob/master/link_script_curso_redes



“Reductionism, as a paradigm, is expired, and complexity, as a field, is tired. Data-based mathematical models of complex systems are offering a fresh perspective, rapidly developing into a new discipline: network science.”

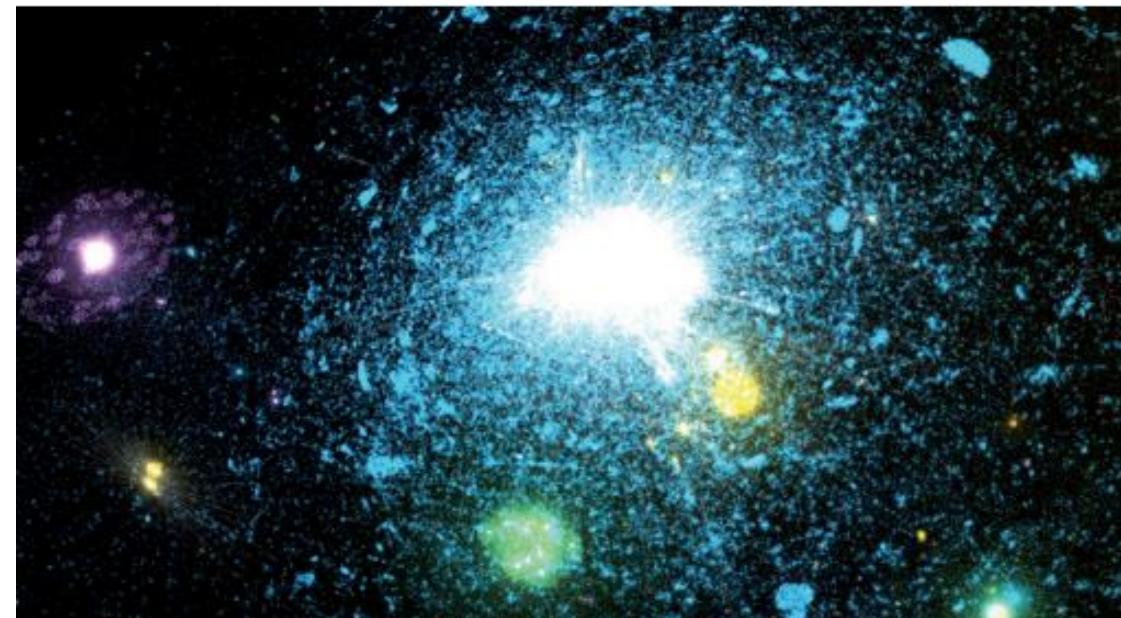
NATURE PHYSICS | COMMENTARY

The network takeover

Albert-László Barabási

Nature Physics 8, 14–16 (2012) | doi:10.1038/nphys2188

Published online 22 December 2011



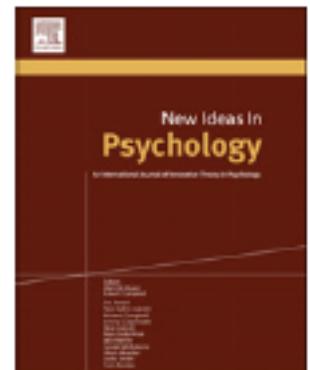


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journal homepage: www.elsevier.com/locate/newideapsych



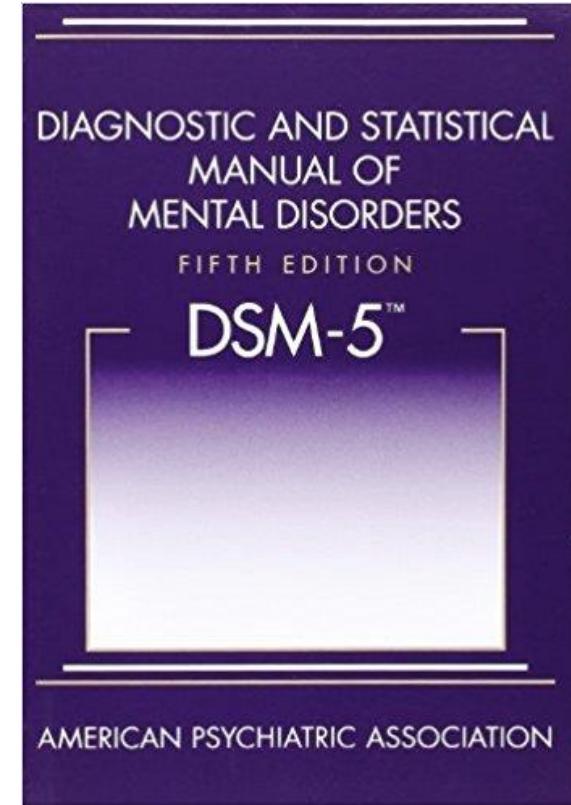
Deconstructing the construct: A network perspective on psychological phenomena

Verena D. Schmittmann, Angélique O.J. Cramer, Lourens J. Waldorp, Sacha Epskamp,
Rogier A. Kievit, Denny Borsboom*

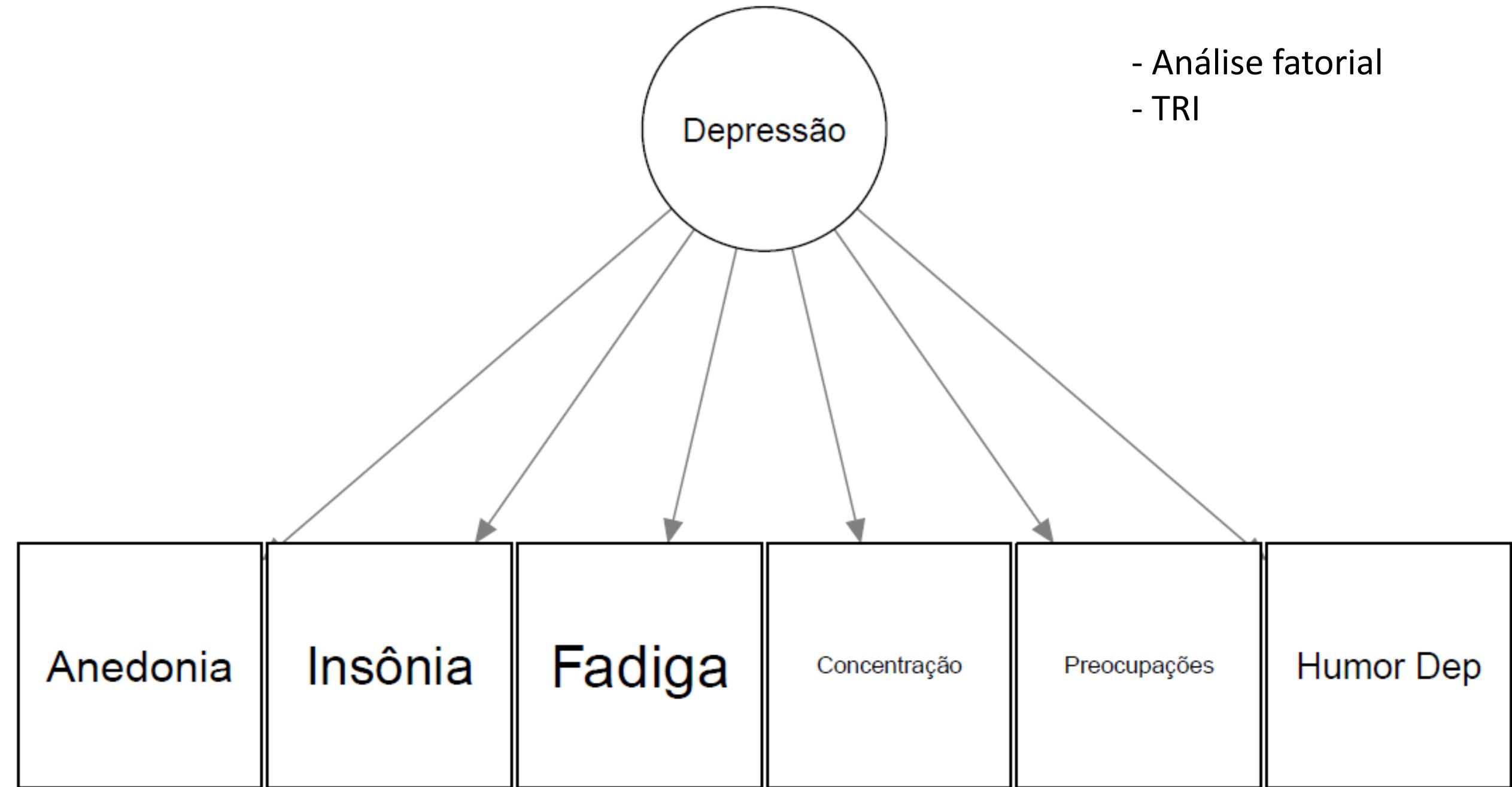
Avaliação em saúde mental: traços latentes e redes

- **Transtorno depressivo maior:**

- Humor deprimido
- Diminuição do interesse ou prazer
- Perda ou ganho significativo de peso
- Insônia ou hipersonia
- Agitação ou retardo psicomotor
- Fadiga ou perda de energia
- Sentimentos de inutilidade ou culpa
- Capacidade diminuída para pensar ou se concentrar
- Pensamentos recorrentes de morte



- Análise factorial
- TRI



Measuring Depression Over Time . . . or not? Lack of Unidimensionality and Longitudinal Measurement Invariance in Four Common Rating Scales of Depression

Eiko I. Fried
University of Leuven

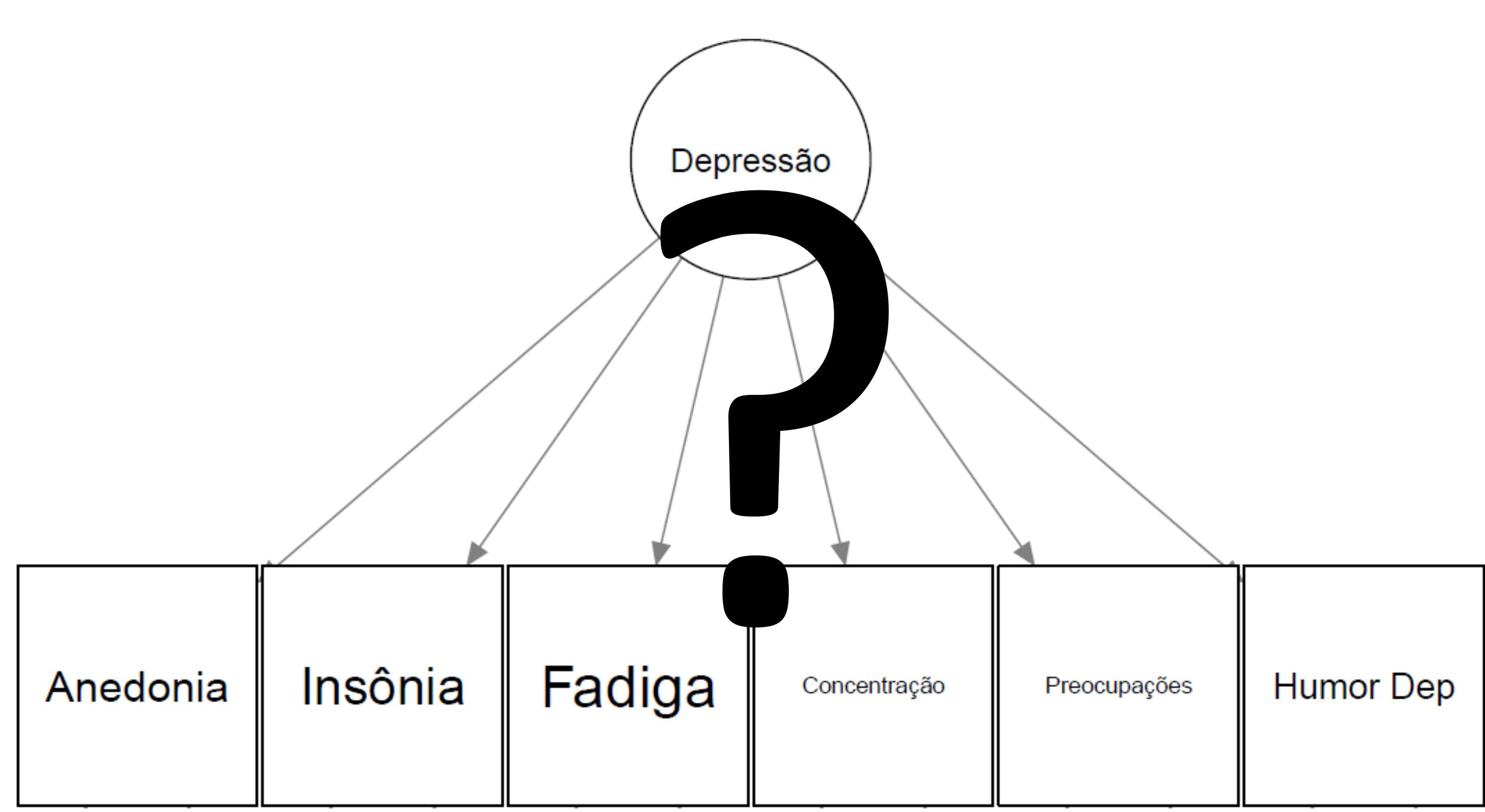
Sacha Epskamp
University of Amsterdam

Francis Tuerlinckx
University of Leuven

Claudia D. van Borkulo
University of Groningen and University of Amsterdam

Robert A. Schoevers
University of Groningen

Denny Borsboom
University of Amsterdam

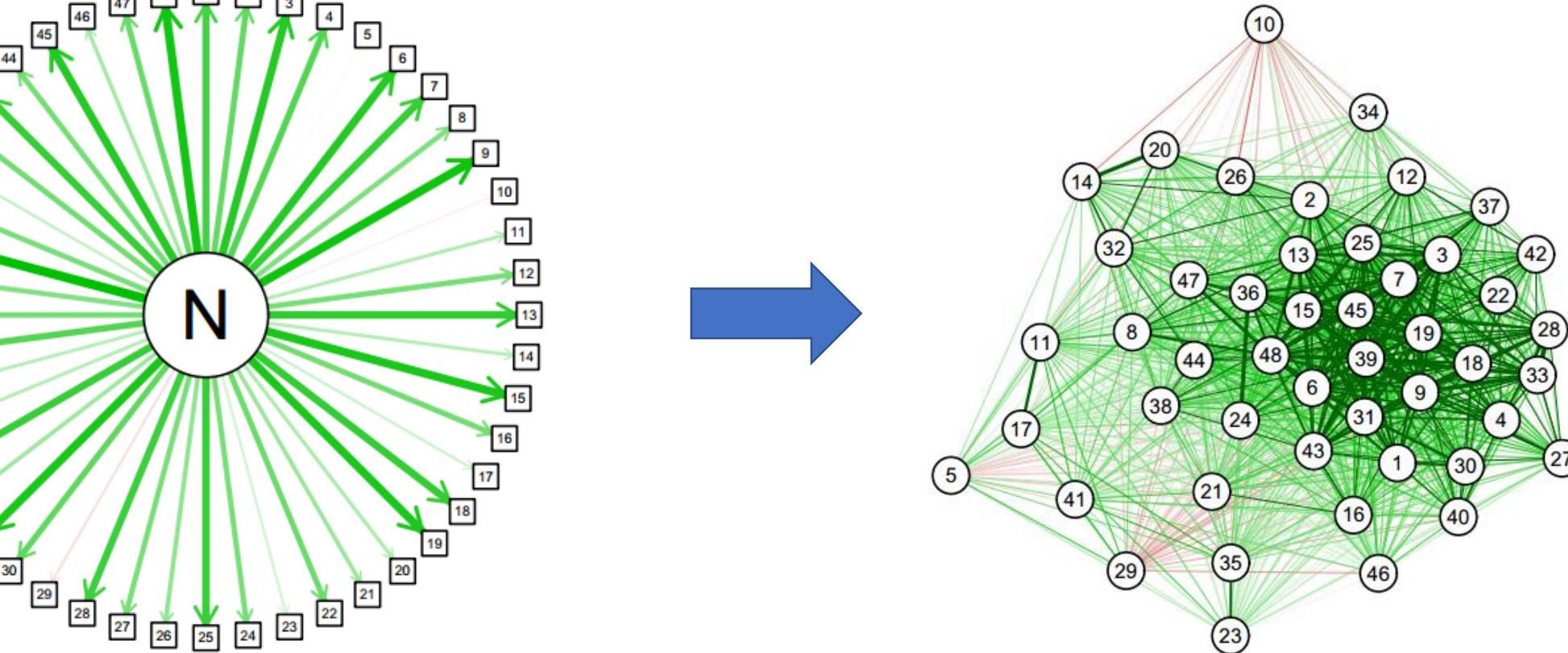




Deconstructing the construct: A network perspective on psychological phenomena

Verena D. Schmittmann, Angélique O.J. Cramer, Lourens J. Waldorp, Sacha Epskamp,
Rogier A. Kievit, Denny Borsboom*

Department of Psychology, University of Amsterdam, Roetersstraat 15, 1018 WB Amsterdam, The Netherlands





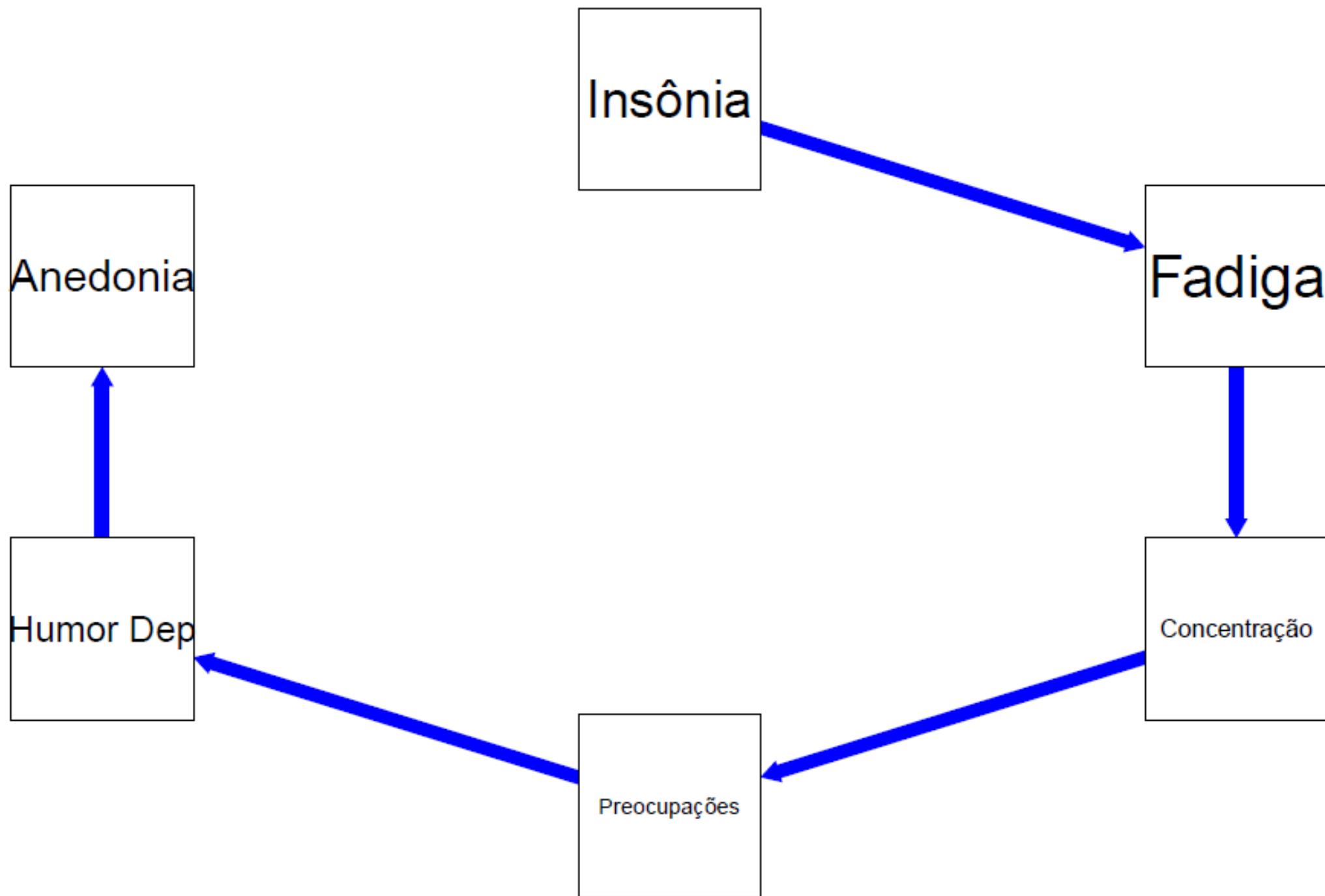
Deconstructing the construct: A network perspective on psychological phenomena

Verena D. Schmittmann, Angélique O.J. Cramer, Lourens J. Waldorp, Sacha Epskamp,
Rogier A. Kievit, Denny Borsboom*

Department of Psychology, University of Amsterdam, Roetersstraat 15, 1018 WB Amsterdam, The Netherlands

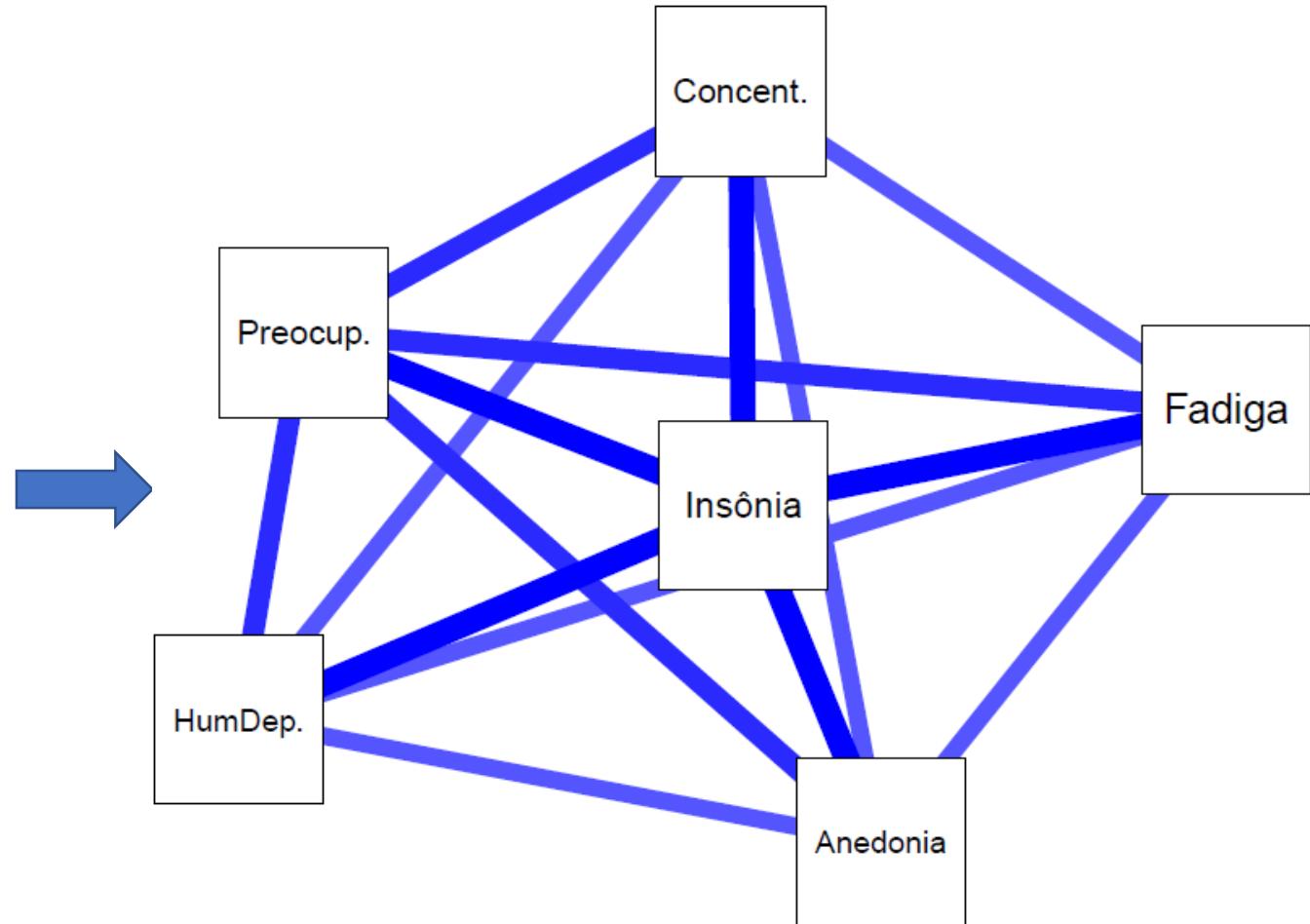


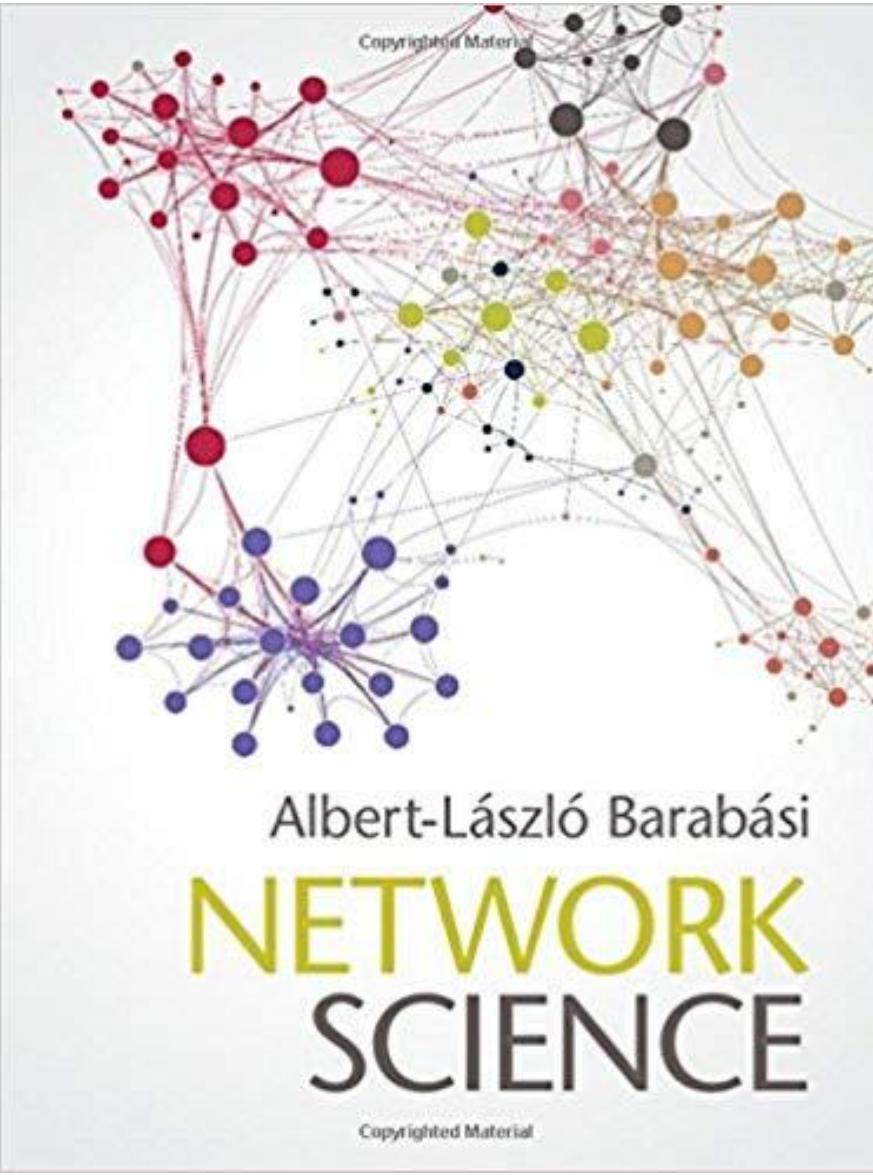
Fig. 6. The best fitting confirmative time series model of the following five constituents of depression: tiredness; concentration difficulties (concentration); self-content; sad mood; pleasure in current activity (activity).



Depressão: estrutura e dinâmica de um sistema

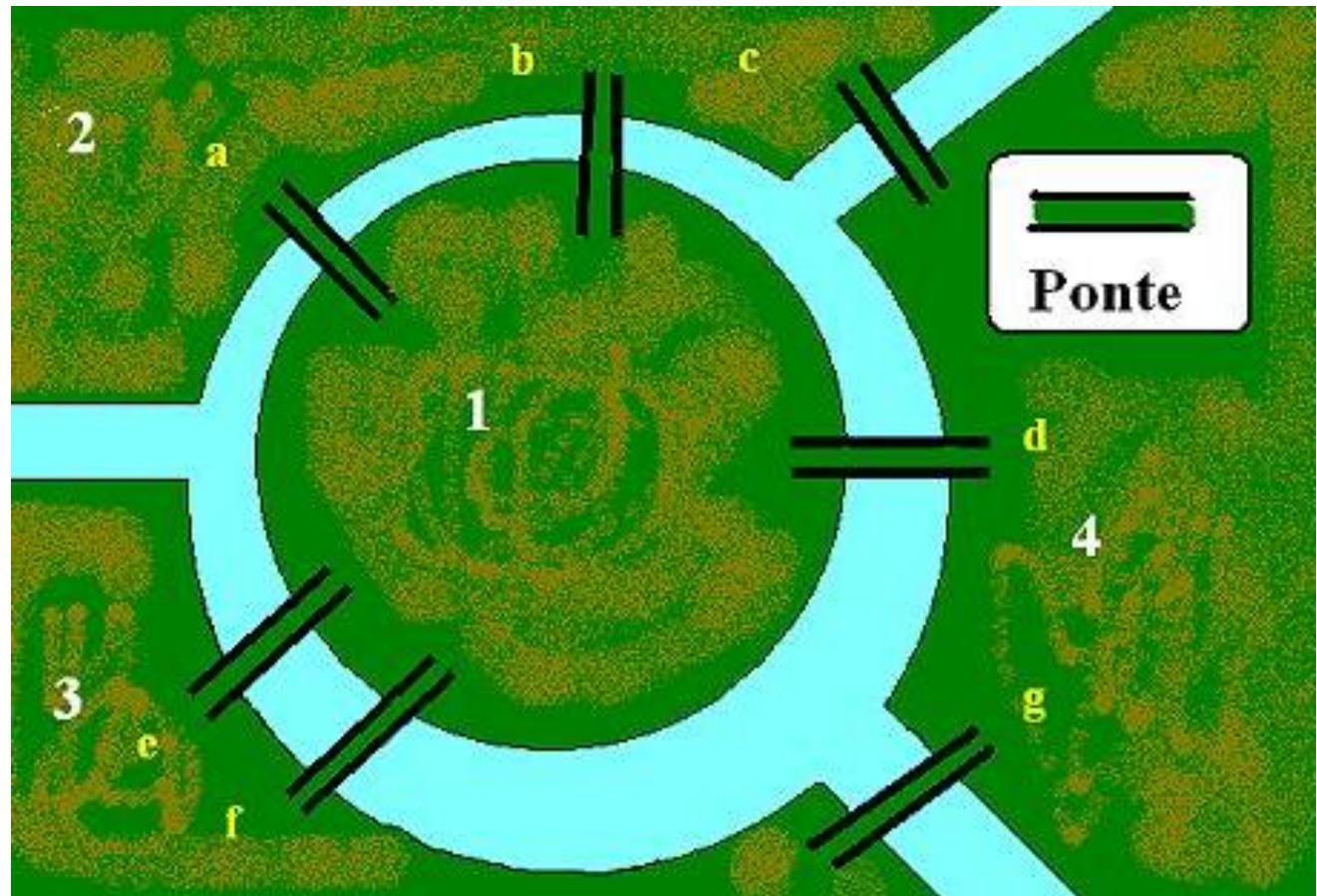
	Insônia	Fadiga	Concent.	Preocup.	HumDep.	Anedonia
Insônia	1.0	0.6	0.6	0.6	0.6	0.6
Fadiga	0.6	1.0	0.4	0.5	0.4	0.4
Concent.	0.6	0.4	1.0	0.5	0.4	0.4
Preocup.	0.6	0.5	0.5	1.0	0.5	0.5
HumDep.	0.6	0.4	0.4	0.5	1.0	0.4
Anedonia	0.6	0.4	0.4	0.5	0.4	1.0





Teoria dos grafos

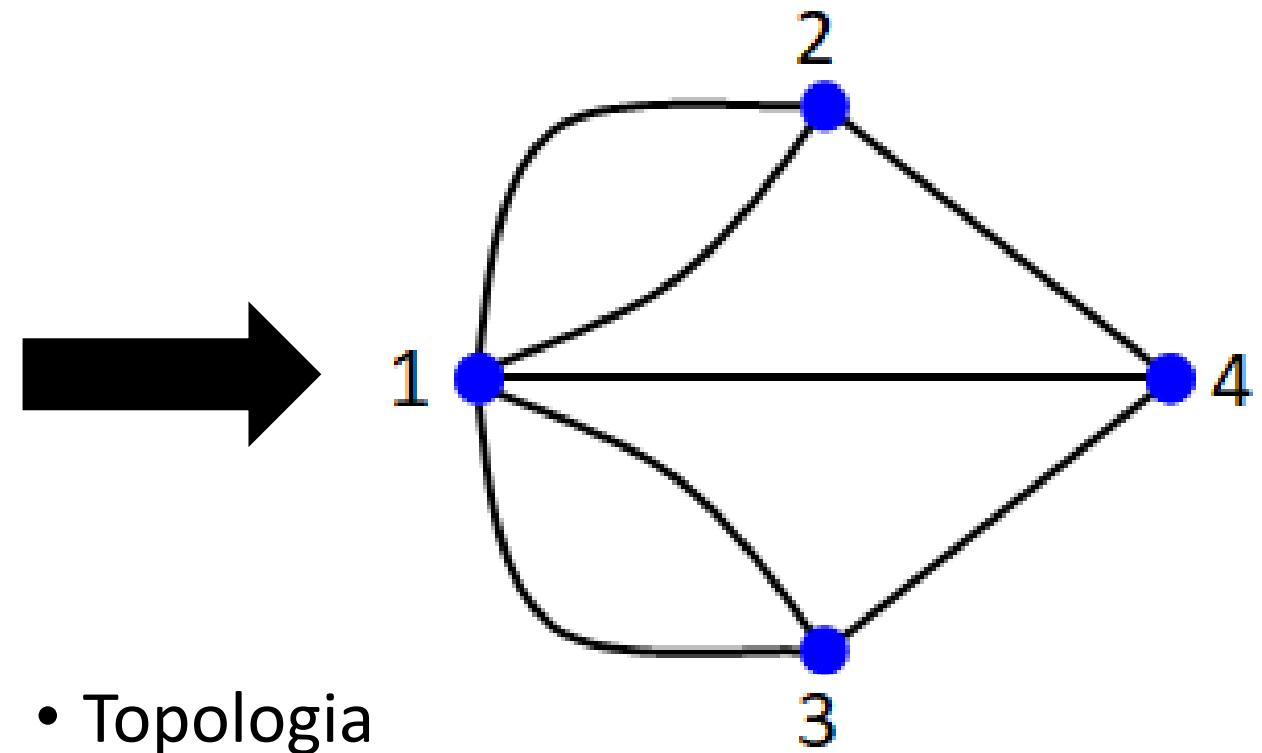
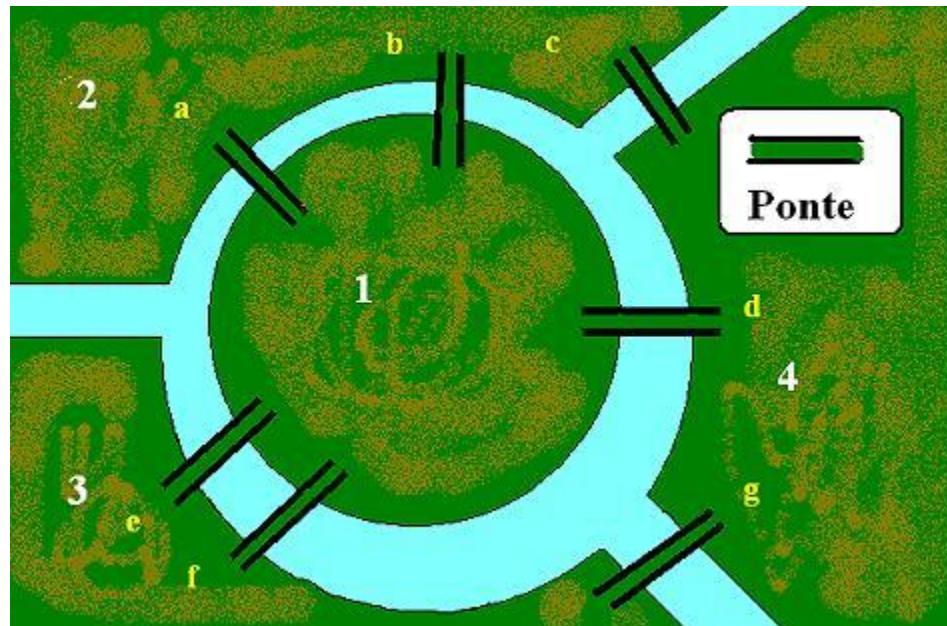
- O problema das pontes de Königsberg
- Discutia-se nas ruas da cidade a possibilidade de atravessar todas as pontes sem repetir nenhuma



https://pt.wikipedia.org/wiki/Sete_pontes_de_K%C3%B6nigsberg

Teoria dos grafos

- Havia uma lenda popular sobre a possibilidade de resolução, quando Leonhard Euler , em 1736, provou que não existia caminho que possibilitasse tais restrições.



O que é uma rede?

- Vértices (nodos) e arestas (linhas)
- Nodos representam variáveis
- As linhas representam a relação entre os nodos

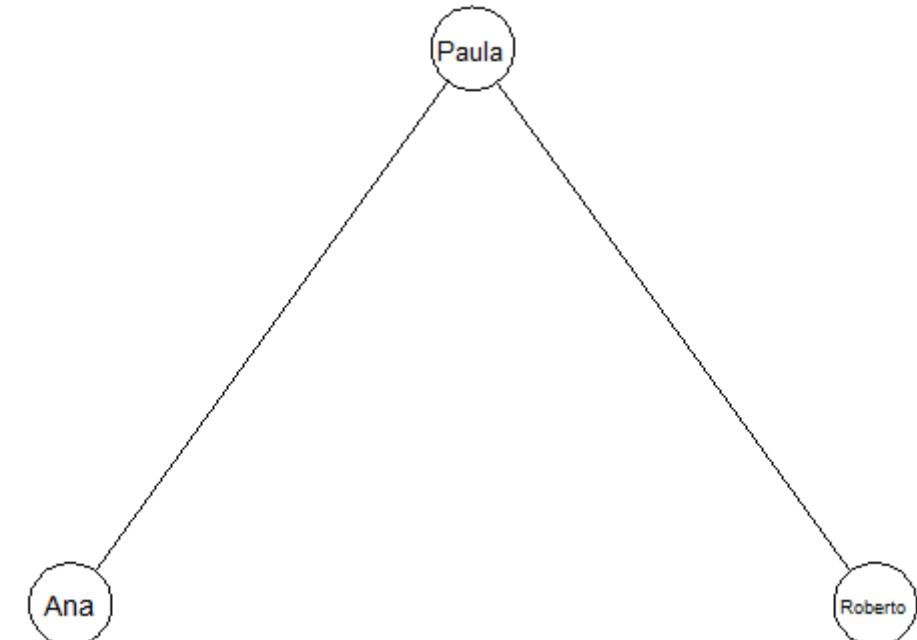
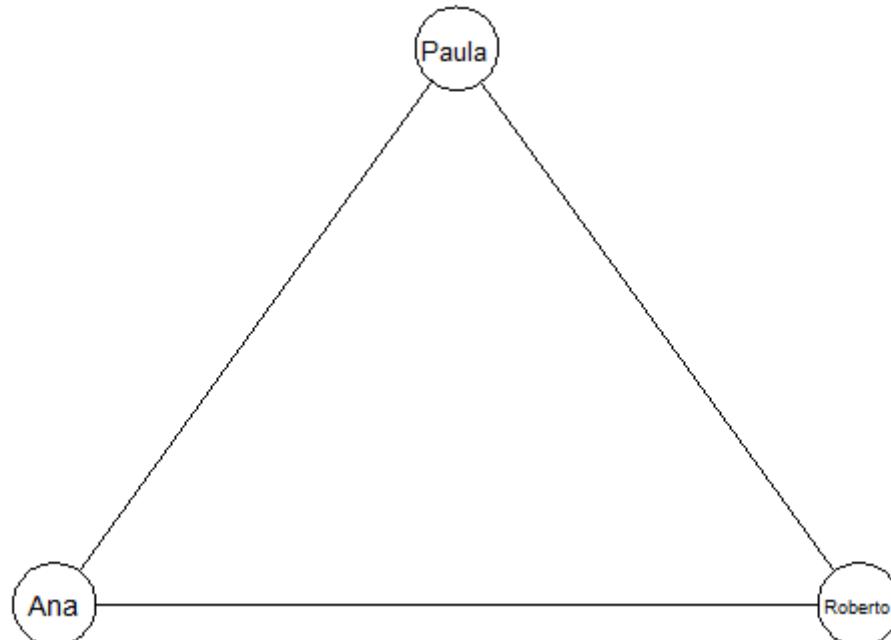


Amizades

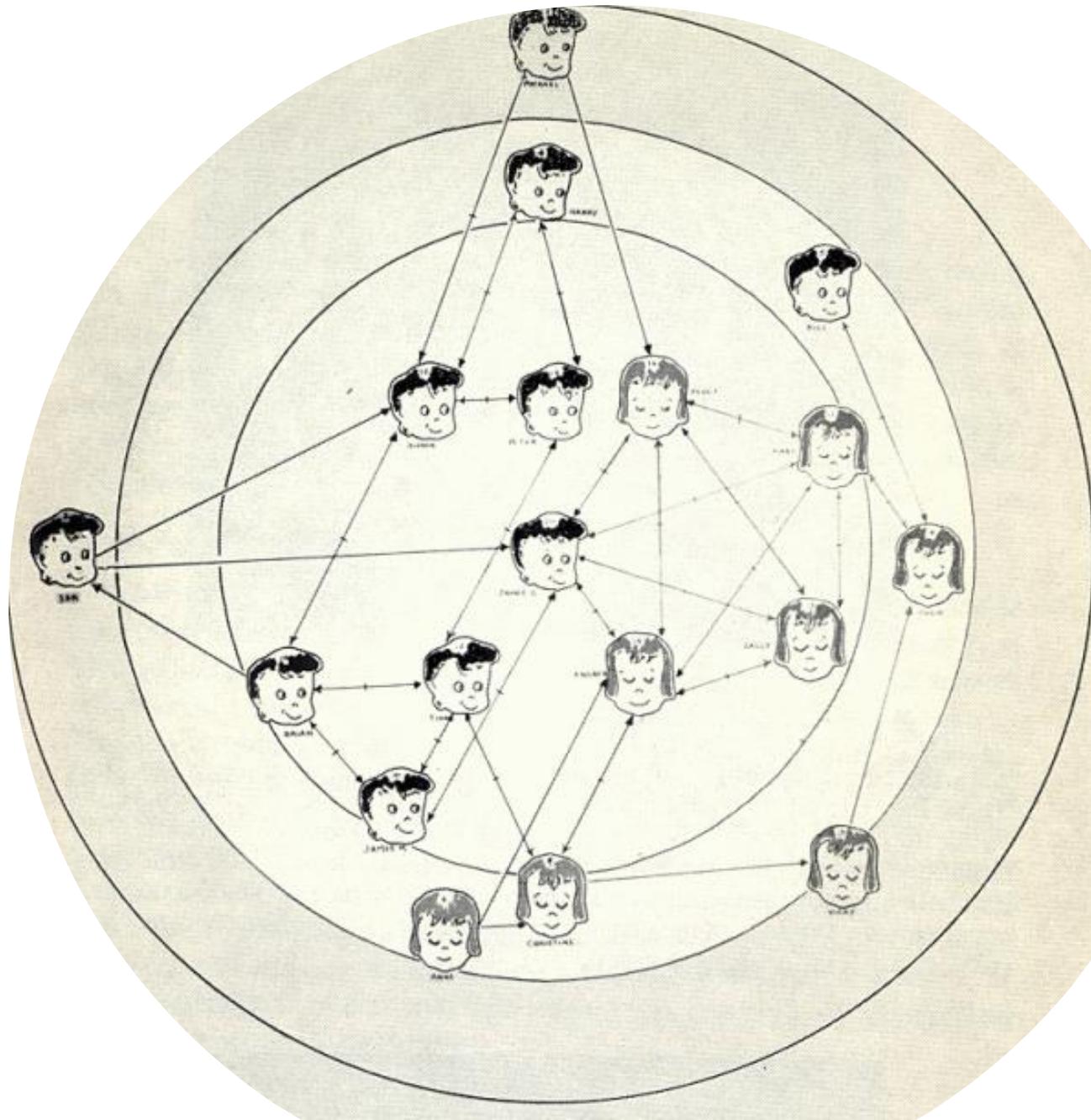
	Paula	Roberto	Ana
Paula	0	1	1
Roberto	1	0	0
Ana	1	0	0

Cenário 1: Paula, Ana e Roberto são amigos

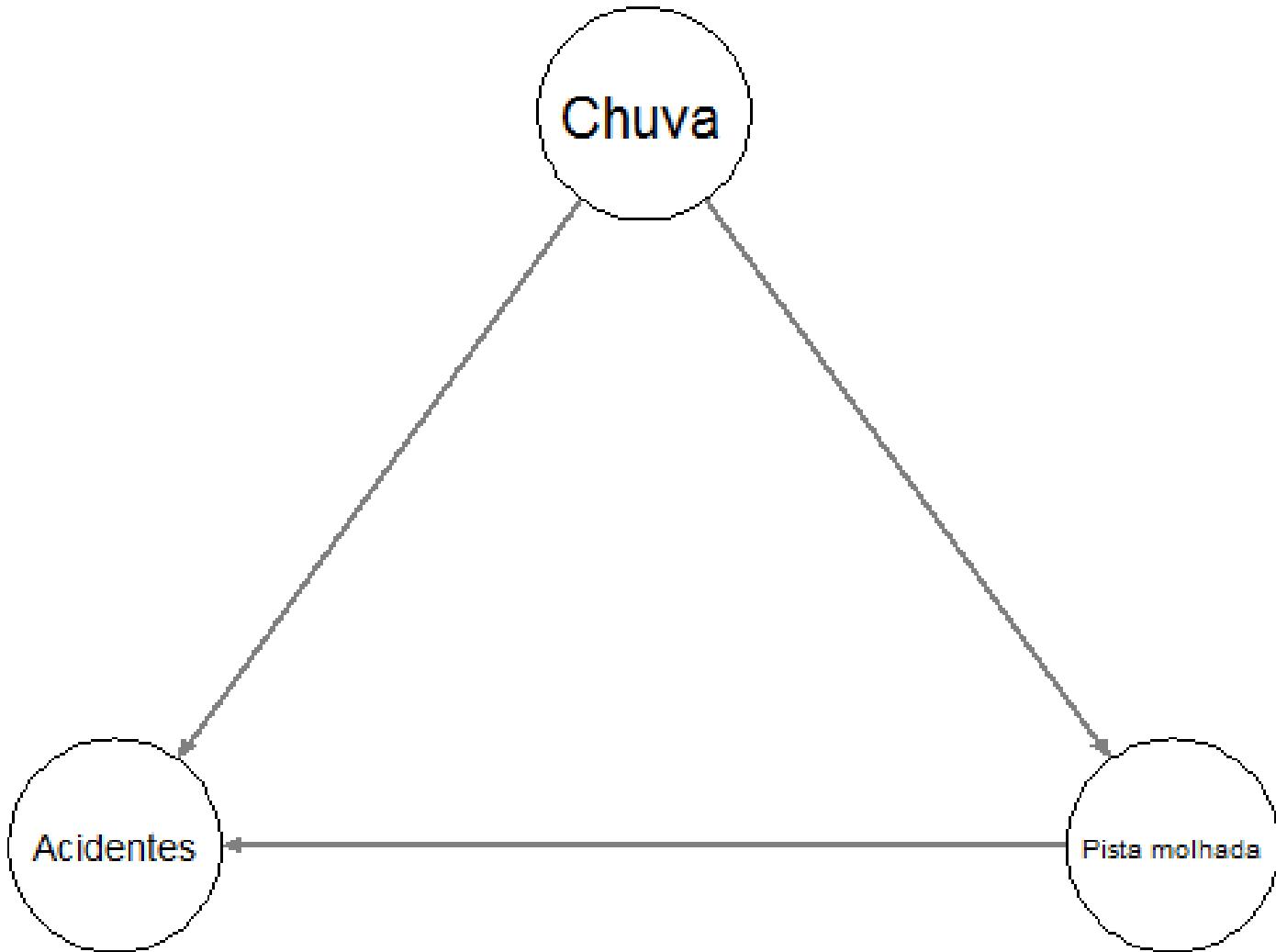
Cenário 2: Paula é amiga de Ana, Paula é amiga de Roberto, Ana e Roberto não são amigos



Jacob Moreno Sociogramma



Redes causais
ou
probabilísticas



Bayesian networks -> Direct Acyclic Graphs

Medidas de associação entre variáveis

- Relação entre bem-estar (A), suporte social (B) e depressão (C)

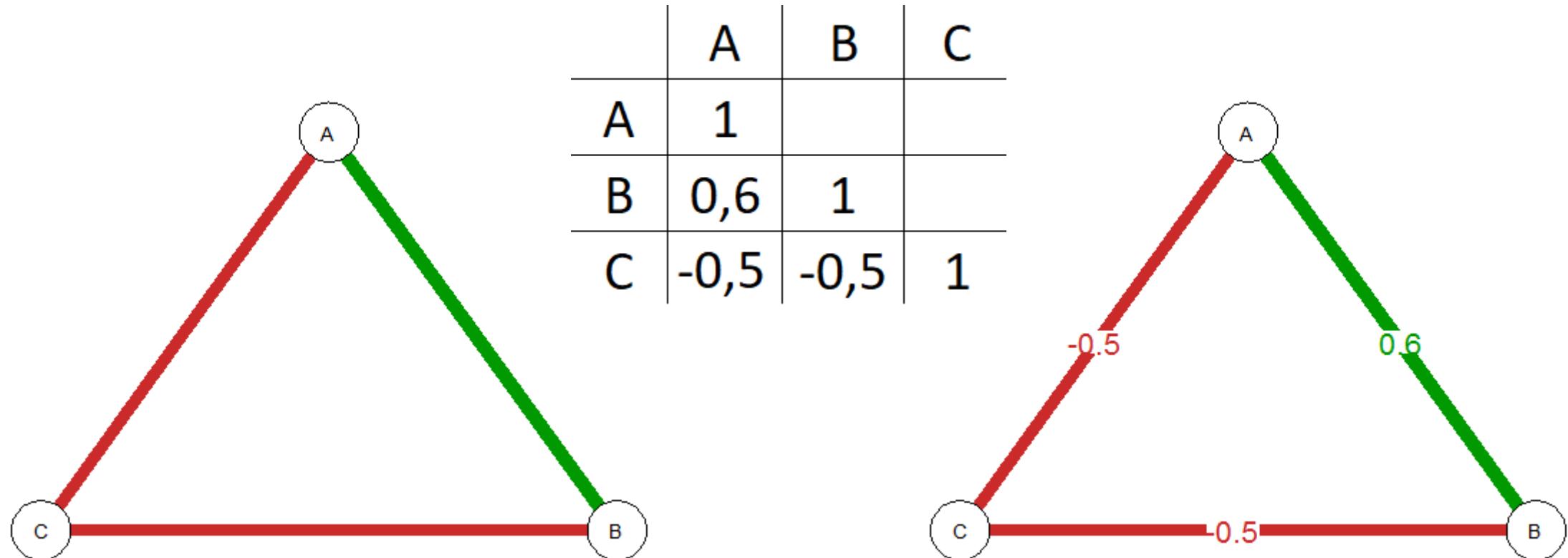


Table 2 Means, standard deviation and Pearson correlation matrix for continuous variables ($n = 228$)

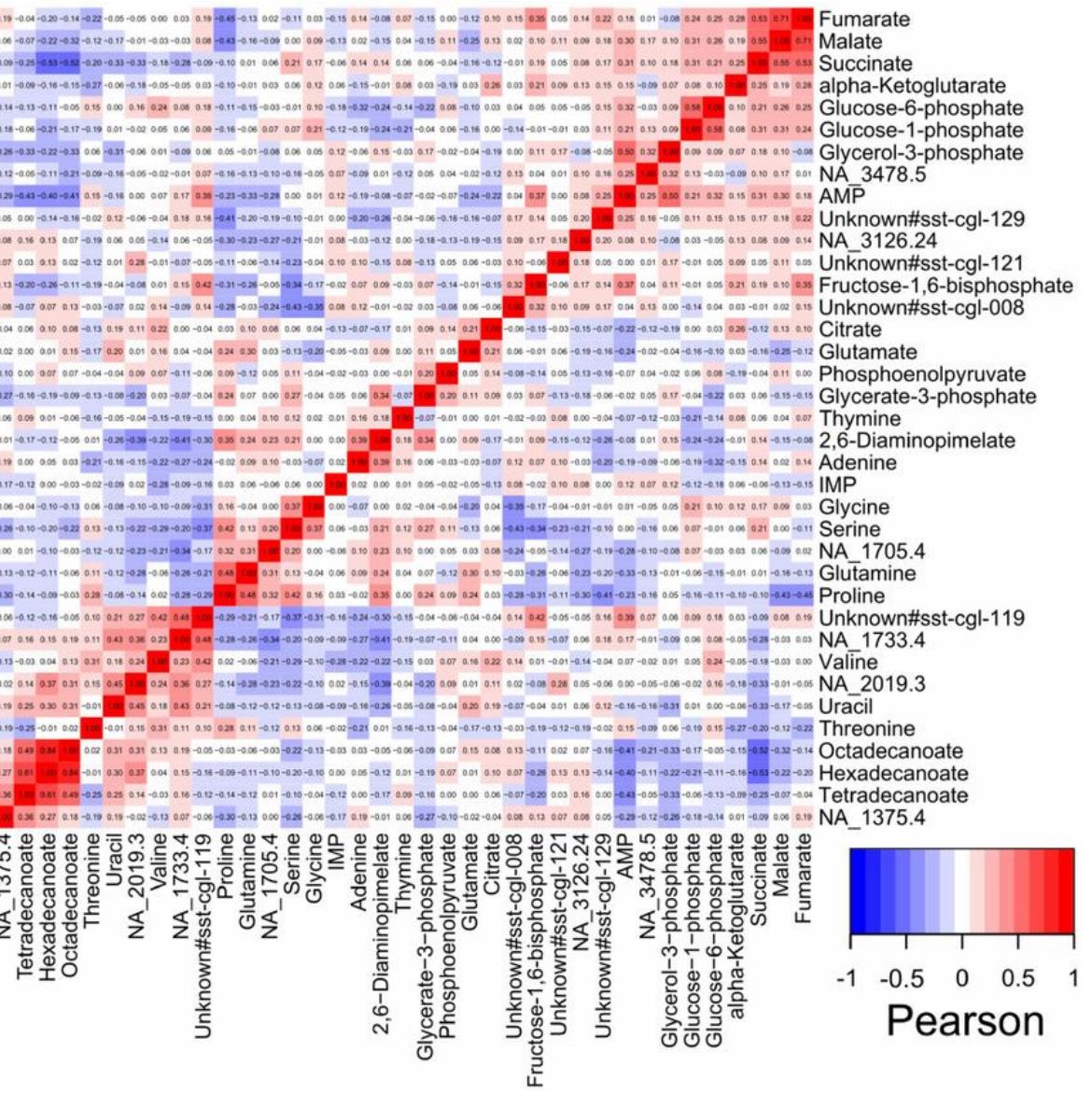
	M	SD	1	2	3	4	5	6	7	8	9	10	11
1. Age	22.75	4.81	—										
2. Extroversion	3.26	.42	.03	(.80)									
3. Emotional stability	2.77	.57	.04	-.04	(.90)								
4. Agreeableness	3.56	.34	.05	.19 ^a	.13 ^b	(.74)							
5. Conscientiousness	3.40	.40	.10	.42 ^a	.02	.12	(.80)						
6. Openness	3.44	.39	.16 ^b	.43 ^a	.15 ^b	.28 ^a	.24 ^a	(.76)					
7. EA	3.27	.77	-.13	.06	-.43 ^a	.11	-.05	.05	(.89)				
8. EC	3.12	.67	.16 ^b	.36 ^a	.18 ^a	.18 ^a	.20 ^a	.40 ^a	.13 ^b	(.84)			
9. ER	3.23	.78	.06	.32 ^a	.35 ^a	.28 ^a	.16 ^b	.32 ^a	-.04	.30 ^a	(.83)		
10. Trust in leader T1	2.91	.85	-.18 ^a	.09	.09	.15 ^b	-.01	-.06	.17 ^b	.13	.11	(.74)	
11. Trust in leader T2	2.90	.83	-.21 ^a	.05	.03	.08	.07	-.16 ^b	.19 ^a	.02	.06	.59 ^a	(.82)

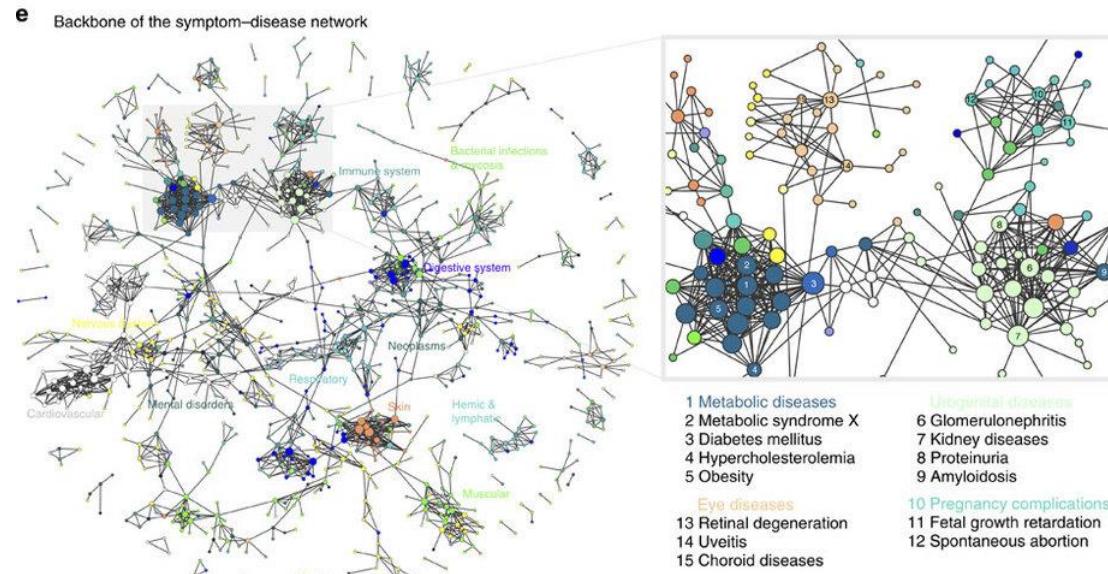
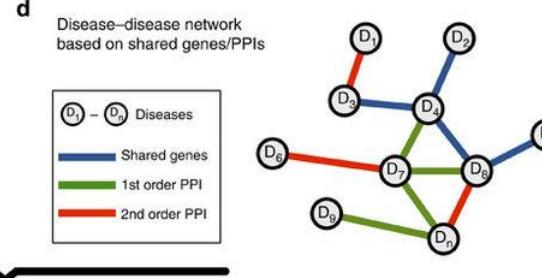
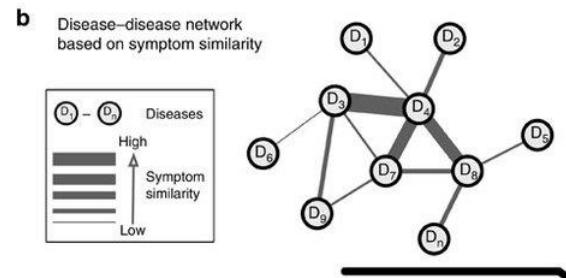
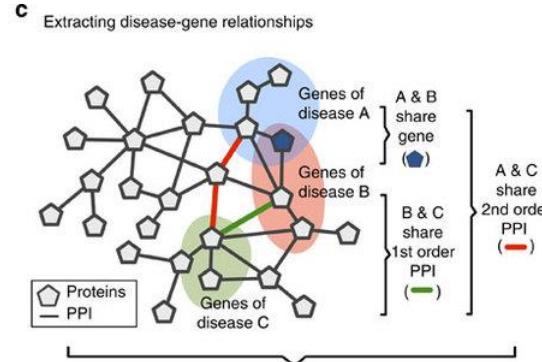
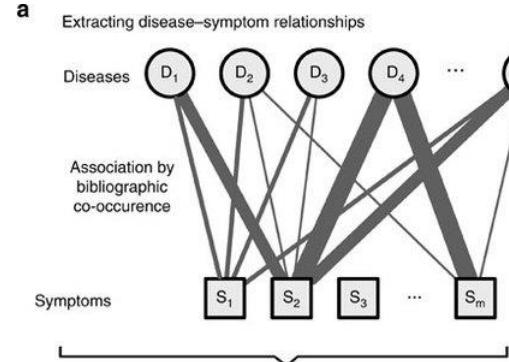
EA: emotional attention; EC: emotional clarity; ER: emotional repair; T1: work session 1; T2: work session 2.

^a $p < .05$.

^b $p < .01$.

Cronbach's alphas are shown in the diagonal.





Article

Human symptoms–disease network

XueZhong Zhou ✉, Jörg Menche, Albert-László Barabási & Amitabh Sharma ✉

Nature Communications 5,

Article number: 4212 (2014)

doi:10.1038/ncomms5212

Received: 07 November 2013

Accepted: 27 May 2014

Published online: 26 June 2014

We extracted **7,109,429** (about 35.5% in over twenty million records) PubMed bibliographic records with one or more disease/symptom terms in the MeSH metadata field (see Methods), yielding a total of 4,442 disease terms and 322 symptom terms

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NATURE NEUROSCIENCE | REVIEW



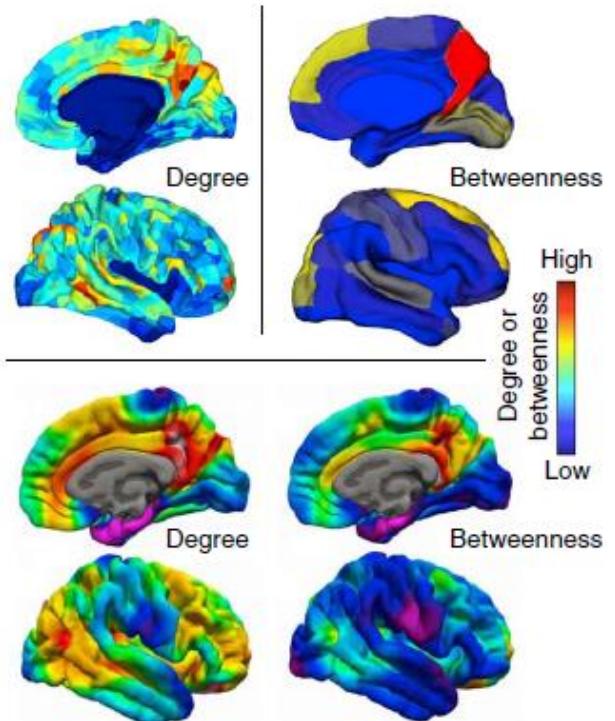
Contributions and challenges for network models in cognitive neuroscience

Olaf Sporns

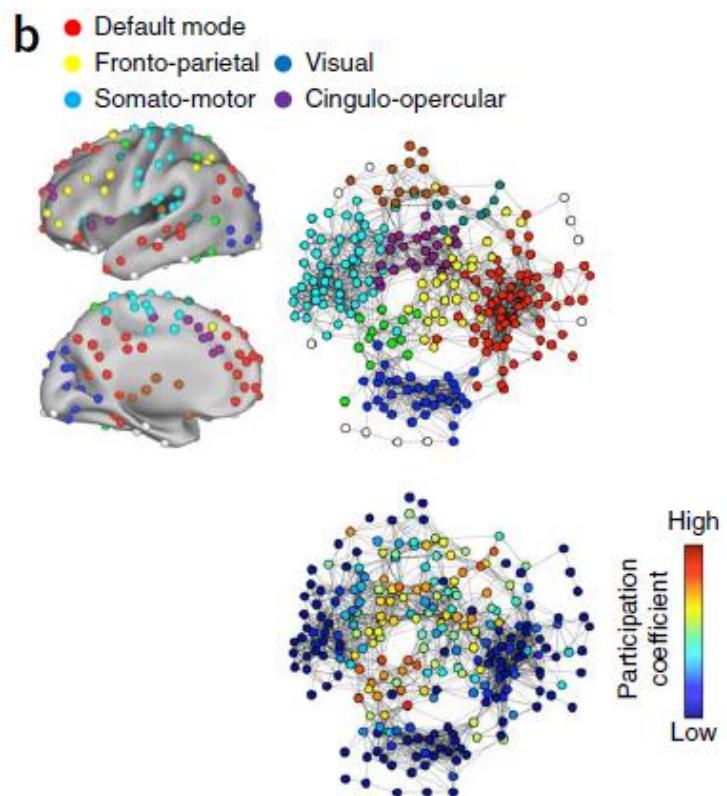
Nature Neuroscience 17, 652–660 (2014) | doi:10.1038/nn.3690

Received 06 October 2013 | Accepted 03 March 2014 | Published online 30 March 2014

a



b



The dynamical structure of political corruption networks

Haroldo V. Ribeiro,^{1,*} Luiz G. A. Alves,²

Alvaro F. Martins,¹ Ervin K. Lenzi,³ and Matjaž Perc^{4,5,6,†}

¹Departamento de Física, Universidade Estadual de Maringá, Maringá, PR 87020-900, Brazil

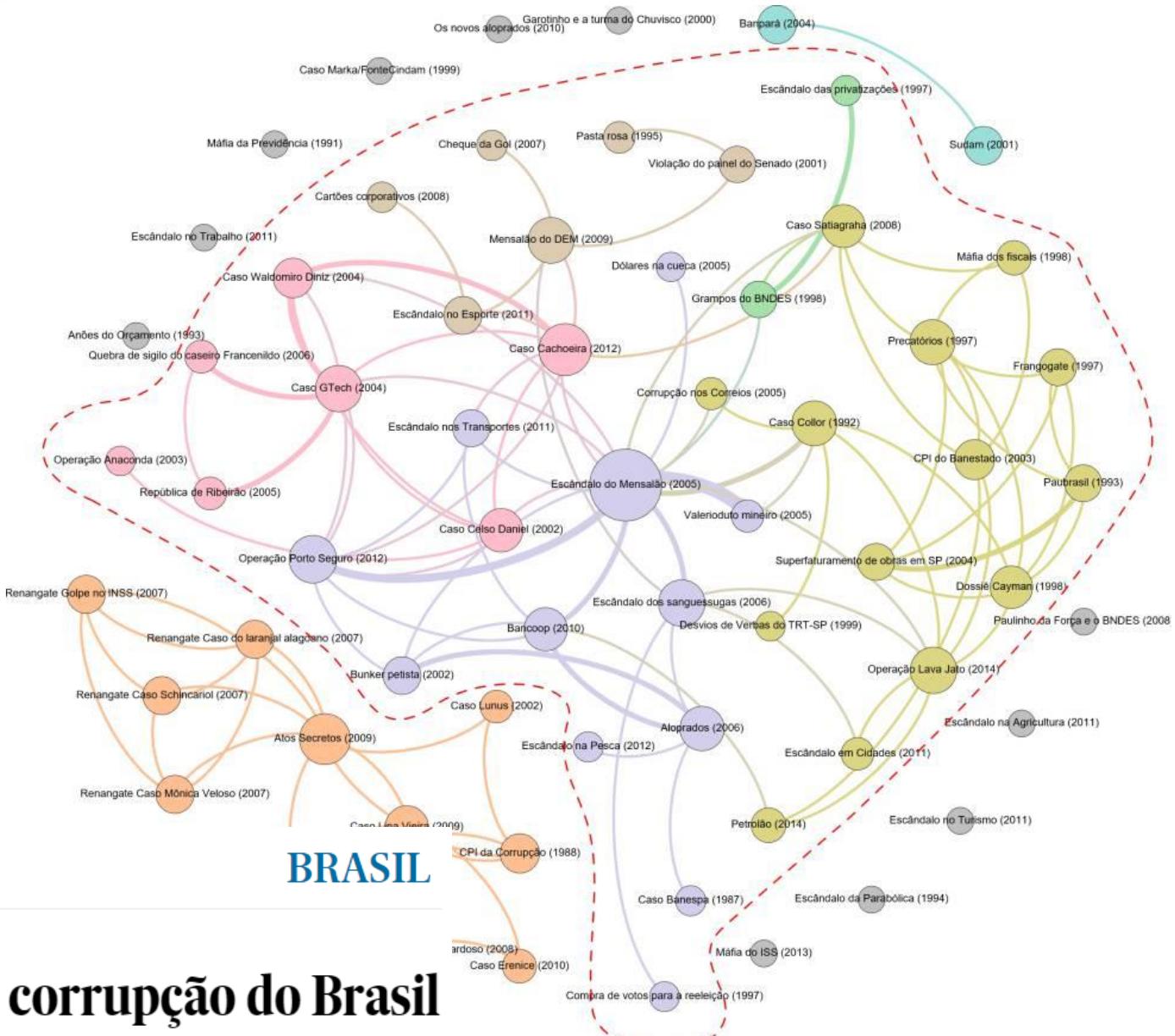
²Institute of Mathematics and Computer Science, University of São Paulo, São Carlos, SP 13566-590, Brazil

³Departamento de Física, Universidade Estadual de Ponta Grossa, Ponta Grossa, PR 84030-900, Brazil

⁴Faculty of Natural Sciences and Mathematics, University of Maribor, Koroška cesta 160, SI-2000 Maribor, Slovenia

⁵CAMTP – Center for Applied Mathematics and Theoretical Physics, University of Maribor, Mladinska 3, SI-2000 Maribor, Slovenia

⁶Complexity Science Hub, Josefstadtterstraße 39, A-1080 Vienna, Austria



≡ EL PAÍS

CORRUPÇÃO >

Por trás do verdadeiro mecanismo de corrupção do Brasil

Pesquisadores mapeiam as redes de relacionamento entre os escândalos de desvio de dinheiro público que assolaram o Brasil após a redemocratização

Network Psychometrics

Sacha Epskamp, Gunter Maris, Lourens J. Waldorp,
and Denny Borsboom

Introduction

“In fact, statistical field theory may have even more to offer. It always struck me that there appears to be a close connection between the basic expressions underlying item-response theory and the solutions of elementary lattice fields in statistical physics. For instance, there is almost a one-to-one formal correspondence of the solution of the Ising model (a lattice with nearest neighbor interaction between binary-valued sites; e.g., Kindermann & Snell (1980), Chapter 1) and the Rasch model Fischer

Revealing the dynamic network structure of the Beck Depression Inventory-II

L. F. Bringmann^{1*}, L. H. J. M. Lemmens², M. J. H. Huibers^{2,3}, D. Borsboom⁴ and F. Tuerlinckx¹

¹ Faculty of Psychology and Educational Sciences, University of Leuven, Leuven, Belgium

² Department of Clinical Psychological Science, Maastricht University, Maastricht, The Netherlands

³ Department of Clinical Psychology, VU University of Amsterdam, Amsterdam, The Netherlands

⁴ Department of Psychology, University of Amsterdam, Amsterdam, The Netherlands

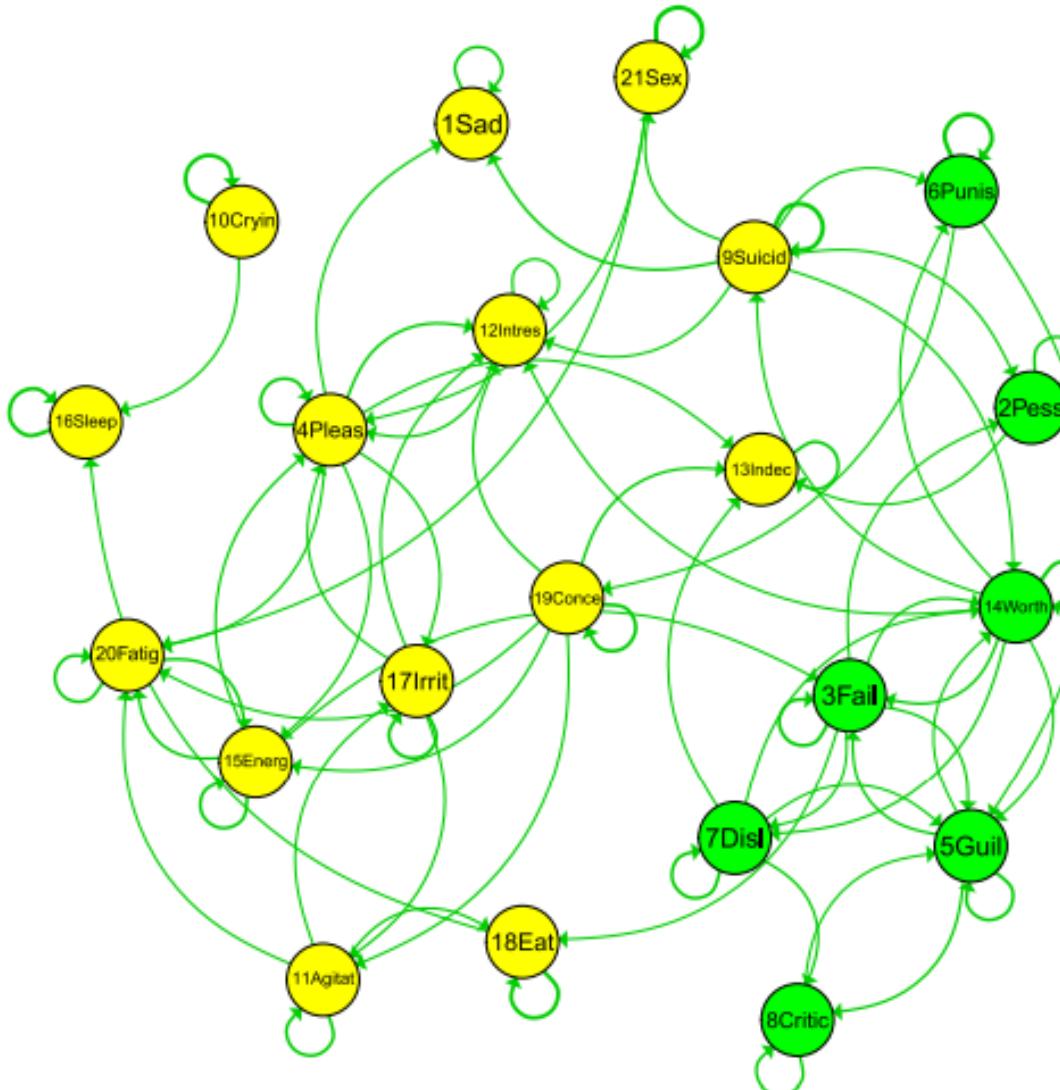


Fig. 3. Community structure of the BDI-II network with the two clusters indicated by two different colours.



SPECIAL ARTICLE

A network theory of mental disorders

Denny Borsboom

Department of Psychology, University of Amsterdam, Amsterdam 1018 XA, The Netherlands

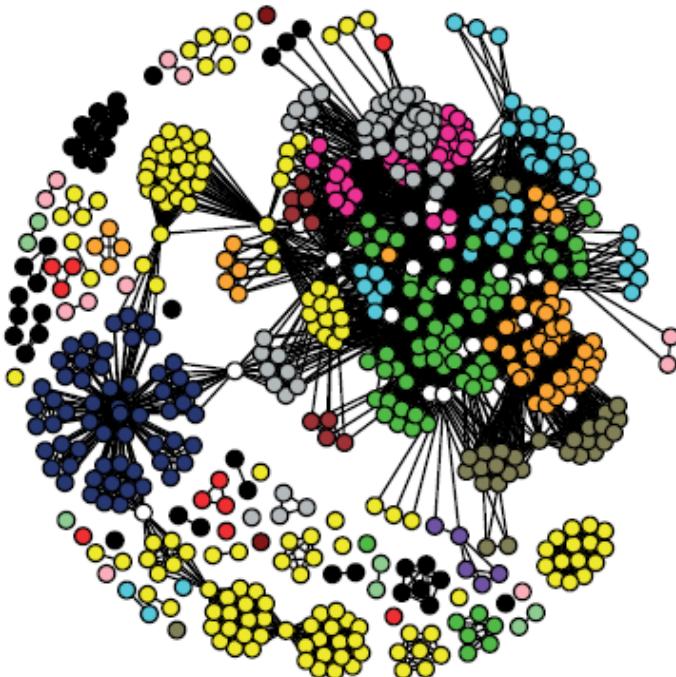
In recent years, the network approach to psychopathology has been advanced as an alternative way of conceptualizing mental disorders. In this approach, mental disorders arise from direct interactions between symptoms. Although the network approach has led to many novel methodologies and substantive applications, it has not yet been fully articulated as a scientific theory of mental disorders. The present paper aims to develop such a theory, by postulating a limited set of theoretical principles regarding the structure and dynamics of symptom networks. At the heart of the theory lies the notion that symptoms of psychopathology are causally connected through myriads of biological, psychological and societal mechanisms. If these causal relations are sufficiently strong, symptoms can generate a level of feedback that renders them self-sustaining. In this case, the network can get stuck in a disorder state. The network theory holds that this is a general feature of mental disorders, which can therefore be understood as alternative stable states of strongly connected symptom networks. This idea naturally leads to a comprehensive model of psychopathology, encompassing a common explanatory model for mental disorders, as well as novel definitions of associated concepts such as mental health, resilience, vulnerability and liability. In addition, the network theory has direct implications for how to understand diagnosis and treatment, and suggests a clear agenda for future research in psychiatry and associated disciplines.

Key words: Psychopathology, network approach, mental disorders, symptom networks, mental health, resilience, vulnerability, diagnosis, treatment

(World Psychiatry 2017;16:5–13)

Mapping the manuals of madness: Comparing the ICD-10 and DSM-IV-TR using a network approach

PIA TIO,¹ SACHA EPSKAMP,¹ ARJEN NOORDHOF² & DENNY BORSBOOM¹



- Disorders of infancy, childhood, and adolescence
- Delirium, dementia, and other cognitive disorders
- Mental disorders due to a medical condition
- Substance-related disorders
- Schizophrenia and other psychotic disorders
- Mood disorders
- Anxiety disorders
- Somatoform disorders
- Facitious disorders
- Dissociative disorders
- Sexual and gender identity disorders
- Eating disorders
- Sleep disorders
- Habit and impulse disorders
- Adjustment disorders
- Personality disorders
- Enduring personality change
- Symptom is featured equally in multiple classes

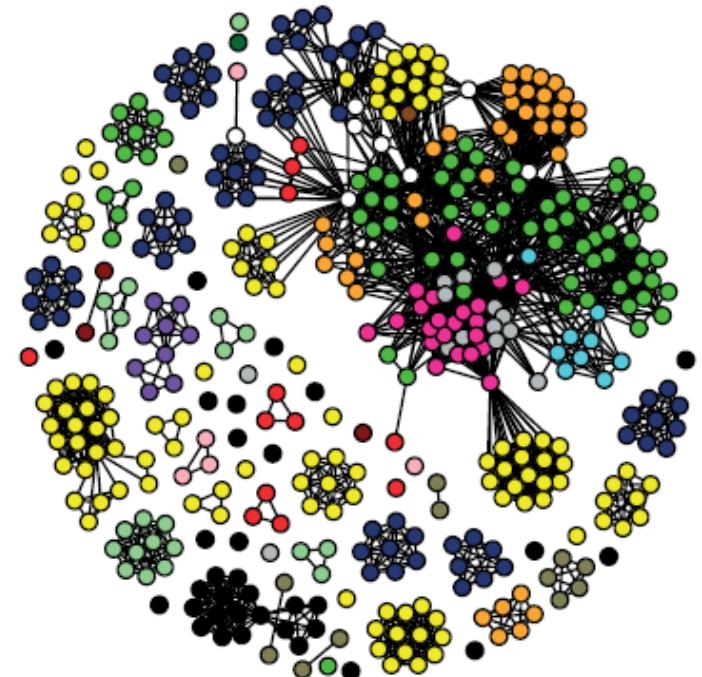


Table 2. Top 10 criteria with the highest degree for ICD-10 and DSM-IV-TR network

	ICD-10	DSM-IV-TR
1	Insomnia ¹	Insomnia ¹
2	Irritability ¹	Psychomotor agitation
3	Apathy	Psychomotor retardation ¹
4	Difficulty in concentrating ¹	Depressed
5	Nausea	Accelerated heart rate
6	Emotional lability	Distractibility
7	Sweating ¹	Irritability ¹
8	Chest pain	Anxiety and Hypersomnia
9	Restless sleep	Sweating ¹ and Weight loss Difficulty in concentrating ¹
10	Psychomotor retardation ¹	and Hallucinations/illusions

¹Criteria that occur in the top 10 of both networks. Places 8 through 10 in the DSM-IV-TR hold multiple symptoms.

Análise de rede

- Técnica de aprendizado de máquina (machine learning)
- Dar sentido a dados complexos
- Representação gráfica para integração e leitura mais “intuitiva” dos dados

Exemplos “hands on” (mão na massa)

- Personalidade
- Depressão
- DASS-21 (depressão, ansiedade e estresse) – comorbidade
- Predição – tratamento de autismo e qualidade de vida

Porquê usar a linguagem r?

- Capacidades gráficas muito sofisticadas e melhores que muitos softwares
- Linguagem de programação que possibilita o desenvolvimento de novas ferramentas
- Comunidade de usuários muito ativa e participativa

The collage includes:

- RStudio logo: A blue circle with a white 'R' and the word 'RStudio' below it.
- Stack Overflow logo: A stylized orange and grey icon followed by the text 'stackoverflow'.
- Github logo: The GitHub octocat icon next to the word 'GitHub'.
- Screenshot of a Facebook group page titled 'Psicometristas BRASIL'. The page has over 700 members and a large banner image.
- Screenshot of the 'Personality Project' website, featuring a dark header and a light blue footer with the 'DataCamp' logo.
- Screenshot of the 'Quick-R' website, which is powered by DataCamp, showing a blue header and a white footer with the 'DataCamp' logo.



Getting Started



- É o sistema básico – feito de forma colaborativa – Possui funções básicas que podem ser combinadas em pacotes mais avançados
- R Studio – Uma interface mais amigável para o uso do R. Permite análise, escrita (tem gente que escreve a tese por aqui), e publicações.

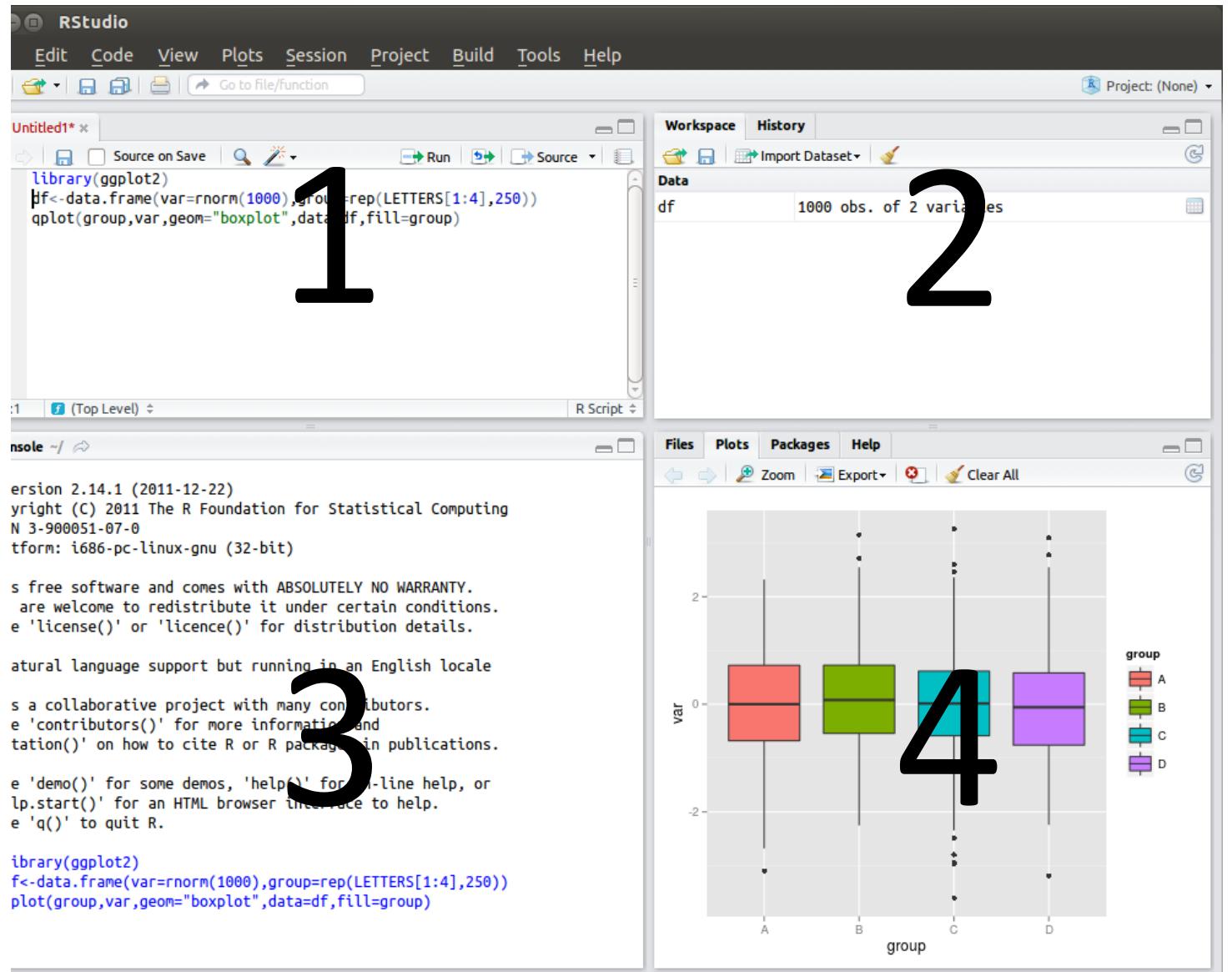
RStudio

1 – script ou comandos; visualização de bancos de dados ou texto

2 – repositório de objetos e funções

3 – log de atividade

4 – gráficos e documentação



Personalidade

Behav Genet (2014) 44:591–604
DOI 10.1007/s10519-013-9625-7

ORIGINAL RESEARCH

The Big Five Personality Traits: Psychological Entities or Statistical Constructs?

Sanja Franić · Denny Borsboom · Conor V. Dolan ·
Dorret I. Boomsma

Dimensions of Normal Personality as Networks in Search of Equilibrium: You Can't Like Parties if You Don't Like People

ANGÉLIQUE O. J. CRAMER^{1*}, SOPHIE VAN DER SLUIS^{1,2}, ARJEN NOORDHOF¹, MARIEKE WICHERS³, NICOLE GESCHWIND^{3,4}, STEVEN H. AGGEN^{5,6}, KENNETH S. KENDLER^{5,6} and DENNY BORSBOOM¹

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³European Graduate School for Neuroscience, SEARCH, Department of Psychiatry and Psychology, Maastricht University Medical Centre, The Netherlands

⁴Research Group on Health Psychology, Centre for the Psychology of Learning and Experimental Psychopathology, University of Leuven, Belgium

⁵Virginia Institute for Psychiatric and Behavioral Genetics, USA

⁶Department of Psychiatry, Virginia Commonwealth University, USA

Author's Response

Measurable Like Temperature or Mereological Like Flocking? On the Nature of Personality Traits

ANGÉLIQUE O. J. CRAMER^{1*}, SOPHIE VAN DER SLUIS^{1,2}, ARJEN NOORDHOF¹, MARIEKE WICHERS³, NICOLE GESCHWIND^{3,4}, STEVEN H. AGGEN^{5,6}, KENNETH S. KENDLER^{5,6} and DENNY BORSBOOM¹

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⁴Research Group on Health Psychology, Centre for the Psychology of Learning and Experimental Psychopathology, University of Leuven, Belgium

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⁶Department of Psychiatry, Virginia Commonwealth University, USA

Contents lists available at [ScienceDirect](#)



Journal of Research in Personality

journal homepage: www.elsevier.com/locate/jrp



State of the aRt personality research: A tutorial on network analysis of personality data in R

Giulio Costantini ^{a,*¹}, Sacha Epskamp ^{b,¹}, Denny Borsboom ^b, Marco Perugini ^a, René Möttus ^{c,d}, Lourens J. Waldorp ^b, Angélique O.J. Cramer ^b

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Journal of Statistical Software

May 2012, Volume 48, Issue 4.

<http://www.jstatsoft.org/>

qgraph: Network Visualizations of Relationships in Psychometric Data

Sacha Epskamp

University of Amsterdam

Angélique O. J. Cramer

University of Amsterdam

Lourens J. Waldorp

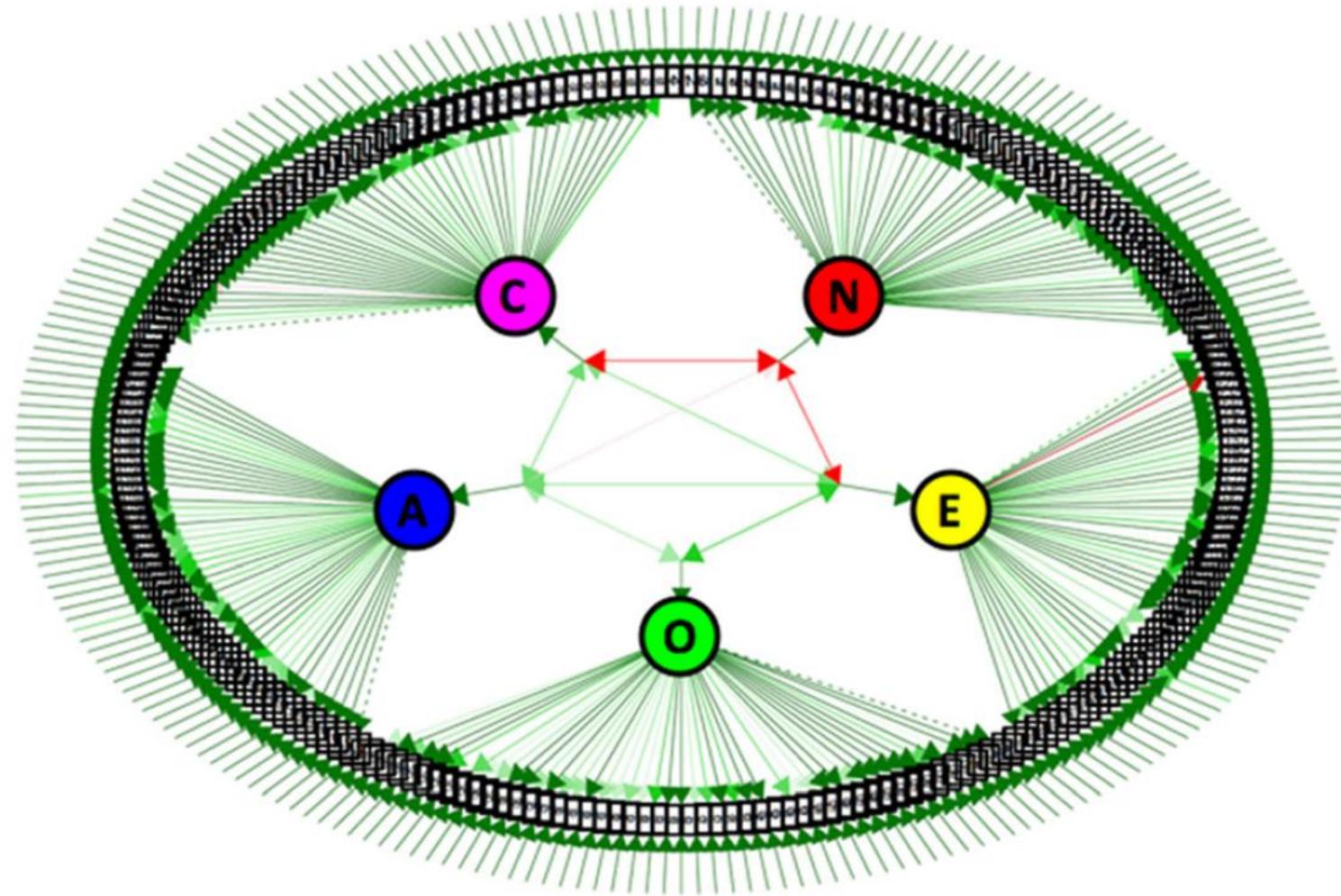
University of Amsterdam

Verena D. Schmittmann

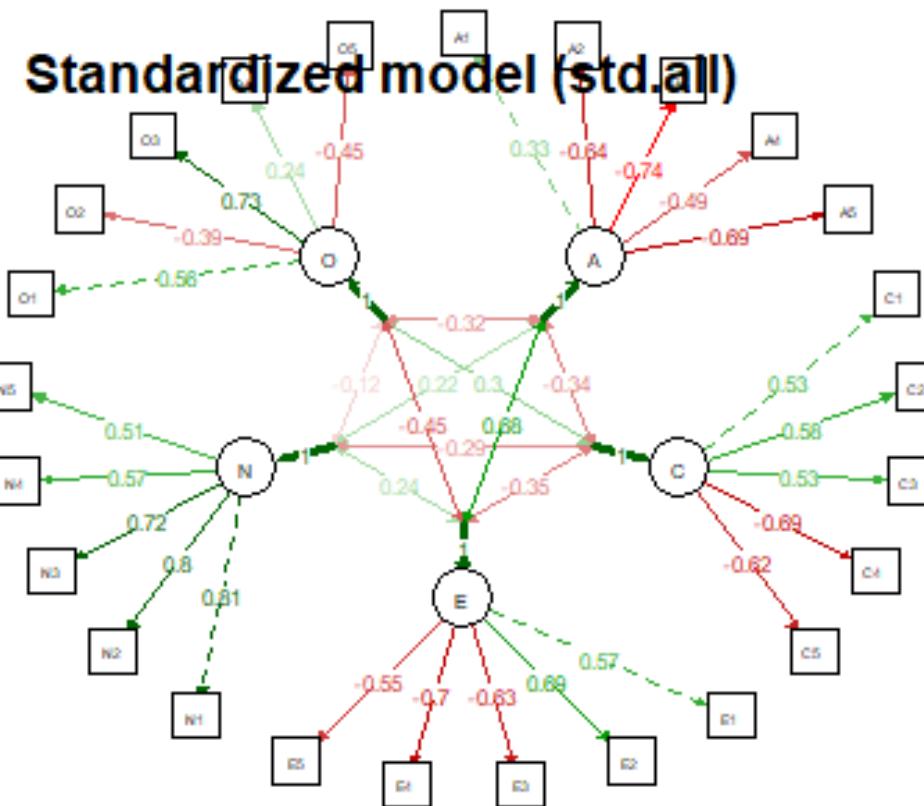
University of Amsterdam

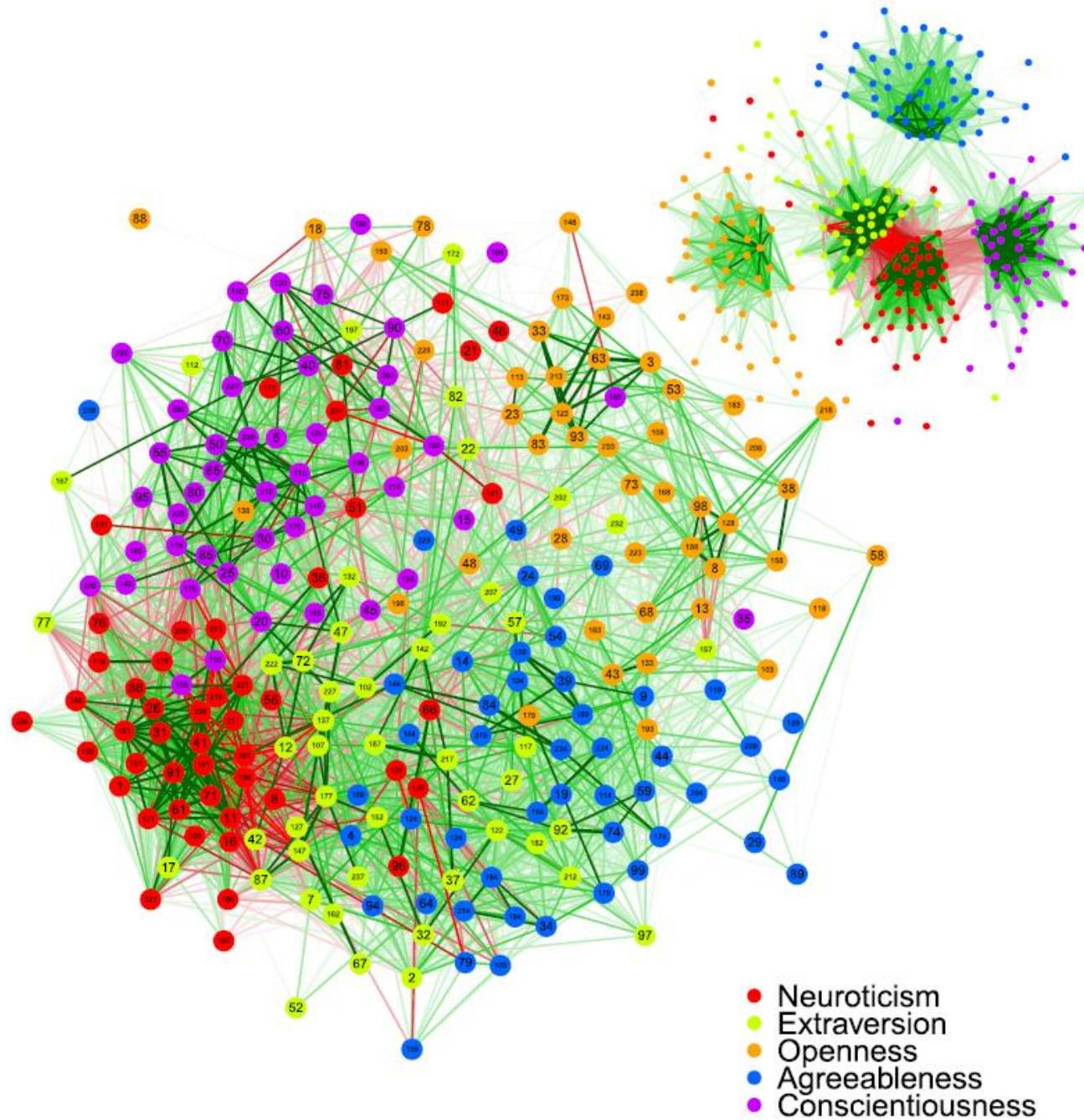
Denny Borsboom

University of Amsterdam

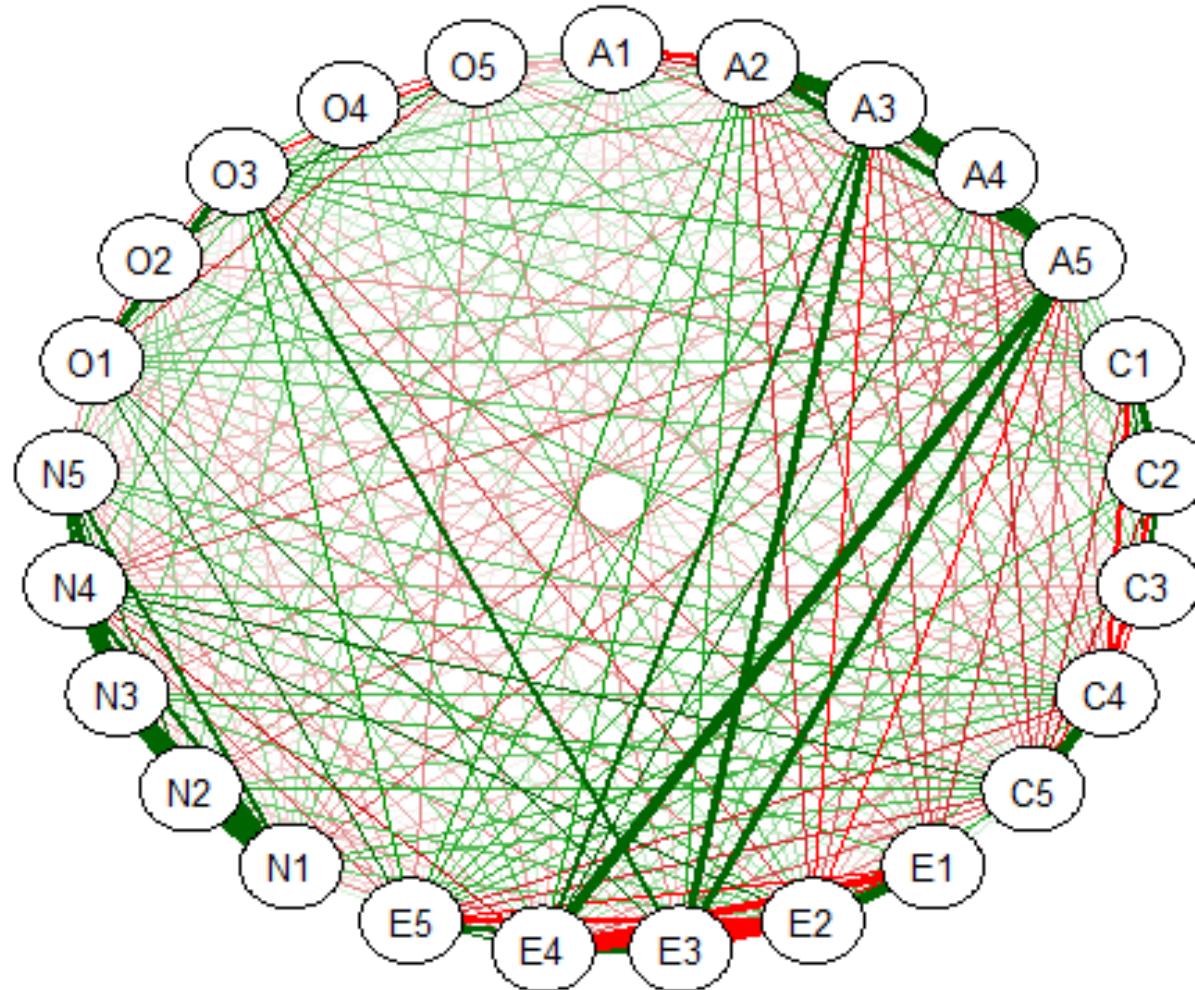


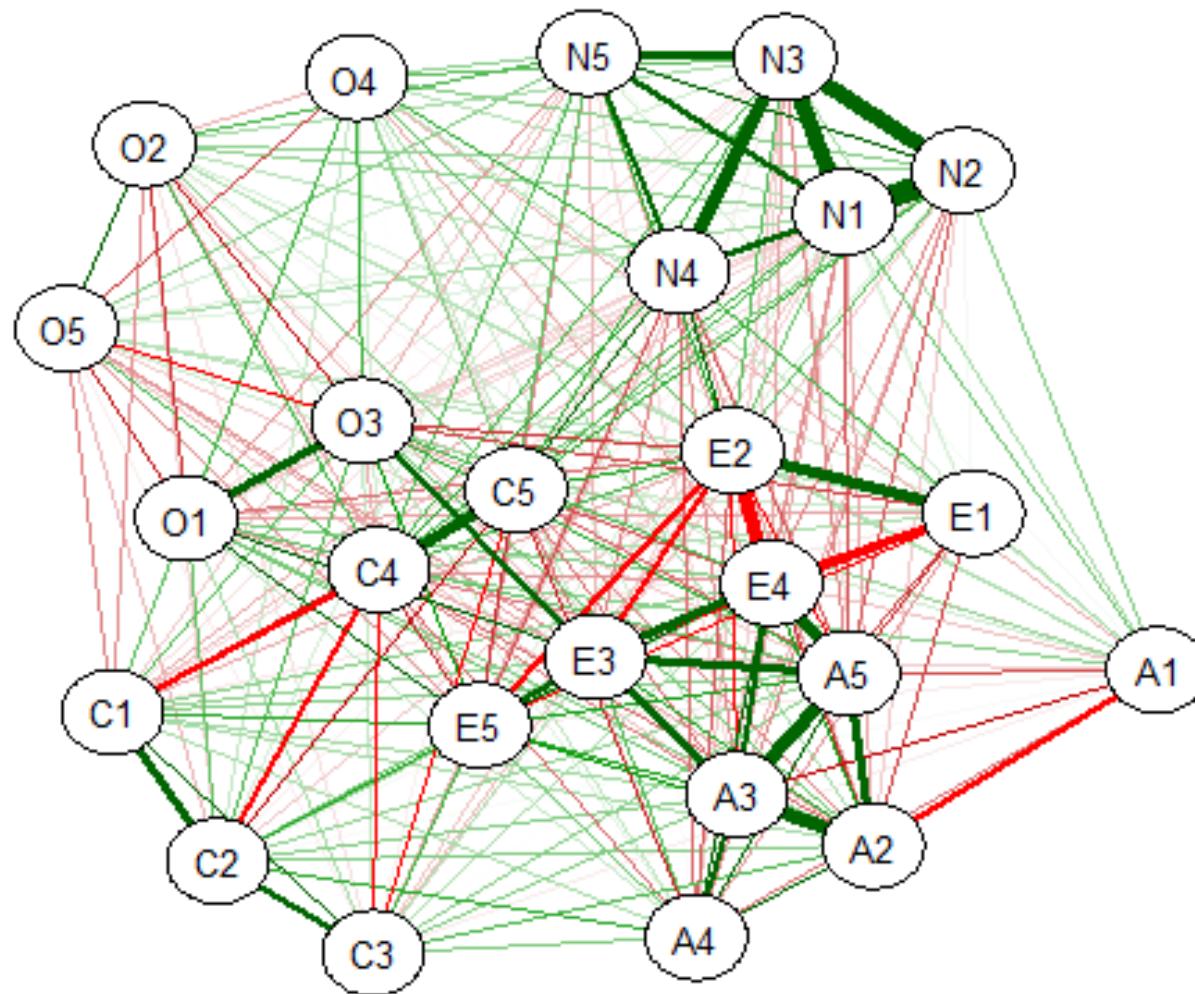
CFA

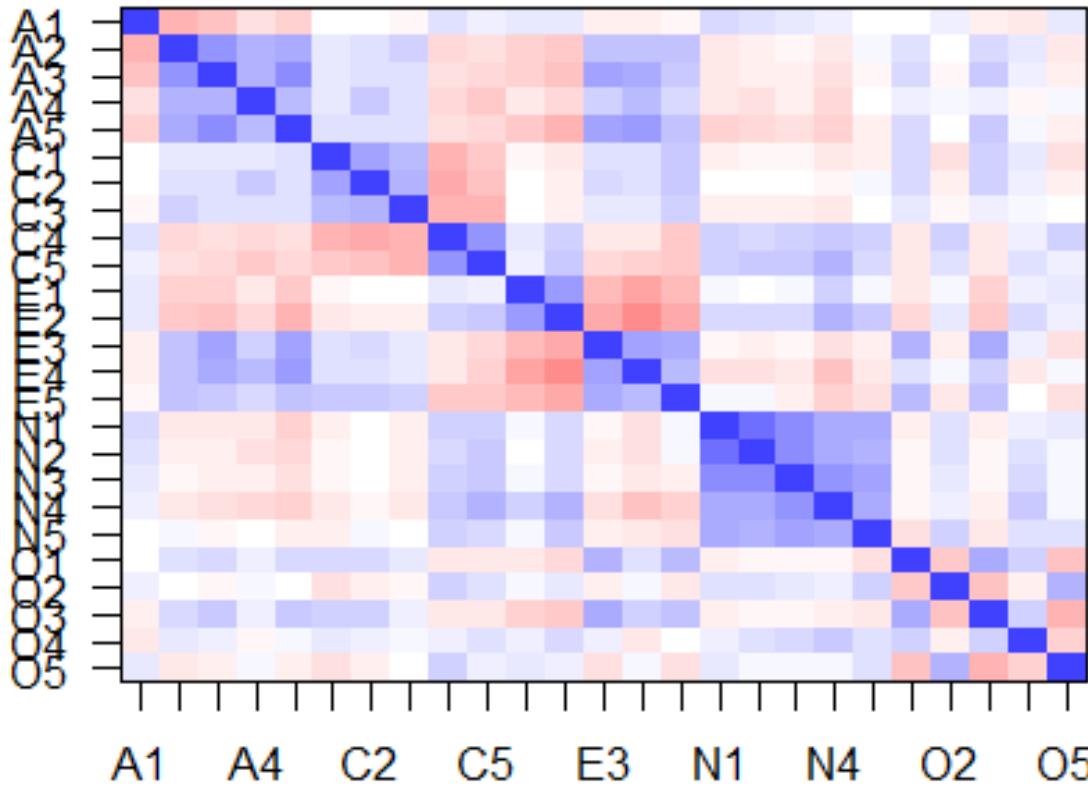




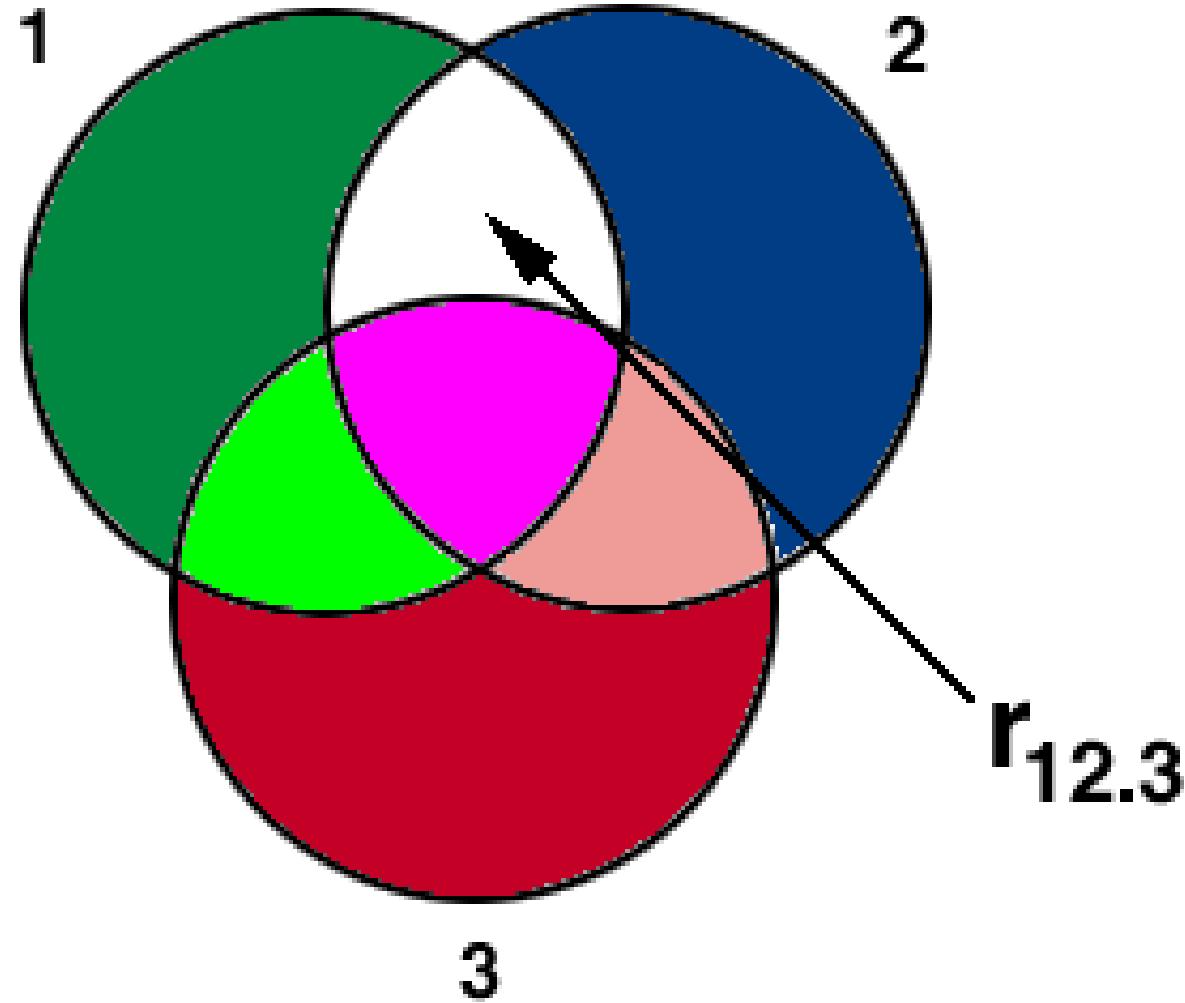
Para o RStudio!!!

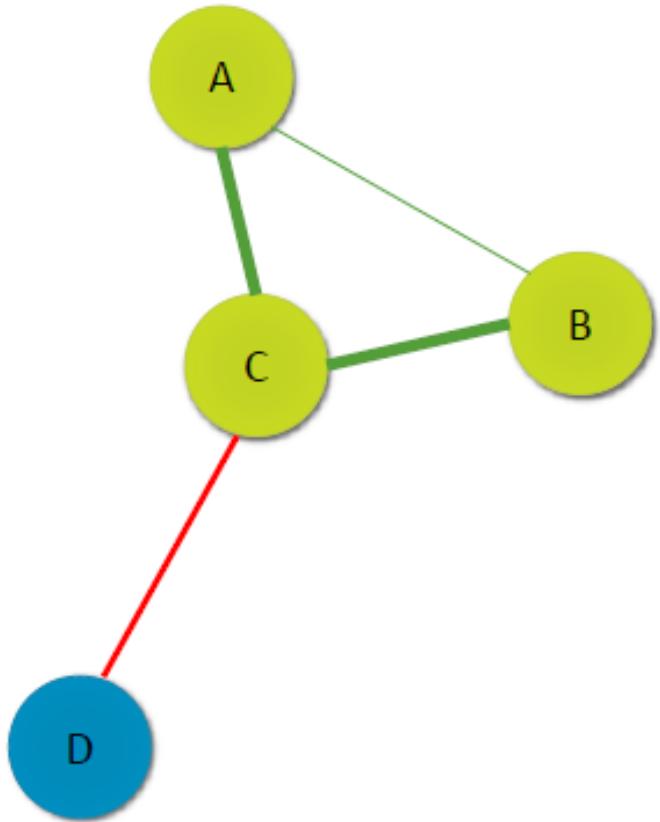




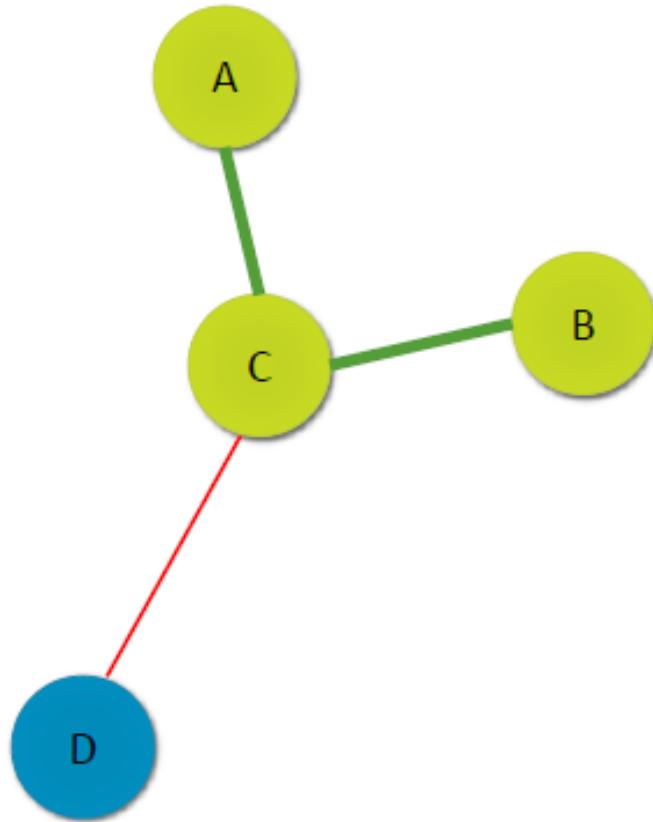


Correlação
parcial

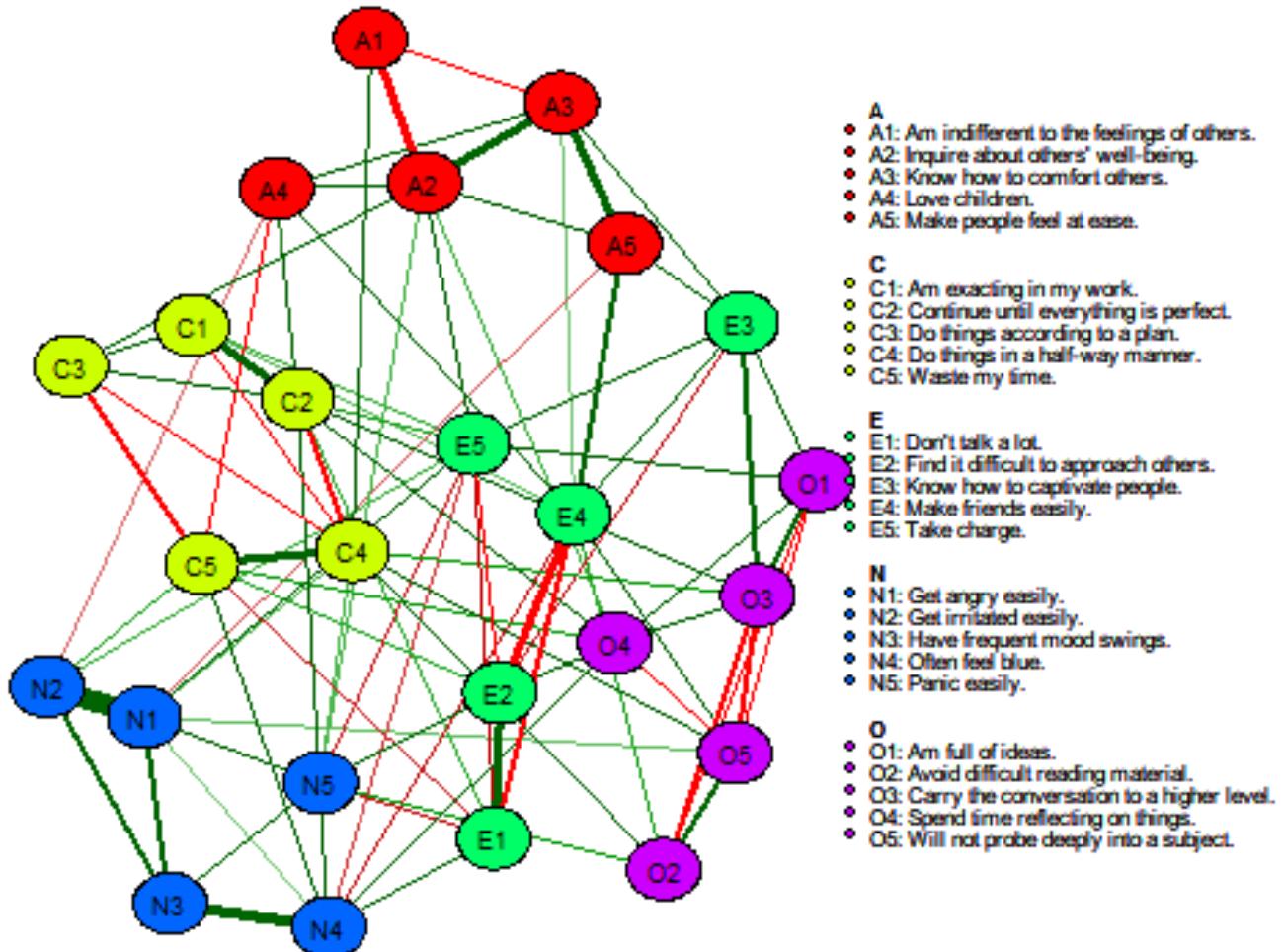


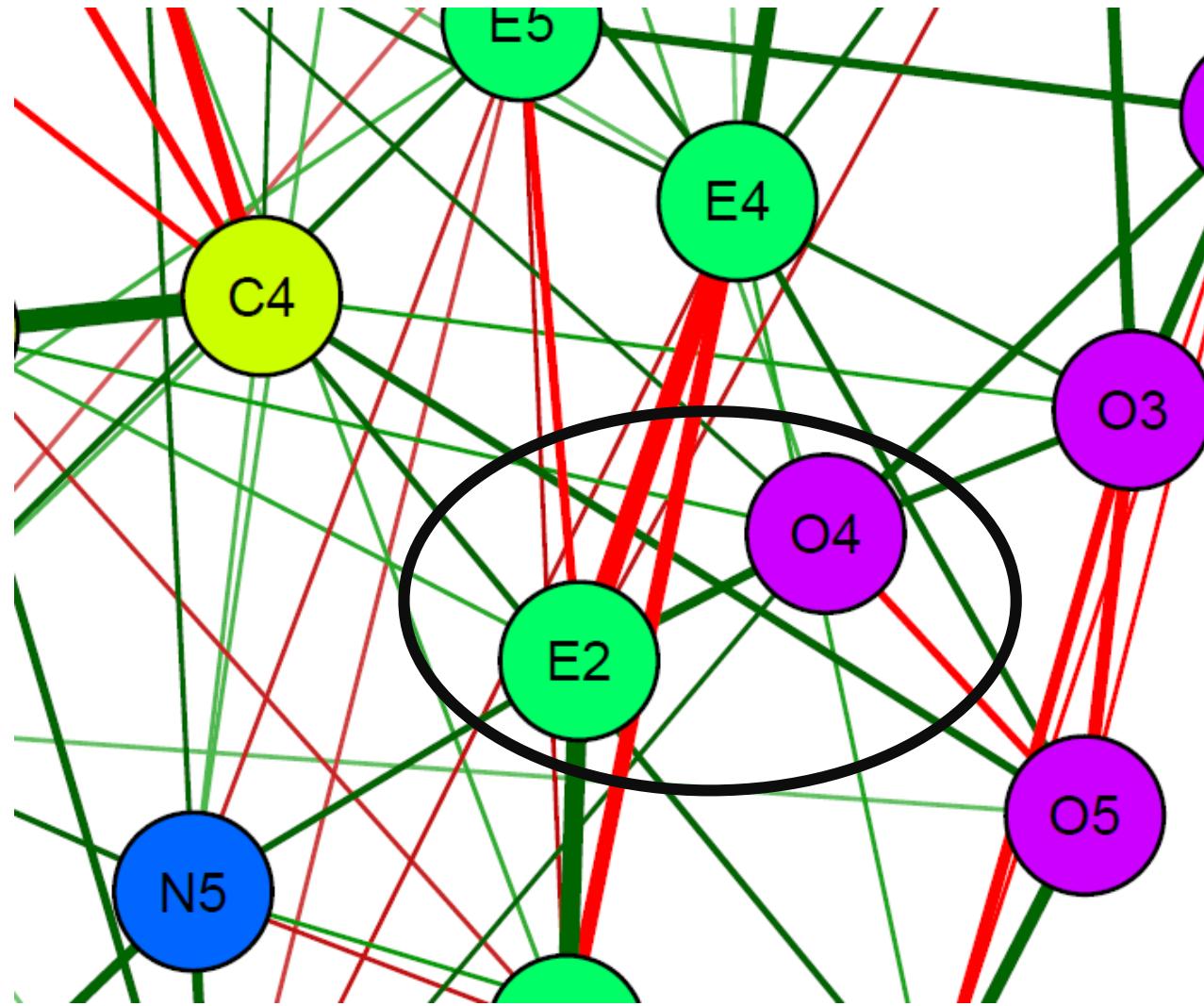


*Rede esparsa, na qual os
valores de baixa magnitude
são fixados em zero*



Friedman, Hastie & Tibshirani (2008)





• E1: Don't know a lot.

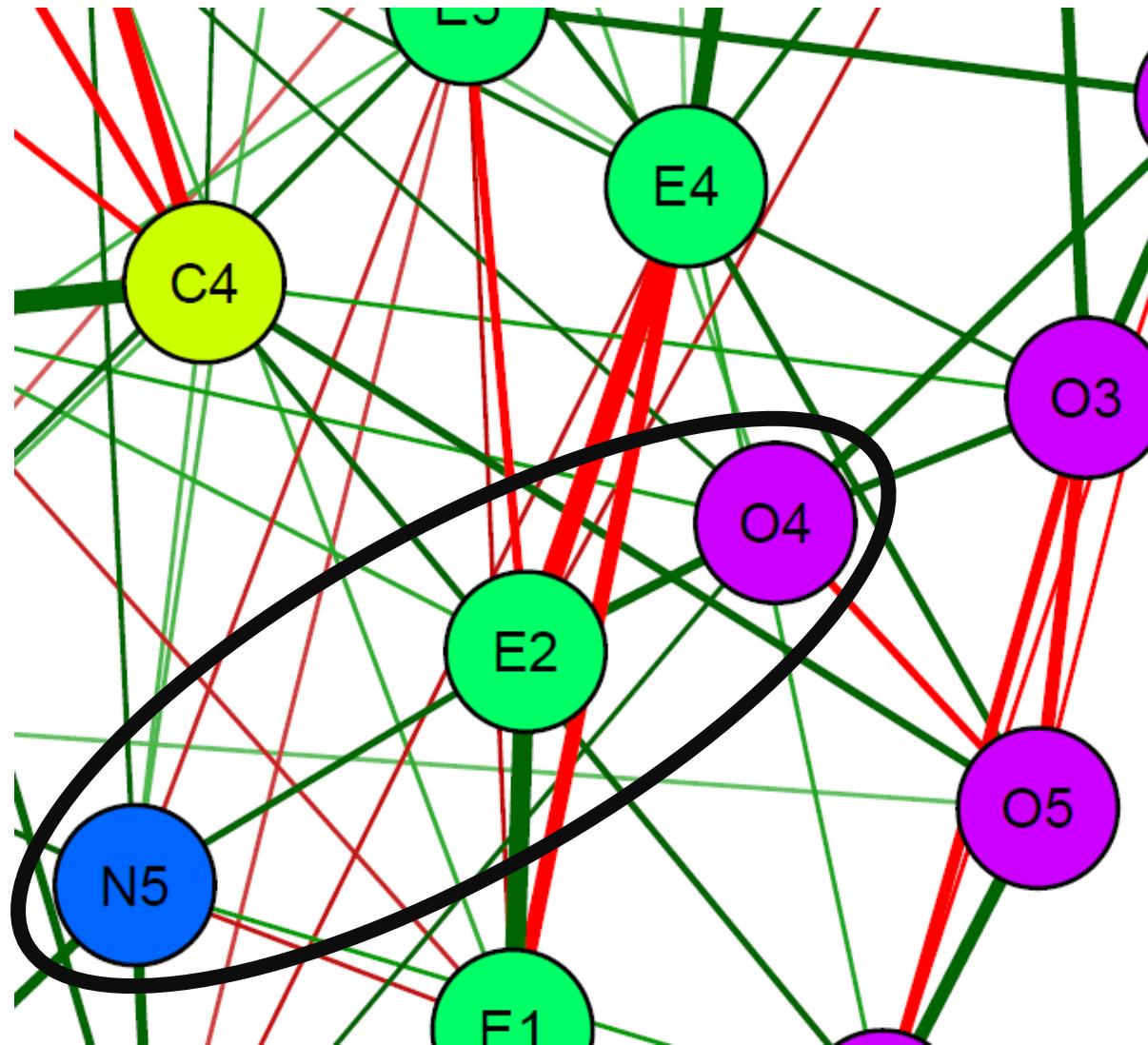
- E2: Find it difficult to approach others.
- E3: Know how to captivate people.
- E4: Make friends easily.
- E5: Take charge.

N

- N1: Get angry easily.
- N2: Get irritated easily.
- N3: Have frequent mood swings.
- N4: Often feel blue.
- N5: Panic easily.

O

- O1: Am full of ideas.
- O2: Avoid difficult reading material.
- O3: Carry the conversation to a higher level.
- O4: Spend time reflecting on things.



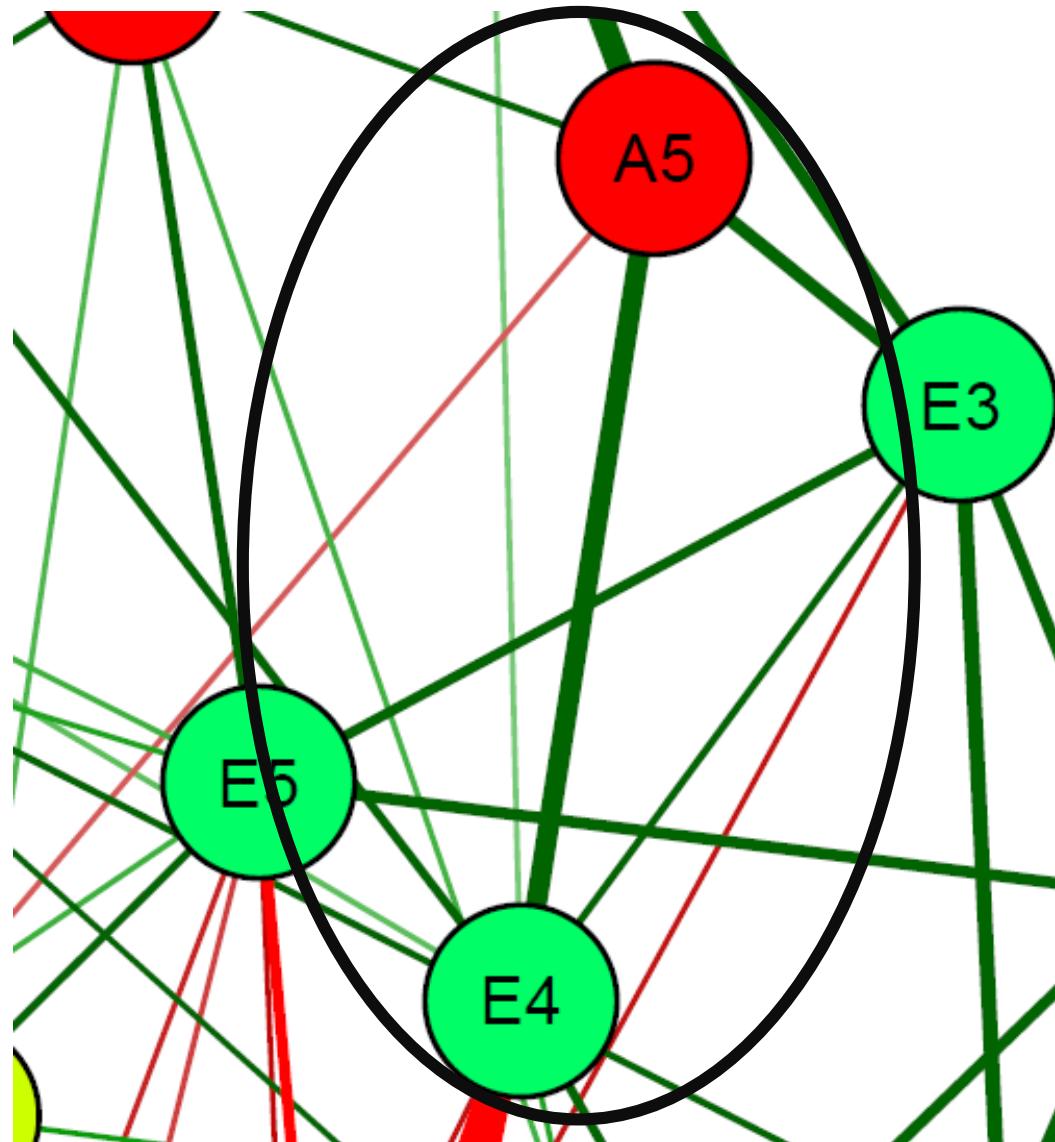
- E2: Find it difficult to approach others.
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N

- N1: Get angry easily.
- N2: Get irritated easily.
- N3: Have frequent mood swings.
- N4: Often feel blue.
- N5: Panic easily.

O

- O1: Am full of ideas.
- O2: Avoid difficult reading material.
- O3: Carry the conversation to a higher level.
- O4: Spend time reflecting on things.
- O5: Will not probe deeply into a subject.



● A4: Love criticism.

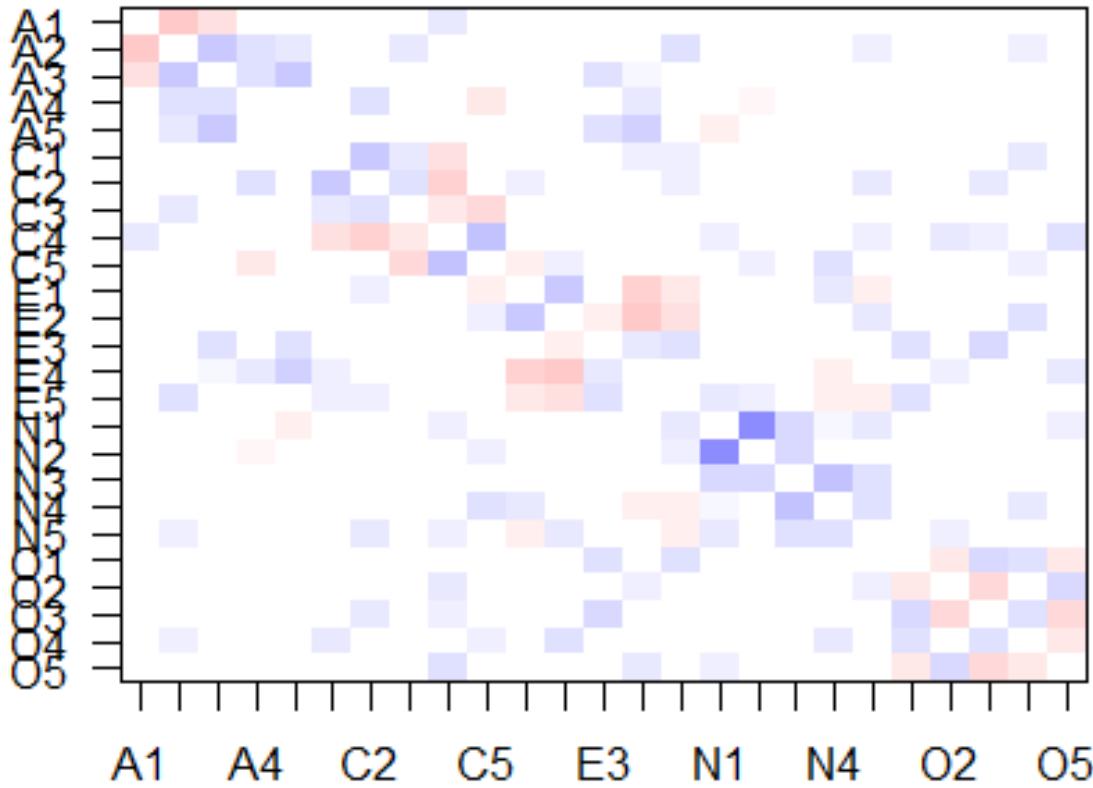
● A5: Make people feel at ease.

C

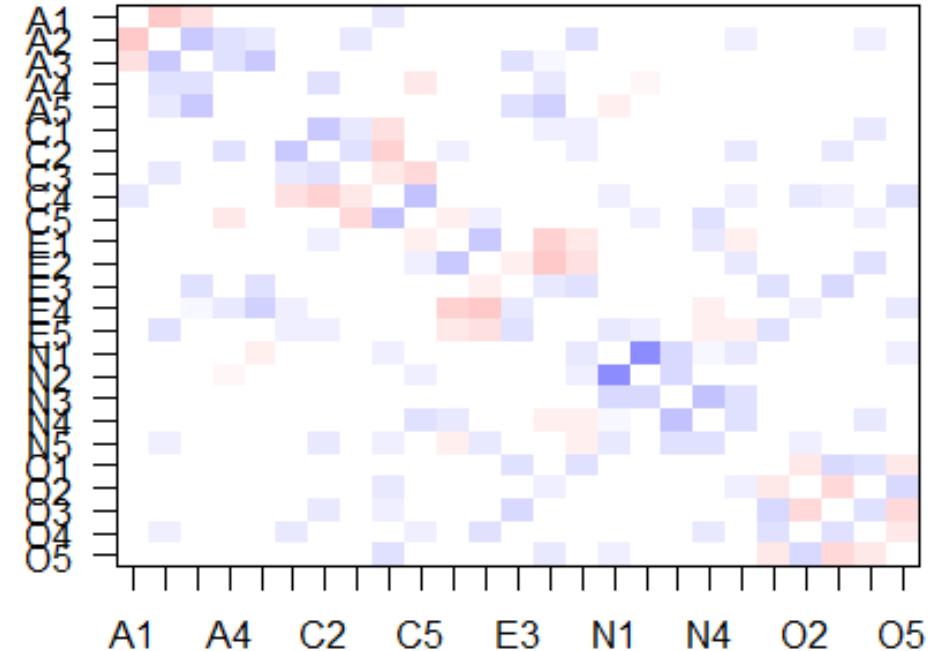
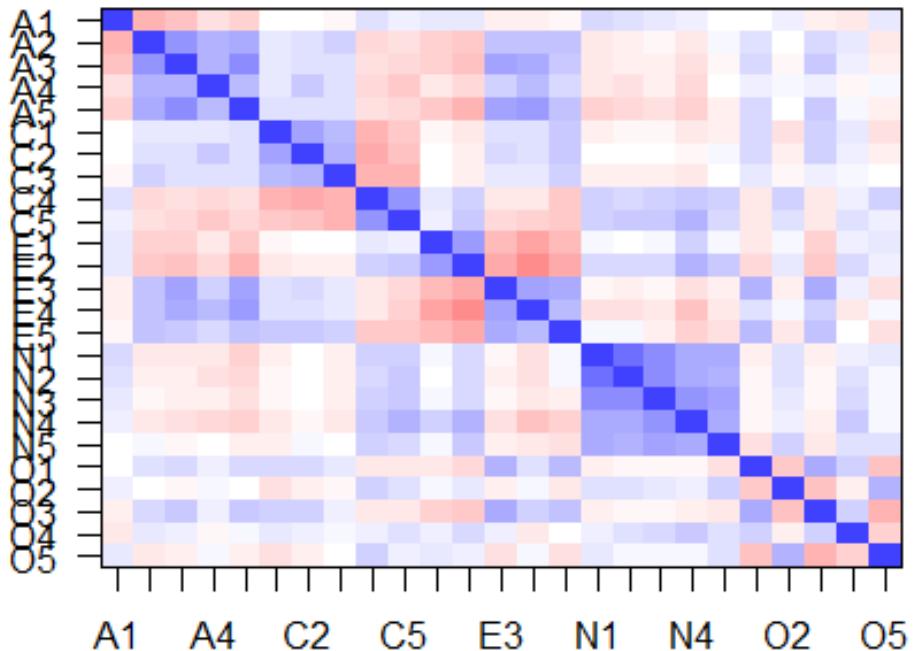
- C1: Am exacting in my work.
- C2: Continue until everything is perfect.
- C3: Do things according to a plan.
- C4: Do things in a half-way manner.
- C5: Waste my time.

E

- E1: Don't talk a lot.
- E2: Find it difficult to approach others.
- E3: Know how to captivate people.
- E4: Make friends easily.
- E5: Take charge.



Diferença entre correlações bivariadas e parciais



Depressão

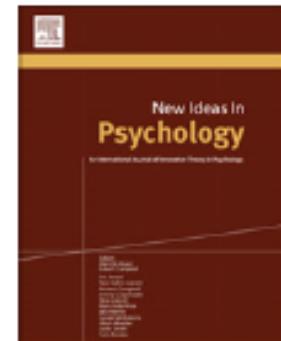


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journal homepage: www.elsevier.com/locate/newideapsych



Deconstructing the construct: A network perspective
on psychological phenomena

Verena D. Schmittmann, Angélique O.J. Cramer, Lourens J. Waldorp, Sacha Epskamp,
Rogier A. Kievit, Denny Borsboom*

Psychometric Perspectives on Diagnostic Systems



Denny Borsboom

University of Amsterdam

1102

Journal of Clinical Psychology, September 2008

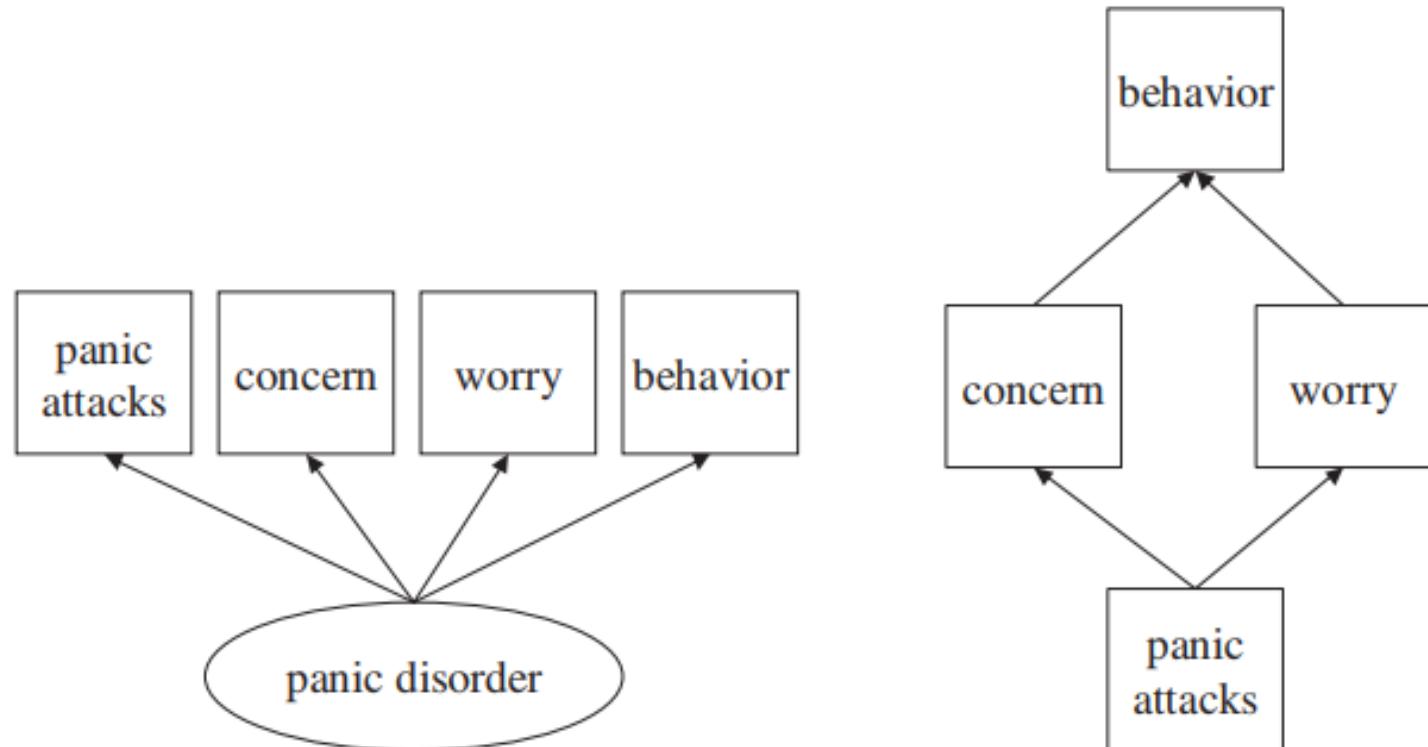
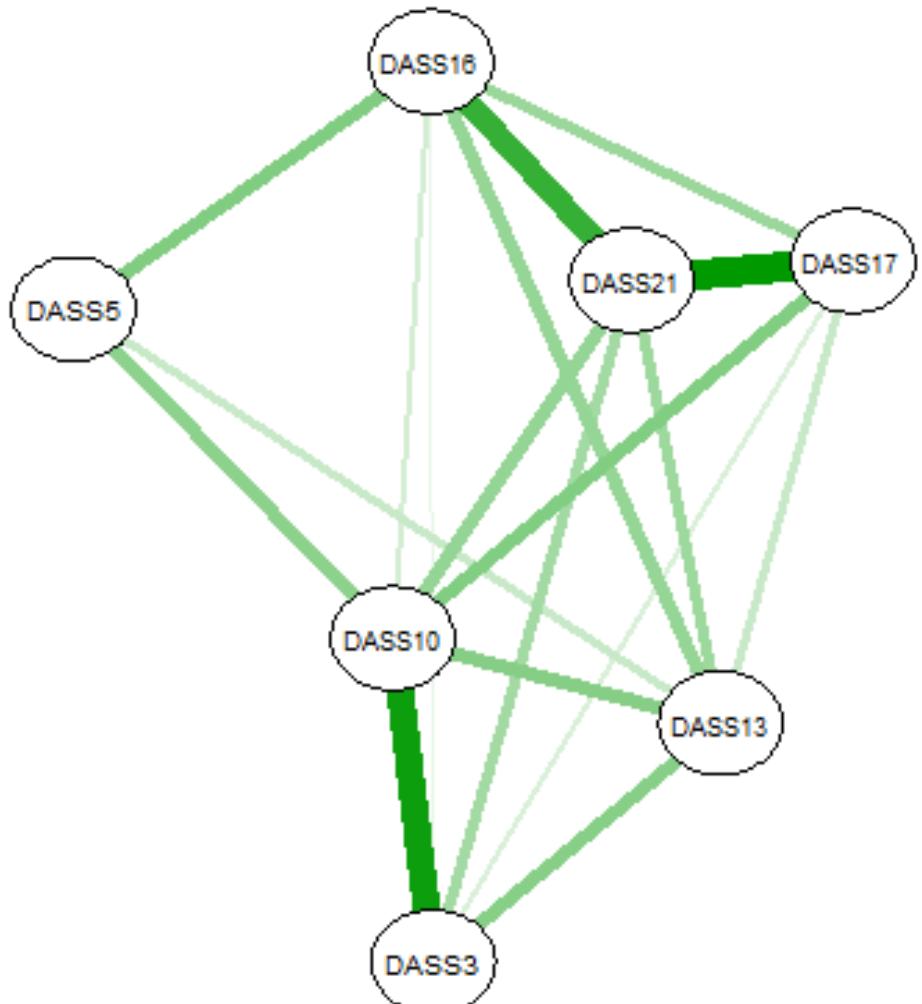
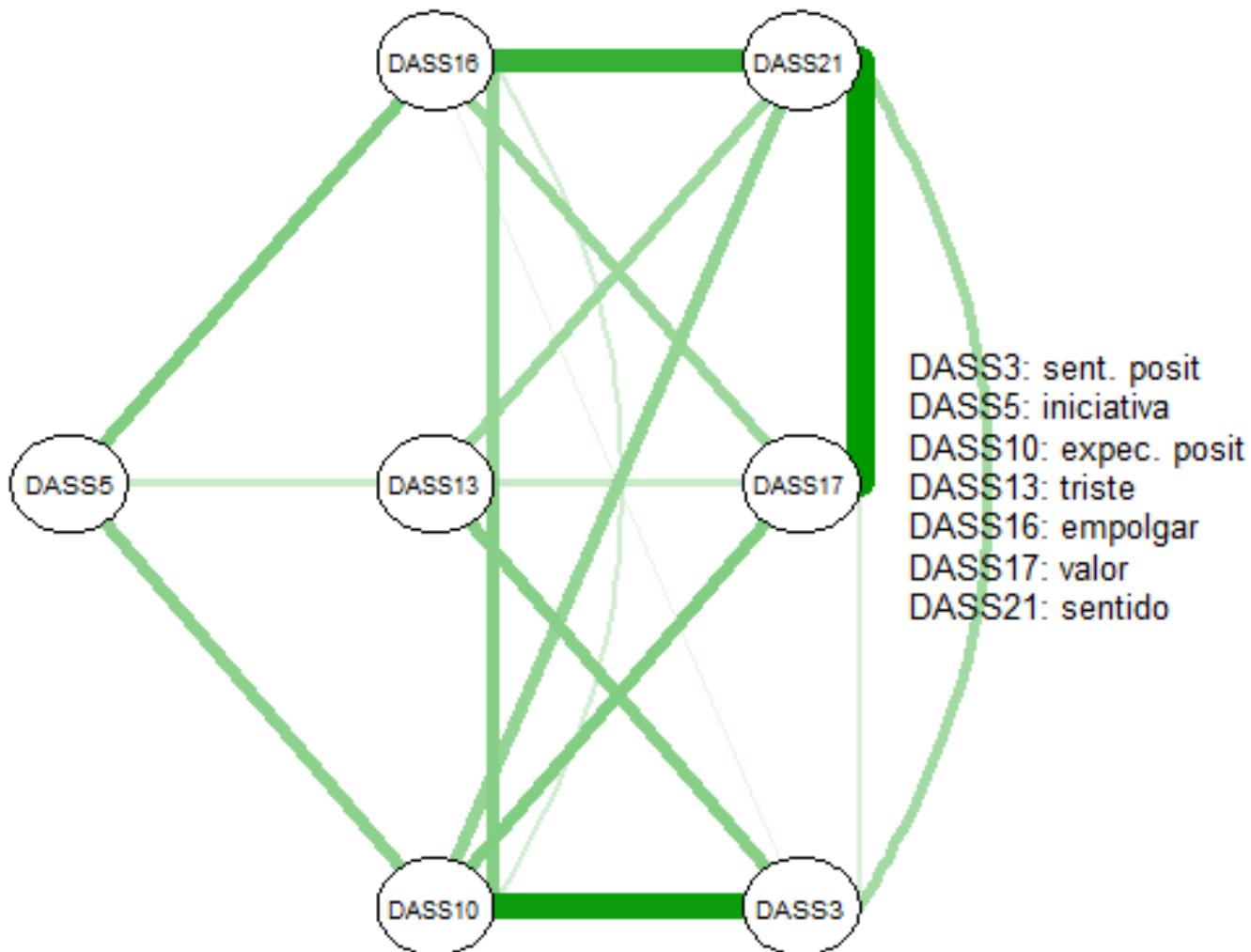


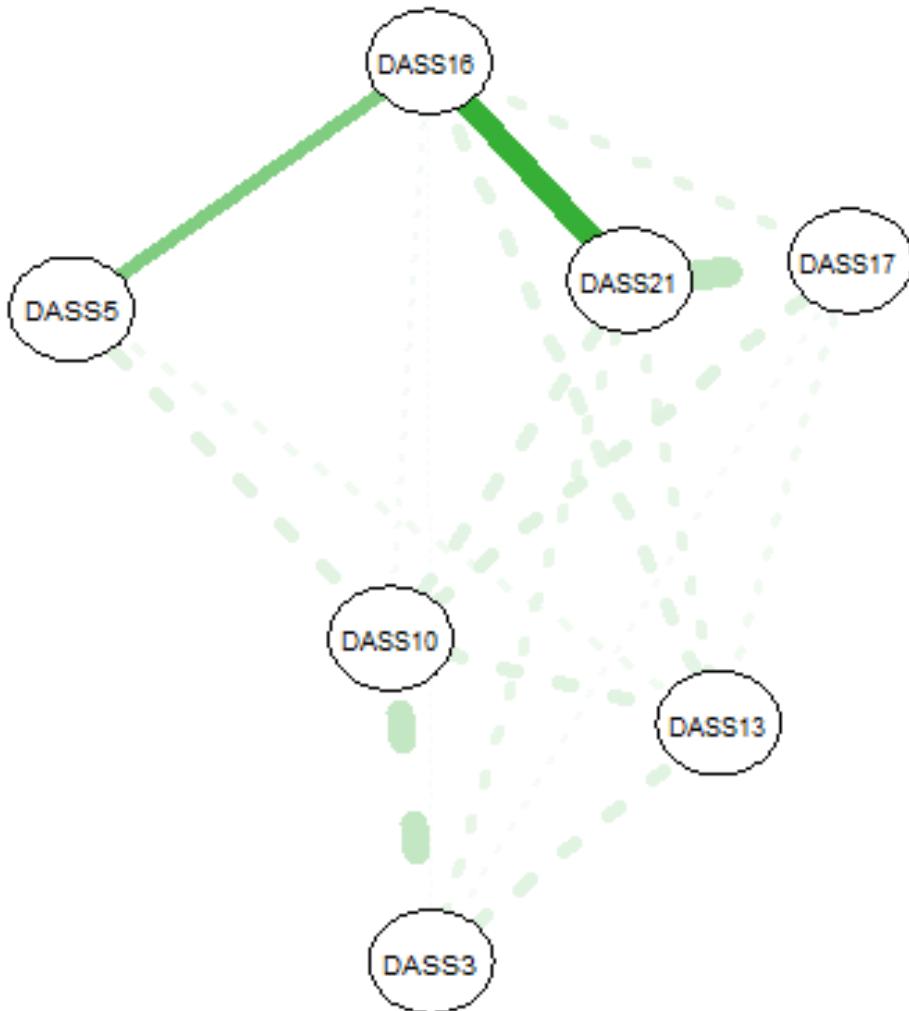
Figure 1. The left panel shows the relation between panic disorder and its symptoms from a latent variable modeling point of view. The right panel shows a representation of these symptoms as a causal system.

Para o RStudio!!!



DASS3: sent. posit
DASS5: iniciativa
DASS10: expec. posit
DASS13: triste
DASS16: empolgar
DASS17: valor
DASS21: sentido





DASS3: sent. posit
DASS5: iniciativa
DASS10: expec. posit
DASS13: triste
DASS16: empolgar
DASS17: valor
DASS21: sentido

DASS-21

Comorbidity: A network perspective

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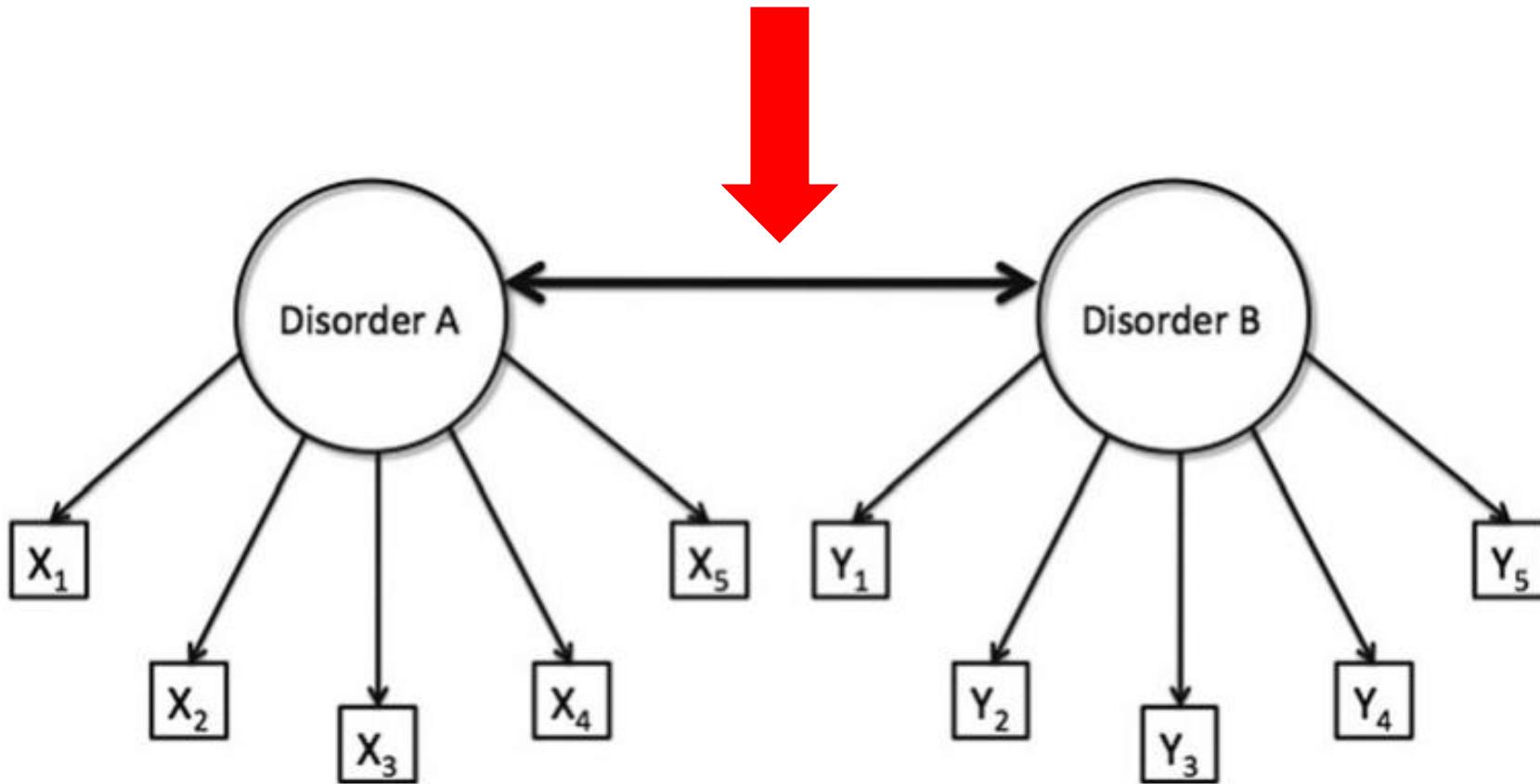
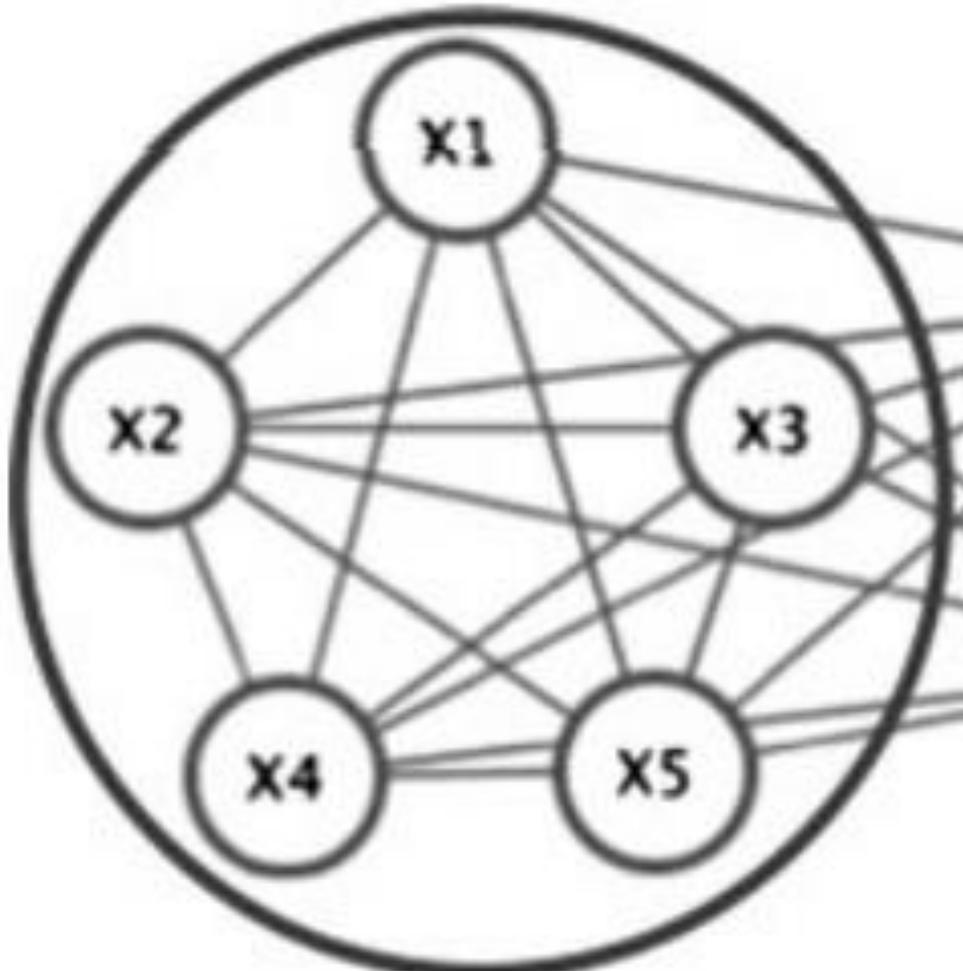
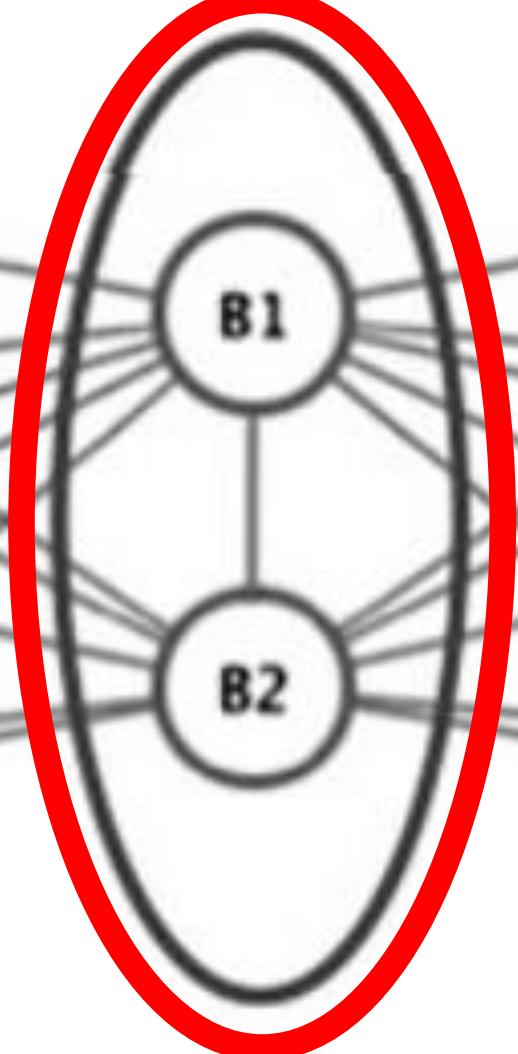


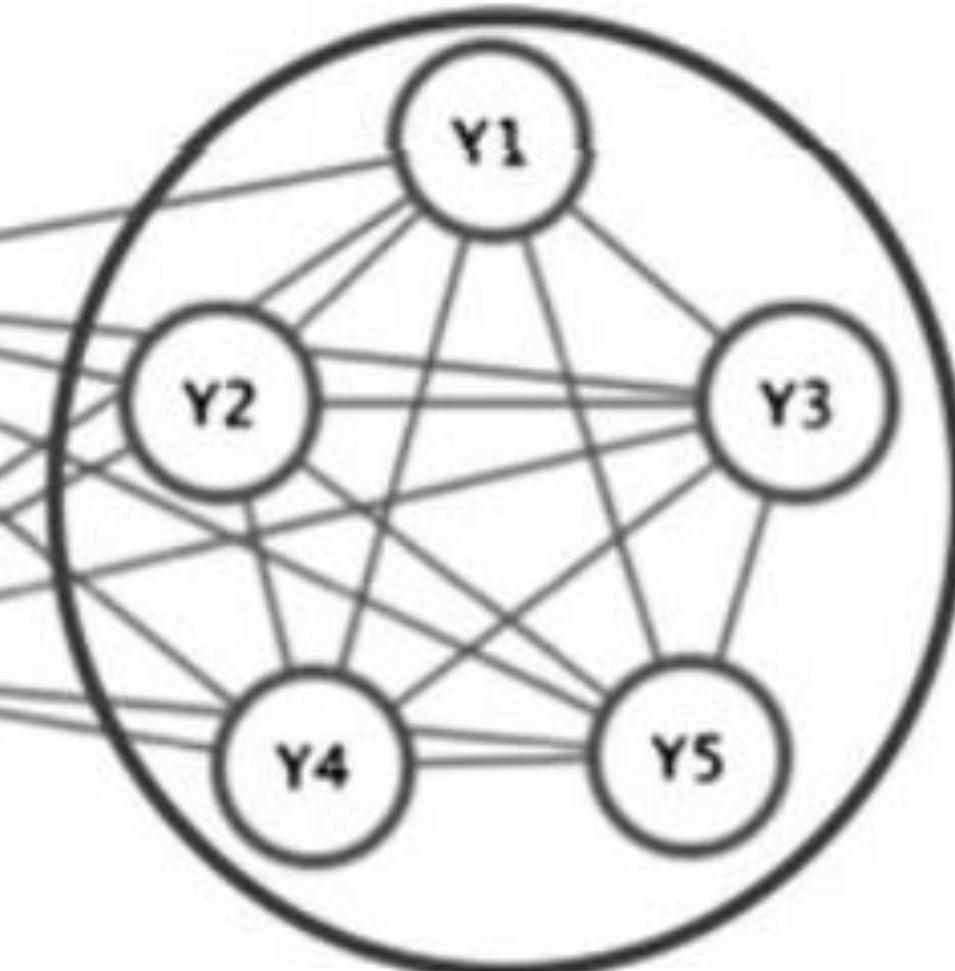
Figure 1. A model of comorbidity between disorders A and B, under the standard assumptions of latent variable modeling. The *circles* represent the disorders (i.e., latent variables) and the *rectangles* represent the observable core symptoms of those disorders (i.e., $X_1 - X_5$ for disorder A, and $Y_1 - Y_5$ for disorder B). In this model, comorbidity is viewed as a correlation between the latent variables, visualized by the *thick bidirectional edge* between disorders A and B.



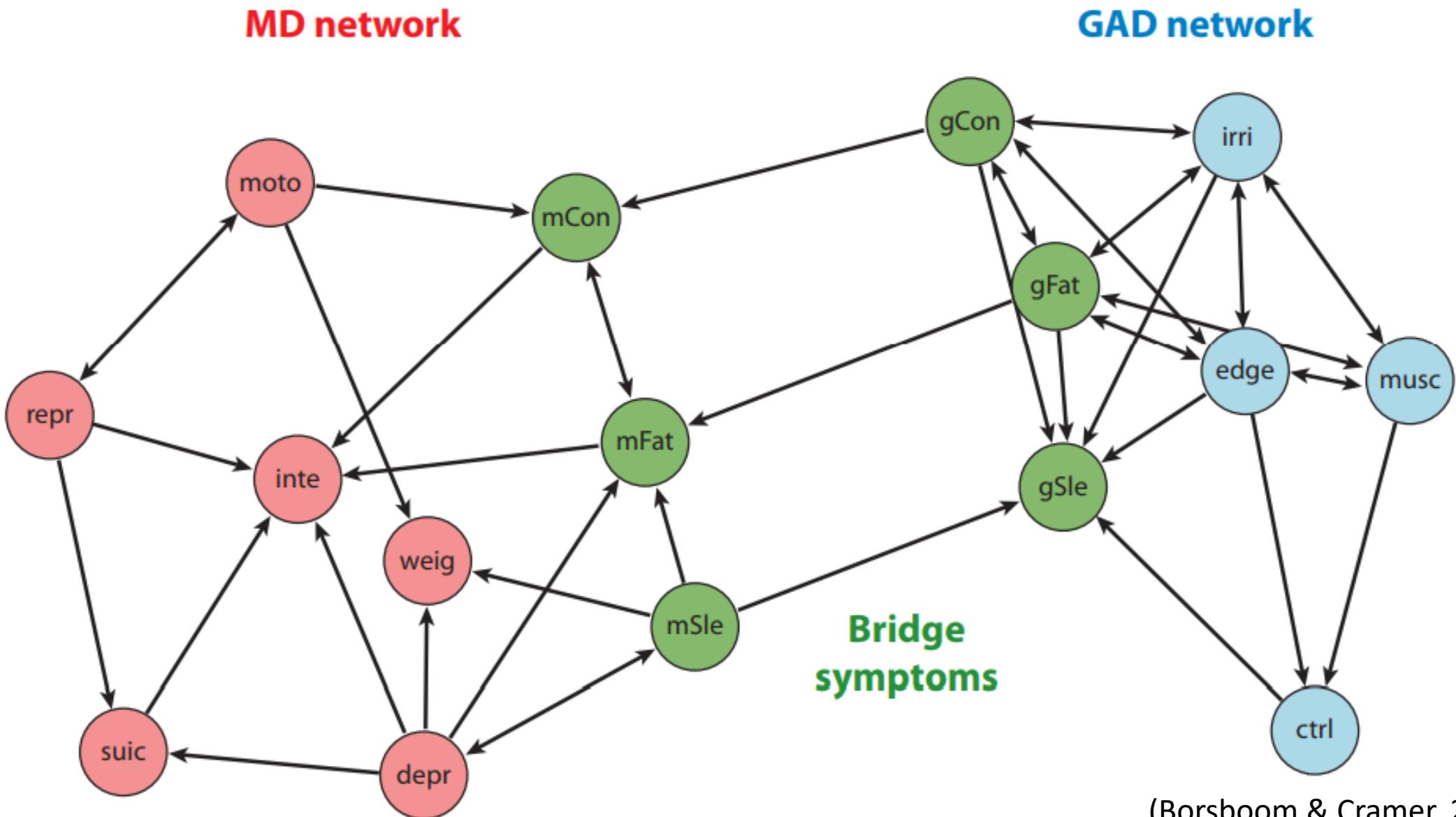
Disorder A

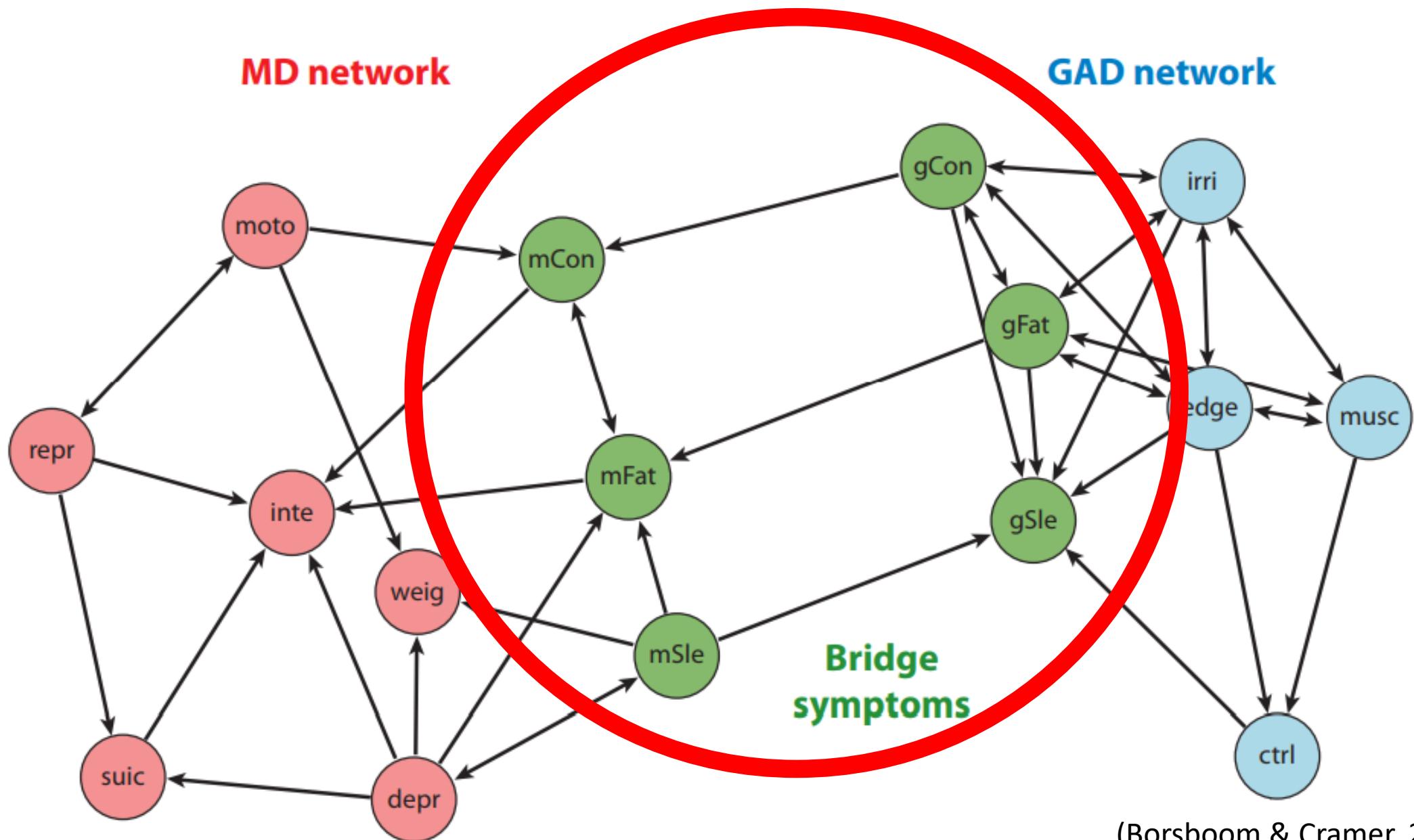


Bridge
symptoms

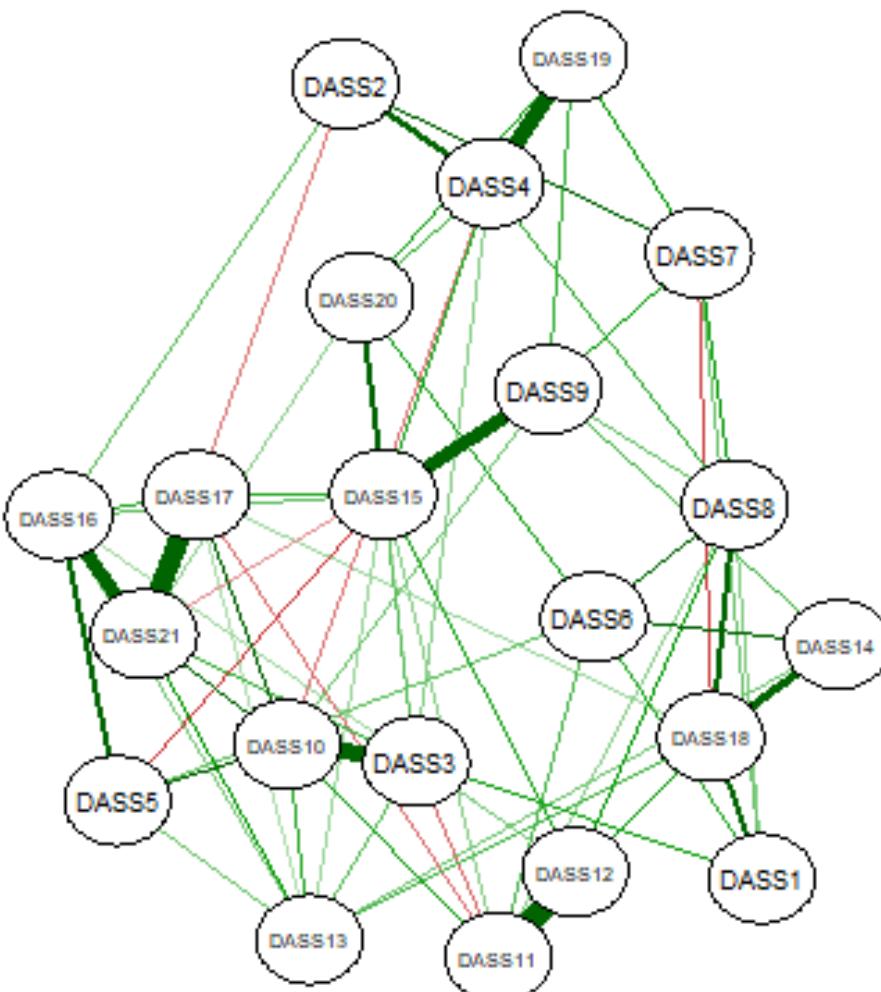


Disorder B



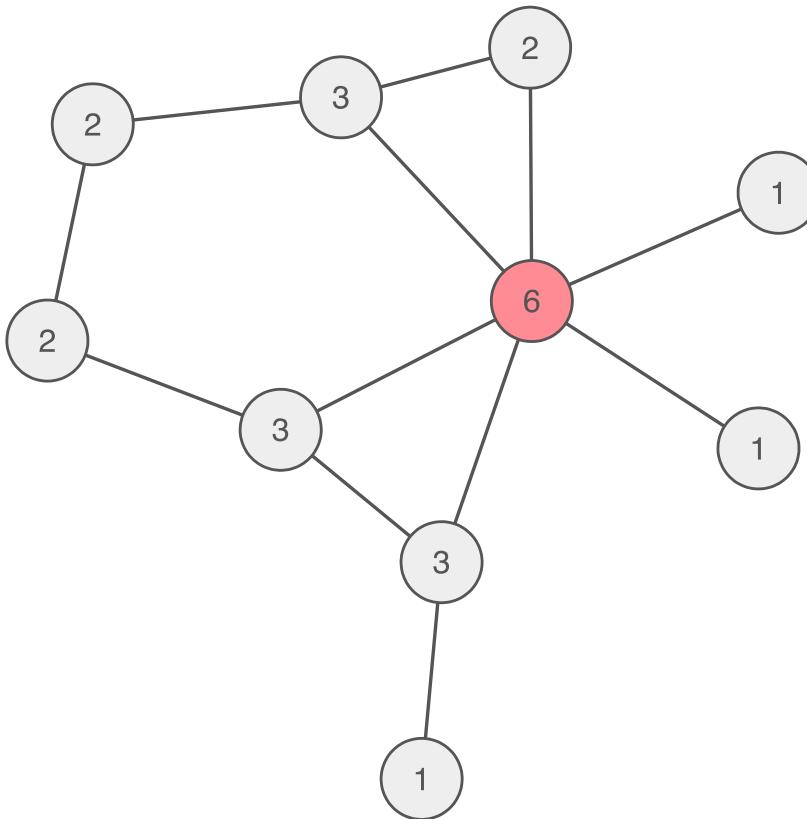


(Borsboom & Cramer, 2013)



- DASS1: acalmar
- DASS2: boca seca
- DASS3: sent. posit
- DASS4: respirar
- DASS5: iniciativa
- DASS6: reac. exager
- DASS7: tremores
- DASS8: nervoso(a)
- DASS9: preoc panico
- DASS10: expec. posit
- DASS11: agitado(a)
- DASS12: relaxar
- DASS13: triste
- DASS14: pacienza
- DASS15: panico
- DASS16: empolgar
- DASS17: valor
- DASS18: irritado(a)
- DASS19: batidas
- DASS20: assustado(a)
- DASS21: sentido

Centralidade

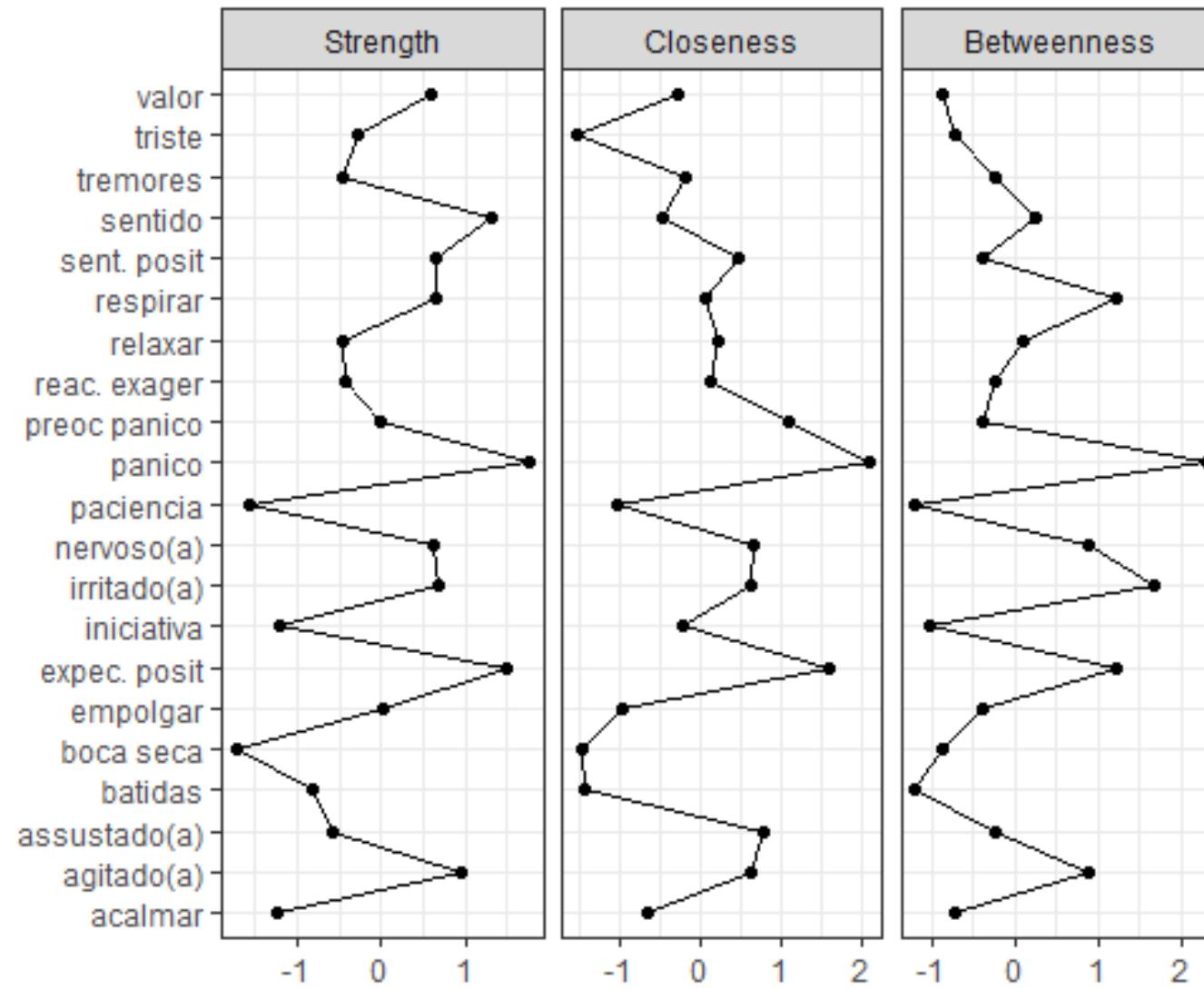


Opsahl, T., Agneessens, F., & Skvoretz, J. (2010). Node centrality in weighted networks: Generalizing degree and shortest paths. *Social Networks*, 23, 245-251.

Centralidade

- Força (strength): soma modular ponderada das arestas de um nodo
- Proximidade (closeness): distância dos vértices adjacentes (inverso da associação)
- Conectividade (betweenness): vezes pelas quais o vértice é a menor distância entre outros dois vértices

Opsahl, T., Agneessens, F., & Skvoretz, J. (2010). Node centrality in weighted networks: Generalizing degree and shortest paths. *Social Networks*, 23, 245-251.



Expected Influence

- Influência esperada: soma das arestas dos nodos adjacentes em primeiro e segundo graus



Published in final edited form as:

J Abnorm Psychol. 2016 August ; 125(6): 747–757. doi:10.1037/abn0000181.

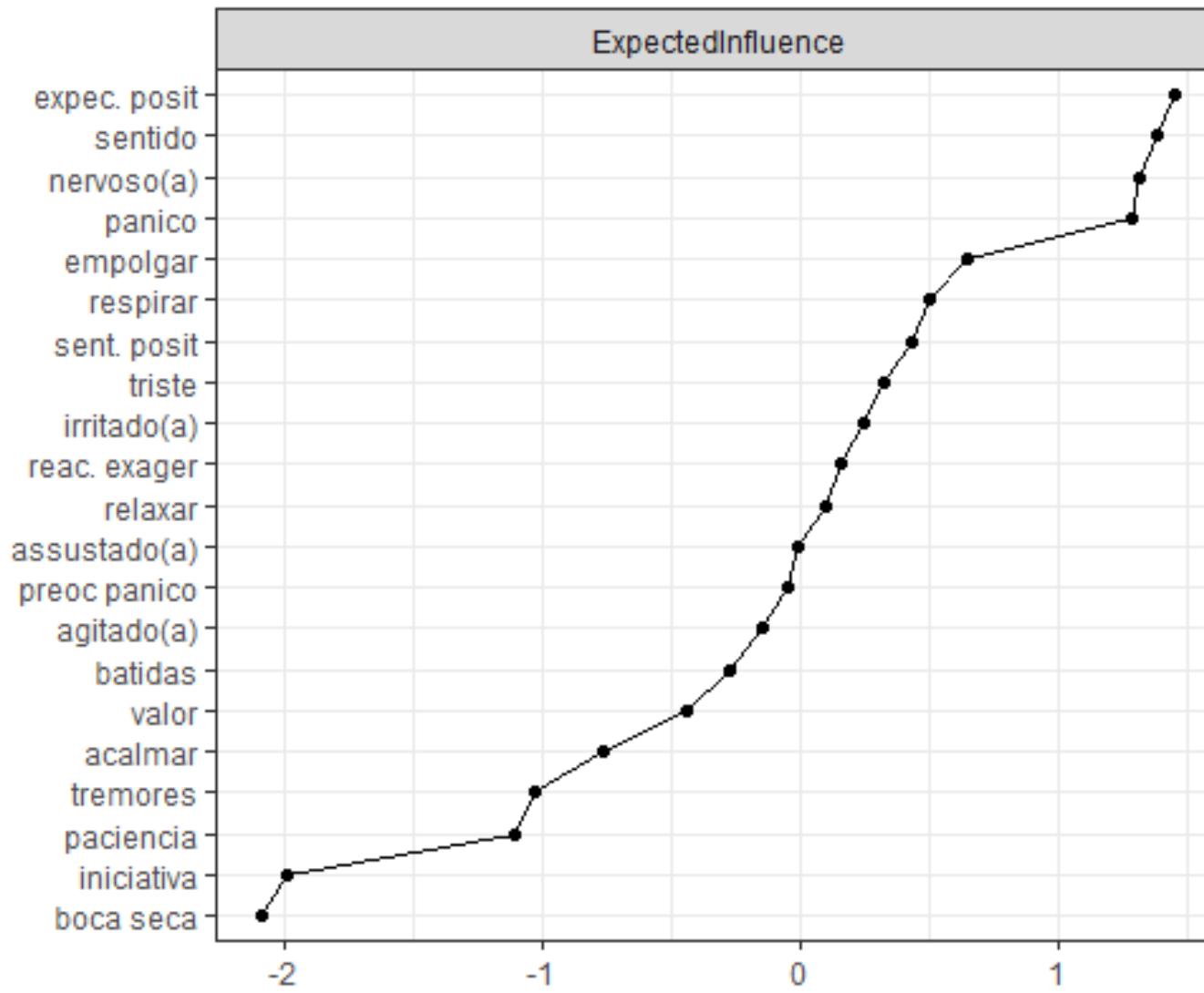
Identifying Highly Influential Nodes in the Complicated Grief Network

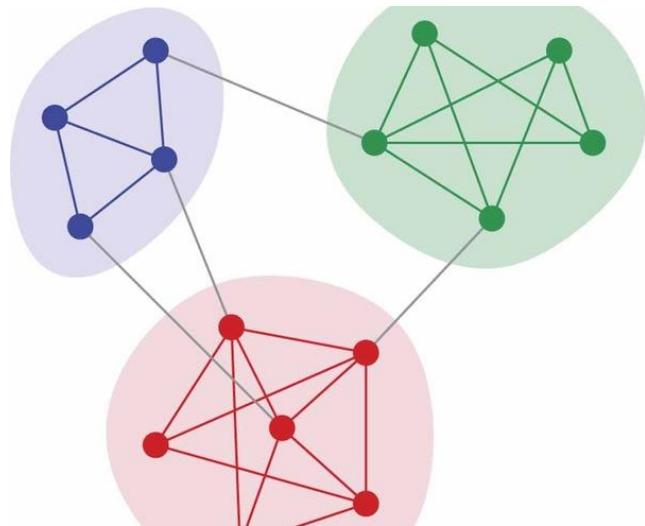
Donald J. Robinaugh^{1,2}, Alexander J. Millner³, and Richard J. McNally³

¹Massachusetts General Hospital, Department of Psychiatry

²Harvard Medical School

³Department of Psychology, Harvard University





A Comparative Analysis of Community Detection Algorithms on Artificial Networks

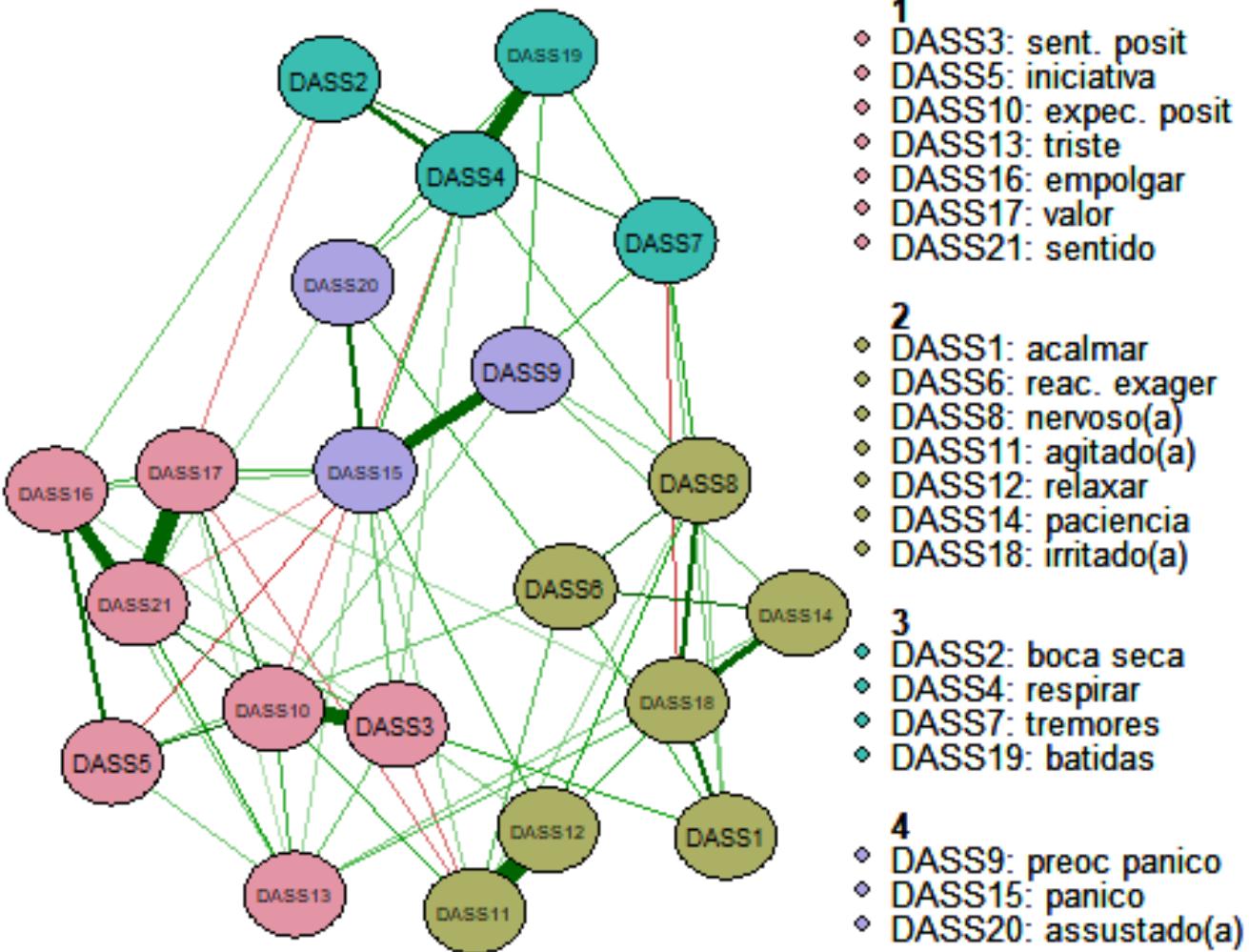
Zhao Yang , René Algesheimer & Claudio J. Tessone

Scientific Reports 6, Article number: 30750
(2016)
doi:10.1038/srep30750

Received: 31 March 2016
Accepted: 07 July 2016
Published online: 01 August 2016

Análise de comunidades

- Existem subgrupos de variáveis ou observações na rede?
- Três métodos mais populares:
- Waltrap – parte de passos aleatórios e vai decompondo o conjunto em $N-1$ comunidades, calculando a distância das arestas entre e dentre comunidades
- Spinglass – baseado também em um modelo do ferromagnetismo (Potts), baseado na ideia de “spin state” e fluxo de energia
- **Multinível** – decomposição e permutação dos vértices até encontrar a solução que otimiza a modularidade (divisão em módulos ou grupos)



Predição exemplo com pacientes do espectro autista

Original Article

Multicausal systems ask for multicausal approaches: A network perspective on subjective well-being in individuals with autism spectrum disorder

Marie K Deserno^{1,2}, Denny Borsboom², Sander Begeer³
and Hilde M Geurts^{1,2}



Autism

1–12

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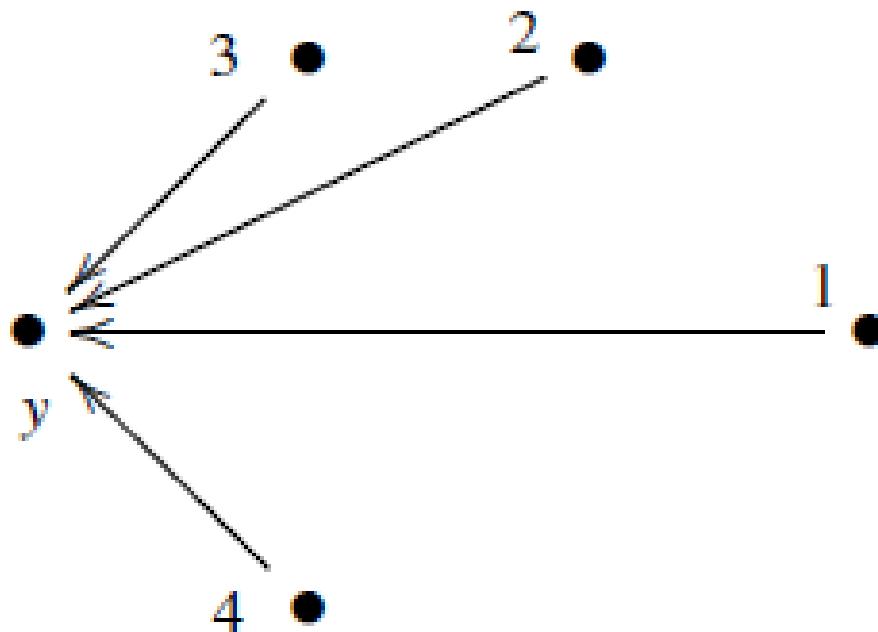
DOI: 10.1177/1362361316660309

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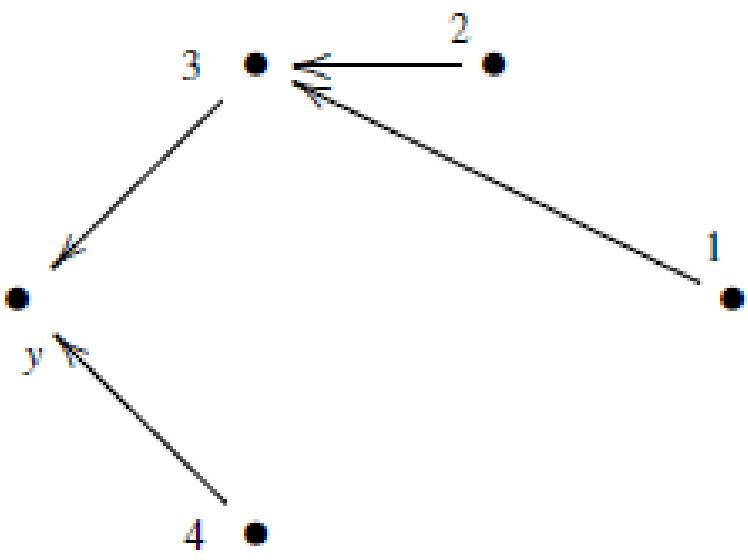


Modelos preditivos

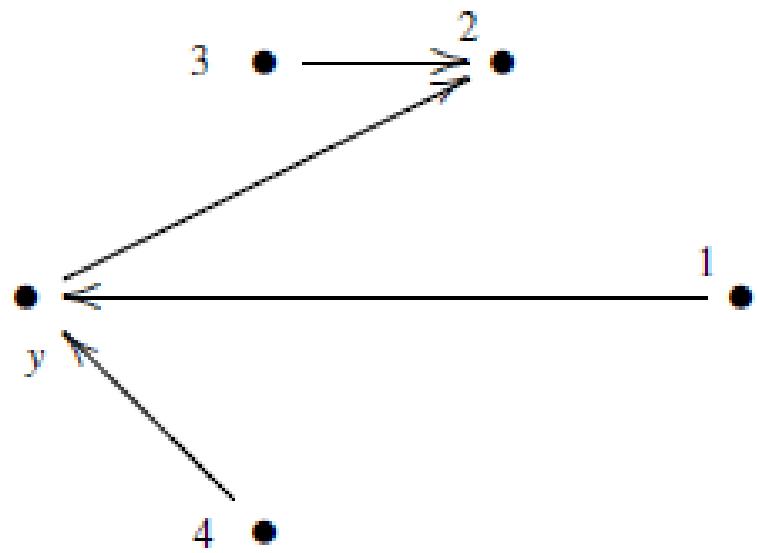
- Modelo de regressão comum

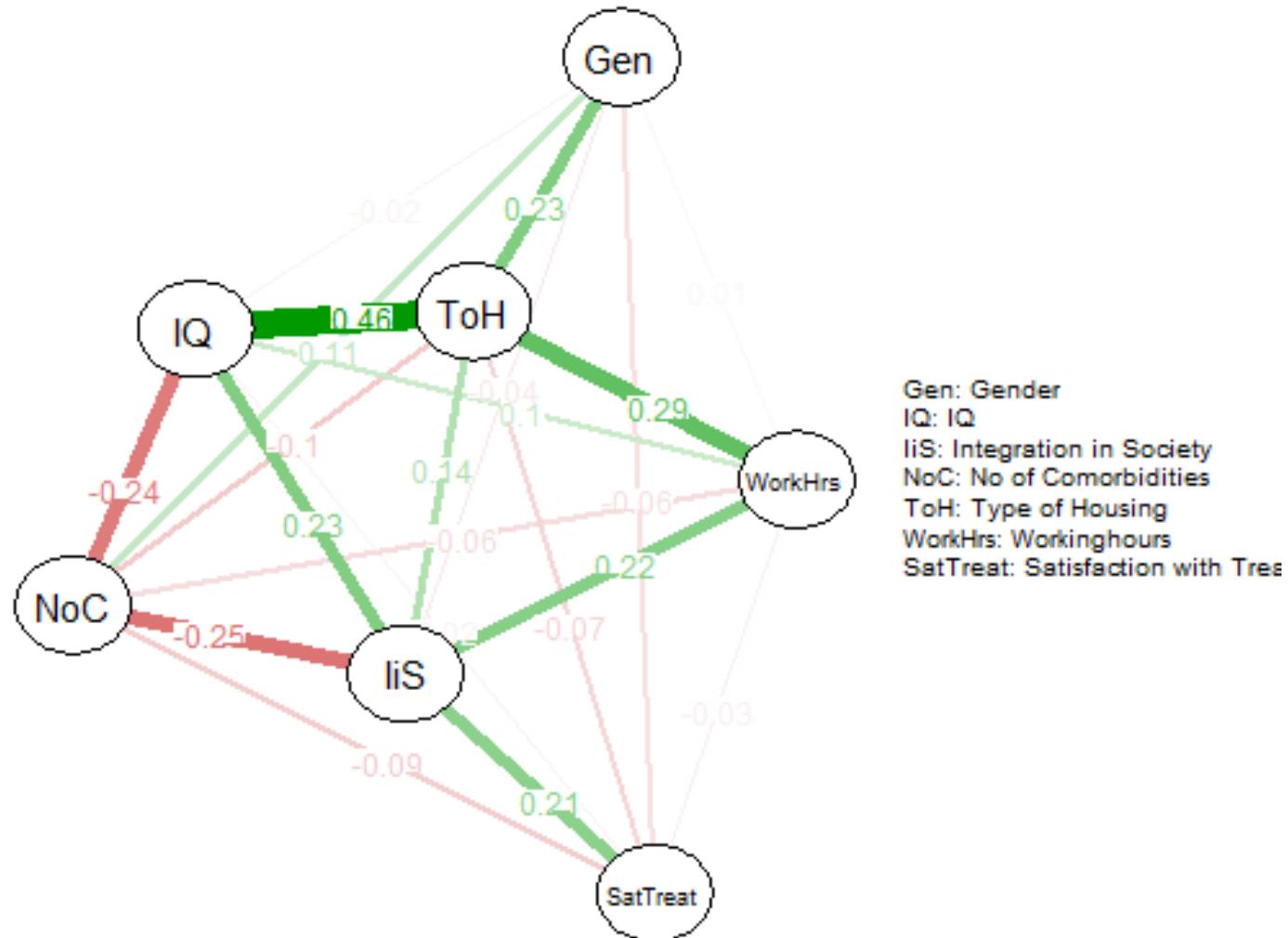


(Epskamp, 2013)



?





Gen: Gender

IQ: IQ

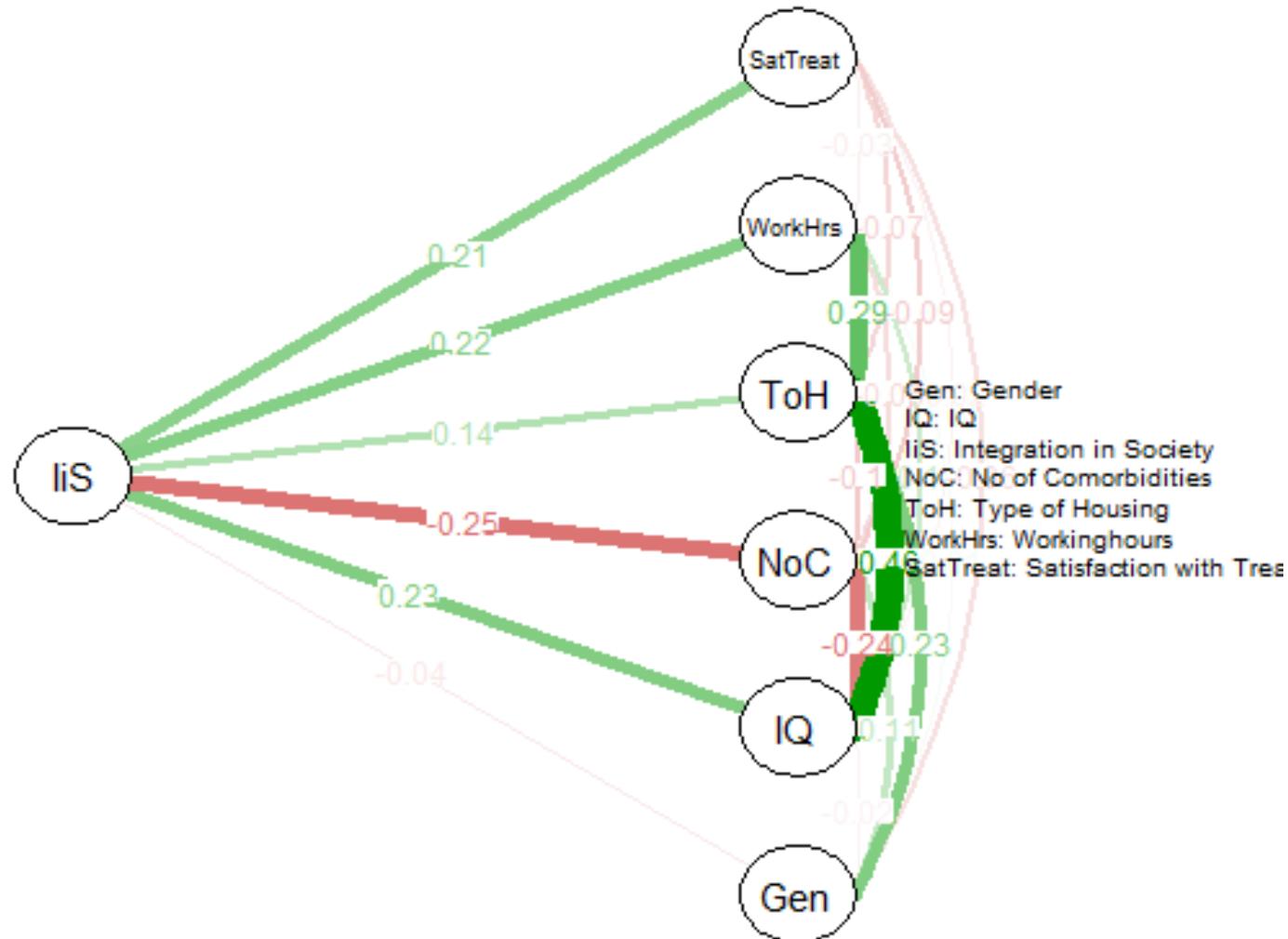
iiS: Integration in Society

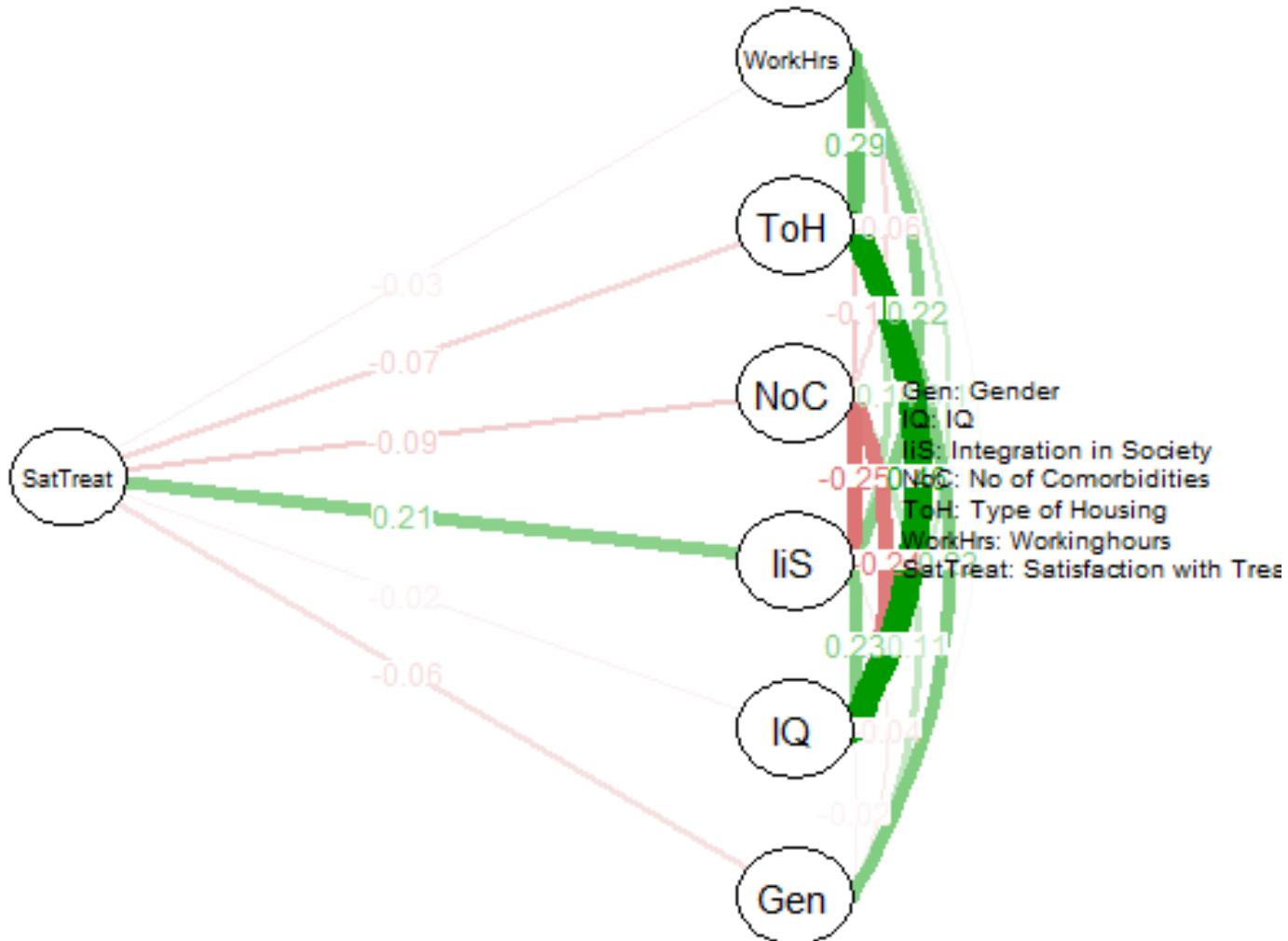
NoC: No of Comorbidities

ToH: Type of Housing

WorkHrs: Workinghours

SatTreat: Satisfaction with Treas





Outros tópicos em análise de rede

- Modelos de dados dicotômicos (0,1)
- Modelos de moderação
- Séries temporais
- $N = 1$ networks
- Modelos multiníveis



Muito obrigado!!!

Redes frequentistas

Prof. Dr. Wagner de Lara Machado

GP Avaliação em Bem-estar e Saúde Mental

wagner.machado@pucrs.br