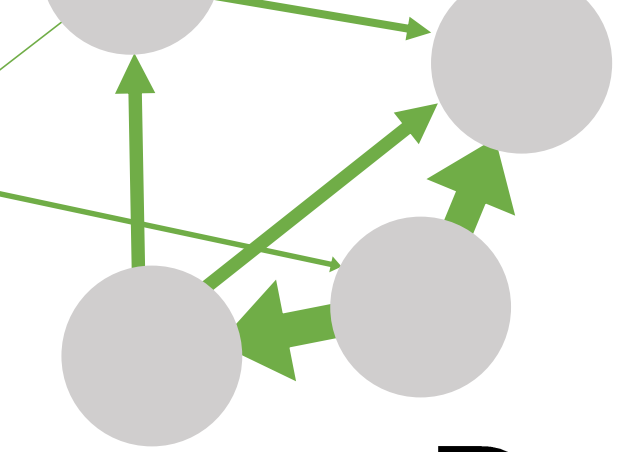

Colloque Grepaco 2022

Psychological Temporal Network Analyses: A Scoping Review

M. Annelise Blanchard, Alba Contreras, Rana Begum Kalkan & Alexandre Heeren

fnrs
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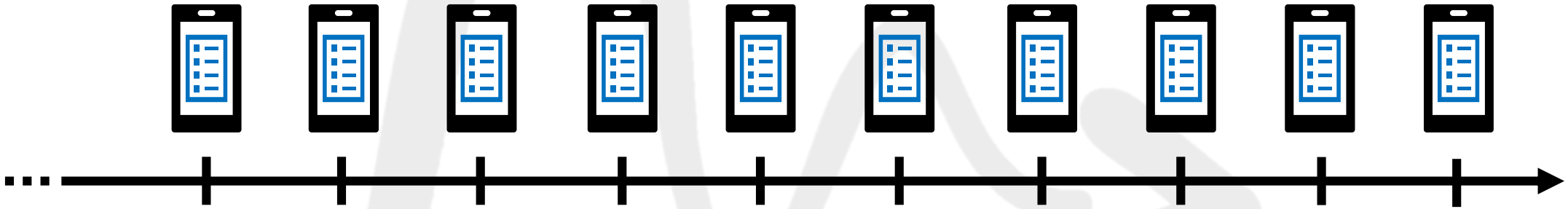
Dynamic

Time series data



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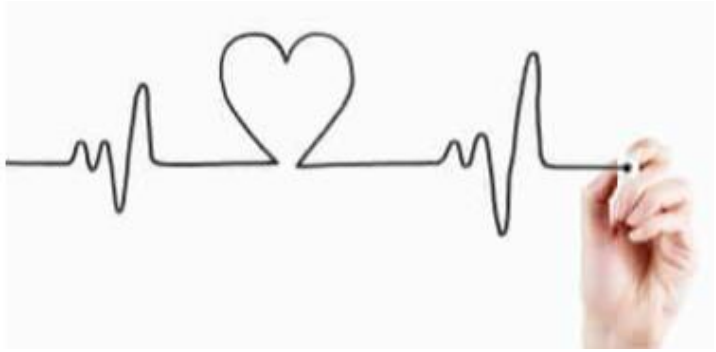
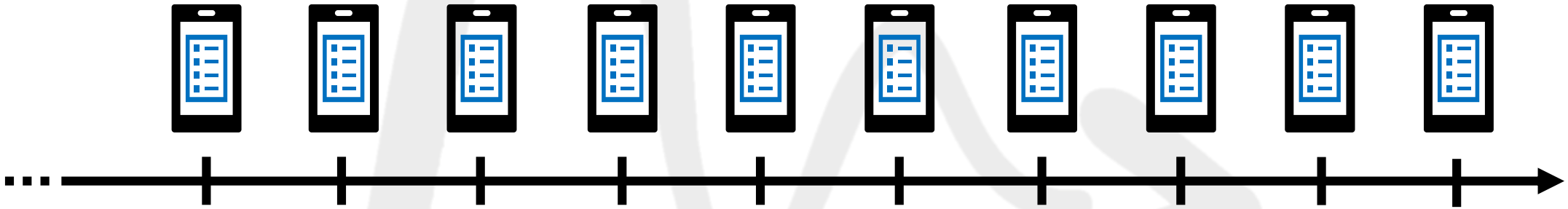
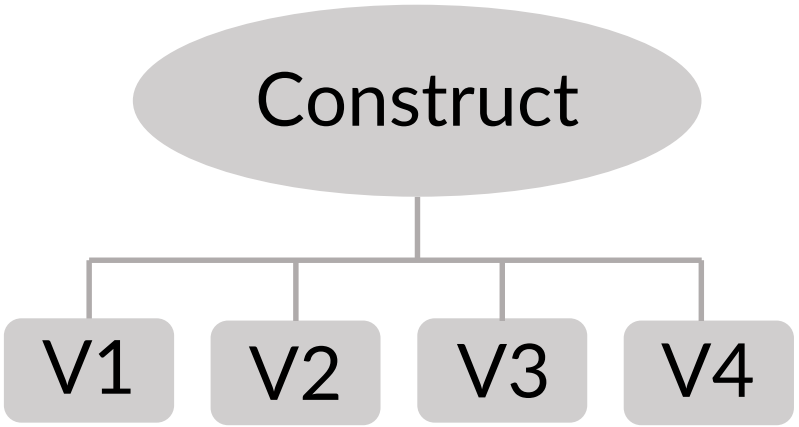


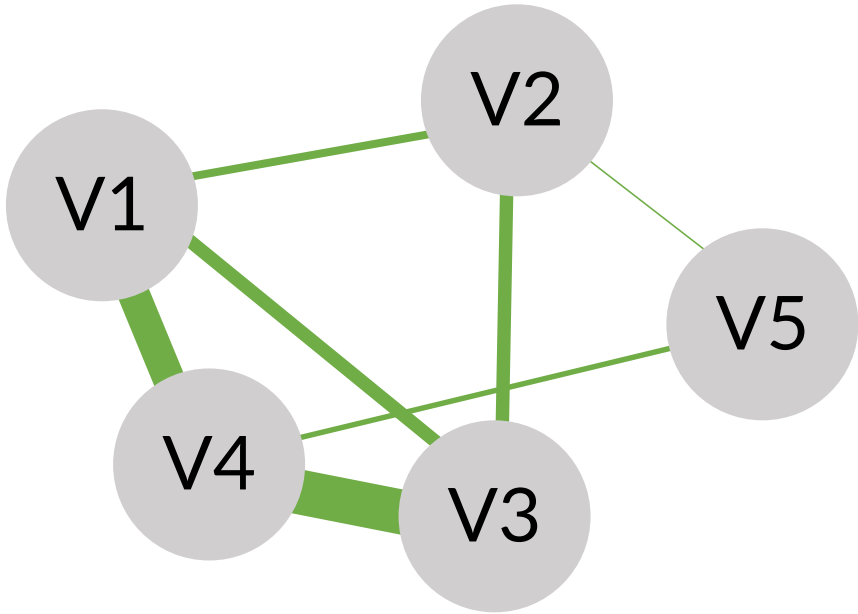


Network Analysis

From *reductionism*

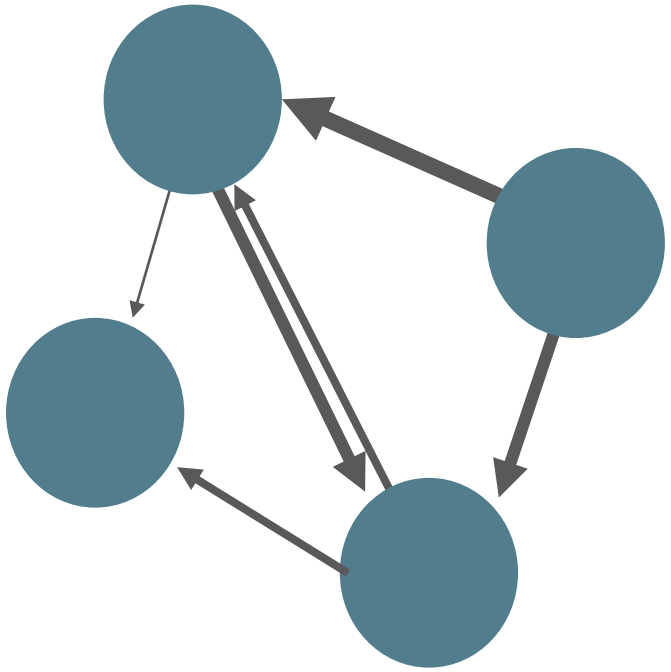


to *complexity*

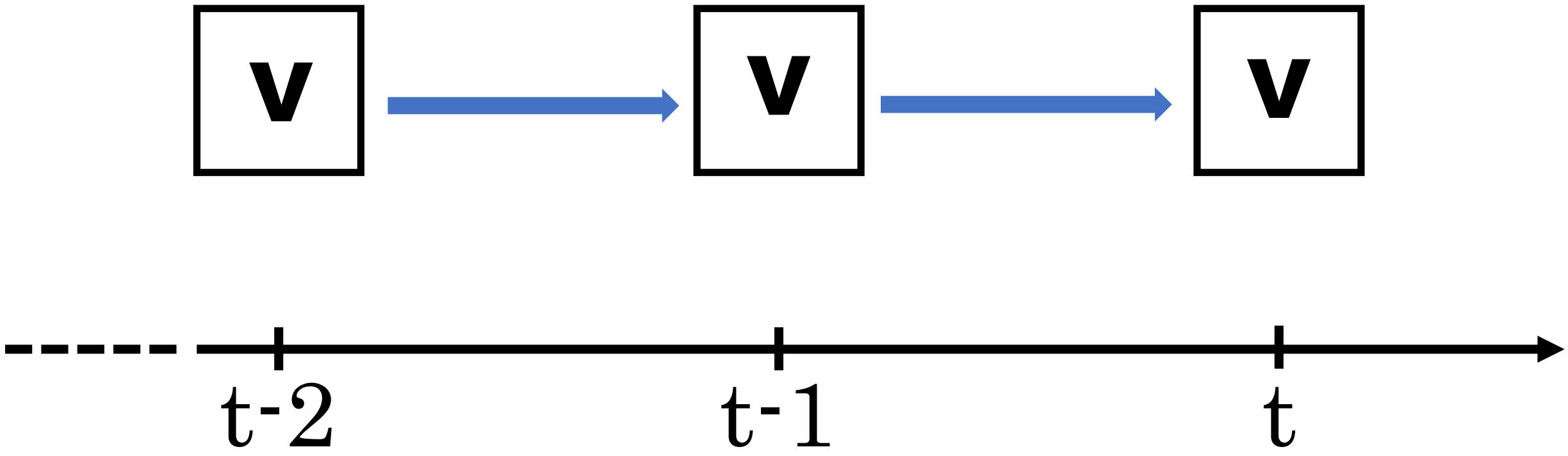


Barabási, A. L. (2012). The network takeover. *Nature Physics*, *8*(1), 14–16. https://doi.org/10.1038/nphys2188

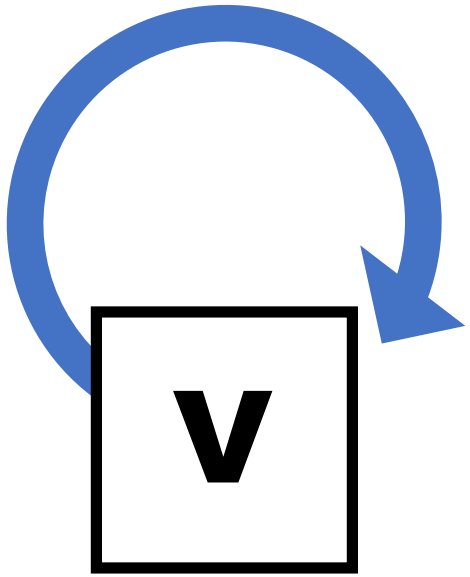
Temporal Network Analysis



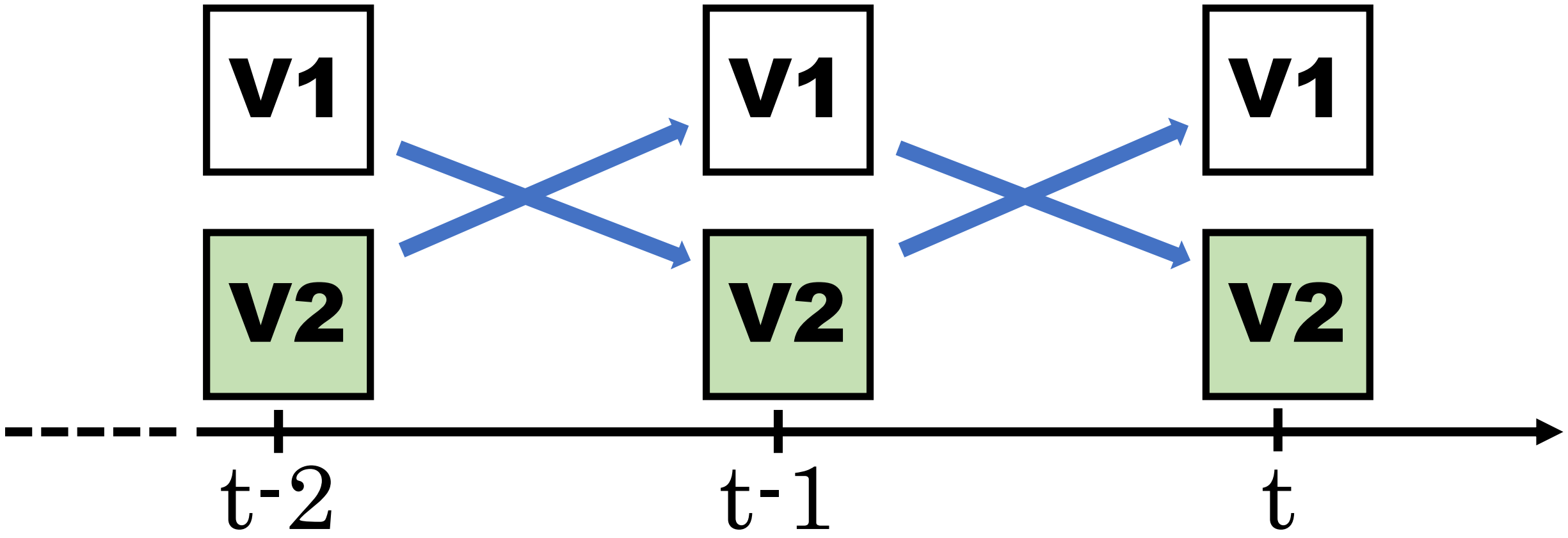
Autoregressive



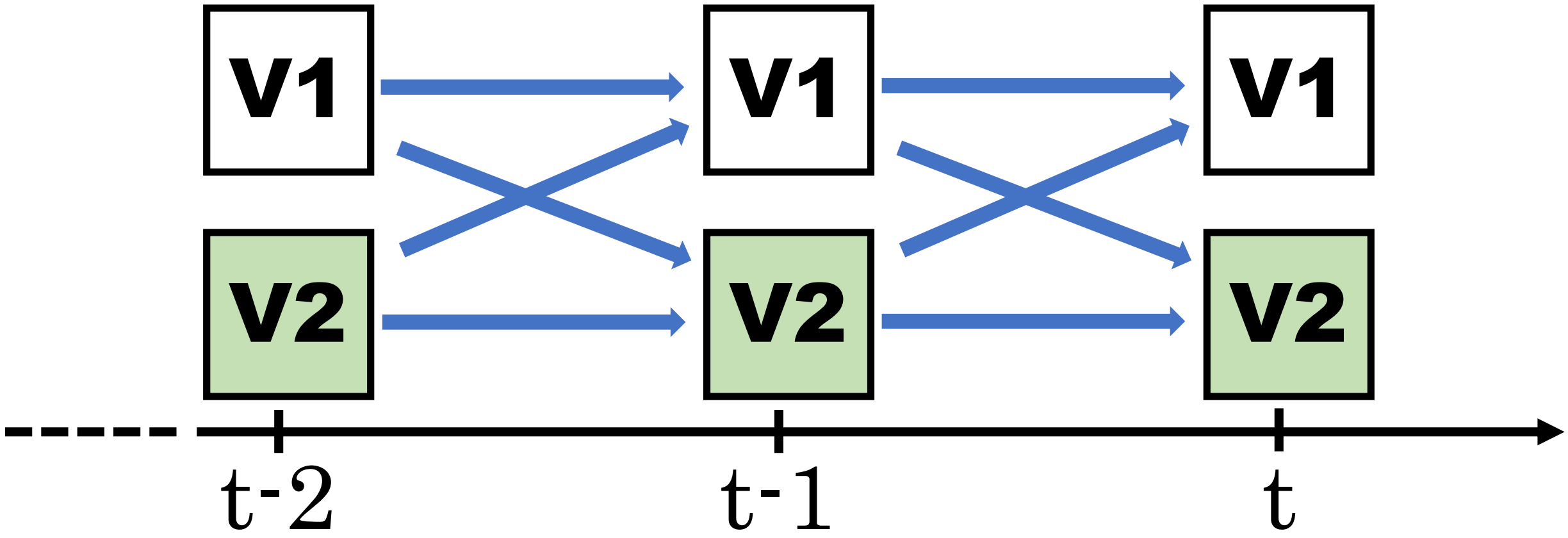
Autoregressive



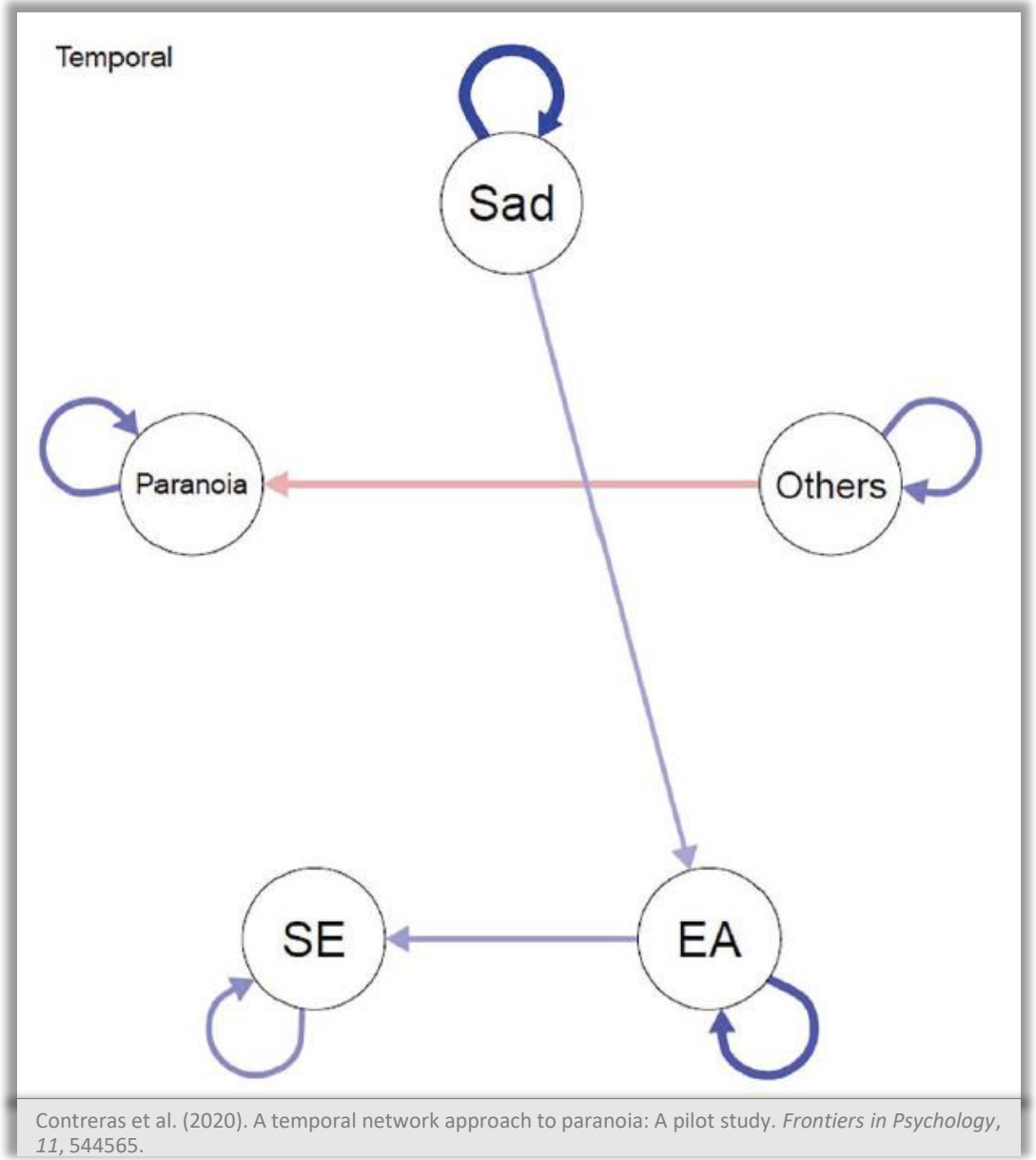
Cross-lagged



Vector Autoregressive (**VAR**)

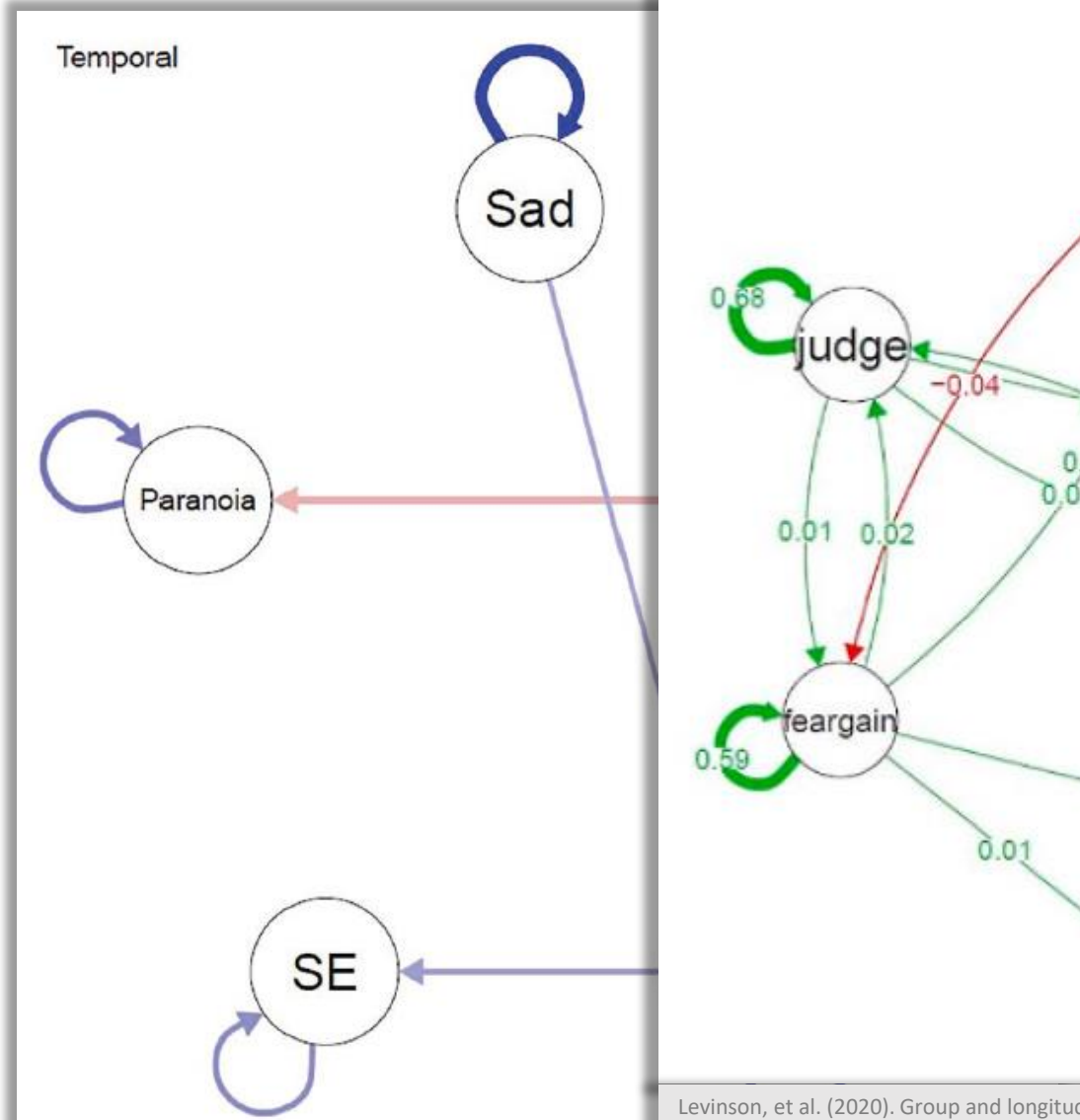


Paranoia



Contreras et al. (2020). A temporal network approach to paranoia: A pilot study. *Frontiers in Psychology*, *11*, 544565.

Paranoia



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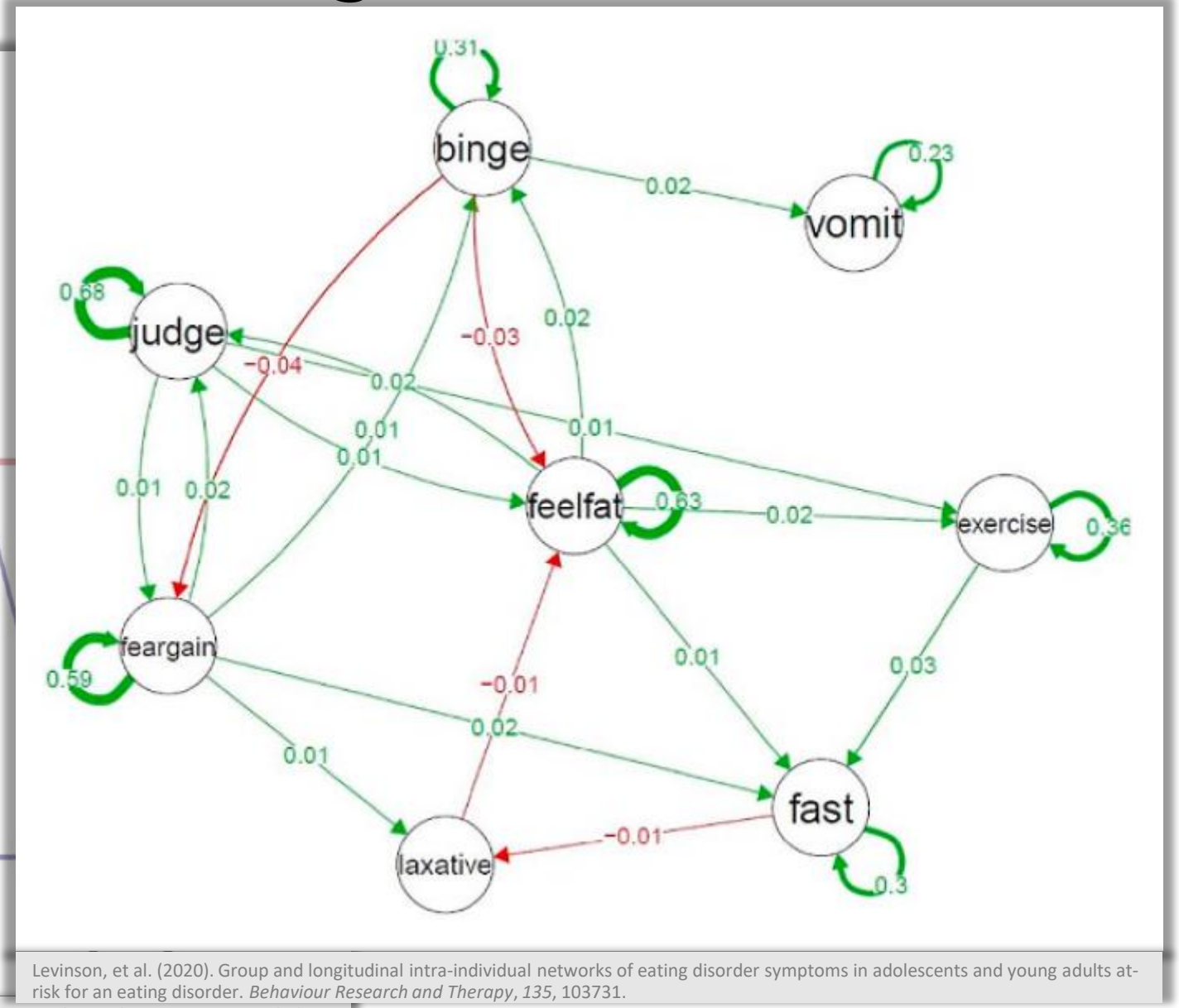
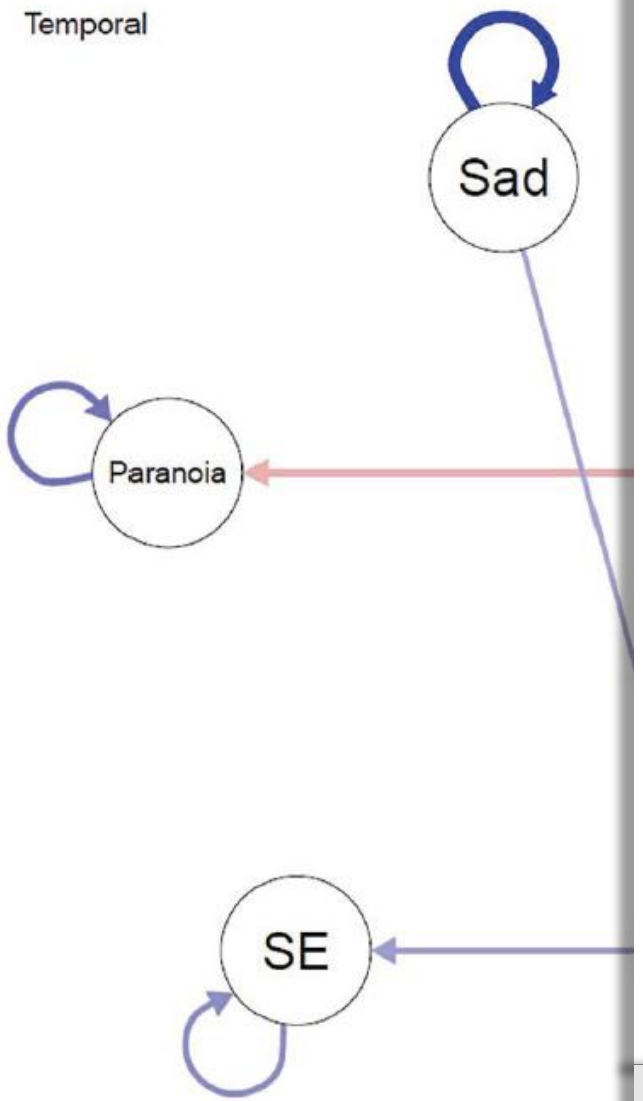
Eating Disorder



Levinson, et al. (2020). Group and longitudinal intra-individual networks of eating disorder symptoms in adolescents and young adults at-risk for an eating disorder. *Behaviour Research and Therapy*, *135*, 103731.

Paranoia



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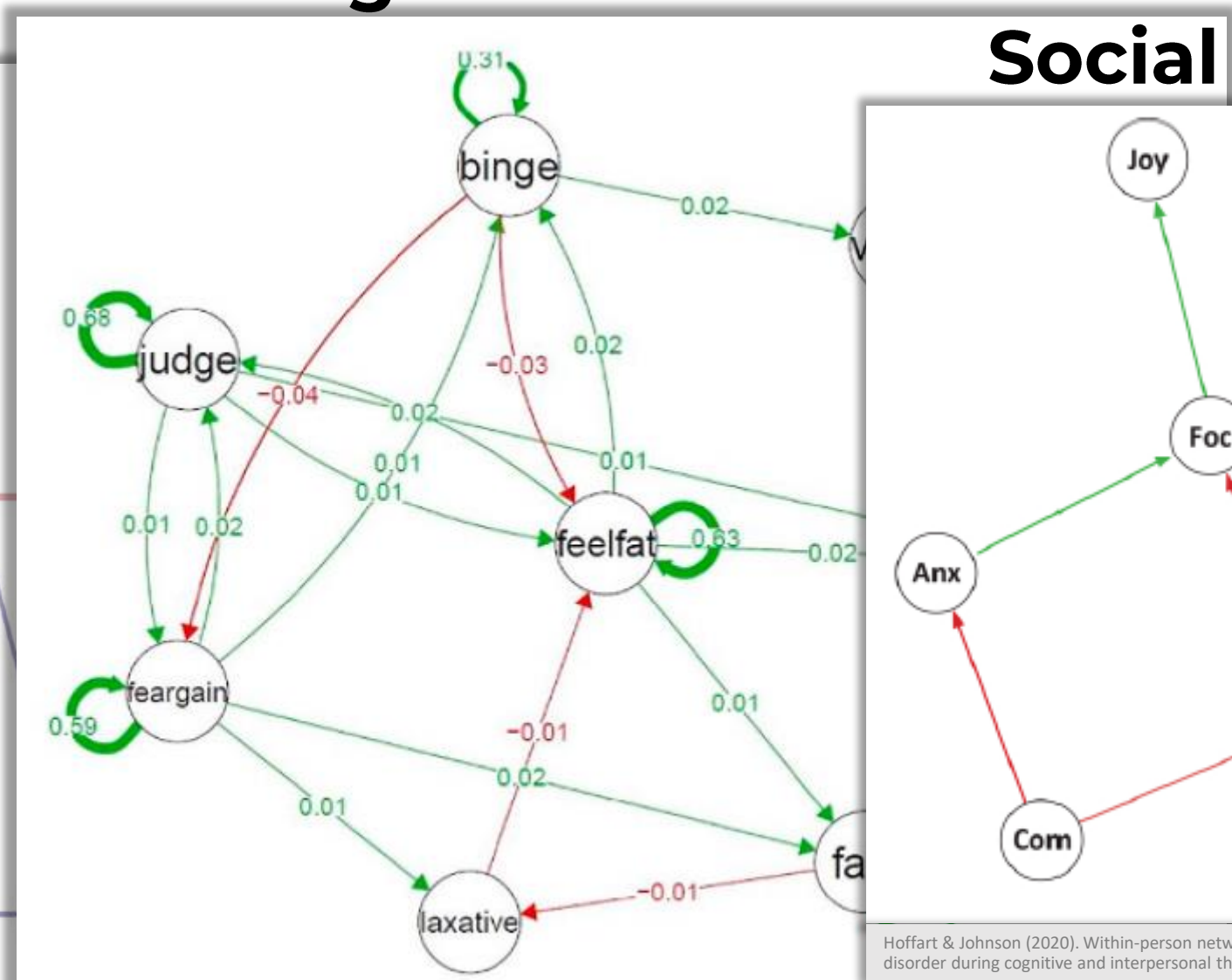
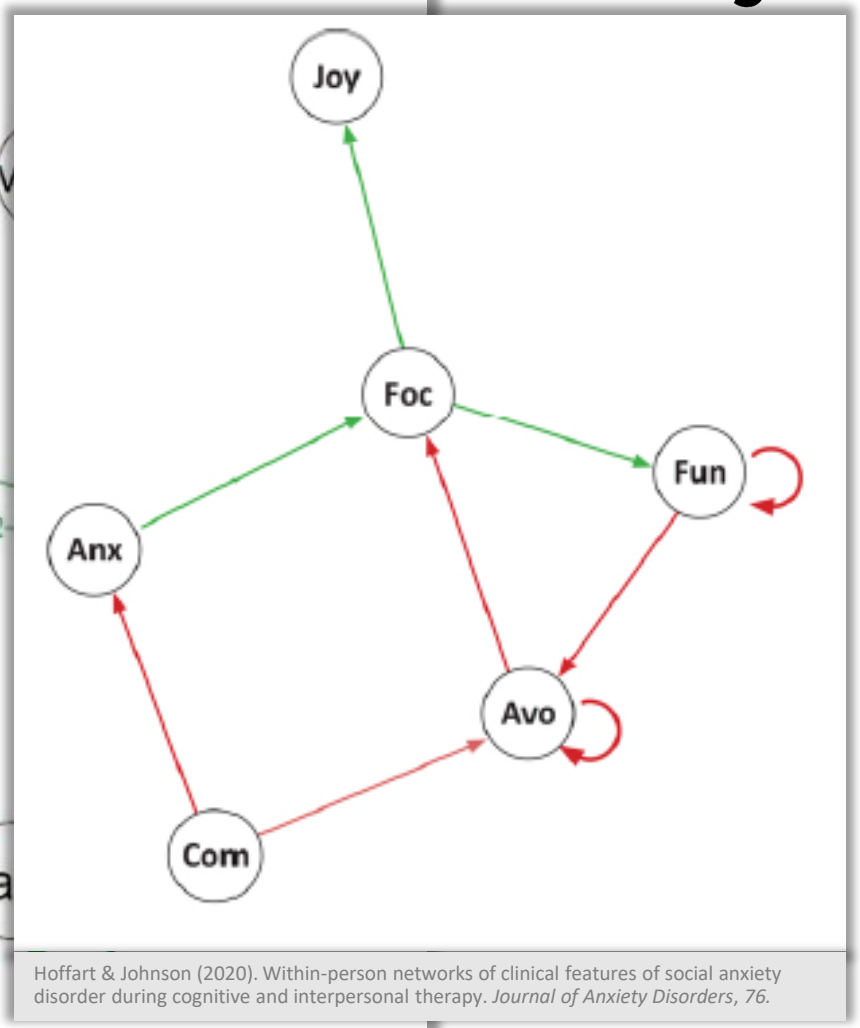
Eating Disorder



Levinson, et al. (2020). Group and longitudinal intra-individual networks of eating disorder symptoms in adolescents and young adults at-risk for an eating disorder. *Behaviour Research and Therapy*, *135*, 103731.

Social Anxiety



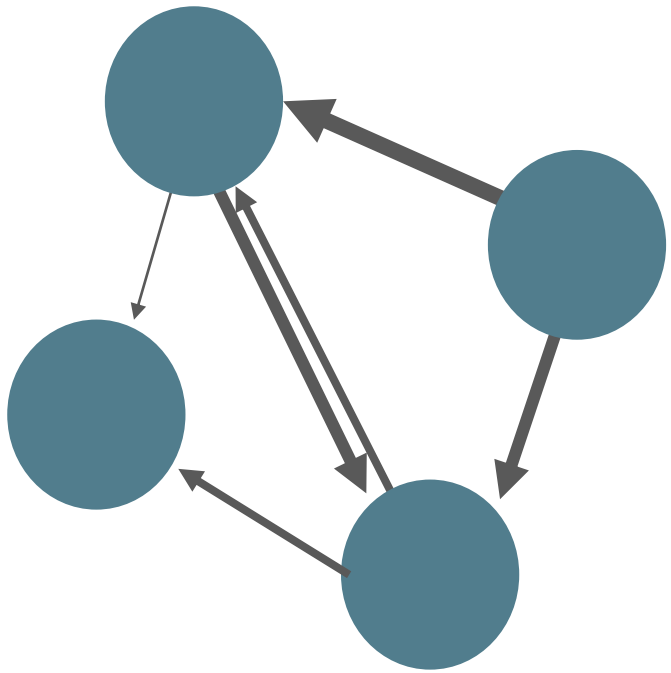
Hoffart & Johnson (2020). Within-person networks of clinical features of social anxiety disorder during cognitive and interpersonal therapy. *Journal of Anxiety Disorders*, *76*.

Uses in Clinical Psychology…

- Many variables
- Predictions while controlling other variables
- Mapping clusters across people

Roefs et al. (2022). A new science of mental disorders: Using personalised, transdiagnostic, dynamical systems to understand, model, diagnose and treat psychopathology. *Behaviour Research and Therapy*, *153*, 104096.

Research Question



Bringmann et al. (2013). A network approach to psychopathology: New insights into clinical longitudinal data. *PLoS ONE, 8*(4).
Epskamp, S., Waldorp, L. J., Mõttus, R., & Borsboom, D. (2018). The Gaussian Graphical Model in cross-sectional and time-series data. *Multivariate Behavioral Research, 53*(4), 453–480.
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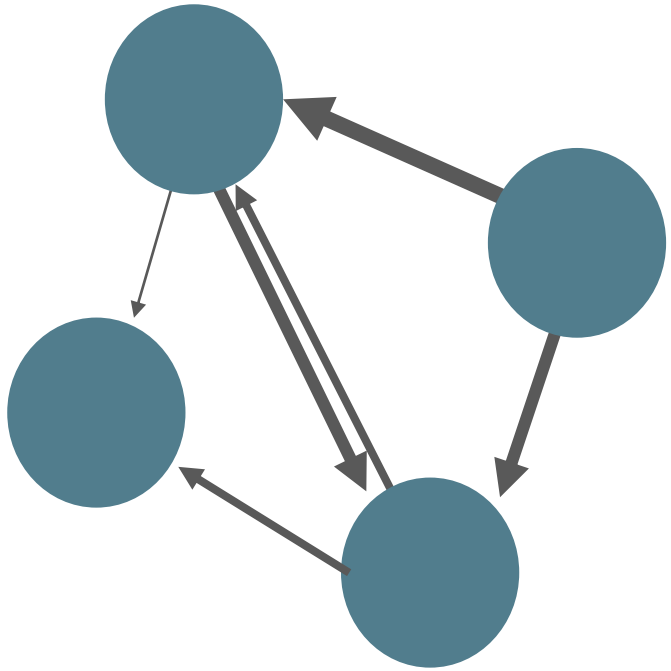

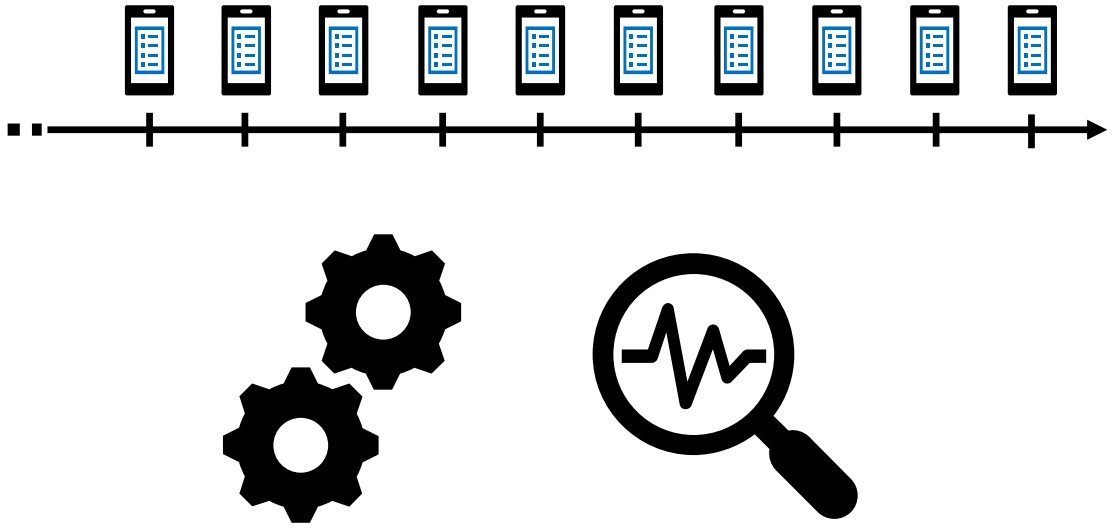

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Methods: Scoping Review

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Annals of Internal Medicine RESEARCH AND REPORTING METHODS

PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation

Andrea C. Tricco, PhD, MSc; Erin Lillie, MSc; Wasifa Zarin, MPH; Kelly K. O'Brien, PhD, BScPT; Heather Colquhoun, PhD; Danielle Levac, PhD, MSc, BScPT; David Moher, PhD, MSc; Micah D.J. Peters, PhD, MA(Q); Tanya Horsley, PhD; Laura Weeks, PhD; Susanne Hempel, PhD; Elie A. Akl, MD, PhD, MPH; Christine Chang, MD, MPH; Jessie McGowan, PhD; Lesley Stewart, PhD, MSc; Lisa Hartling, PhD, MSc, BScPT; Adrian Aldcroft, BA(Hons), BEd; Michael G. Wilson, PhD; Chantelle Garritty, MSc; Simon Lewin, PhD; Christina M. Godfrey, PhD, RN; Marilyn T. Macdonald, PhD, MSN; Etienne V. Langlois, PhD; Karla Soares-Weiser, MD, PhD; Jo Moriarty, MA; Tammy Clifford, PhD, MSc; Özge Tunçalp, MD, PhD, MPH; and Sharon E. Straus, MD, MSc

Scoping reviews, a type of knowledge synthesis, follow a systematic approach to map evidence on a topic and identify main concepts, theories, sources, and knowledge gaps. Although more scoping reviews are being done, their methodological and reporting quality need improvement. This document presents the PRISMA-ScR (Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews) checklist and explanation. The checklist was developed by a 24-member expert panel and 2 research leads following published guidance from the EQUATOR (Enhancing the QUAlity and Transparency Of health Research) Network. The final checklist contains 20 essential reporting items and 2 optional items. The authors provide a rationale and an example of good reporting for each item. The intent of the PRISMA-ScR is to help readers (including researchers, publishers, commissioners, policymakers, health care providers, guideline developers, and patients or consumers) develop a greater understanding of relevant terminology, core concepts, and key items to report for scoping reviews.

Ann Intern Med. 2018;169:467-473. doi:10.7326/M18-0850 **Annals.org**
For author affiliations, see end of text.
This article was published at Annals.org on 4 September 2018.

Methods: Article Selection

Big picture...

- ❑ Temporal network → **group level**
- ❑ **Psychological**
- ❑ **Peer-reviewed**

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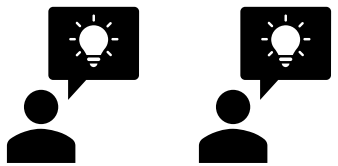

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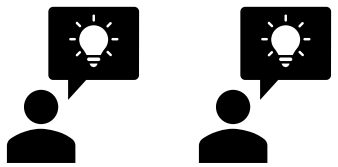
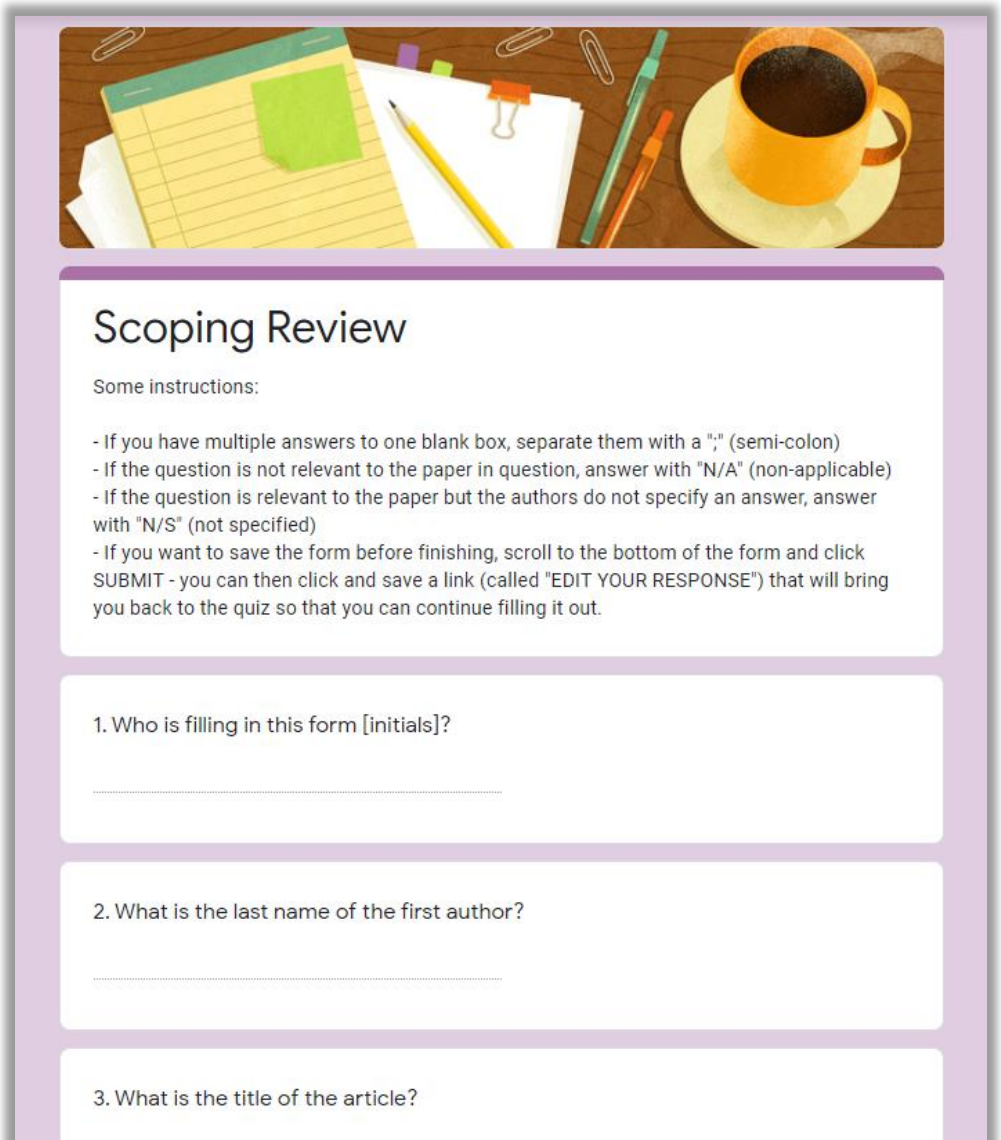


43 full-text articles

Methods: Data Extraction

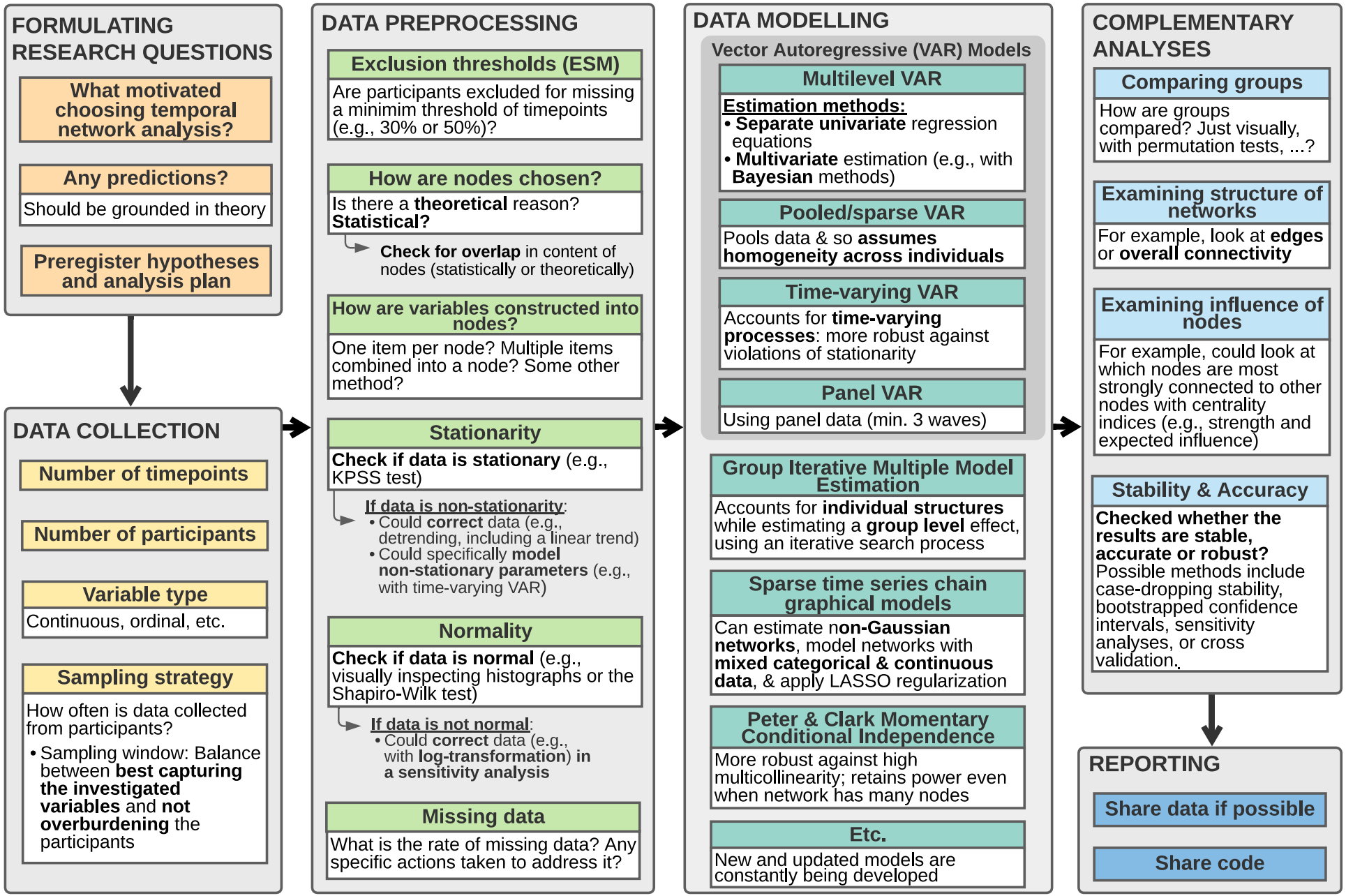


- ✓ Metadata
- ✓ Sample characteristics
- ✓ Data collection
- ✓ Data preprocessing & analysis
- ✓ Visualization
- ✓ Robustness
- ✓ Open science practices

Results

Scoping review results + expert literature = recommendations

Temporal Network Analyses: Considerations



FORMULATING RESEARCH QUESTIONS

What motivated choosing temporal network analysis?

Any predictions?

Should be grounded in theory

Preregister hypotheses and analysis plan

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DATA COLLECTION

Number of timepoints

Number of participants

Variable type

Continuous, ordinal, etc.

Sampling strategy

How often is data collected from participants?

- Sampling window: Balance between **best capturing the investigated variables** and **not overburdening** the participants

DATA PREPROCESSING

Exclusion thresholds (ESM)

Are participants excluded for missing a minimim threshold of timepoints (e.g., 30% or 50%)?

How are nodes chosen?

Is there a **theoretical** reason? **Statistical?**

→ **Check for overlap** in content of nodes (statistically or theoretically)

How are variables constructed into nodes?

One item per node? Multiple items combined into a node? Some other method?

Stationarity

Check if data is stationary (e.g., KPSS test)

→ **If data is non-stationarity**:
- Could **correct** data (e.g., detrending, including a linear trend)
- Could specifically **model non-stationary parameters** (e.g., with time-varying VAR)

Normality

Check if data is normal (e.g., visually inspecting histographs or the Shapiro-Wilk test)

→ **If data is not normal**:
- Could **correct** data (e.g., with **log-transformation**) **in a sensitivity analysis**

Missing data

What is the rate of missing data? Any specific actions taken to address it?

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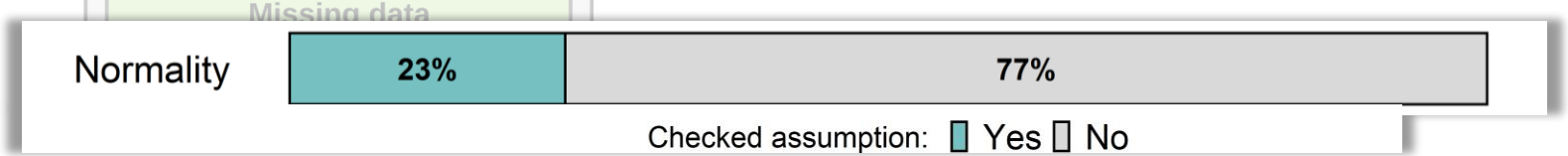
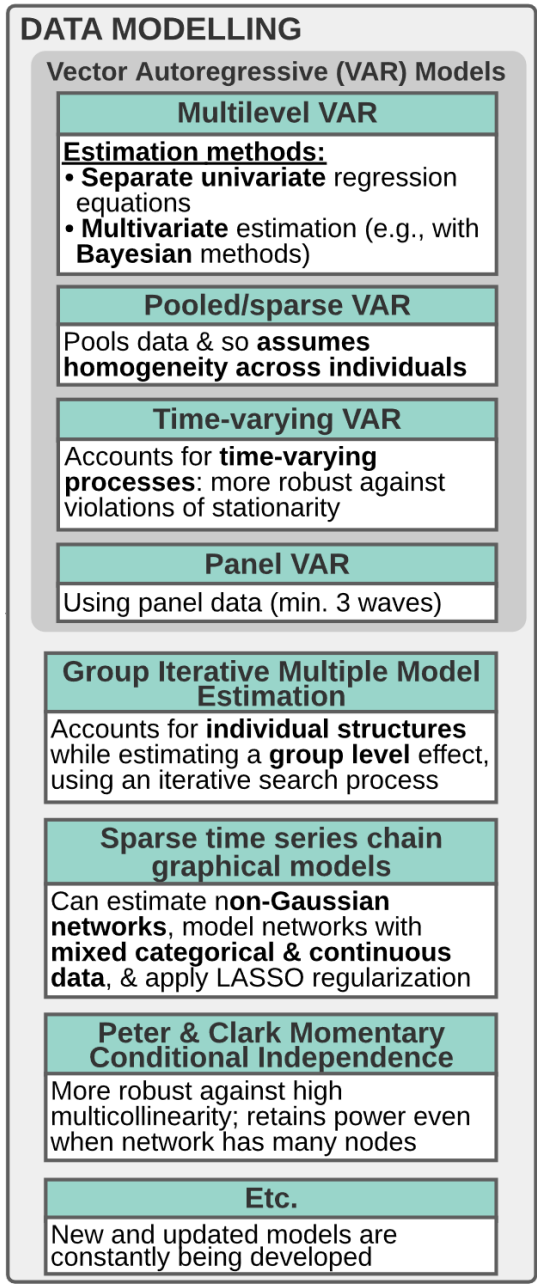


Many possible models



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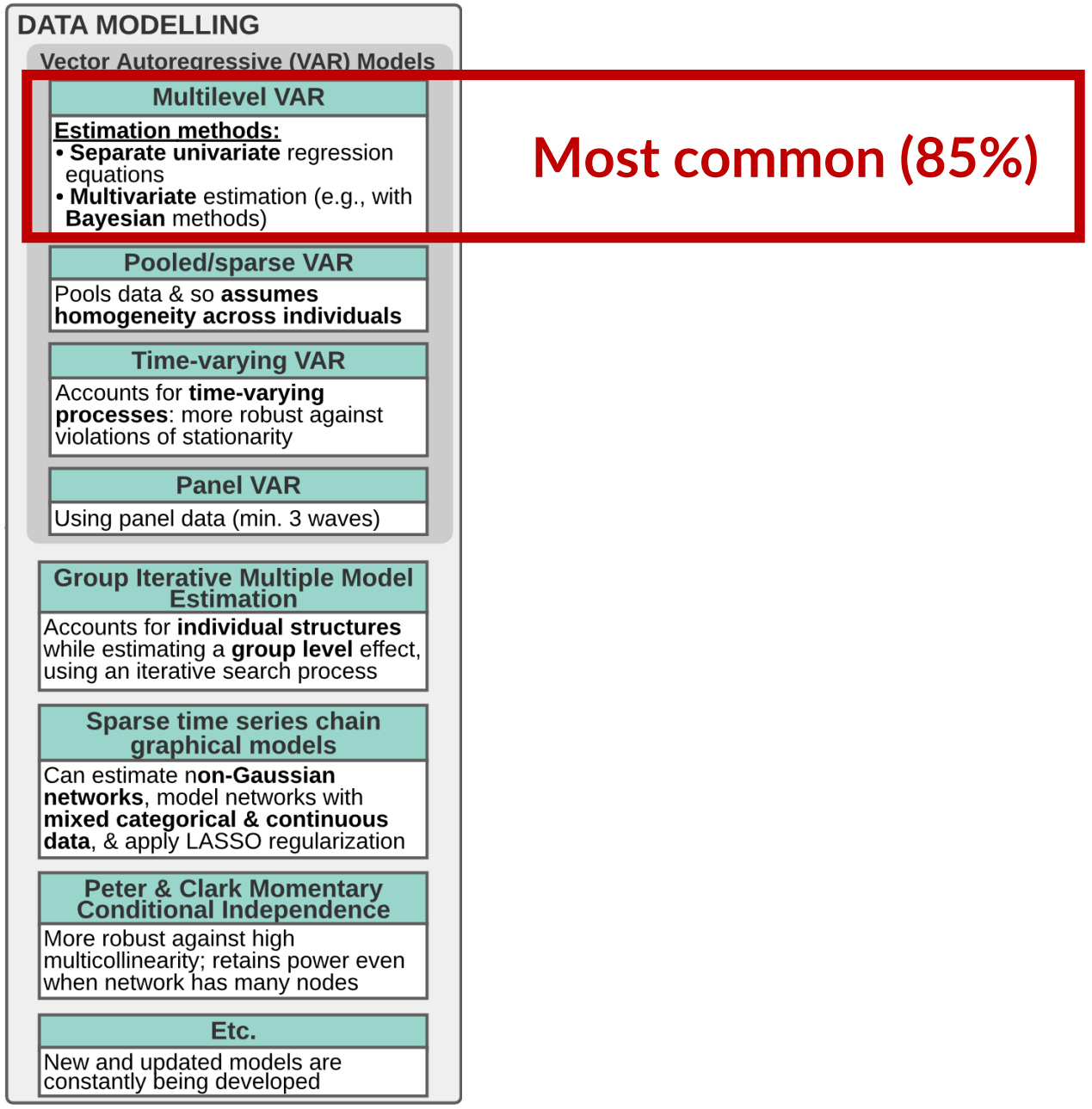

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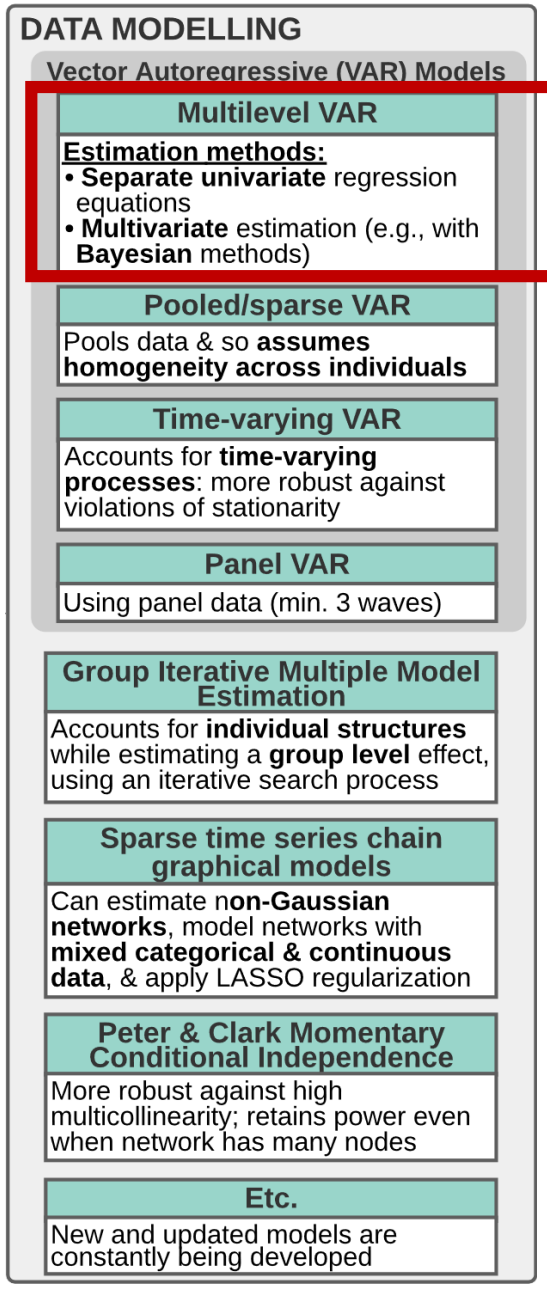


Most common (85%)

- ❑ Many tutorials
- ❑ R code/etc

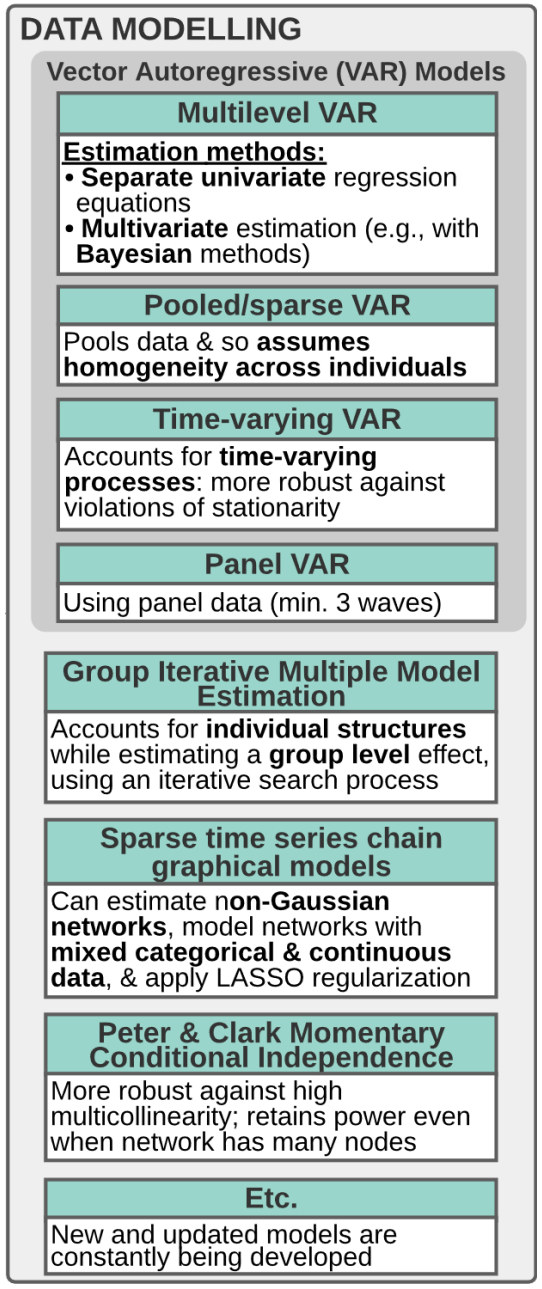
Example R code mlVAR

```
#Estimation: two-step multilevel Vector Autoregressive (mlVAR):
#---------------------------------------------------------------
   baseline_mlVAR <- mlVAR(baseline, vars, idvar, lags = 1, estimator = "lmer",
                   temporal = "correlated", contemporaneous = "correlated")


#Visualization:
#--------------
    temporal<-plot(baseline_mlVAR, "temporal", layout = "circle", nonsig = "hide", theme = "colorblind", title = "Temporal",
                   labels = vars, vsize = 13, rule = "and", asize = 5, mar = c(5,5,5,5))
```

Many possible models

Different pros/cons



COMPLEMENTARY ANALYSES

Comparing groups

How are groups compared? Just visually, with permutation tests, ...?

Examining structure of networks

For example, look at **edges** or **overall connectivity**

Examining influence of nodes

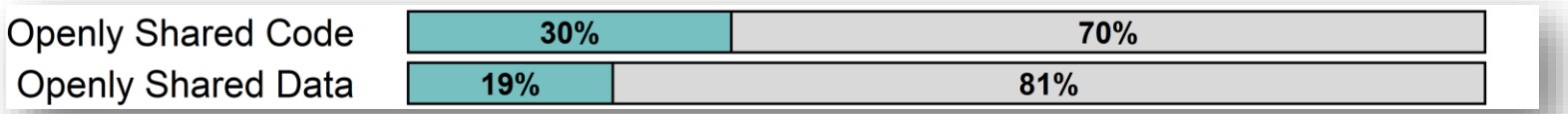
For example, could look at which nodes are most strongly connected to other nodes with centrality indices (e.g., strength and expected influence)

Stability & Accuracy

Checked whether the results are stable, accurate or robust? Possible methods include case-dropping stability, bootstrapped confidence intervals, sensitivity analyses, or cross validation.

REPORTING

- Share data if possible
- Share code



Behavior Research Methods
https://doi.org/10.3758/s13428-022-01839-y

Auditing the research practices and statistical analyses of the group-level temporal network approach to psychological constructs: A systematic scoping review

M. Annelise Blanchard[1,2] · Alba Contreras[1] · Rana Begum Kalkan[1,3] · Alexandre Heeren[1,2,4]

Accepted: 17 March 2022

Abstract

Network analyses have become increasingly common within the field of psychology, and temporal network analyses in particular are quickly gaining traction, with many of the initial articles earning substantial interest. However, substantial heterogeneity exists within the study designs and methodology, rendering it difficult to form a comprehensive view of its application in psychology research. Since the field is quickly growing and since there have been many study-to-study variations in terms of choices made by researchers when collecting, processing, and analyzing data, we saw the need to audit this field and formulate a comprehensive view of current temporal network analyses. To systematically chart researchers' practices when conducting temporal network analyses, we reviewed articles conducting temporal network analyses on psychological variables (published until March 2021) in the framework of a scoping review. We identified 43 articles and present the detailed results of how researchers are currently conducting temporal network analyses. A commonality across results concerns the wide variety of data collection and analytical practices, along with a lack of consistency between articles about what is reported. We use these results, along with relevant literature from the fields of ecological momentary assessment and network analysis, to formulate recommendations on what type of data is suited for temporal network analyses as well as optimal methods to preprocess and analyze data. As the field is new, we also discuss key future steps to help usher the field's progress forward and offer a reporting checklist to help researchers navigate conducting and reporting temporal network analyses.

Keywords Temporal network analysis · Scoping review · Ecological momentary assessment · Time series data · Network approach

The study of complexity has gained traction within multiple fields over the last few decades (Barabási, 2012), and psychology has recently embraced approaches exploring complexity as well. One such example is the network approach, which graphically models psychological phenomena as dynamic systems of interacting variables: a network (for an overview of the methodological approach, see Borsboom et al., 2021). Most of the research applying a network approach within psychology has specifically focused on psychopathology, viewing mental disorders as arising from the interactions between symptoms instead of from one common cause (Borsboom & Cramer, 2013). This view of psychopathology as a system of symptoms that interact

Thank you!

OSF

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