Introduction to our developed tools for "Cognitive-Affective Maps"

Answers to the following questions:
Which research questions could currently be addressed?
How to collect and analyze data?

Albert-Ludwigs-Universität Freiburg

Tools developed by
Julius Fenn, M.Sc.
Florian Gouret, M.Sc.
under supervision of Prof. Andrea Kiesel

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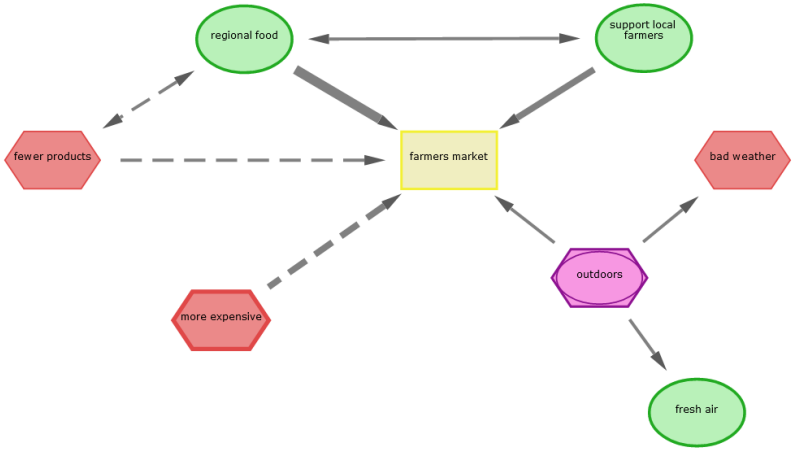
Brief introduction to Cognitive-Affective Maps (CAMs)



CAMs introduction

- CAMs as a quantitative and qualitative research method first became popular through Thagard (2010); possible to identify and visually represent any kind of declarative knowledge:

Sendtner (2021)

CAMs theory

- CAMs are „*conceptual structures that people use to represent important aspects of the world*“
- „*cognitive-affective map is a visual representation of the emotion values of a group of interconnected concepts*“
  - this is how CAMs differ from semantic networks, because CAMs additionally contain emotions (valence)
- *hot cognition*: emotions cannot be separated from cognitions
- the stepwise construction process of CAMs can be understood as a **multiple constraint satisfaction process**, where concepts, conditions, goals, etc. are mentally represented with the involvement of emotions
  - Concepts in the CAM are only changed or added if they correspond to the „*most coherent account of what we want to understand*“

Thagard (2000); Thagard (2008); Thagard (2010); Milkoreit (2013)

Fundamental hypothesis for quantitative research

- Hypothesis: The generation process of CAMs is not arbitrary, but is determined by multiple processes at multiple levels, and thus CAMs from similar individuals on an identical topic exhibit systematic correlations (similar *data generating process*)
- representable by a „emergent product of interaction between networks of mental representations at the individual level and networks of social communication at the group level“

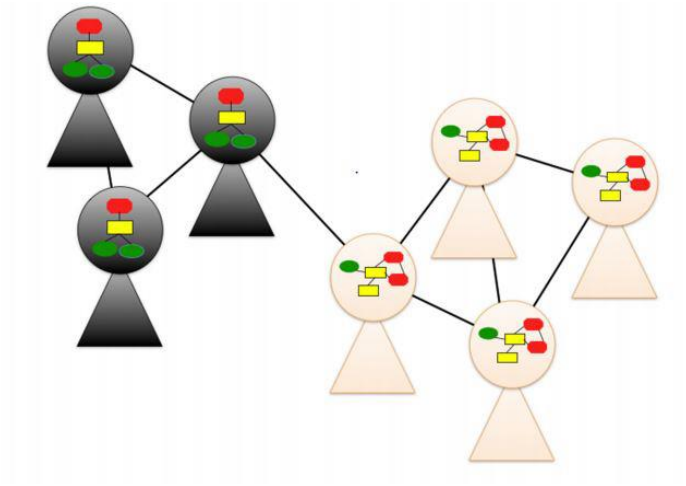


Figure 1. Ideologies as networks of concepts embedded in networks of people.

Homer-Dixon et al. (2013)

Research questions

- Possible research questions (not all specific livMats):

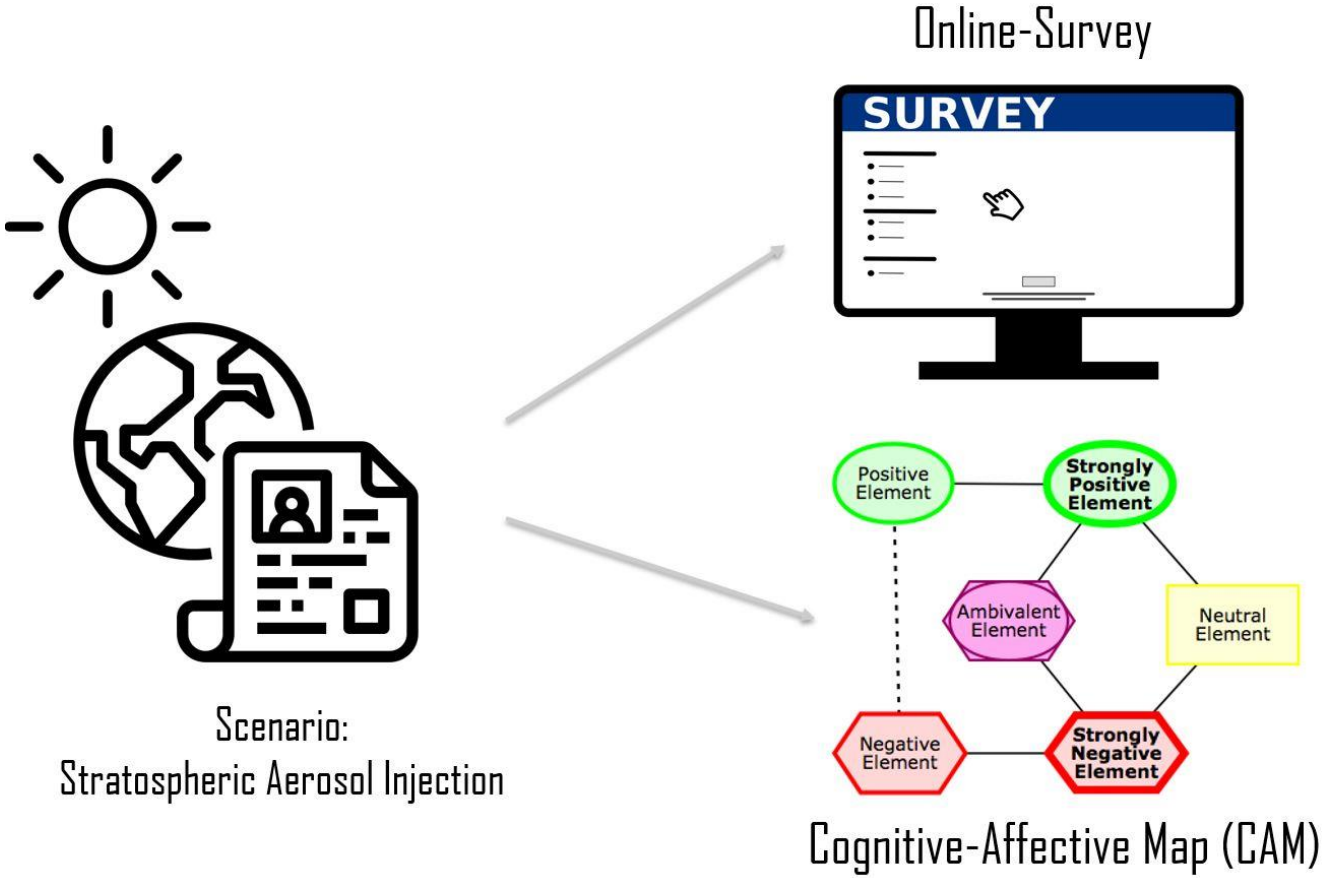
  - How people / groups are perceiving the COVID-19 pandemic? What are possible interventions? (Lisa Reuter, Roland Thomaschke)
  - Can CAMs be used to identify ethical principles underlying the evaluation of bioinspired technologies? (Lisa Reuter, Philipp Höfele)
  - How researchers from different disciplines do understand the concept “life”? (Sabrina Livanec , Philipp Höfele)
  - How can CAM help in value-sensitive design and human-centered engineering approaches (especially in human-machine collaboration)? (Sabrina Livanec)
  - How does knowledge about the cost of cars impact the perception of environmentally friendly mobility? (Michael Stumpf)
  - What are key-psychological factors influencing the acceptance of yet fictitious technologies? (Julius Fenn, Jessica Helm)
  - …

Fields of application

- to study if CAMs are supplementary to questionnaires - Mansell et al. (2020), J. Mansell et al. (2021)*
- agent-based modelling - e.g. Wolf et al. (2014), Schröder and Wolf (2016)
- tool for abstract knowledge representation - e.g. Thagard (2014, 2015)
- use CAMs for conflict mediation - e.g. Homer-Dixon et al. (2013), Scott and Lee (2020)
- evaluate via CAMs the success of an intervention - e.g. Luthardt et al. (2020), Reuter et al. (2021)

* to study if CAMs are supplementary to questionnaires

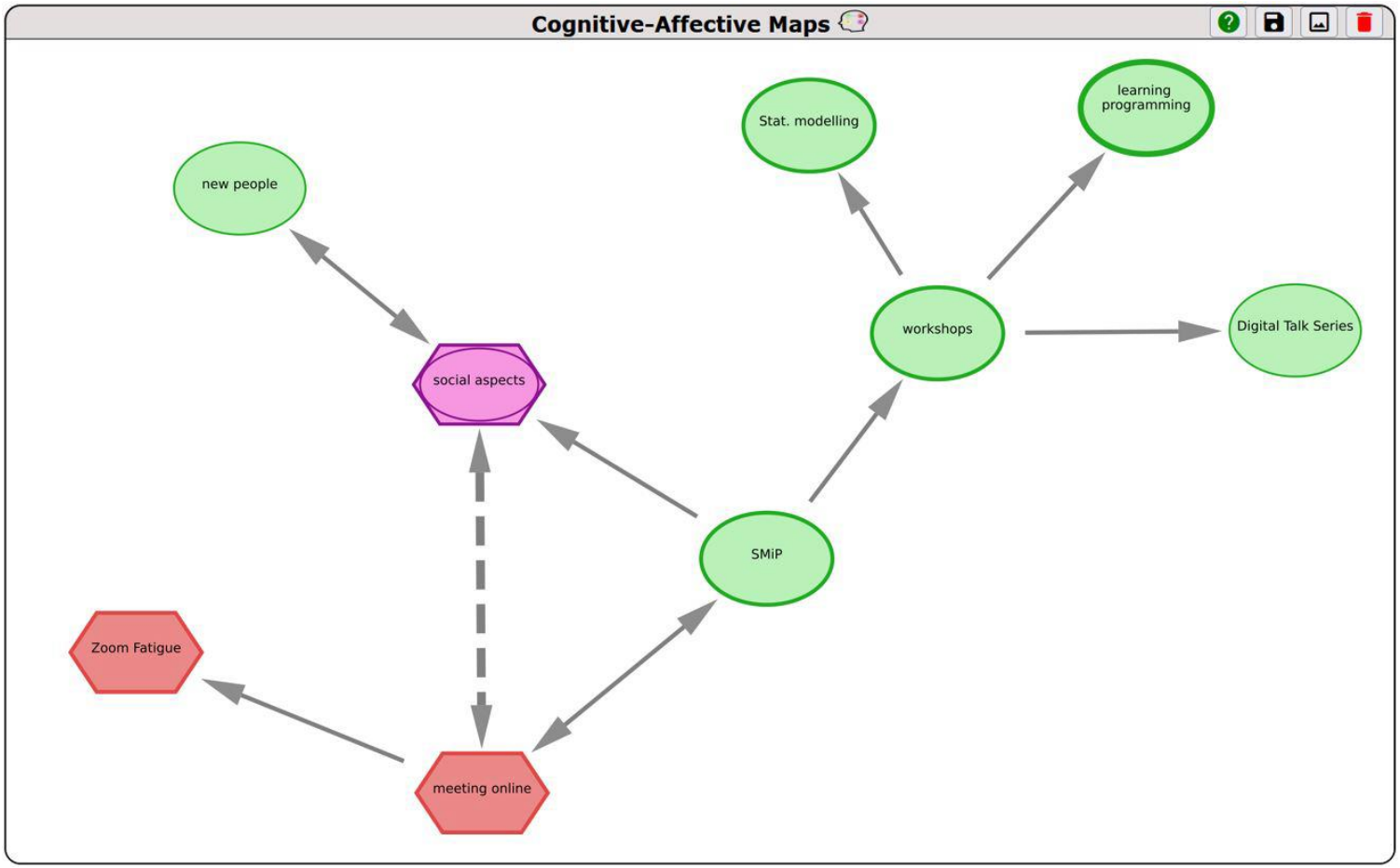
- possible study design:



C.A.M.E.L.

Cognitive Affective Map Extended Logic

Developed new software: User Interface



Essential features

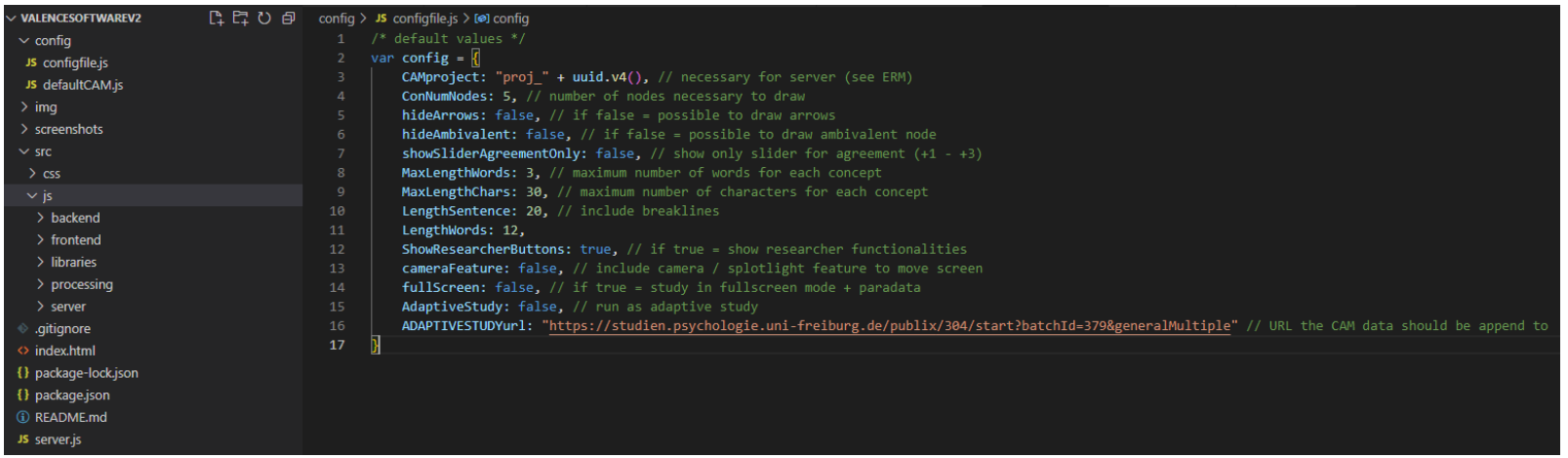
- draw, move, delete nodes and connectors
- change text, comment, valence and strength of nodes
- change strength, type and directionality of connectors
- save CAM as data file or upload CAM from data file

Main features

- preprocessing of drawn CAMs
  - are all nodes connected, have participants drawn X nodes, . . . ?
- customization of features
  - like disable arrows, ambivalent nodes, …
- adaptive study designs
  - individual questioning why, for example, participant drew node X or connected nodes X and Y? (for example set up open questions after CAM was drawn)

Customisability of software

every part of the software works independently, so features can be added, modified or disabled easily:



Example with maximum settings:

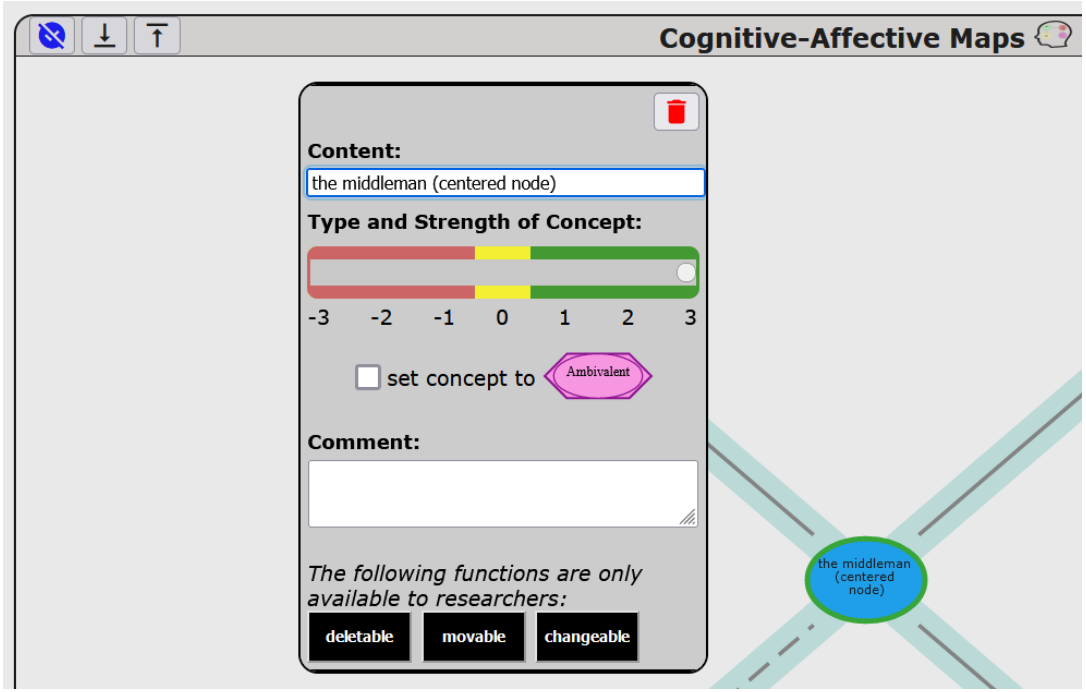
https://camgalaxy.github.io/?cameraFeature=true&fullScreen=true&ShowResearcherButtons=true&hideArrows=false&hideAmbivalent=false&showSliderAgreementOnly=false

Example with minimal settings:

https://camgalaxy.github.io/?cameraFeature=false&fullScreen=false&ShowResearcherButtons=false&hideArrows=true&hideAmbivalent=true&showSliderAgreementOnly=true

Two interfaces

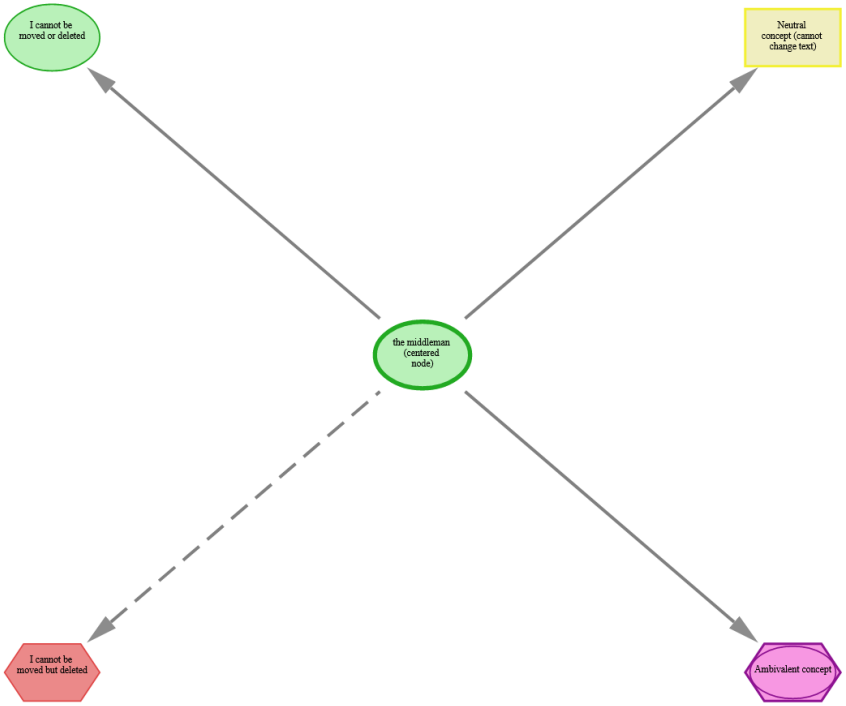
- Provide an interface for researchers and participants



> Change attributes of nodes and edges for your predefined elements

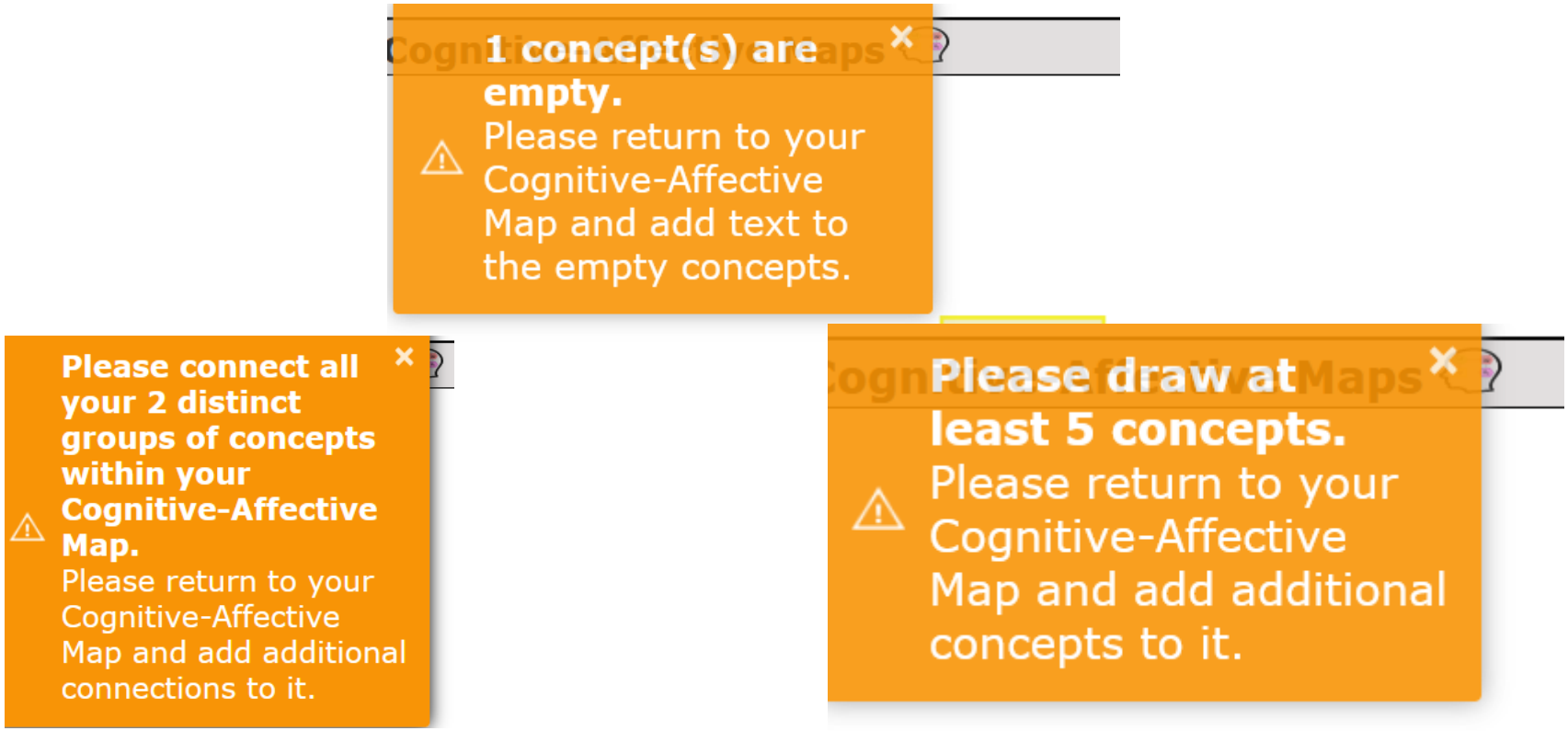
Publication-ready images

- create publication-ready images



Strong data model > increase data quality

- increase the data quality (check number of concepts, no empty concepts, all connected)



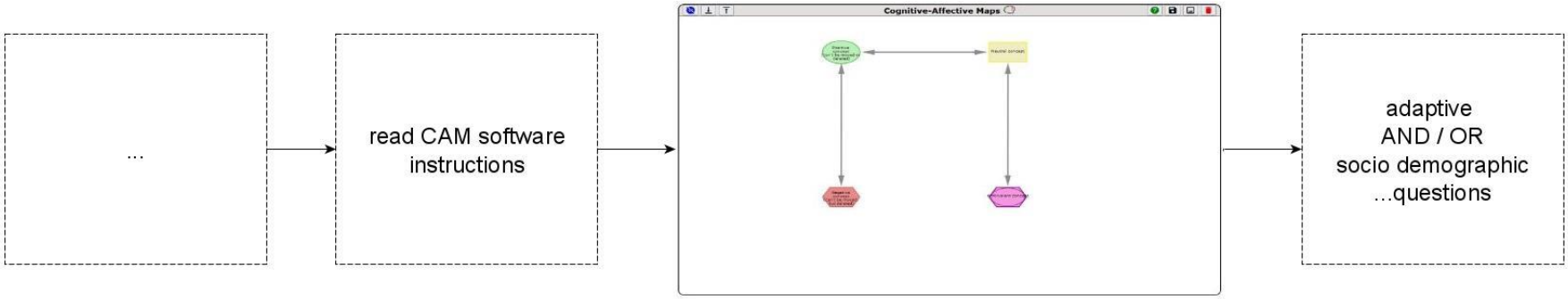
Strong data model > run adaptive study designs

- Data model split in
  - Connectors
  - Nodes

we can apply **cytoscape** (https://js.cytoscape.org/) in a preprocessing step to ask any kind of questions after a CAM has been drawn

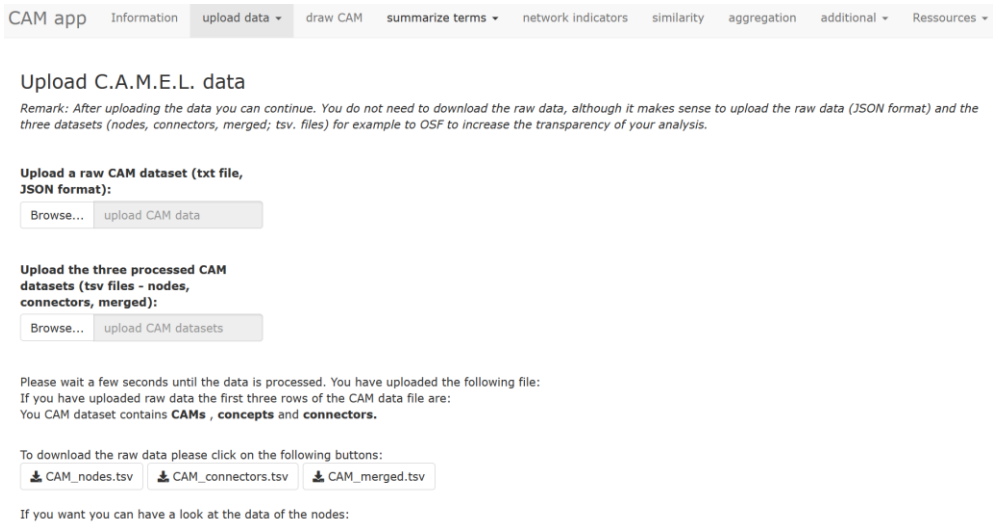
Example adaptive study

- „classical“ CAM study design:



- Example: https://studien.psychologie.uni-freiburg.de/publix/389/start?batchId=494&generalMultiple

Functionalities of the CAM app

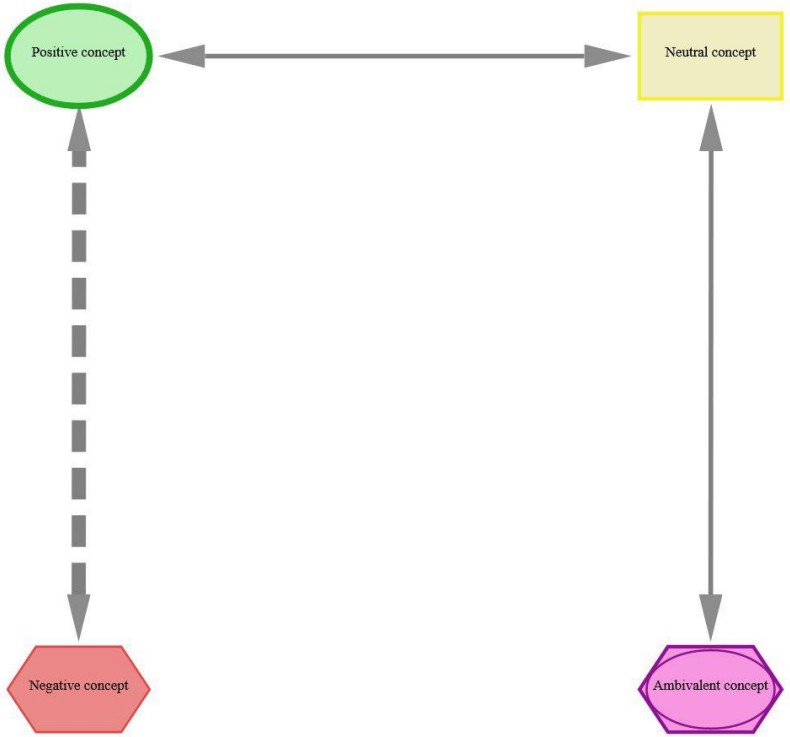


R-package and shiny app

- R-package and shiny app are under development to analyze CAM data:

CAM consists of:

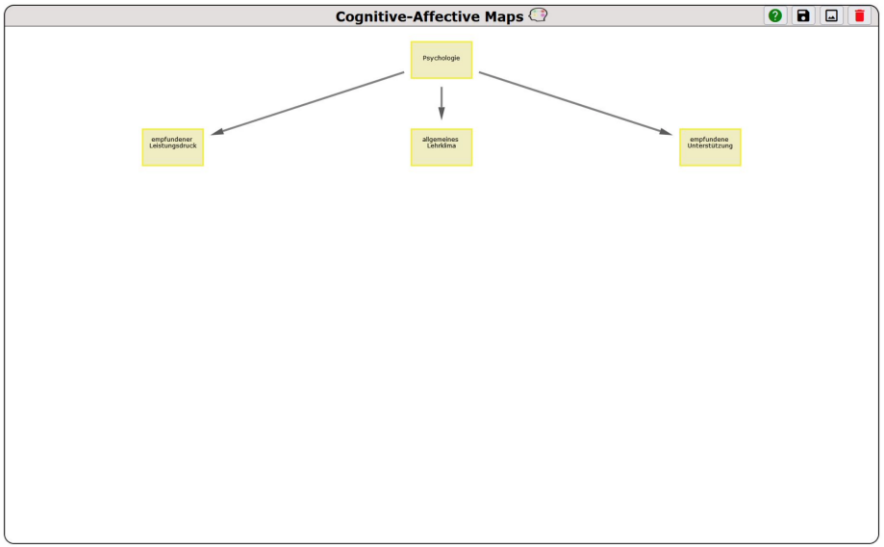
- nodes (concepts, goals, ...)
  - {content, valence, comment}
- connectors (pos. / neg. associations, ...)
  - {strength, type}



Development of R-package partly based on insights of current empirical CAM research: Jordan Mansell, Reuter, et al. (2021), Jordan Mansell, Mock, et al. (2021), Reuter et al. (2021)

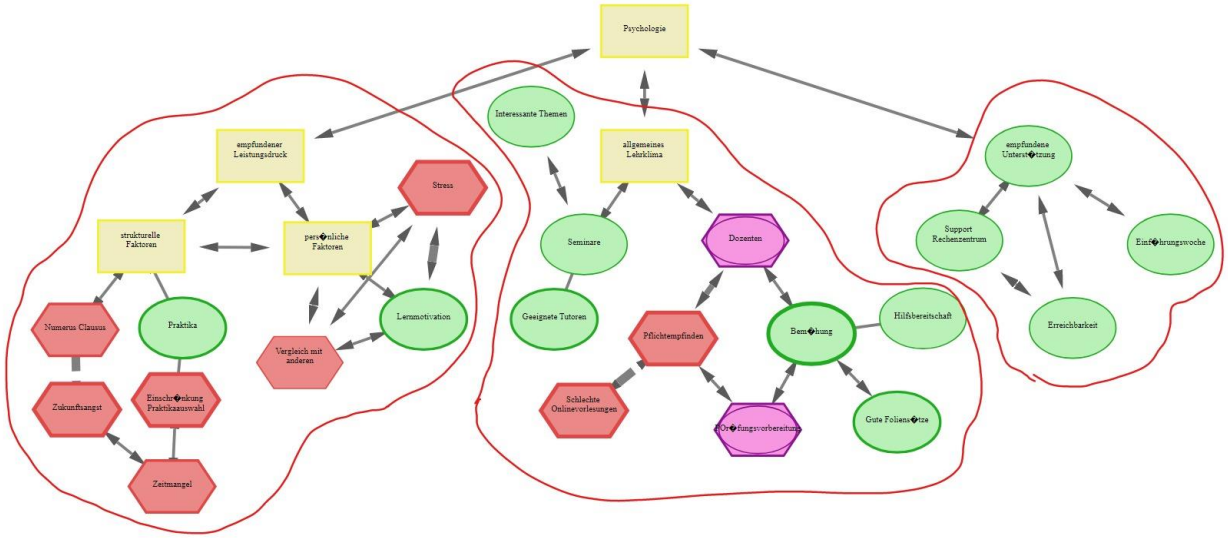
Example using shiny app I

- Study examines personal attitudes of psychology students towards the psychology programme at the University of Freiburg
  - N=65 CAMs
  - three predefined concepts: general teaching climate, perceived support, perceived pressure to perform



Example using shiny app II

- Results:
  - Mean value comparisons of term clusters around predefined nodes
  - Evaluation of central factors for satisfaction (interest, learning group) and dissatisfaction (stress, internship search)



Example using shiny app III

- Possible workflow:

1) Upload data
2) Draw CAMs
3) Summarize terms
4) Compute network indicators
5) Get overall wordlist
6) Aggregate CAMs

Link CAM app: https://fennapps.shinyapps.io/shinyCAMELv01/

Web based administration panel to set up C.A.M.E.L. studies

Send us an Email

If you have any questions feel warmly invited to send one of us an Email:

Julius Fenn:

julius.fenn@psychologie.uni-freiburg.de

Florian Gouret:

florian.gouret@psychologie.uni-freiburg.de

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