Breaking the Assumption of Group Homogeneity in Networks:

Partitioning Networks with Machine Learning

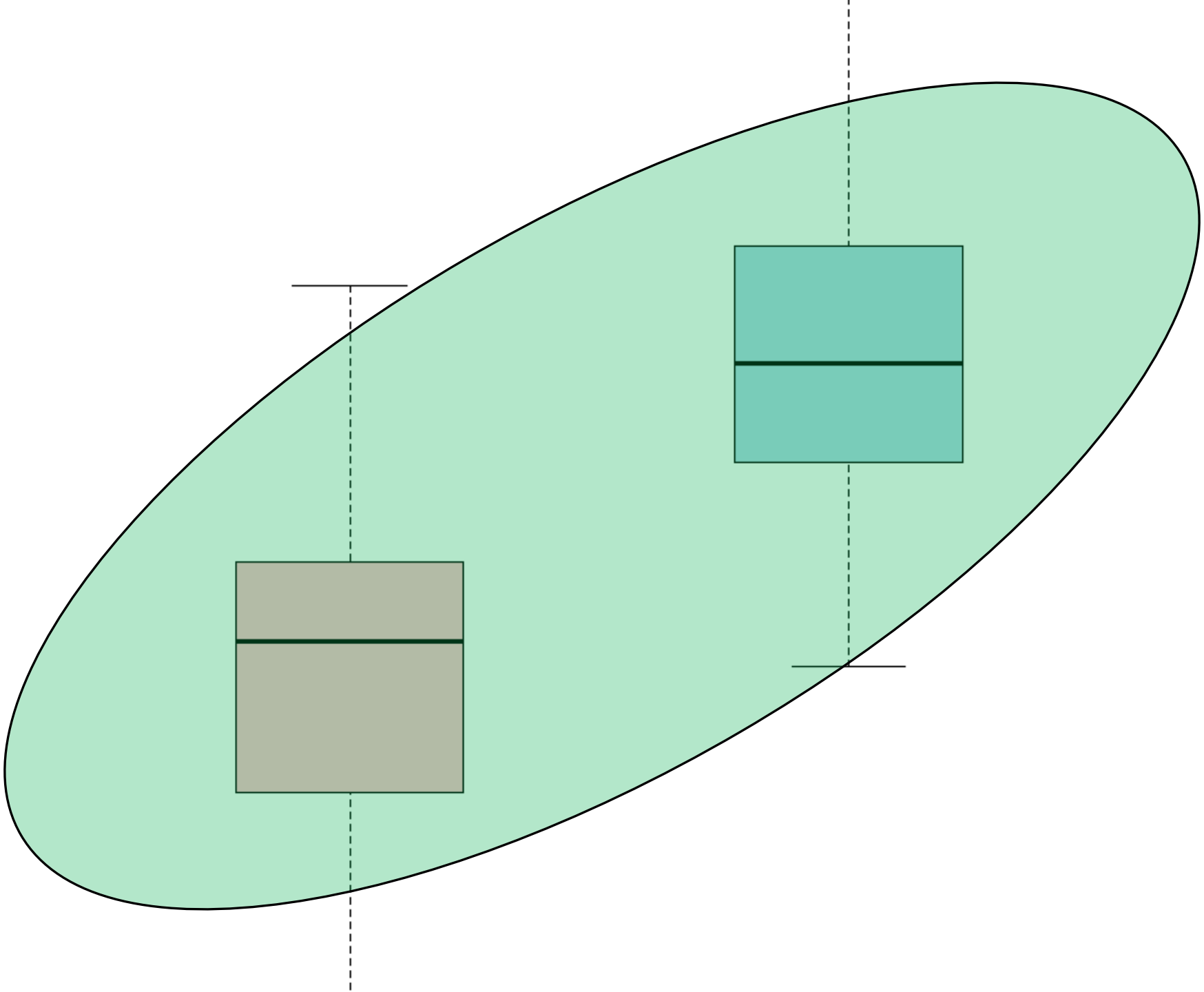
PAYTON JONES[1], PATRICK MAIR[1], THORSTEN SIMON[2], & ACHIM ZEILEIS[2]

[1]HARVARD UNIVERSITY

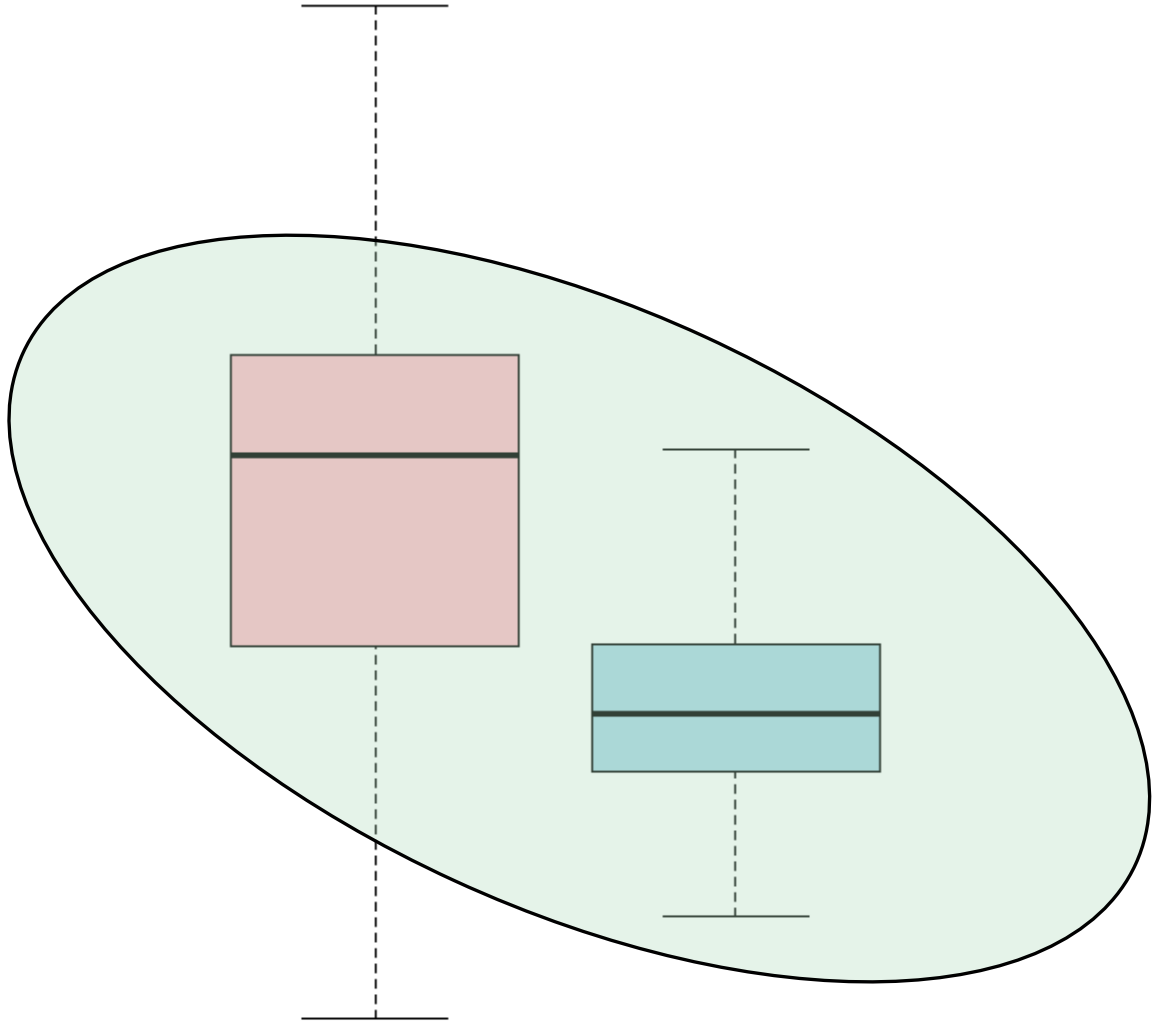
[2]UNIVERSITÄT INNSBRUCK

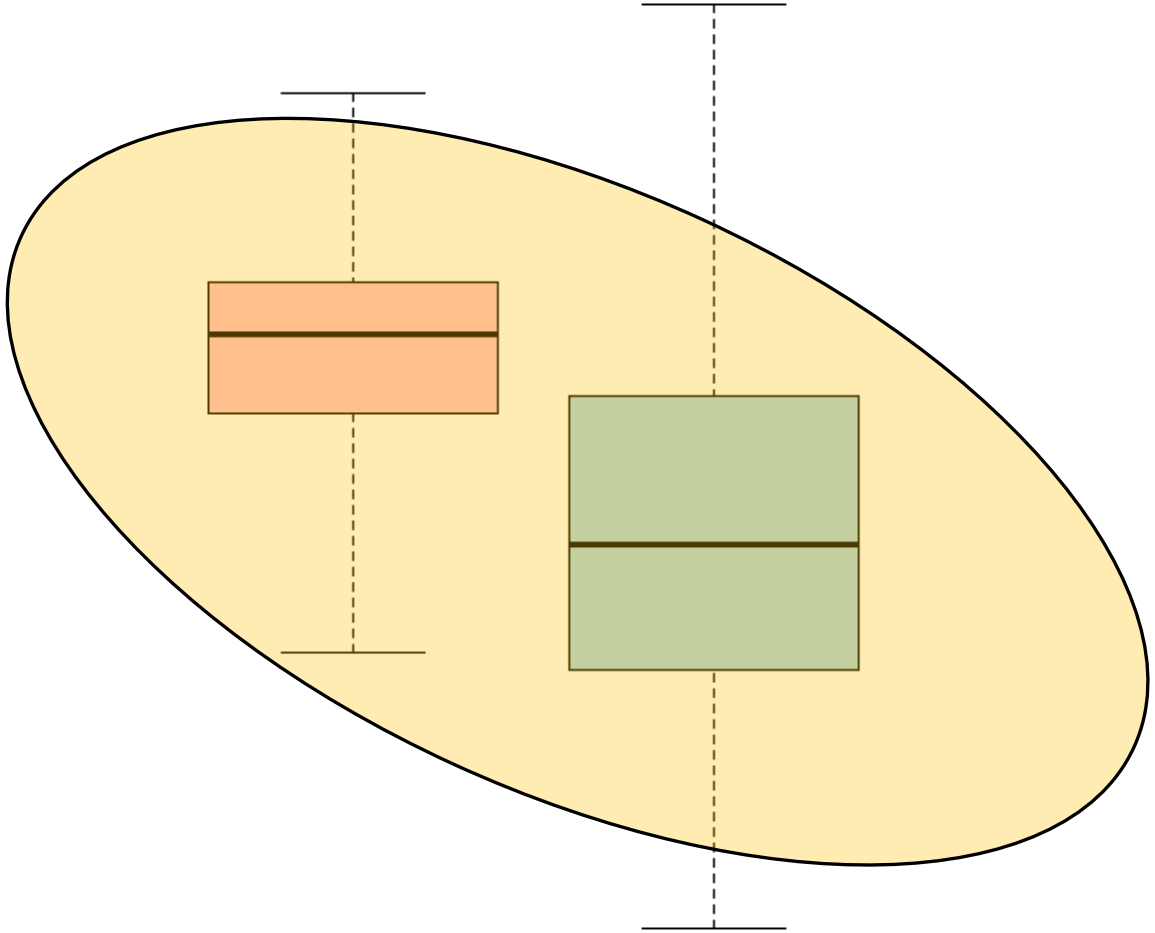
Berkeley

UNIVERSITY OF CALIFORNIA



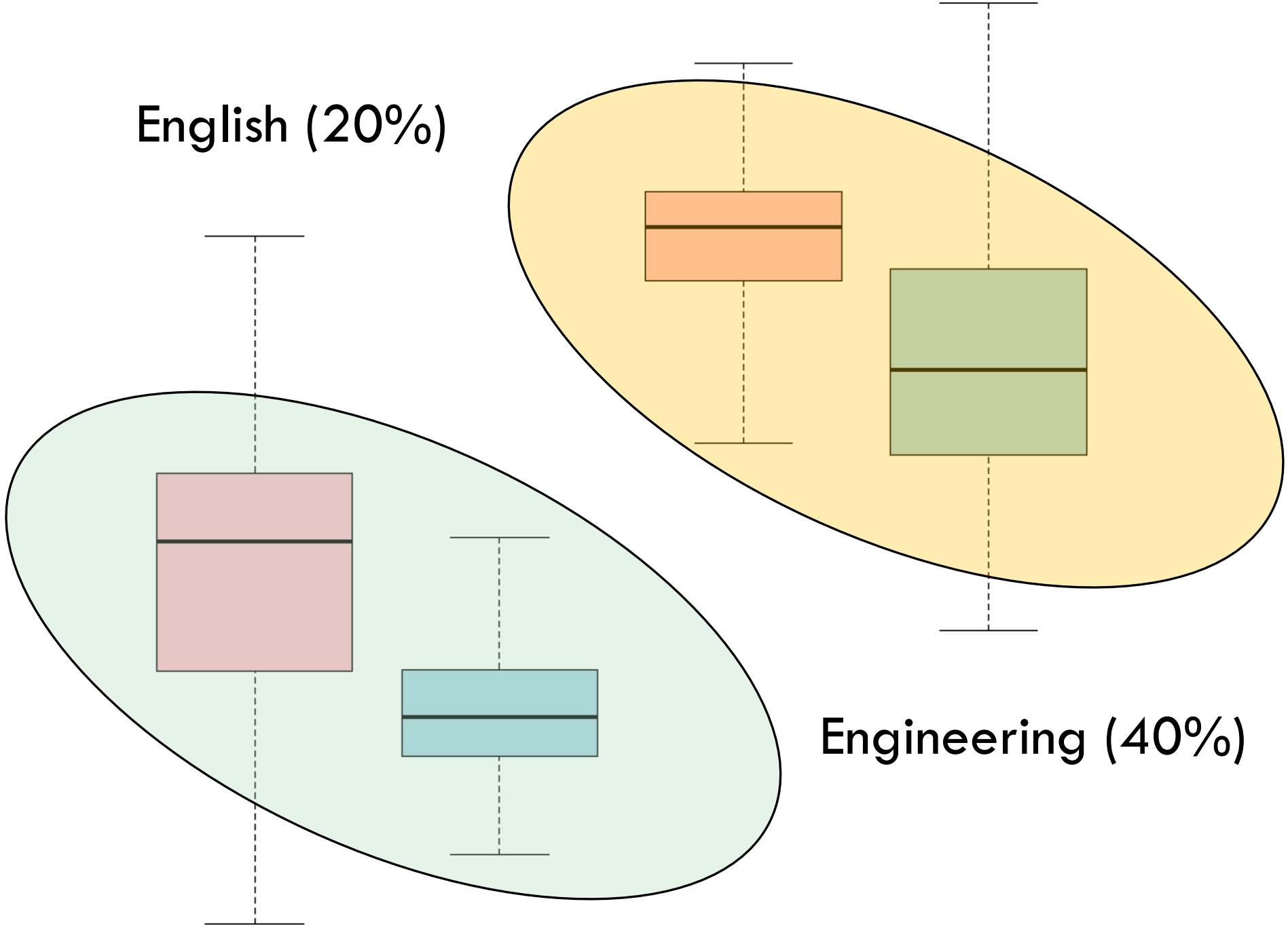
English



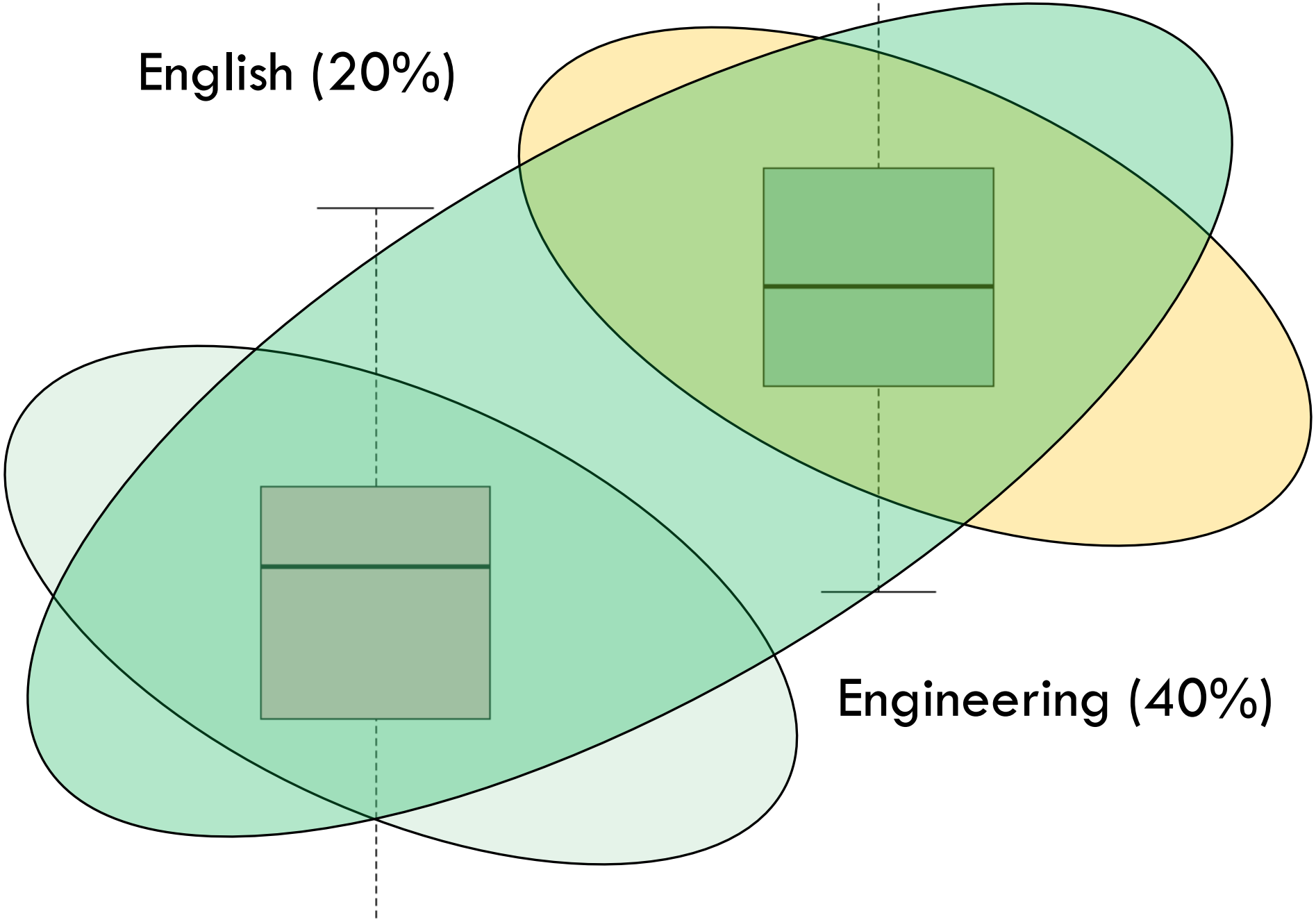


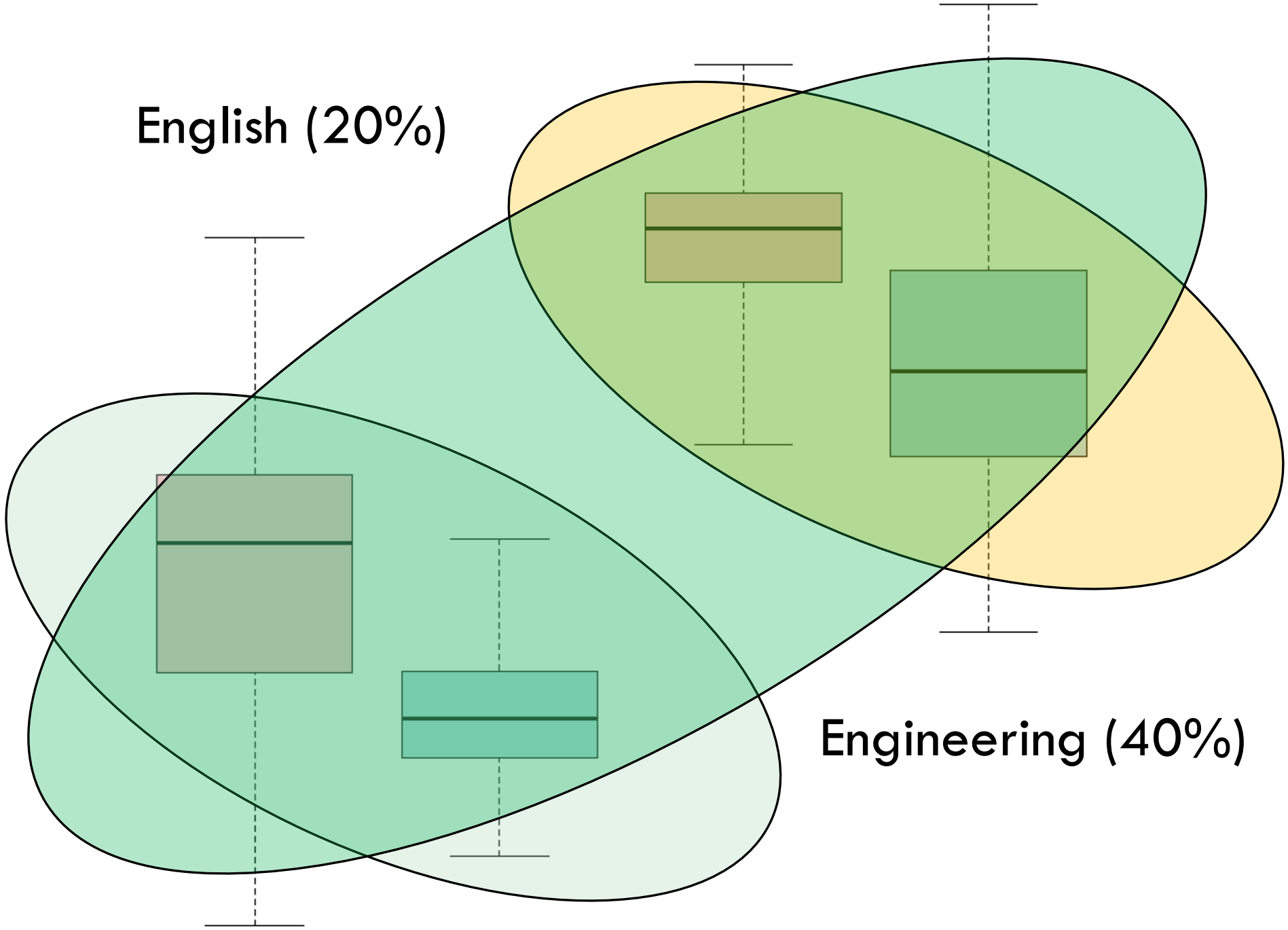
Engineering

English (20%)

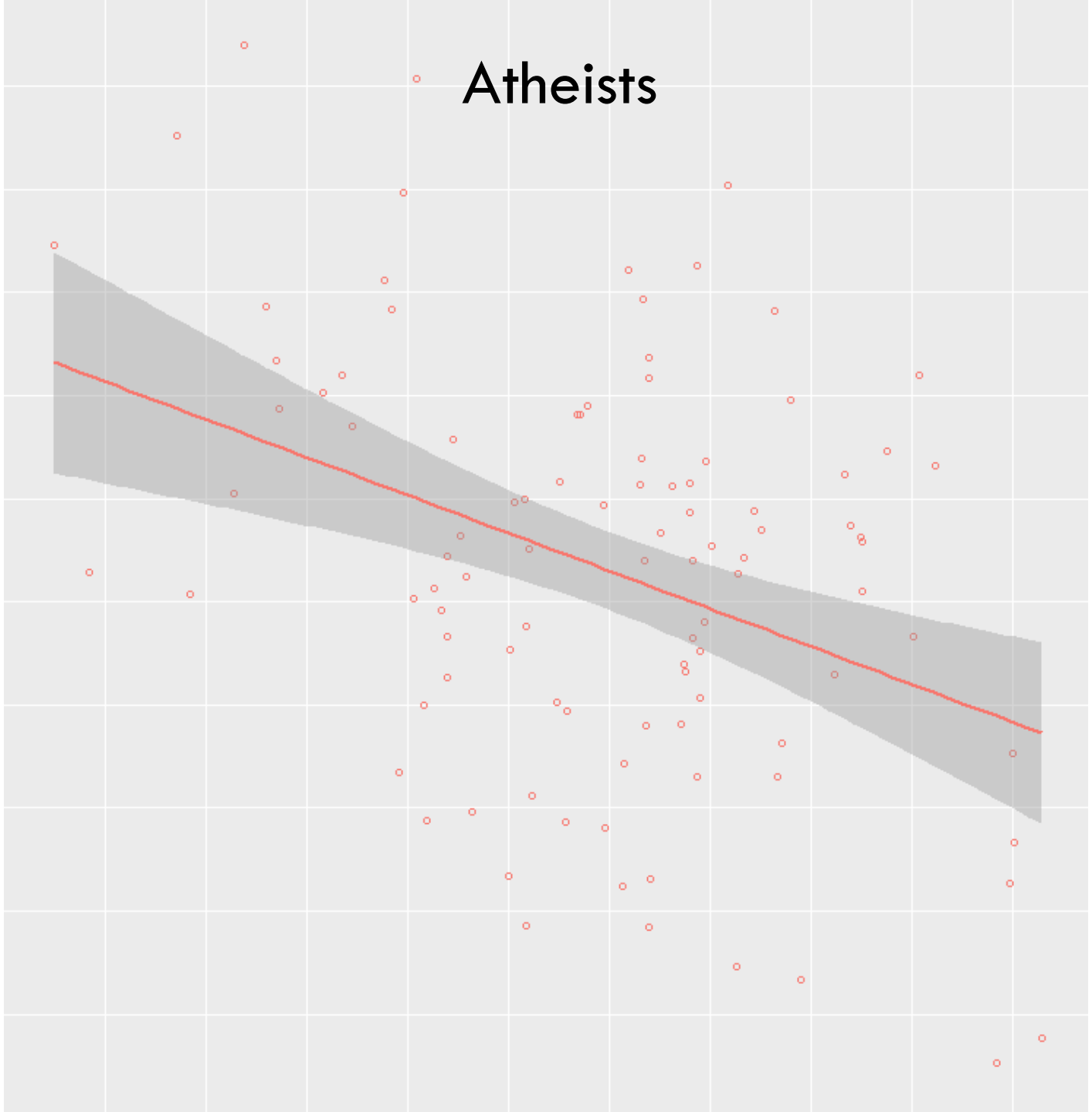


Engineering (40%)

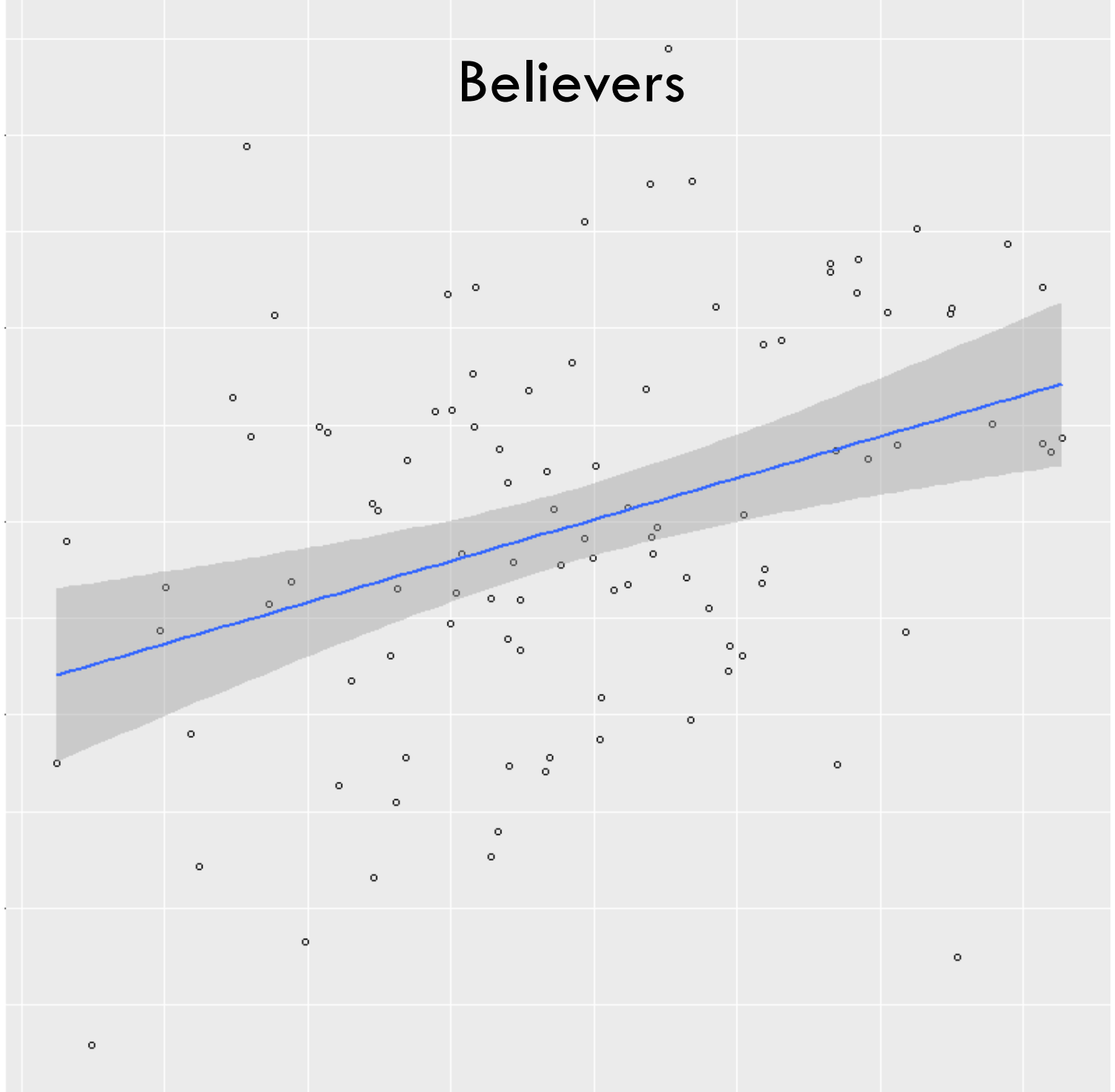

English (20%)
Engineering (40%)


English (20%)
Engineering (40%)

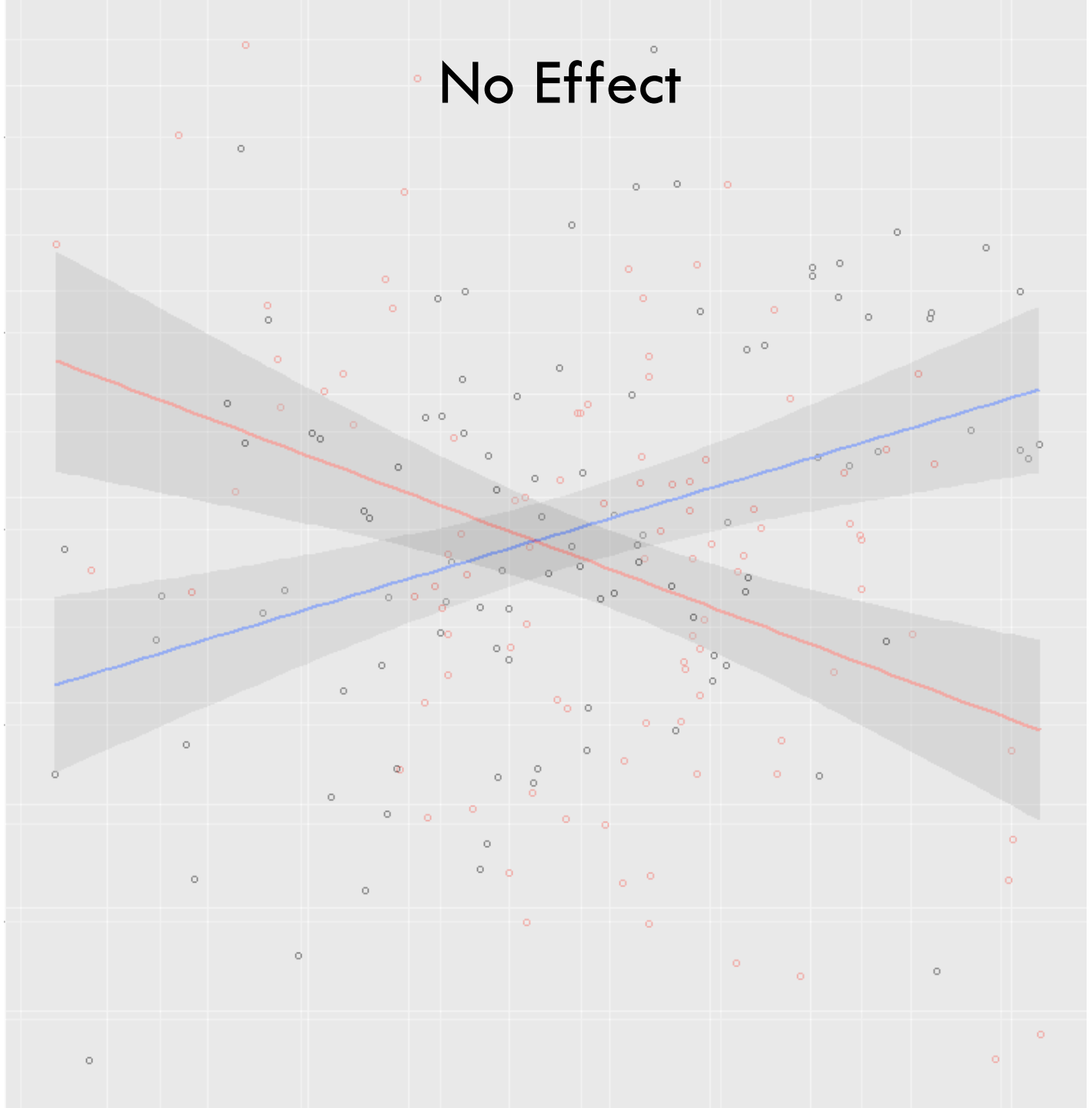
Atheists

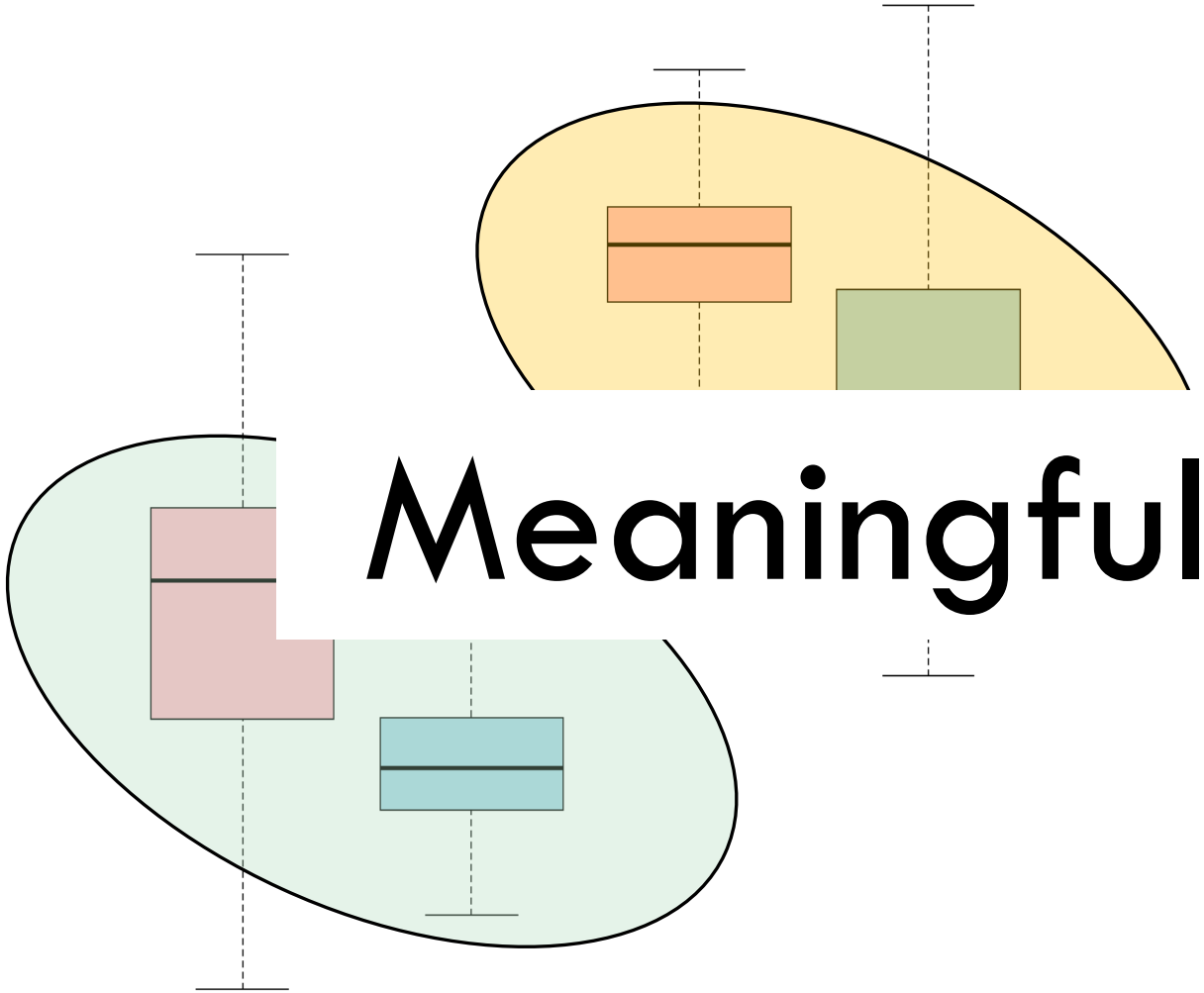


Believers

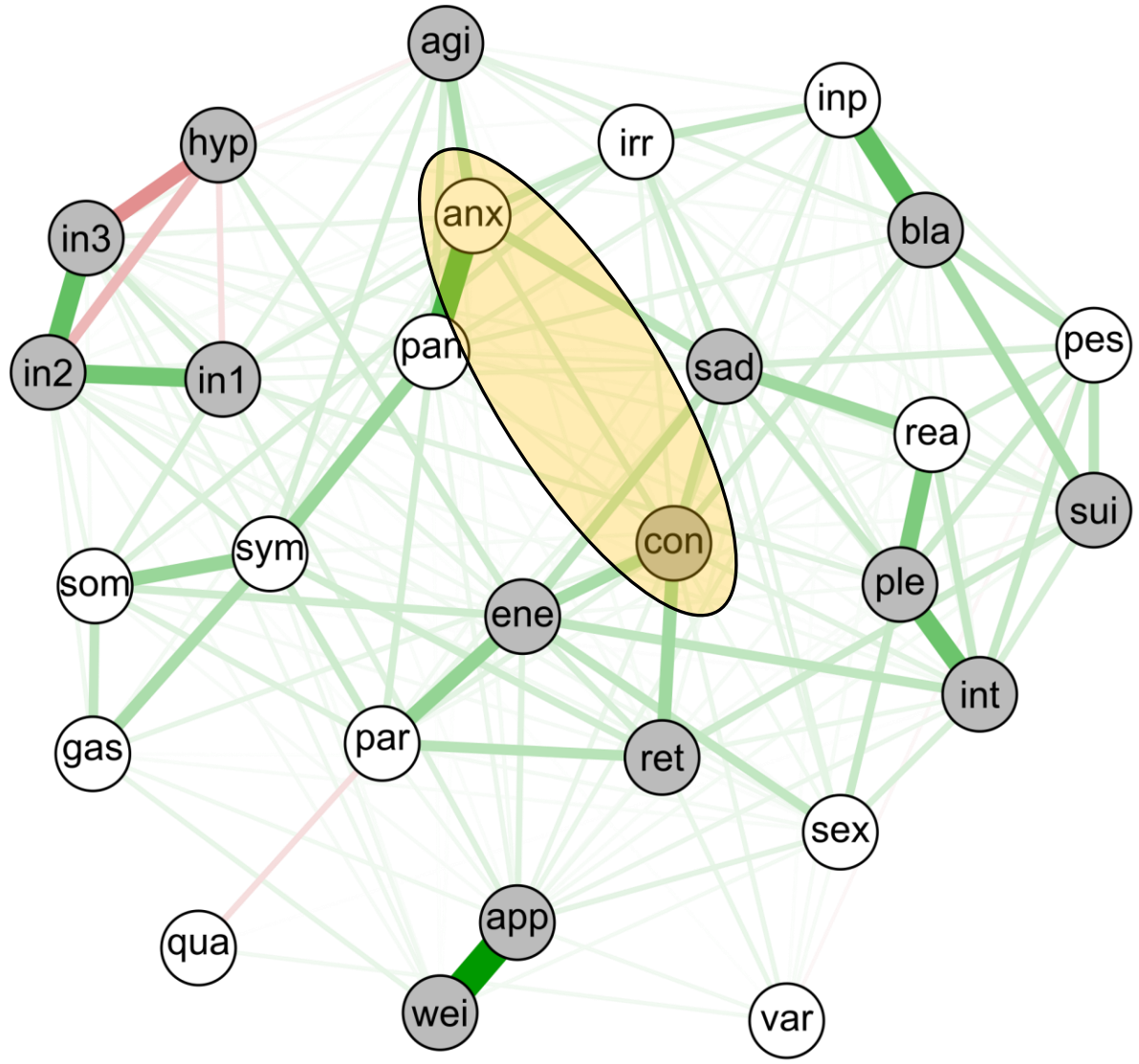


No Effect

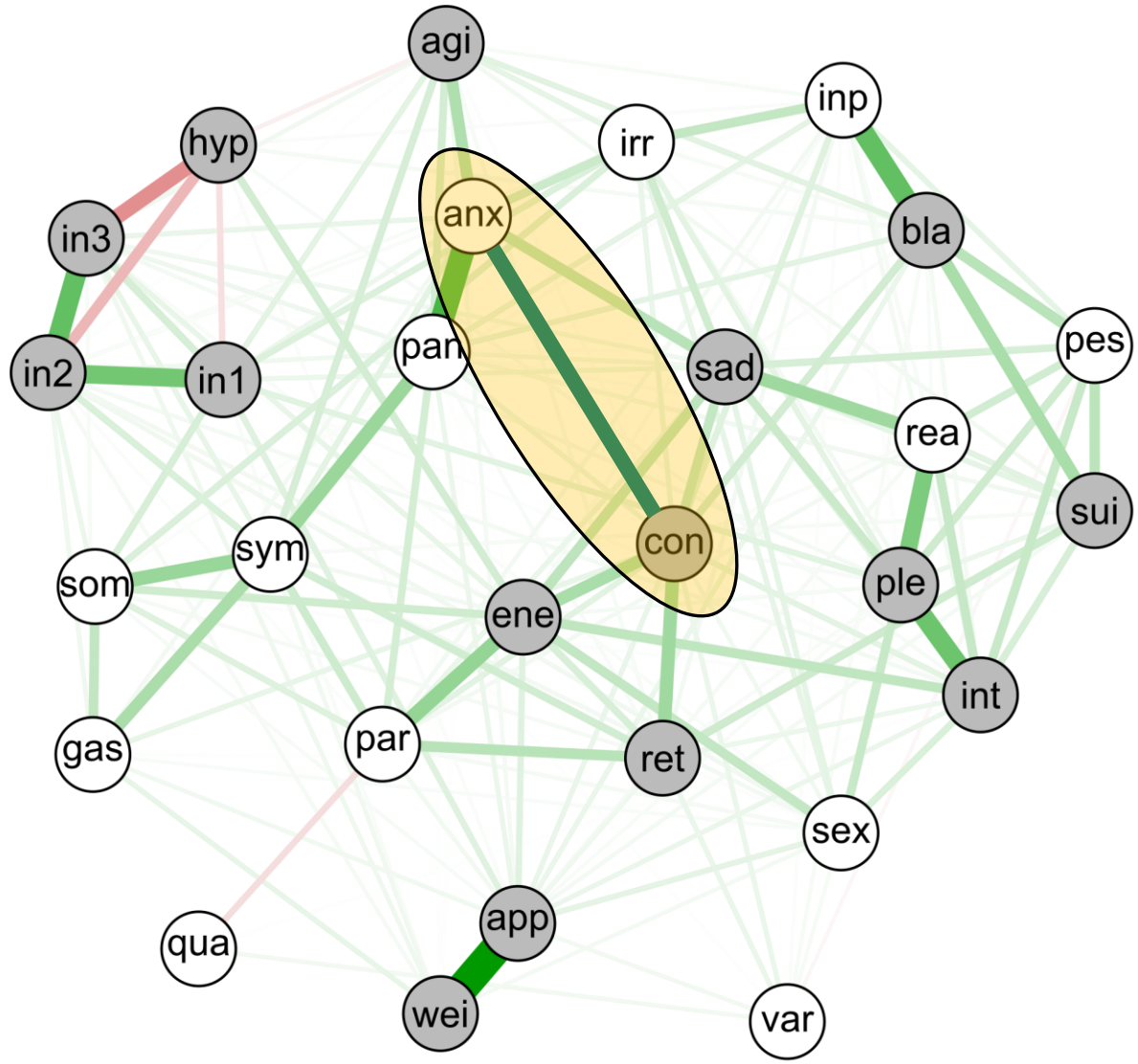




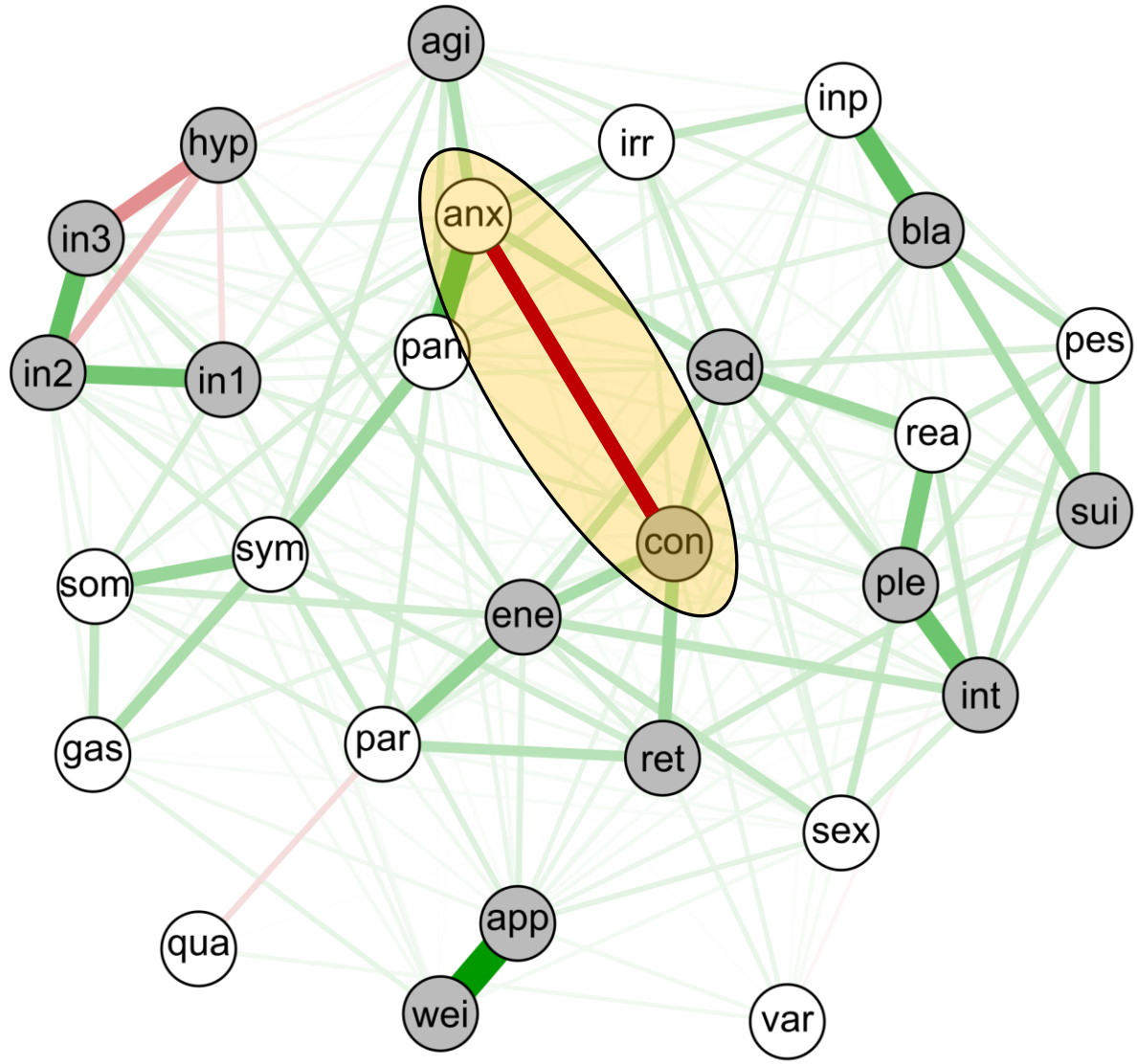
Meaningful Subgroups



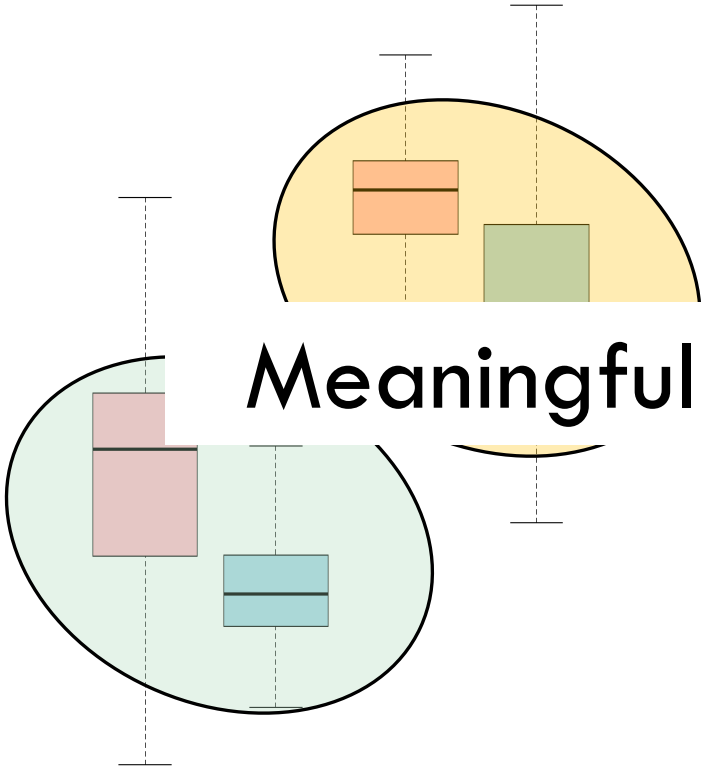
Energy loss
Sadness
Sympathetic arousal
Interest loss
Pleasure loss
Concentr. problems
Panic / phobia
Appetite probl.
Mid insomnia
Anxious / tense
Self-blame
Late insomnia
Paralysis
Early insomnia
Retardation
Interpers. sensitivity
Mood reactivity
Suicidal ideation
Pessimism
Somatic complaints
Irritability
Weight probl.
Agitation
Sexual disinterest
Hypersomnia
Gastroint. probl.
Diurnal variation
Mood quality

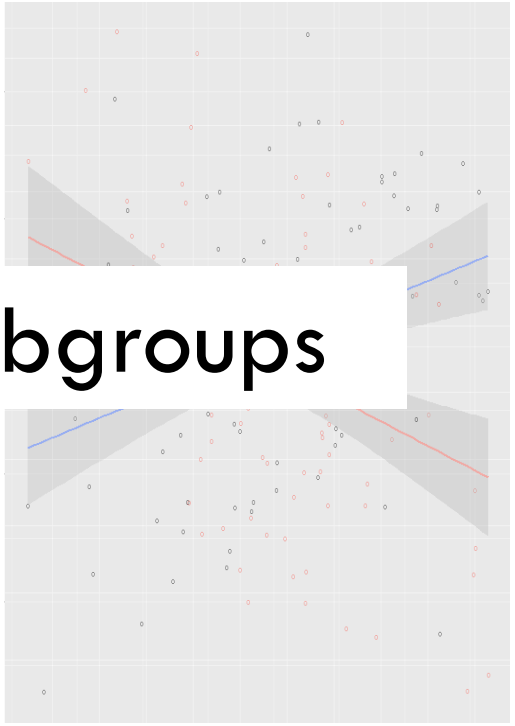


Energy loss
Sadness
Sympathetic arousal
Interest loss
Pleasure loss
Concentr. problems
Panic / phobia
Appetite probl.
Mid insomnia
Anxious / tense
Self-blame
Late insomnia
Paralysis
Early insomnia
Retardation
Interpers. sensitivity
Mood reactivity
Suicidal ideation
Pessimism
Somatic complaints
Irritability
Weight probl.
Agitation
Sexual disinterest
Hypersomnia
Gastroint. probl.
Diurnal variation
Mood quality

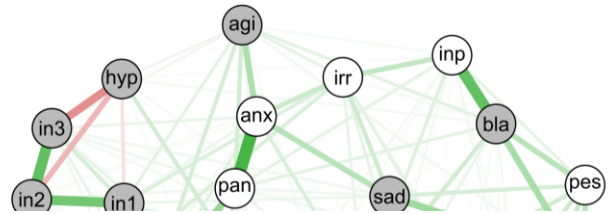


Energy loss
Sadness
Sympathetic arousal
Interest loss
Pleasure loss
Concentr. problems
Panic / phobia
Appetite probl.
Mid insomnia
Anxious / tense
Self-blame
Late insomnia
Paralysis
Early insomnia
Retardation
Interpers. sensitivity
Mood reactivity
Suicidal ideation
Pessimism
Somatic complaints
Irritability
Weight probl.
Agitation
Sexual disinterest
Hypersomnia
Gastroint. probl.
Diurnal variation
Mood quality



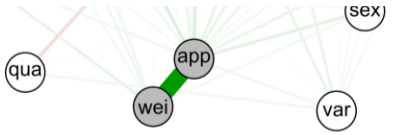


Meaningful Subgroups



Energy loss
Sadness
Sympathetic arousal
Interest loss
Pleasure loss
Concentr. problems
Panic / phobia
Appetite probl.
Mid insomnia
Anxious / tense

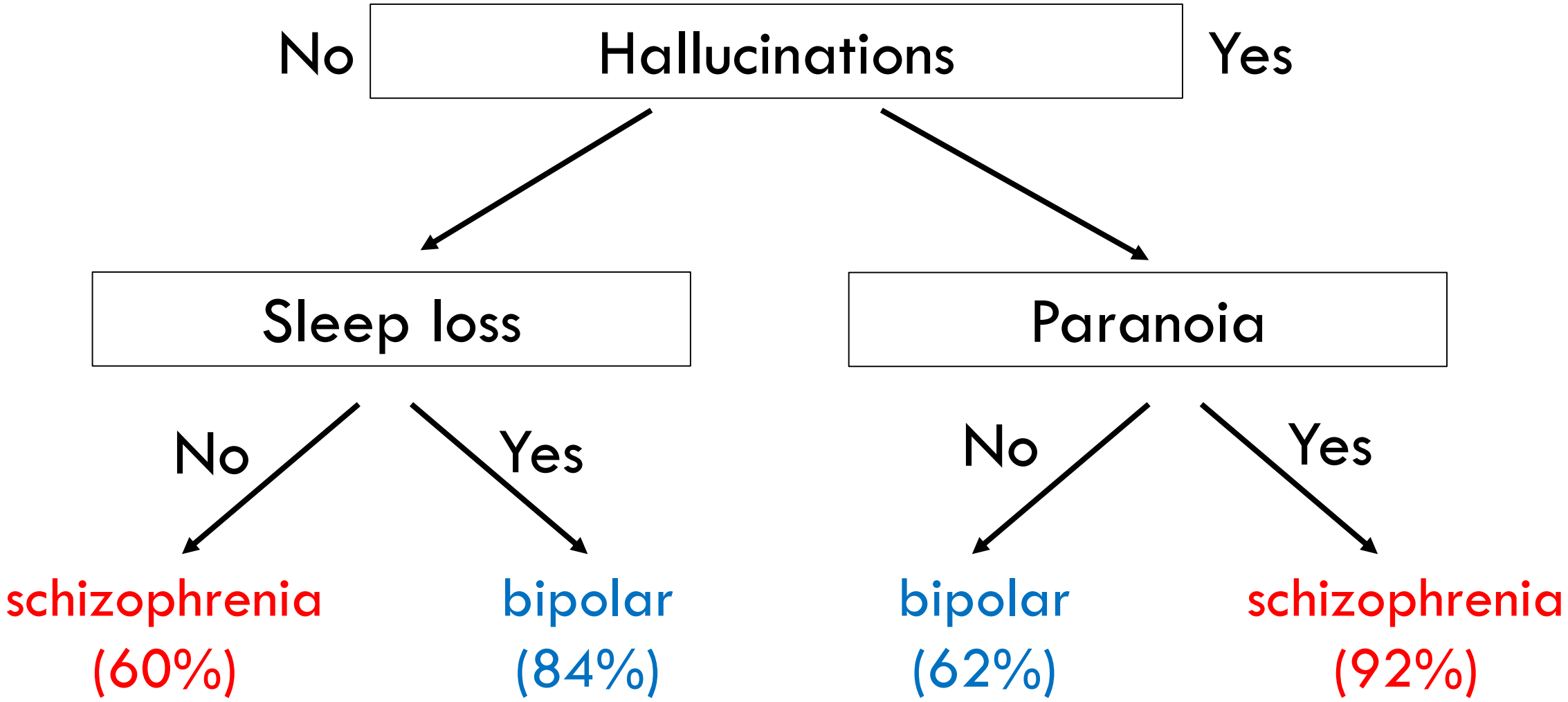
Meaningful Subgroups in Networks

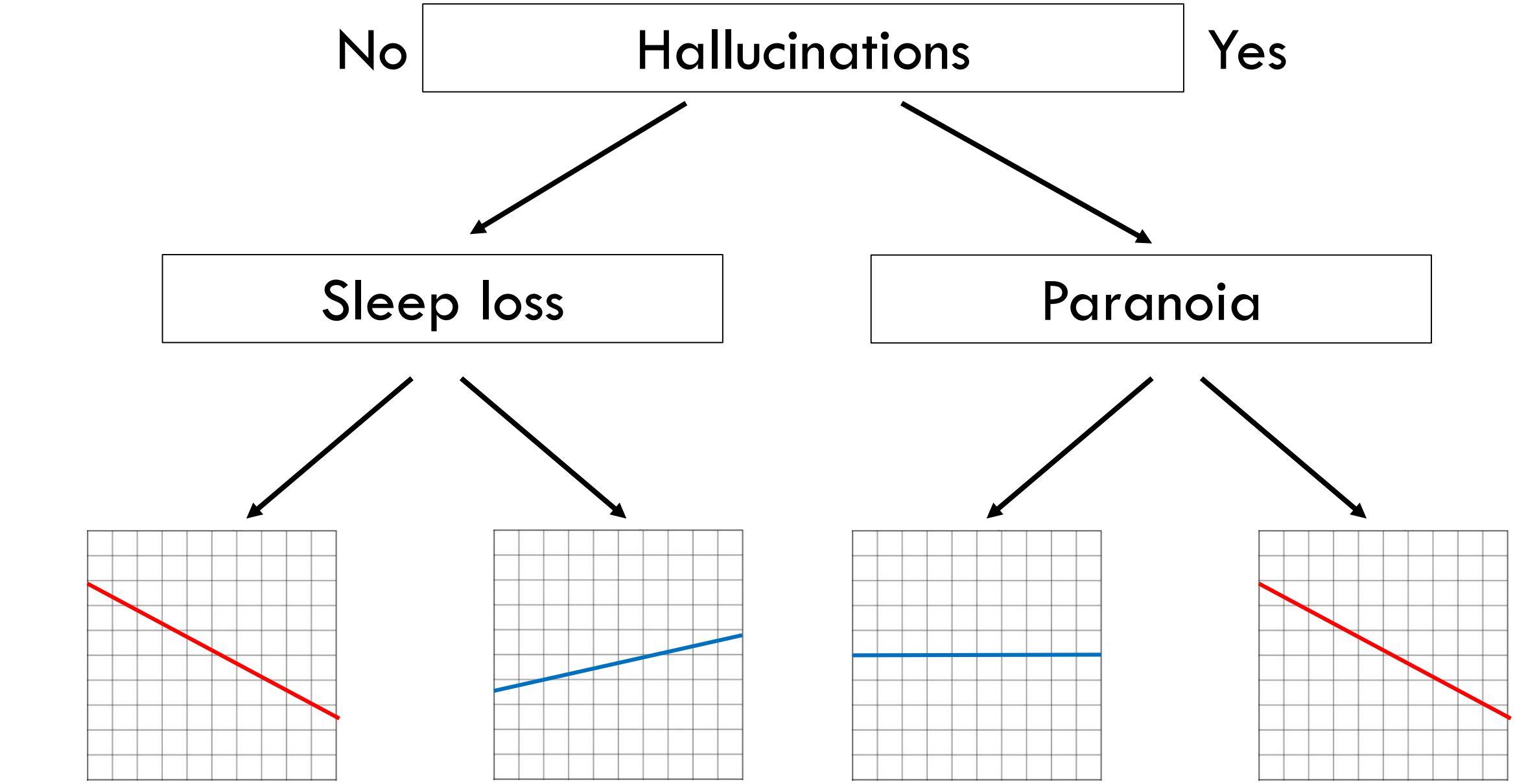


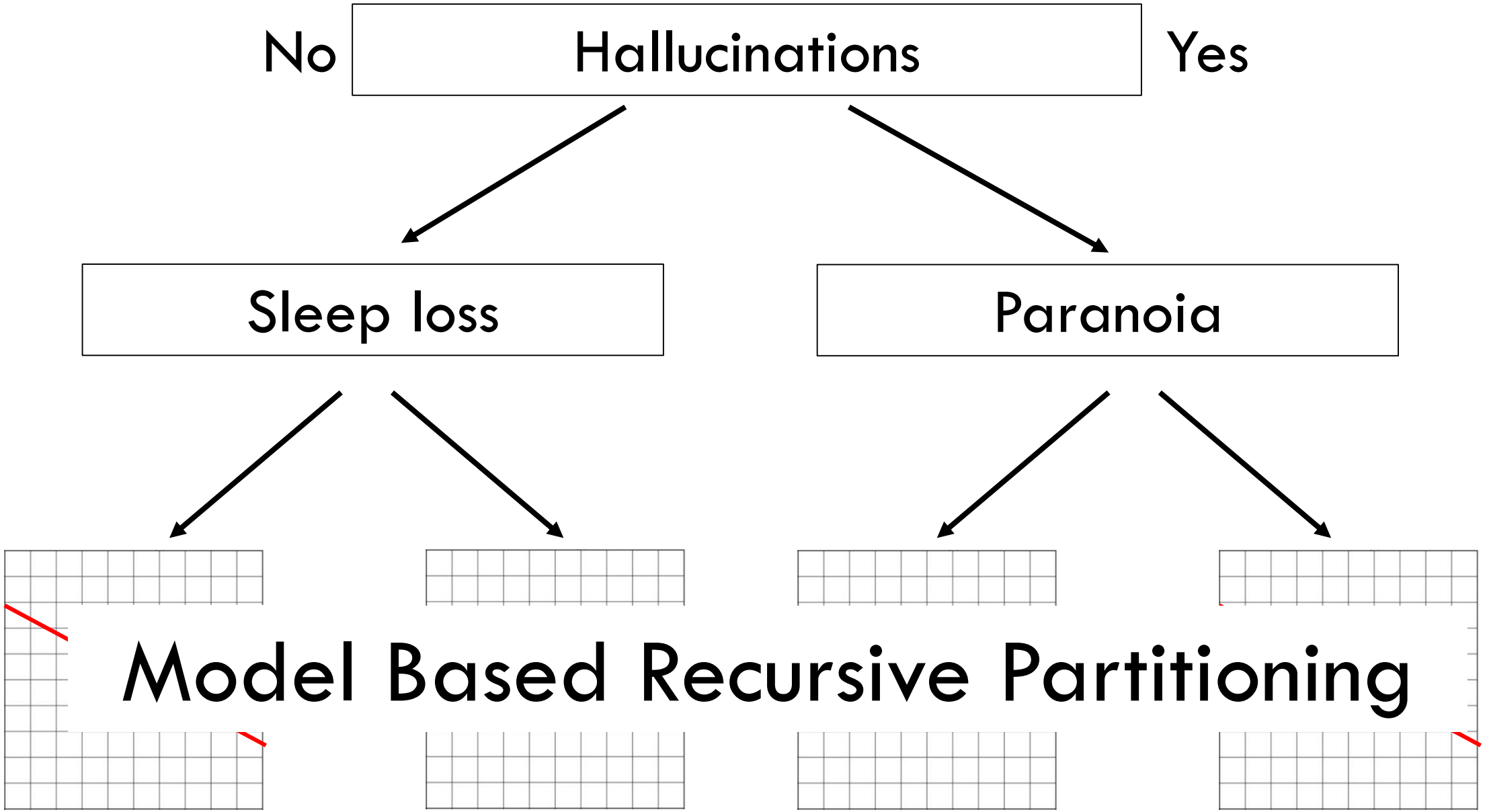
Somatic complaints
Irritability
Weight probl.
Agitation
Sexual disinterest
Hypersomnia
Gastroint. probl.
Diurnal variation
Mood quality

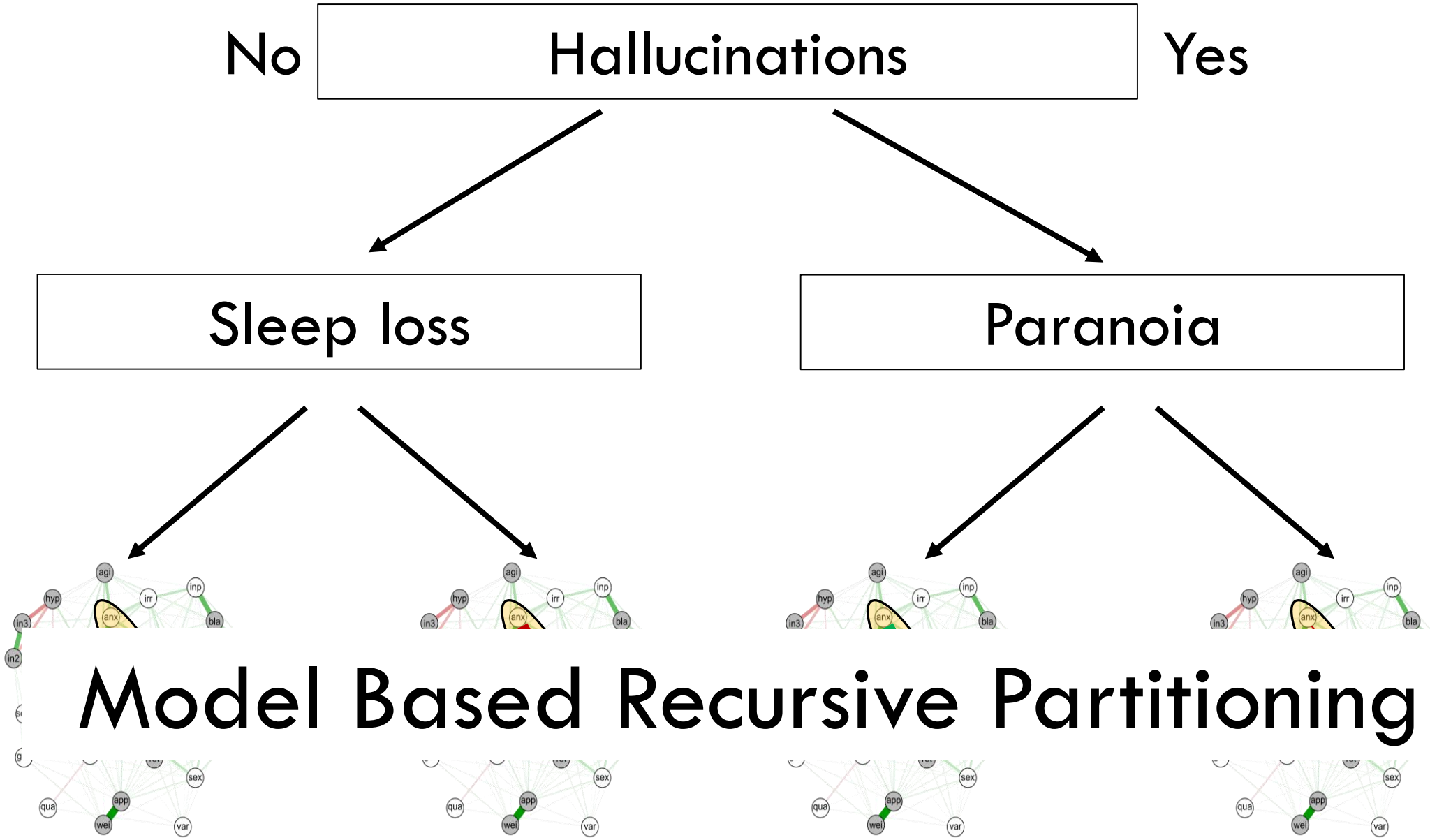
DSM criterion symptom
Non-DSM symptom

Decision Trees


No
Hallucinations
Yes
Sleep loss
Paranoia
No
Yes
No
Yes
schizophrenia
(60%)
bipolar
(84%)
bipolar
(62%)
schizophrenia
(92%)

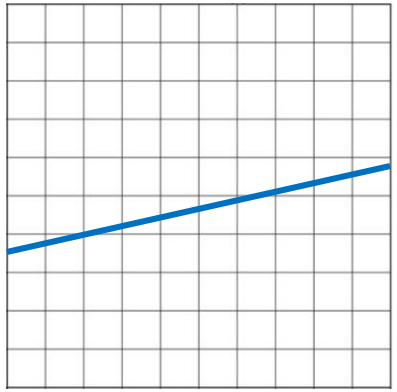

No
Hallucinations
Yes
Sleep loss
Paranoia


No
Hallucinations
Yes
Sleep loss
Paranoia
Model Based Recursive Partitioning

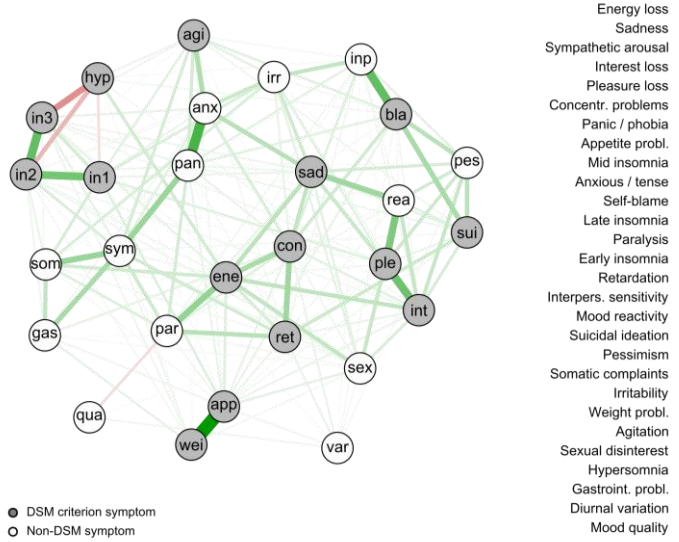


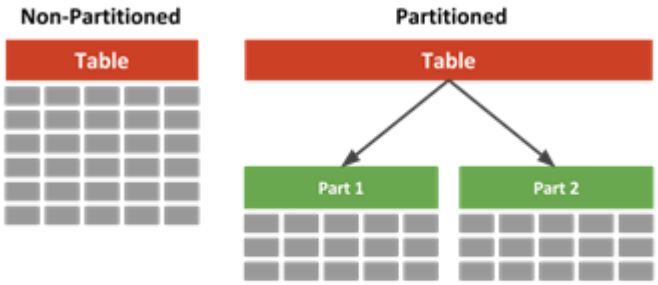
Model Based Recursive Partitioning

Model Based Recursive Partitioning

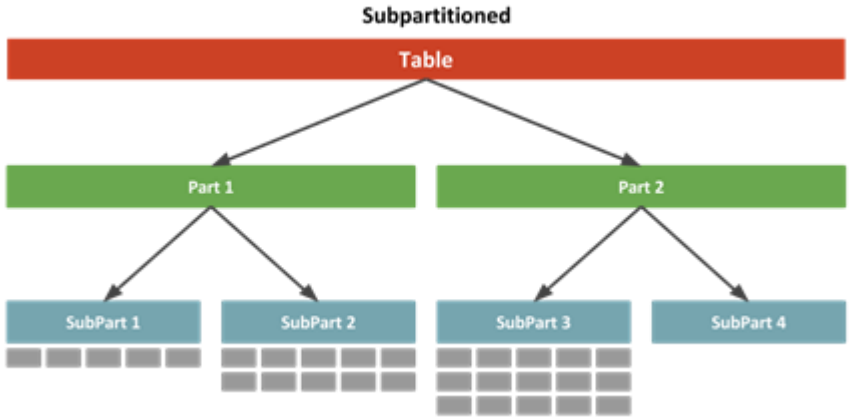


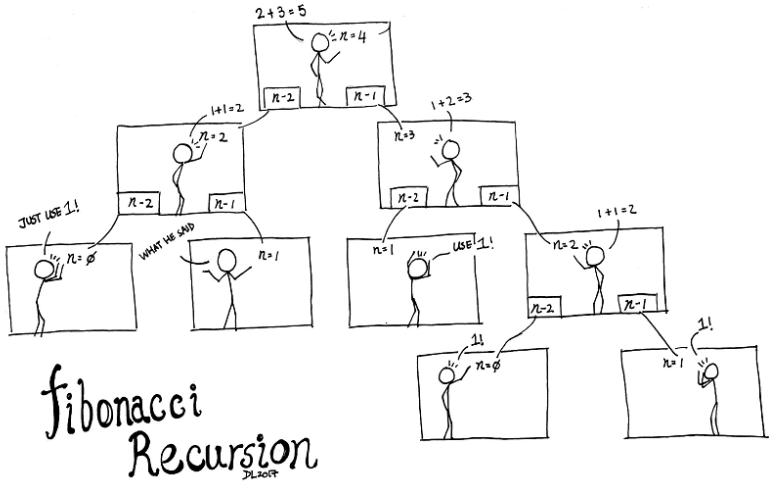
Model Based Recursive Partitioning



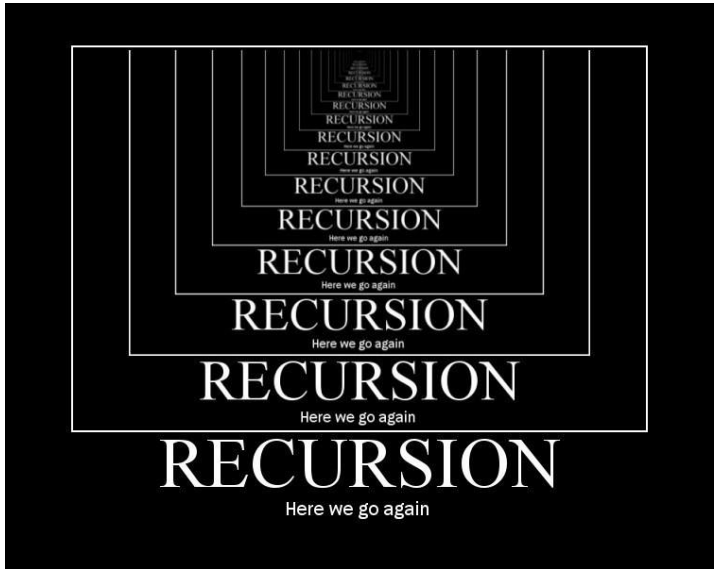


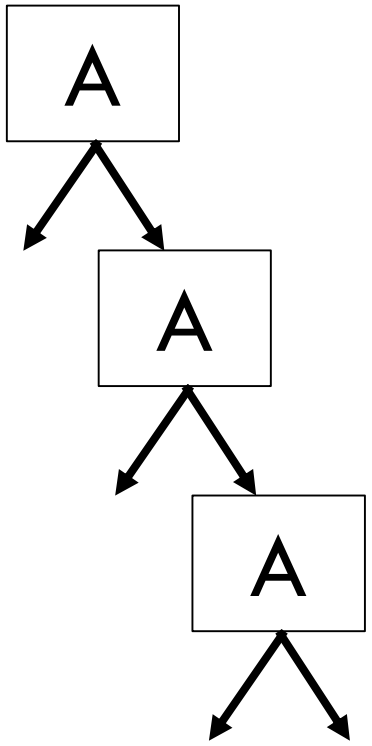
Model Based Recursive Partitioning



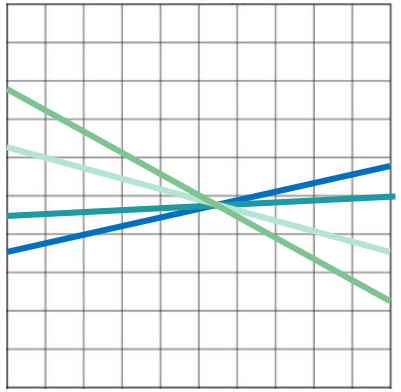


Model Based Recursive Partitioning





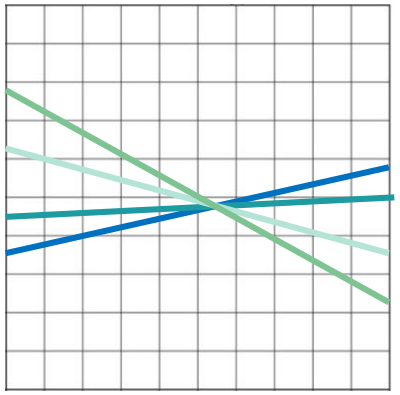
Model Based Recursive Partitioning

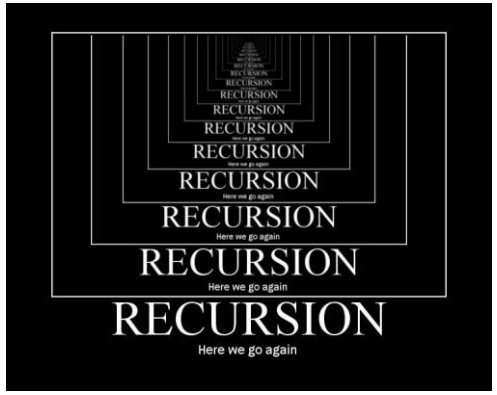


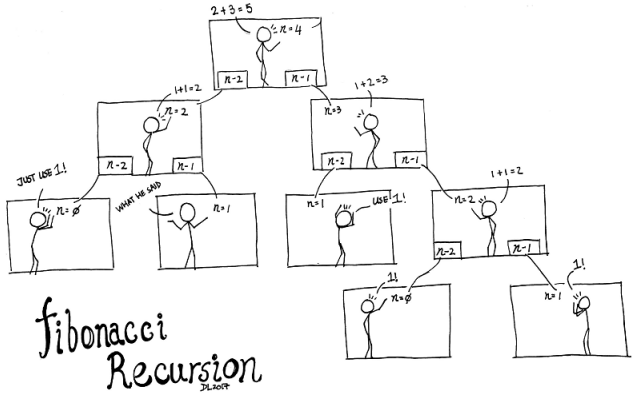
Model Based

$\frac{dy}{dx}$ $f'(x)$

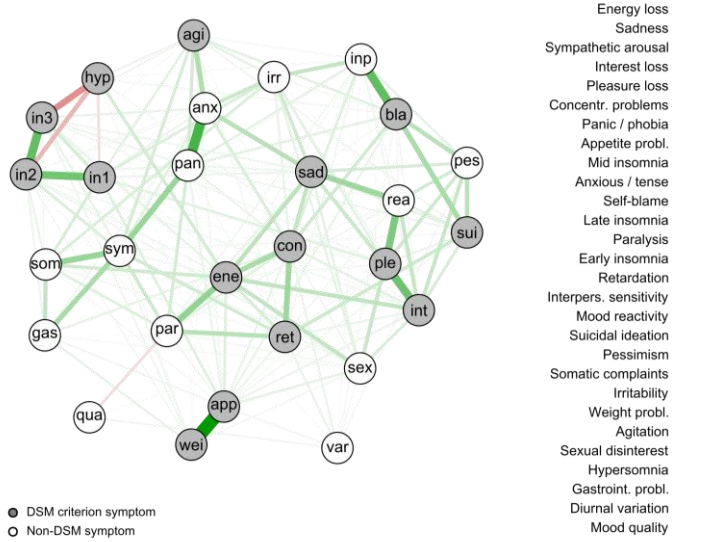
Recursive Partitioning



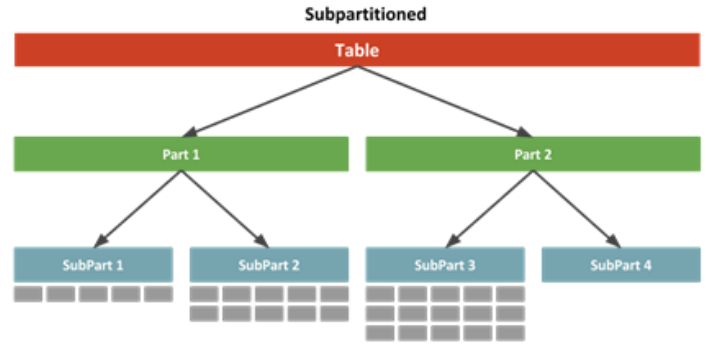




Model Based Recursive Partitioning



$$\frac{dy}{dx} \qquad f'(x)$$



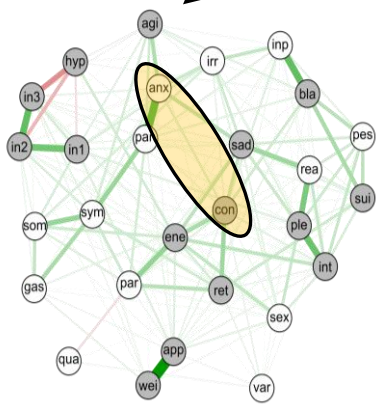
No

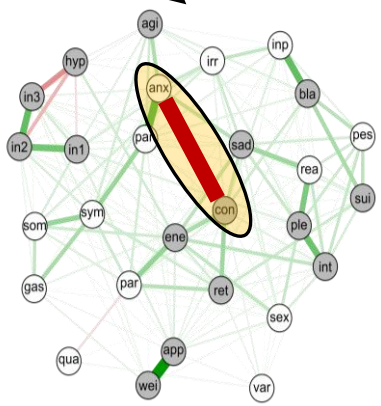
Hallucinations

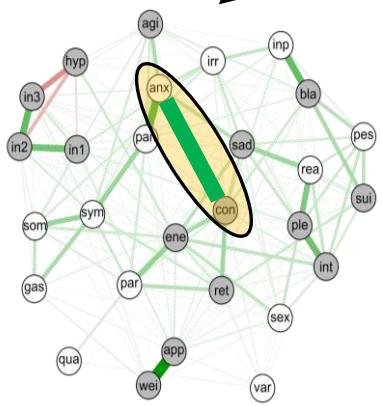
Yes

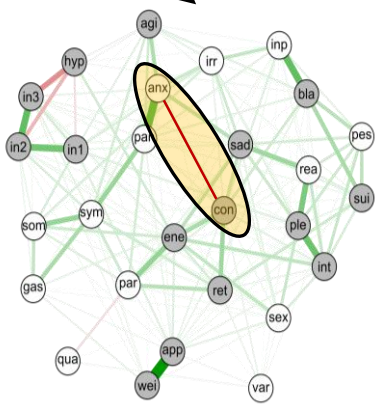
Sleep loss

Paranoia





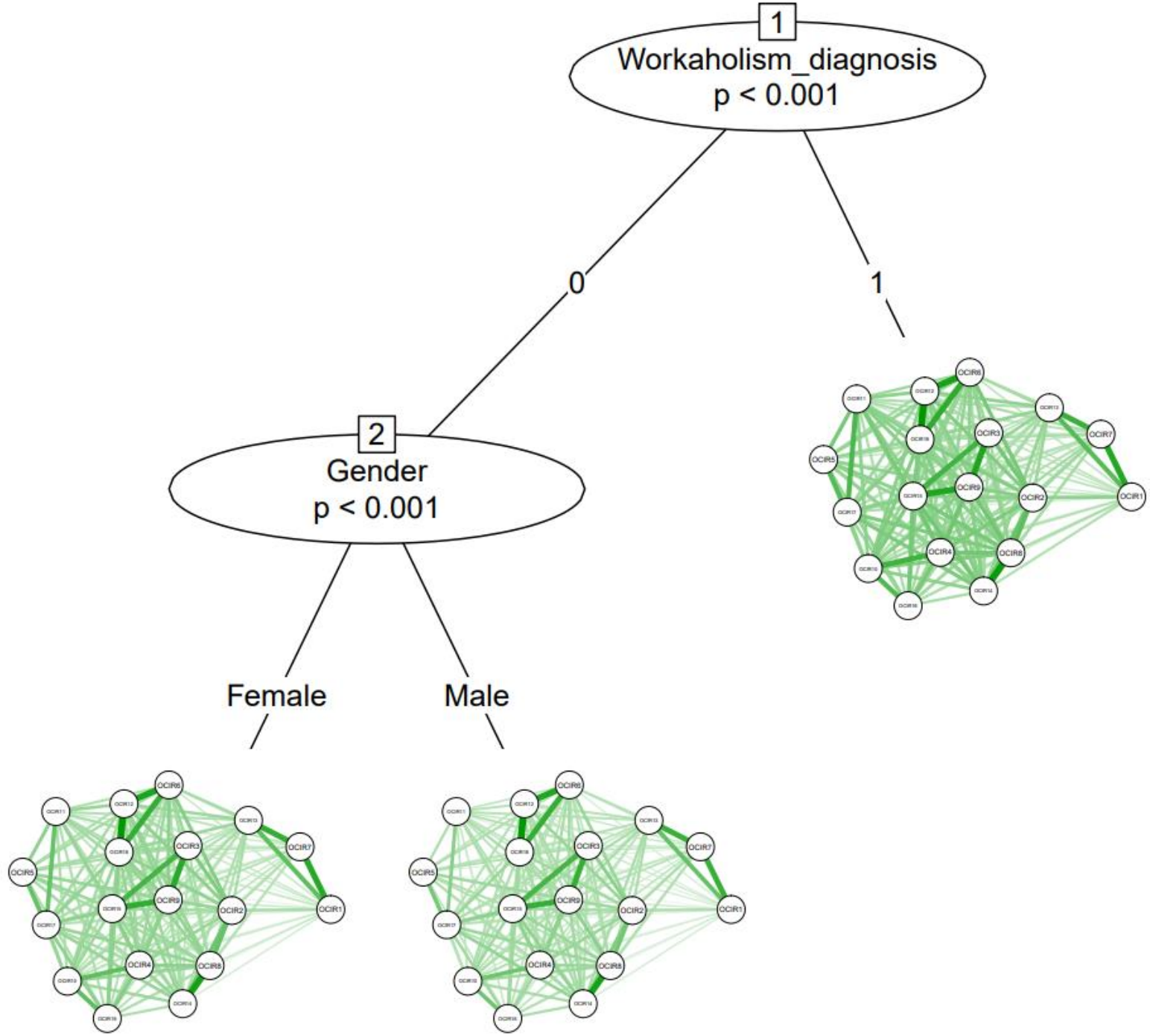


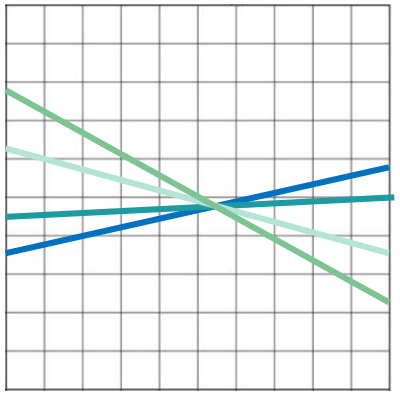


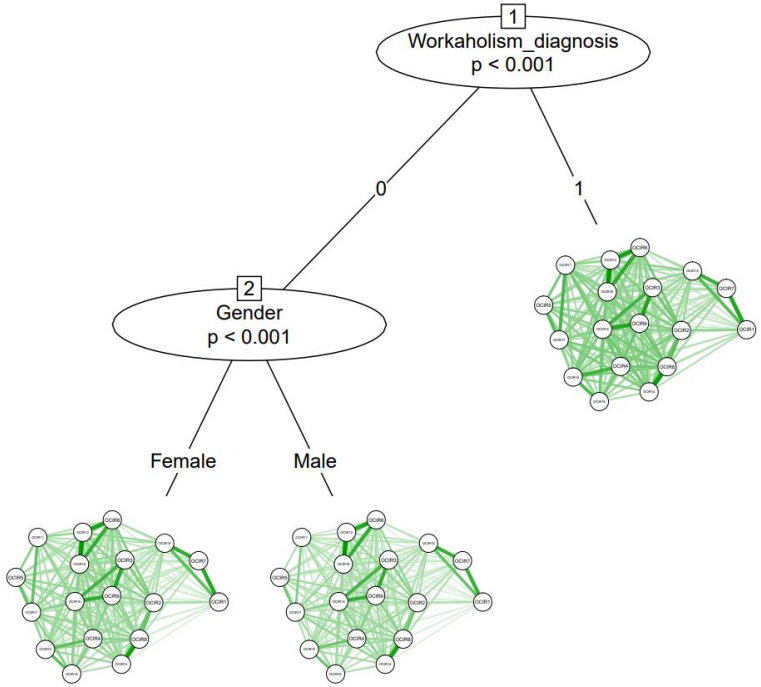
```
> install.packages(“networktree”)
> library(networktree)
```

```
> data(“workaholic”)
> nodevars <- paste("OCIR",1:18,sep="")
> splitvars <- c("Workaholism_diagnosis","Gender")
```

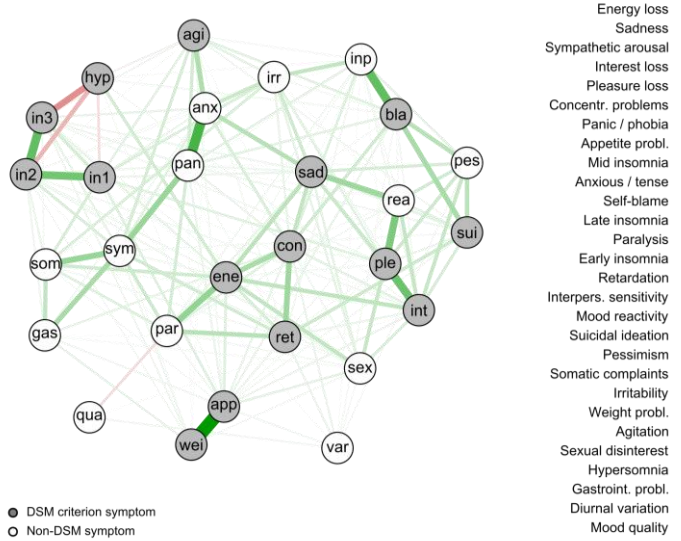
```
> myTree<- networktree(nodevars=workaholic[,nodevars]
                       splitvars=workaholic[,splitvars])
> plot(myTree)
```


1
Workaholism_diagnosis
p < 0.001
0
1
2
Gender
p < 0.001
Female
Male

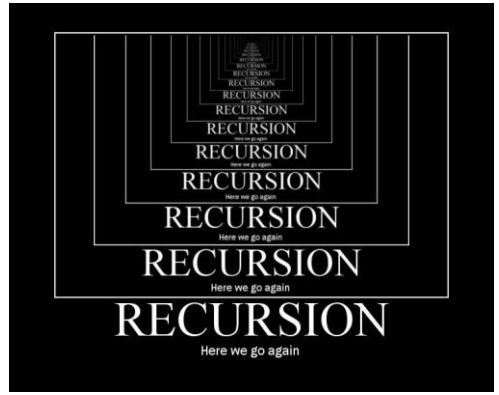




Model Based Recursive Partitioning



$$\frac{dy}{dx} \qquad f'(x)$$



THANK YOU!

Co-Authors:

Patrick Mair

Achim Zeileis

Thorsten Simon

Learn more about the method:

networktree R package

paytonjjones.wordpress.com/networktree