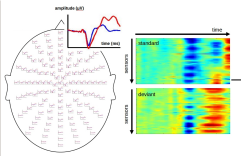
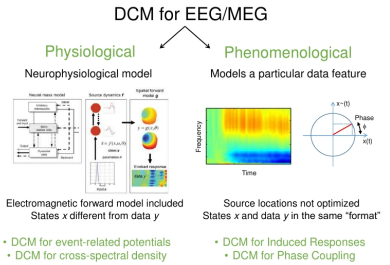
DCM for EEG:

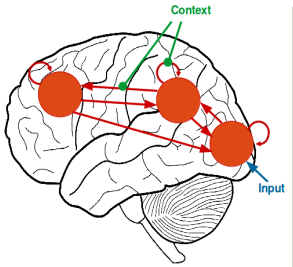
The Practical Approach

What is the effect I want to explain?



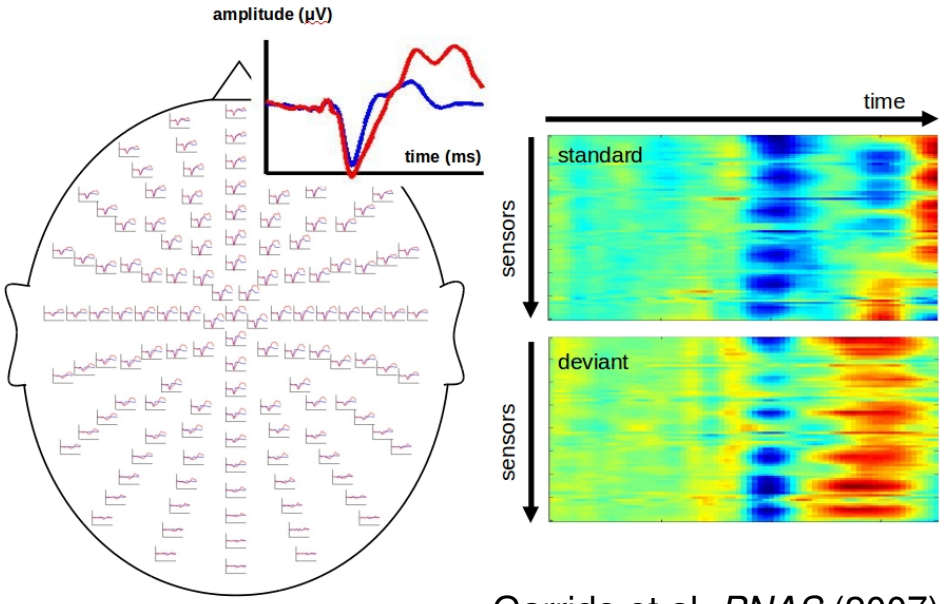
What is the data feature I want to model?



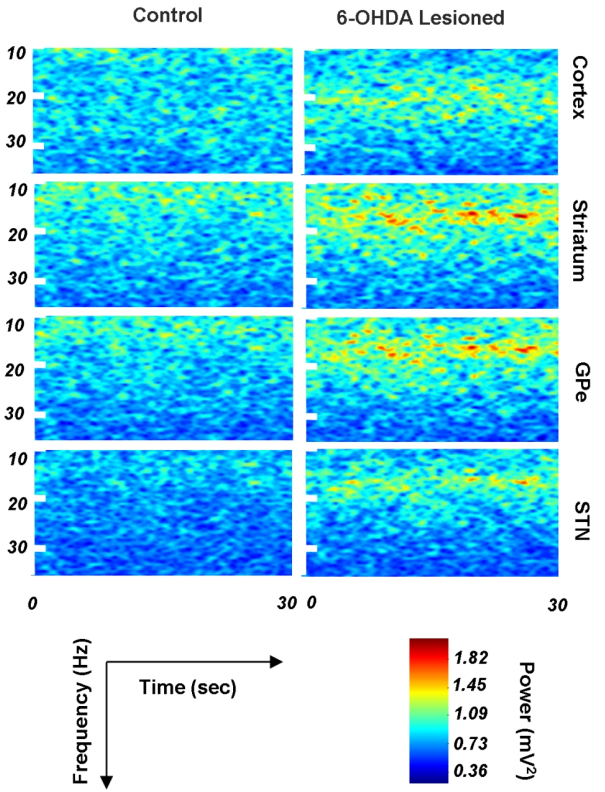


What questions can be answered with DCM?

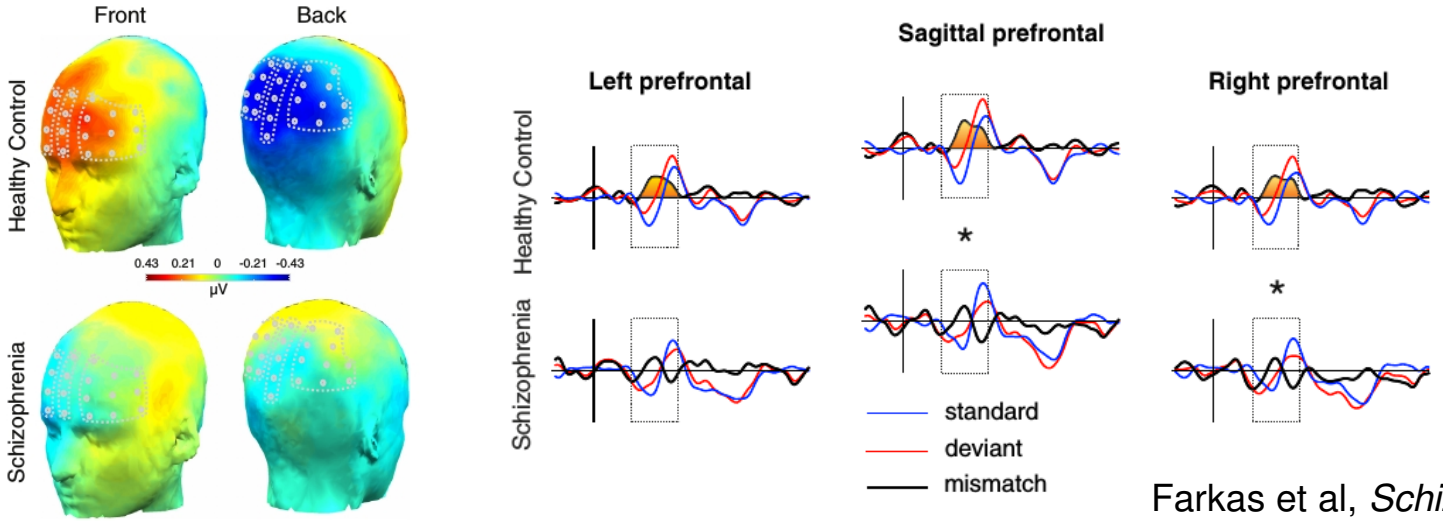
What is the effect I want to explain?



Garrido et al, *PNAS* (2007).

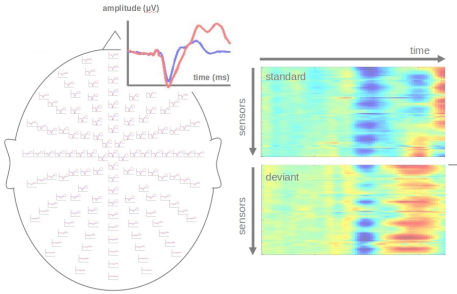


Moran et al, *PLOS Comput Biol* (2011).

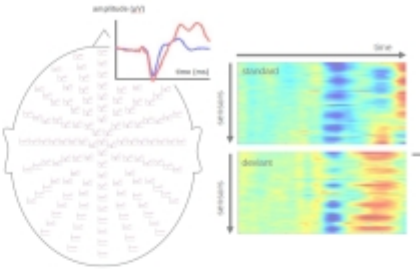


Farkas et al, *Schiz. Res.* (2007).

What is the effect that I classically find?



What is the effect that I classically find?

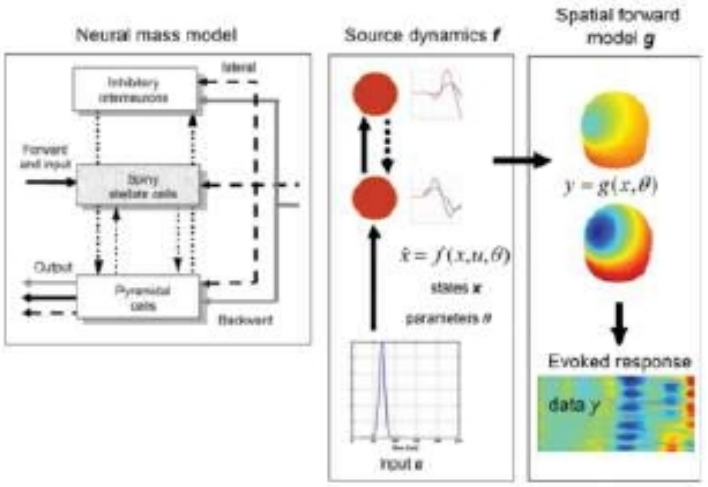


What is the data feature that I want to model?

DCM for EEG/MEG

Physiological

Neurophysiological model

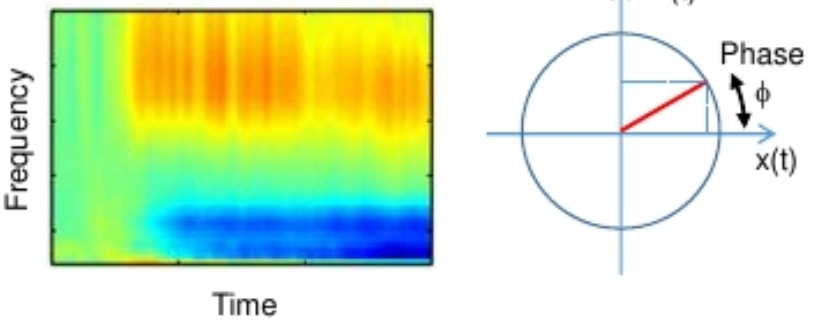


Electromagnetic forward model included
States *x* different from data *y*

- DCM for event-related potentials
- DCM for cross-spectral density

Phenomenological

Models a particular data feature

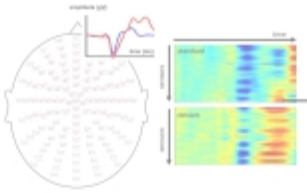


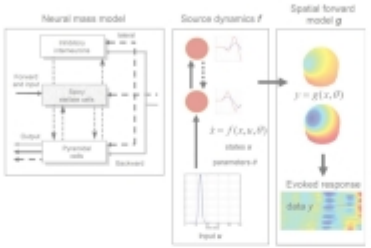
Source locations not optimized
States *x* and data *y* in the same "format"

- DCM for Induced Responses
- DCM for Phase Coupling

Slide by R. Auksztulewicz, *SPM course slides* (2015).

What is the effect that I classically find?

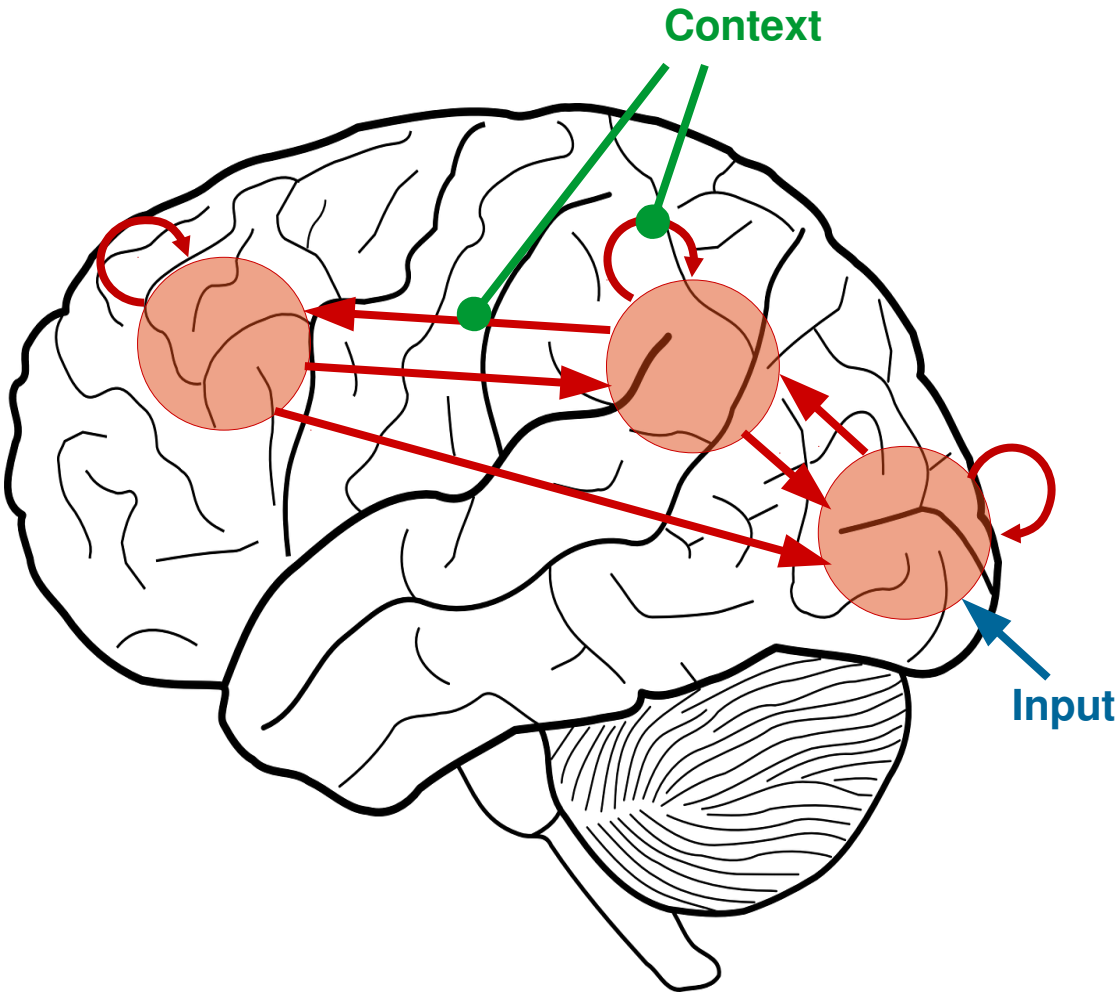




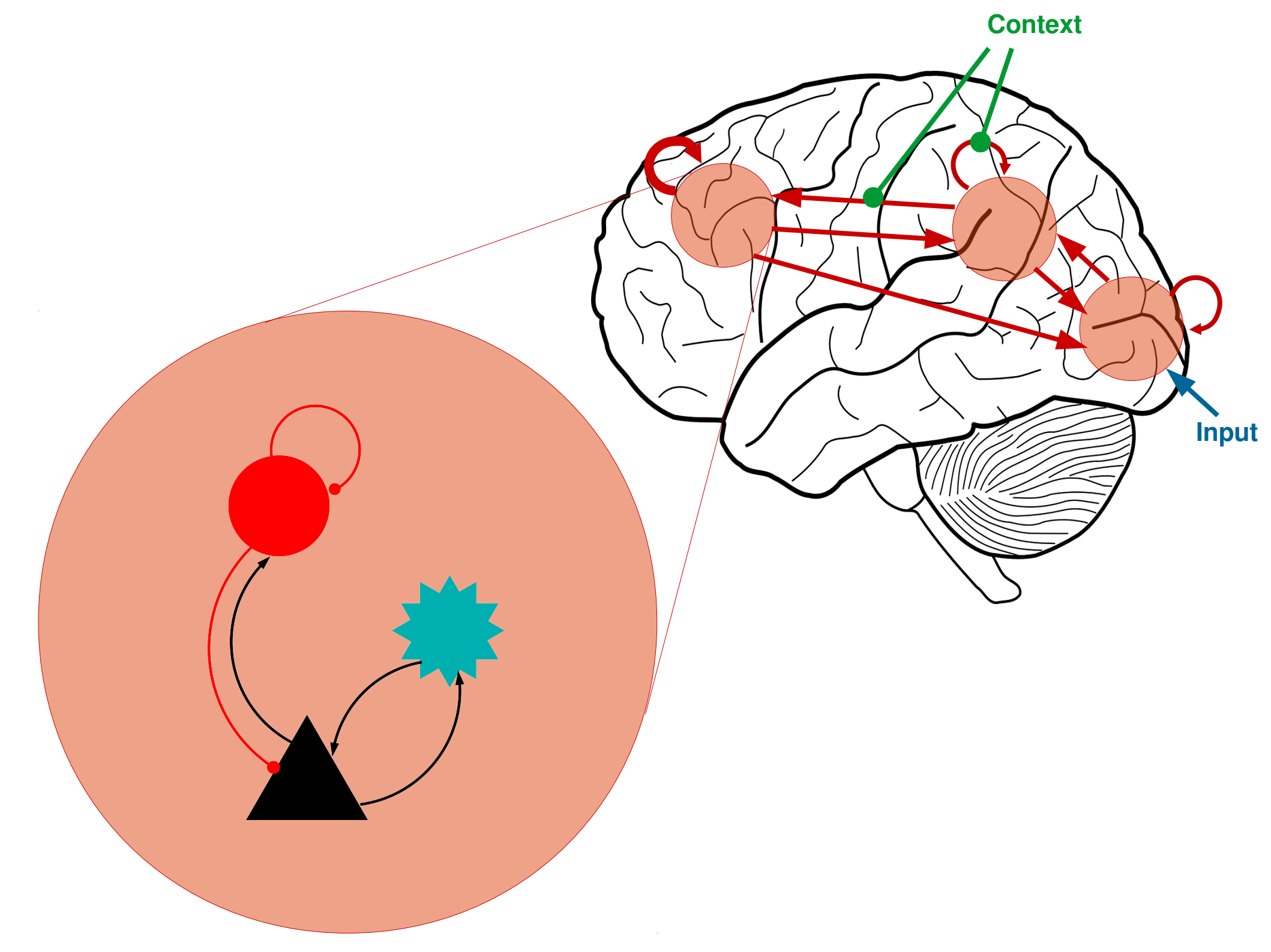
What is the data feature that I want to model?

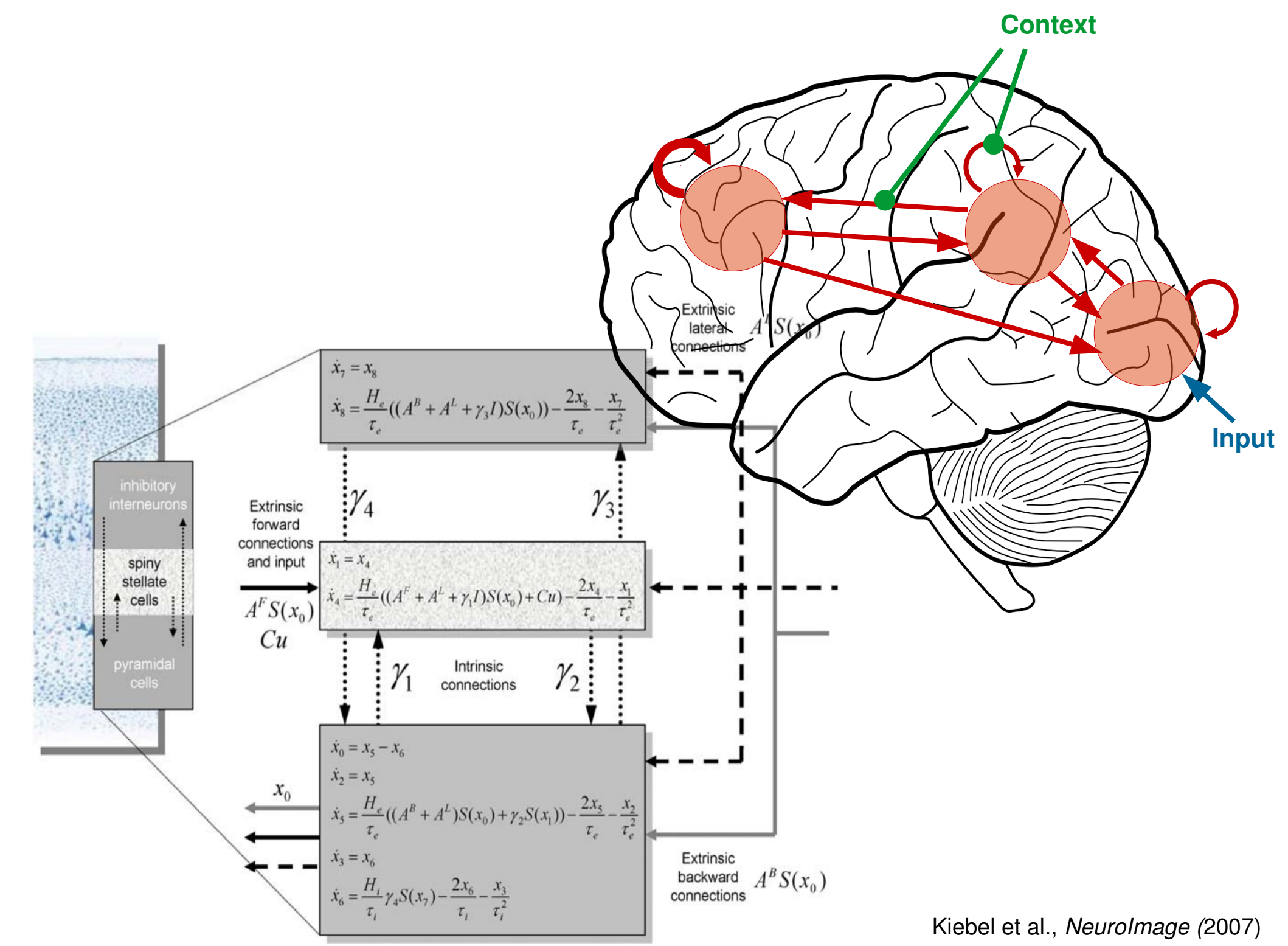
What questions can be answered with DCM?

- Does network XYZ explain my data better than network XY?
- Which XYZ connectivity structure best explains my data?
- Are X & Y linked in a bottom-up, top-down or recurrent fashion?
- Is my effect driven by extrinsic or intrinsic connections?
- Which connections determine observed frequency coupling?
- ...
- How would changing a parameter influence the data?

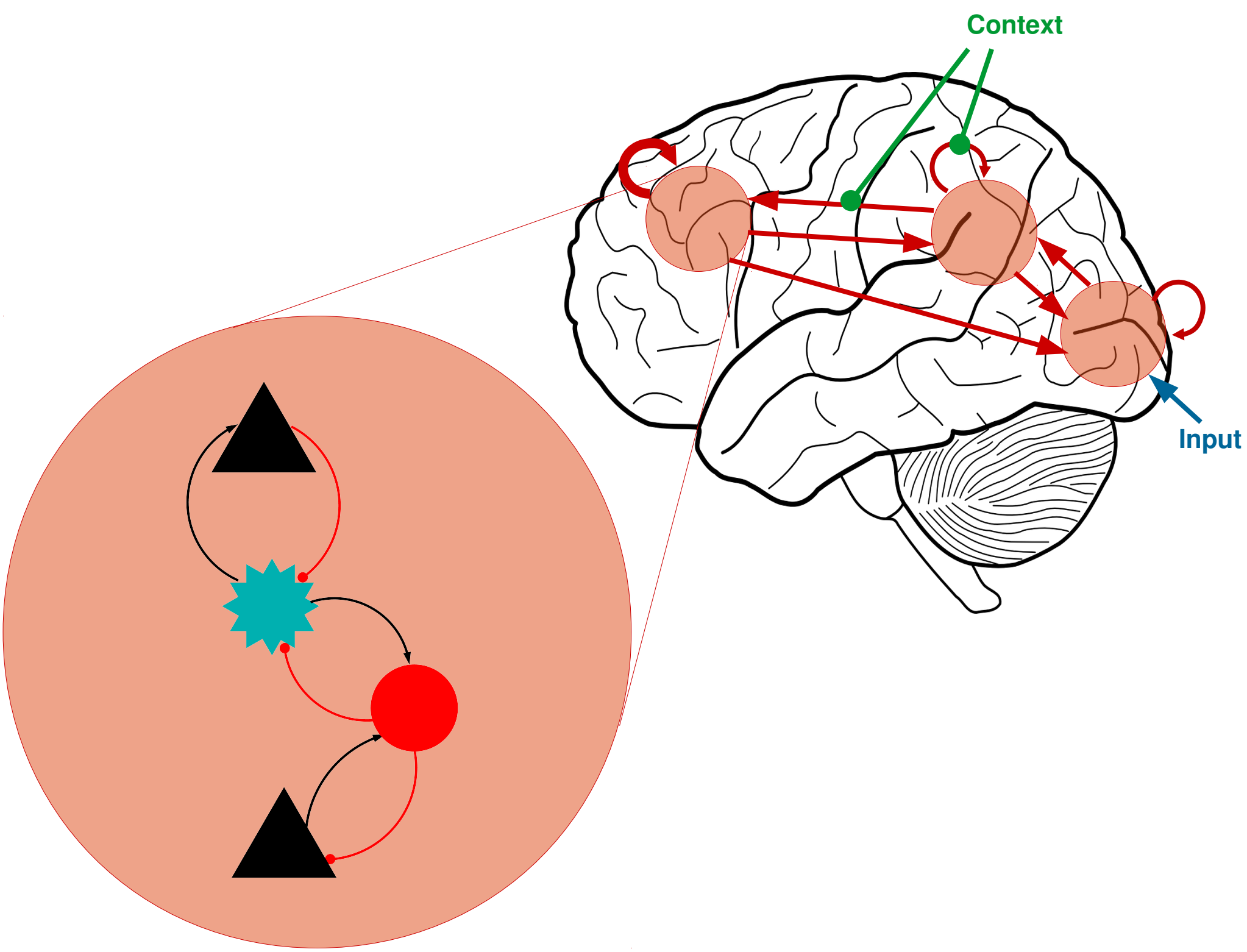


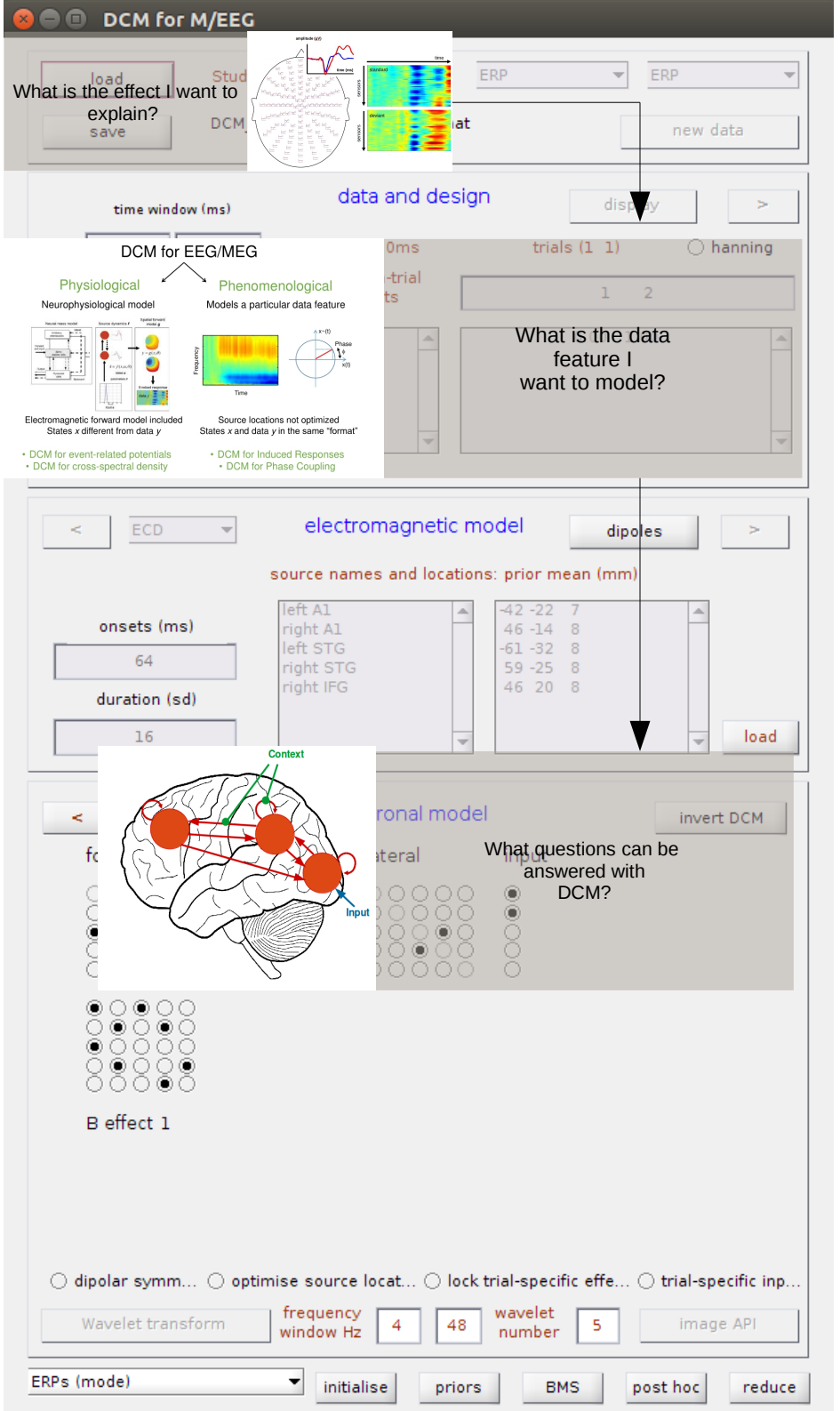
Inspired by R. Auksztulewicz, *SPM course slides* (2015).

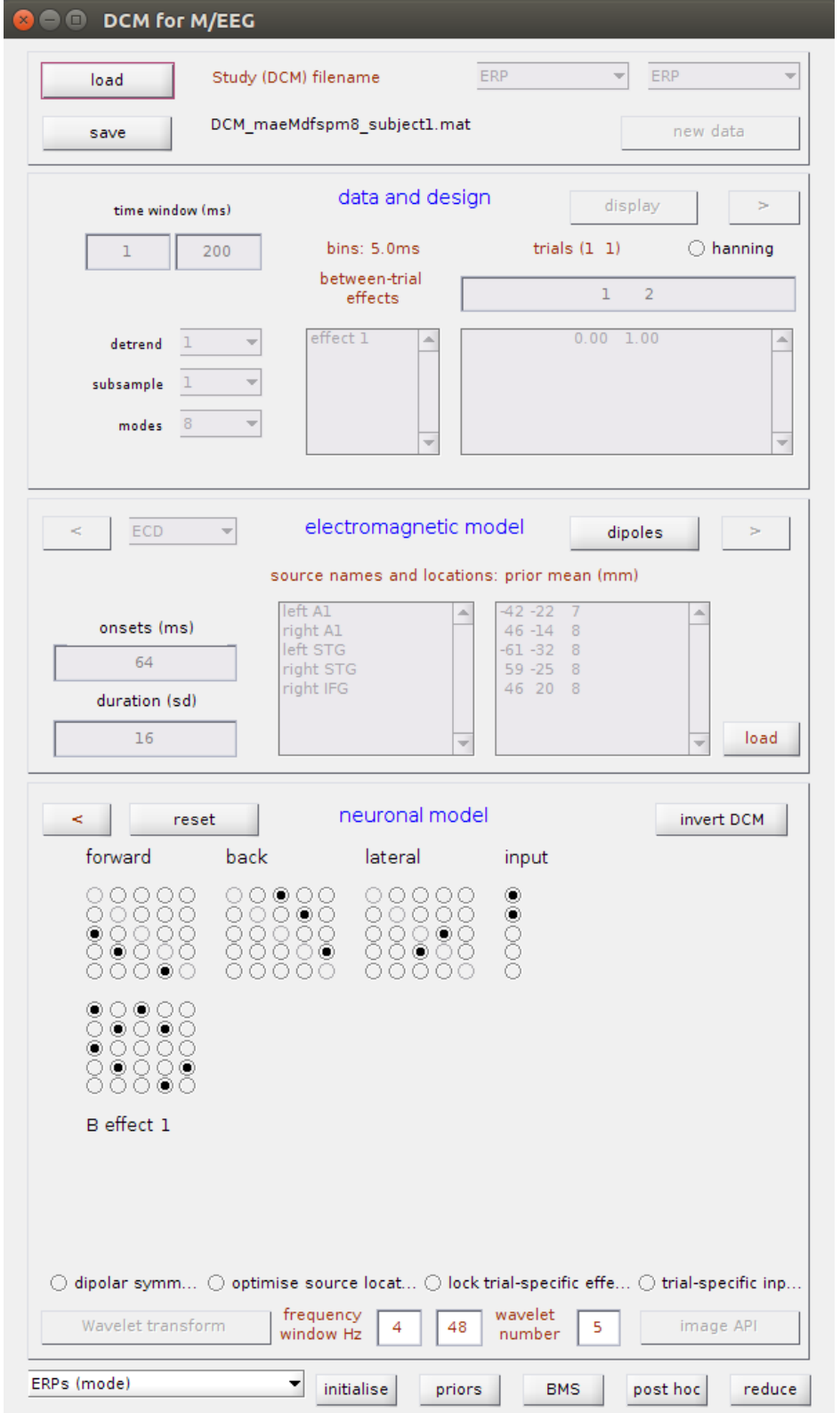

Context
Input



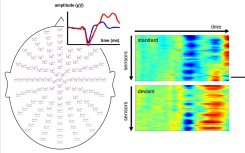
Kiebel et al., *NeuroImage* (2007)


Context
Input


DCM for M/EEG
What is the effect I want to explain?
ERP
ERP
new data
data and design
time window (ms)
DCM for EEG/MEG
Physiological
Phenomenological
Neurophysiological model
Models a particular data feature
Electromagnetic forward model included
States x different from data y
Source locations not optimized
States x and data y in the same "format"
• DCM for event-related potentials
• DCM for cross-spectral density
• DCM for Induced Responses
• DCM for Phase Coupling
trials (1 1)
hanning
What is the data feature I want to model?
electromagnetic model
dipoles
ECD
source names and locations: prior mean (mm)
left A1
right A1
left STG
right STG
right IFG
-42 -22 7
46 -14 8
-61 -32 8
59 -25 8
46 20 8
onsets (ms)
64
duration (sd)
16
load
Context
Input
invert DCM
What questions can be answered with DCM?
B effect 1
dipolar symm...
optimise source locat...
lock trial-specific effe...
trial-specific inp...
Wavelet transform
frequency window Hz
4
48
wavelet number
5
image API
ERPs (mode)
initialise
priors
BMS
post hoc
reduce



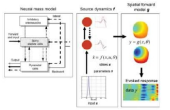
What is the effect I want to explain?



DCM for EEG/MEG

Physiological

Neurophysiological model

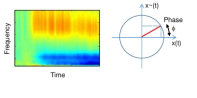


Electromagnetic forward model included
States x different from data y

- DCM for event-related potentials
- DCM for cross-spectral density

Phenomenological

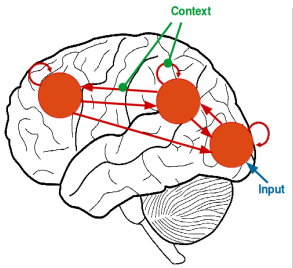
Models a particular data feature



Source locations not optimized
States x and data y in the same "format"

- DCM for Induced Responses
- DCM for Phase Coupling

What is the data feature I want to model?



What questions can be answered with DCM?