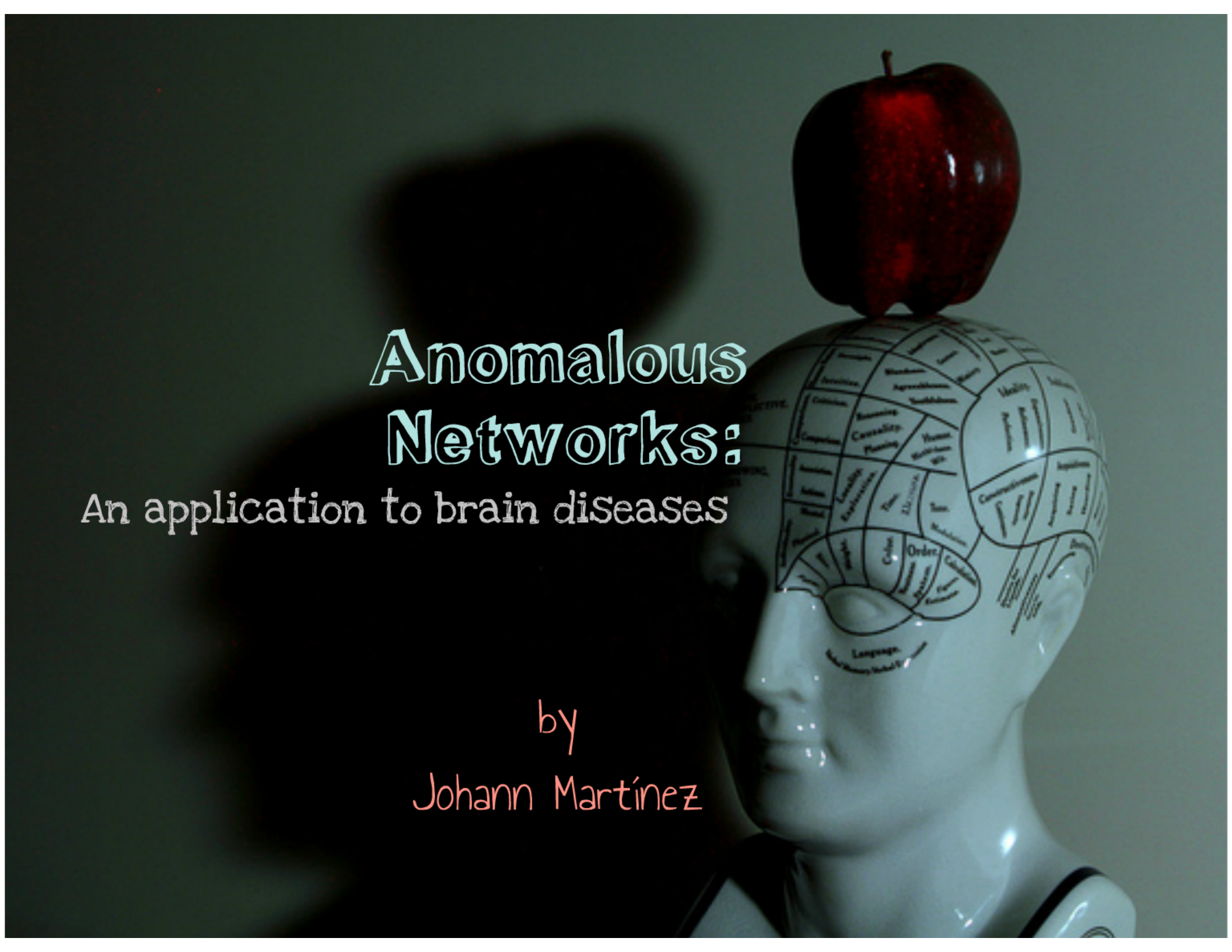


Anomalous Networks:

An application to brain diseases

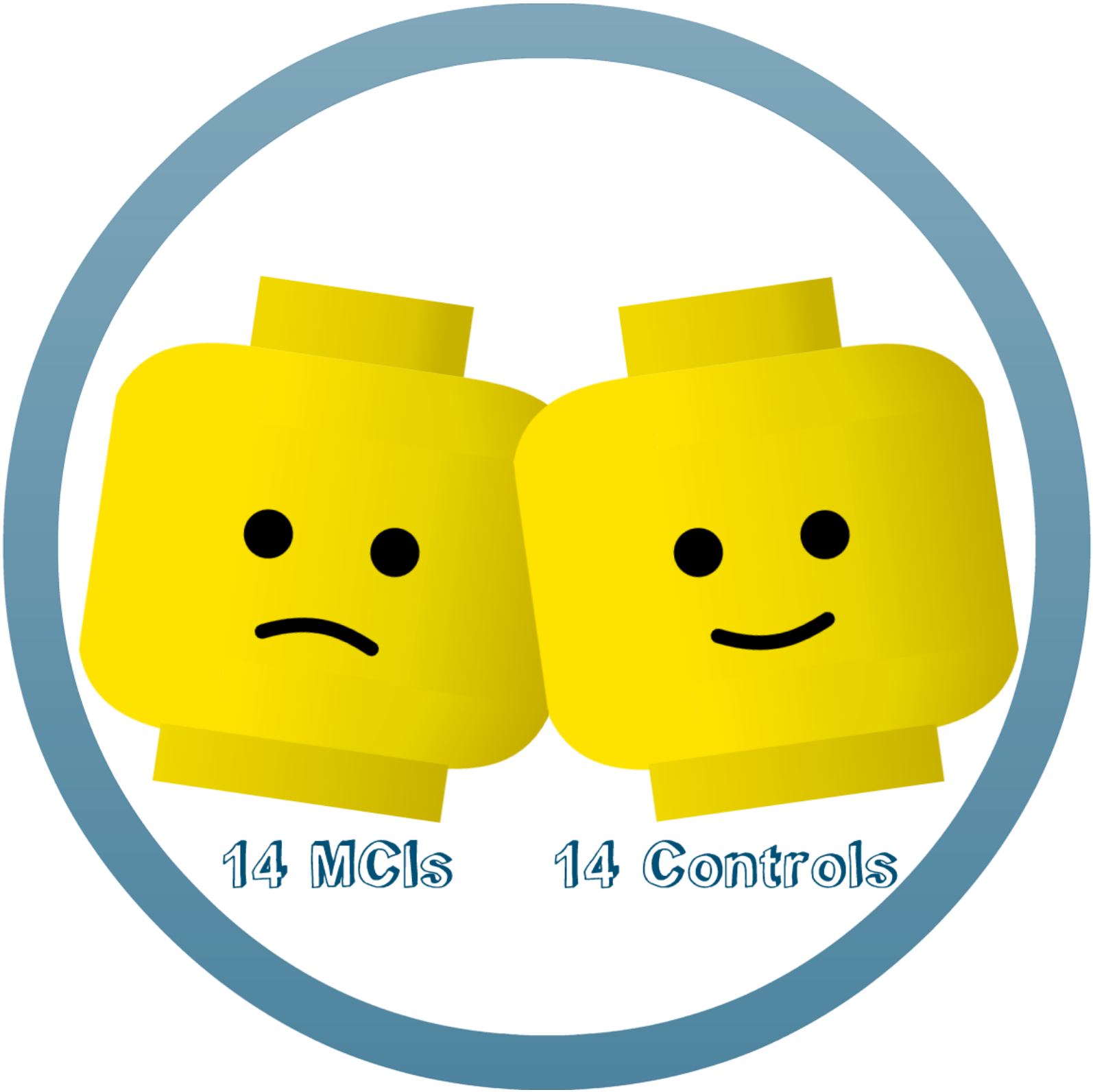
by

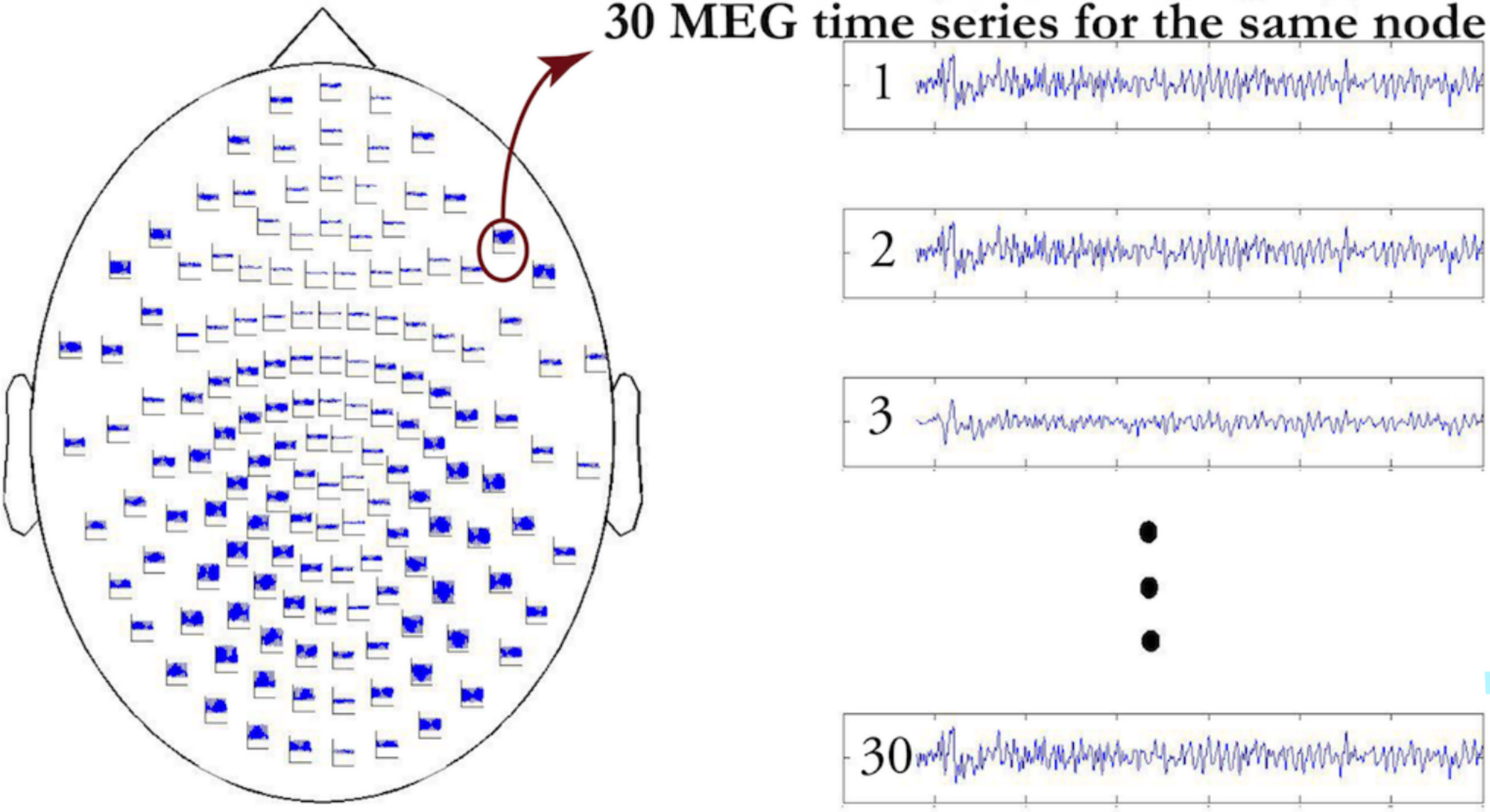
Johann Martínez

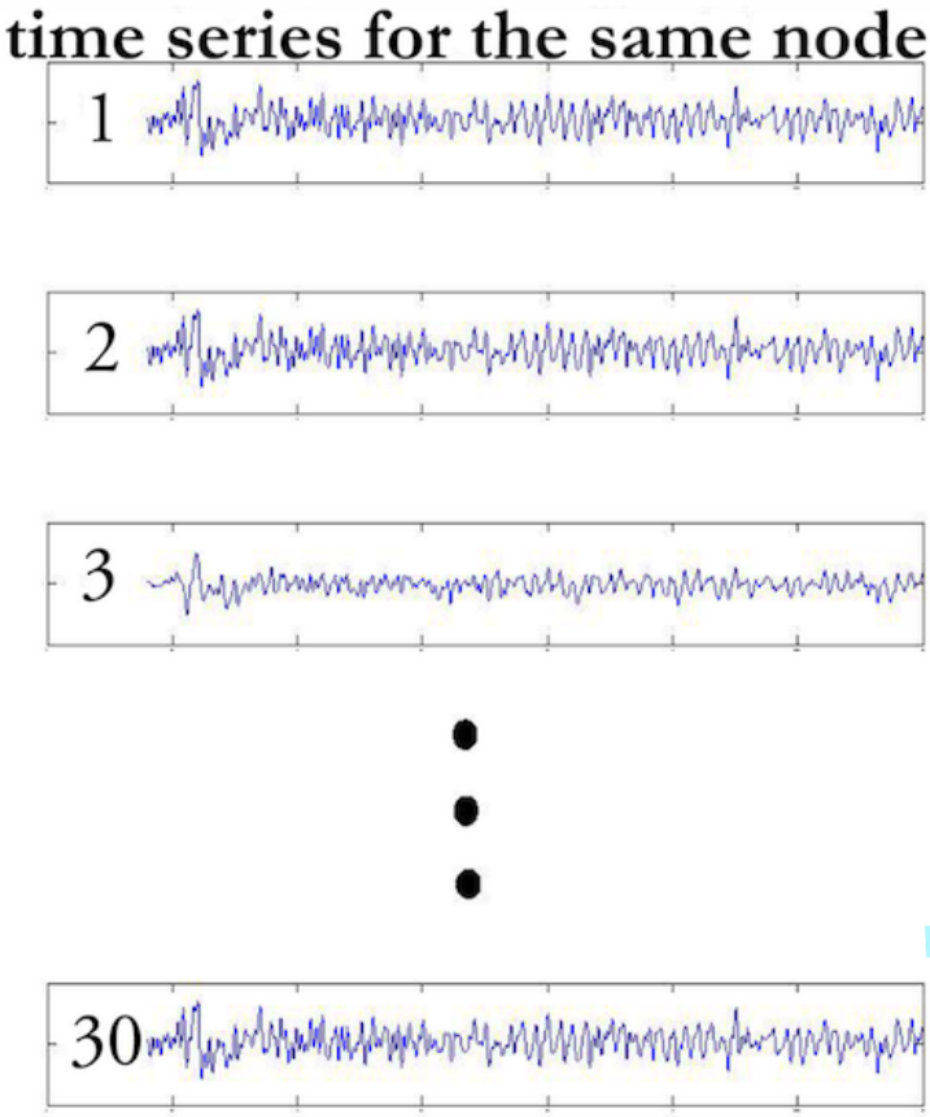

Our problem !
Mild Cognitive Impairment
• It is a precursor of Alzheimer
• Developed by elder people
• Memory impairment

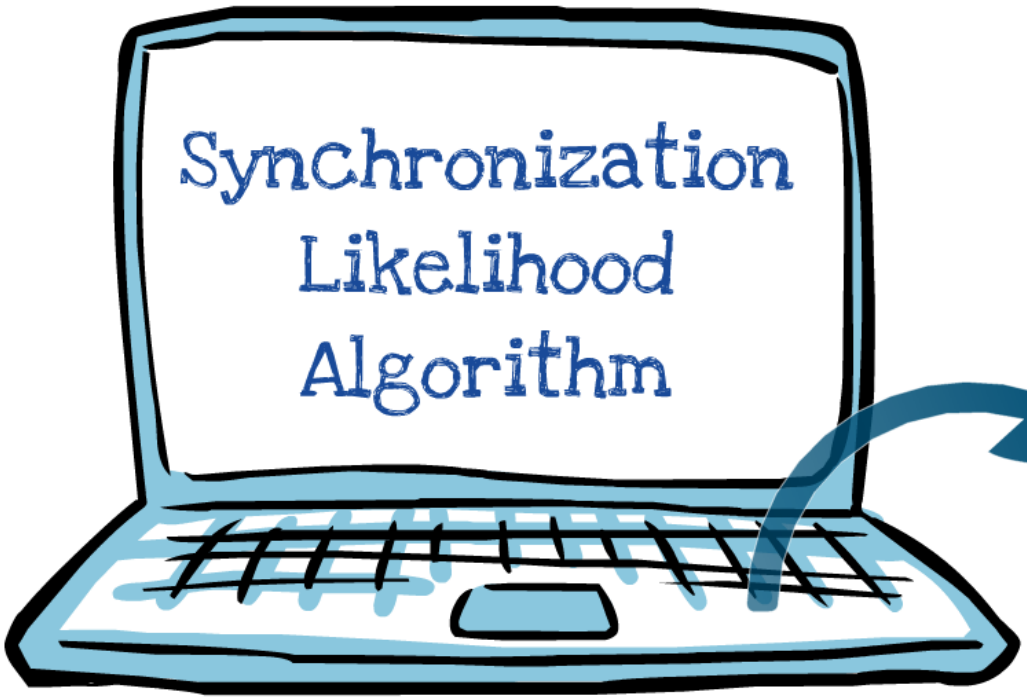

WANTED
Are there differences
between healthy
individuals and MCI
patients
related to their
functional networks?

History matters!

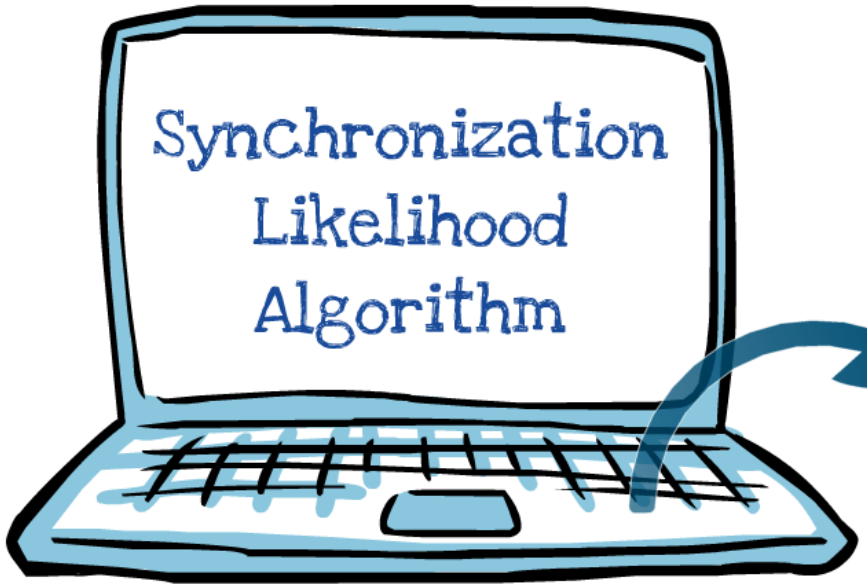

14 MCIs
14 Controls


30 MEG time series for the same node
1
2
3
30


time series for the same node
1
2
3
30

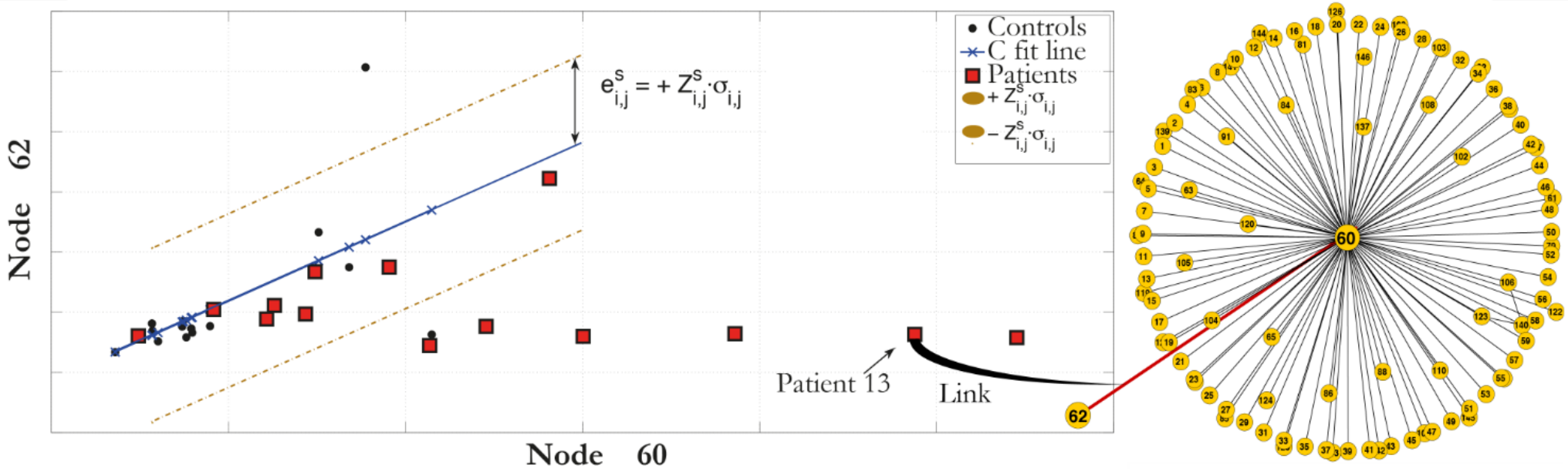

Synchronization
Likelihood
Algorithm

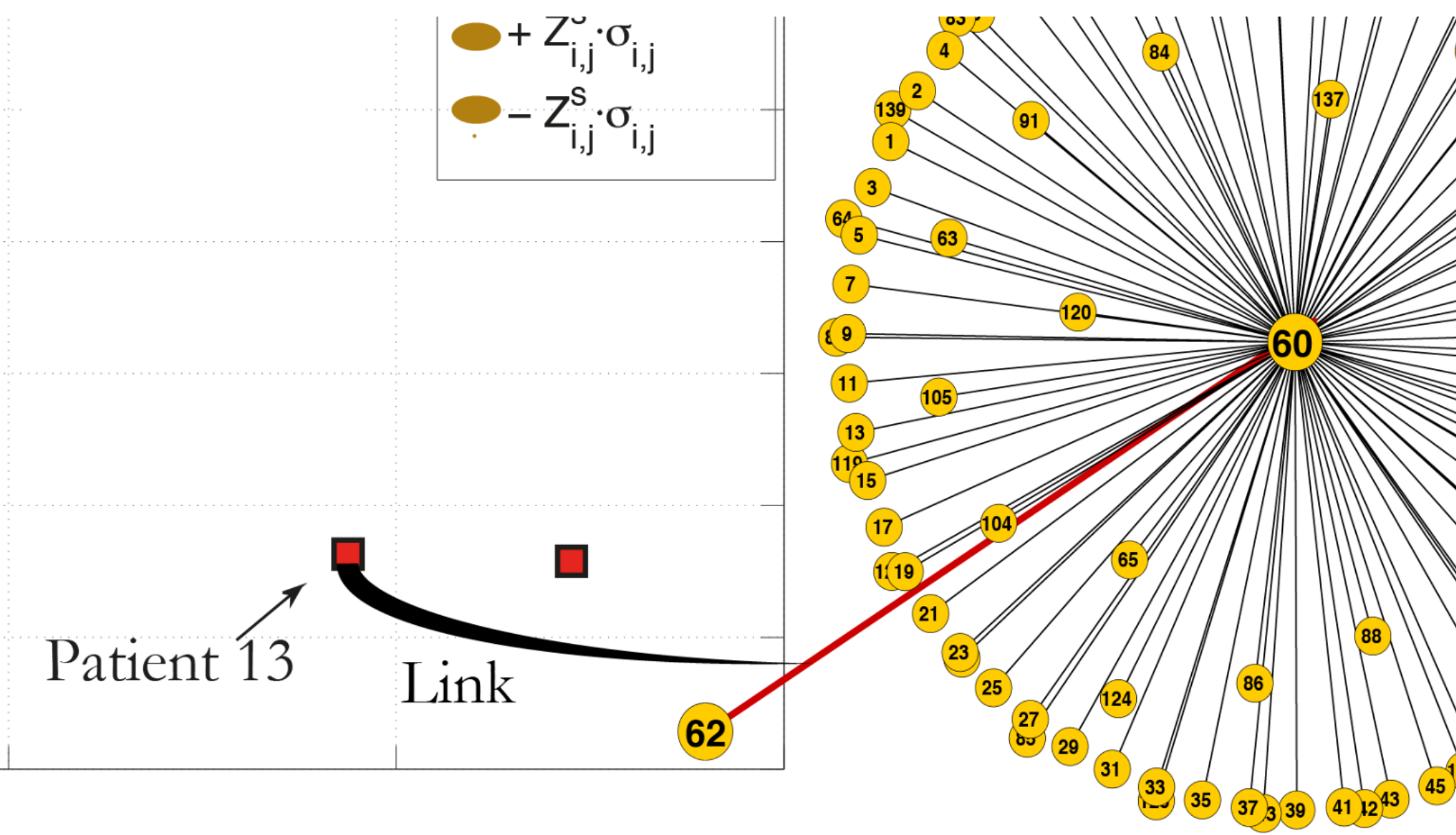
Consistency.



It is the ability of a node to perform a functional task in the same way when the same external stimulus is applied.

Now What?


Node 62
Node 60
Controls
C fit line
Patients
+ $Z^s_{i,j}\cdot\sigma_{i,j}$
– $Z^s_{i,j}\cdot\sigma_{i,j}$
$e^s_{i,j} = + Z^s_{i,j}\cdot\sigma_{i,j}$
Patient 13
Link
60
62


+ $Z^s_{i,j} \cdot \sigma_{i,j}$
– $Z^s_{i,j} \cdot \sigma_{i,j}$
Patient 13
Link
62
60
4
84
2
139
91
137
1
3
64
5
63
7
120
9
11
105
13
15
17
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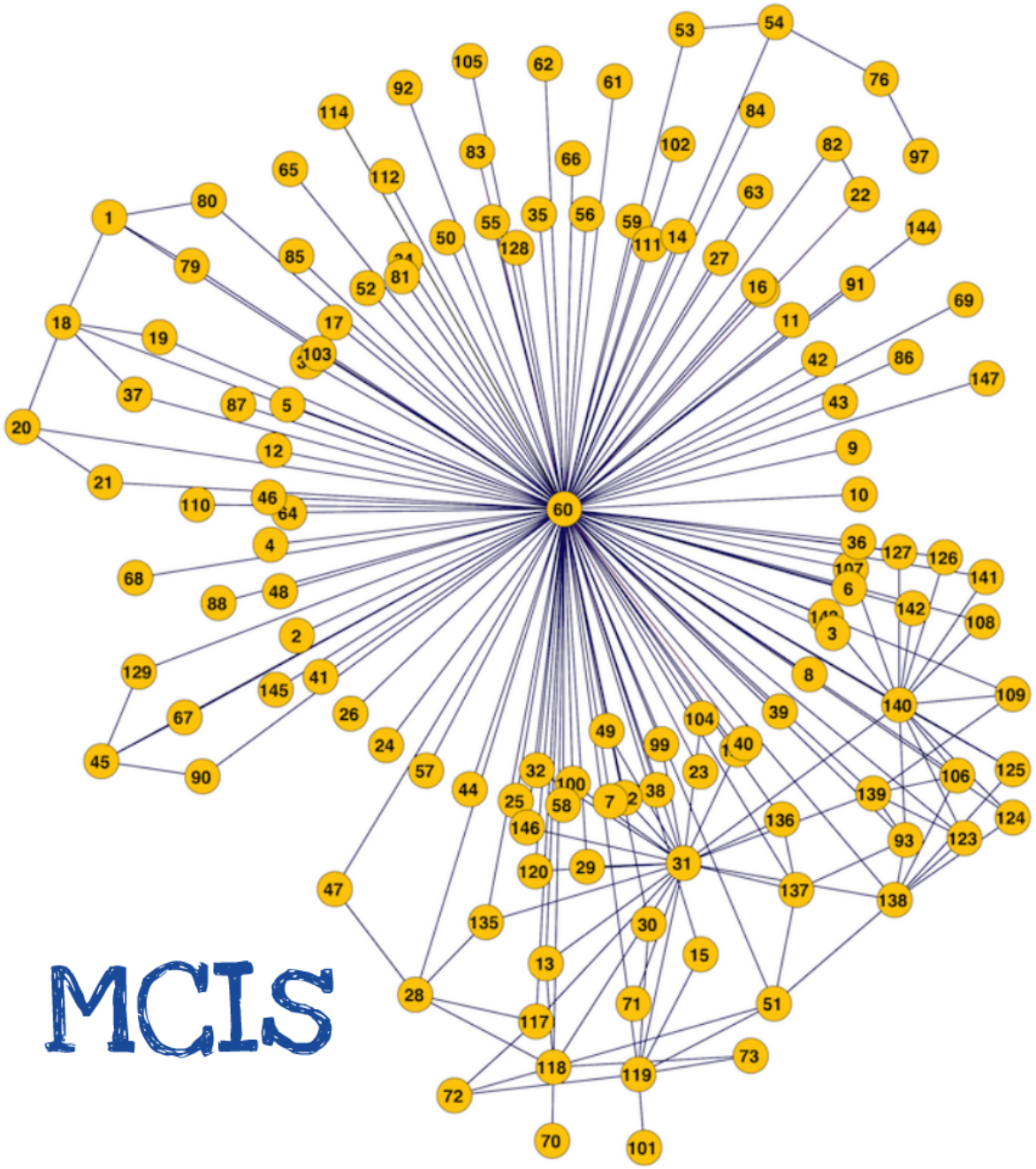
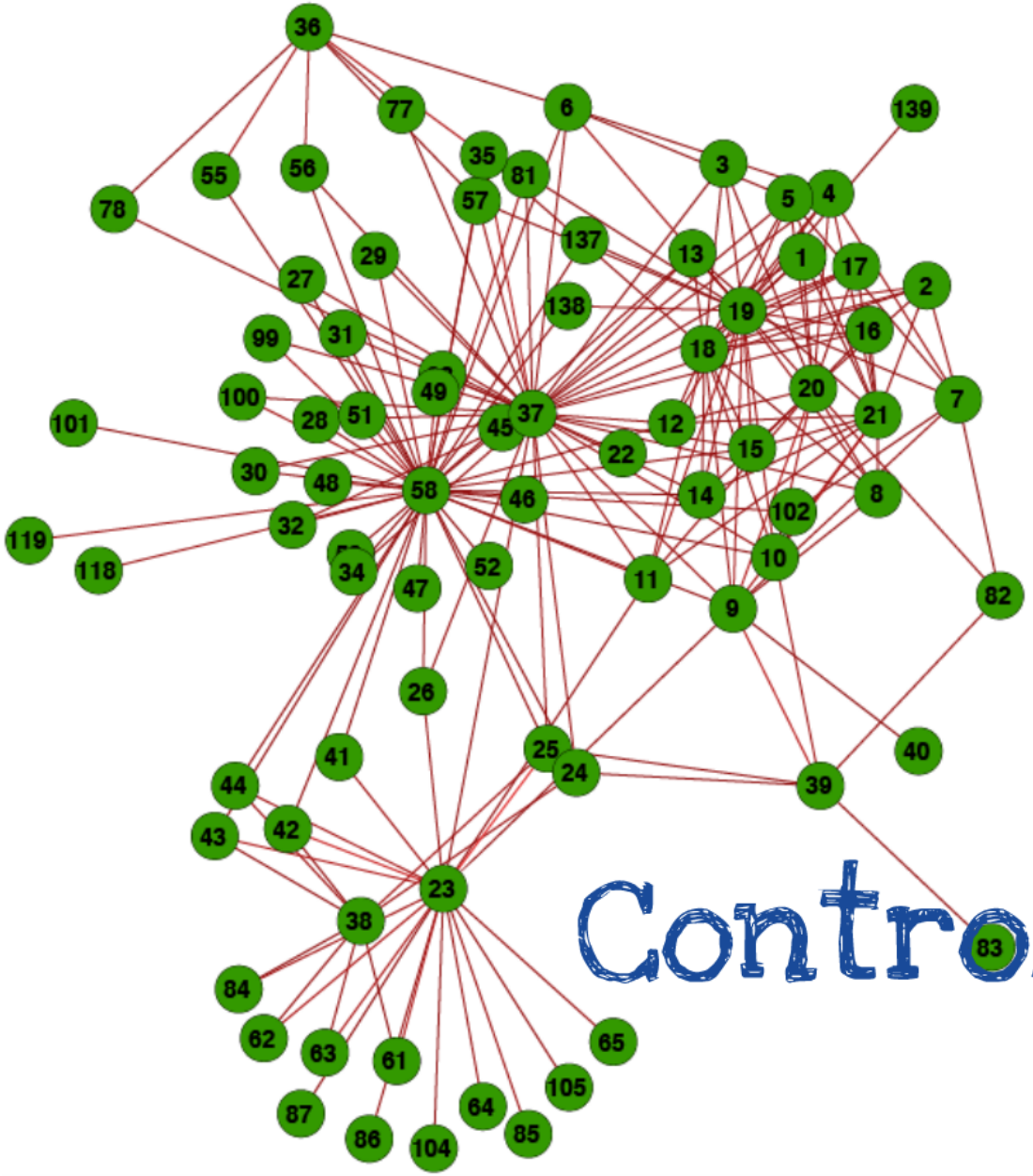
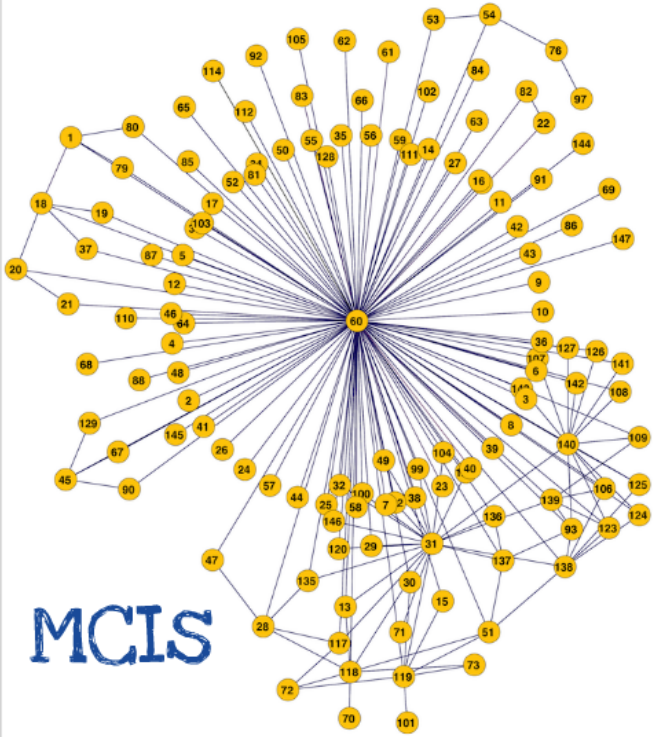
29
31
33
35
37
39
41
43
45


MCIS
Star-like

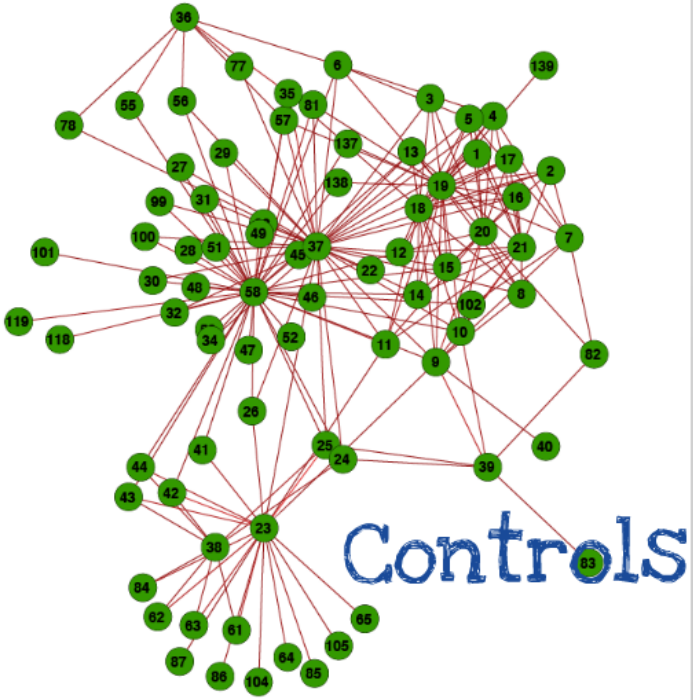


Controls

Random-like



Star-like

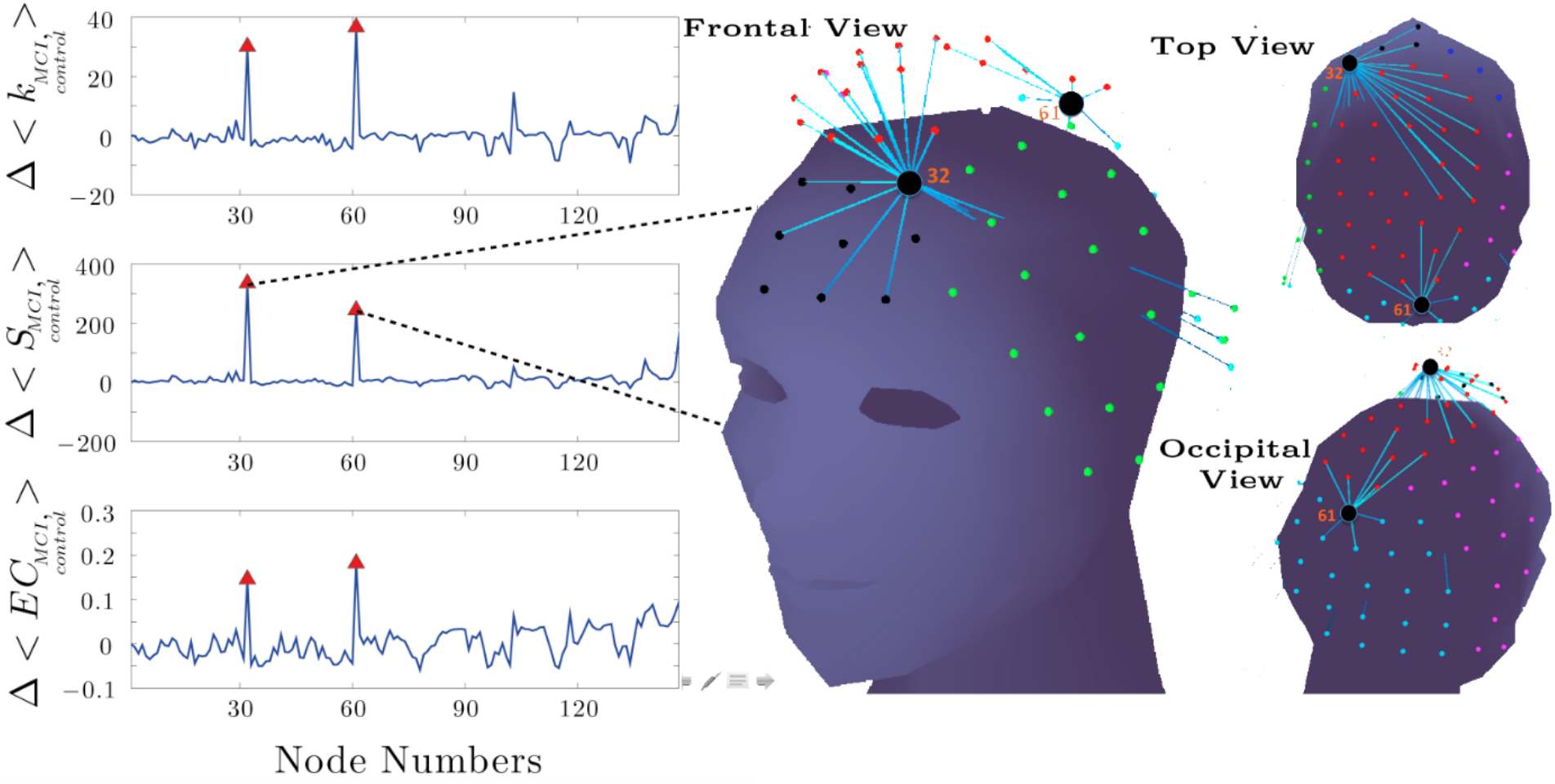


Random-like

Anomalous Networks

A subtype of functional networks whose links represent failures (deviations from the expected behaviour) among nodes

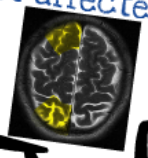

What is it all about?



Node 32 and 61 are the most influential

Drawing Conclusions

1. Star-like for MCIs
   Random for Controls
2. Frontal and Occipital Cortical regions contain the most affected nodes



3. Nodes 32 & 61
   Larger failures in their consistency in comparison with healthy individuals
4. Not only for neuroscience purposes, but for a wide range of natural systems

Universidad Rey Juan Carlos

Juan Manuel Pastor

Massimiliano Zanin

Fernando Maestú

Ricardo Bajo

Javier M. Buldú

Thanks !