

Context

General objective and approach

Objective : to validate the “Mental Information Theory”
Approach : identification of brain circuits involved in working memory from real EEG data recorded with a high spatial resolution

Mental Information Theory

71 Mental information is robust and durable → **must be redundant**

72 Neocortex → **Very recurrent (loopy) graph**

73 The neocortex behaves like a distributed decoder!
→ « Neural Clique »



Brain activity measurement techniques

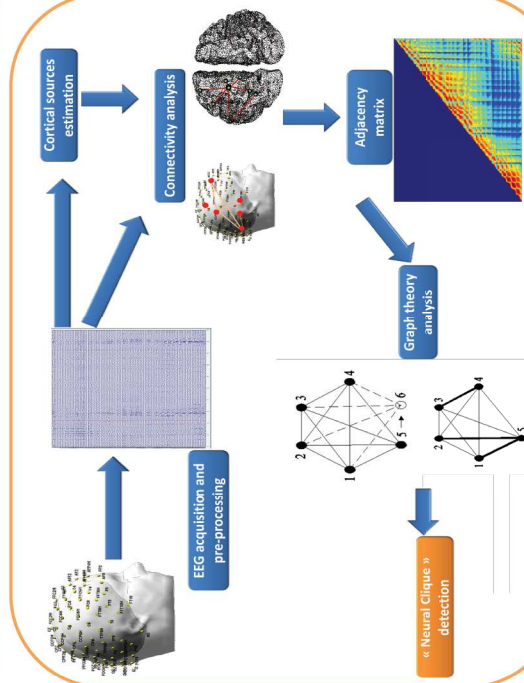


High Spatial Resolution
Low Temporal Resolution

High Spatial Resolution + High Temporal Resolution



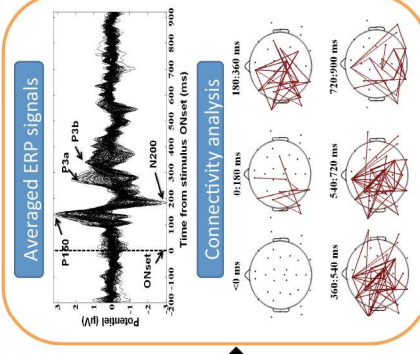
Strategy



First results

Hassan M., Dufor O., Mheich A., Berrou C., Wendling F.,
Graph-based analysis of brain connectivity during spelling task, International Conference on Advances in Biomedical Engineering 2013, (ICABME'13)

Onset: The stimulus Onset
P150 : Visual feature processing
N200 : access to the semantics of the picture
P3a and P3b : link between intentional system and the ongoing process
Connectivity analysis: using the Phase Locking Value



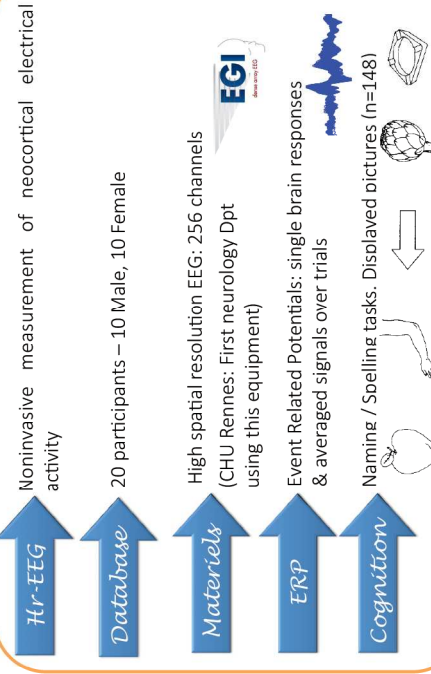
Graph measurements: Left Vs. Right
BC: Betweenness Centrality D: density
NE: Number of Edges LI: Lateralization Index

	0-180ms	180-360 ms	360-540 ms	540-720 ms	720-900 ms
Left					
BC	0,022	0,12	0,107	0,06	0,001
NE	8	16	18	18	5
D	0,0879	0,175	0,197	0,197	0,05
Right					
BC	0	0	0	0,037	0,0009
NE	0	0	1	3	2
D	0	0	0,011	0,033	0,022
LI	-100 (L)	-100 (L)	-100 (L)	-88,57	-33,3

To Do!

- 1 Focus on neocortex connectivity during memory task: from EEG signals to source activity (inverse problem) solutions + functional connectivity measures
- 2 Identification / characterization of “Neural Cliques” (Graph theory based analysis)
- 3 Analysis of identified cliques w.r.t. restored objects (reproducibility, distance vs. semantics) ↔↔ Mental Information Theory

Experimental Protocol



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