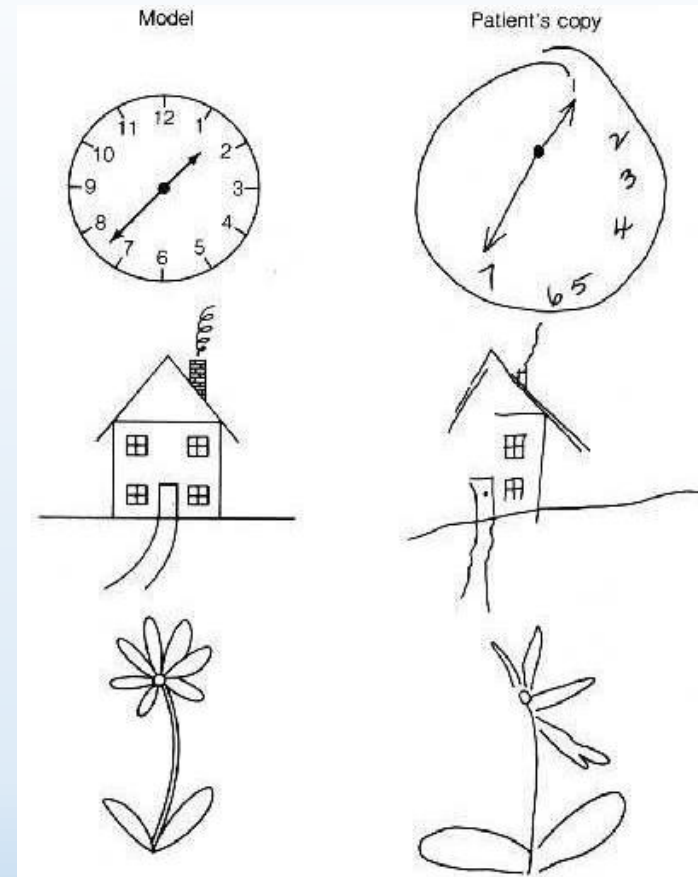


# Early target selection and evidence accumulation is impaired in the left hemifield after right hemisphere stroke

**Gerard Loughnane**

# Unilateral neglect

- **Unilateral neglect** – inability to detect and pay attention to stimuli on the side *contralateral* to cerebral damage (e.g. post-stroke).
- It is more severe following **right** hemisphere stroke, resulting in **left** inattention.



# Objective measure of Neglect?



Electroencephalography (EEG)

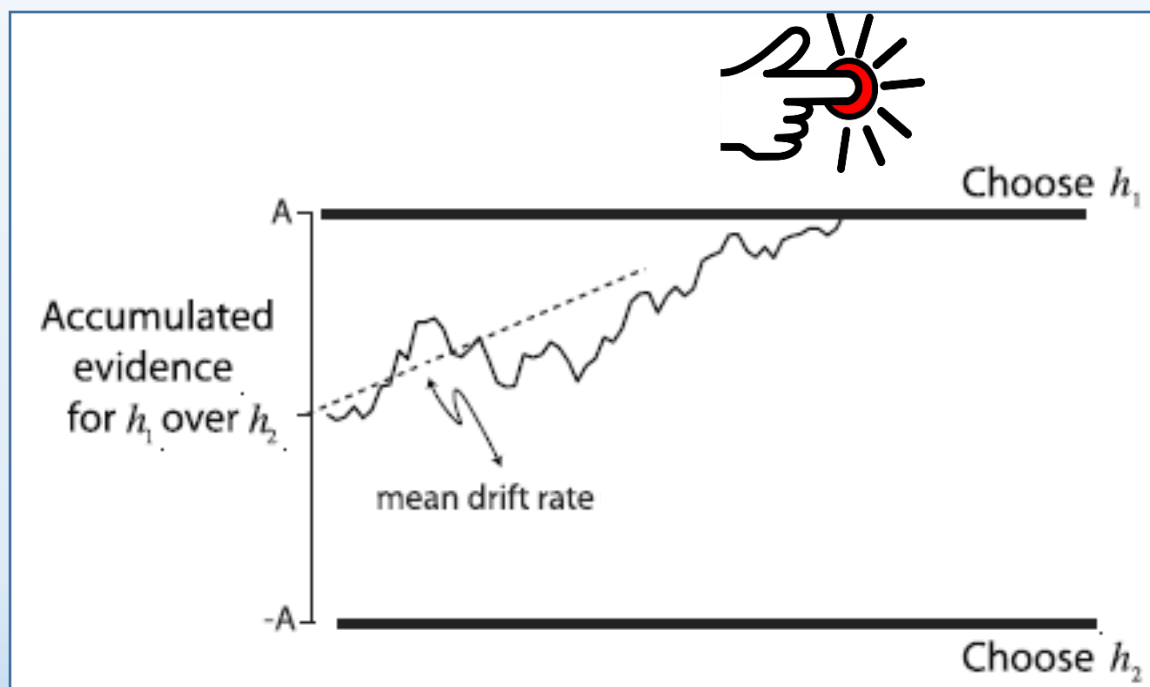
# Brief background on foundations of our study

# How do we make perceptual decisions?



# How do we make perceptual decisions?

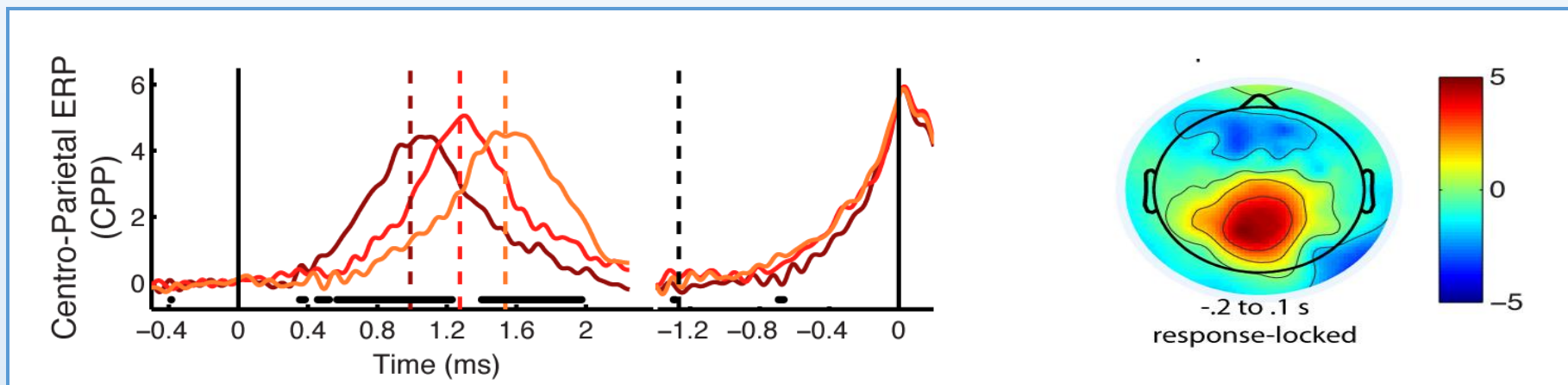
- Model: Accumulate evidence from sensory information -> build to a threshold -> respond!



Adapted from Shadlen & Kiani, 2013

# Centro-Parietal Positivity (CPP)

- ERP component over central scalp region tracks this evidence accumulation process.



O'Connell et al., 2012

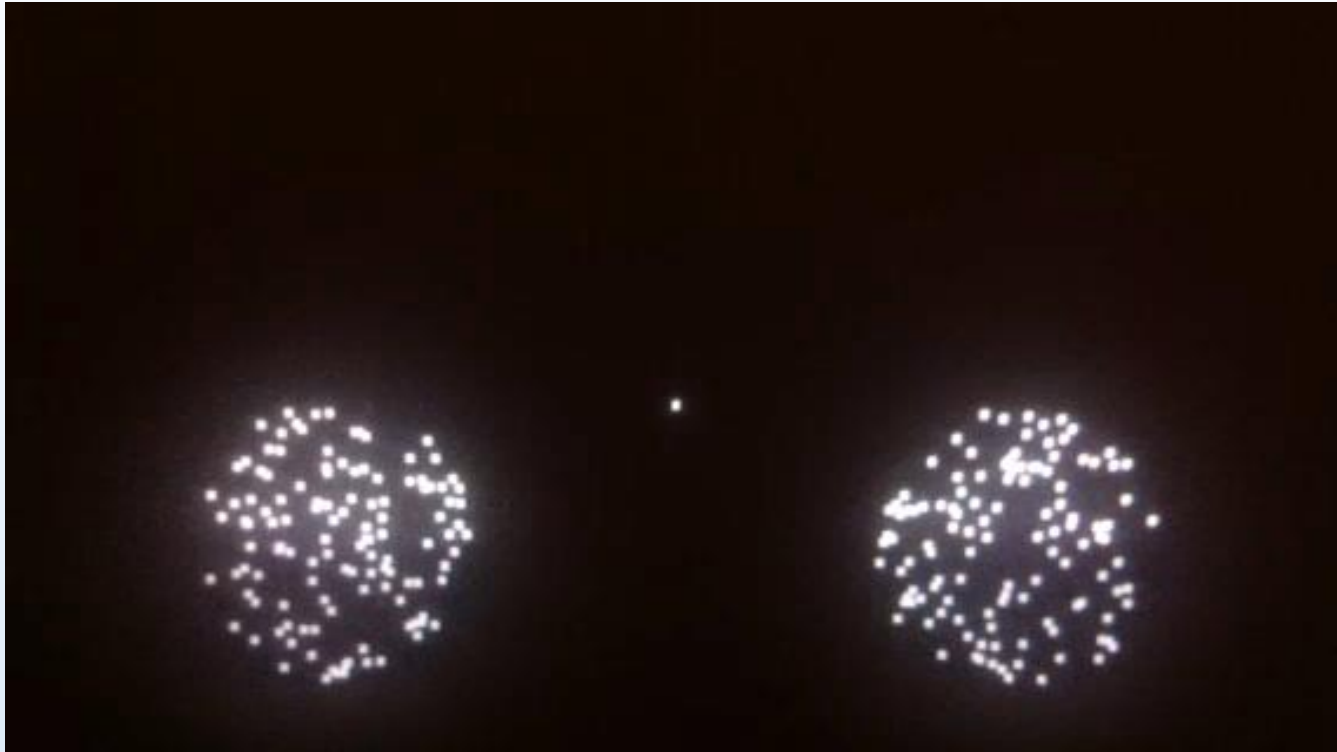


# How does visual attention affect decision making?

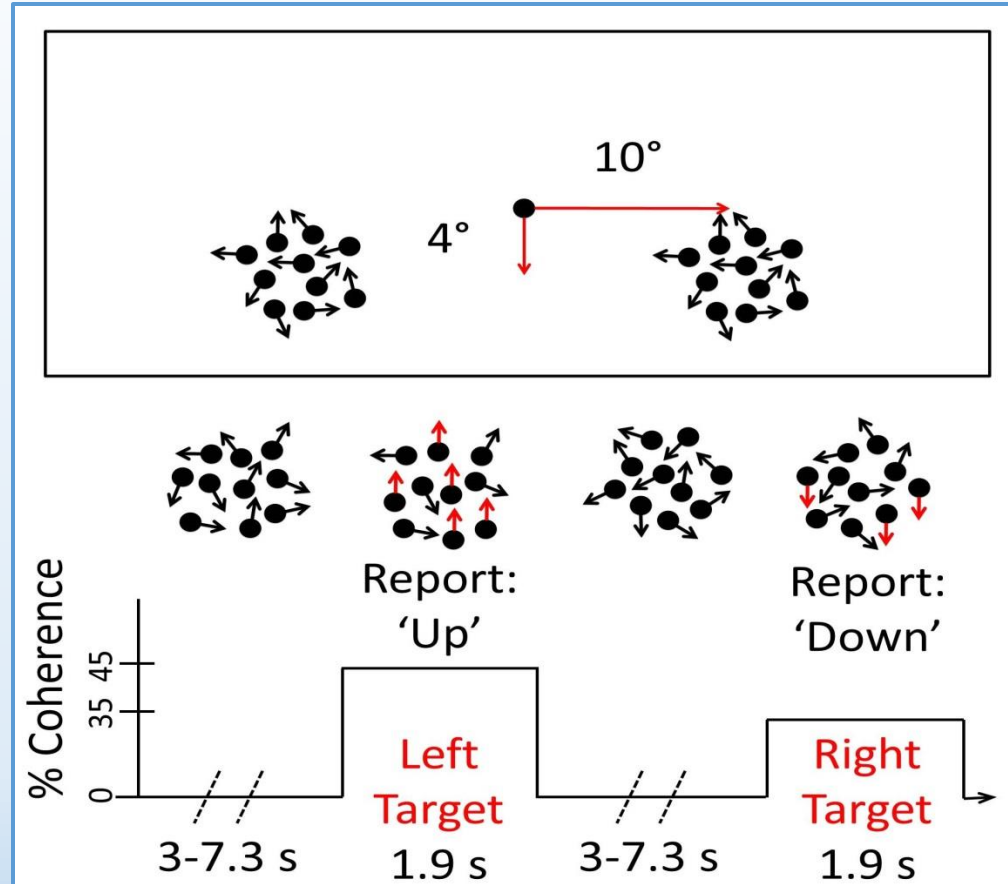




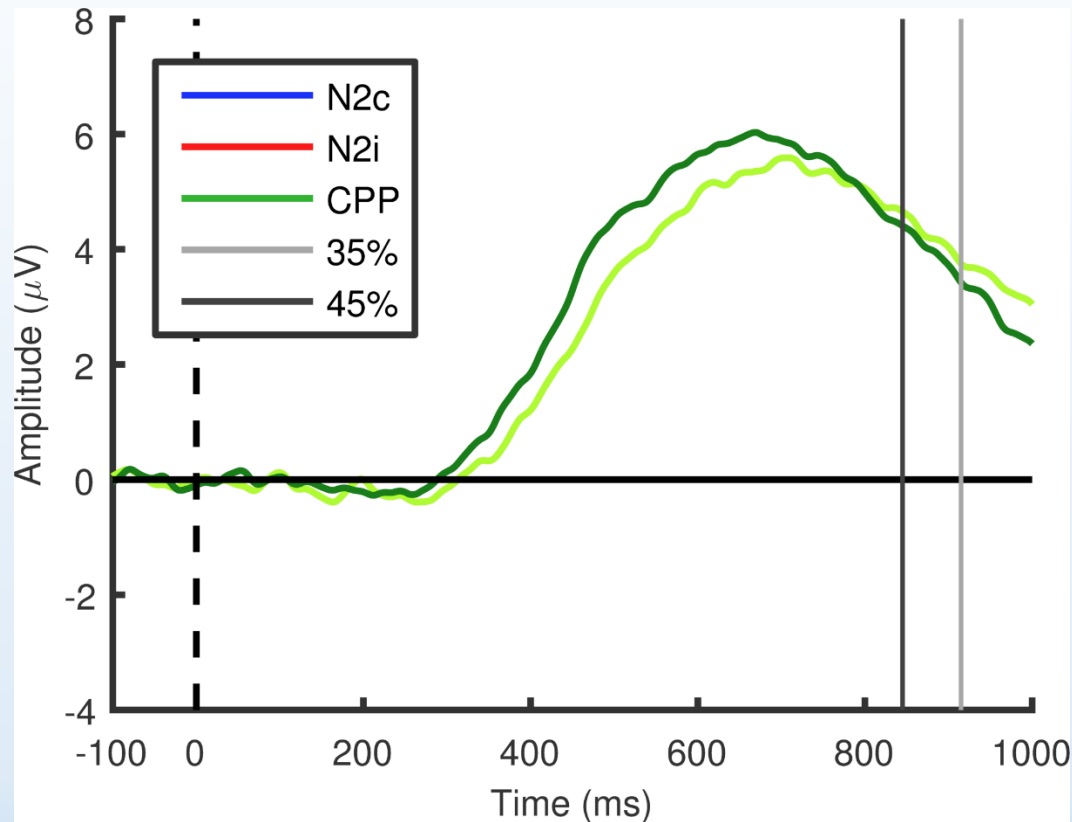
# Random dot motion task



# Random dot motion task

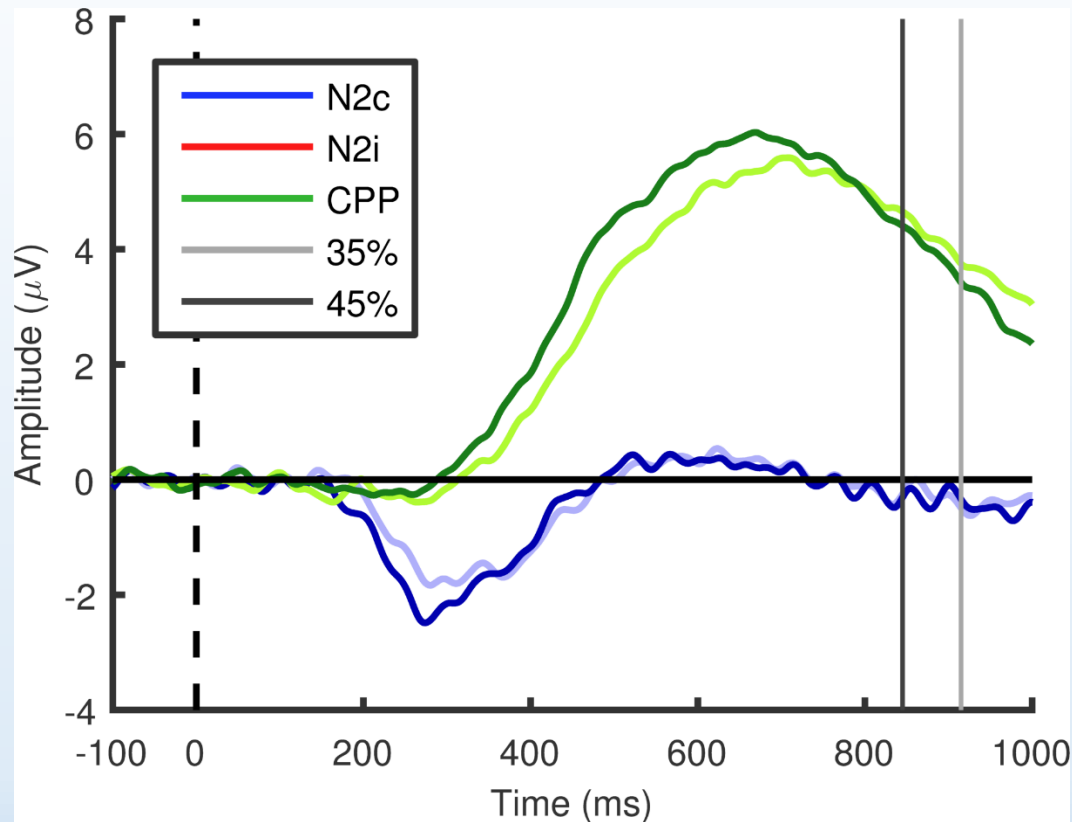


# Expected decision signal – the CPP

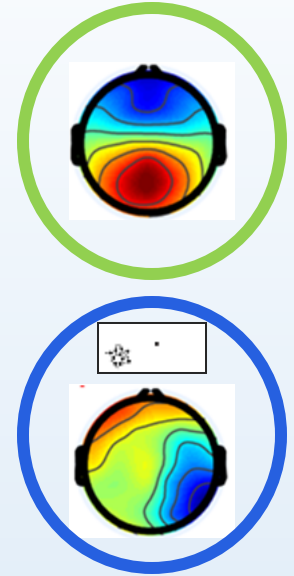


Loughnane et al., *Curr Biol* (in press)

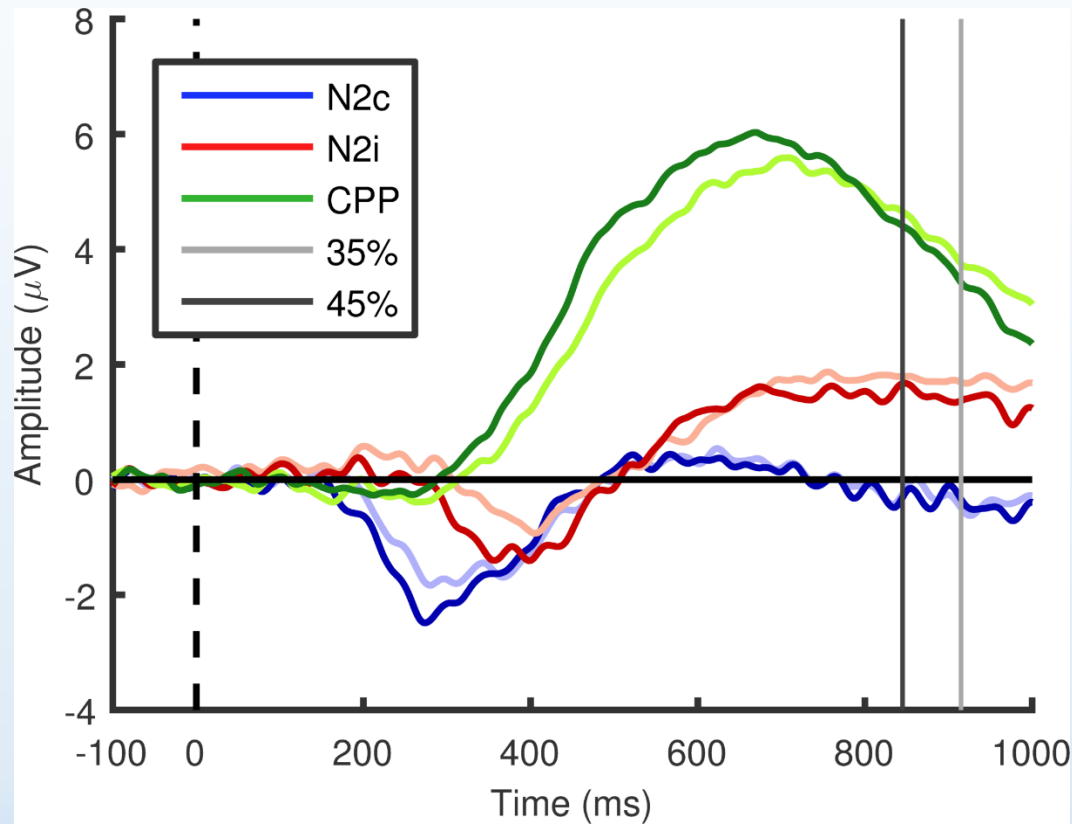
# Unexpected early signal – the N2



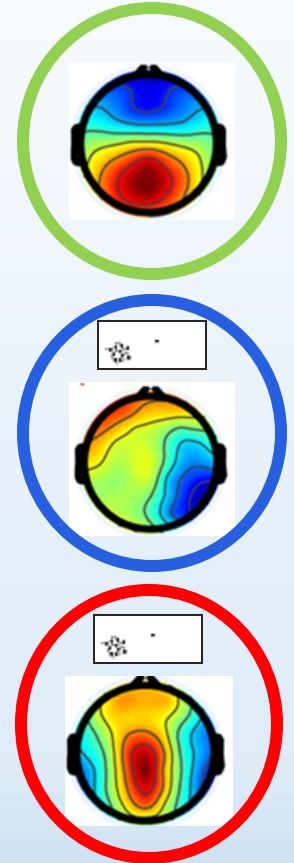
Loughnane et al., *Curr Biol*



# Unexpected early signal – the N2



Loughnane et al., *Curr Biol*



# The N2

Report

## Current Biology

### Target Selection Signals Influence Perceptual Decisions by Modulating the Onset and Rate of Evidence Accumulation

#### Highlights

- Early contralateral and ipsilateral target selection signals are isolated in human EEG
- Selection signals predict the onset and rate of neural evidence accumulation

#### Authors

Gerard M. Loughnane,  
Daniel P. Newman, Mark A. Bellgrove,  
Edmund C. Lalor, Simon P. Kelly,  
Redmond G. O'Connell

- Is a purely goal-relevant signal related to target detection.
- Predicts how fast people will react to a target.
- Predicts the rate of evidence accumulation towards the perceptual decision.

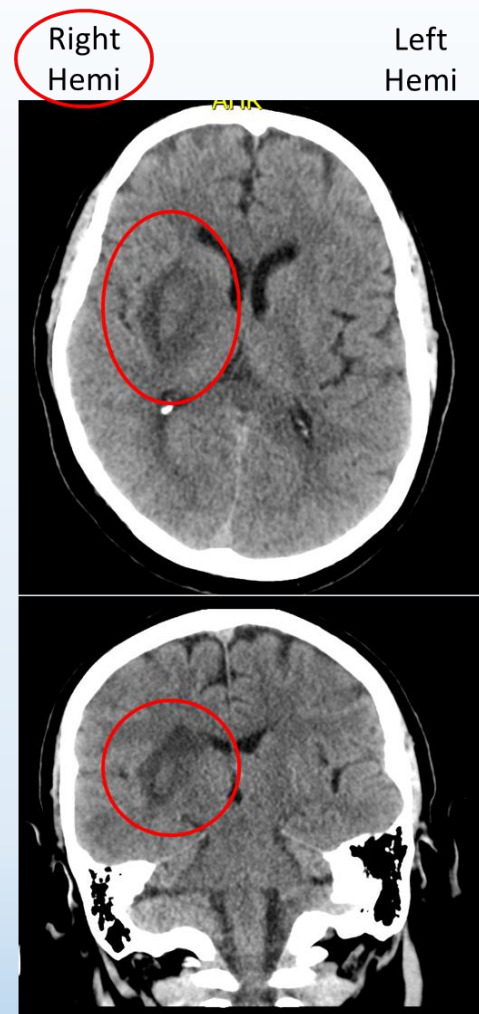
# Unilateral Neglect



# Electrophysiology of Neglect

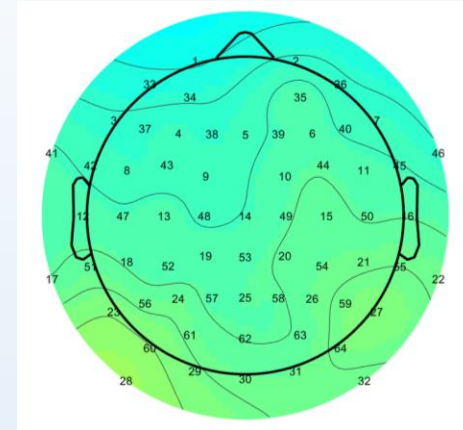
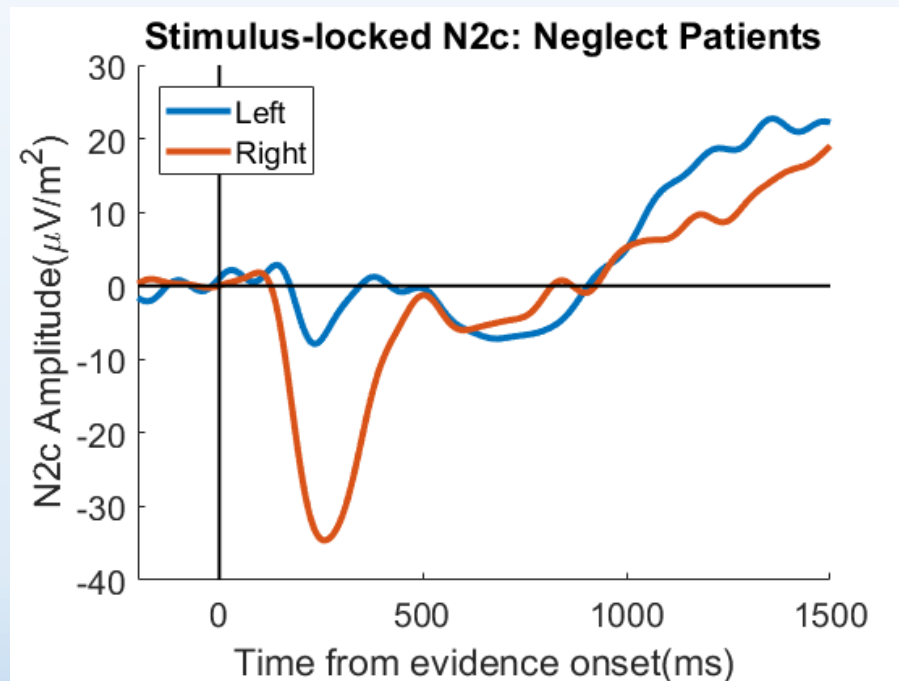
## Patient “T”

- Male, 69 years
- Deep right MCA stroke
  - temporal lobe, insula cortex and subcortical regions (putamen)
- Hospital admission April 2015
  - Acute unilateral spatial neglect and left hemiparesis mainly affecting the arm
- Hospital discharge June 2015
  - Recovered from Neglect according to clinical tests

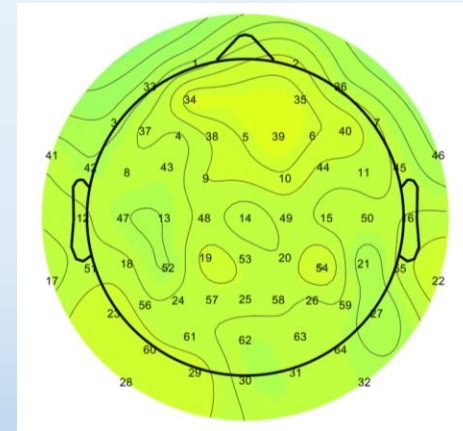


# Impaired visual attention in Neglect

- Contralateral selection (N2c) heavily impaired to left hemifield targets



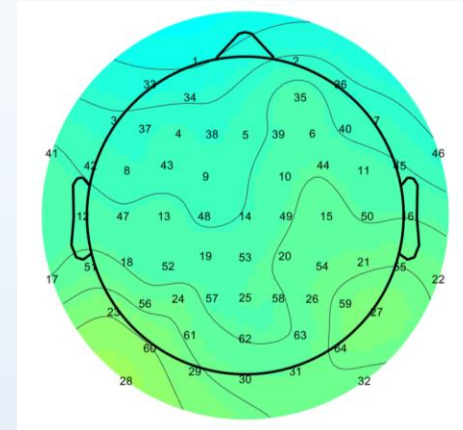
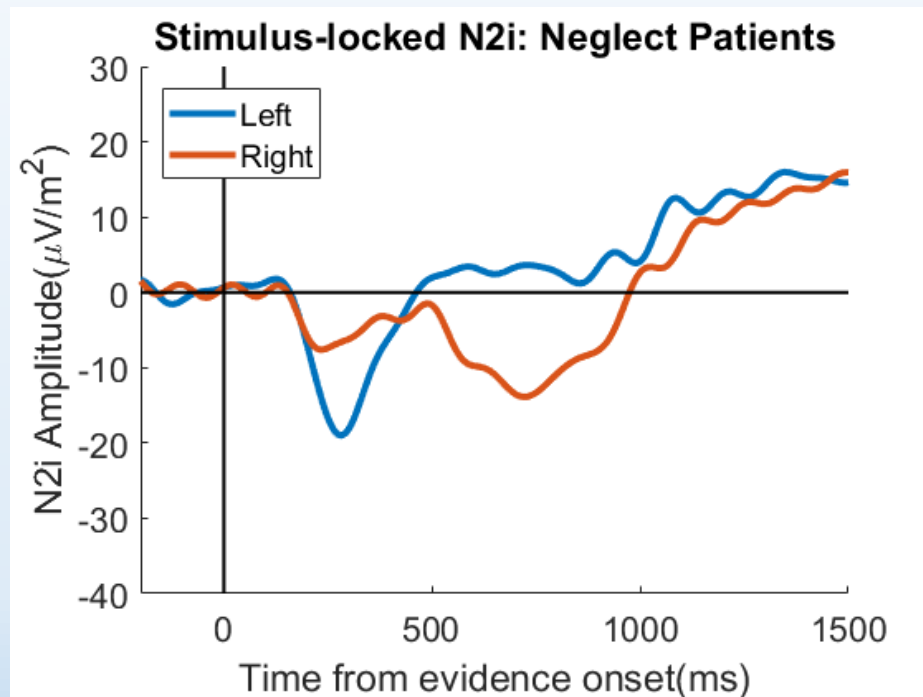
**Right**  
hemifield  
targets



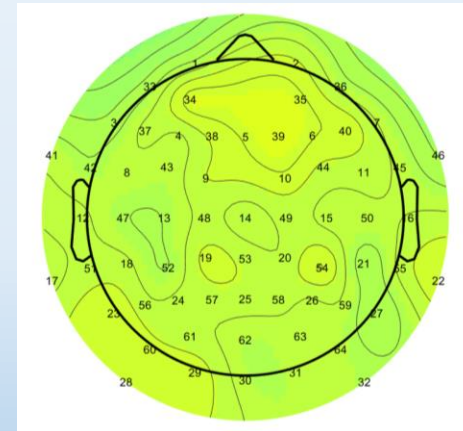
**Left**  
hemifield  
targets

# Compensatory mechanism?

- Left hemisphere *ipsilateral* selection (N2i) actually better in neglect patients!



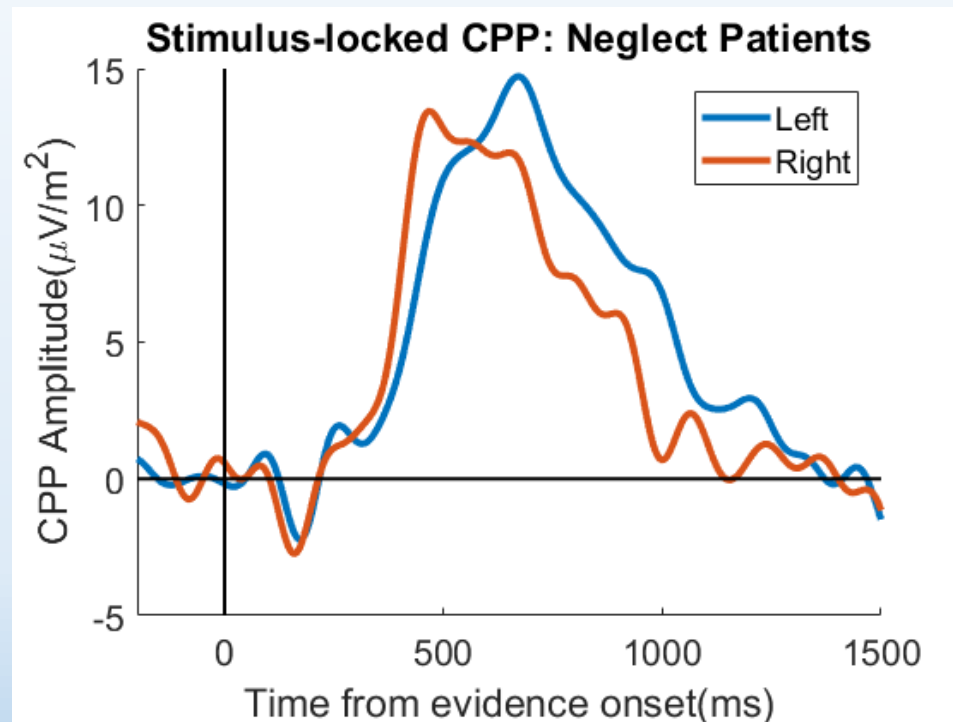
**Right**  
hemifield  
targets



**Left**  
hemifield  
targets

# Effect on decision making

- Decision making signal (CPP) slower to accumulate for left targets



# Conclusions and future directions

- EEG signals related to selective attention index attentional deficiencies in Unilateral Neglect.
- This can potentially be used as a more sensitive diagnostic tool, particularly in cases with motor difficulties.
- Also sheds light on the neurophysiology of how Unilateral Neglect can lead to behavioural difficulties in patients.
- Exciting times! New data has just come in, collaboration between Monash University Melbourne and Oxford.

# Thanks



**Monash University  
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Prof. Redmond  
O'Connell

**Oxford University:**

Dr. Meadhbh Brosnan

**Any questions?**



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