

**The perceptual roots of the social brain:  
on the importance of the eyes and fixation  
location in face and emotion perception**

**Roxane J. Itier, Ph.D.**



# Overview

## Introduction

1. Is there an eye detector in the human brain?
2. Effects of fixation location on face decoding
  1. Fixation location and orientation
  2. Fixation location and expressions

## Conclusions

# Facial cues: windows to others' minds

Social cognition



Gaze



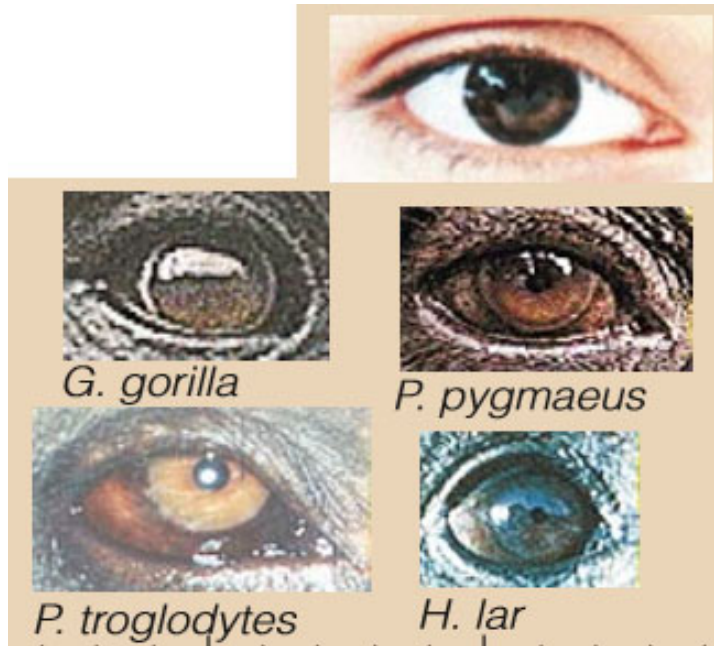
gender  
age  
attractiveness

...

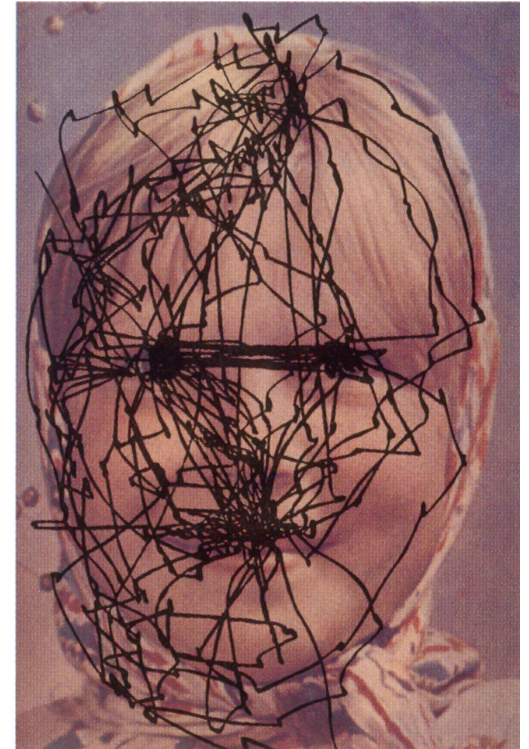
Expressions



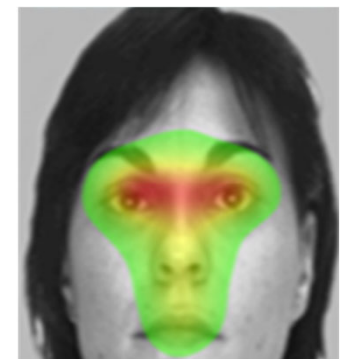
# Importance of the eyes



*Kobayashi & Kohshima, 1997*



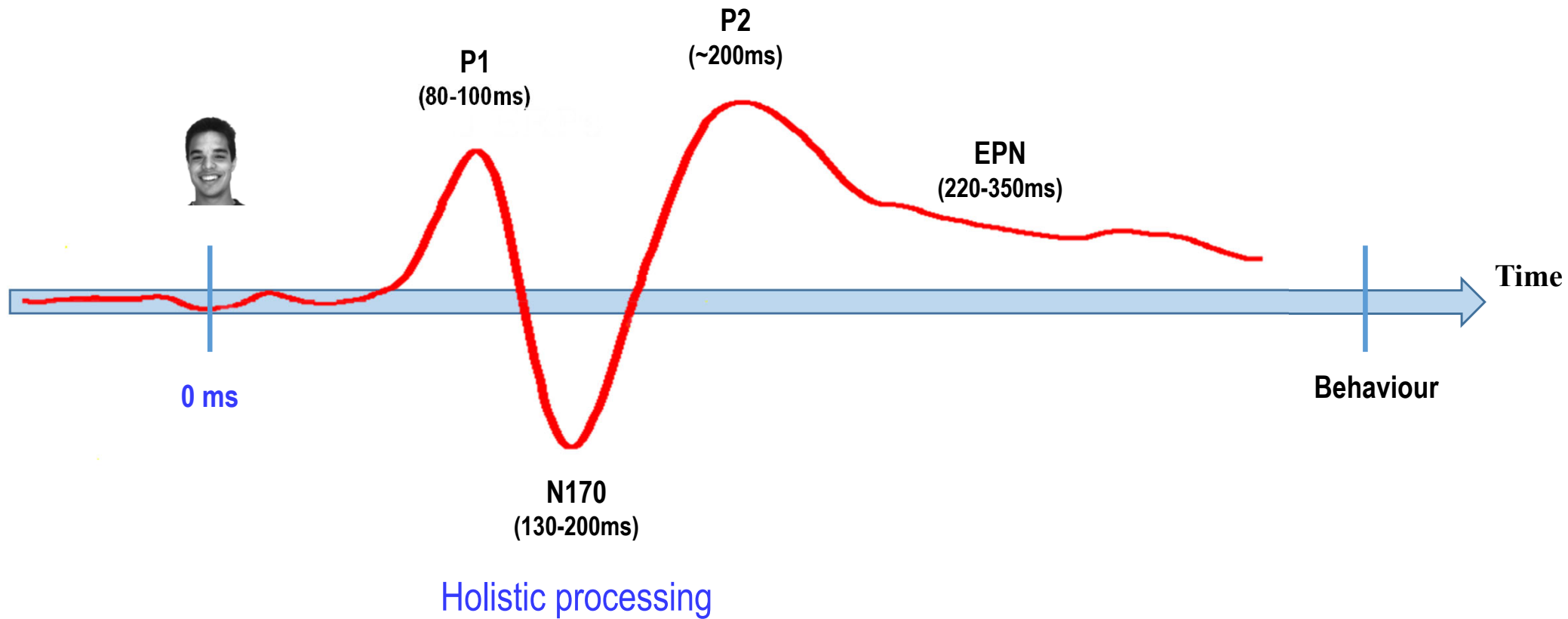
*Yarbus, 1967*



# How does the brain extract facial information?



# Processing time course with ERPs

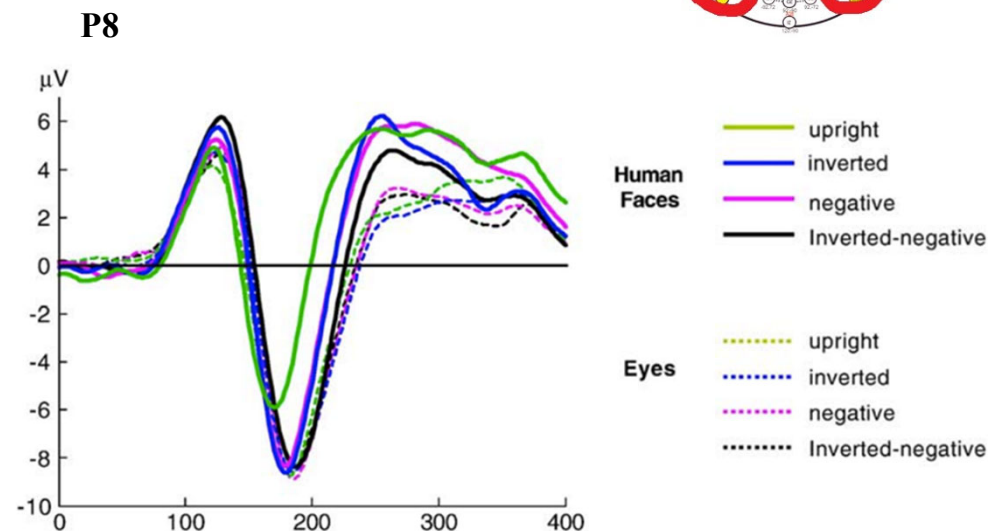
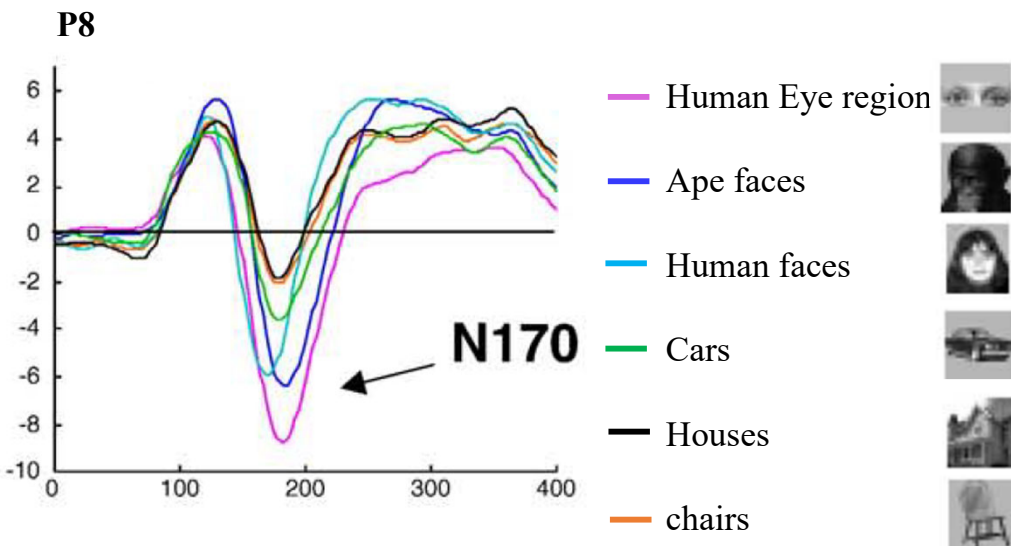
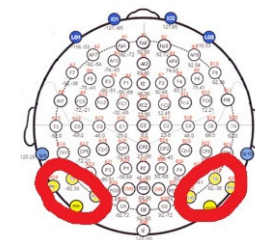


# 1. Is there an eye detector in the human brain?

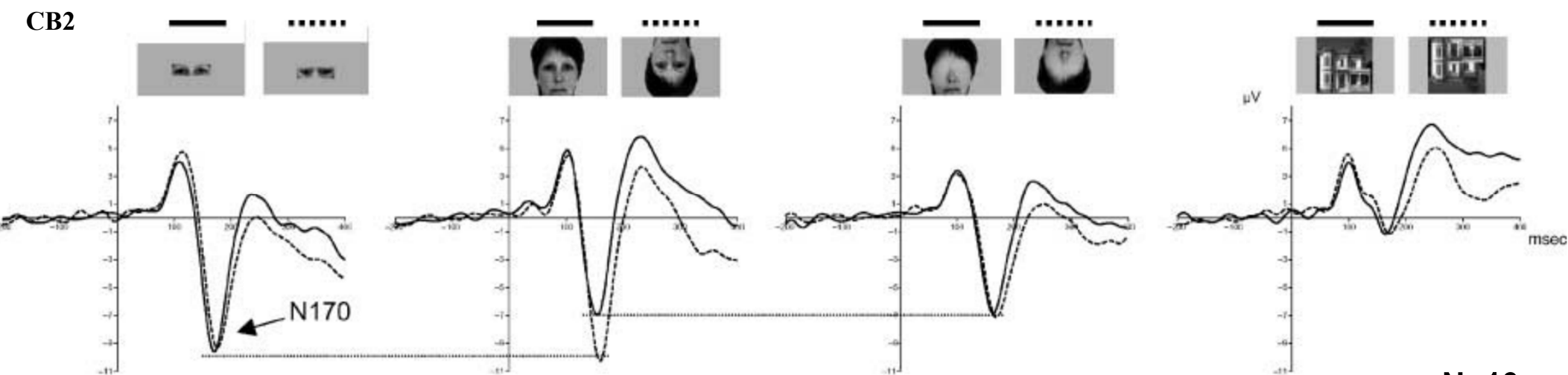




# Electrophysiological signature



*Itier et al., 2006, Neuroimage* **N=19**



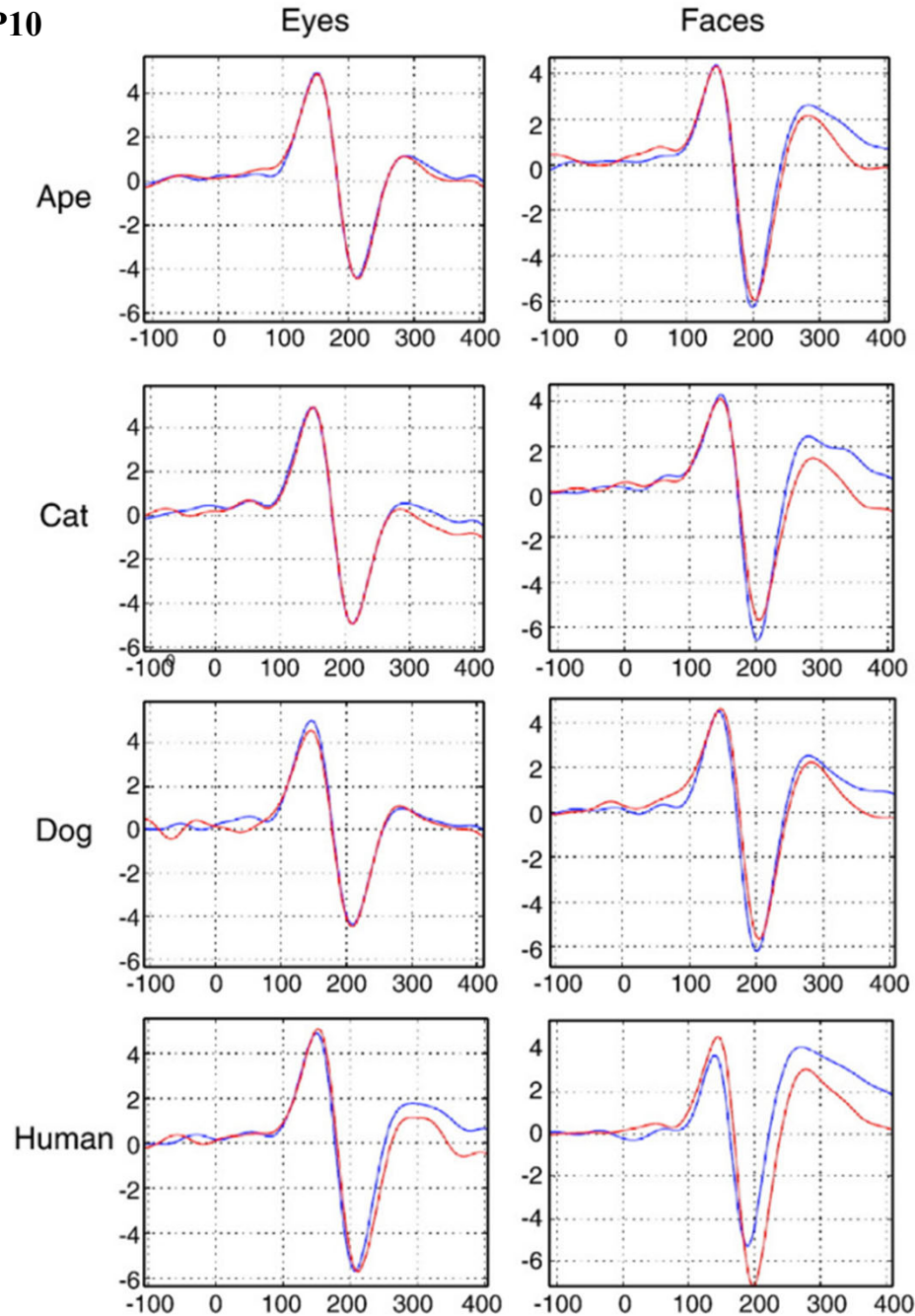
*Itier et al., 2007, J. Cogn. Neurosci.* **N=13**



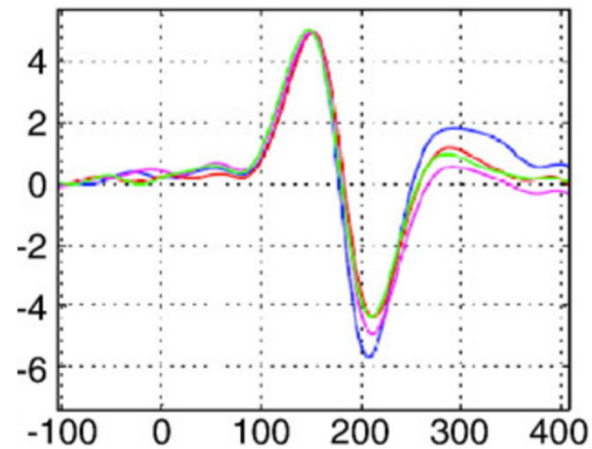
# Species specificity

P10

— upright  
— inverted

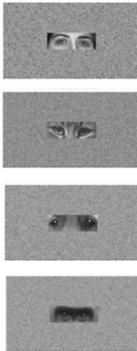


P10

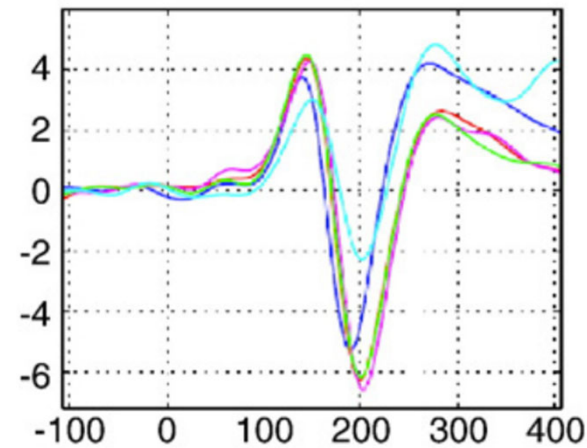


Eyes

— Human  
— Cat  
— Dog  
— Ape

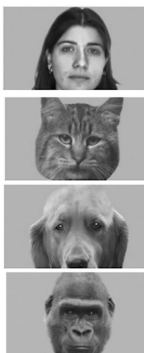


P10



Faces

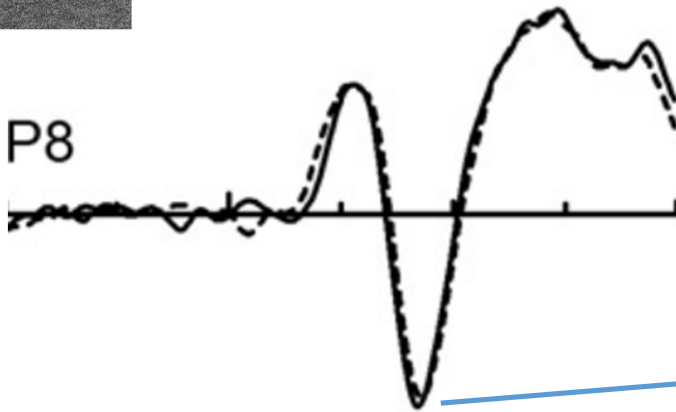
— Human  
— Cat  
— Dog  
— Ape



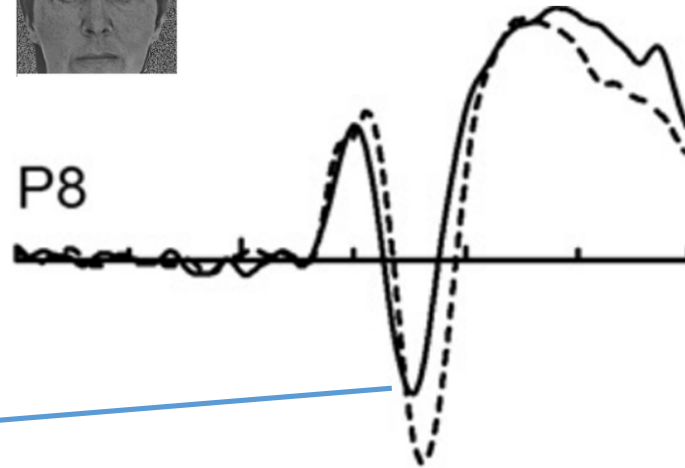
# Part/whole effect?



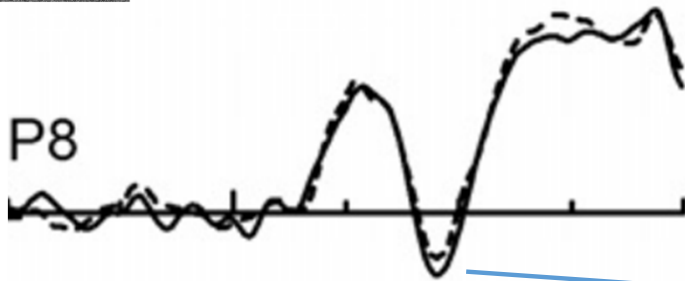
P8



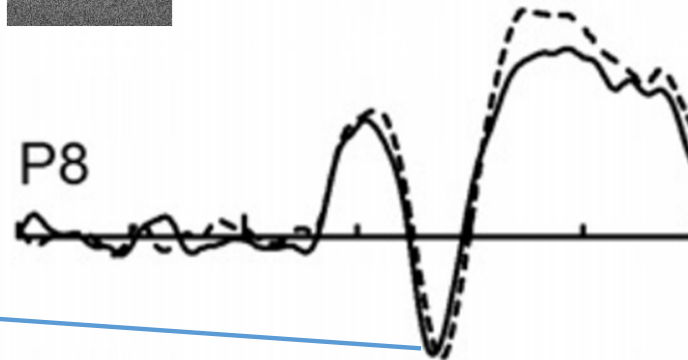
P8



P8



P8



— upright  
- - - inverted

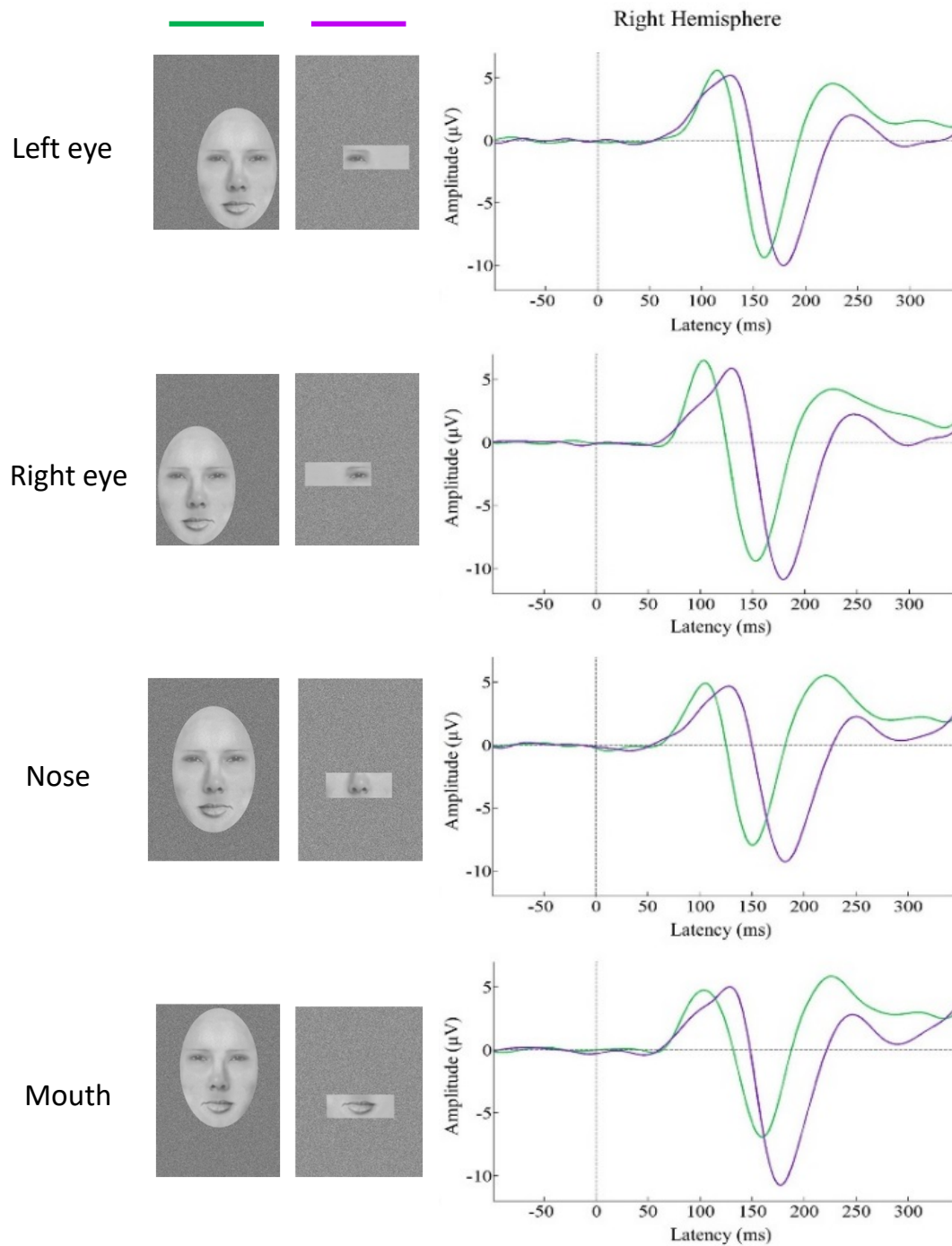
N=16

# Fixation contingent procedures





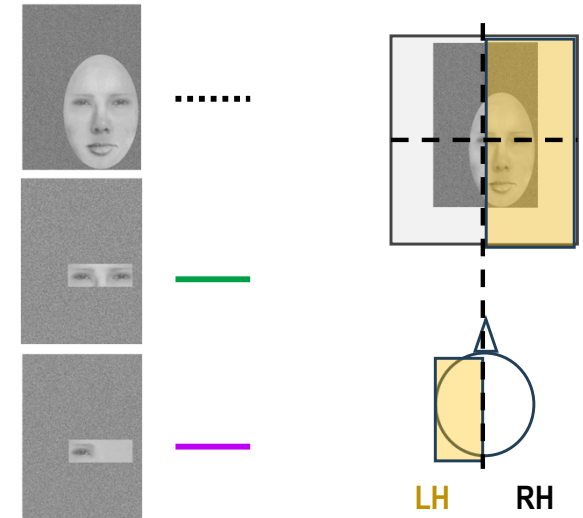
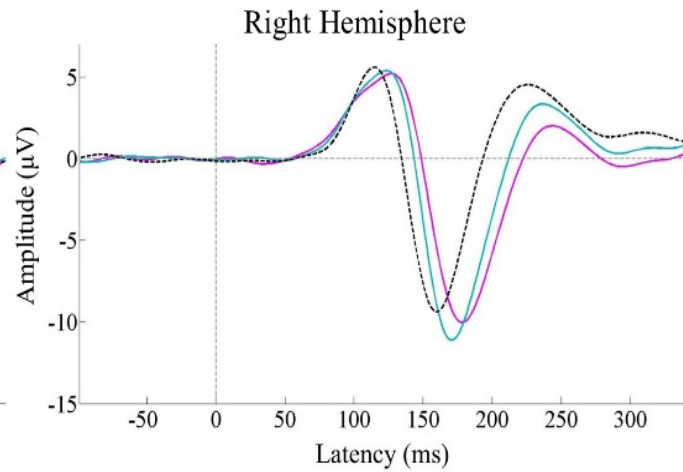
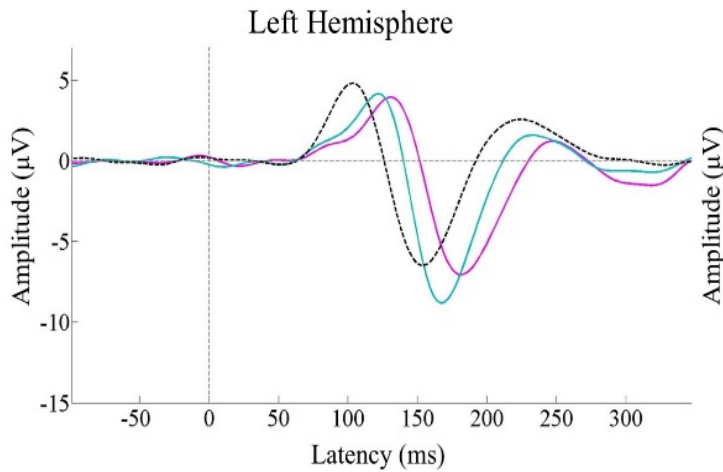
# Isolated features vs. faces



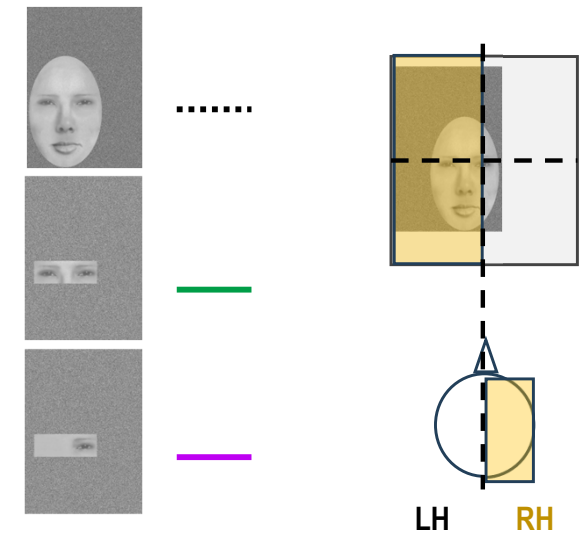
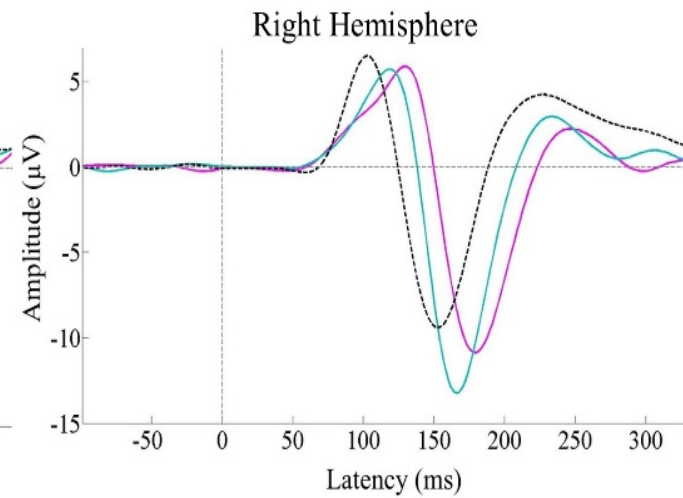
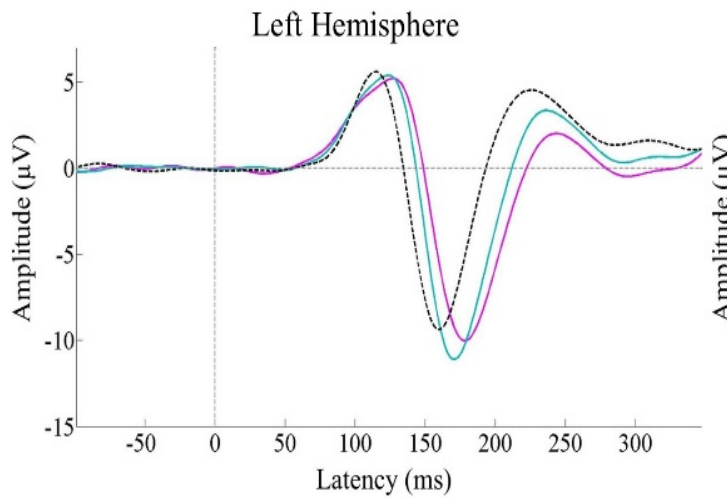
N=34

# Is the eye region special?

## Left eye fixation

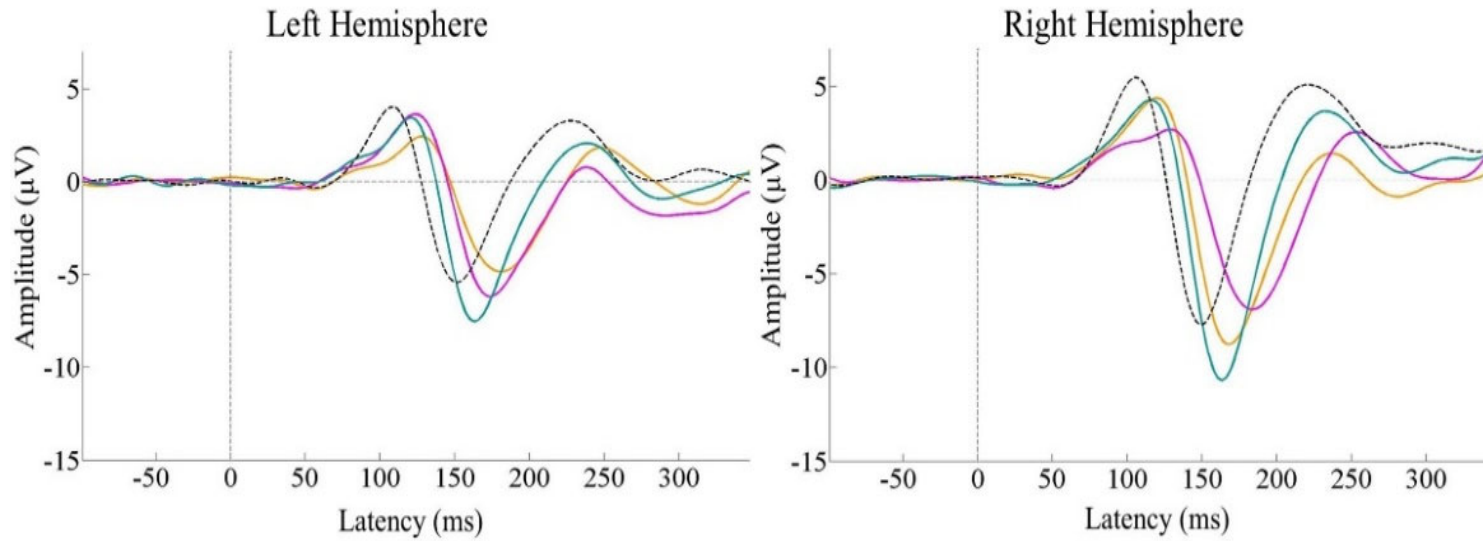


## Right eye fixation

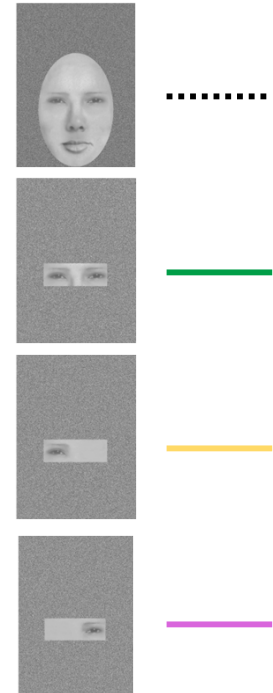


N=34

# Is the eye region special?

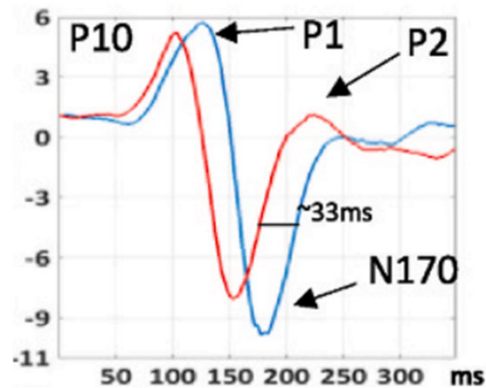


Nasion fixation

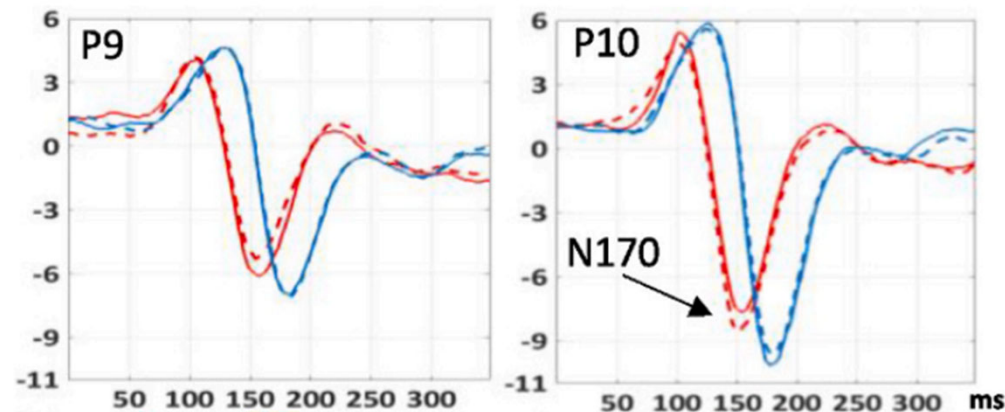
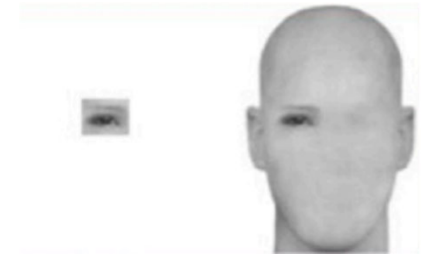


N=34

# Importance of the face outline



Left eye fixation

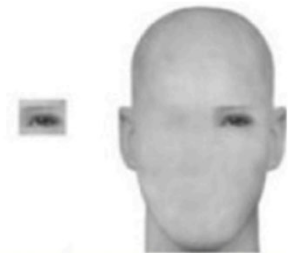


Left eye fixation

Right eye fixation



Right eye fixation



N=45

Winward et al., 2022, *Neuroimage: Reports*  
Parkington & Itier, 2019, *Brain Research*



## Section summary

1. Electrophysiological signature for the eyes
2. May play a role in early face perception (inversion)
3. Species sensitivity
4. Not a simple part-whole effect (not seen in objects)
5. Different responses to features and faces
6. Special response to the eye *region*
7. The face outline switches the response from feature to face

## 2. Effects of fixation location on face decoding





Eye tracker



Eye tracker



Eye tracker

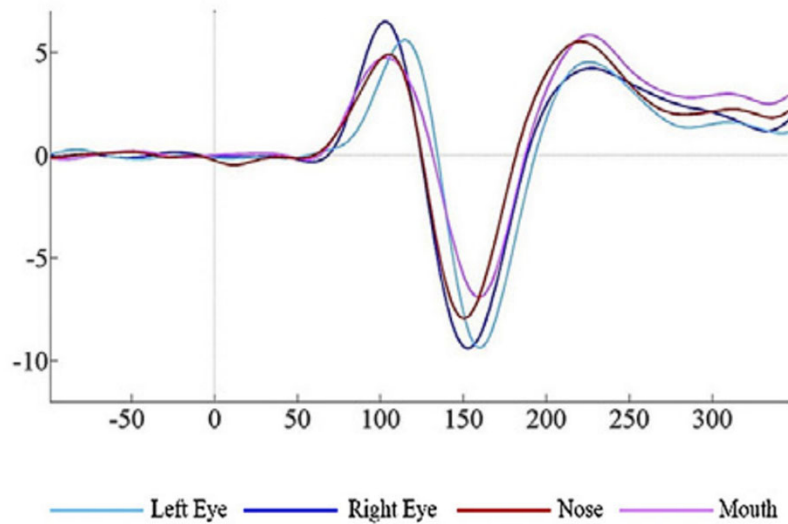




Eye tracker

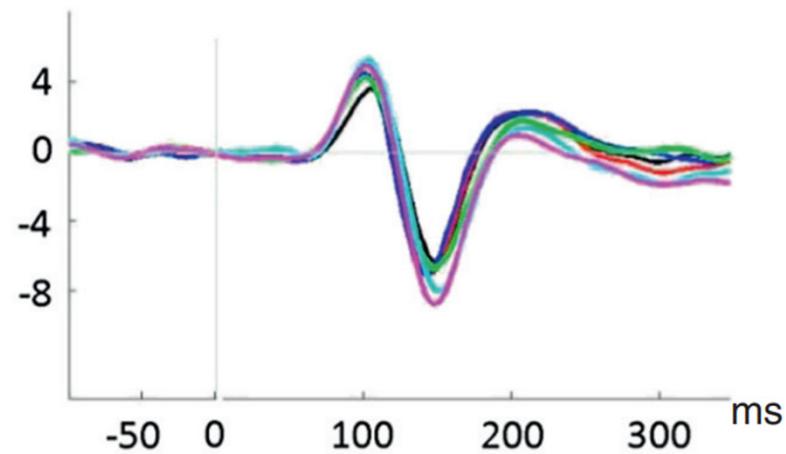
# Fixation location and face perception

N=34



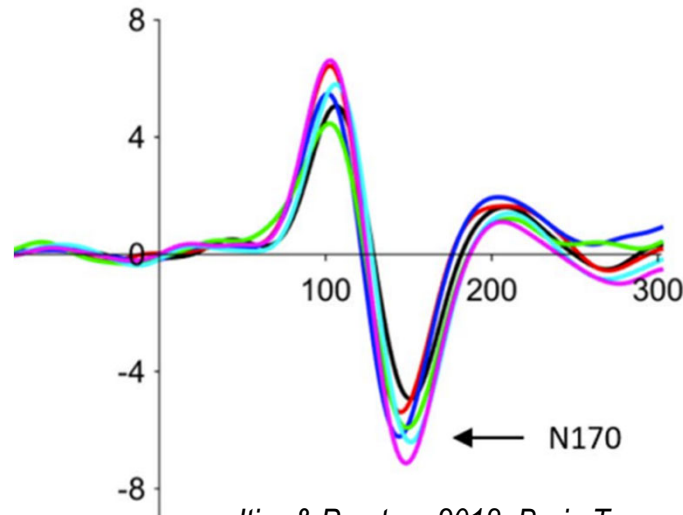
*Parkington & Itier, 2018, Cortex*

N=20



*Nemrodov et al., 2014, Neuroimage*

N=34

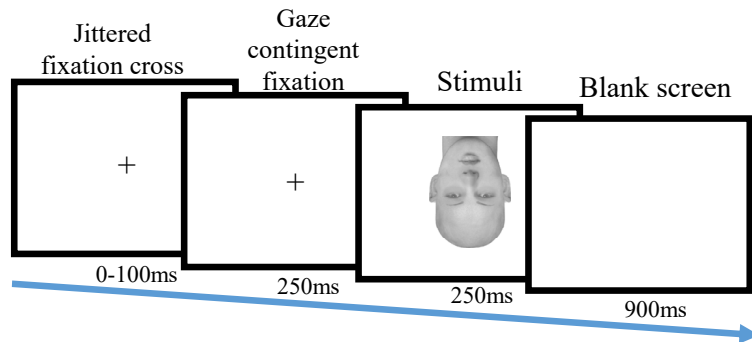


*Itier & Preston, 2018, Brain Topography*

**N170 ≠ holistic processing!**

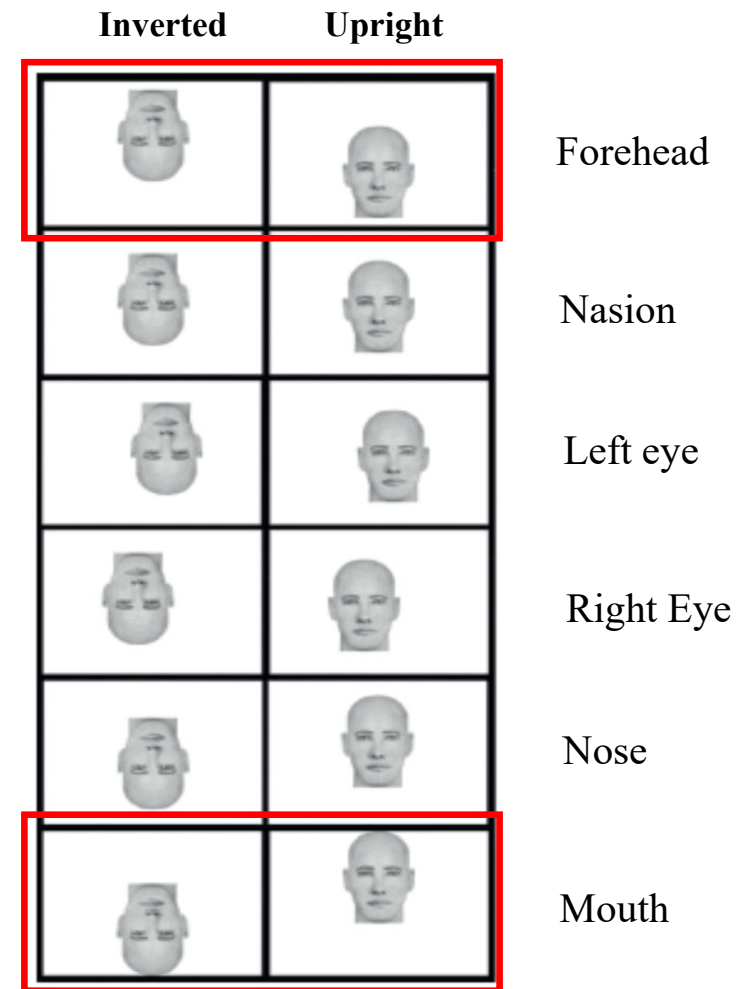
- Forehead
- Nasion
- Left Eye
- Right Eye
- Nose
- Mouth

## 2. Fixation Location and inversion



N=52

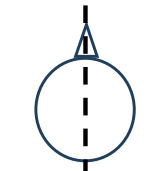
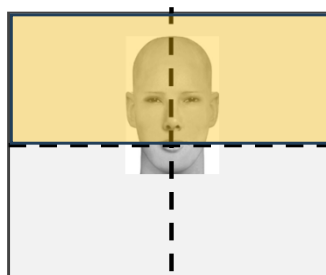
2 Orientation x 6 Fixation Locations



Mass Univariate Analyses (LIMO-EEG)

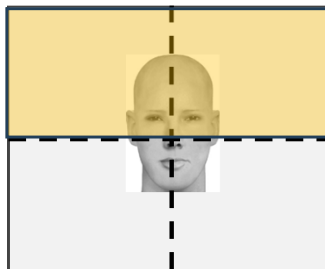
*Siklos-Whillans & Itier, 2024, Brain Topography*  
*Nemrodov et al., 2014, Neuroimage*  
*Itier & Preston, 2018, Brain Topography*

**Mouth**



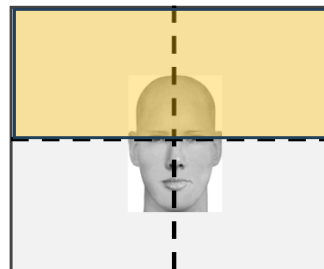
LH RH

**Nose**



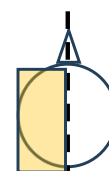
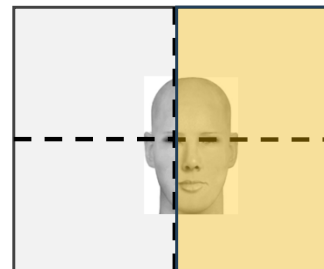
LH RH

**Nasion**



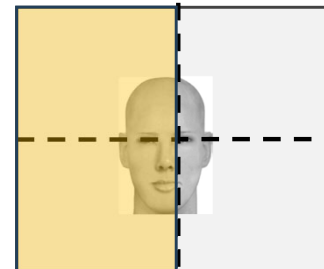
LH RH

**Left eye**



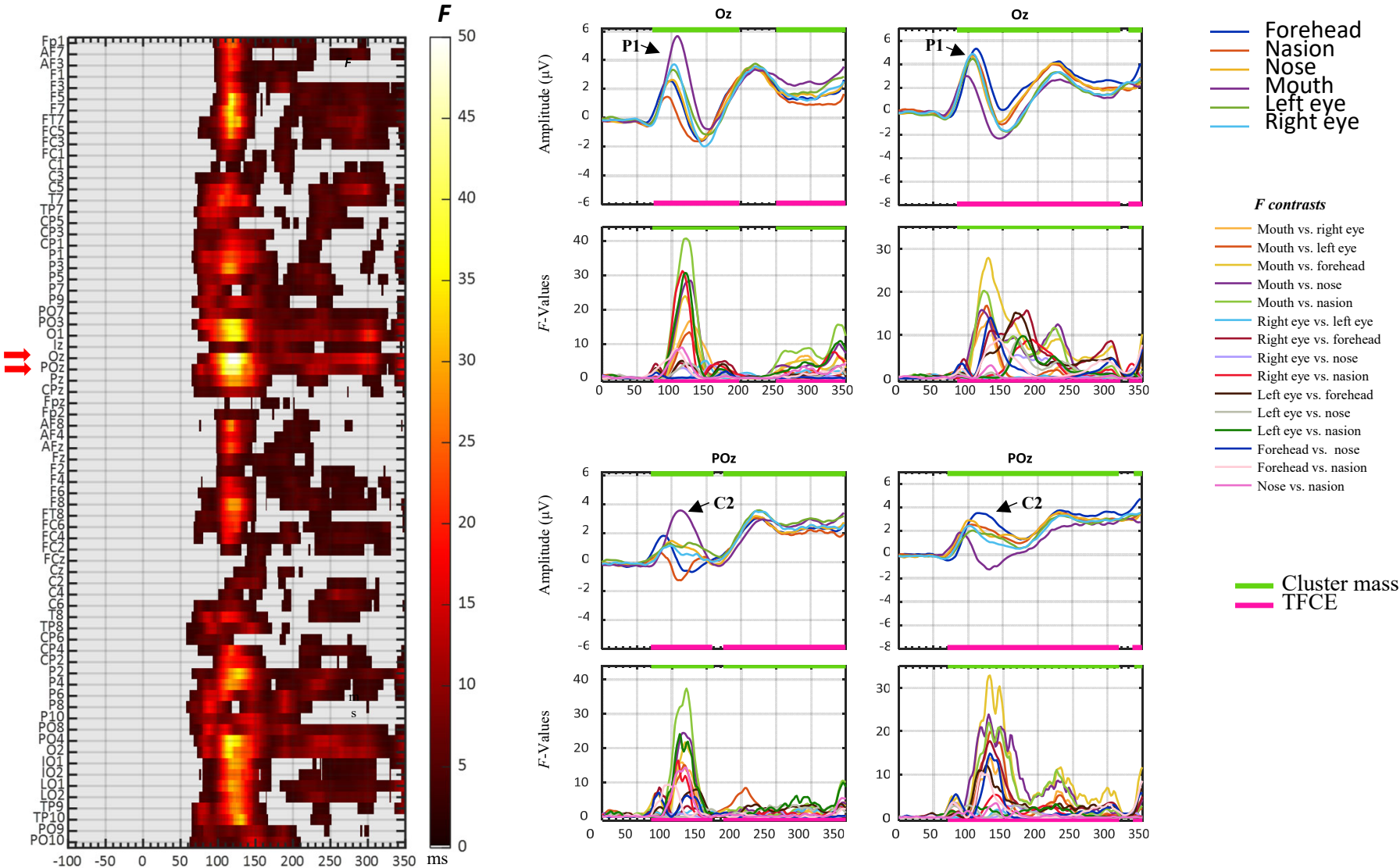
LH RH

**Right eye**



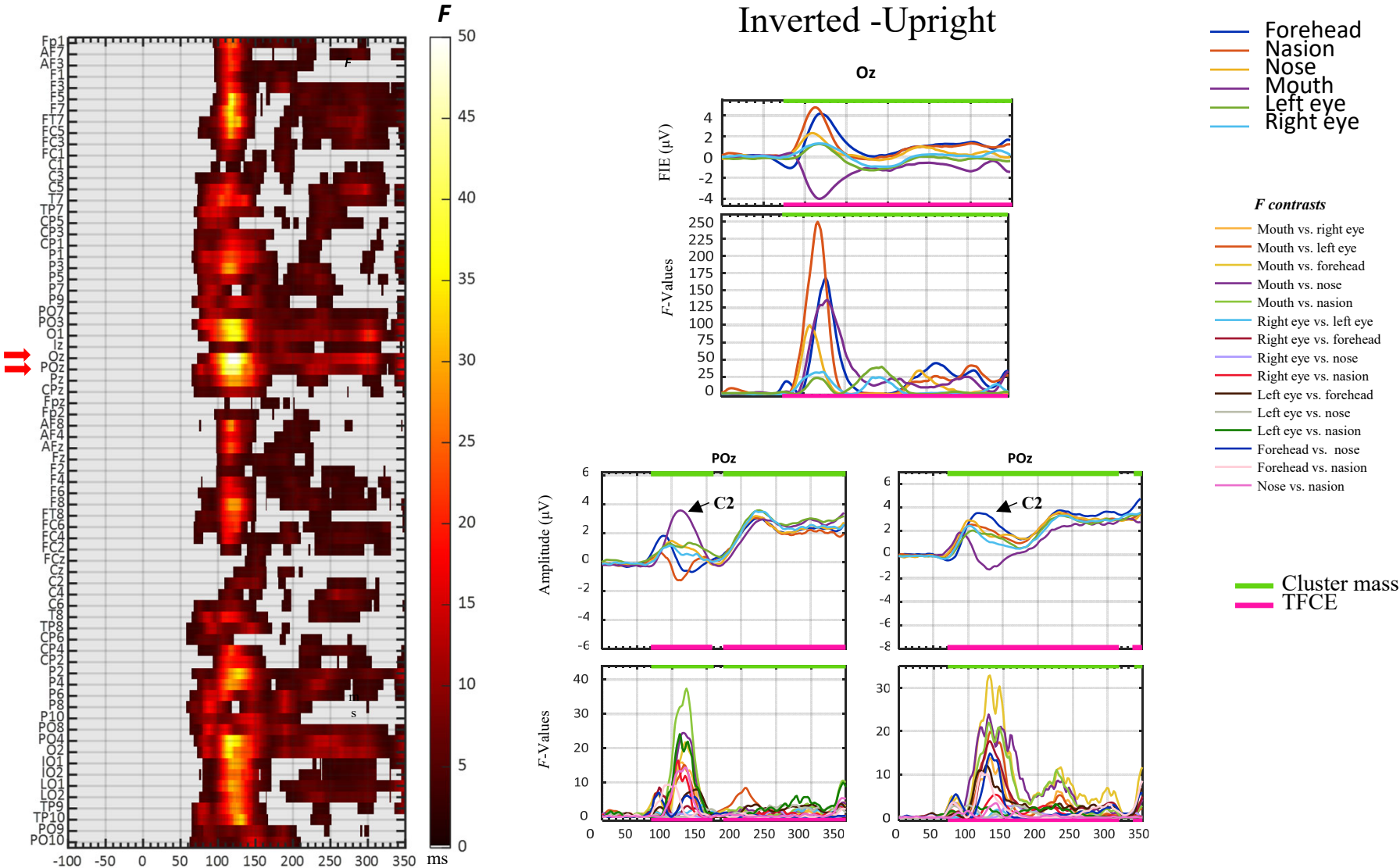
LH RH

# Orientation x Fixation Location interaction



N=52

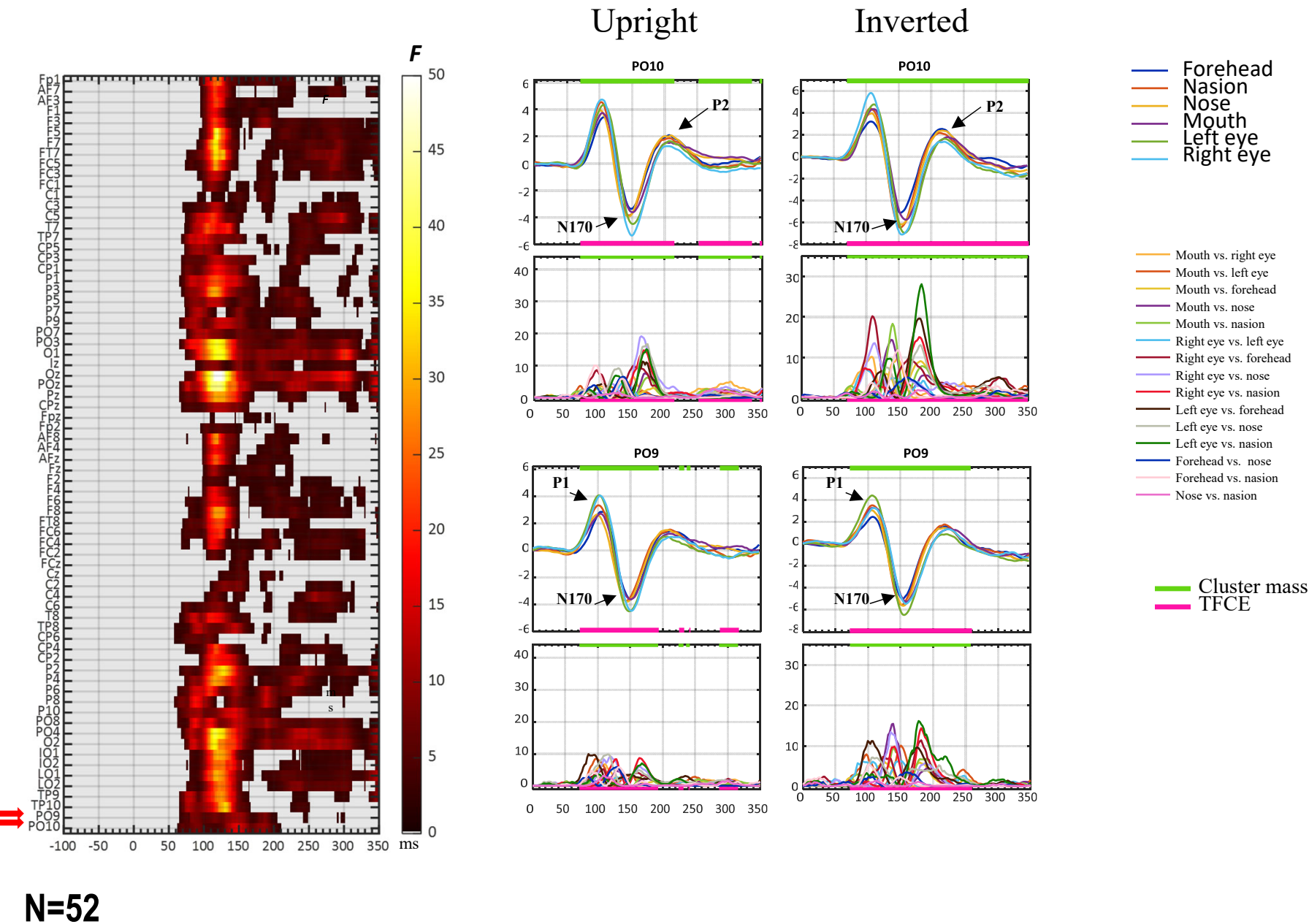
# Orientation x Fixation Location interaction



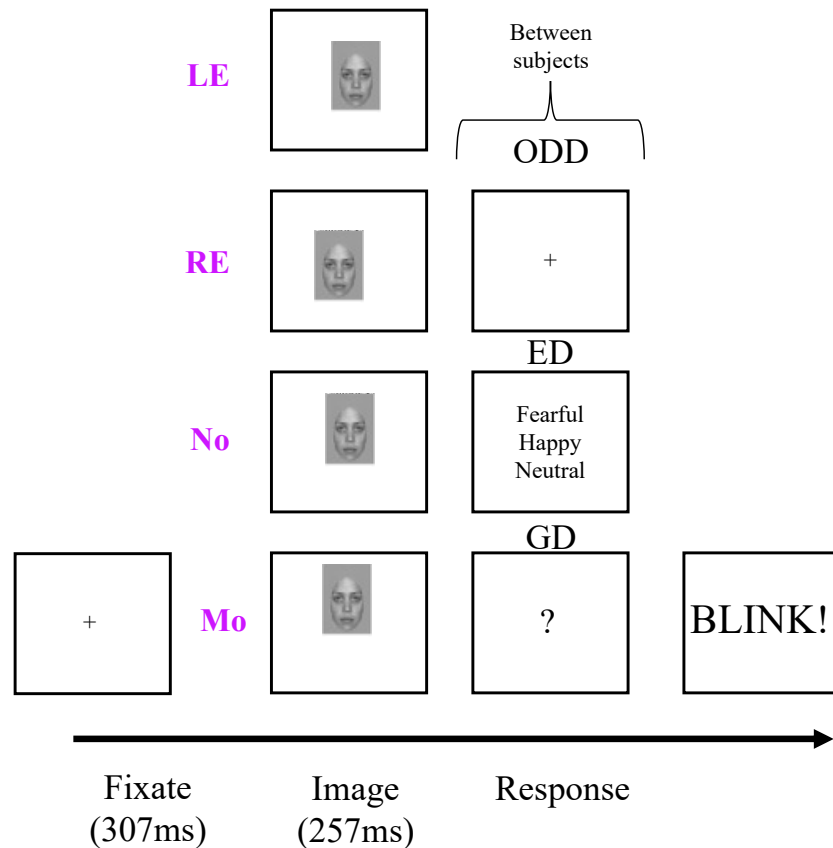
N=52



# Orientation x Fixation Location interaction



# Fixation location and facial expressions



Fearful Happy Neutral (Flower)

N=54

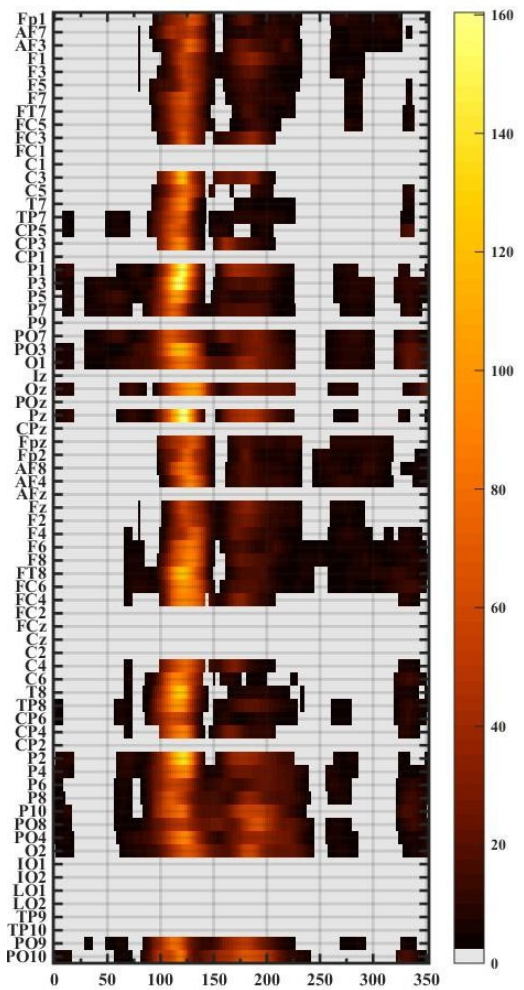
Mass Univariate Analyses (LIMO-EEG)

3 Tasks x 3 Expressions x 4 Fixation Locations

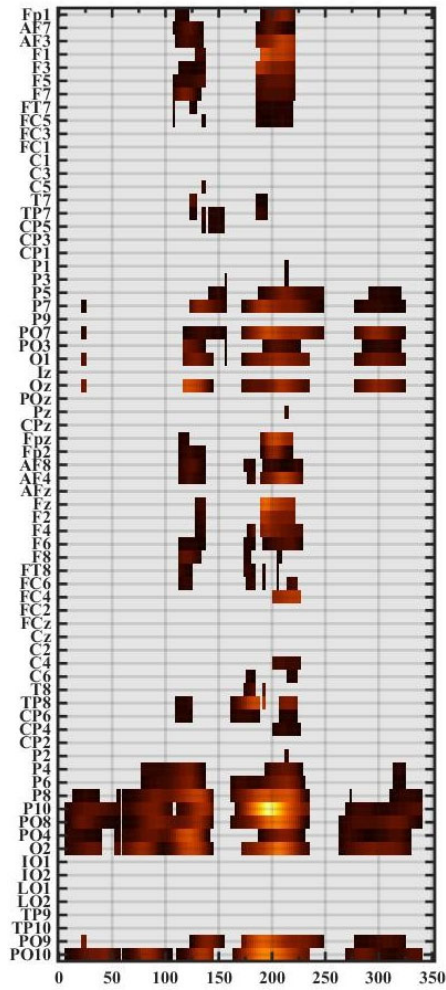
*Itier & Durston, 2023, Scientific Report*  
*Neath-Tavares & Itier, 2016, Biological Psychology*  
*Neath & Itier, 2015, Brain and Cognition*

# Fixation location and facial expressions

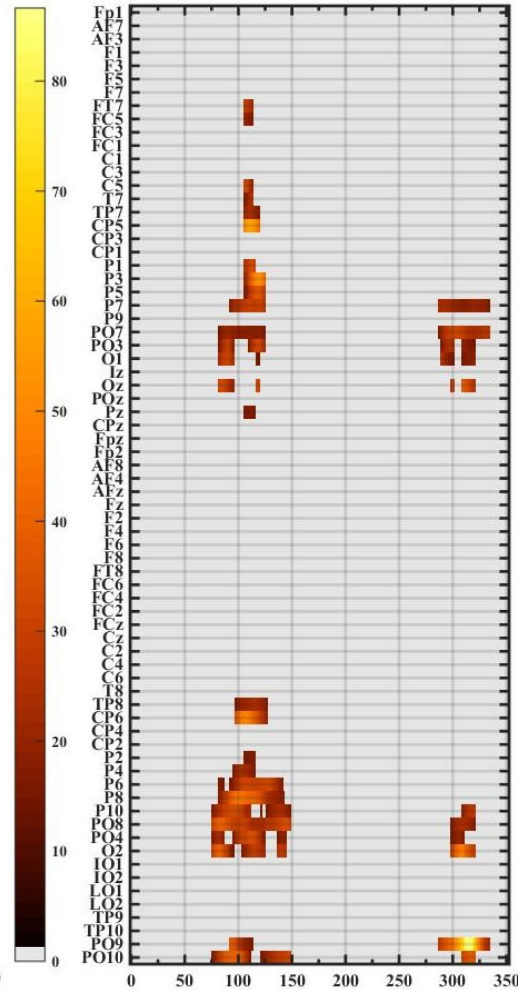
Fixation Effect



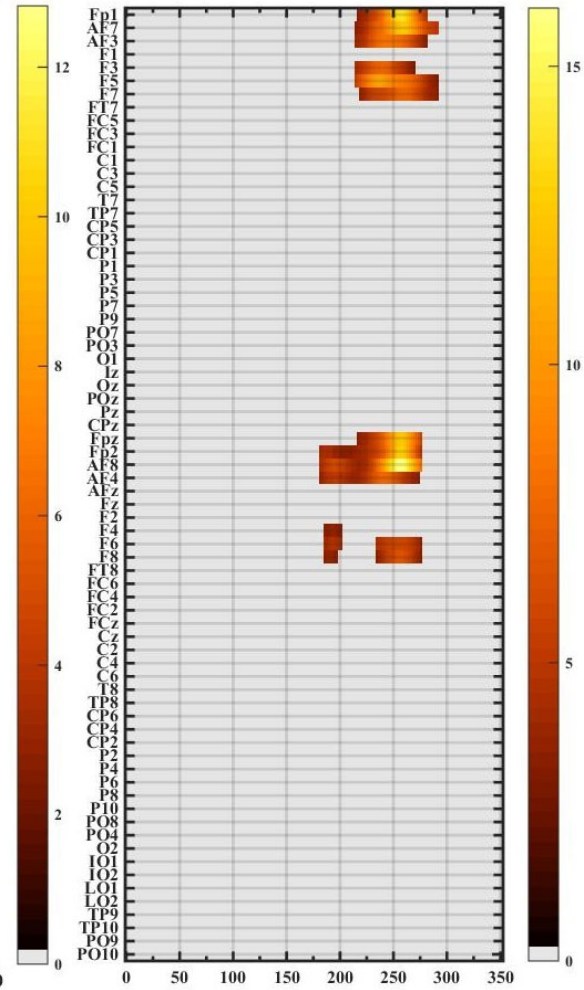
Emotion Effect



Emotion x Fixation



Task Effect

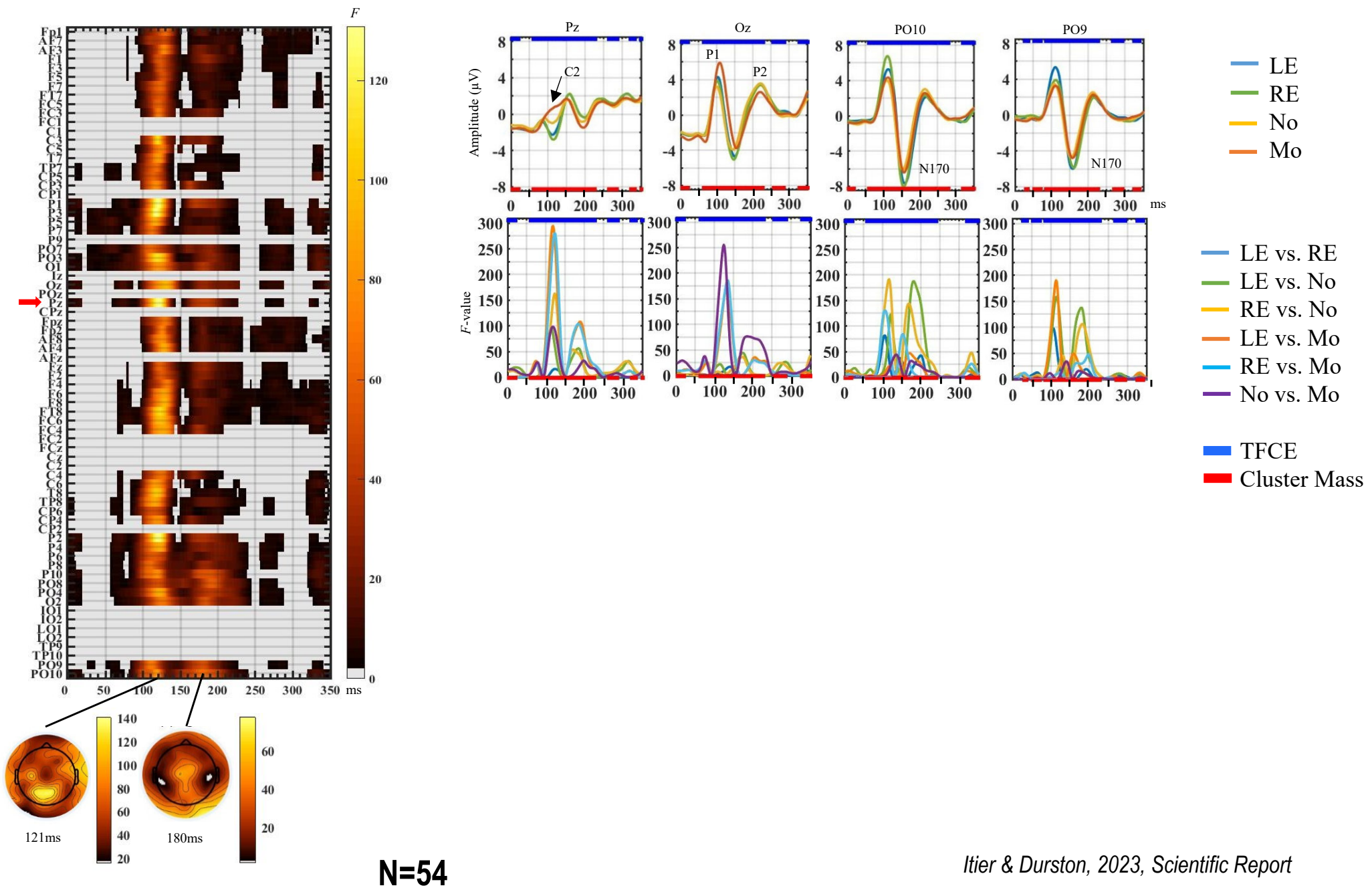


No Task x emotion interaction anywhere!

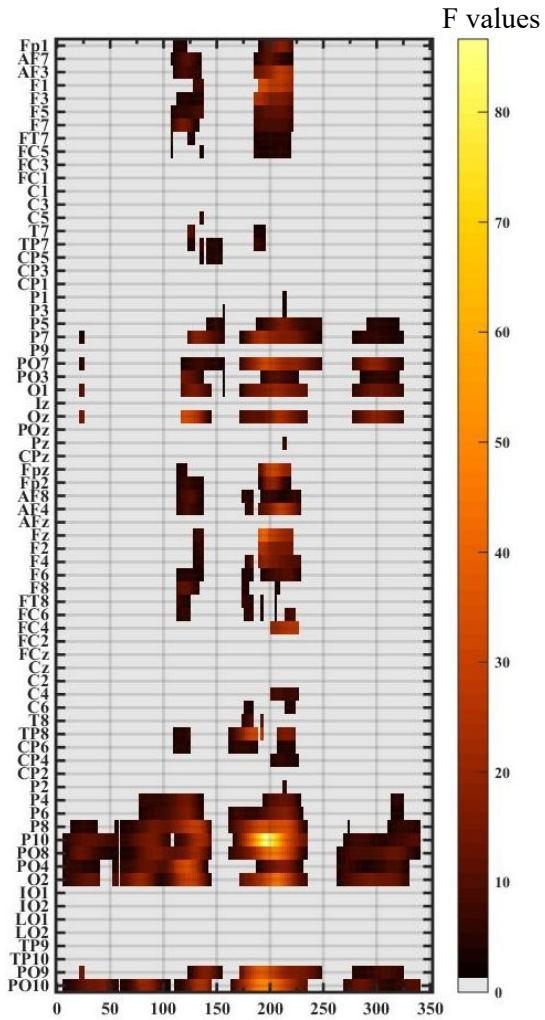
No Task x emotion x fixation



# Fixation Location effect

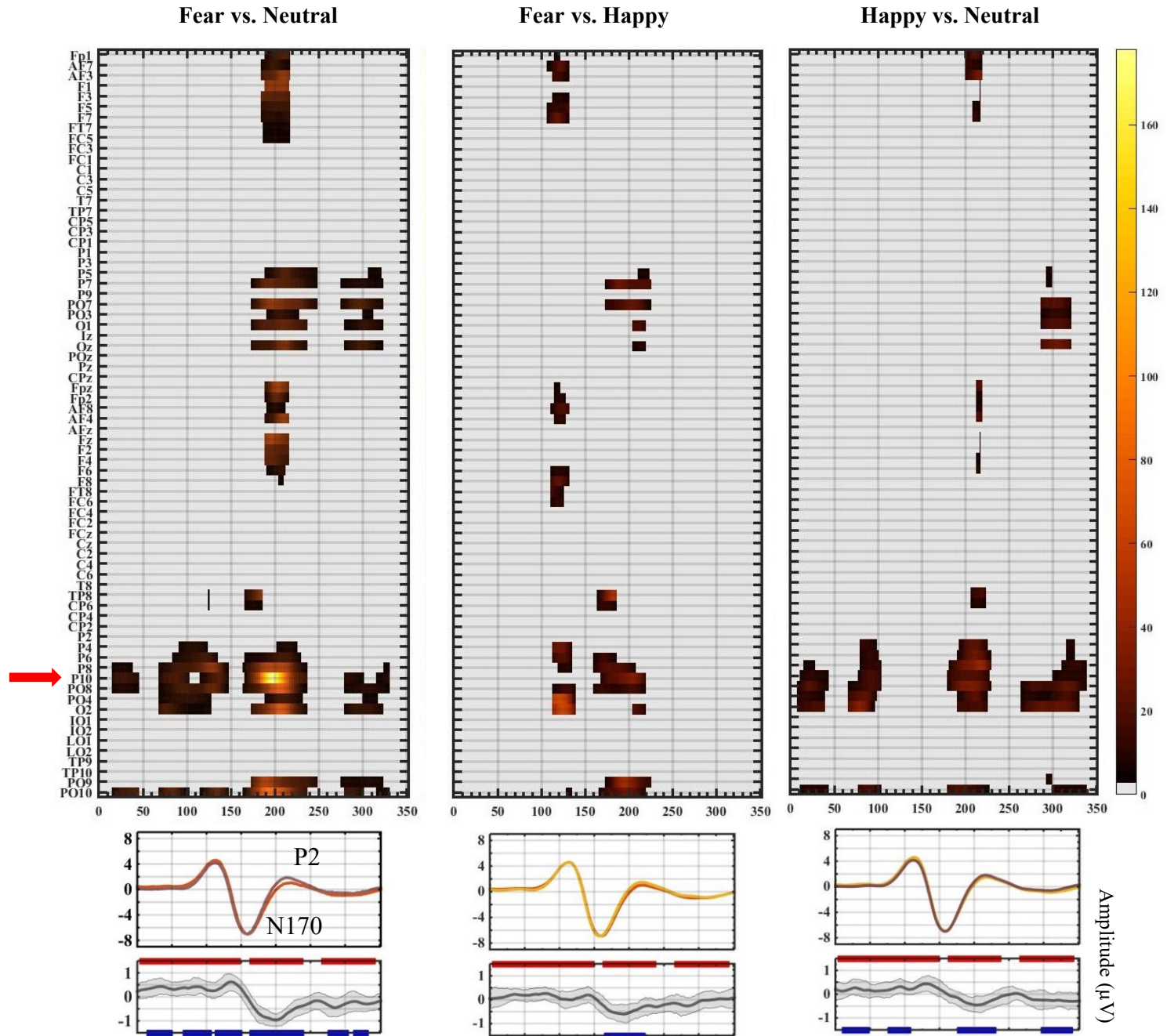


## Emotion effect



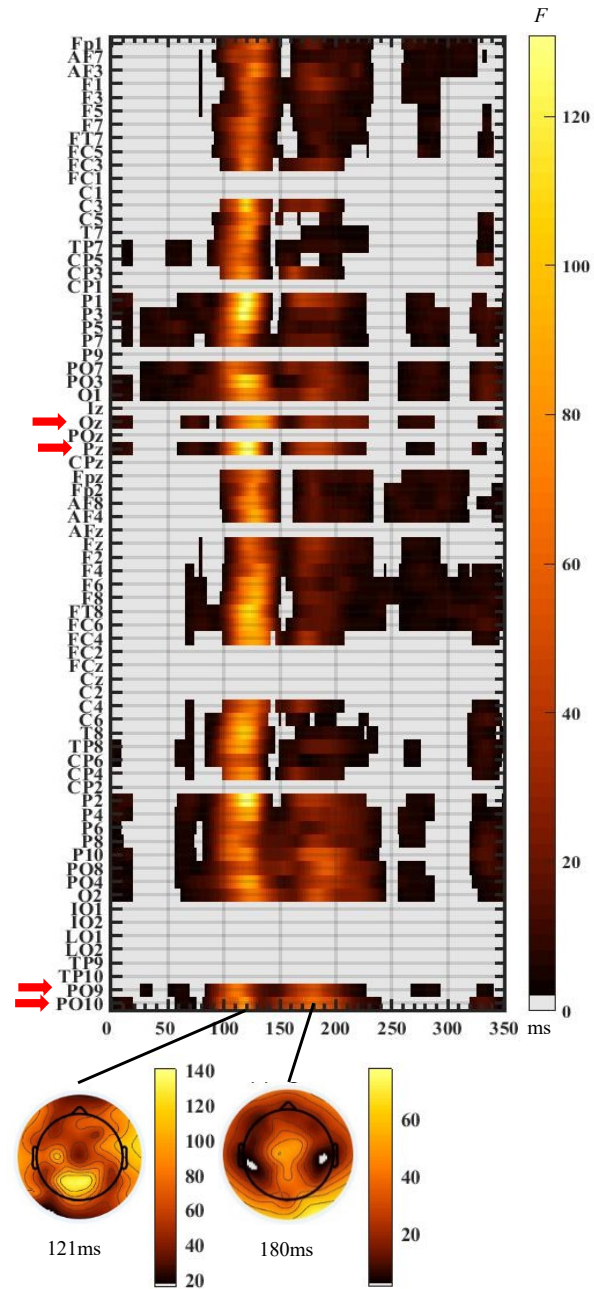
**N=54**

*Itier & Durston, 2023*  
*Scientific Report*

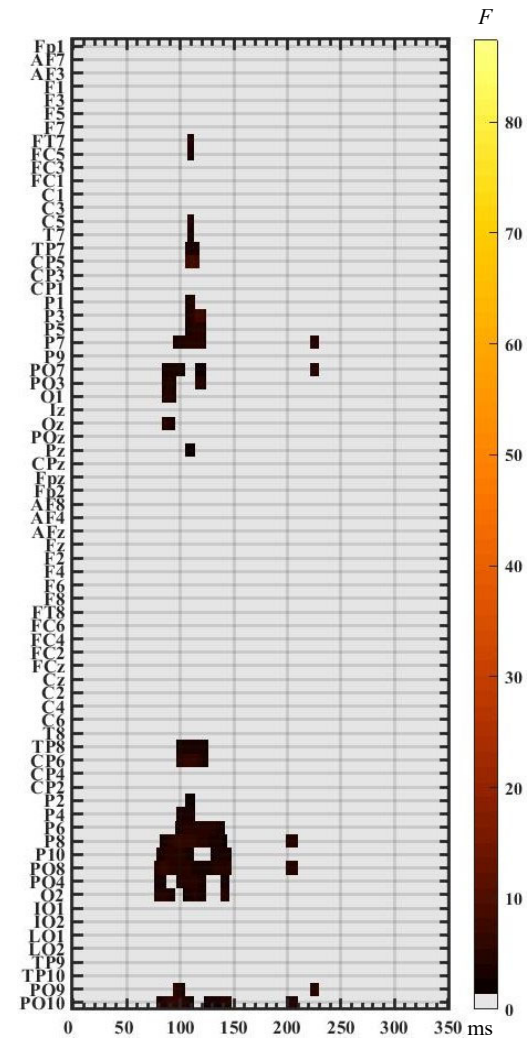


## Fixation Location effect

## Interaction with emotion



**N=54**



Itier &amp; Durston, 2023, Scientific Report



## Section summary:

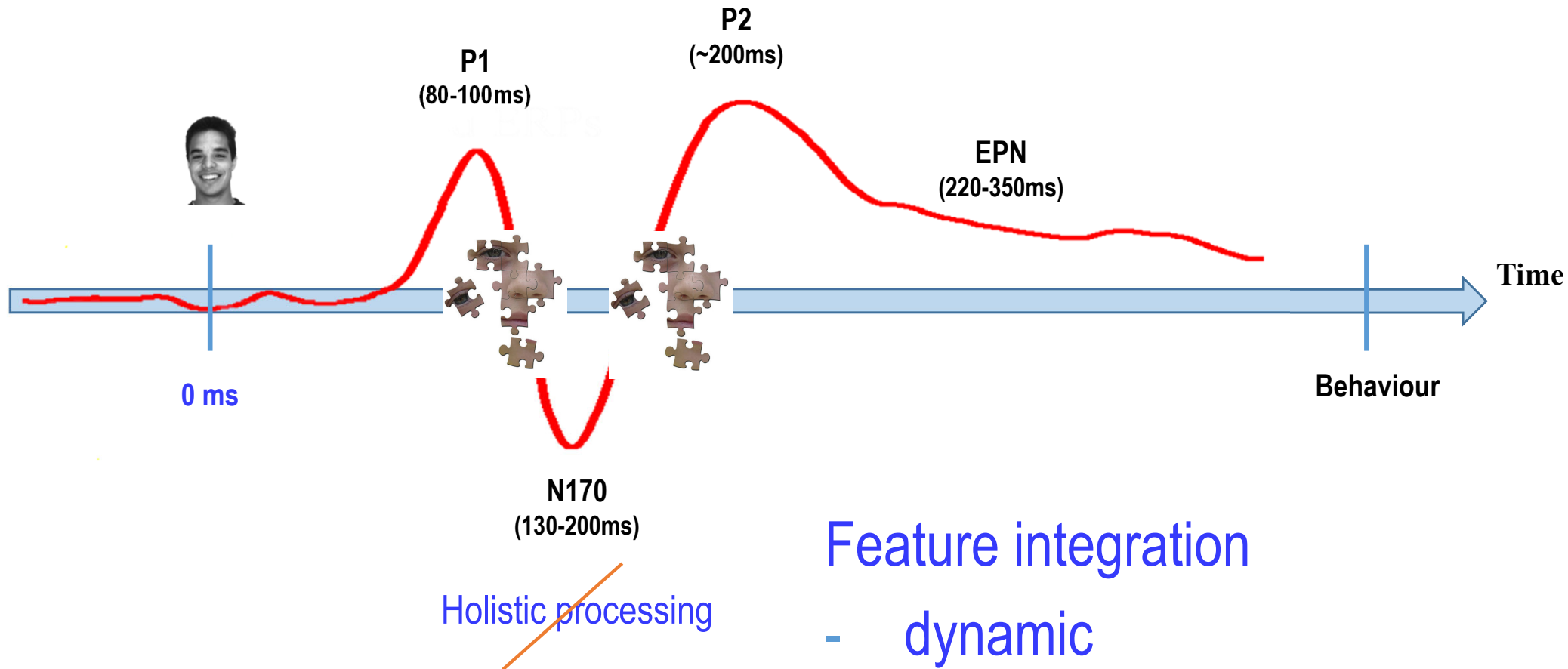
### **Effect of fixation location**

- massive and widespread
- special role of Nasion fixation
- Independant of task demands
- Interacts with orientation
- Interacts with expression (?)

### **Effect of emotion**

- Independant of task demands

# Face processing time course



## Feature integration

- dynamic
- protracted
- fixation/view-dependant

## **Conclusions:**

- 1. there exists an eye-region detector in the human brain**
- 2. eyes play a fundamental role during face coding**
- 3. feature integration into a face percept depends on where on the face one fixates and is protracted (not done at 170ms)**
- 4. extraction of emotional cues is largely independent of attentional task demands during the early stages of processing**

# Thank you!

## Face perception and social cognition Lab (FaceLab)



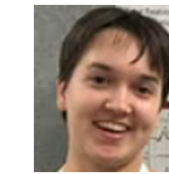
Karly Neath



Amie Durston



James  
Siklos-Whillans



Calla Mueller



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