# Actividade #2

# Mistérios da Luz e da Côr

## Sessão #4

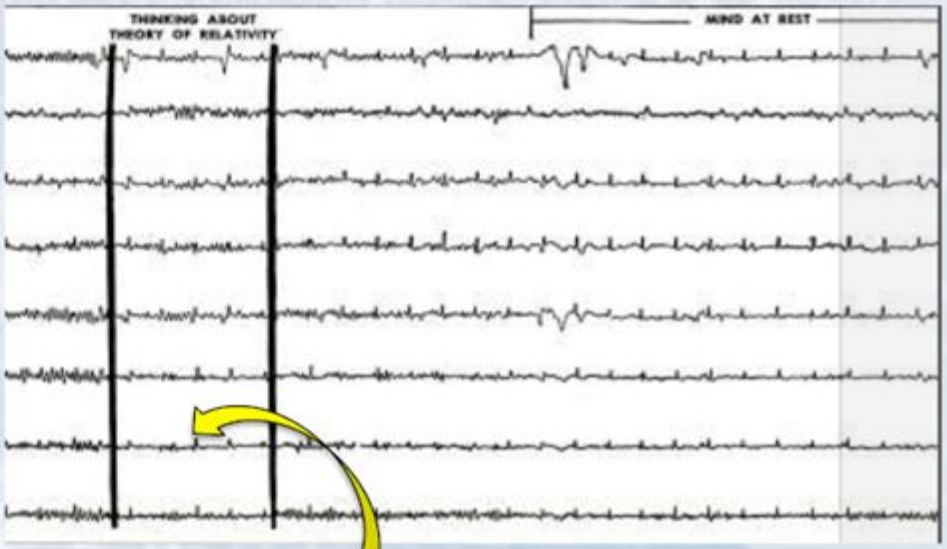
Grupo MCB, CIBIT, UC

Escola EB2+3 Martim de Freitas, Coimbra
2020/30

Marta Teixeira

Cofinanciado por:

# Um Pouco de história....

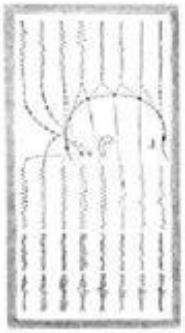



## EINSTEIN'S BRAIN WAVES

They are charted to learn how a genius thinks


*Life Magazine reporting on the brain waves of the theory of relativity. [From Life International Magazine, April 9, 1951, pp. 44–45*

Actividade eléctrica de um cérebro ‘normal’



NORMAL BRAIN made these waves. The circles indicate the positions of the electrodes.

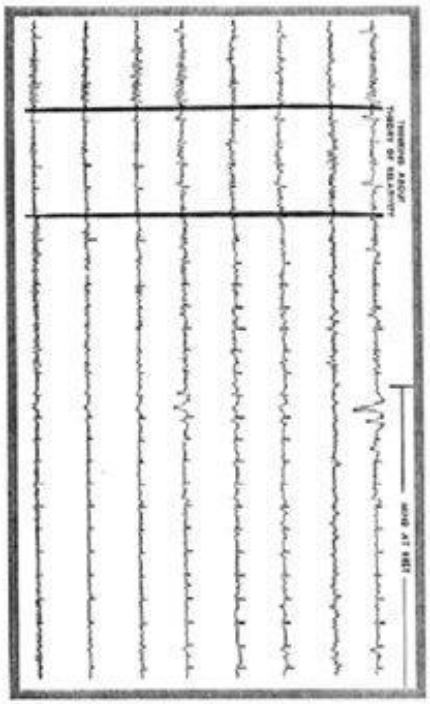
Artigo original, Revista Life, 1941

SCIENCE

# EINSTEIN'S BRAIN WAVES

## They are charted to learn how a genius thinks

The world's greatest living genius lay on a cot in Princeton as metal electrodes were attached to his scalp, up his nostrils and against his eardrums. Albert Einstein was serving as a guinea pig for some experiments on the brain. The experimenters wanted to learn what mysterious action in the brain of a genius allows him to solve problems too complex for an average man. To chart the brain waves, they measured electric currents that pulse through the brain, recorded them in the form of a graph. How the brain works is shown by the frequency, height, grouping of the recorded waves. After comparing Einstein's brain waves (right) with those of ordinary people (above), they offered their theory: that in the genius many separate groups of brain cells work on a problem at once. Then his mind tunes in on one group of cells after another in rapid succession, scanning the entire brain for the correct answers like a radar search antenna scanning the sky for planes.




GENIUS BRAIN of Einstein produced this chart when the scientist was asked to think about relativity, then to relax and make his mind become blank. Patterns of waves show how all portions of his brain behaved during period of concentrated thinking, then how activity tapered off into relaxation.

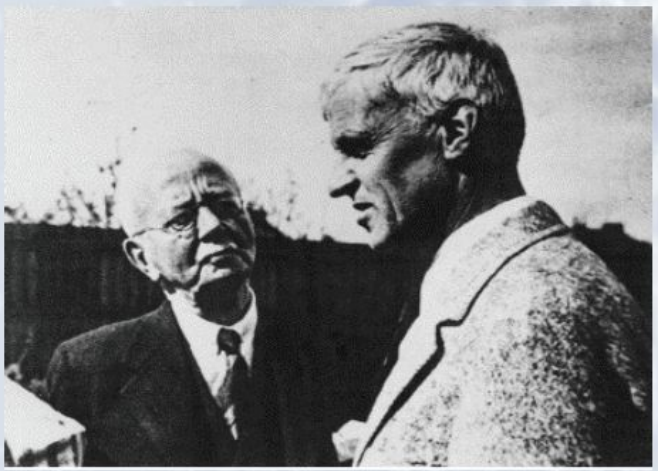
ELECTRODE IS ATTACHED to Einstein's forehead by a brain specialist in order to pick up the brain's tiny electrical impulses, magnify and record them for study. As many as 16 electrodes at a time are sometimes used to give eight-station charting simultaneous action going on in various parts of brain.

Registo da actividade do Einstein

# Um Pouco de história….

Em 1924, o Sr Hans Berger gravou o primeiro EEG

**Hans Berger (1873 –1941)**



**Charles Sherrington and E.D. Adrian in 1938**

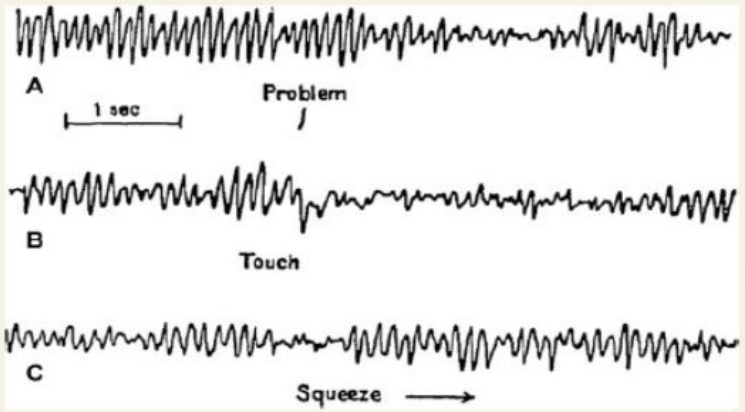
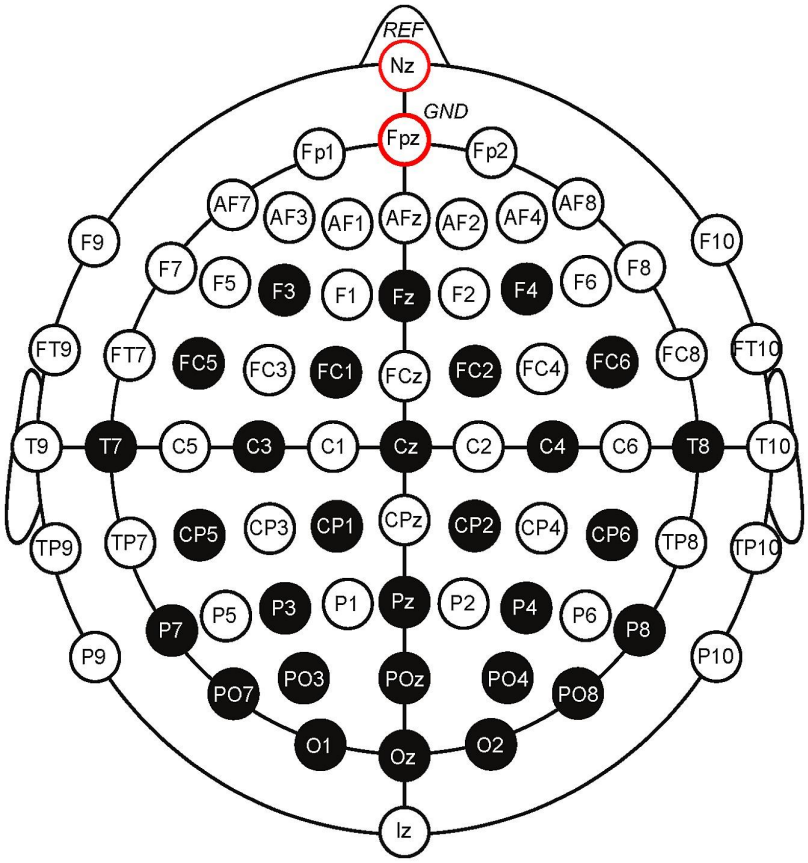



Figure 5 Abolition of the rhythm by non-visual activities. (A) E.D.A. Eyes closed. Problem in mental arithmetic given at signal. (B) W.H. Eyes closed. Touch on the nose with cotton wool. (C) Persistence of rhythm in spite of muscular effort. W.H. Eyes closed, squeezing pliers as tightly as possible.

Finkler, 1930: ***"Today the brain writes in secret code, tomorrow scientists will be able to read neuropsychiatric conditions in it, and the day after tomorrow we will write our first authentic letters in brainscript."***

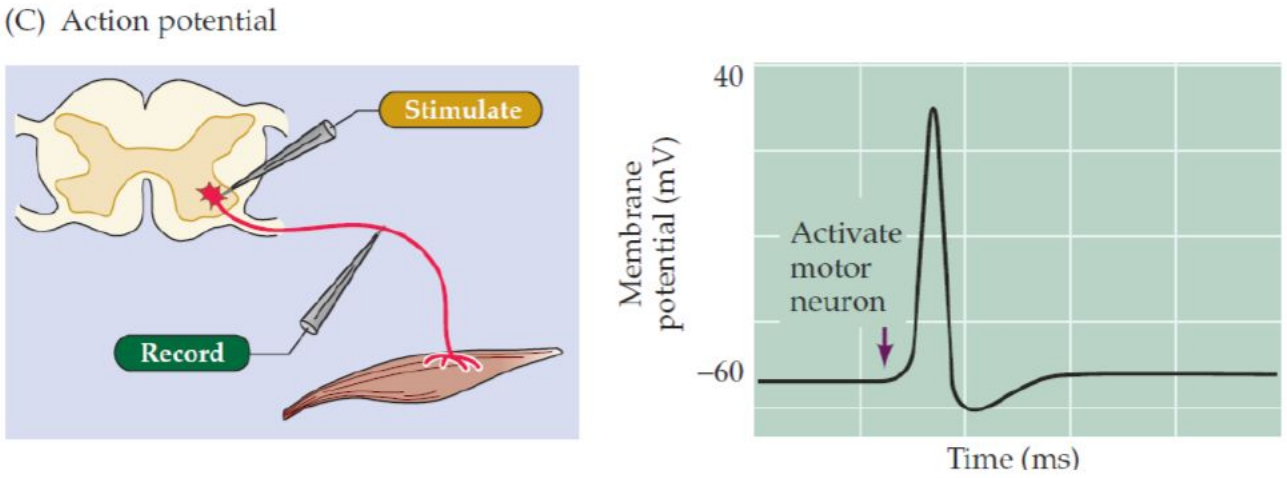
https://www.youtube.com/watch?v=B10pc0Kizsc&feature=emb_logo

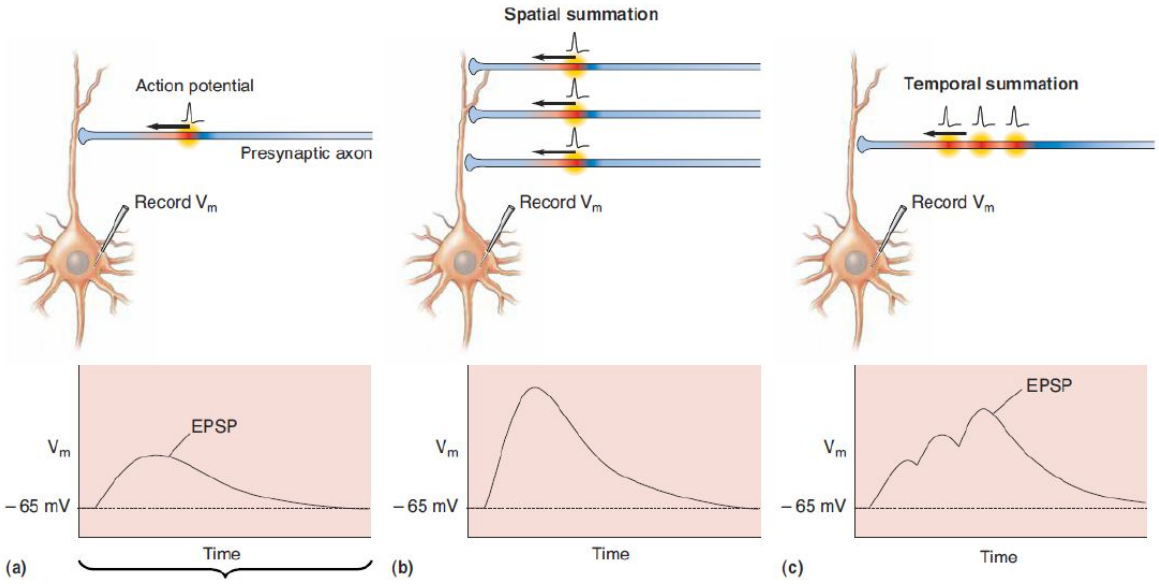



# ***EEG***: Registo dos potenciais eléctricos gerados pelo cérebro

# Neural basis of the EEG

**Origem Neuronal do sinal de EEG**



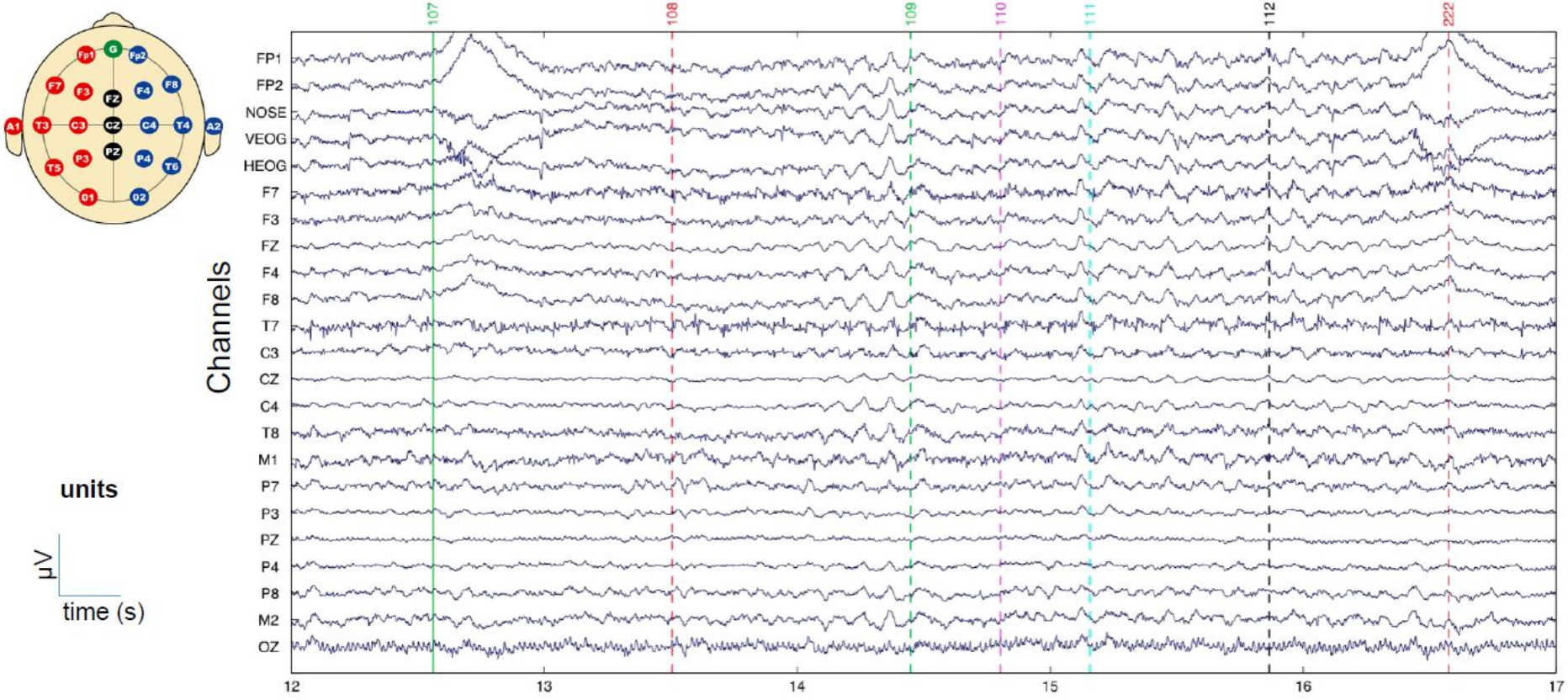




Potenciais pós-sinápticos somam-se dando origem a um sinal mais forte!

Purves 2004 Neuroscience

# Exemplo de um traçado de EEG

Continuous EEG recording



# Sinais bioeléctricos – os ritmos do cérebro

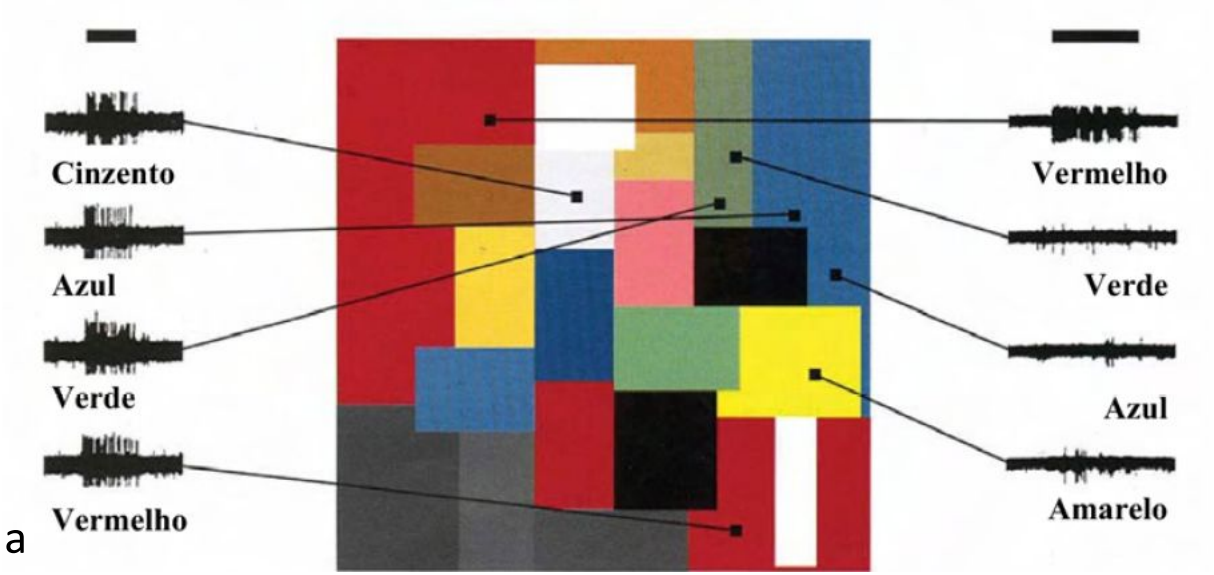

**Figura 2.** As ondas cerebrais e seus ritmos (ciclos por segundo).

O ritmo das ondas equivale ao número de ciclos por segundo que, por sua vez são respostas a vários tipos de fenómenos eletrofisiológicos, refletindo várias operações mentais

# Como podemos medir a côr no cérebro?

- Córtex Visual ⟷ Células sensíveis à cor.
- Alguns neurónios expressam padrões de actividade distinta, quando estimulados por diferentes comprimentos de onda de luz. Alguns respondem melhor a comprimentos de onda longos, outros a curtos.

Célula de V1




Célula de V4

- Não reconhece a cor
- responde à mistura idêntica de comprimento de onda em cada elemento do mosaico.

- V4 dispara na área vemos como vermelho
- Dispara menos nas outras cores

V4 pode assim constituir a área do cérebro responsável pela percepção da cor, embora haja neurocientistas que pensam que esta não é a única área envolvida no processo.

Neuroscience: The Science of the Brian, IBRO 2005 (Portuguese version)

# Como podemos medir a **côr** no cérebro?

**Current Biology**
Volume 18, Issue 6, 25 March 2008, Pages R250-R251

Dispatch

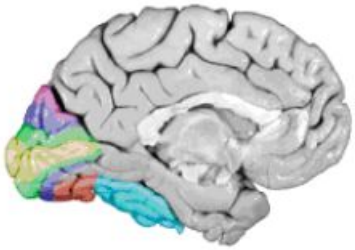
## Colour Vision: Cortical Circuitry for Appearance

Brian Wandell

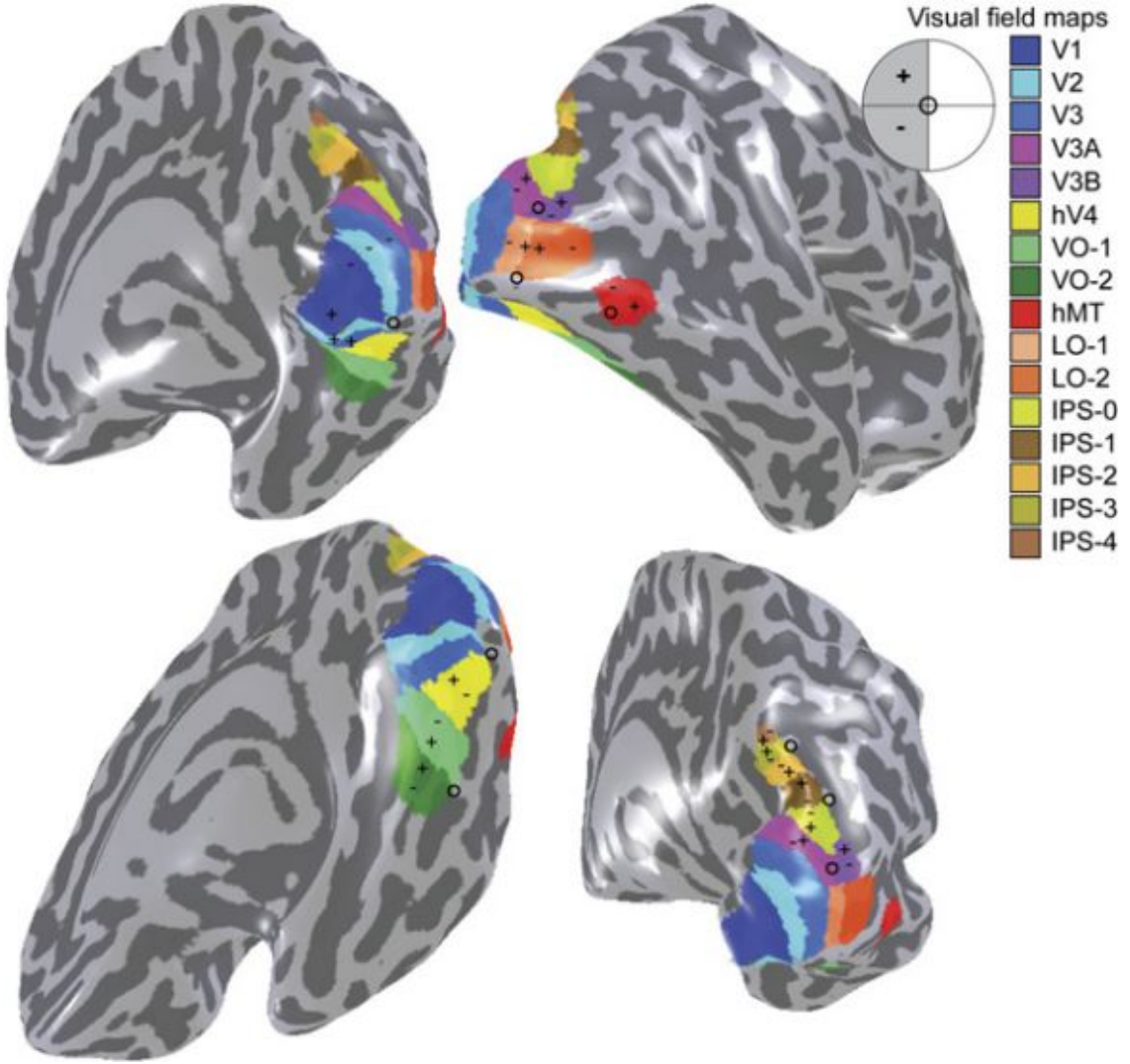


https://doi.org/10.1016/j.cub.2008.01.045





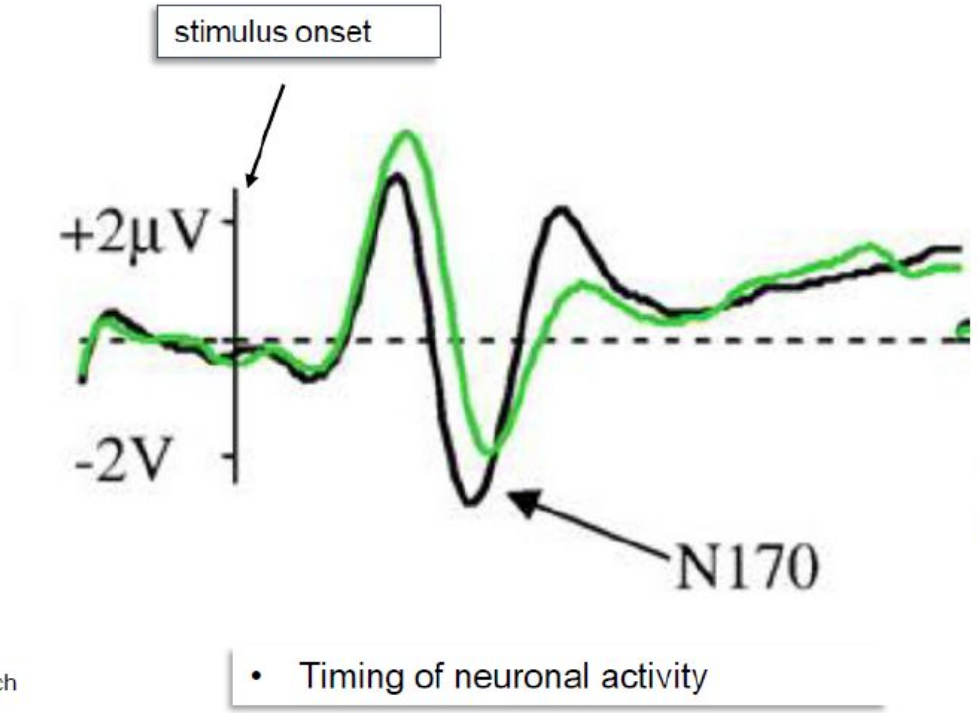
Composto por 4 a 6 biliões de neurónios, organizados em mais de uma dúzia de áreas funcionais distintas

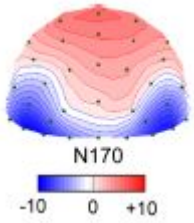


# Potenciais Evocados em Neurociências - ERPs (event related potentials)



Flevaris et al 2008 Brain Research

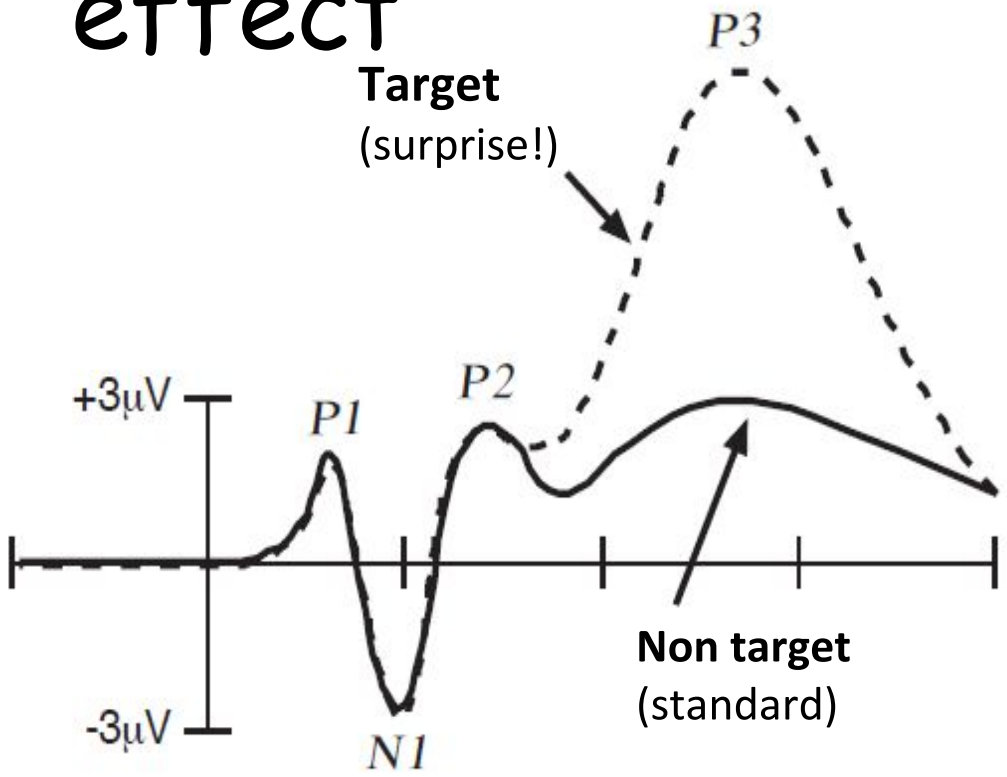



- ERPs são pequenas voltagens geradas pela actividade neuronal em algumas estruturas do cérebro, em resposta a estímulos específicos

- Cada um desses estímulos provoca a emissão de sinais eléctricos que viajam ao longo dos nervos e são captados por eléctrodos e interpretados

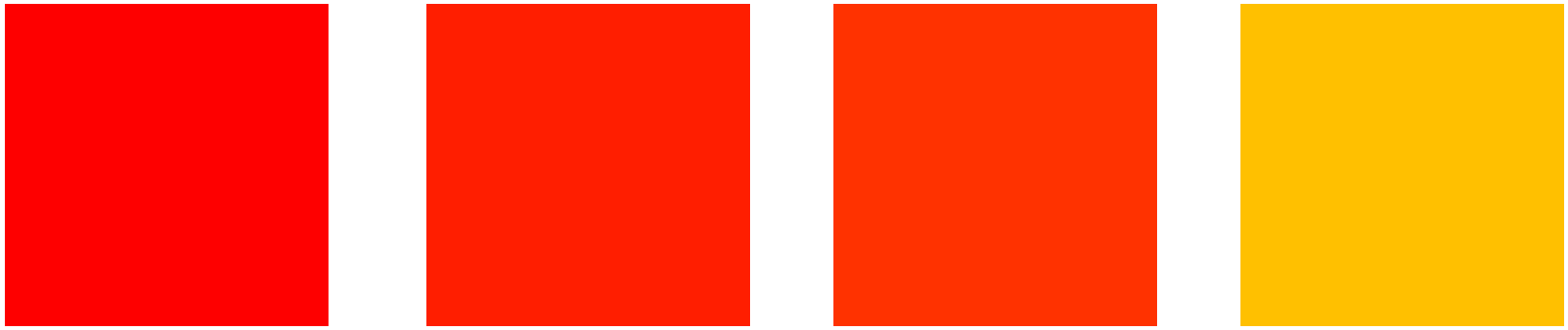
# P300 - Oddball effect

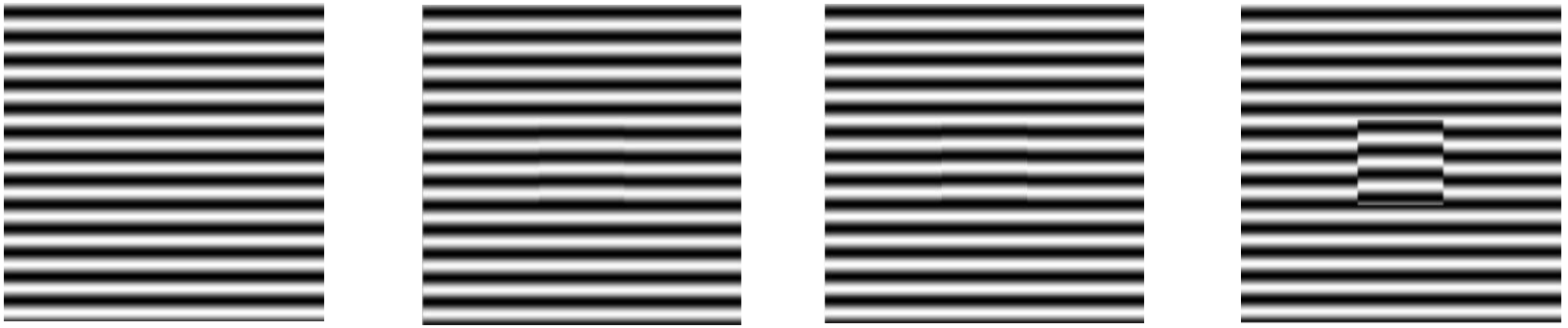




Até aos 100 ms – **componentes sensoriais ou exógenos** – dependem dos parametros físicos do estímulo

> 100 ms **- cognitivos ou endógenos** – reflectem a forma como as pessoas avaliam e examinan a informação

# Experiência 1

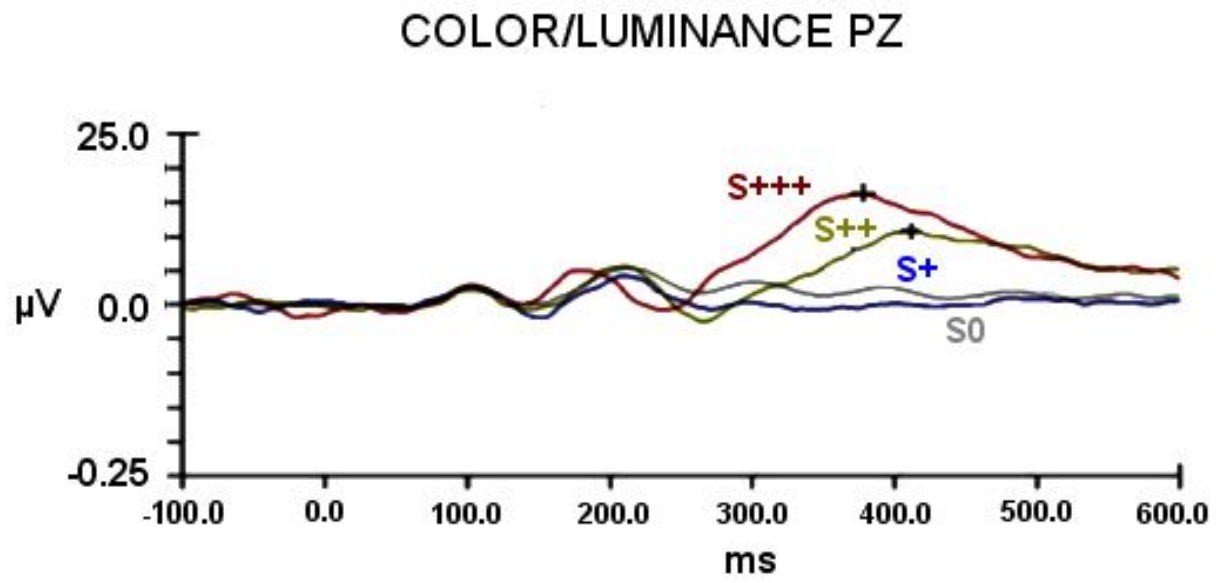


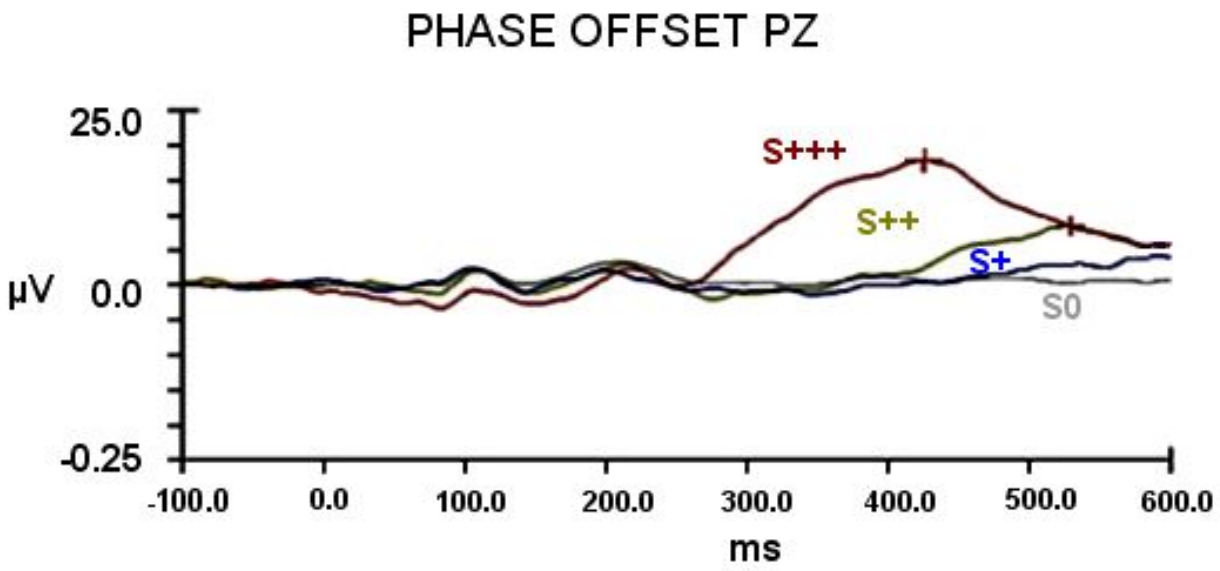




ESTÍMULOS

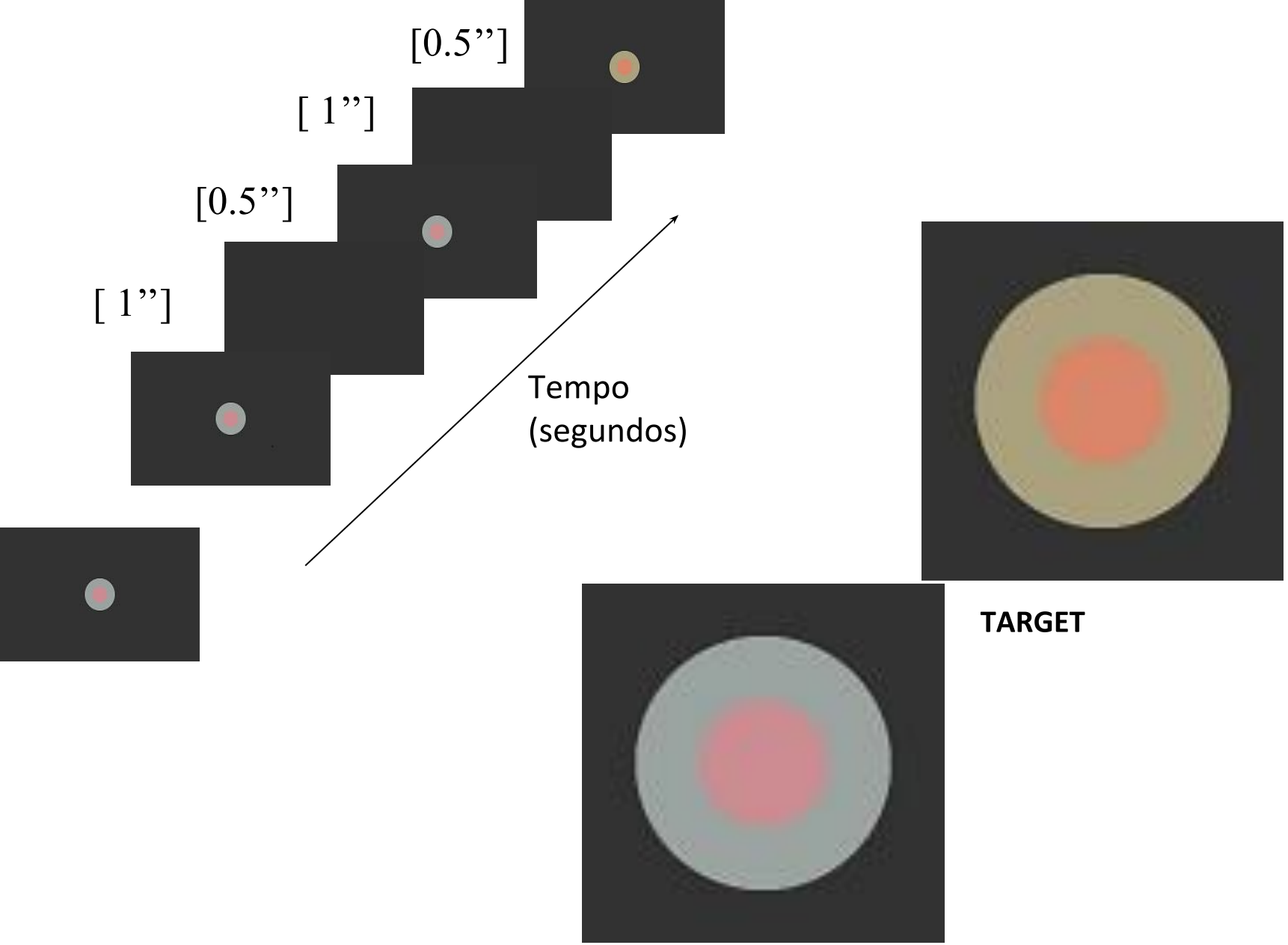
**3 níveis de saliência (gradação do vermelho ao amarelo)**

Teixeira M.,*et al*. (2014) *PLoS ONE*, 9 (1) , art. no. e86201

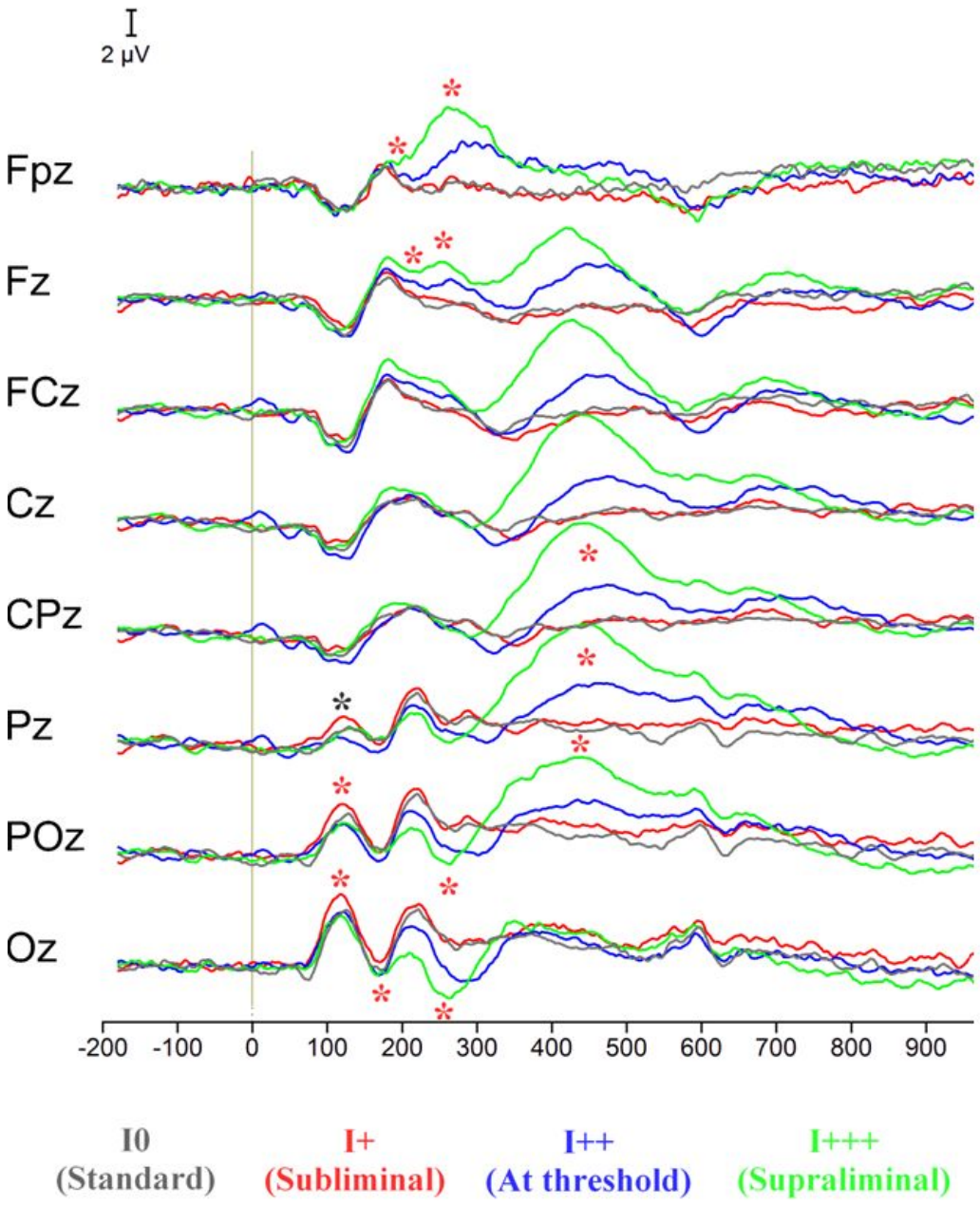


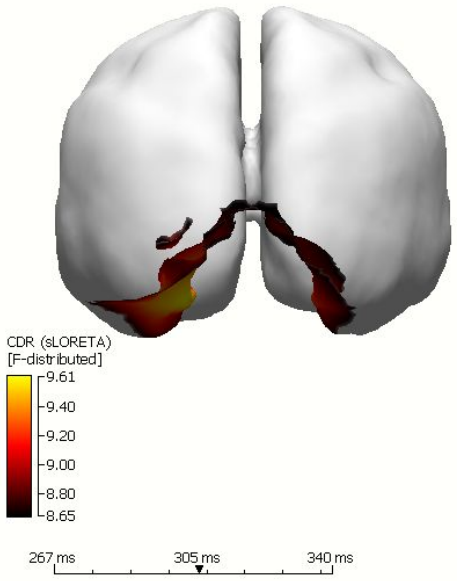



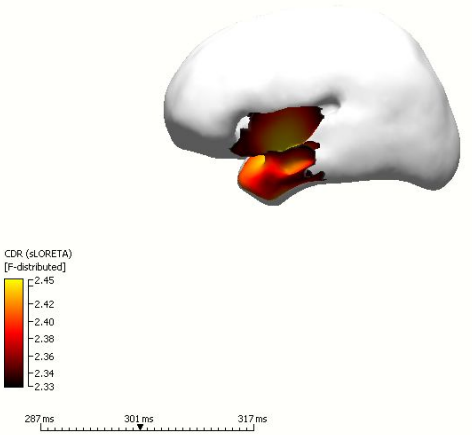

Teixeira M.,*et al*. (2014) *PLoS ONE*, 9 (1) , art. no. e86201


[0.5”]
[ 1”]
[0.5”]
[ 1”]
Tempo
(segundos)
TARGET
STANDARD

(Re)Referenced to Ear-Lobes



# Clube Ciência Viva - Escola Martim de Freitas

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