

Actividade #2

Mistérios da Luz e da Cór

Sessão #4

Grupo MCB, CIBIT, UC

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

Marta Teixeira

Um Pouco de história....



EINSTEIN'S BRAIN WAVES

They are charted to learn how a genius thinks



Thinking about theory of relativity

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'

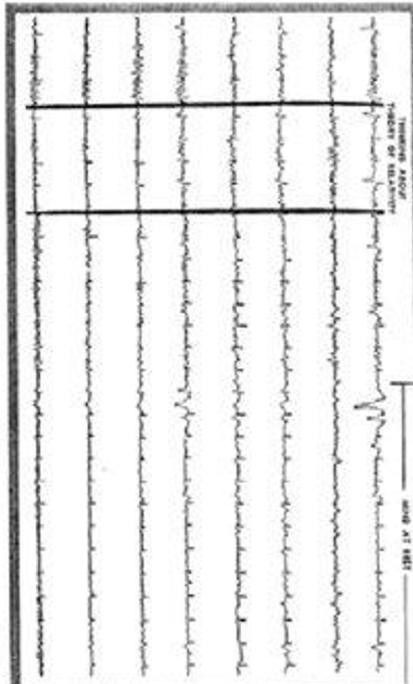


NORMAL BRAIN made these waves. The circles indicate the positions of the electrodes.

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's medical electrodes were attached to his scalp, up his nostrils and against his eyebrows. Albert Einstein was serving as a guinea pig for some experiments on the brain. The experimenters wanted to learn what mechanism in the brain of a genius allows him to solve problems far simpler 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 brainwaves (right) with those of ordinary people (below), they offered their theory: that in the genius many separate groups of brain cells work on a problem at once. Then his mind moves to 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 "severe. 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.



Rest for study. As many as 16 electrodes at a time are sometimes used to give eight curves showing simultaneous action going on in various parts of brain.

Artigo original, Revista Life, 1941



←
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

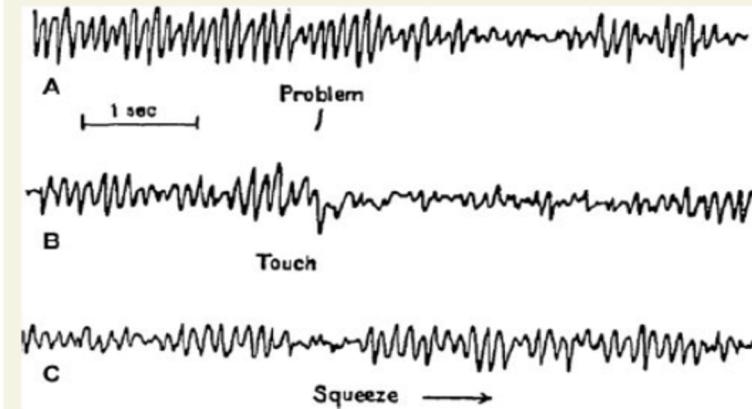
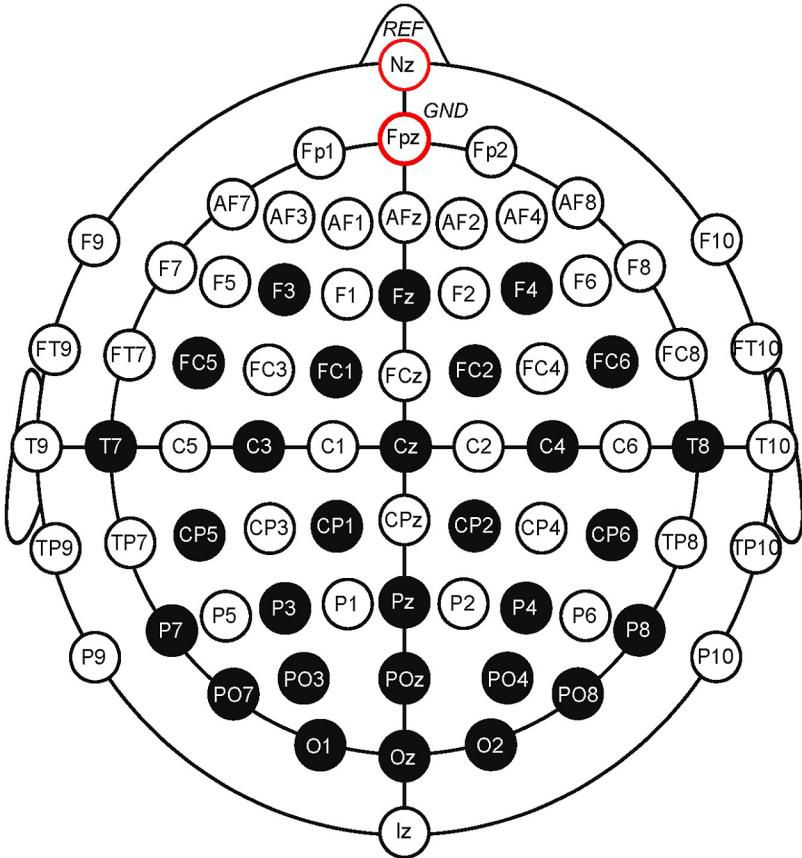


Figure 5 Abolition of the rhythm by non-visual activities.
(A) E.D.A. Eyes closed. Problem in mental arithmetic given at signal. (B) W.H. Eyes closed. Touch on the nose with cotton wool. (C) Persistence of rhythm in spite of muscular effort. W.H. Eyes closed, squeezing pliers as tightly as possible.

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



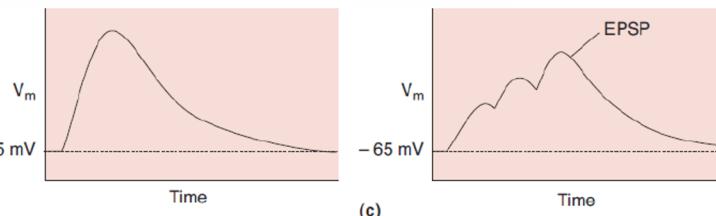
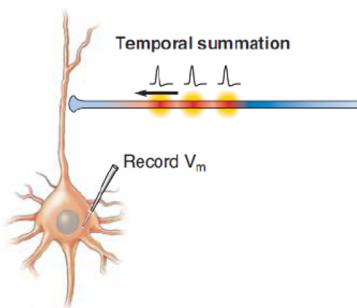
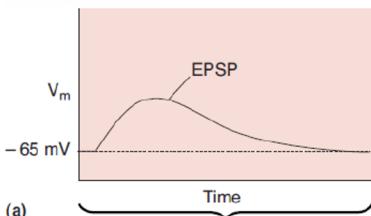
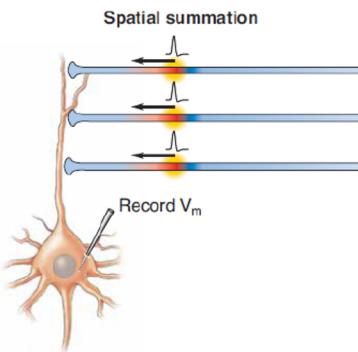
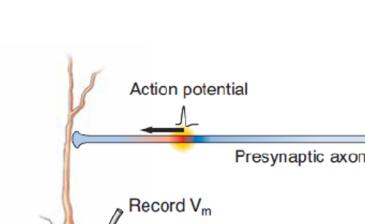
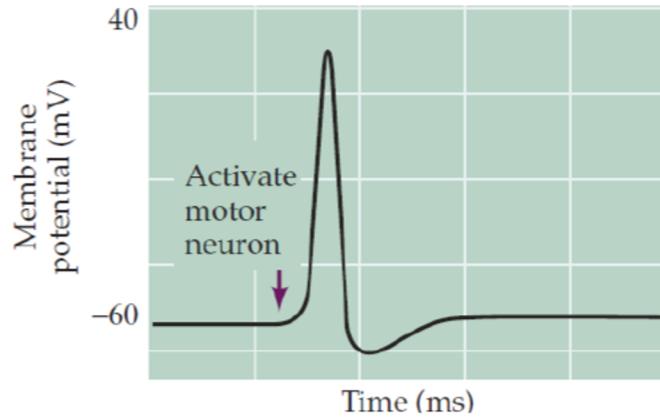
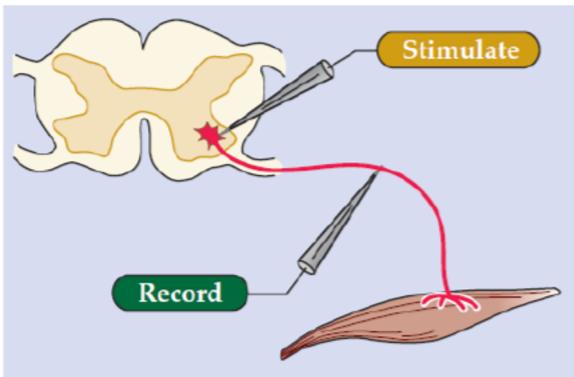
EEG: Registo dos potenciais eléctricos gerados pelo cérebro



Neural basis of the EEG

Origem Neuronal do sinal de EEG

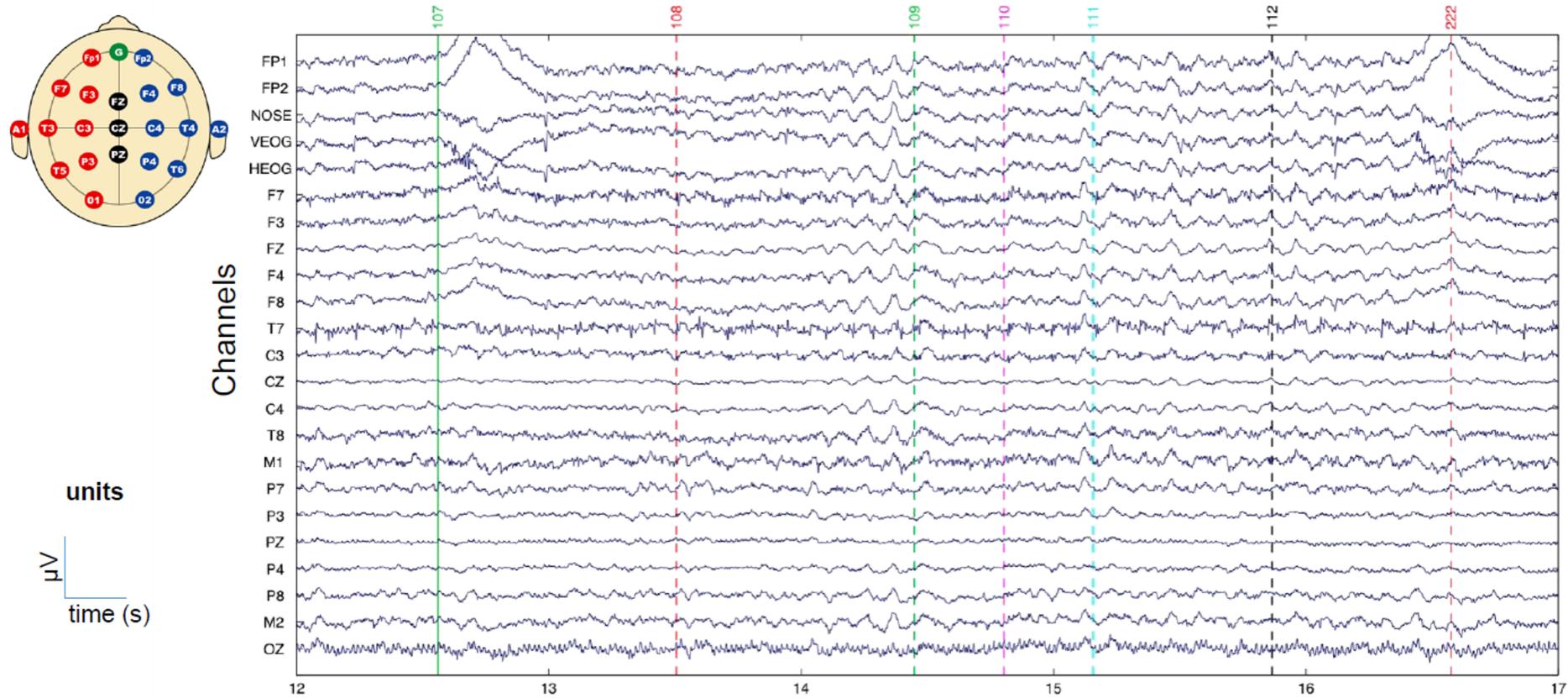
(C) Action potential



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

Exemplo de um traçado de EEG

Continuous EEG recording



Sinais bioeléctricos - os ritmos do cérebro

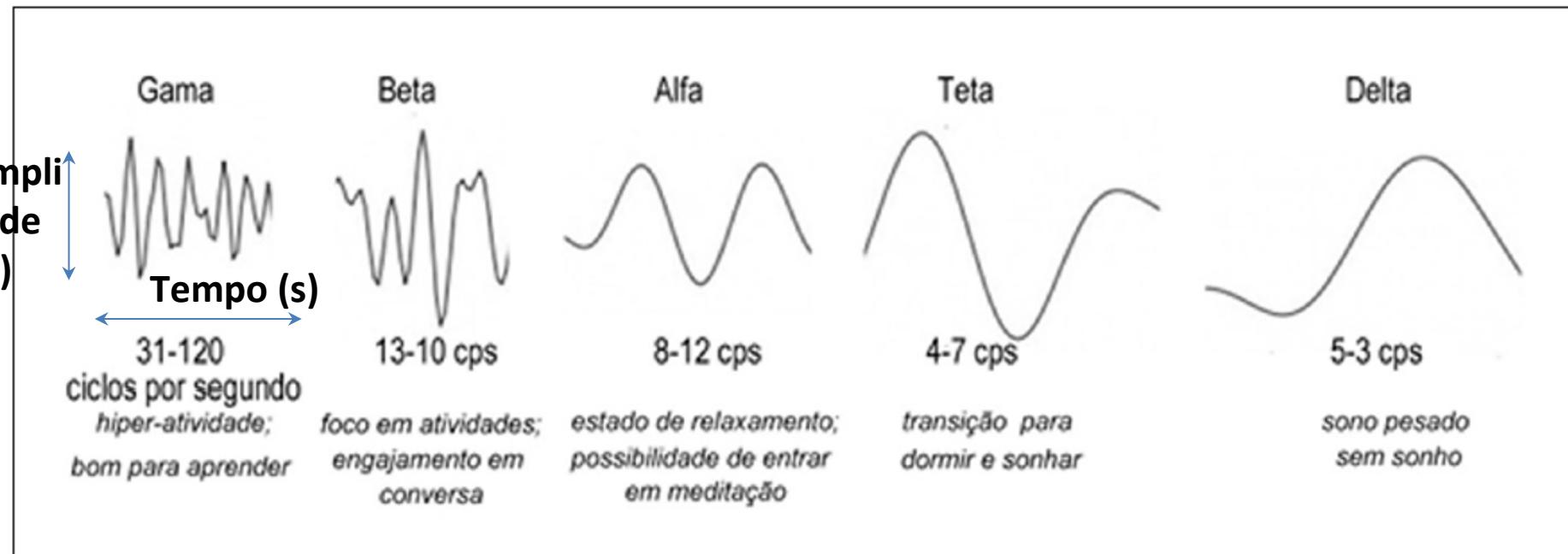
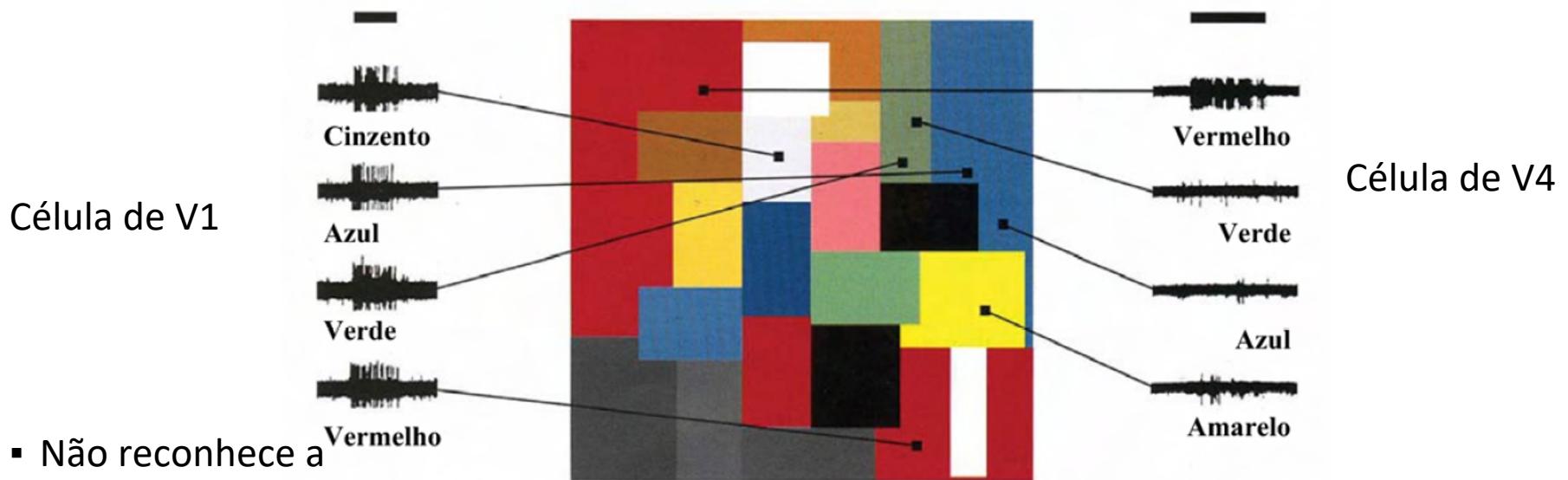


Figura 2. As ondas cerebrais e seus ritmos (ciclos por segundo).

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.



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

- V4 dispara na área vermelha
- 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.

Como podemos medir a cor no cérebro?

Current Biology

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



Dispatch

Colour Vision: Cortical Circuitry for Appearance

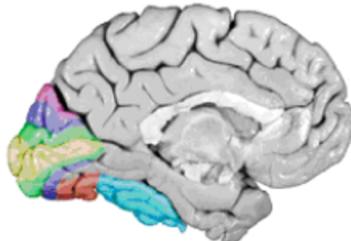
Brian Wandell✉

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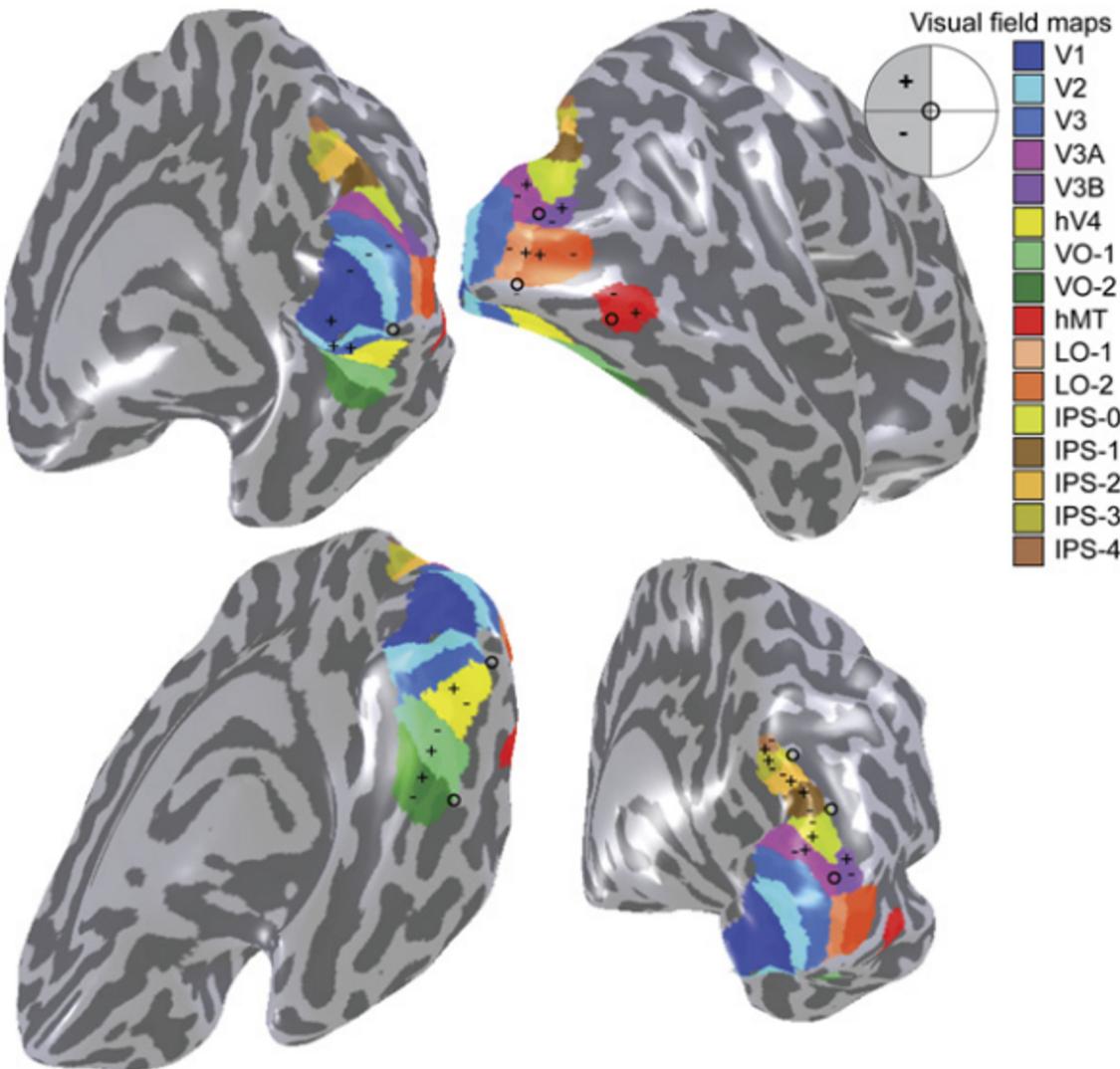
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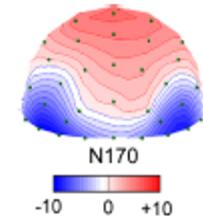
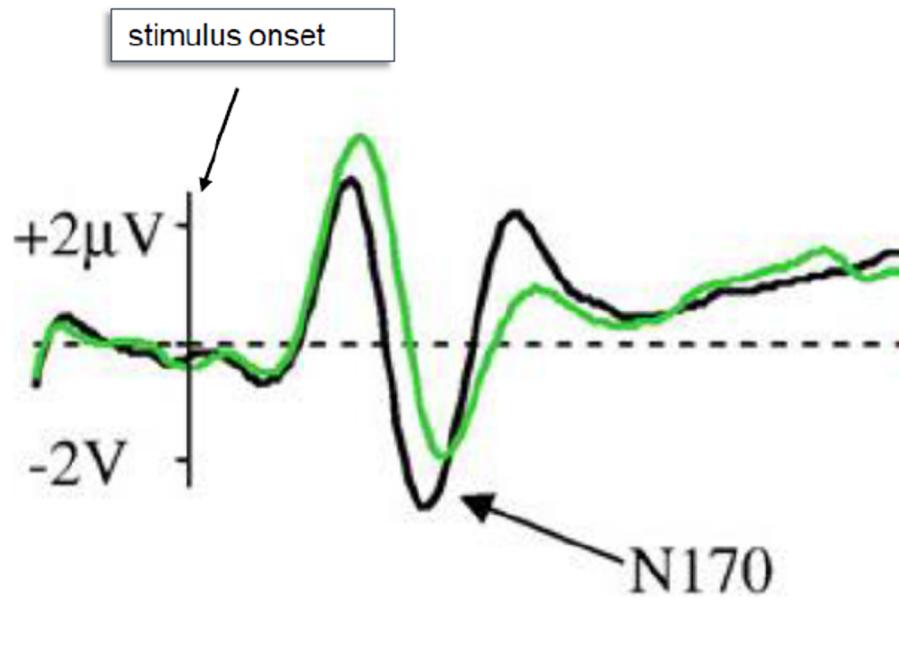
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Composto por 4 a 6 biliões de neurónios, organizados em mais de uma dúzia de áreas funcionais distintas



Potenciais Evocados em Neurociências - ERPs (event related potentials)

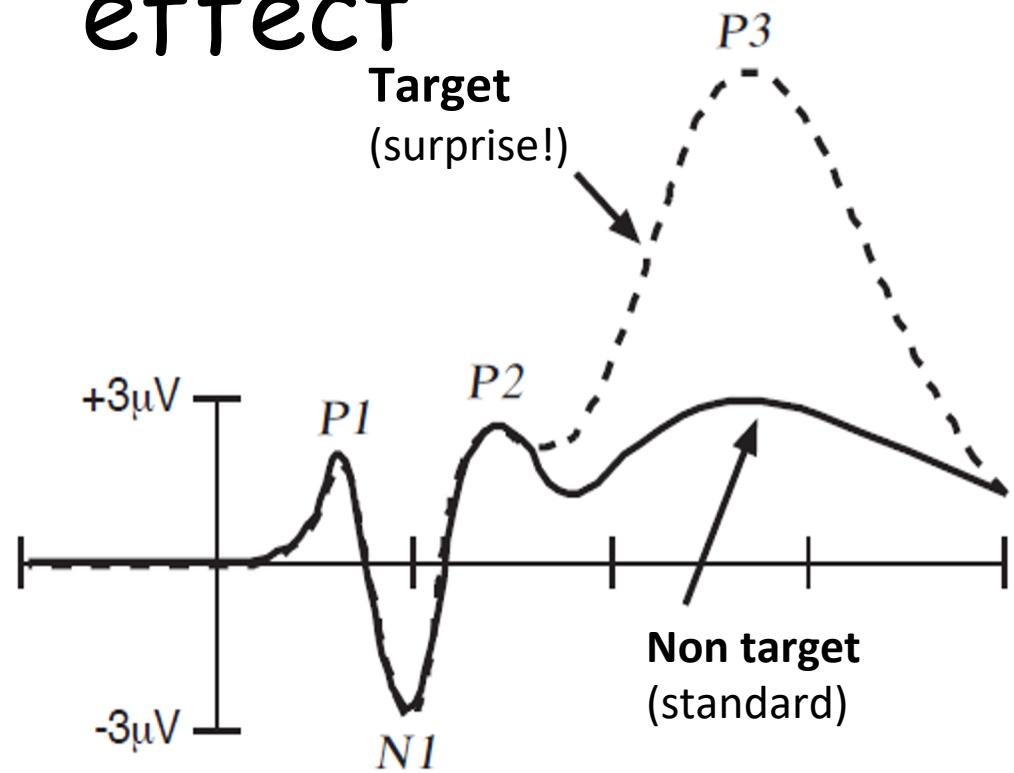


Flevaris et al 2008 Brain Research

- Timing of neuronal activity

- 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

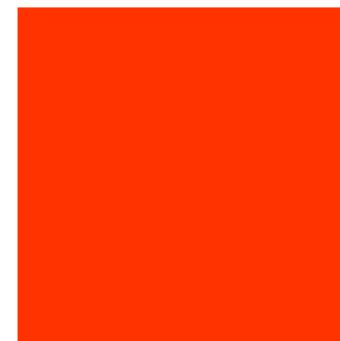
P300 - Oddball effect



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

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

Experiência 1

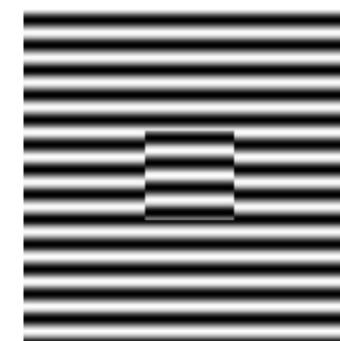


STANDARD

TARGET

TARGET 2

TARGET 3



STANDARD

TARGET 1

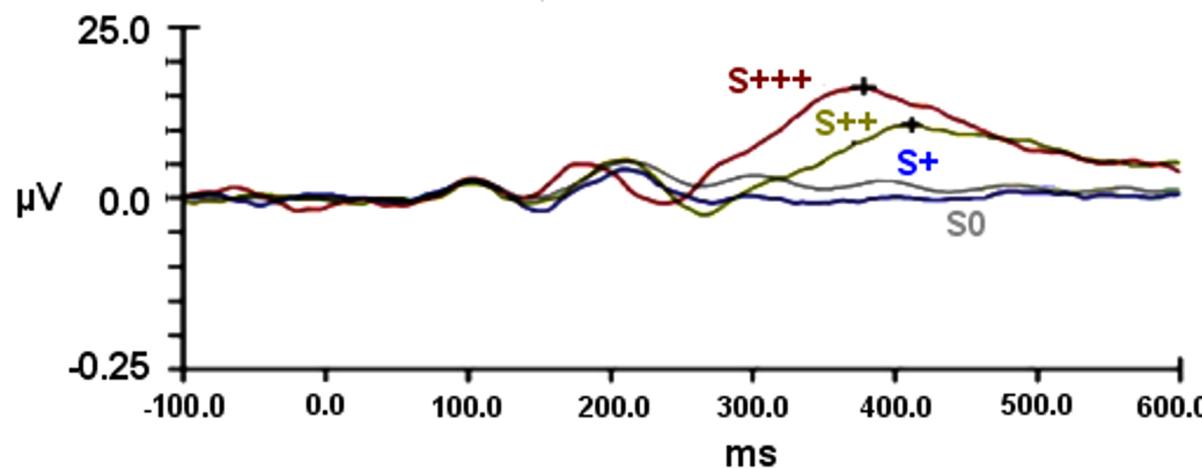
TARGET 2

TARGET 3

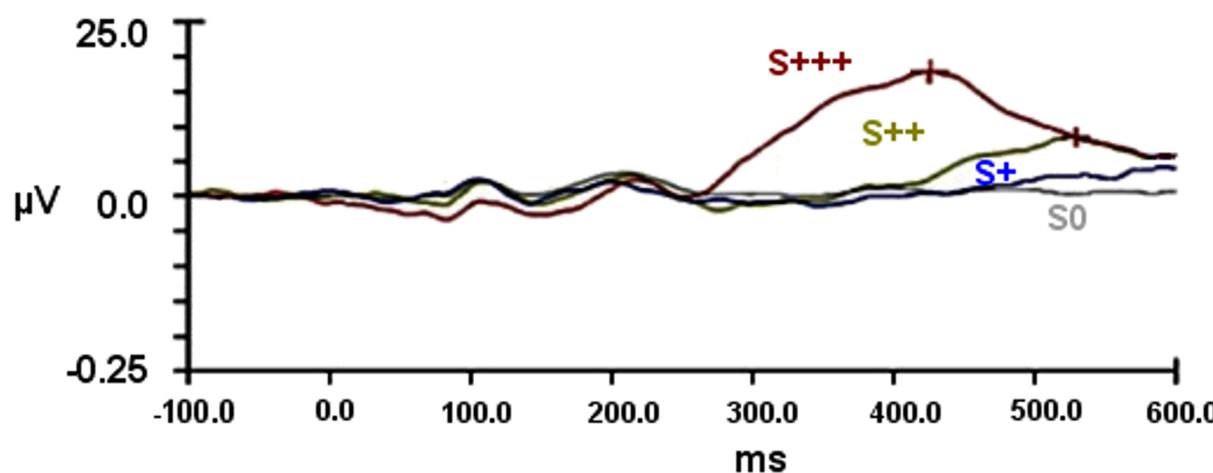
ESTÍMULOS

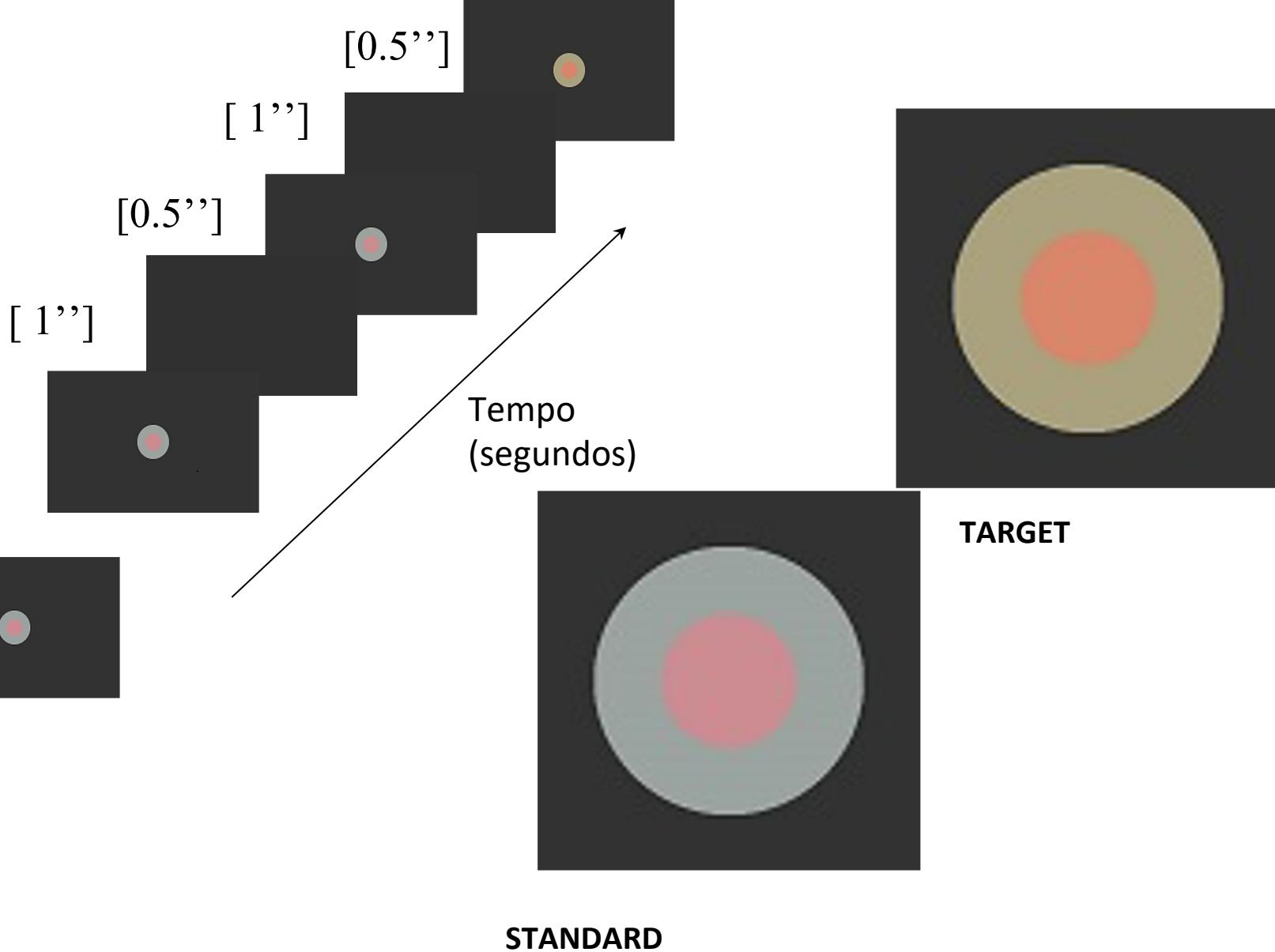
3 níveis de saliência (gradação do vermelho ao amarelo)

COLOR/LUMINANCE PZ

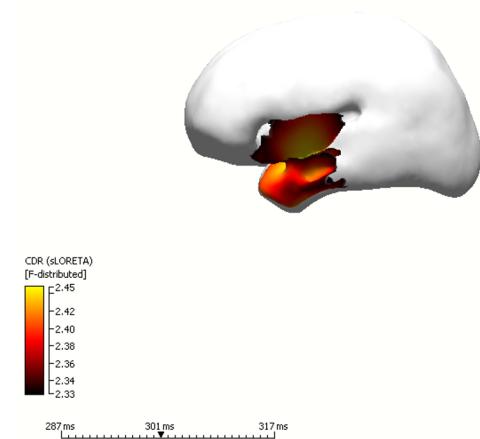
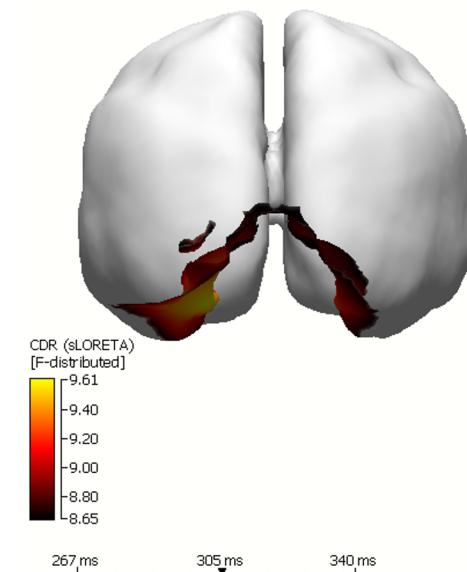
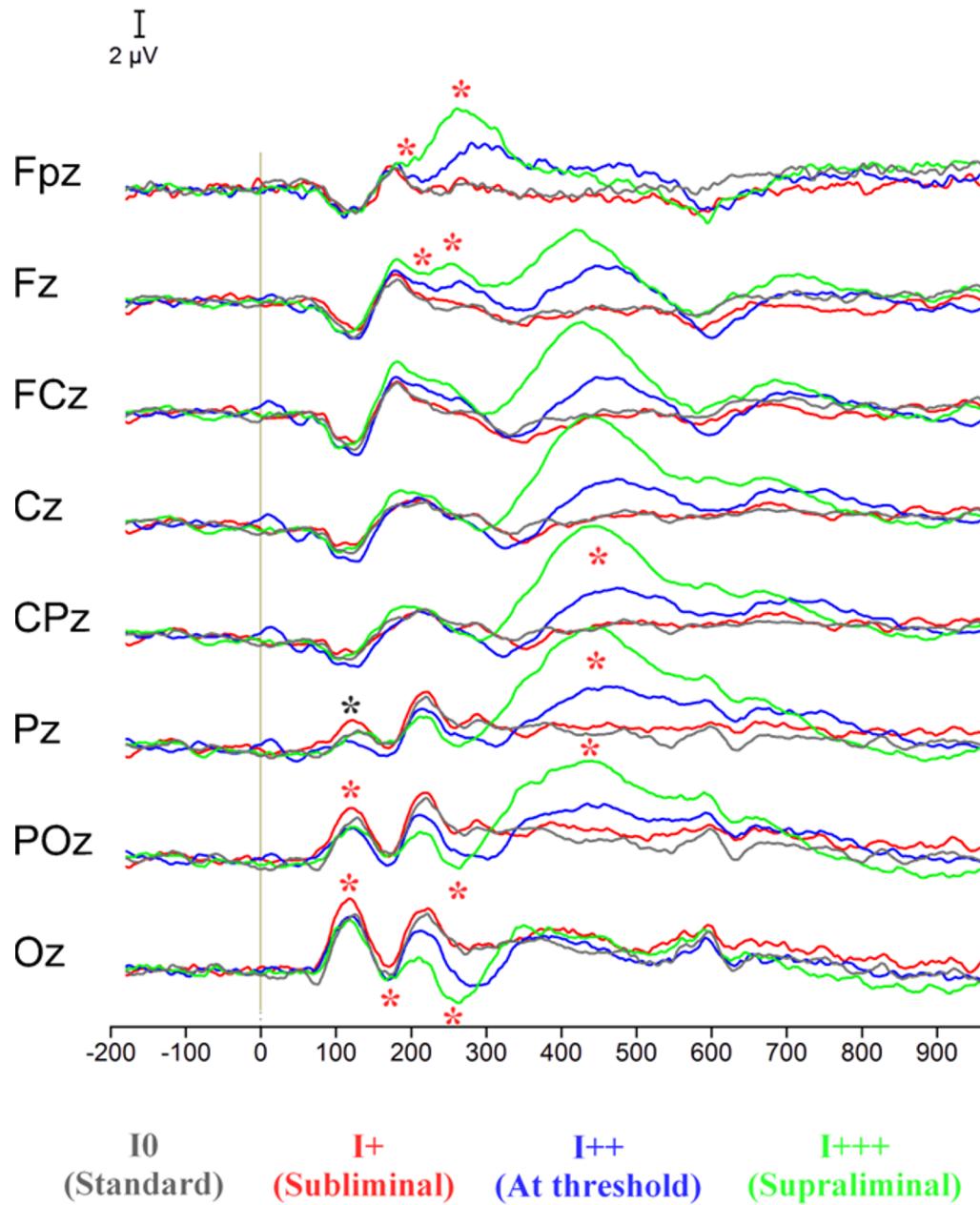


PHASE OFFSET PZ





Teixeira M.,et al. (2020). The conscious experience of color constancy and neural responses to subliminal deviations - A behavioral and EEG/ERP oddball study. Consciousness and Cognition 84. DOI: 10.1016/j.concog.2020.102987



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