

ILUSÕES MULTISSENSORIAIS

O ESPERADO E O INESPARADO NA INTEGRAÇÃO MULTISSENSORIAL

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PORTUGAL

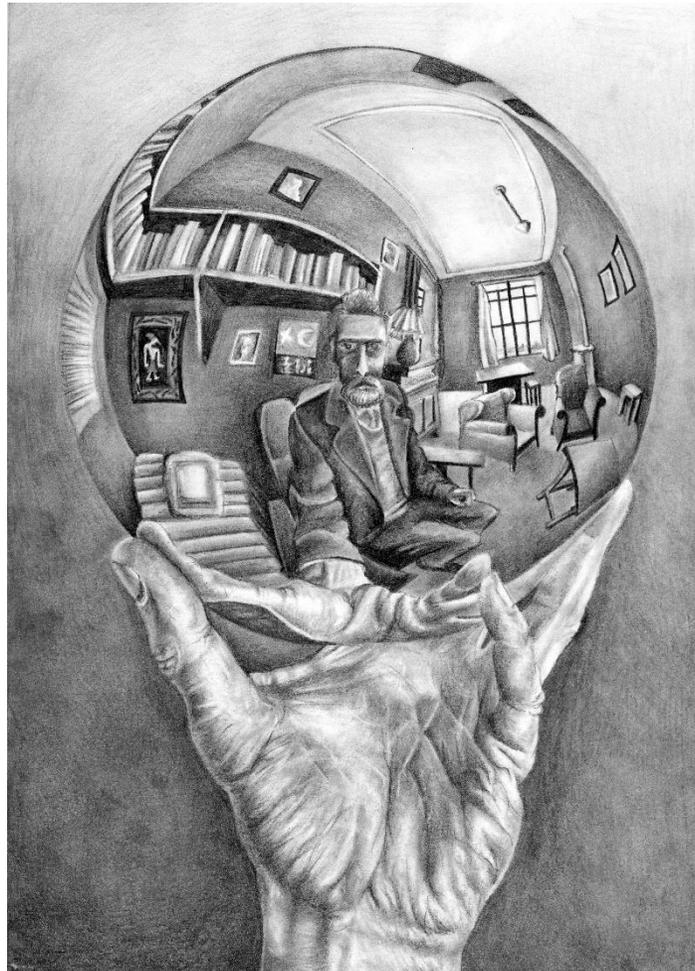
DEPARTAMENTO DE FÍSICA E ASTRONOMIA

FACULDADE DE CIÊNCIAS

UNIVERSIDADE DO PORTO

1 DE SETEMBRO DE 2015

A UNICIDADE DA PERCEÇÃO SENSORIAL

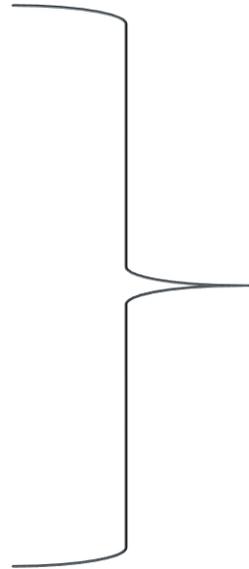


Maurits Elscher, 1935
Hand with Reflecting Globe

MULTISSENSORIAL?...

■ Unisensorial:

- Visão
- Audição
- Tato
- Olfacto
- Paladar



MULTISSENSORIAL?...

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MULTISSENSORIAL?...

■ Unisensorial:

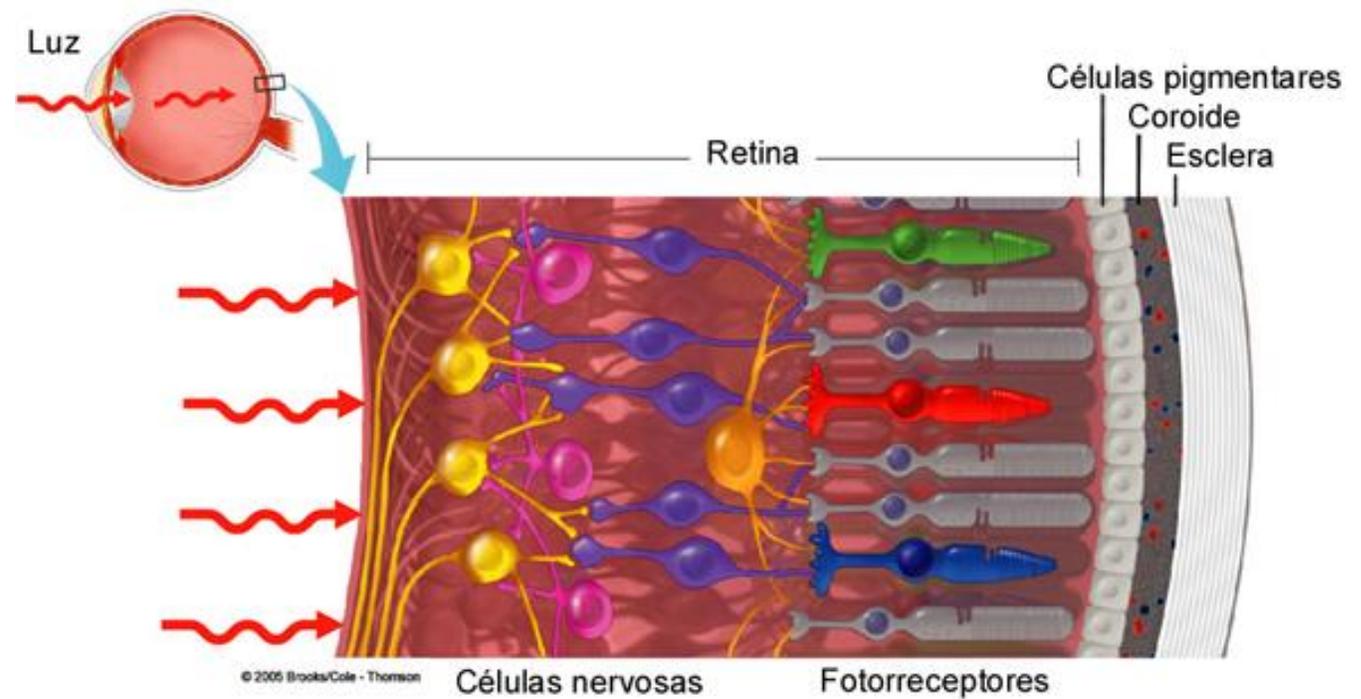
■ Visão

■ Audição

■ Tato

■ Olfacto

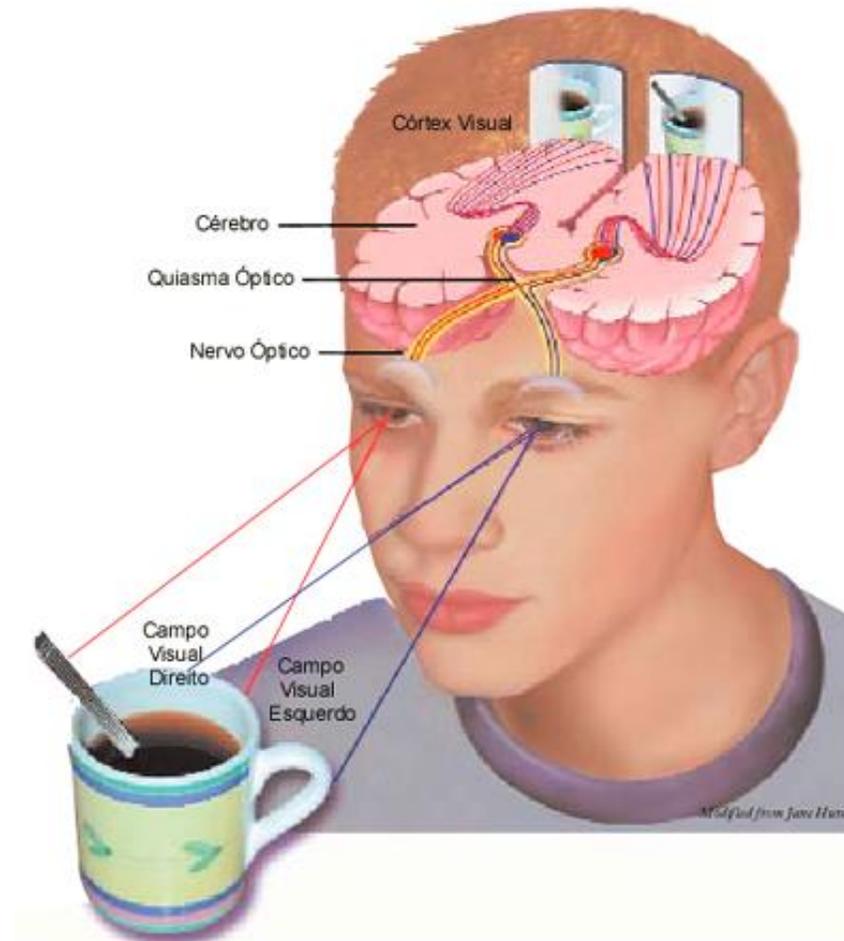
■ Paladar



MULTISSENSORIAL?...

■ Unisensorial:

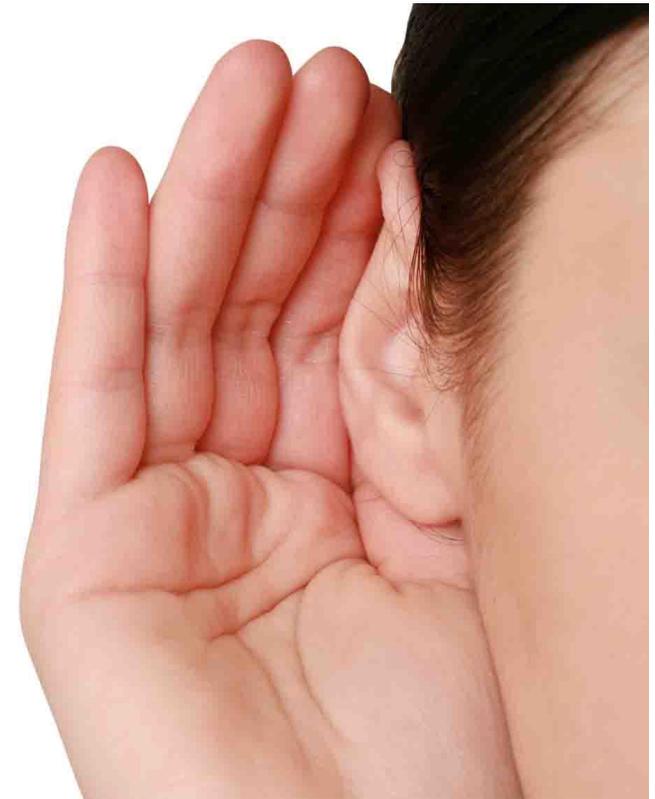
- Visão
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MULTISSENSORIAL?...

■ Unisensorial:

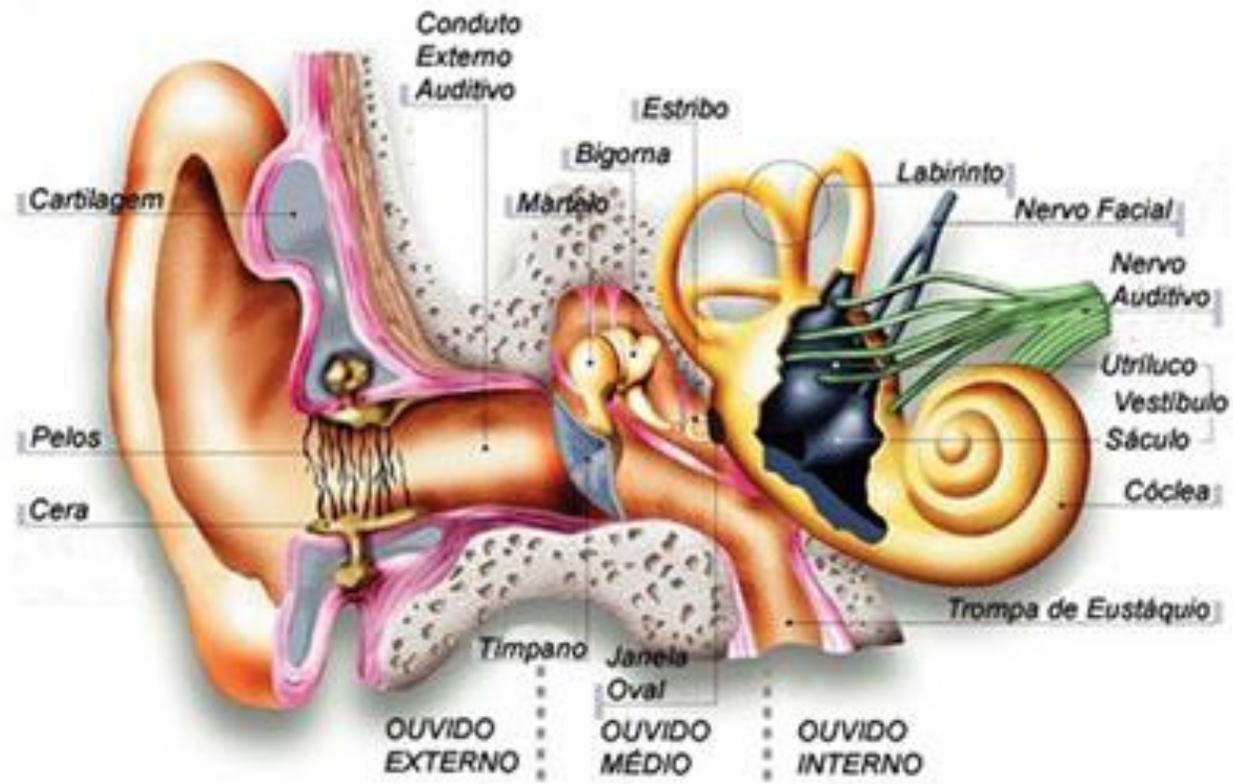
- Visão
- **Audição**
- Tato
- Olfacto
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MULTISSENSORIAL?...

■ Unisensorial:

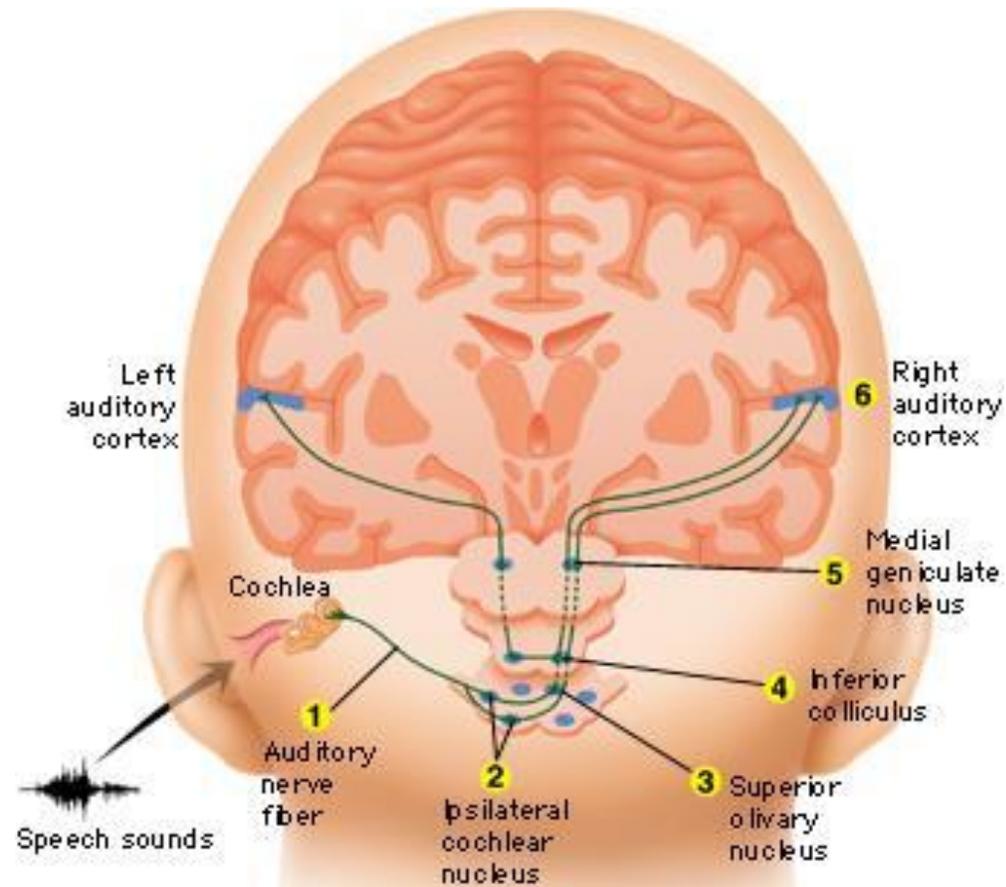
- Visão
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MULTISSENSORIAL ?...

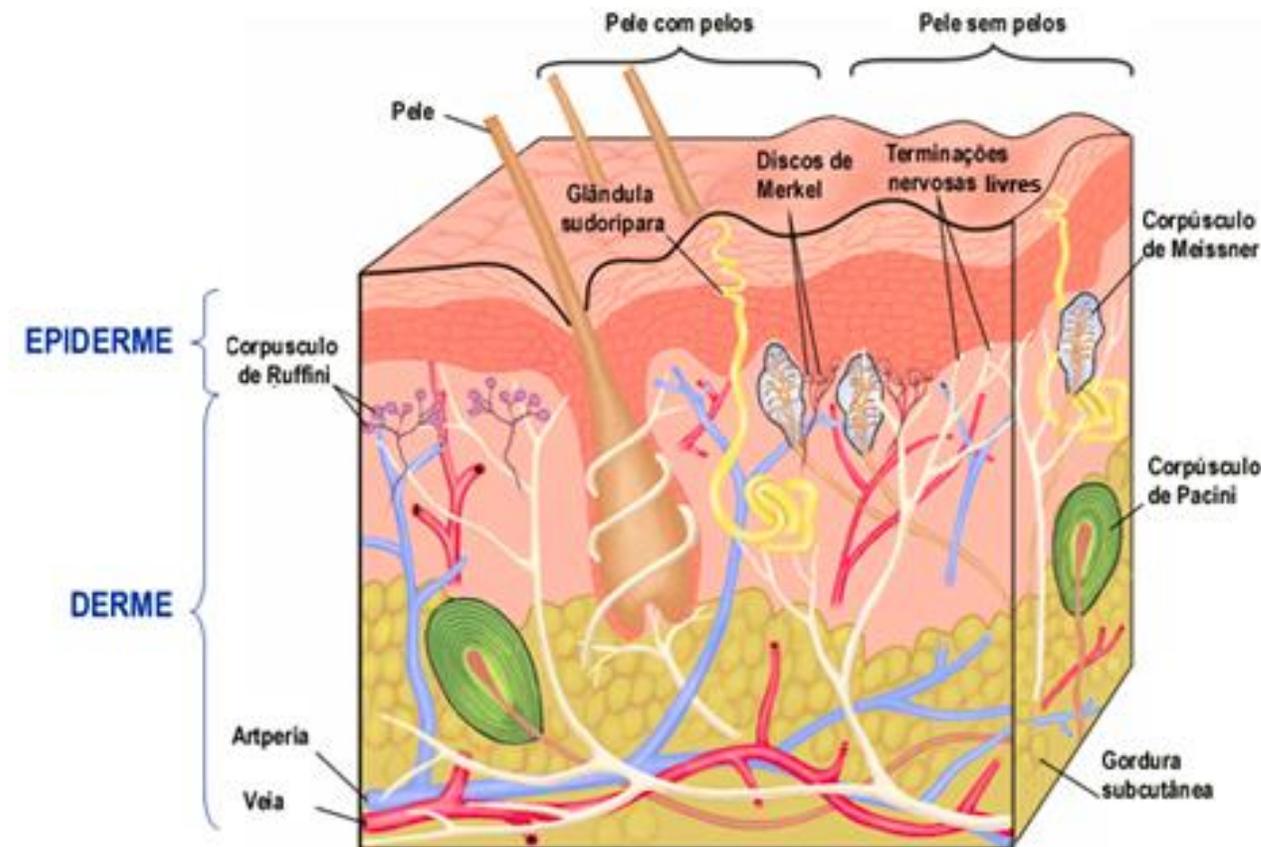
- Unisensorial:
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MULTISSENSORIAL ?...

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Mecanoreceptores

Epiderme (small receptive field)

- Meissner (rápida adaptação)
- Merkel's (lenta adaptação)

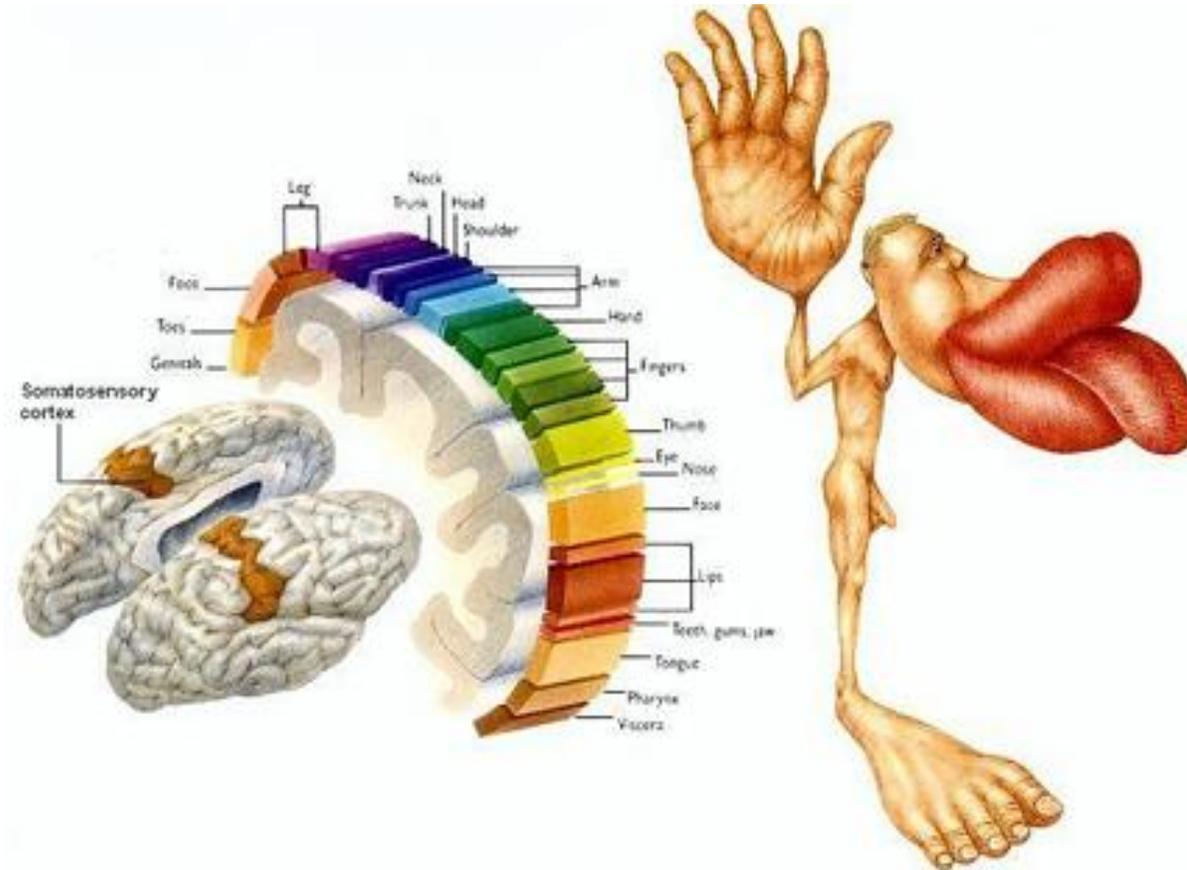
Derme (large receptive field)

- Ruffini (lenta adaptação)
- Pacini (rápida adaptação)

MULTISSENSORIAL ?...

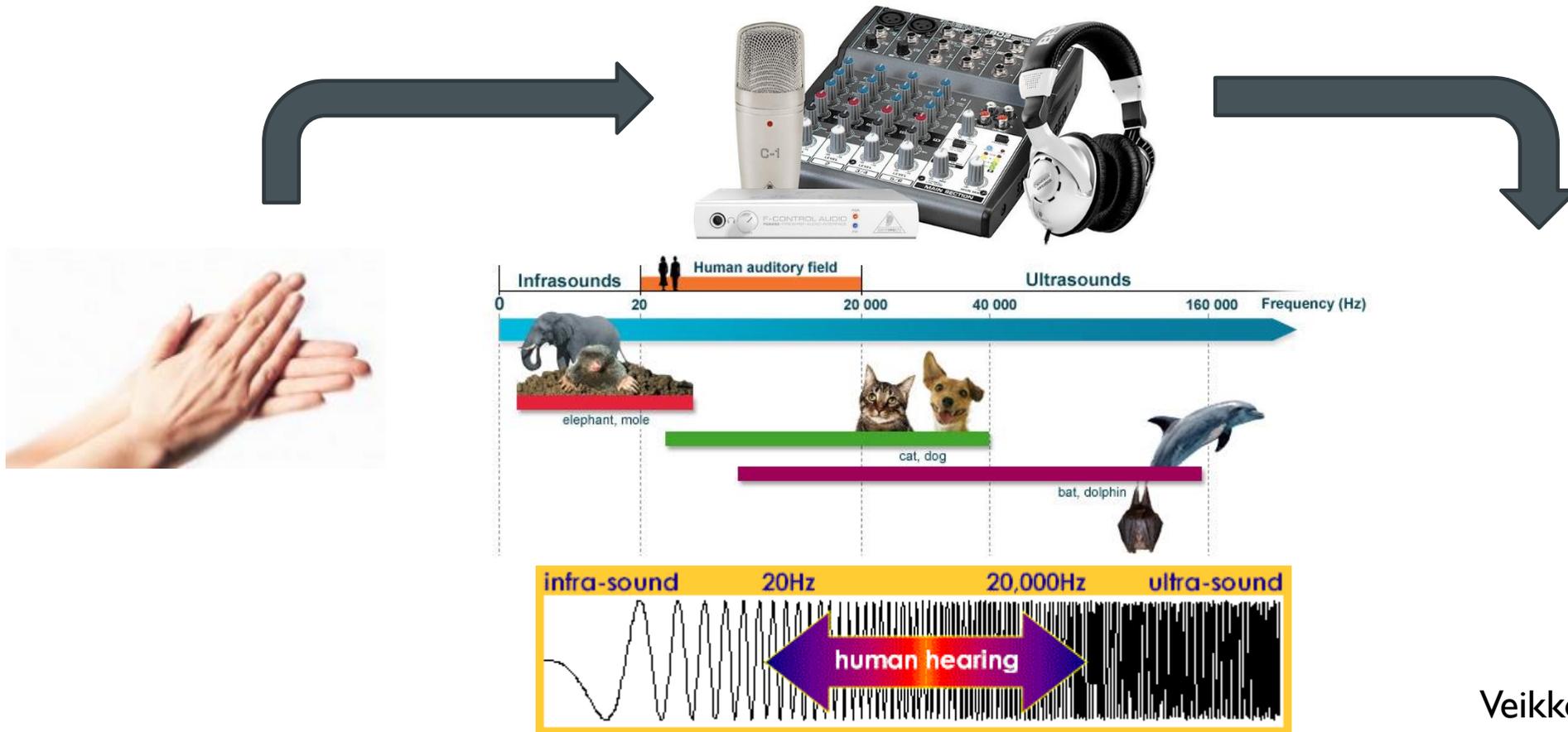
■ Unisensorial:

- Visão
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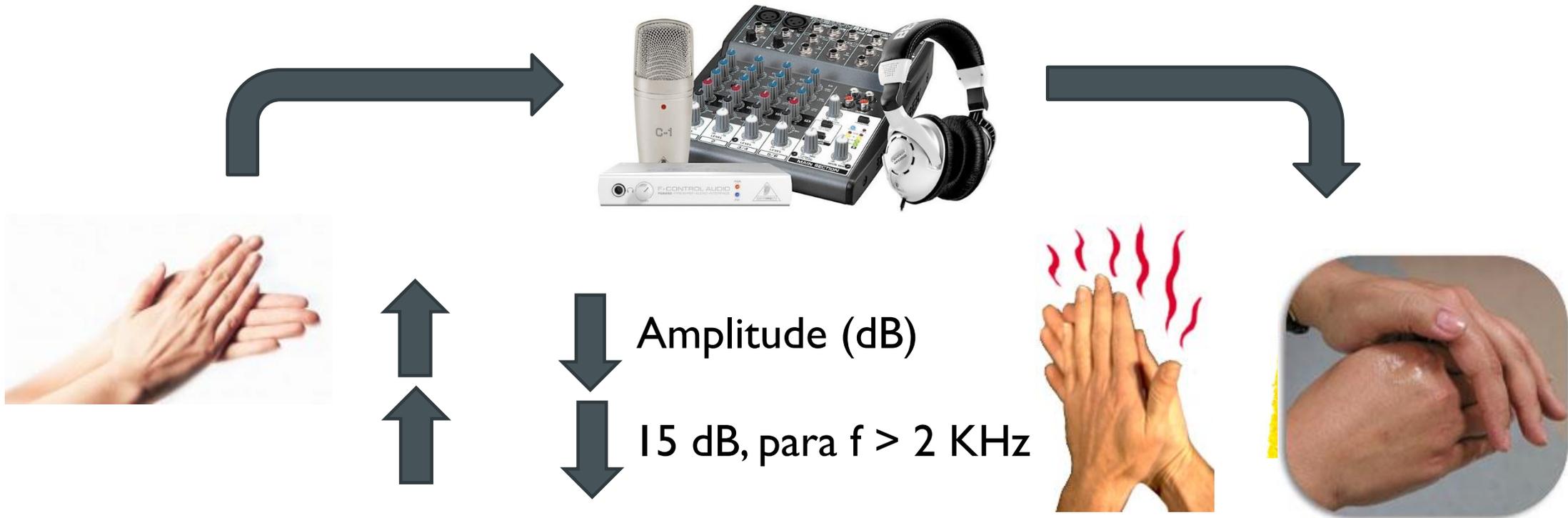
PARCHMENT SKIN ILLUSION

- Sensação de tato alterada pelas propriedades do som



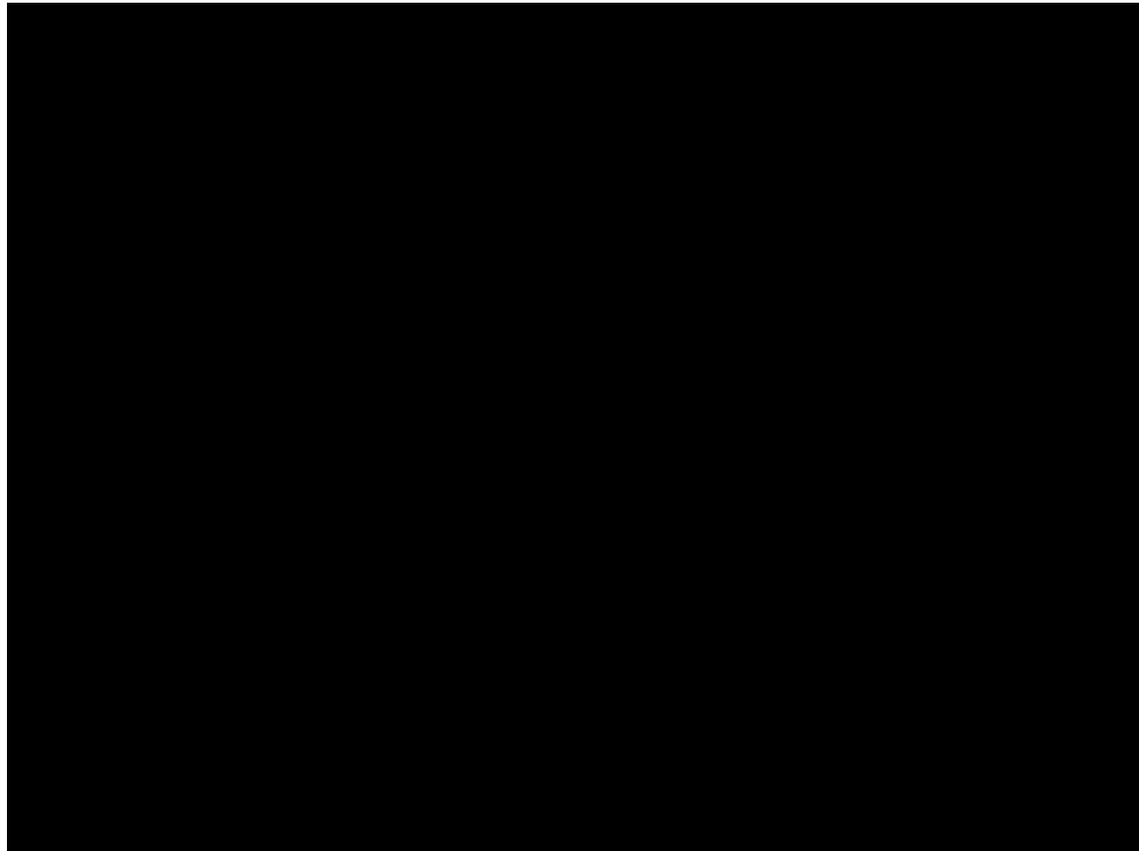
PARCHMENT SKIN ILLUSION

- Sensação de tato alterada pelas propriedades do som



MCGURK EFFECT

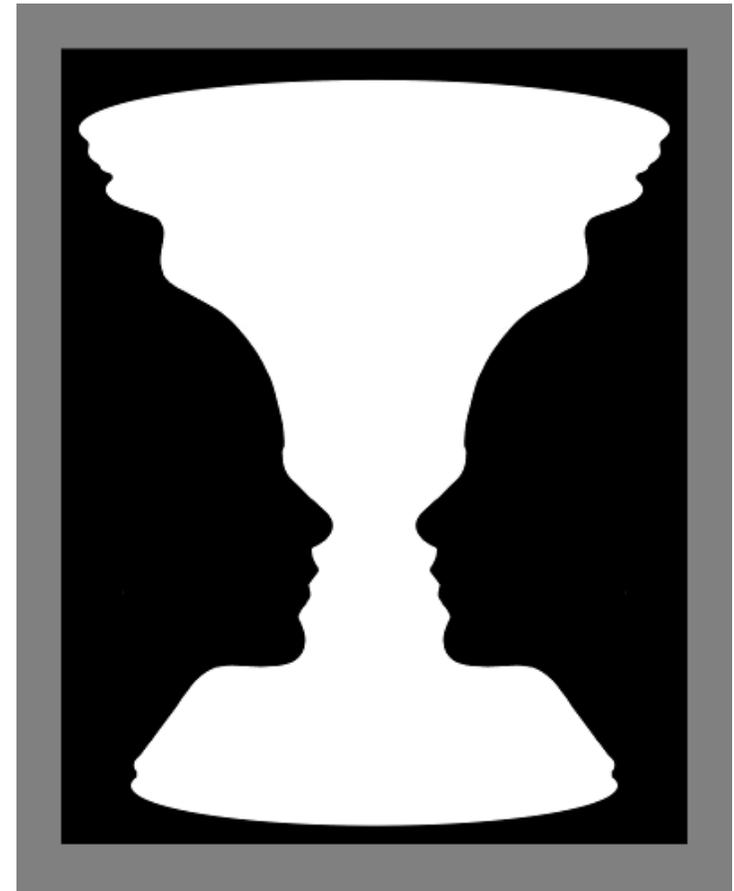
- Incongruência na informação Audio-Visual: nova percepção



Hearing Lips Seeing Voices
McGurk & MacDonald
Nature 1976

QUE PARÂMETROS SÃO DECISIVOS ?

- Janela Temporal
- Congruência/Incongruência
- Atenção
- Dominância de modalidade sensorial

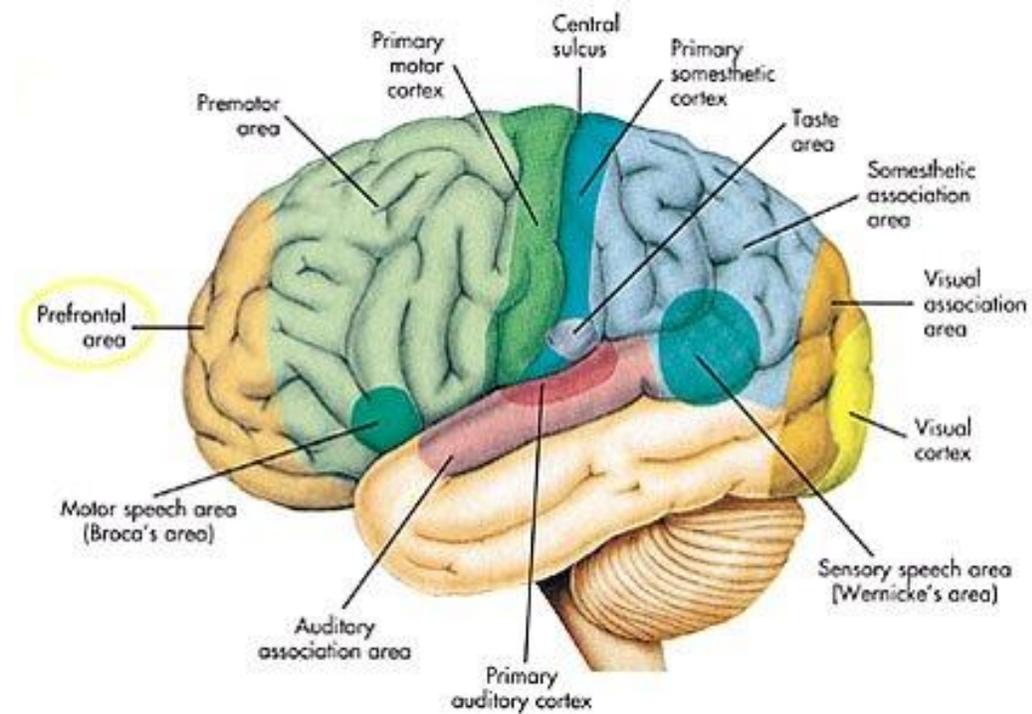


Rubin Face-Vase

COMO SE INTERPRETAVA A INTEGRAÇÃO

1º Processamento em áreas
UNISSENSORIAIS

2º Processamento em áreas
de ASSOCIAÇÃO

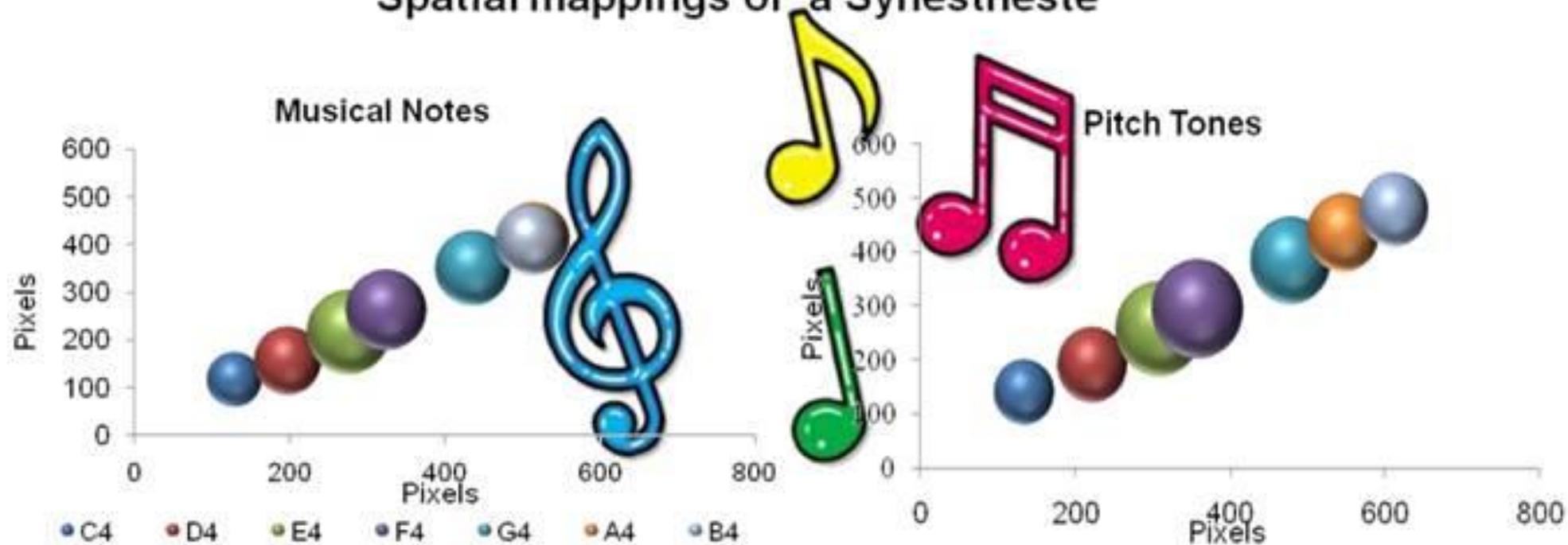


AS NOVAS HIPÓTESES

- Existem neurónios multissensoriais
- Estes existem em zonas do cérebro, onde o processamento de informação ocorre antes de chegar ao córtex (zonas sensoriais primárias)
- Integração multissensorial também ocorre nas zonas classicamente definidas como puramente unissensoriais

SINESTISIA ... UM EXEMPLO EXTREMO

Spatial mappings of a Synestheste



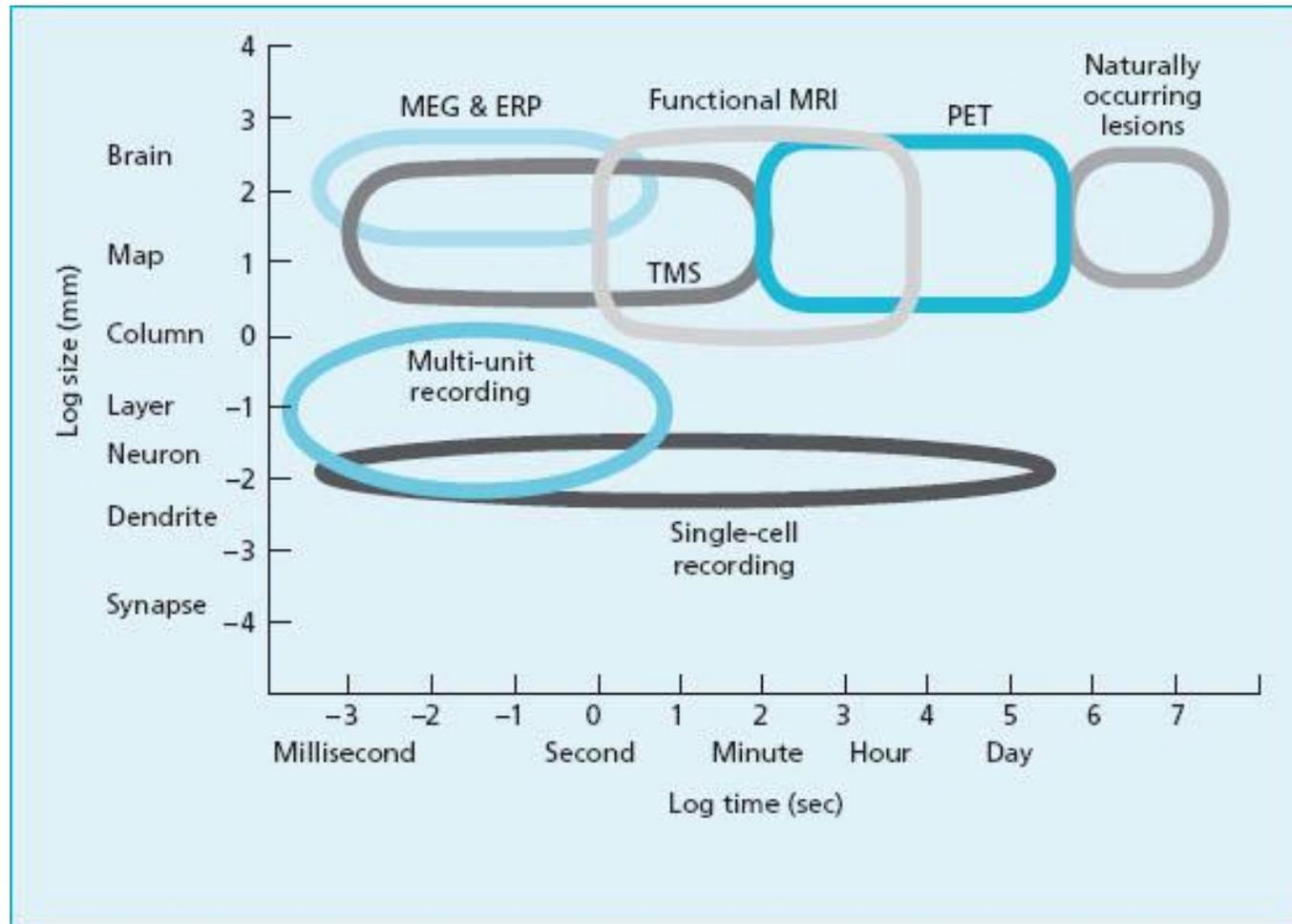
SINESTISIA ... UM EXEMPLO EXTREMO

A B C D E F G H
I J K L Ł M N O
P Q R S T U V
W X Y Z
1 2 3 4 5 6 7 8 9 0

SINESTISIA ... UM EXEMPLO EXTREMO



COMO VER O QUE SE PASSA NO CÉREBRO?

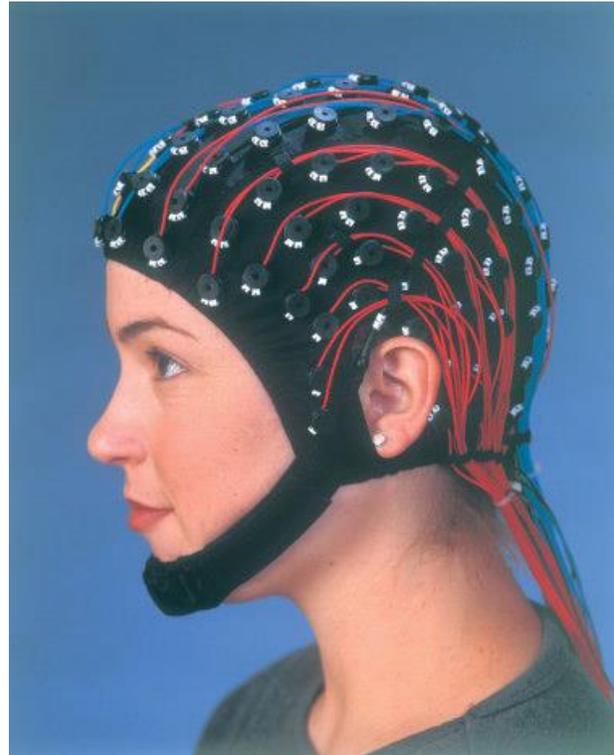


COMO VER O QUE SE PASSA NO CÉREBRO?

Magnetoencefalografia



Electroencefalografia

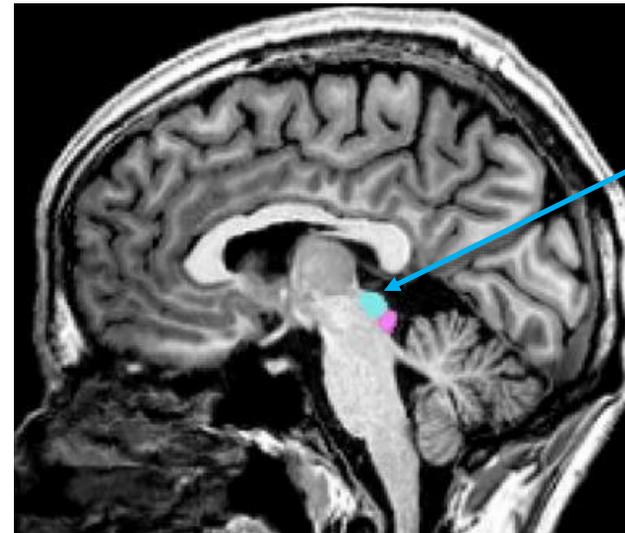


Ressonância Magnética



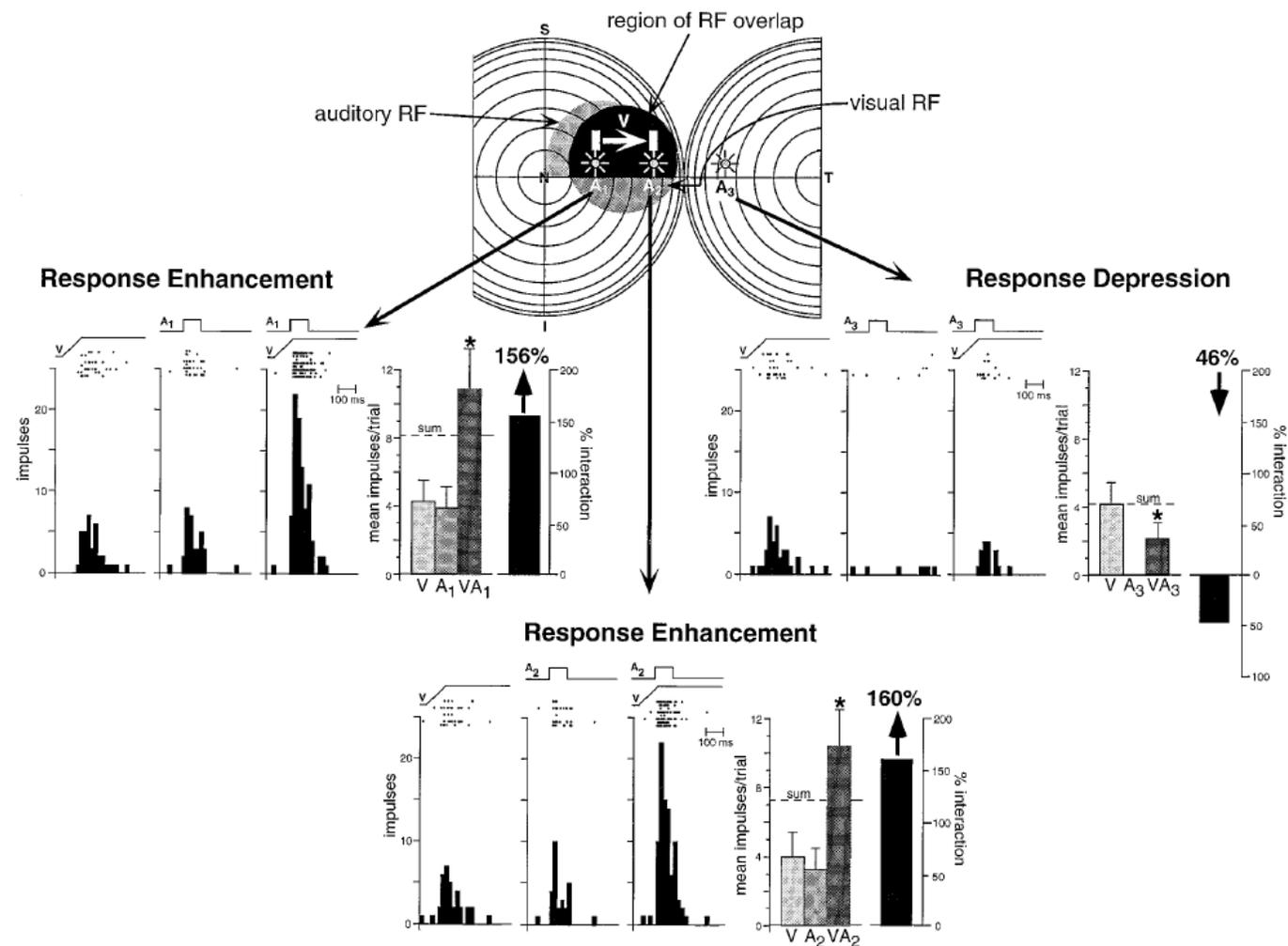
ESTUDOS EM MODELOS ANIMAIS

- Wallace and Stein (1997) - *‘Multisensory neurons receive convergente input from two or more senses, and they show enhanced activity when stimuli are spatially concordant and synchronized’*

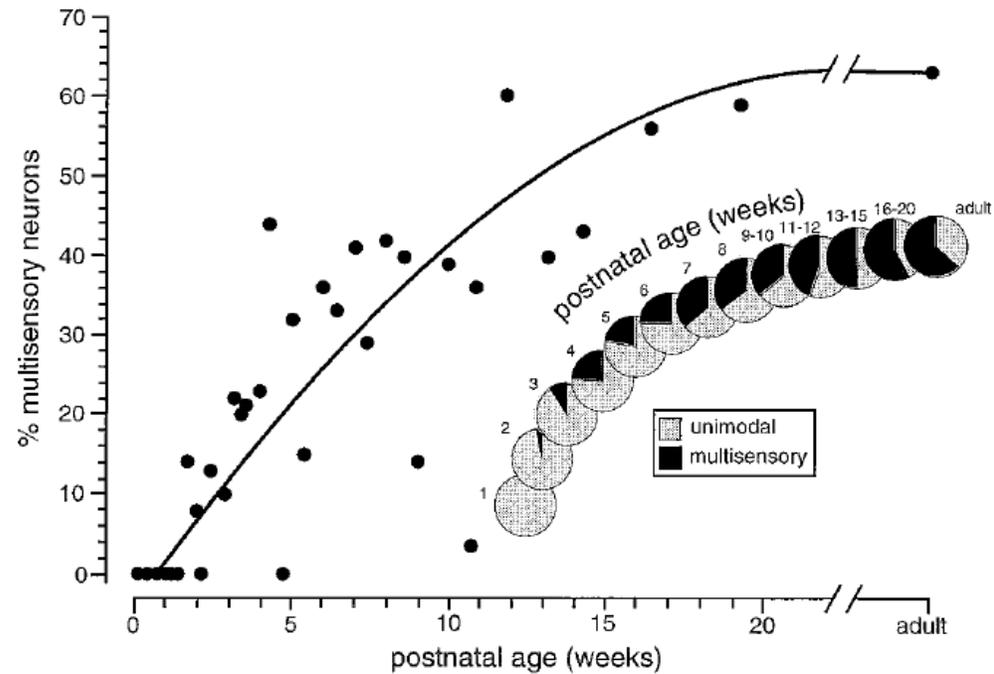


Colículo Superior

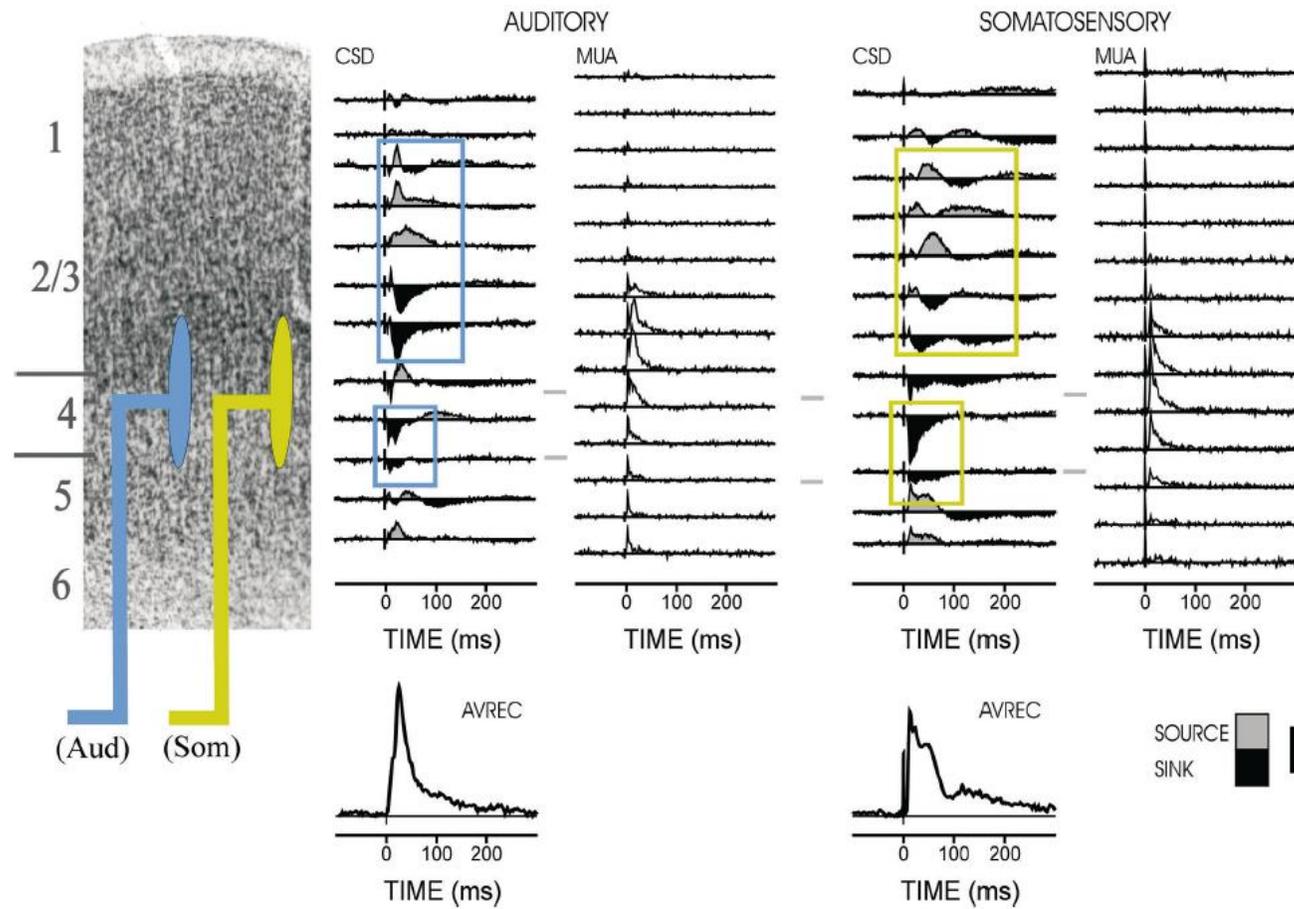
ESTUDOS EM MODELOS ANIMAIS



ESTUDOS EM MODELOS ANIMAIS



ESTUDOS EM MODELOS ANIMAIS



ESTUDOS EM MODELOS ANIMAIS

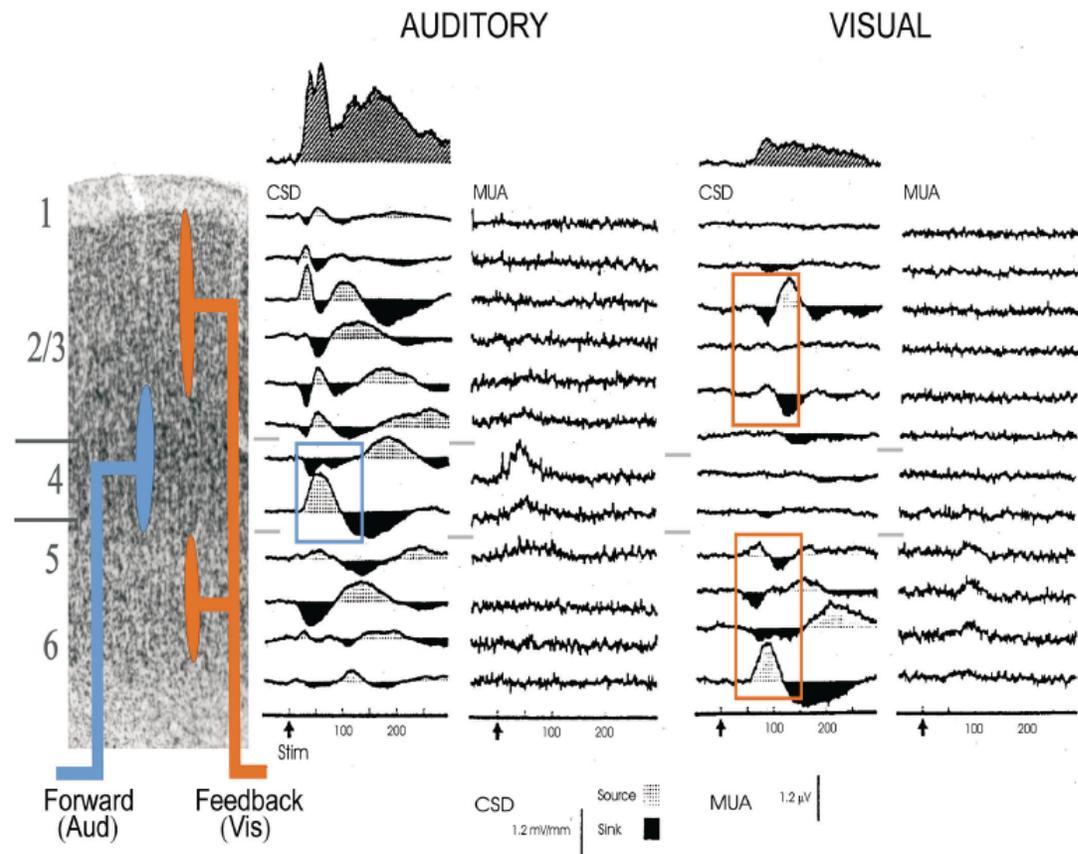


Fig. 3. Laminar CSD and MUA profiles evoked by auditory (left) and visual stimuli (right) and recorded from one site in auditory association cortex, poster lateral to A1 cortex. Intercontact spacing on the multielectrode was 150 μm . Each tracing represents an average of 100 stimulus-evoked responses. Those on the left represent the averaged responses to binaural 65 dB clicks. Those on the right were elicited by intense binocular light flashes (10 μs duration, 7.8×10^5 lux intensity). The boxes circumscribe CSD configurations that reflect the initial excitatory response at the depth of lamina 4 (blue—auditory profile), as opposed to, above and below lamina 4 (red—visual profile). At the extreme left is a diagram depicting the laminar pattern of termination for feedforward inputs from auditory (blue) and feedback visual (red) systems.

O QUE VEMOS NO CÉREBRO HUMANO?

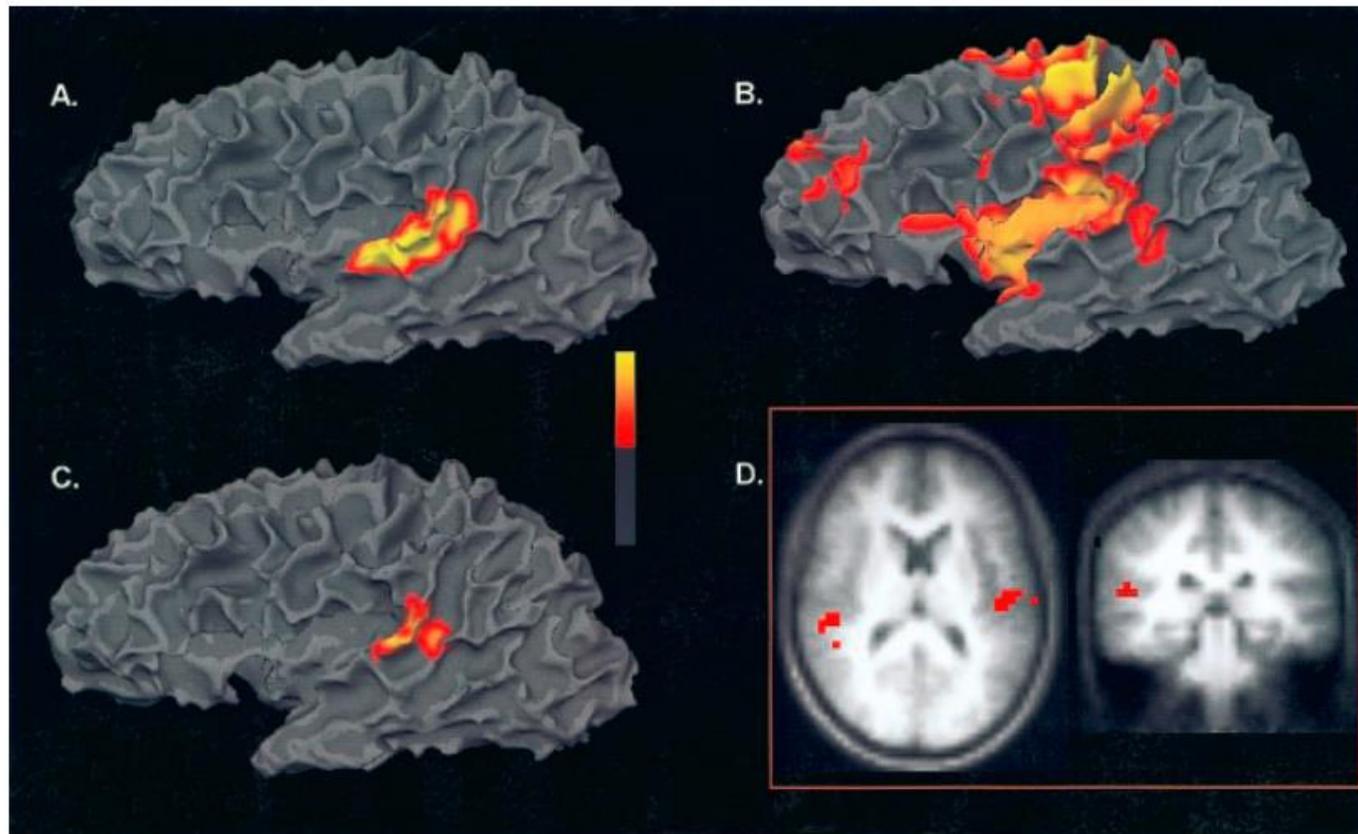


FIG. 1. Group ($n = 12$) activation maps for auditory (A) and somatosensory (B) stimulation, projected onto a 3-dimensional rendering of the left hemisphere, which was derived from one representative subject's anatomic magnetic resonance imaging scan. The color scale indicates significance values from $P < 0.05$ (red) to $P < 0.001$ (yellow). The region of significant overlap between these 2 activation maps (Aud \cap Soma) is shown projected onto the same rendered surface (C). D: the overlap fields in both an axial slice ($z = 12$), which shows overlap fields in both hemispheres, and in a coronal slice ($y = -32$), which shows the overlap field in the posterior portion of the left auditory cortex. These slices were derived from of a group-averaged brain, obtained by averaging the anatomic scans of the 12 subjects who participated in the study.

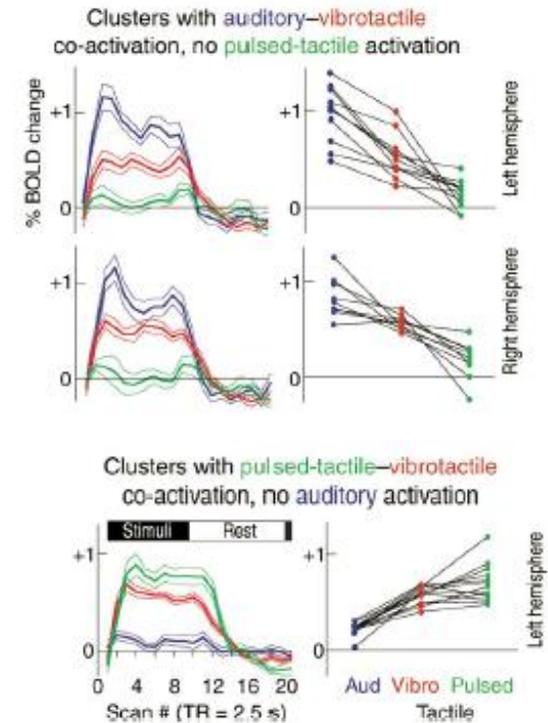
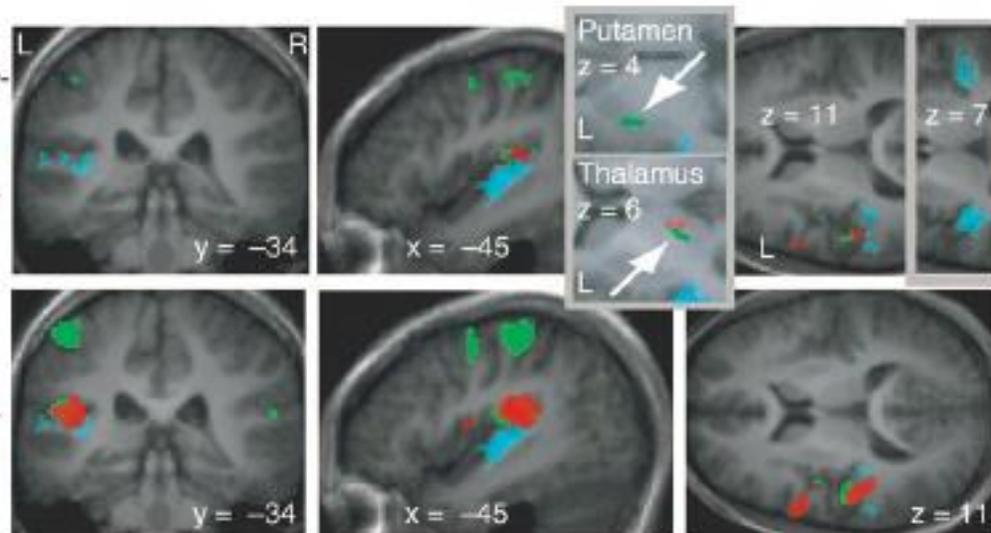
O QUE VEMOS NO CÉREBRO HUMANO?

A Stimulus-related activation (*random-effects analysis, N = 13*)

minimal smoothing

Vibrotactile
Pulsed-tactile
Auditory

liberal smoothing



OBRIGADA 😊