

语言认知实验及研究

刘汉军

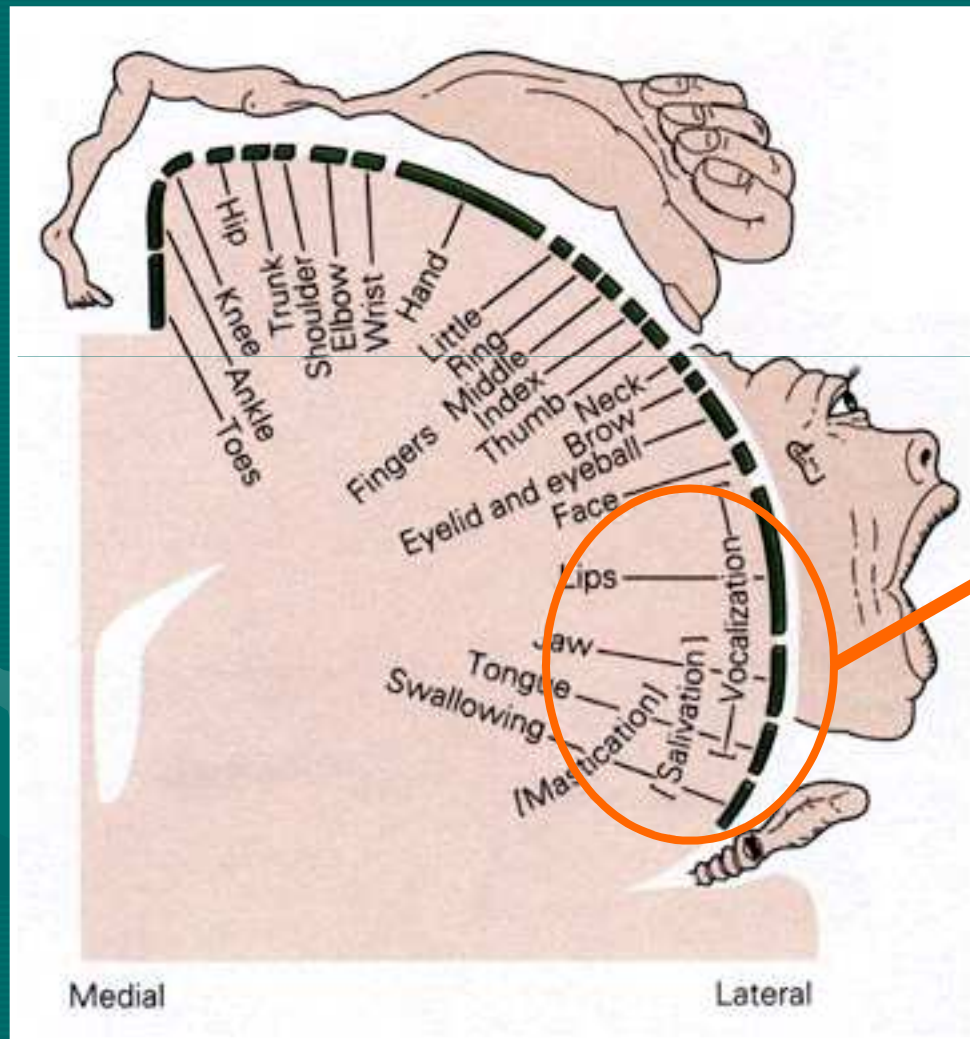
康复医学科

中山大学附属第一医院

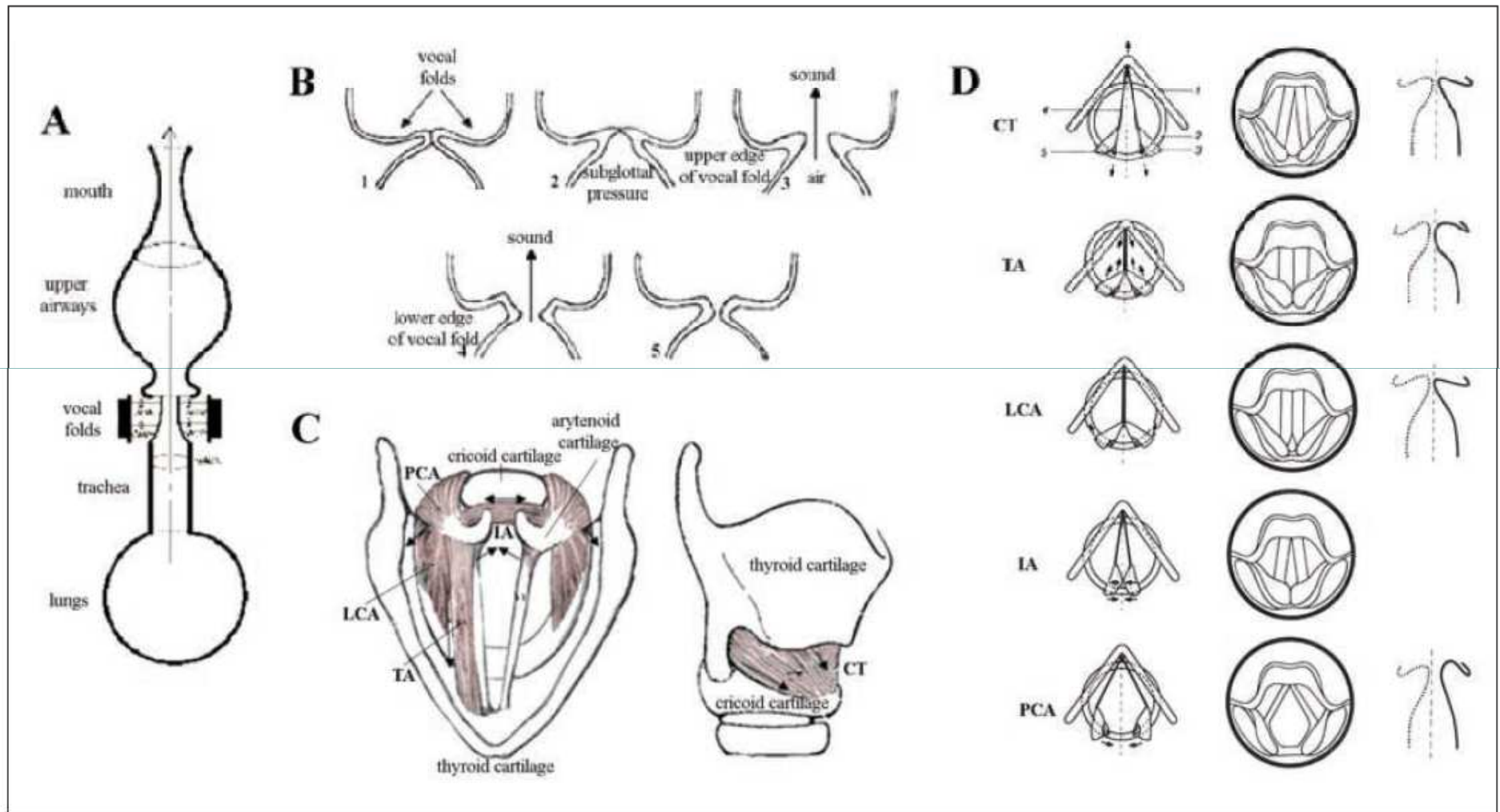
言语研究-语音语言病理学

- 由于发声器官功能性病变和中枢系统神经性病变导致的言语障碍
- 发声运动控制机制与言语康复治疗技术
- 中国处于起步阶段，国外已有百年历史

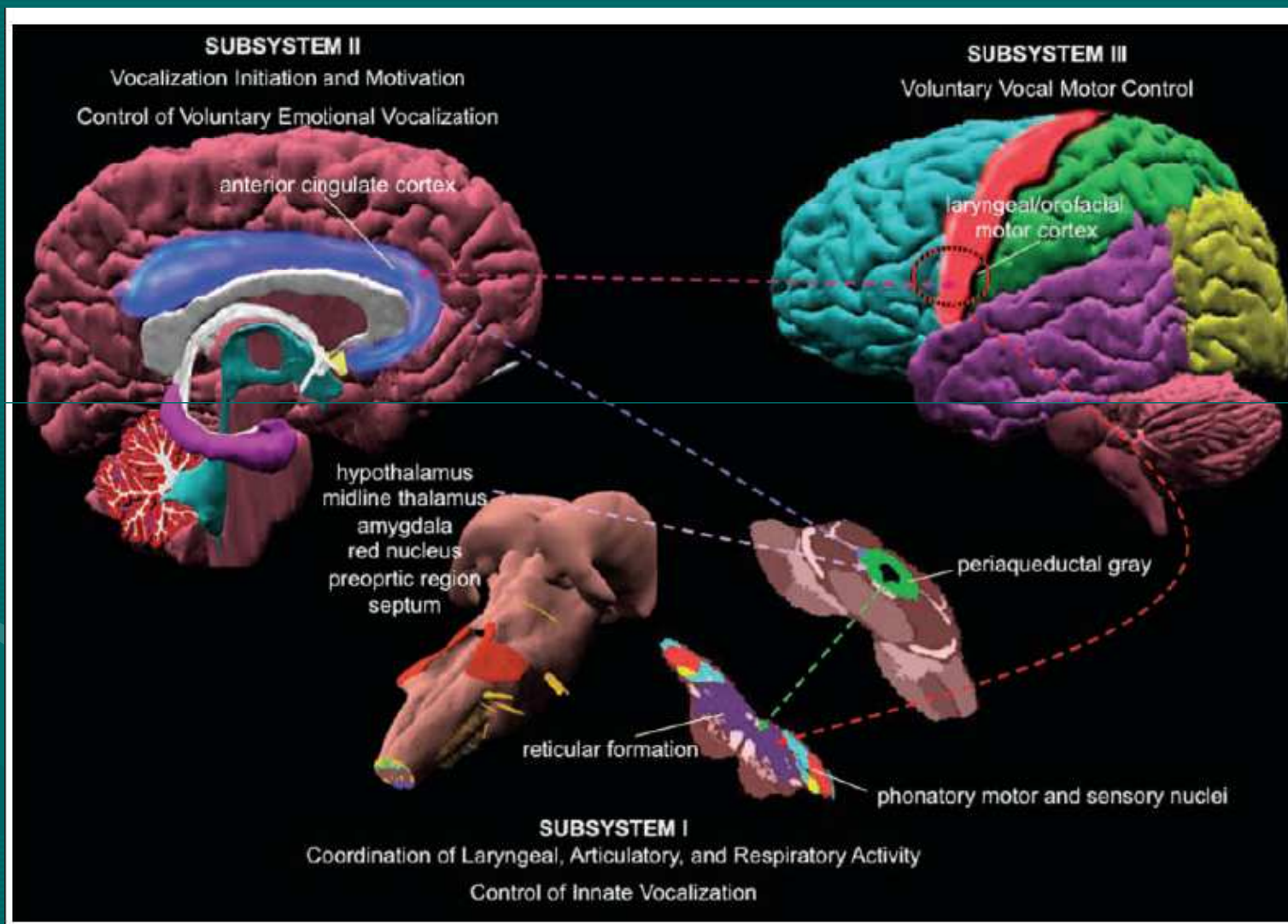
言语运动的神经调控



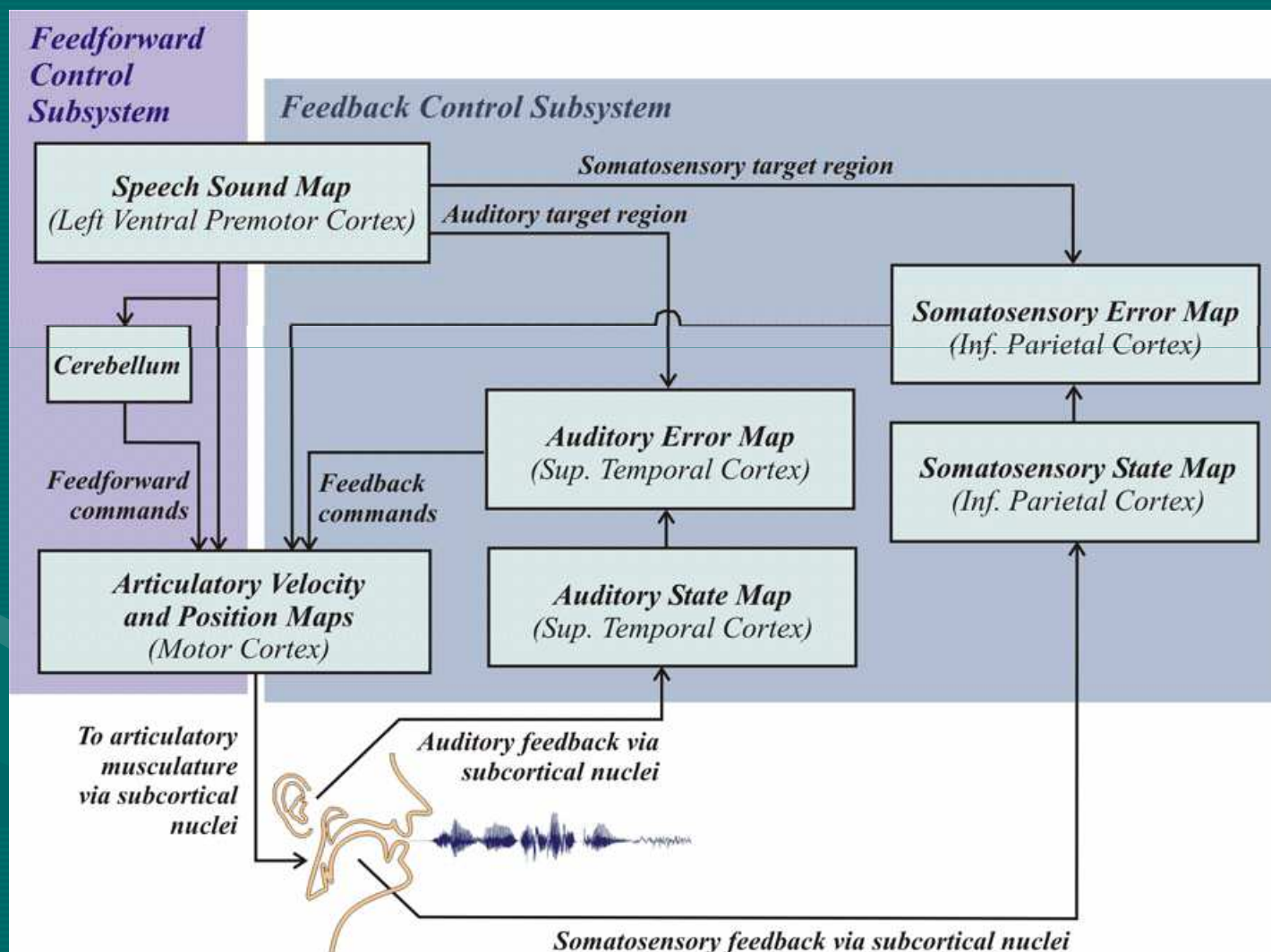
喉部发声运动系统



言语运动有关的中枢神经系统



言语运动调控的神经系统模型



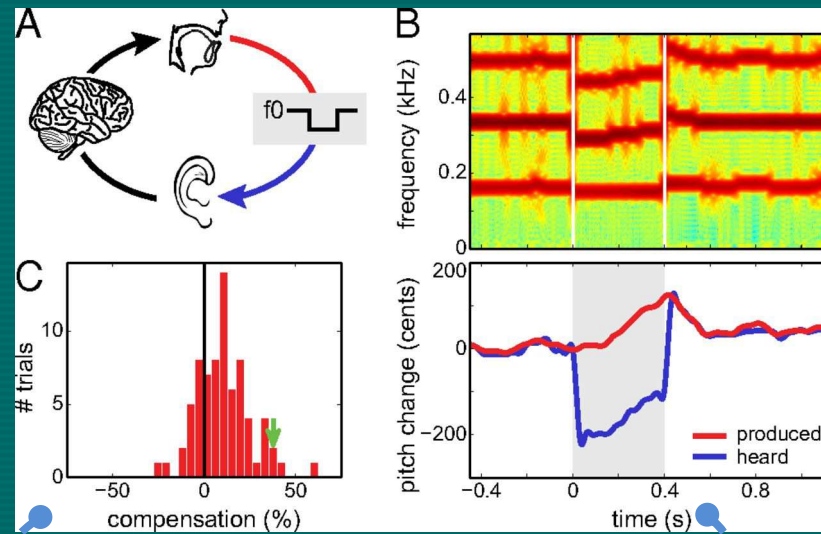
发声运动的调控方法-听觉反馈

- Lombard effect
- Side-tone amplification
- Delayed auditory feedback



发声运动调控的神经机制

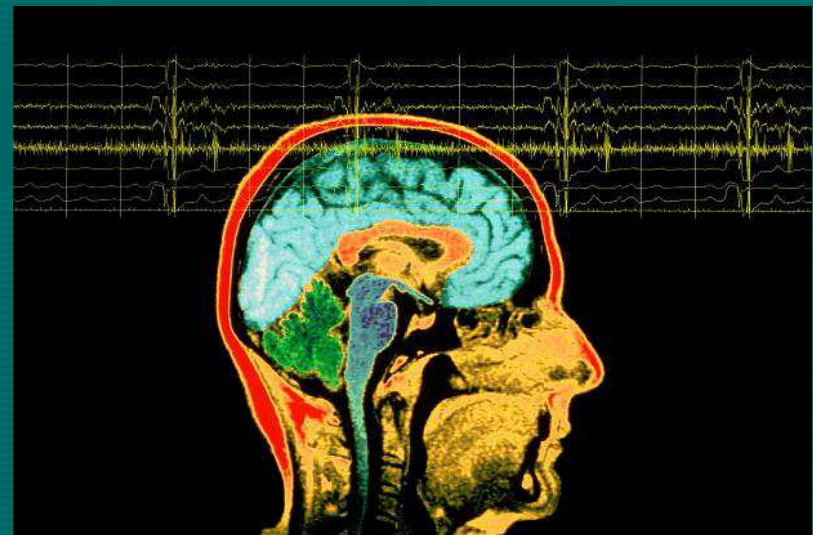
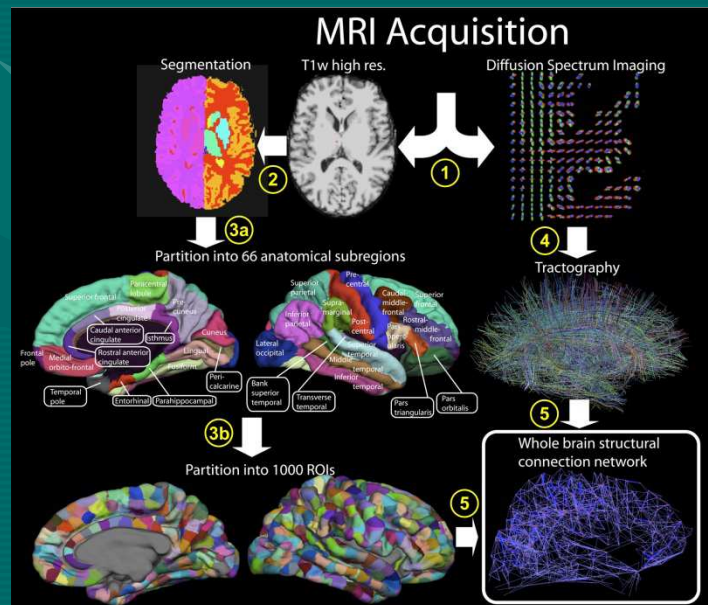
- 发声运动调控的声学表达方式
- 发声运动调控的肌肉活动方式
- 发声运动调控的中枢神经网络



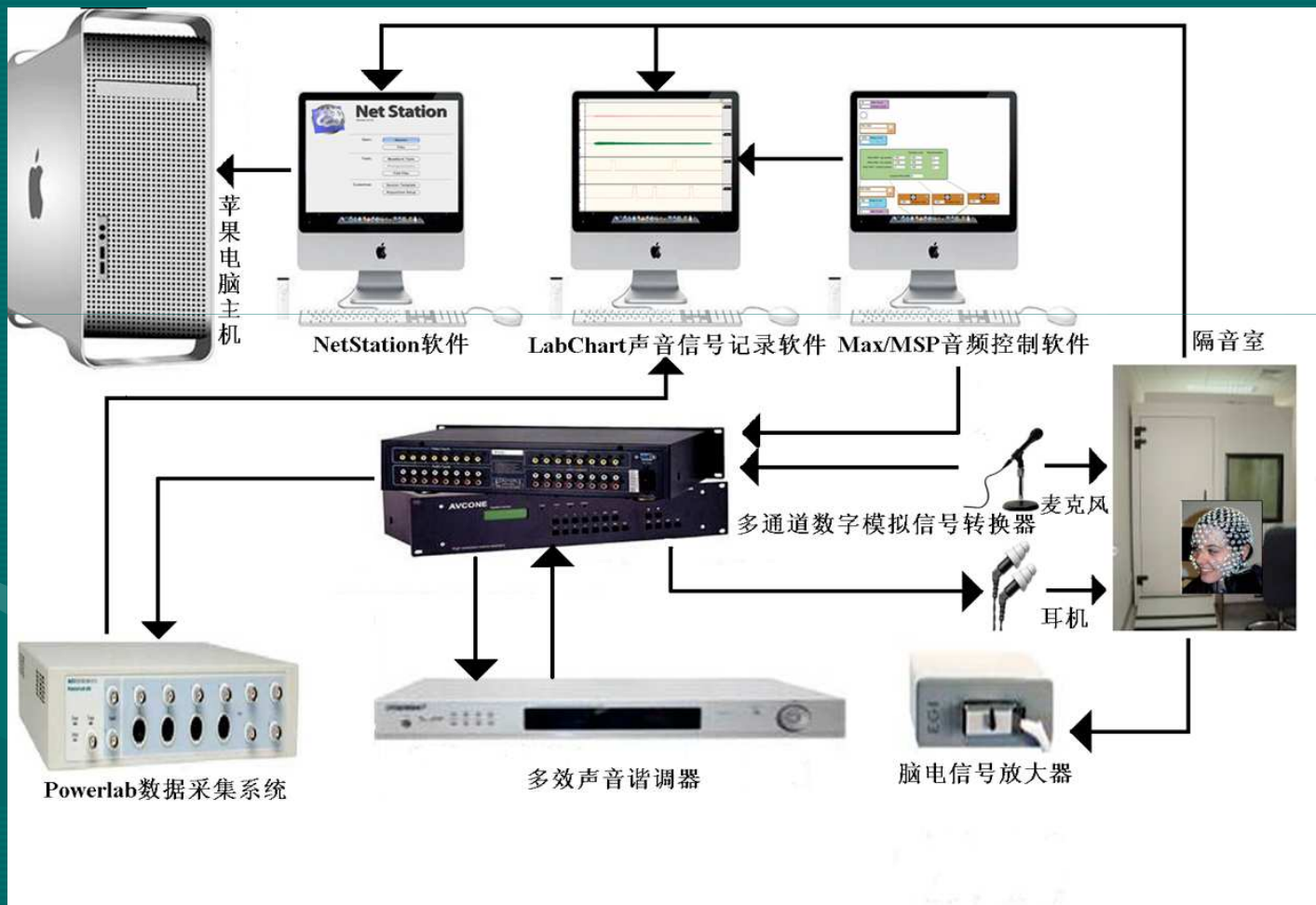
Psychoacoustics

fMRI

EEG/ERP



基于听觉反馈的声学-脑电测试系统

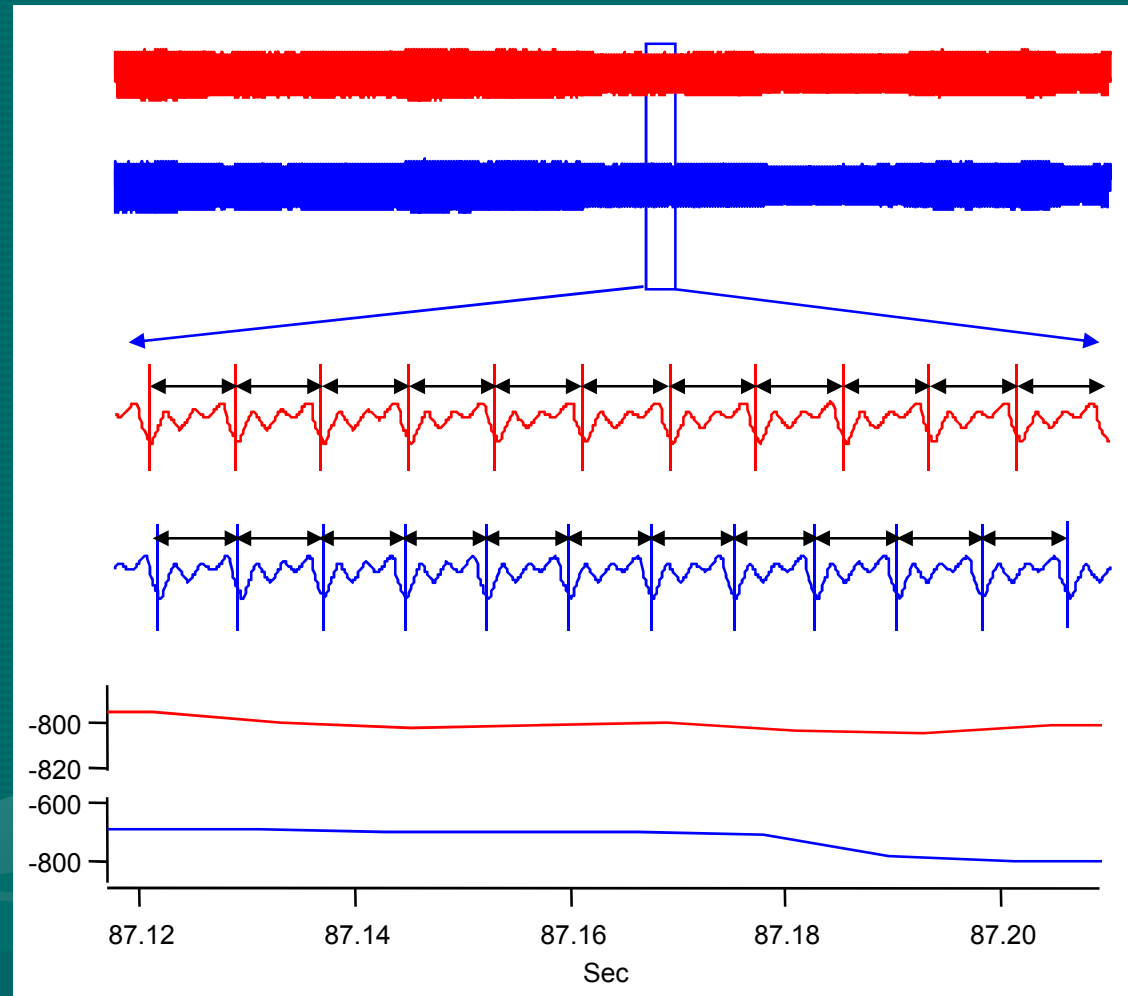


Generating a F_0 Contour

Voice
Feedback

Glottal
Cycle
Pulses

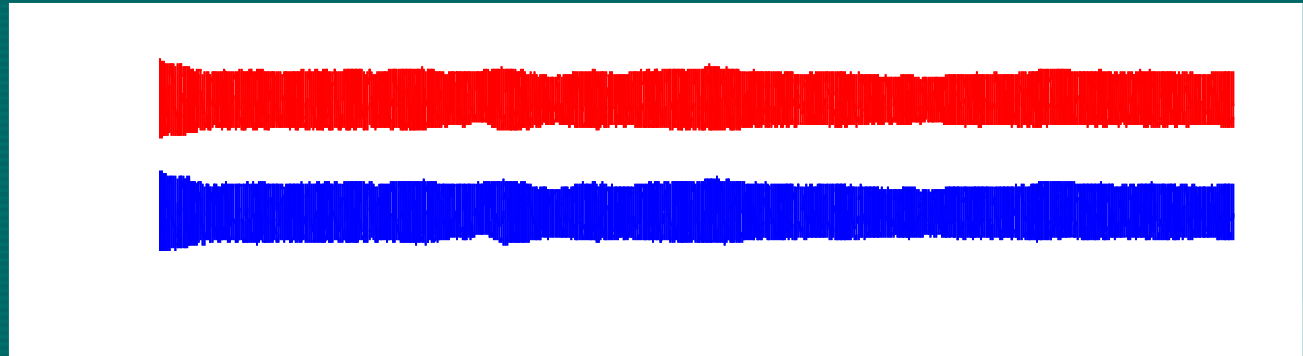
Contours



Example Data

Voice

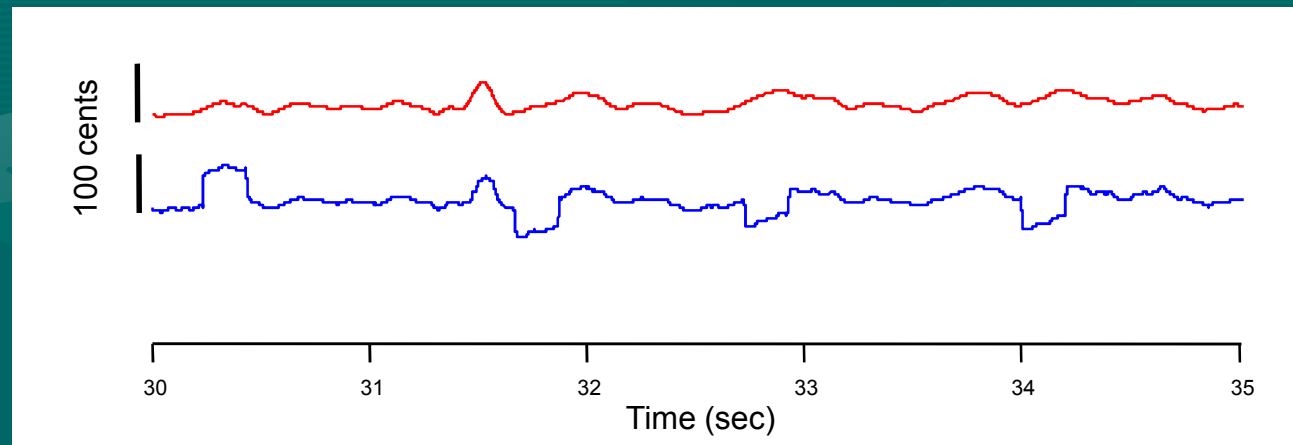
Feedback



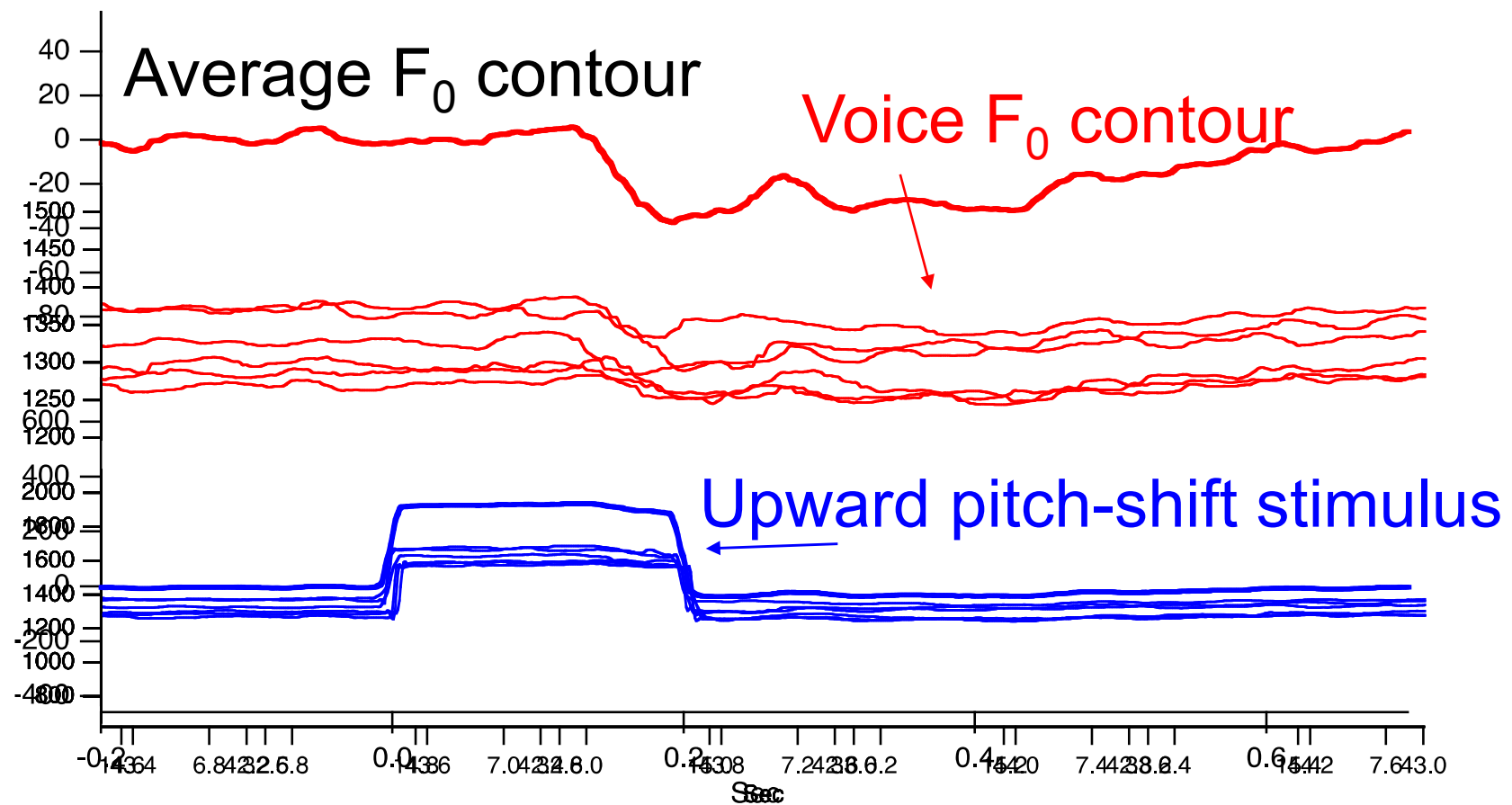
The F₀ Contour Reveals Pitch-Shift Stimuli and Vocal Responses

F₀ (cents)

Feedback (cents)



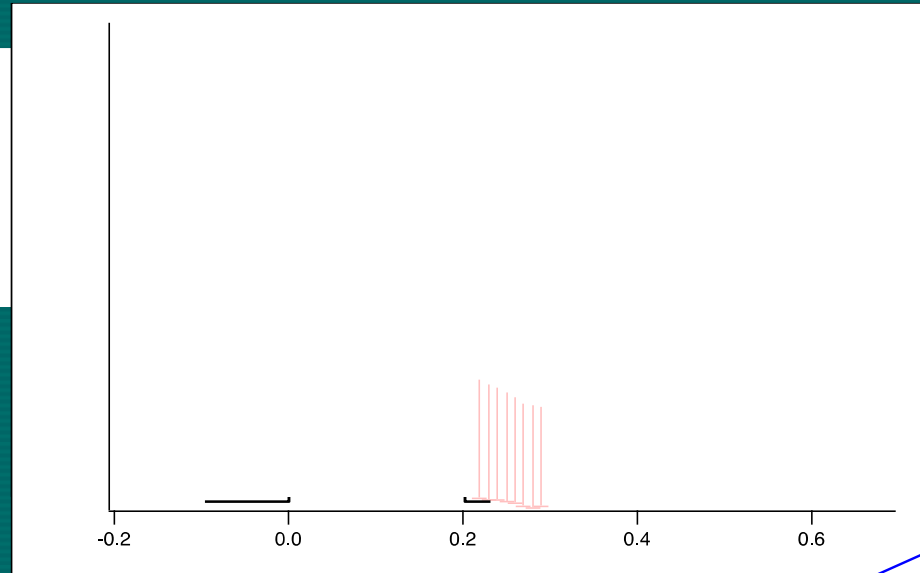
Signal Averaging



Averaged F_0 Responses

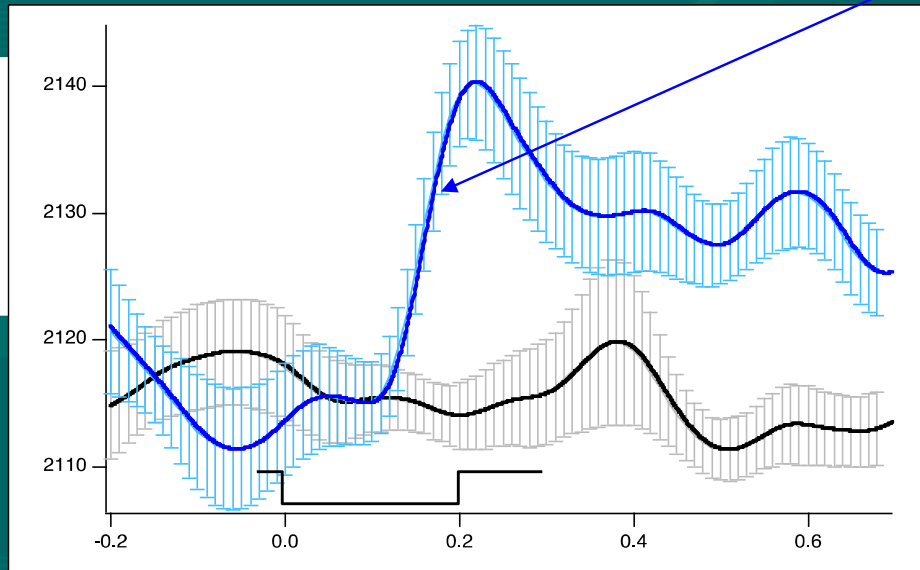
Black lines --control

**Red lines --response
to stimulus**



Black lines -- control

**Blue lines -- response
to stimulus**



Averaged F_0 Responses

Black lines -- control

Red lines -- response
to stimulus

Compensating
Response

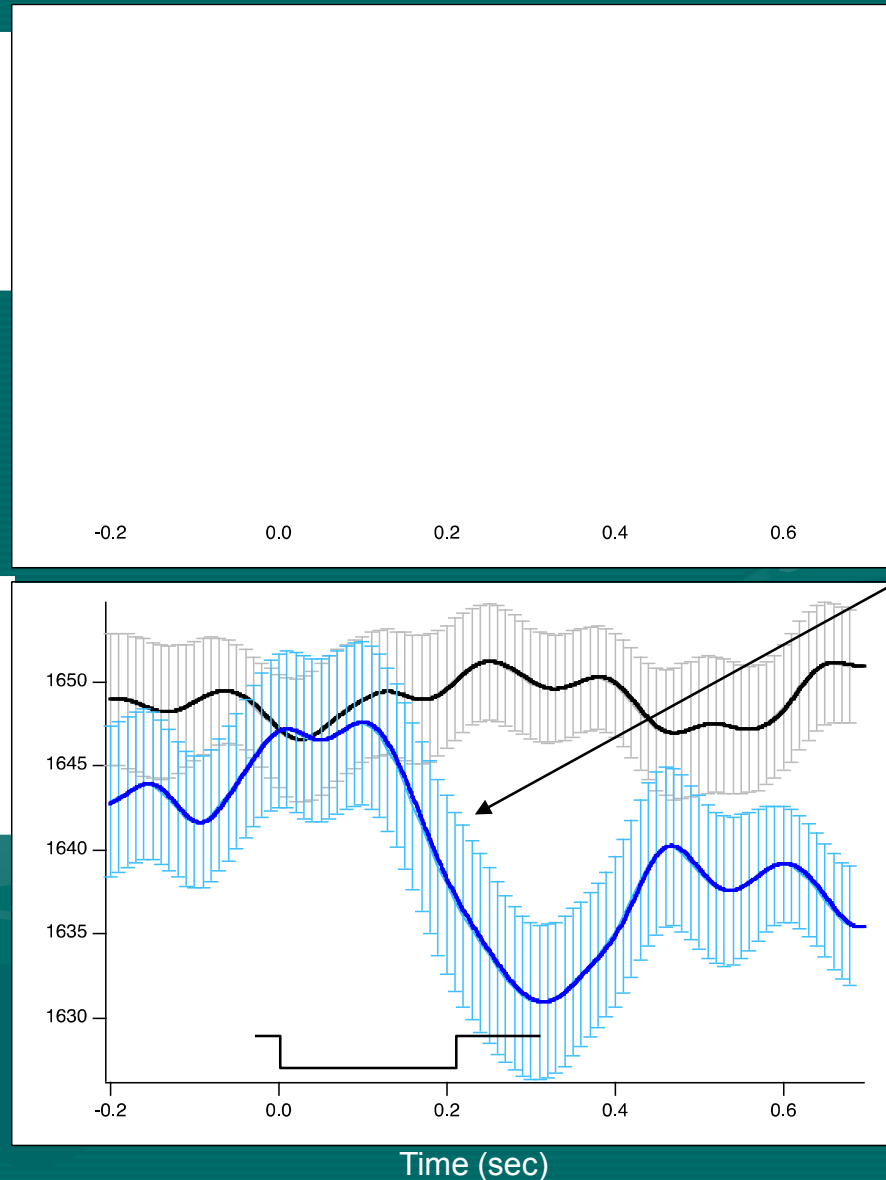
Stimulus, upward
40 cent pitch shift

Following
Response

Black lines -- control

Blue lines -- response
To stimulus

Stimulus, downward
40 cent pitch shift



言语运动调控的神经活动： EEG



EEG实验操作



功能性磁共振成像：fMRI



脑磁：MEG

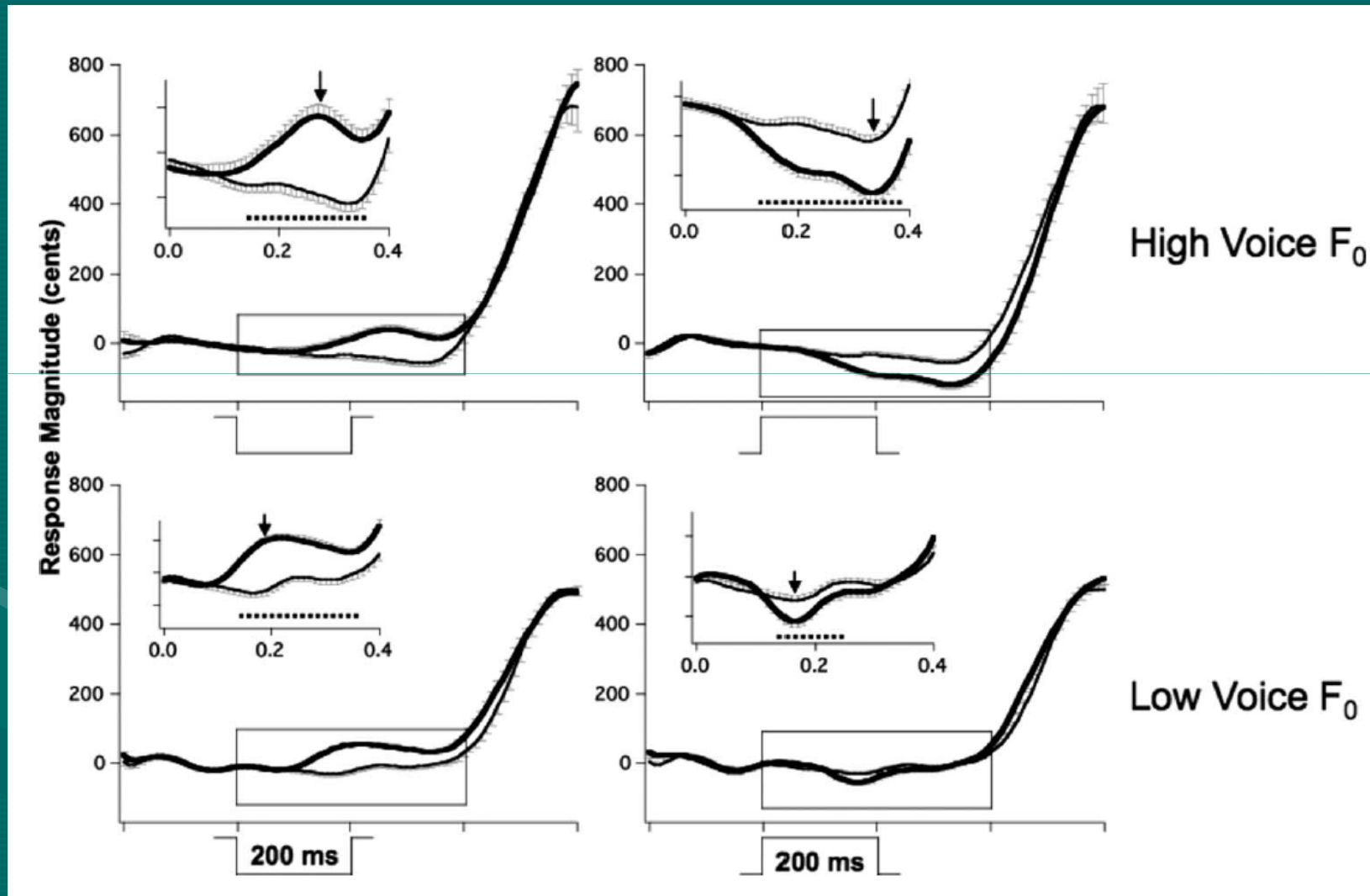


经颅磁刺激：TMS

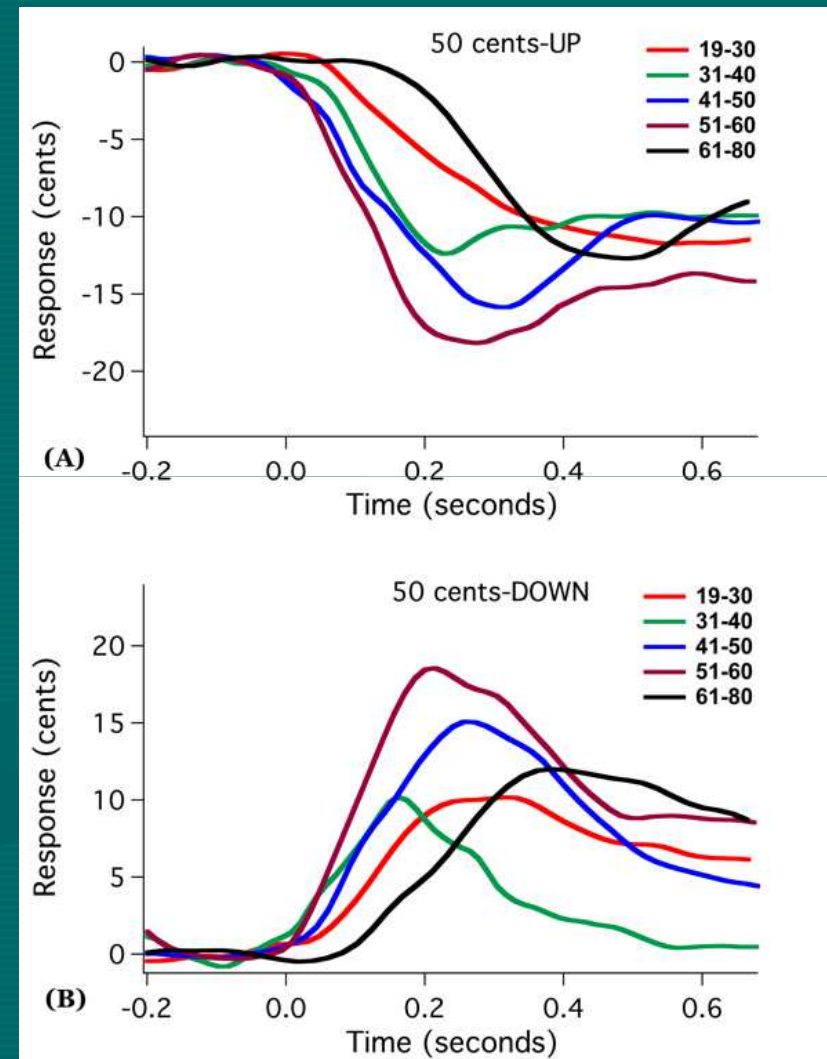
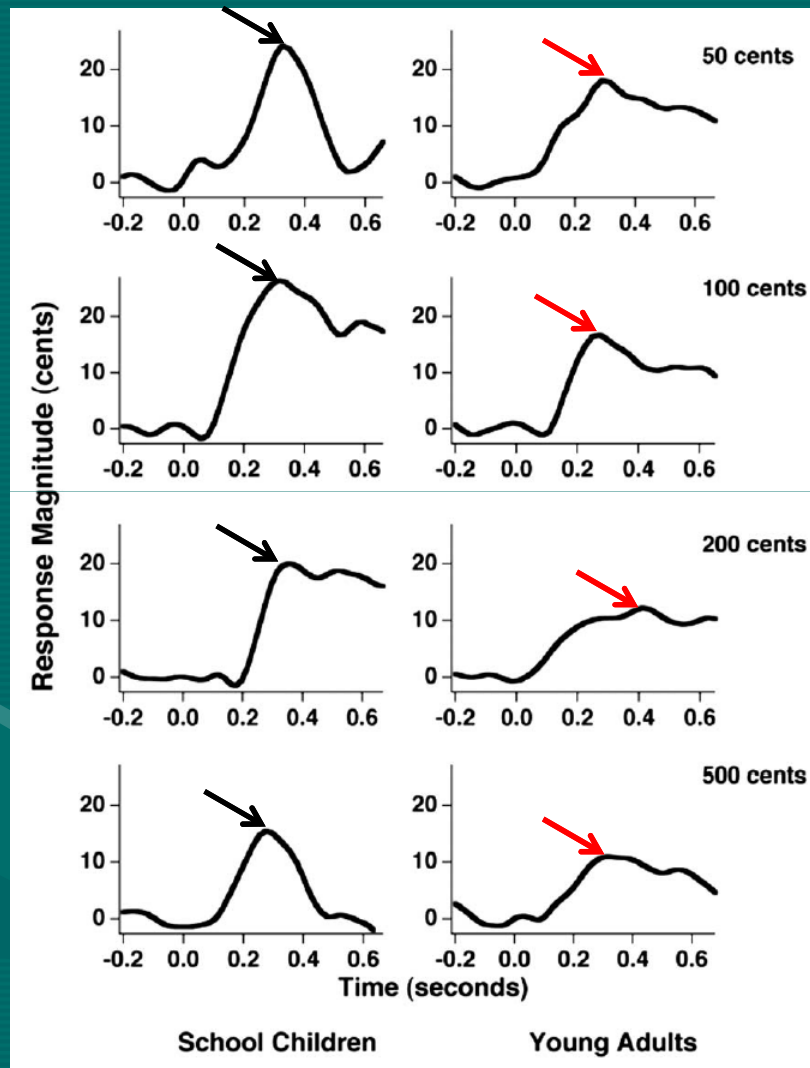




言语运动调控的任务依赖性

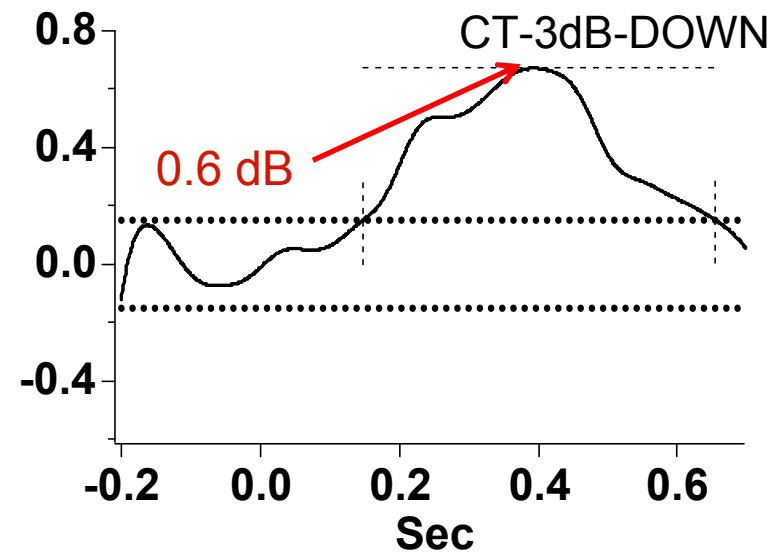
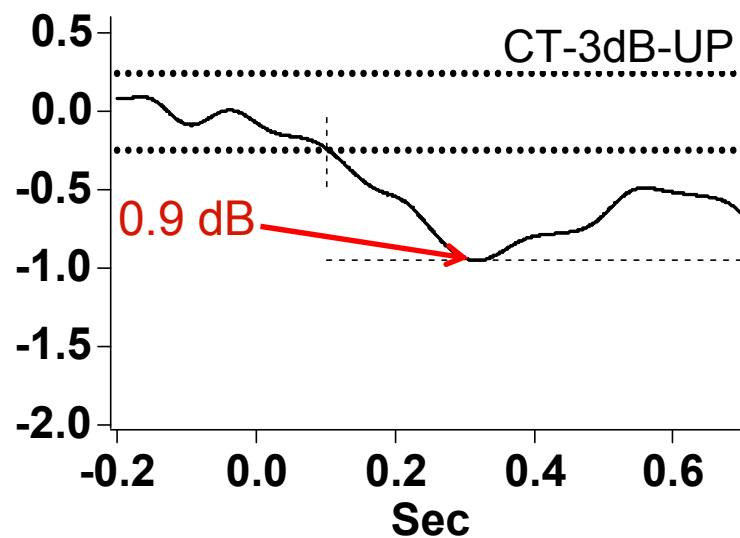
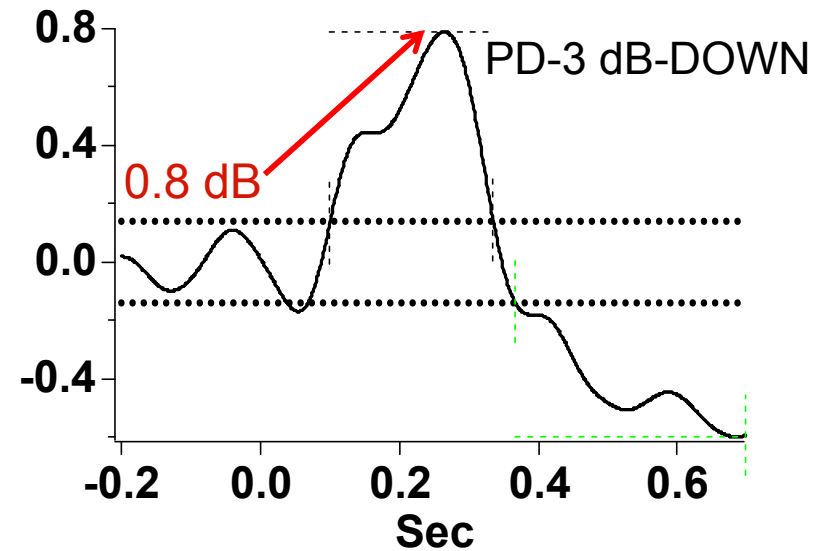
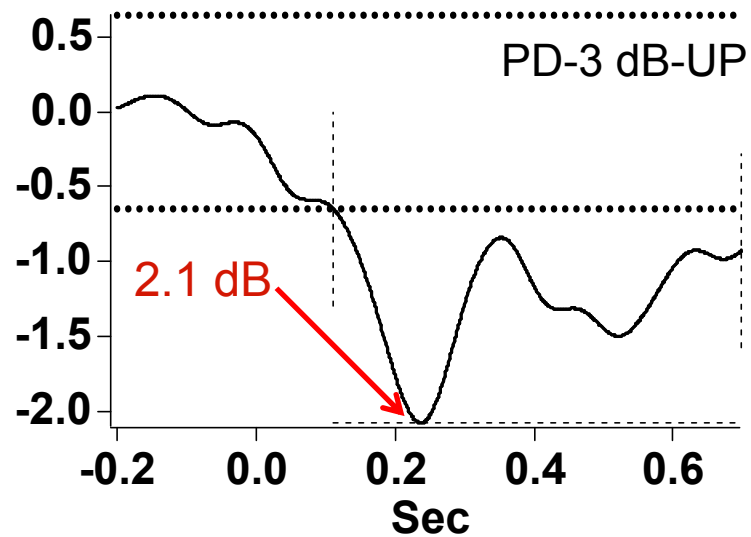


言语运动调控的年龄效应

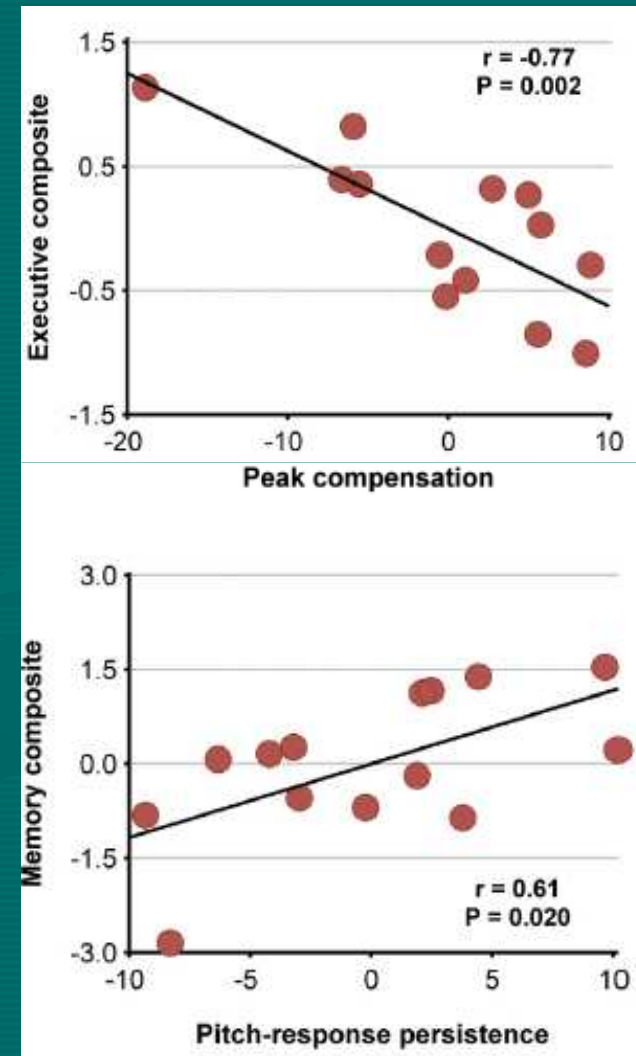
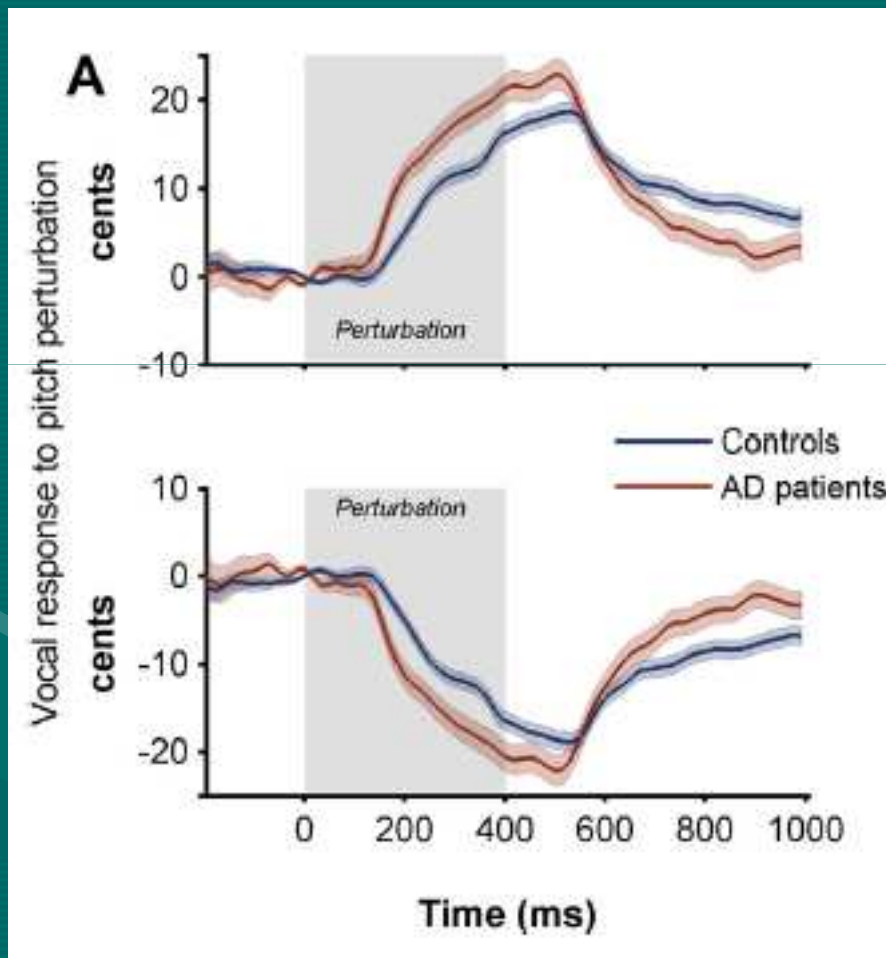


Liu et al., JASA, 2010.
Liu et al., PLoS ONE, 2012.

帕金森氏病言语运动控制障碍

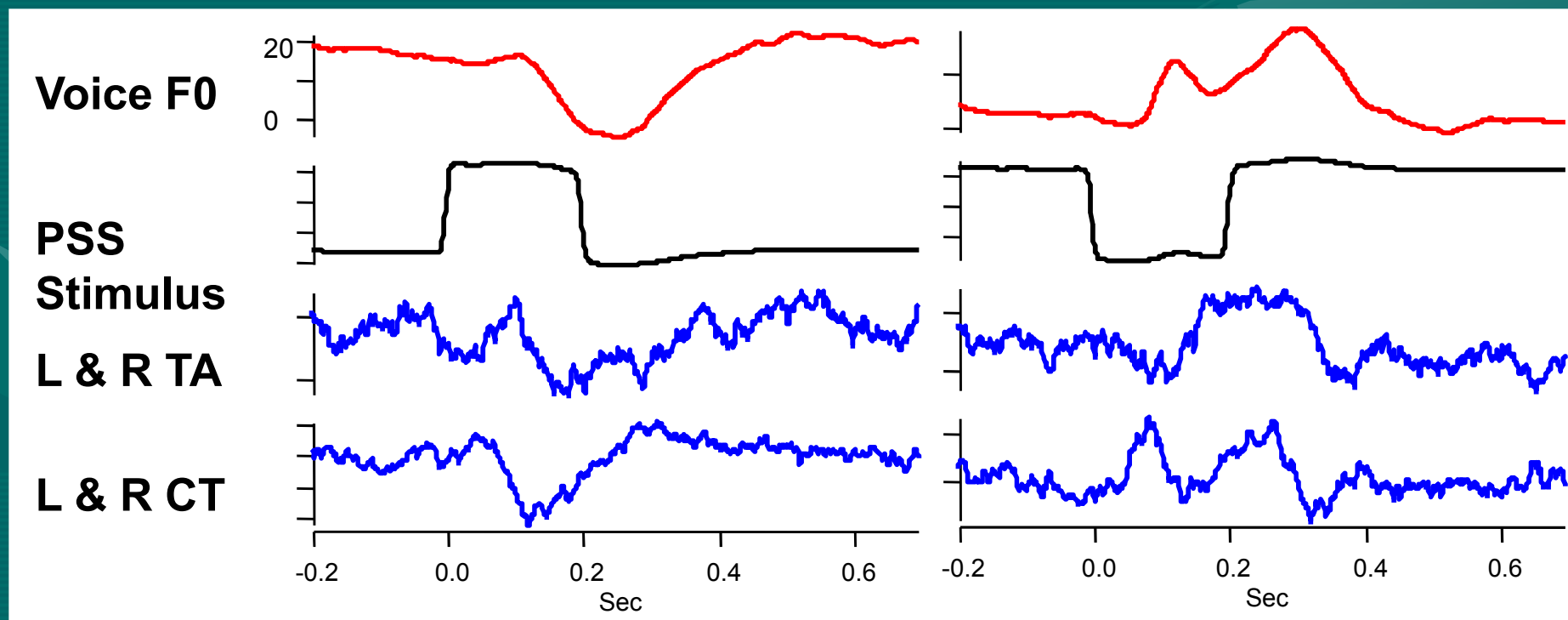


阿尔茨海默病言语运动控制障碍

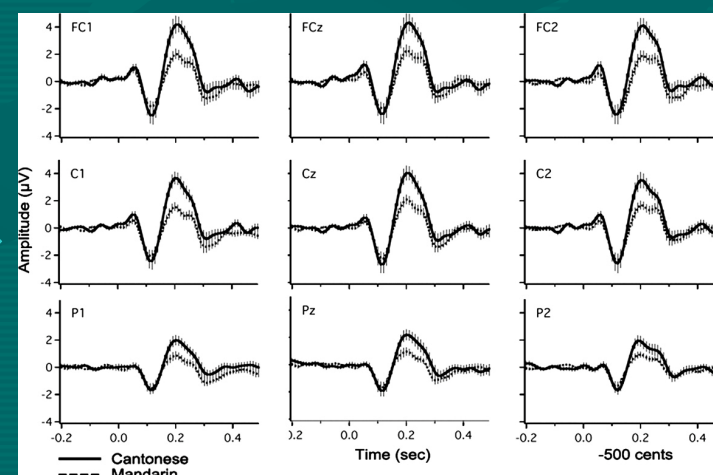
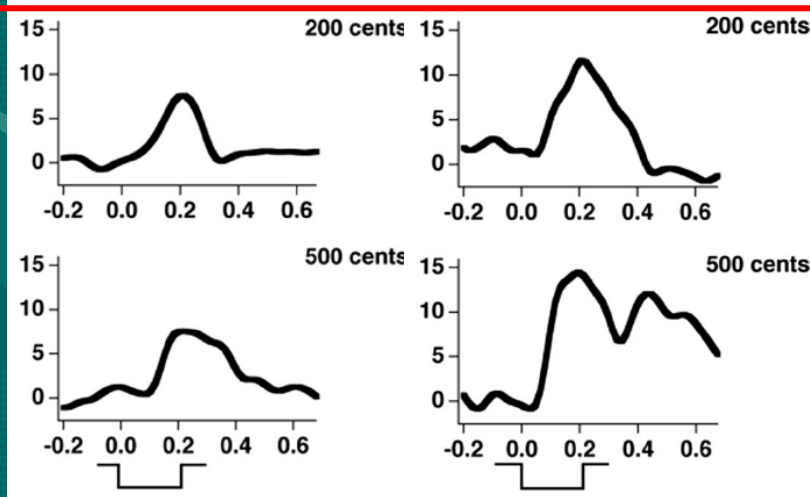
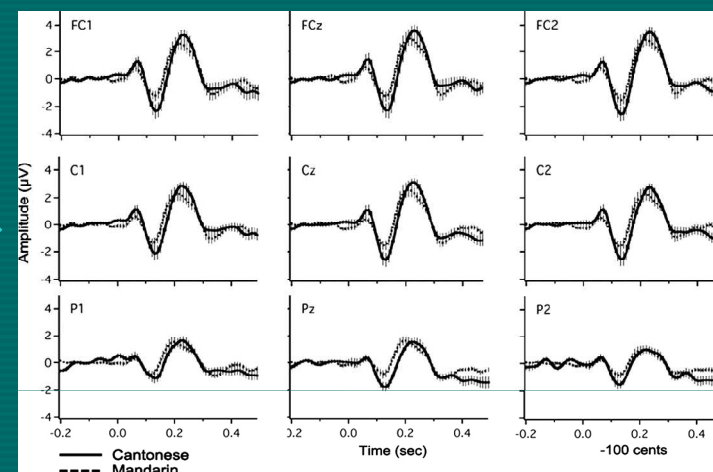
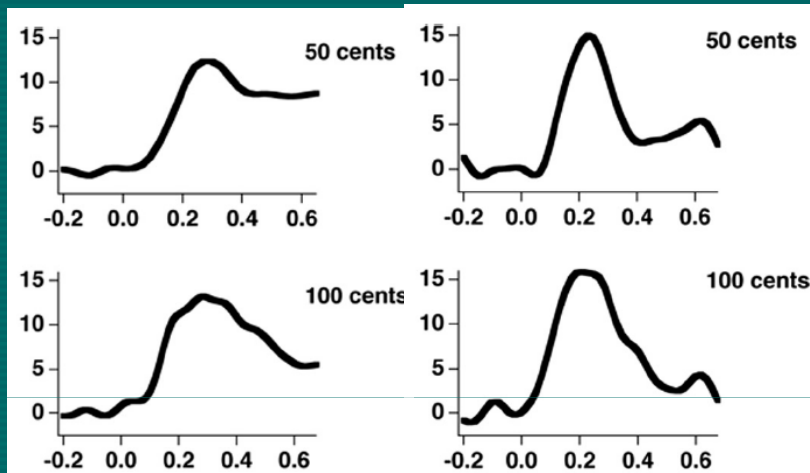


发声运动调控的肌肉活动方式

Falsetto, 300 cents,
Sum of L & R TA and L & R CT



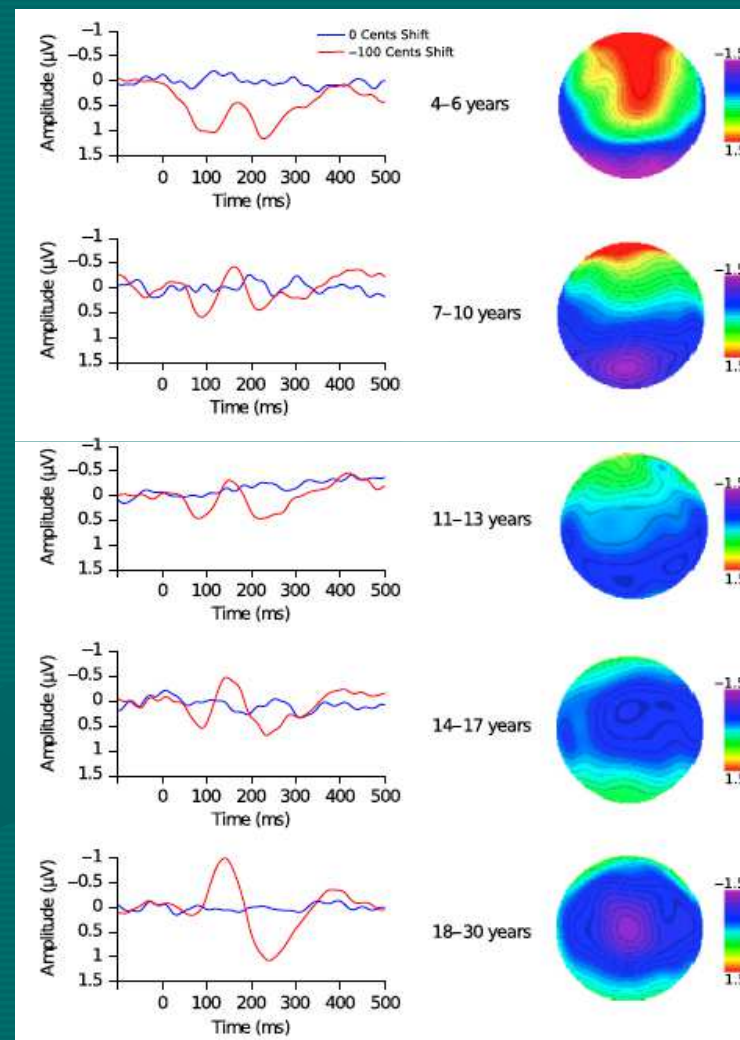
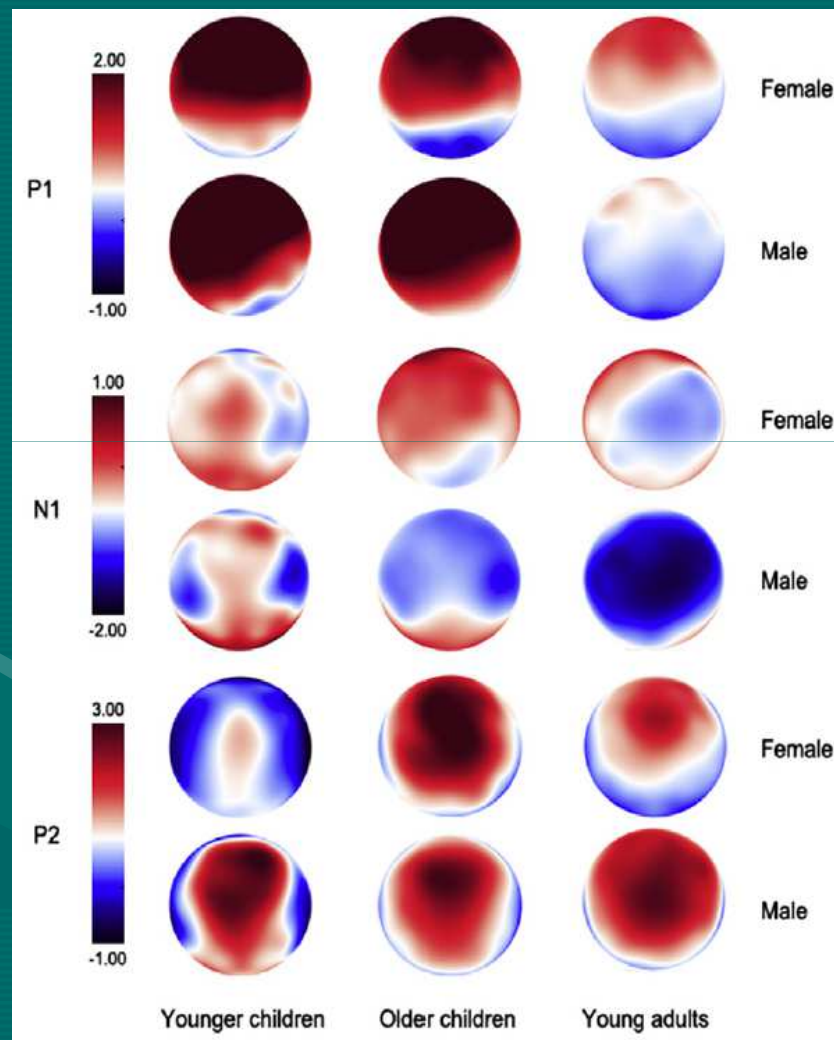
言语运动调控的脑电活动模式



Cantonese

Mandarin

言语运动调控的脑电活动模式

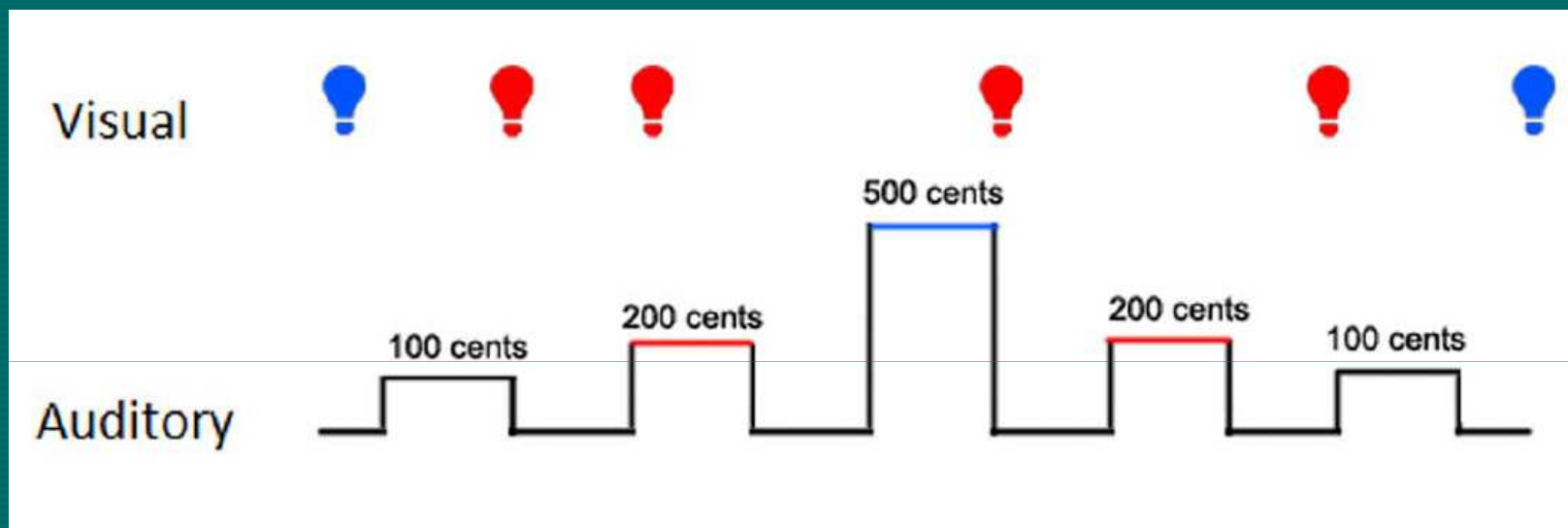


Liu et al., Clin. Neurophysiol., 2013.
Scheerer et al., Euro. J. Neurosci., 2013.

言语运动调控的认知机制

- 言语运动调控是一个自动化加工过程
- 言语运动行为是一个复杂的认知过程
- 认知功能（注意力、工作记忆）的作用？

注意力对言语运动调控的作用机制

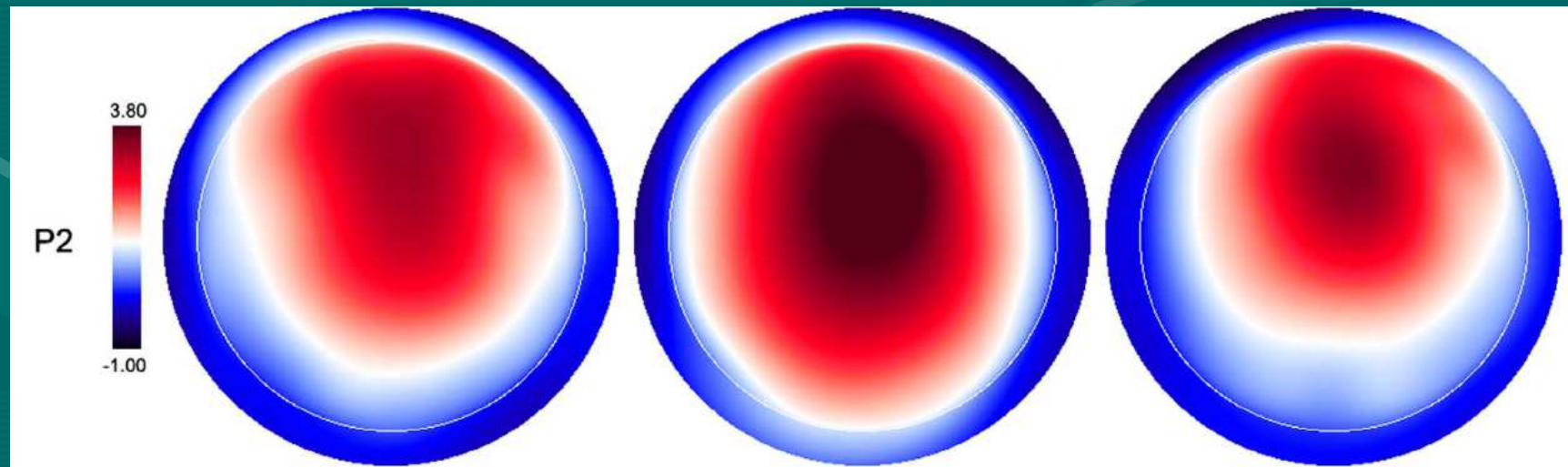
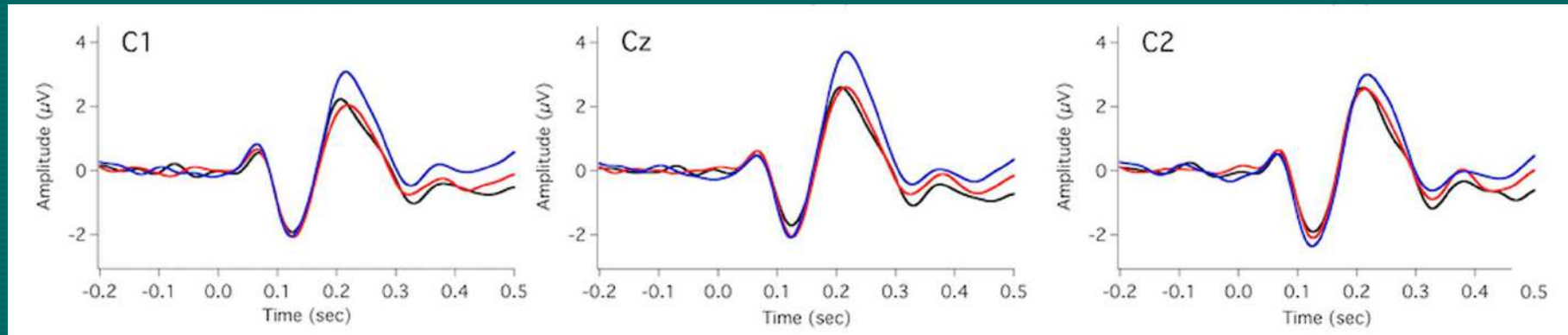


Task:

Visual stimuli: the number of flashing lights

Auditory stimuli: the number or the type of pitch perturbations

选择性注意力作用

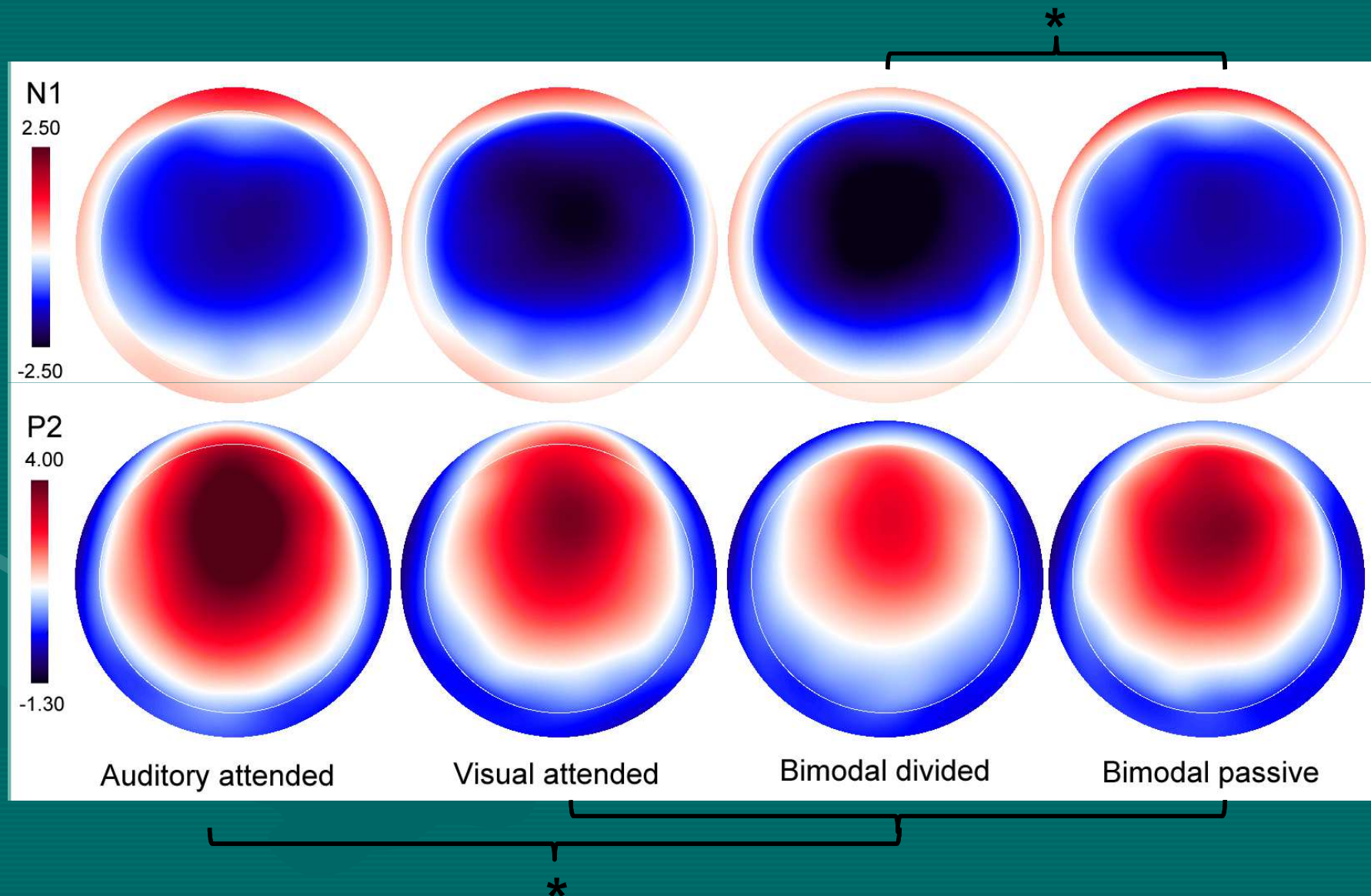


Baseline condition

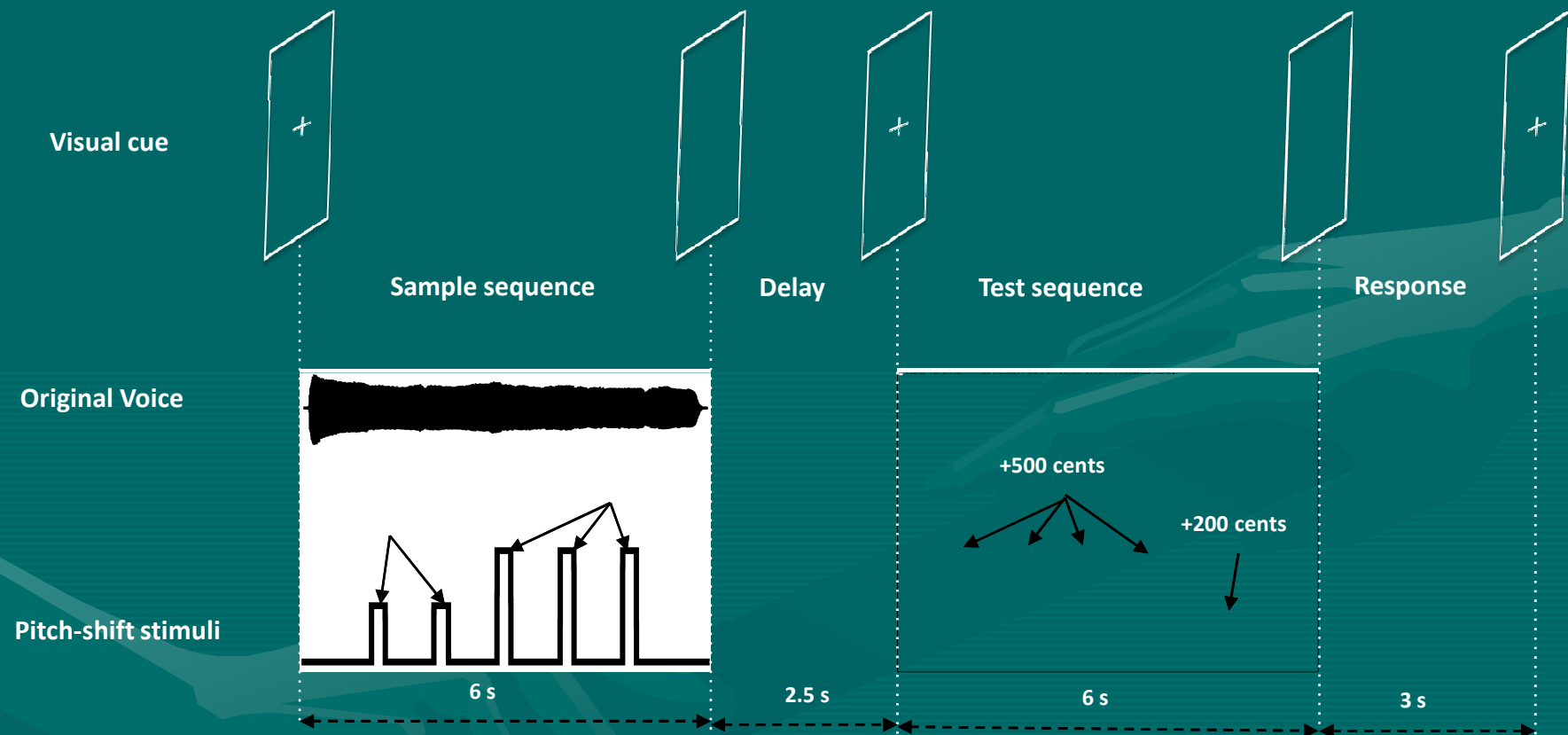
Attention-Low load

Attention-High load

选择性注意力与分散性注意力

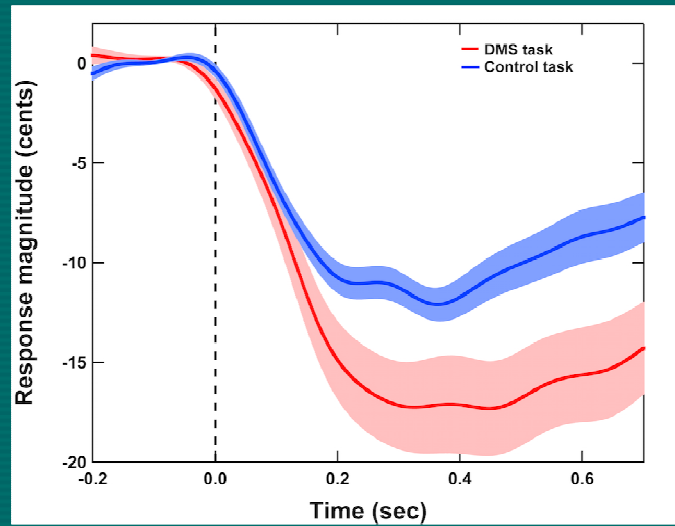


工作记忆对言语运动调控的影响

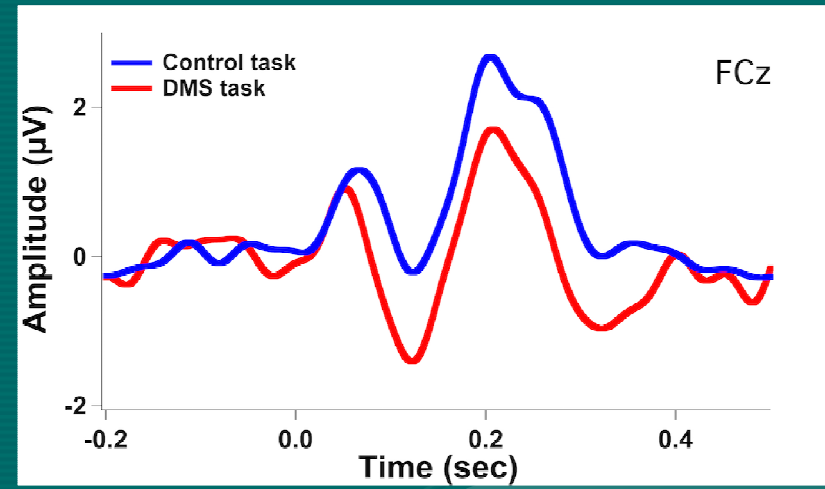


Delayed matching-to-sample (DMS) paradigm

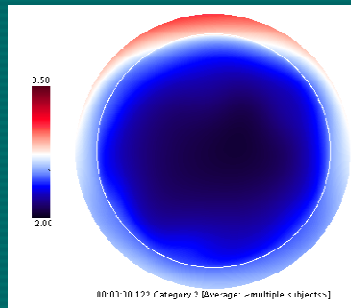
(A)



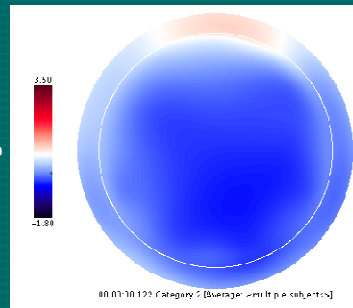
(B)



N1



>

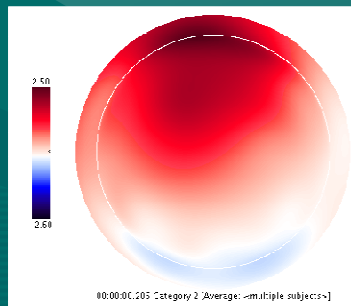


(C)

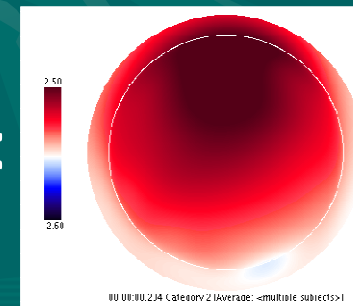
DMS task

Control task

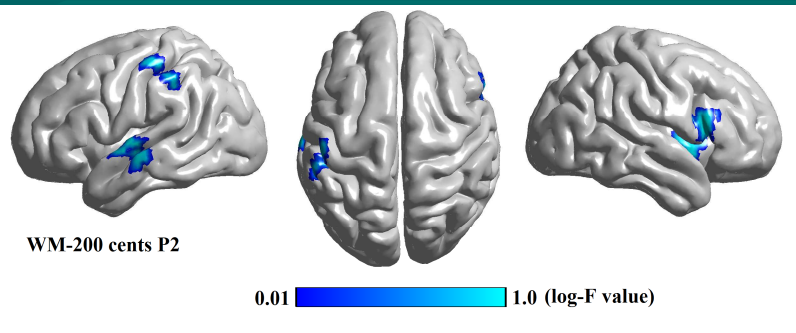
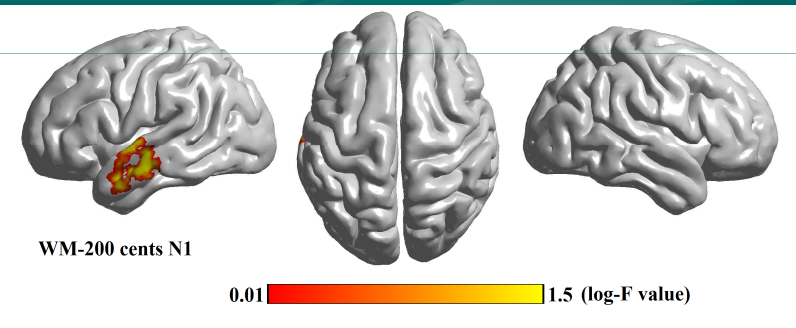
P2



<



(D)



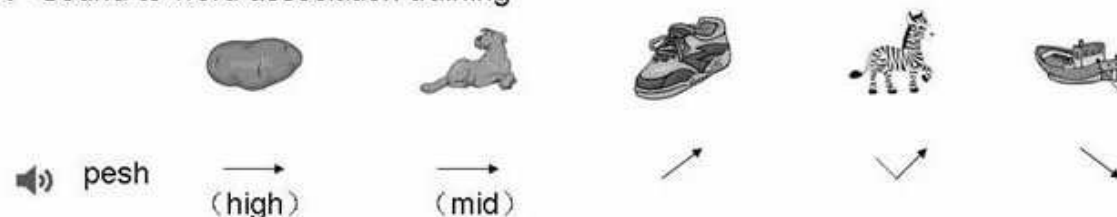
Unpublished data

言语运动调控的神经可塑性

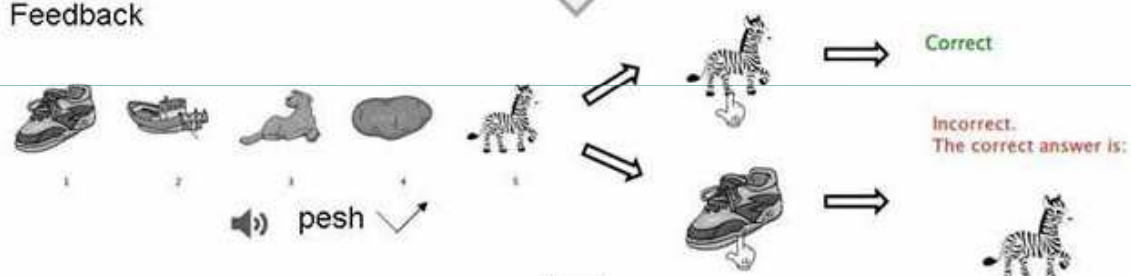
- 神经系统的结构和功能不是一成不变的
- 言语运动调控行为是否存在可塑性？
- 如何通过训练提高言语运动调控能力？

言语感知训练与言语运动调控

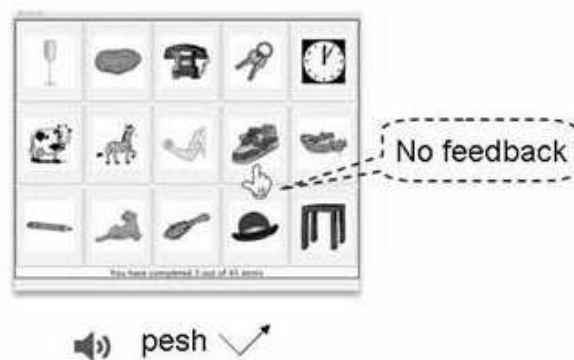
A Sound-to-word association training

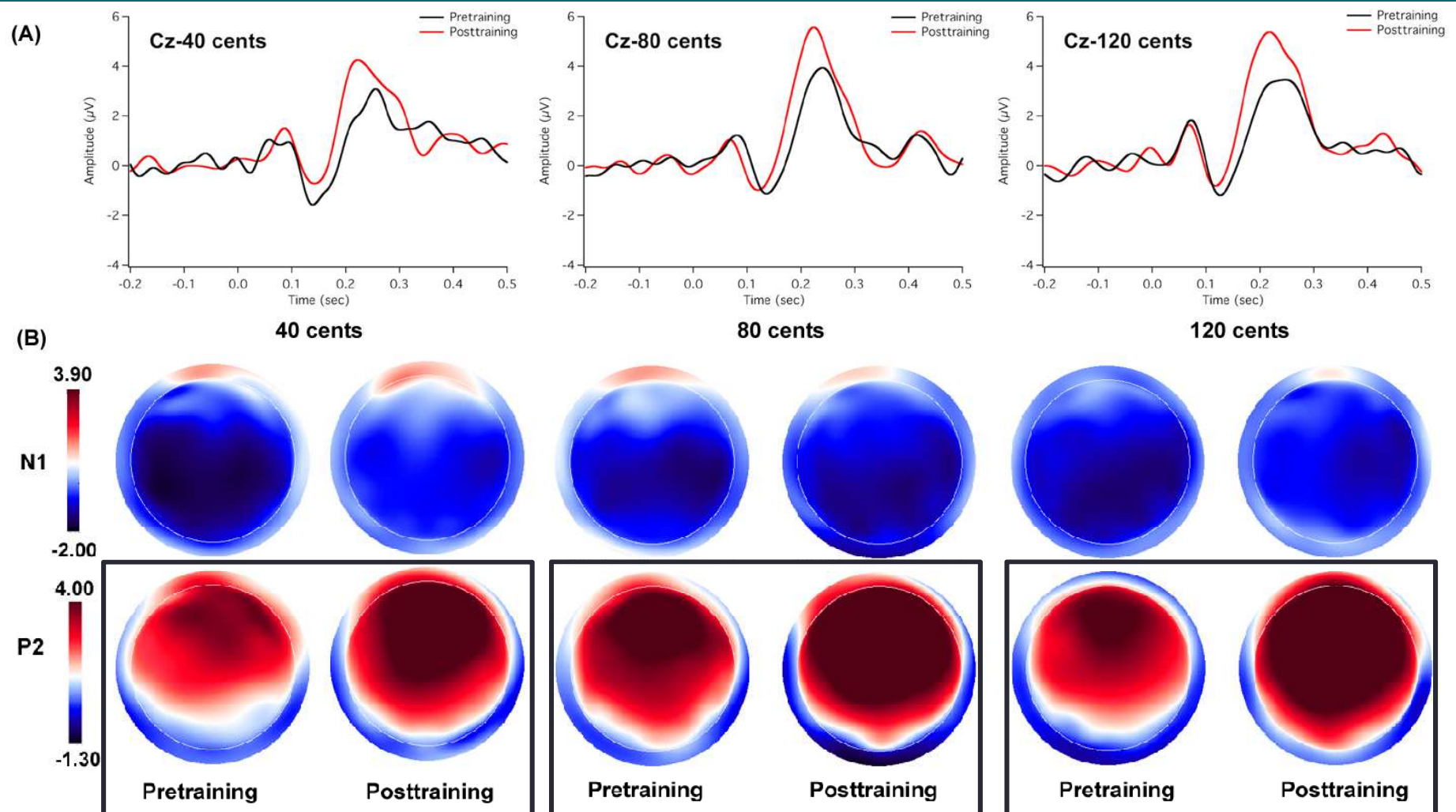


B Feedback



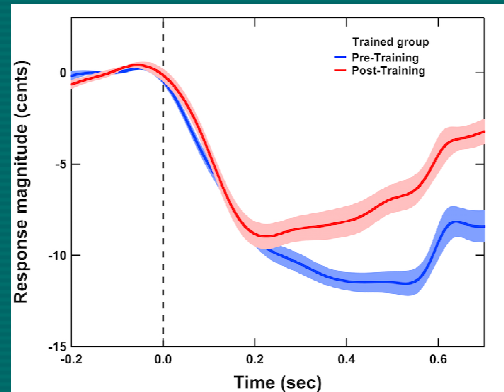
C Test



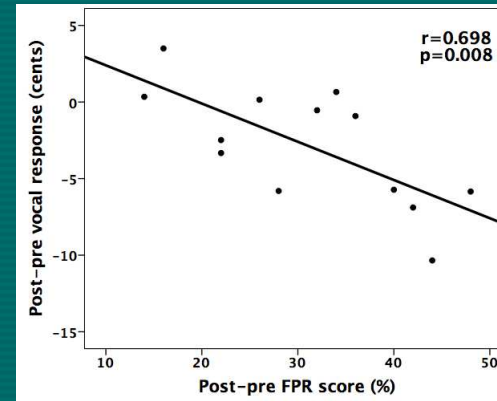


工作记忆训练与言语运动调控

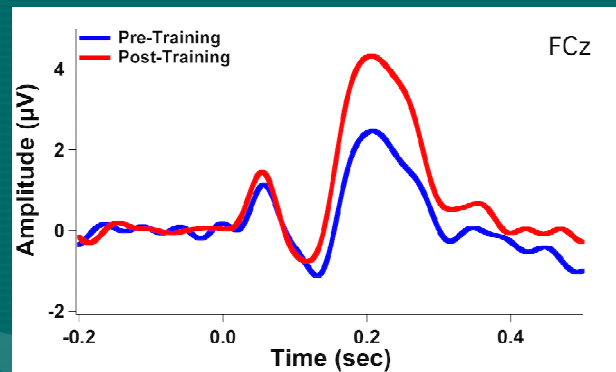
(A)



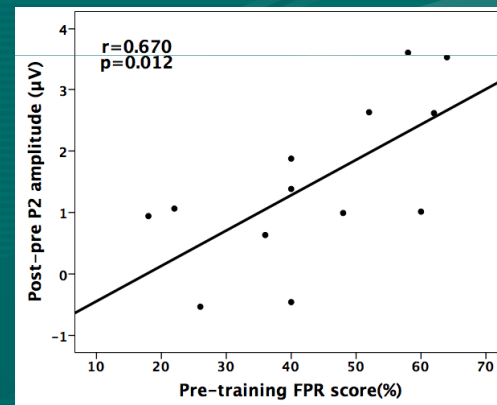
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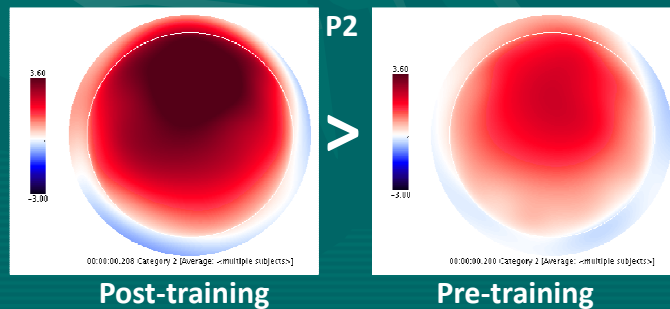
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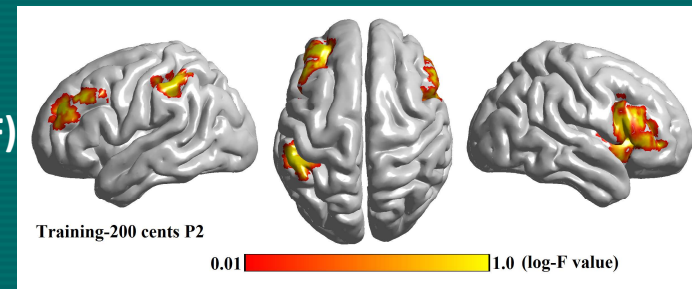
(D)



(E)

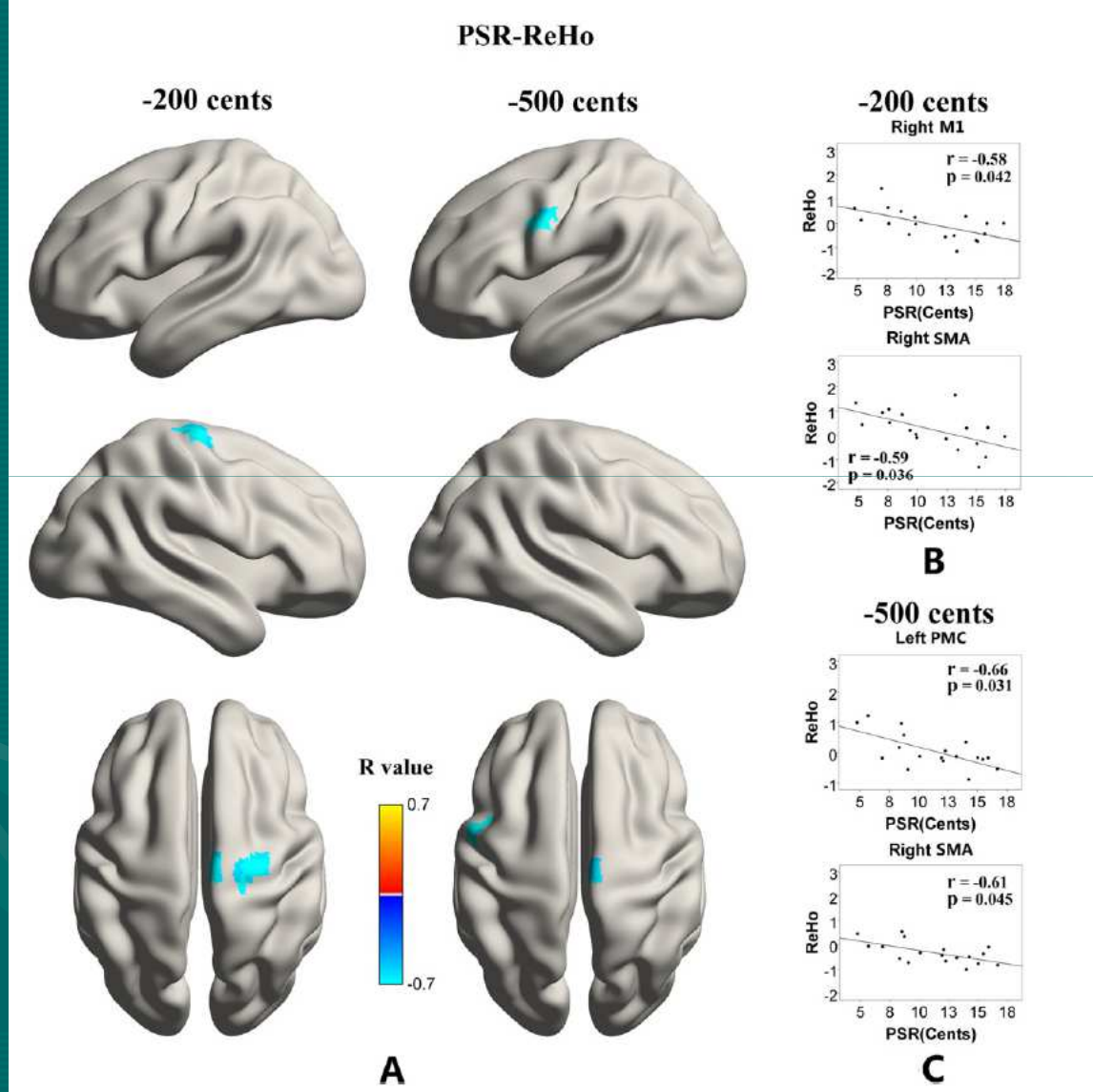
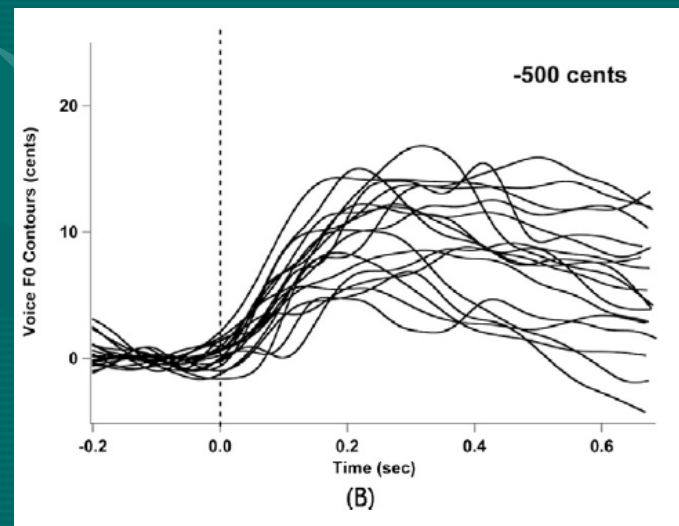
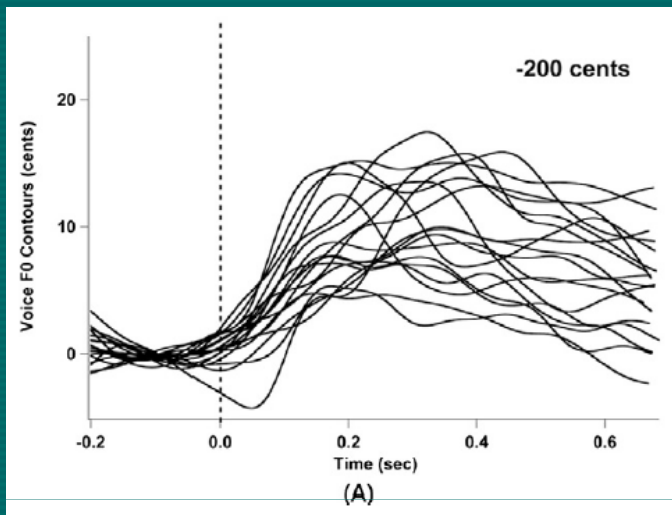


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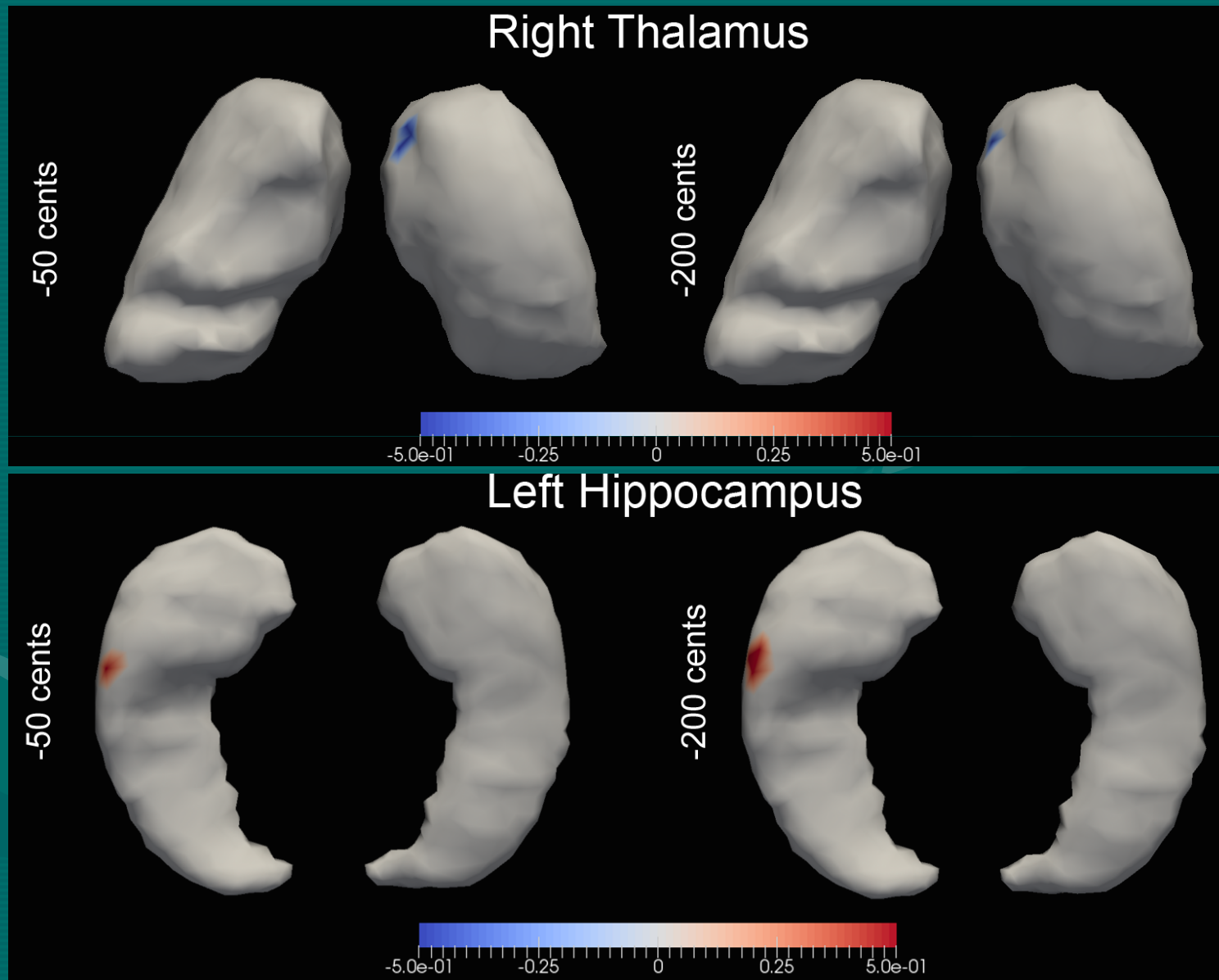


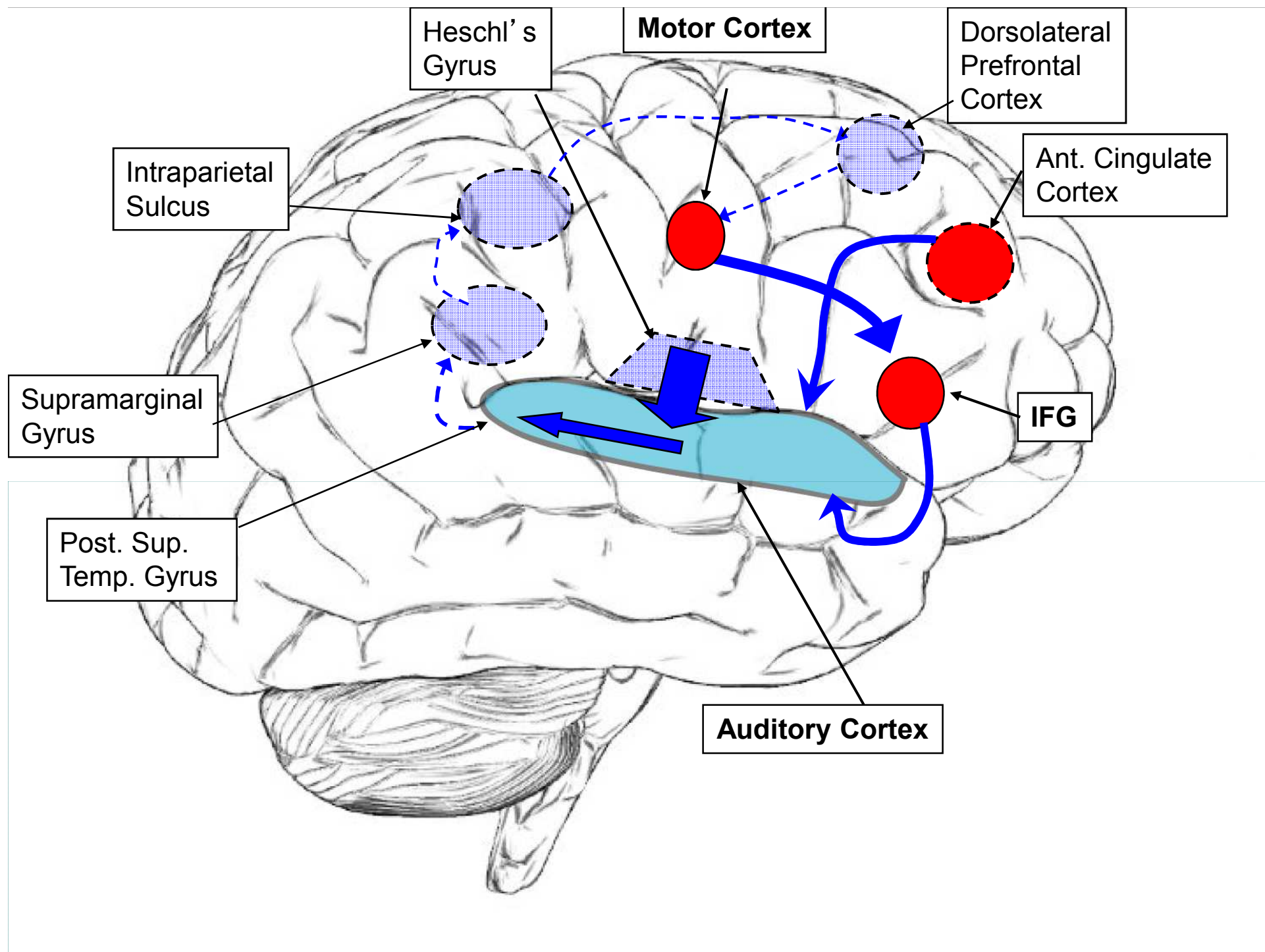
Unpublished data

言语运动调控个体差异的神经基础



言语运动调控与皮层下结构的形变





The background is a solid teal color. A faint, stylized illustration of two hands shaking is visible, rendered in a lighter shade of teal. The hands are positioned diagonally across the frame, with one hand on the left and the other on the right, meeting in the center.

Thank you!