



Attività Didattica Elettiva
Anno Accademico 2007-2008

Corso di Formazione ECM



Neuroimaging funzionale in psichiatria (1)

*FMRI e tecniche di imaging di risonanza magnetica:
aspetti clinici e tecnici*

Benvenuti

Massimo Piccirilli

Dal *cervello* alla *mente*

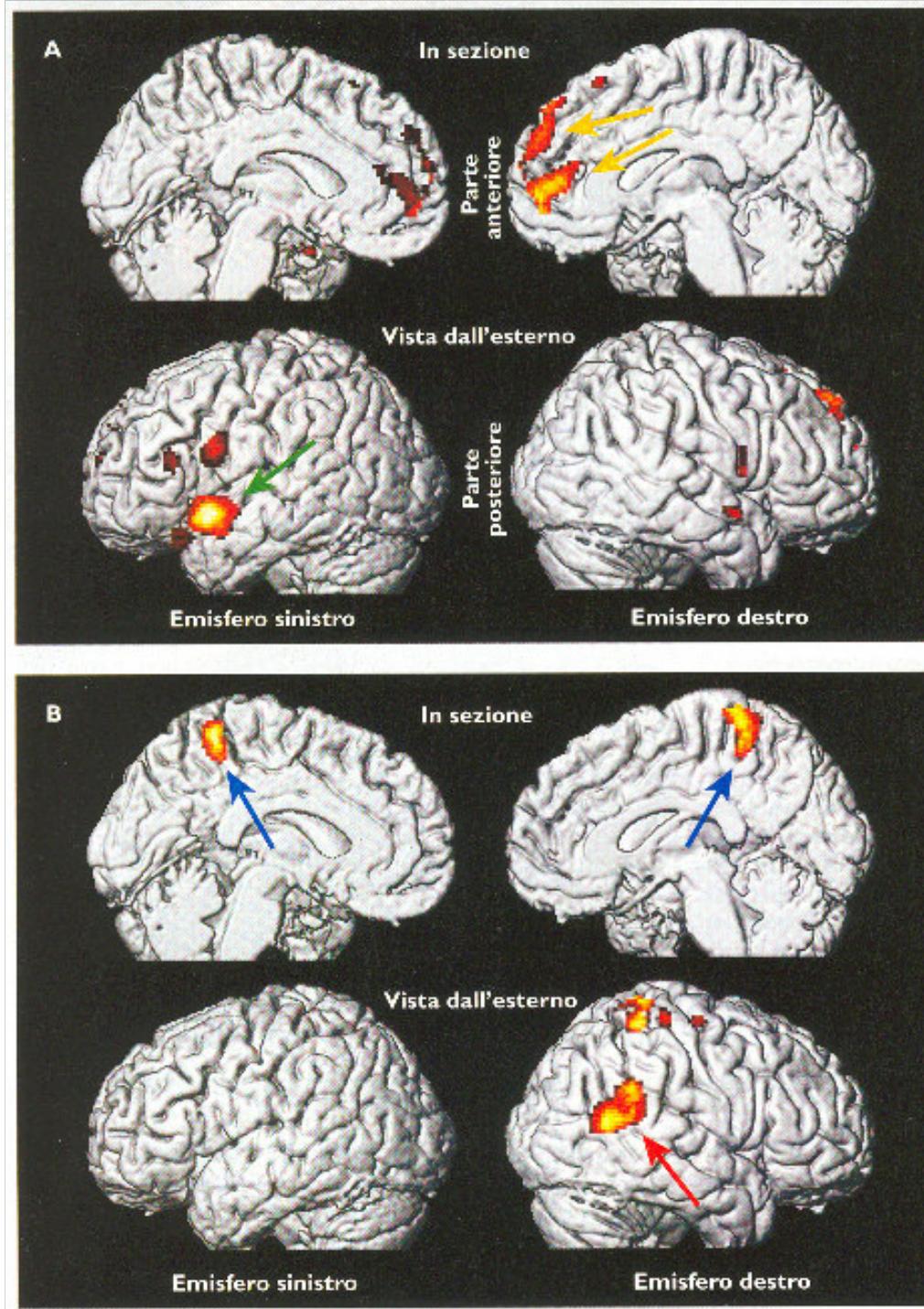
appunti di neuropsicologia



Morlacchi Editore

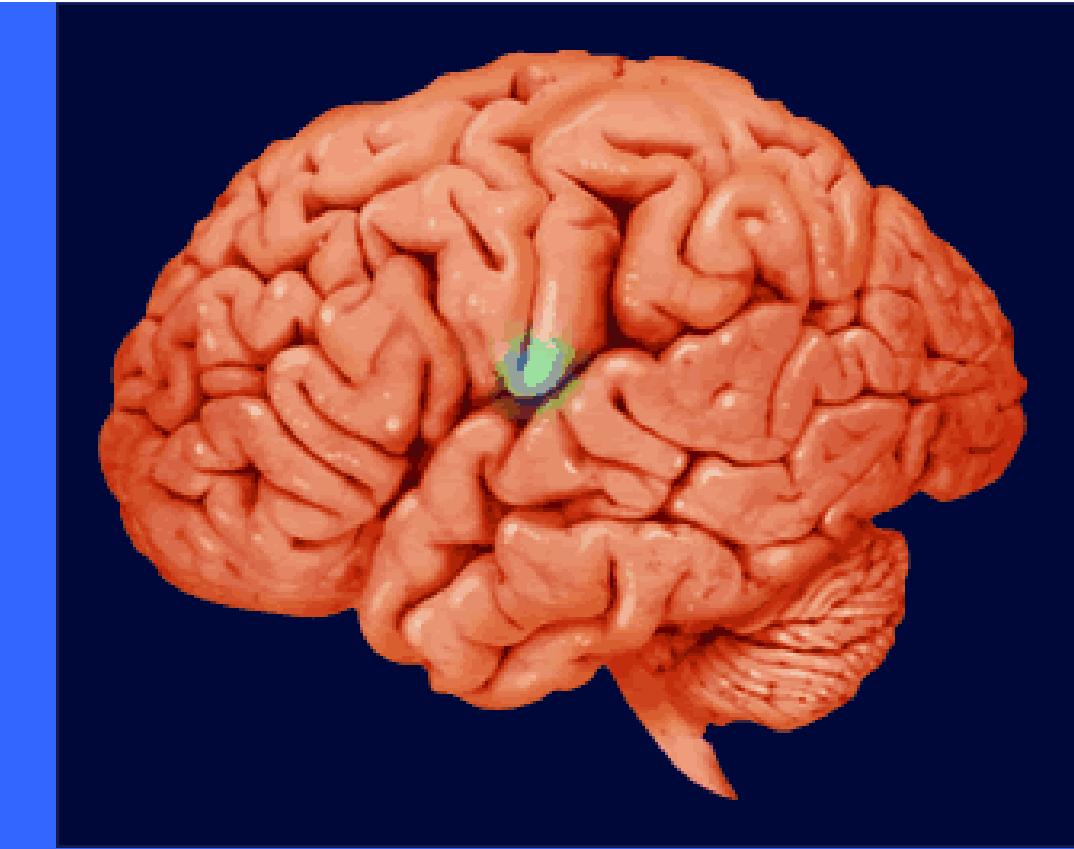
Introduzione

www.dalcervelloallamente.com



Michael Posner ha paragonato l'impatto delle neuroimmagini funzionali sulle neuroscienze a quello del telescopio sull'astronomia:

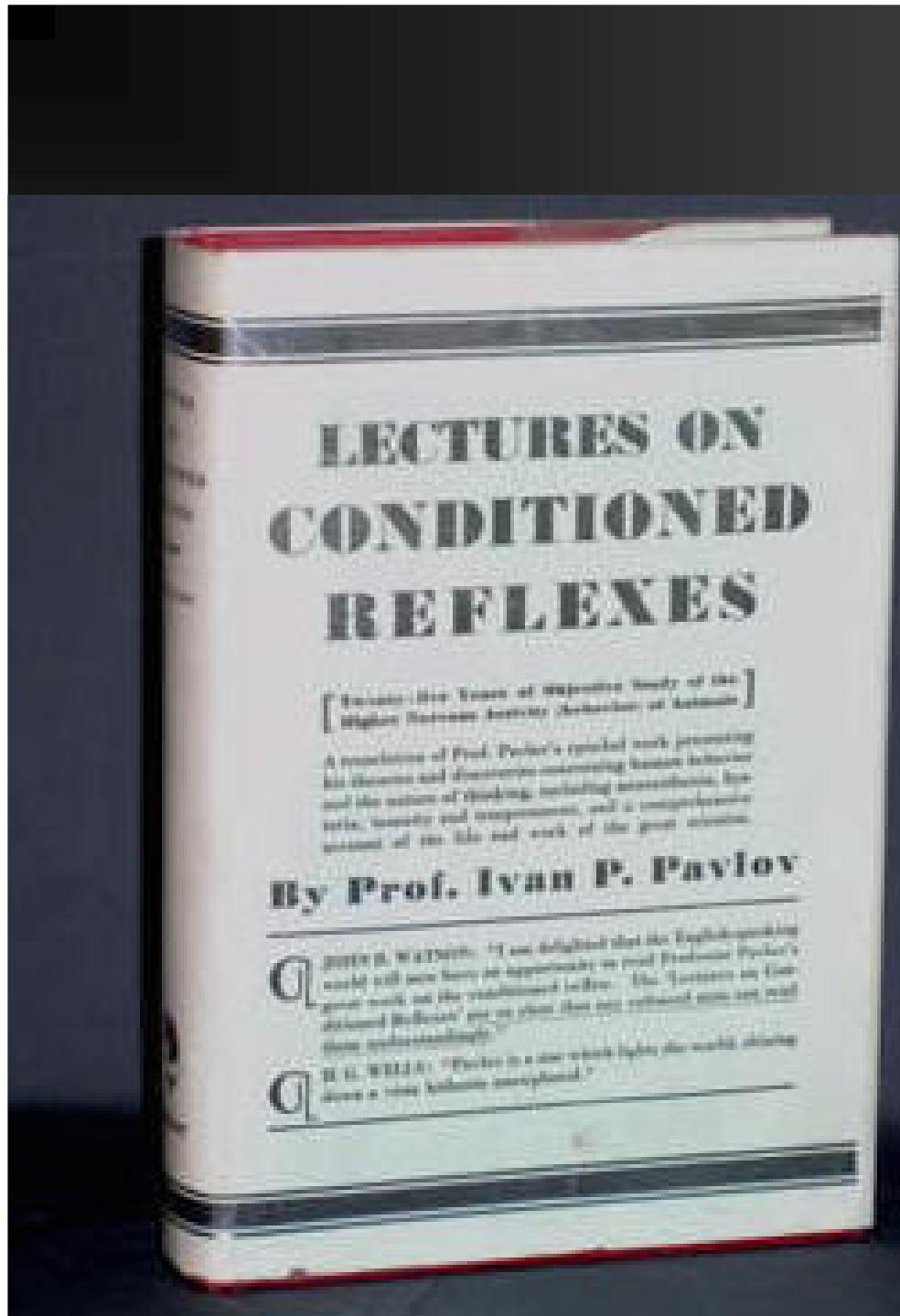
diventa possibile osservare direttamente ciò che poteva soltanto essere intuito ed ipotizzato basandosi su dati indiretti.



Thomas Stern Eliot nel poema "The love song of F. Alfred Prufrock", descrive il timido Prufrock che di fronte alla donna che ama si trova improvvisamente senza parole ("mi riesce impossibile dire ciò che sento")

e immagina che, invece di faticare per dire esattamente ciò che pensa, sarebbe stato possibile mostrare i lampi dell'attività mentale corrispondenti ai suoi pensieri

"come se una *lanterna magica*
proiettasse i nervi in immagini su uno schermo"



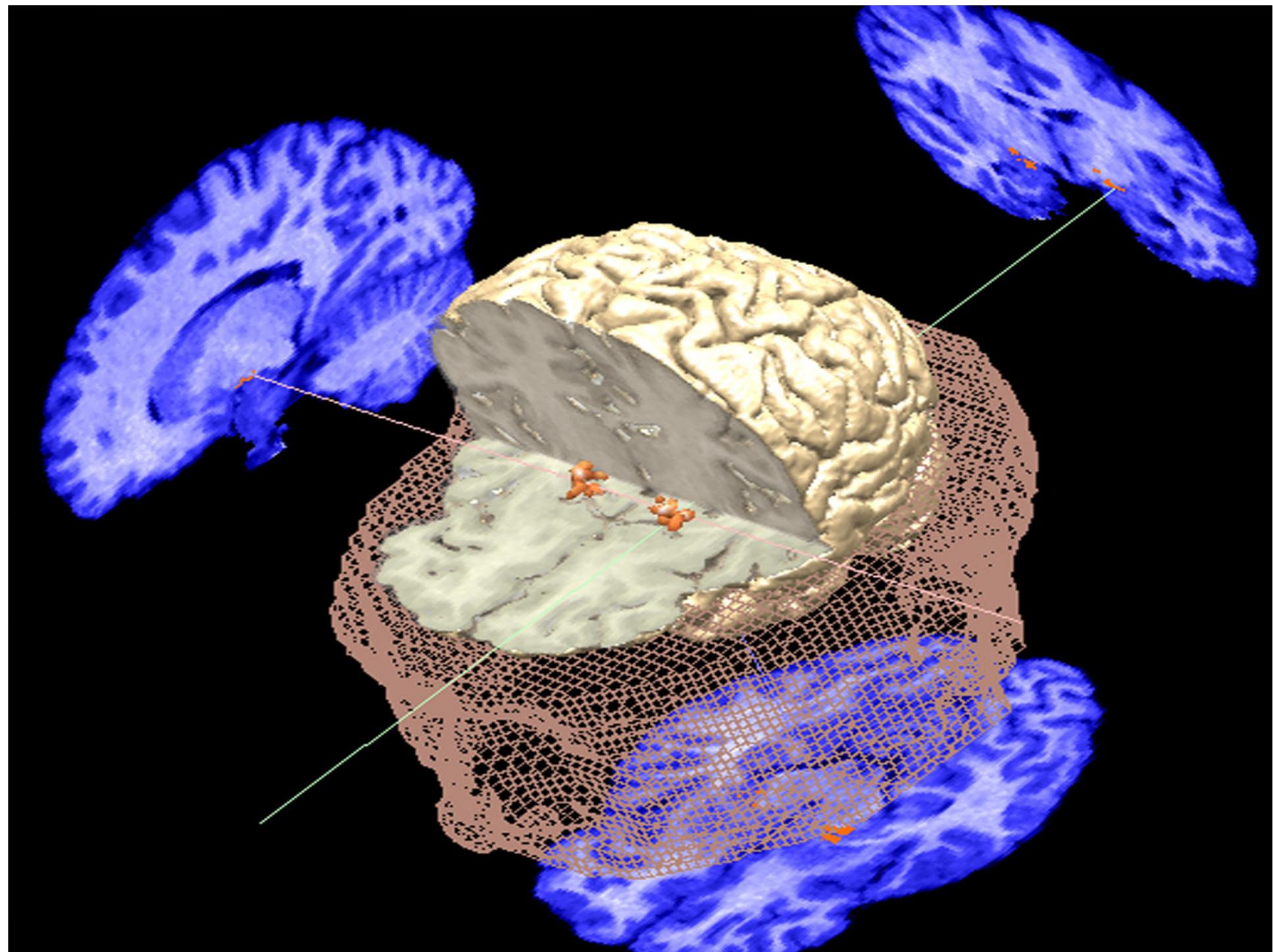
Se fosse possibile vedere attraverso la scatola cranica e se la zona maggiormente eccitata fosse luminosa,

si potrebbe seguire, in un uomo intento a pensare,

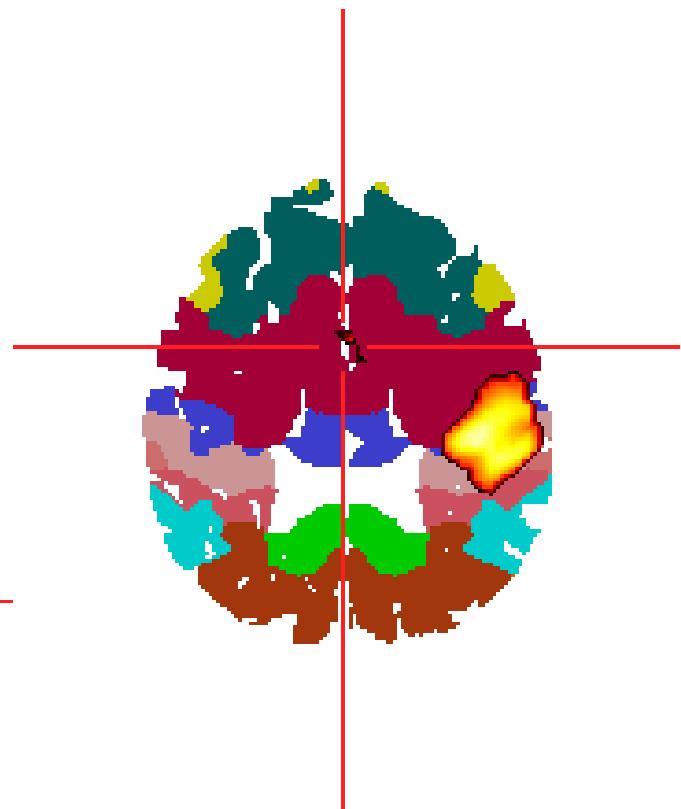
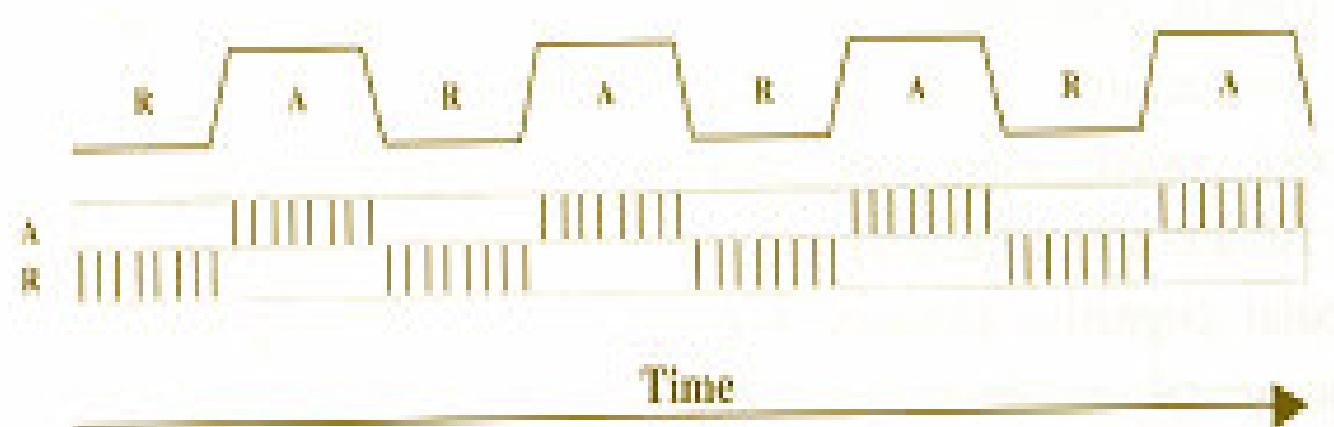
lo spostamento incessante di questo punto luminoso,

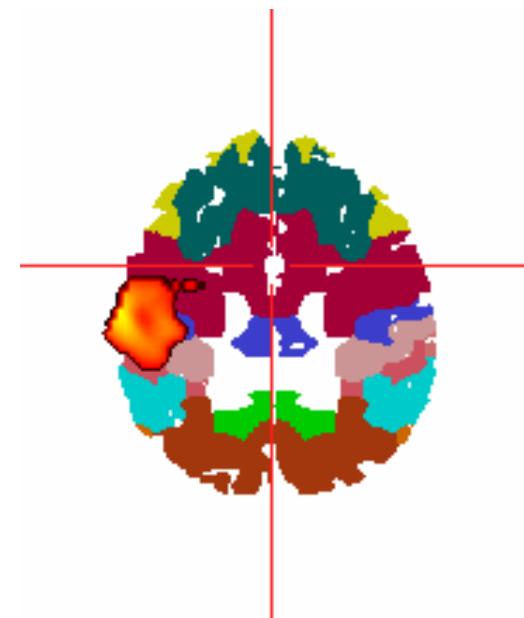
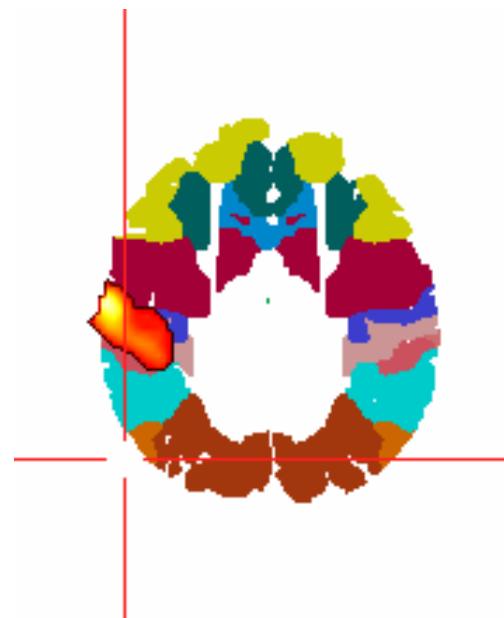
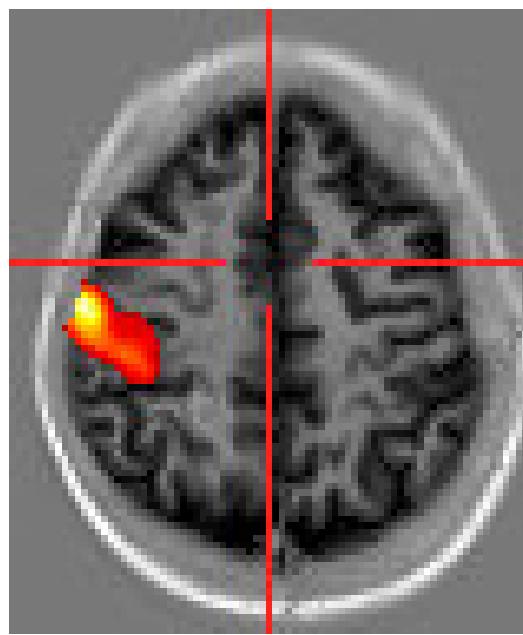
in un continuo cambiamento di forma e dimensione, e circondato da una zona d'ombra più o meno fitta che occuperebbe tutto il resto degli emisferi

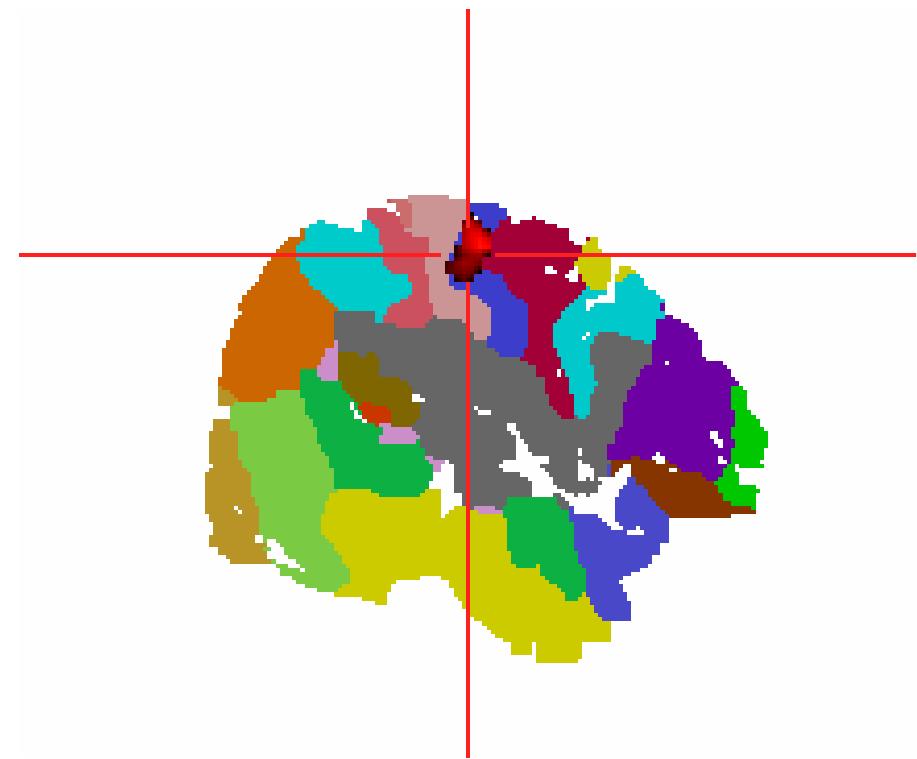
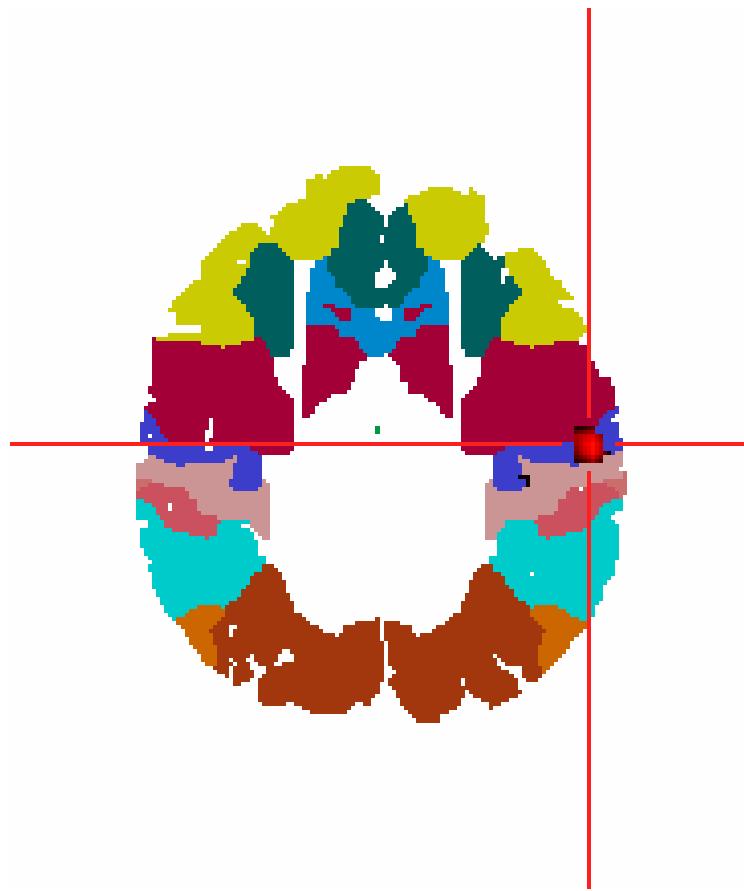
(Ivan P Pavlov, 1927)

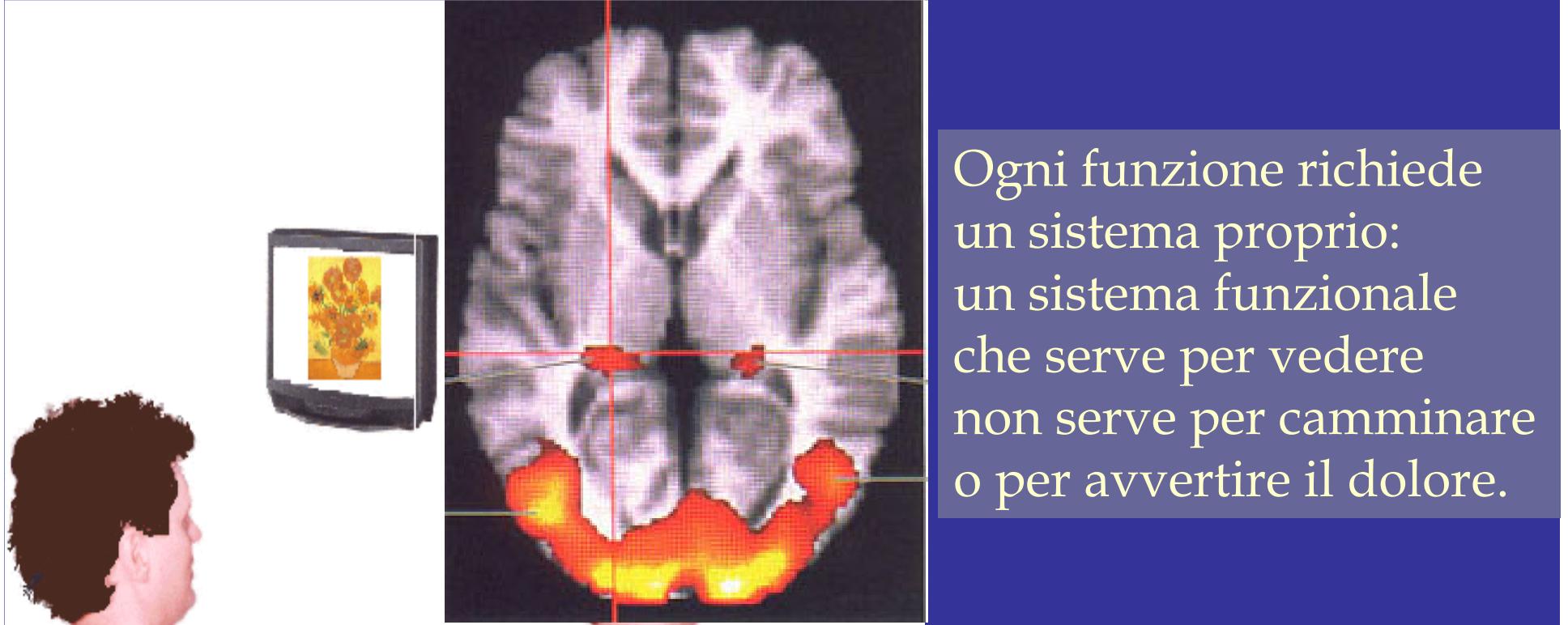


Alternating Design









Ogni funzione richiede un sistema proprio: un sistema funzionale che serve per vedere non serve per camminare o per avvertire il dolore.

Le funzioni cognitive non hanno sede in un “centro nervoso” inteso come raggruppamento neuronale direttamente responsabile di una specifica funzione.

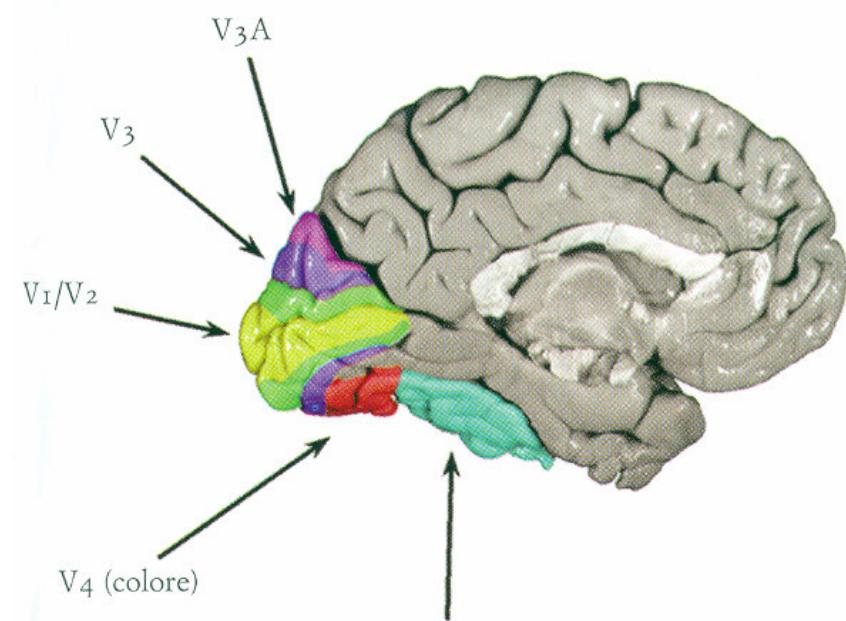
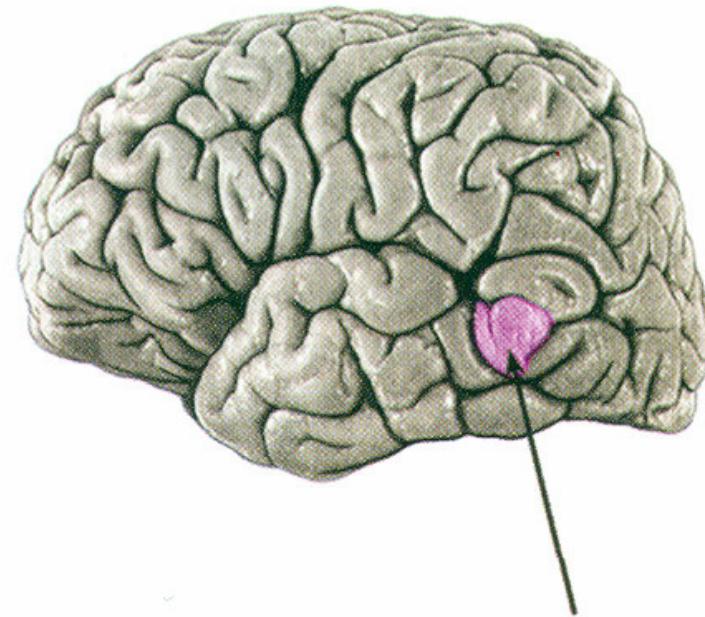
Per l'espletamento di qualunque processo mentale è necessario un intero sistema di aree corticali intimamente collegate tra loro, che lavorano in sintonia e si integrano.

Frontal Lobe



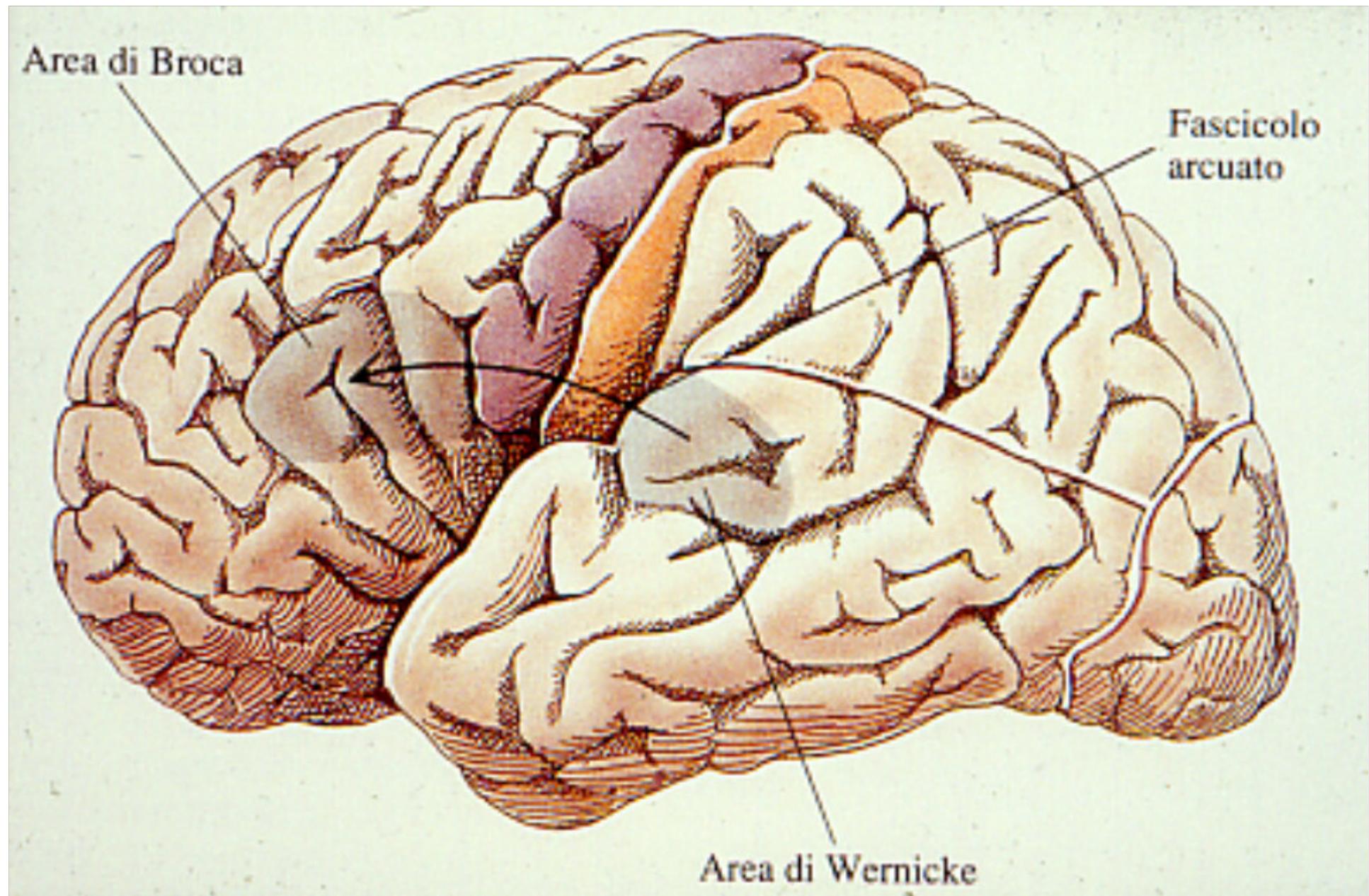
Ogni area è altamente differenziata e svolge un ruolo preciso all'interno di tutto il sistema funzionale.

Il sistema nervoso può essere pensato come un mosaico di dispositivi (un insieme di strutture altamente specializzate) che funzionano come un tutto unico



Aree del riconoscimento
dei volti e degli oggetti





“Nous parlons avec l’hemisphère gauche!” (P. Broca)

Fluenza verbale

generazione di

parole
verbi
frasi

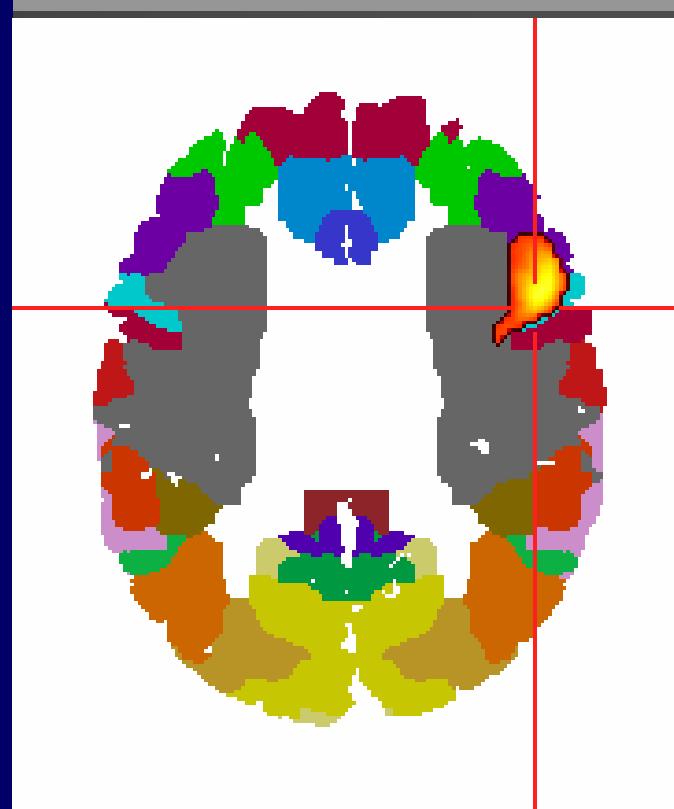
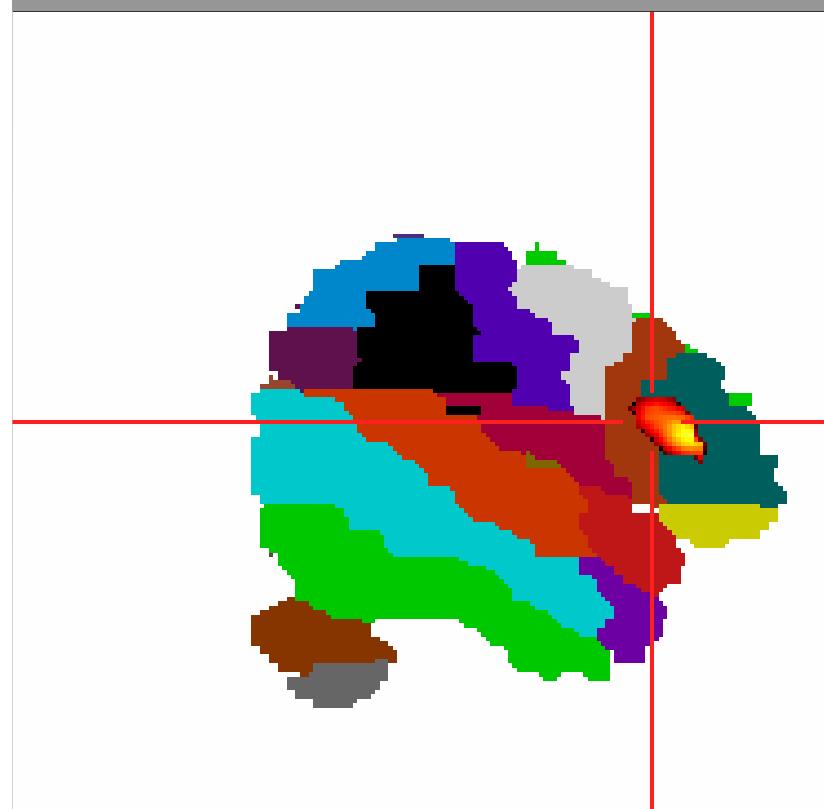
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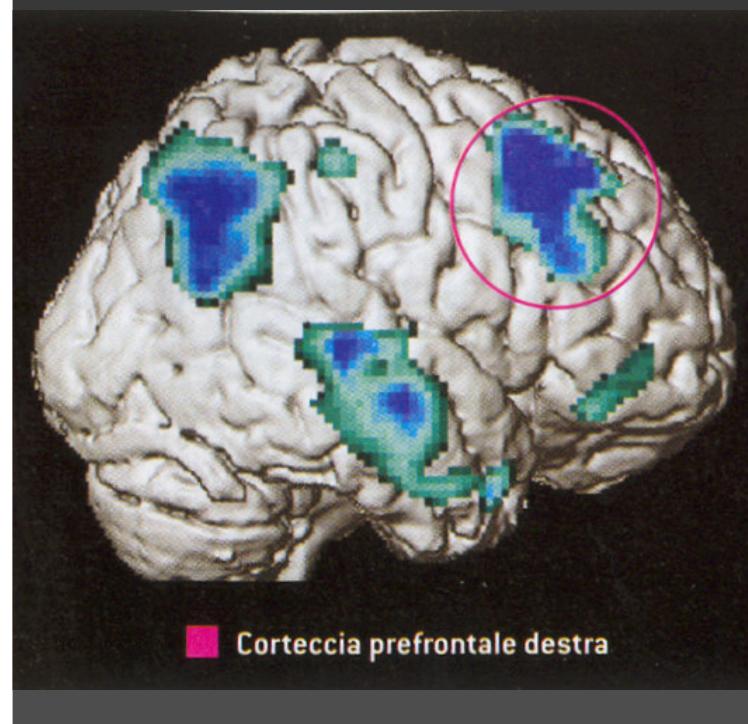
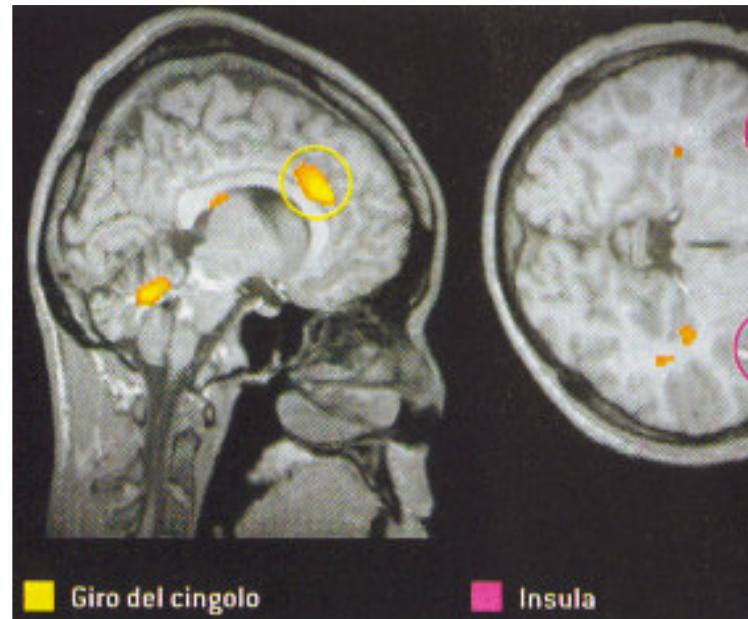
stimolo

acustico
visivo
.....

suggerimento

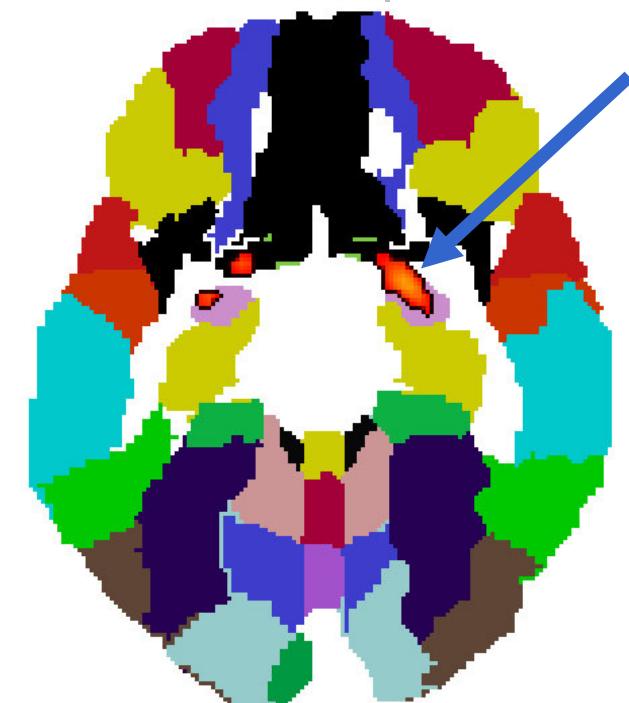
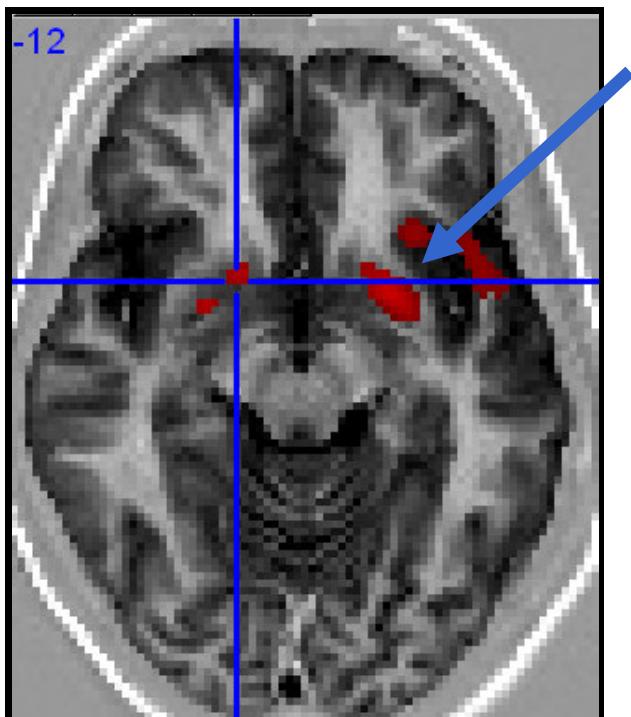
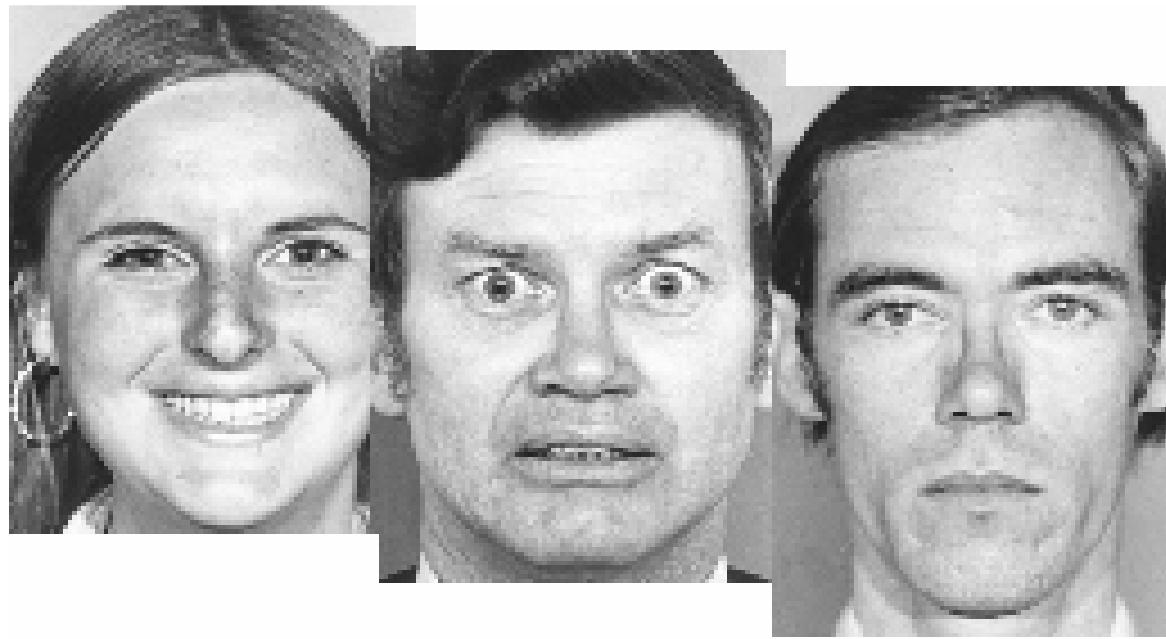
categoria semantica
lettera iniziale
.....

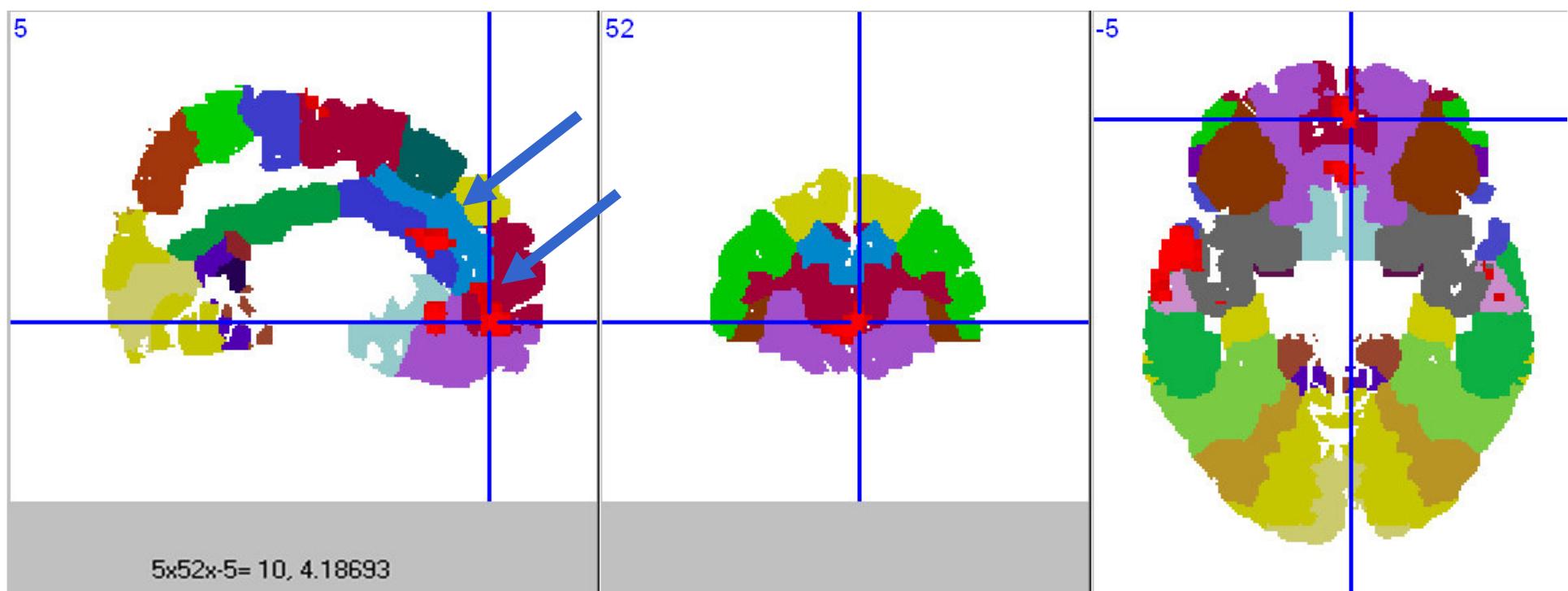
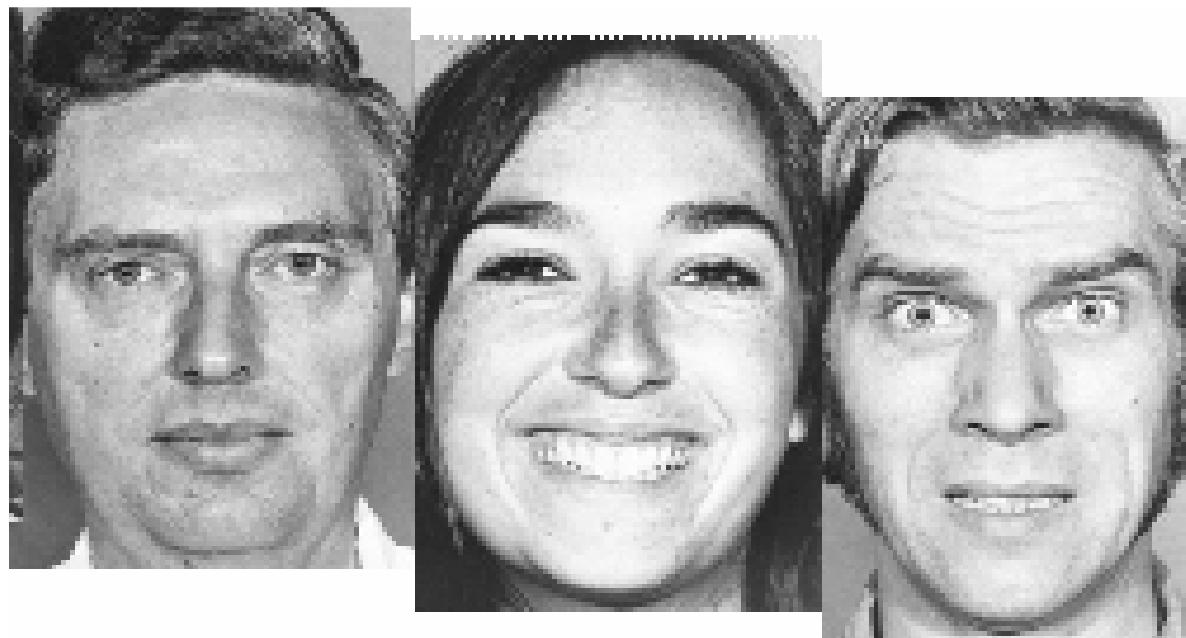


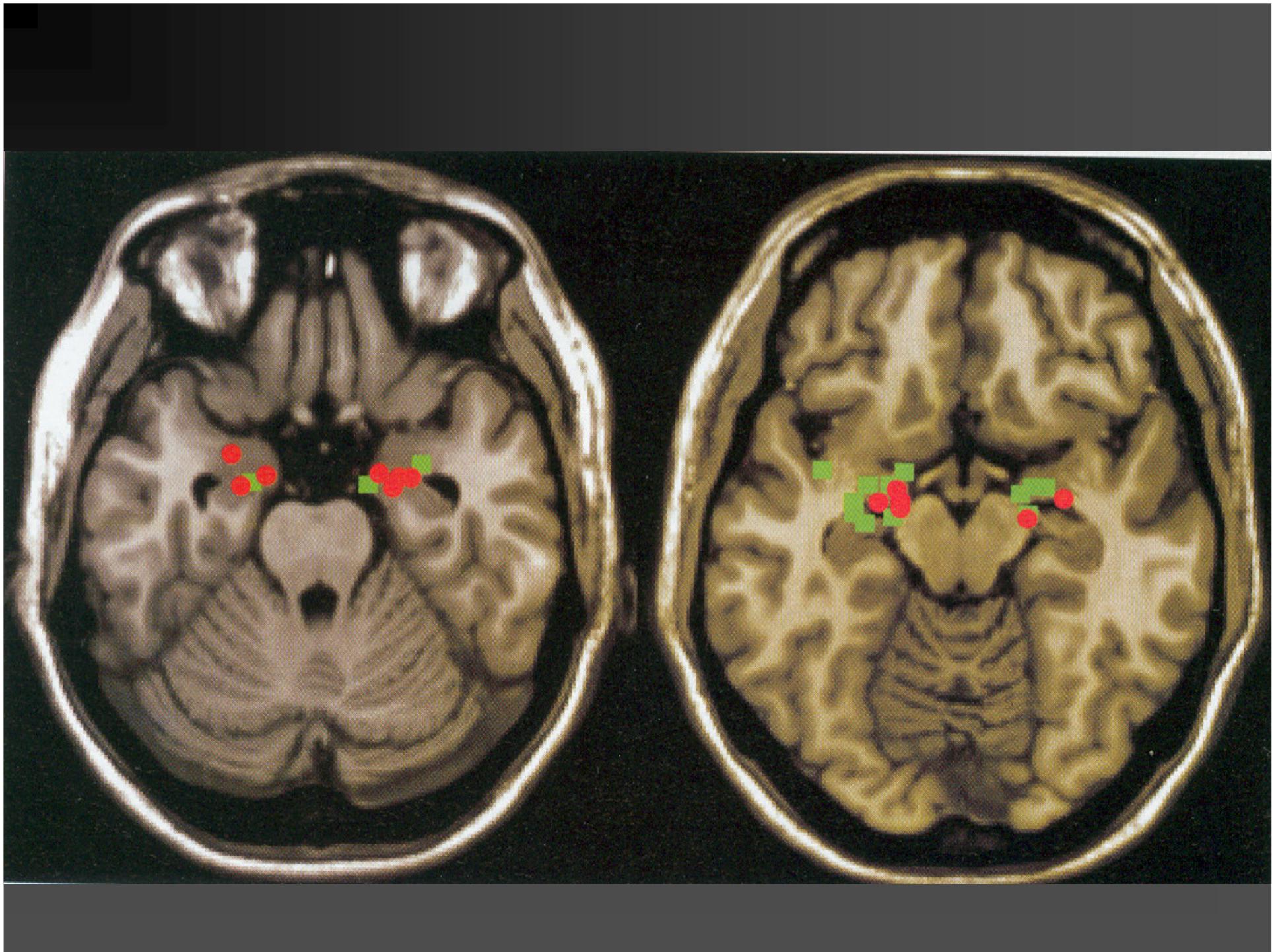


The neural basis of romantic love

A Bartels e S Zeki, 2000







Valori morali

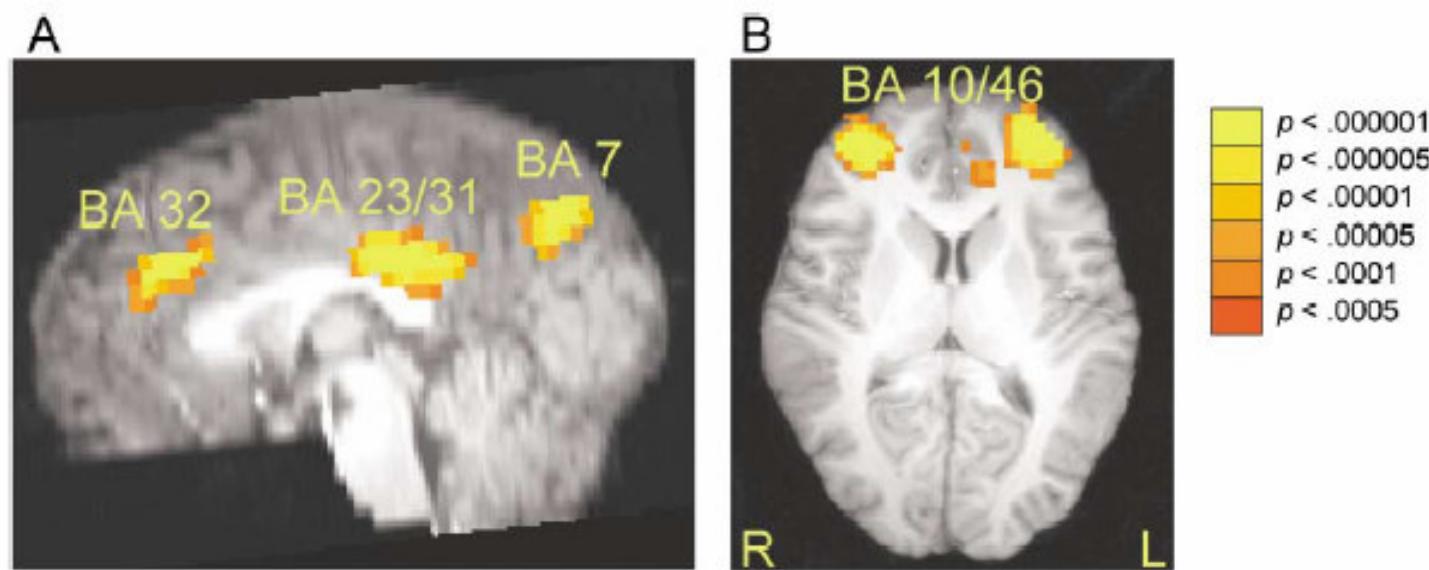
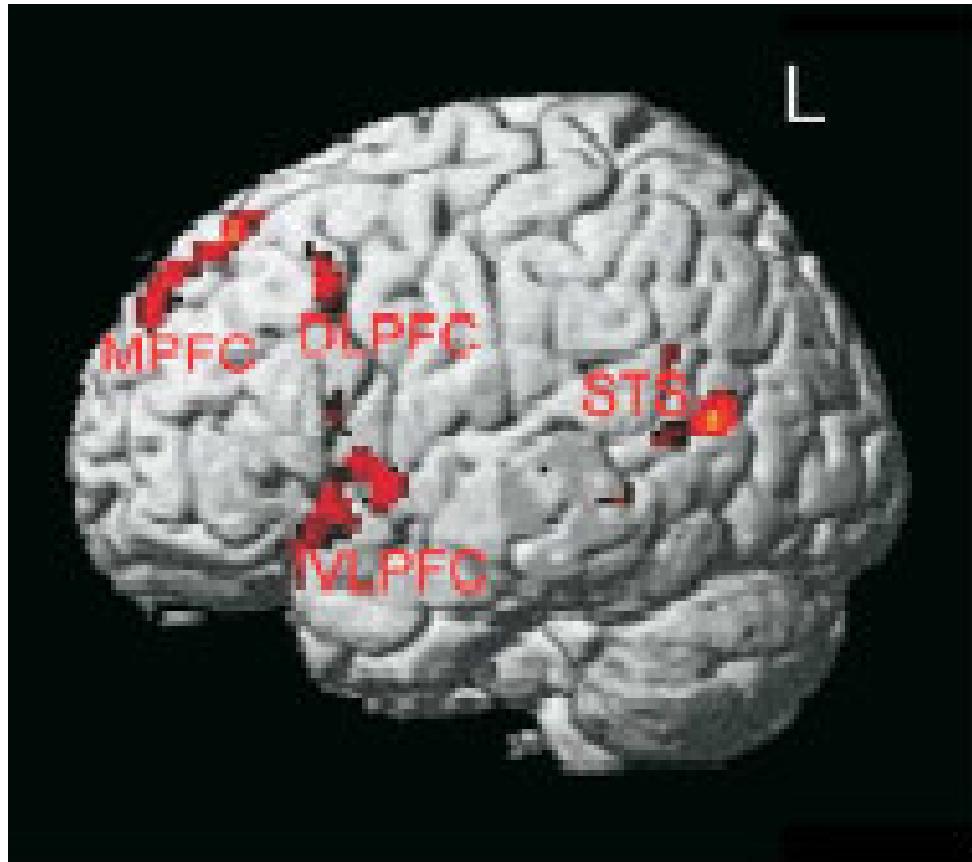


Figure 2. Difficult versus Easy Personal Moral Judgment

Selected brain regions (see Table 2) exhibiting significantly increased activity for difficult (high-RT), as compared to easy (low-RT), personal moral judgment: anterior cingulate cortex (BA 32), posterior cingulate cortex (BA 23/31), precuneus (BA 7), right and left middle frontal gyrus (BA 10/46). Statistical maps of voxelwise t scores were thresholded for significance ($p < 0.0005$) and cluster size (≥ 8 voxels). (A) Sagittal slice plane is $x = 0$; (B) axial slice plane is $z = +9$ (Talairach and Tournoux, 1988). Image is reversed right to left according to radiologic convention.

Menzogna



Bloccare la risposta automatica per produrre la menzogna

Human *Homo sapiens sapiens*

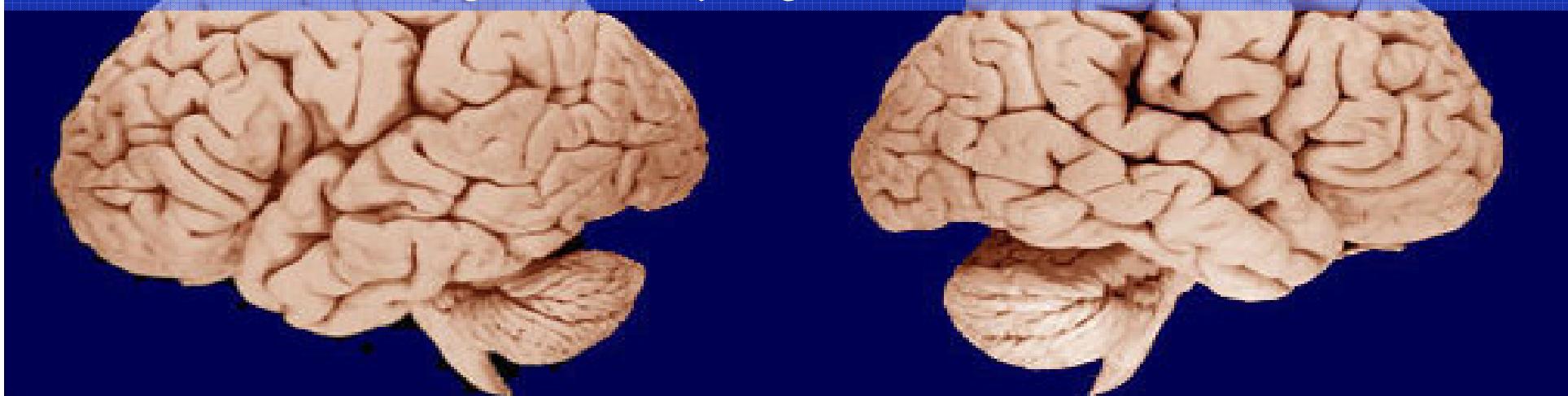


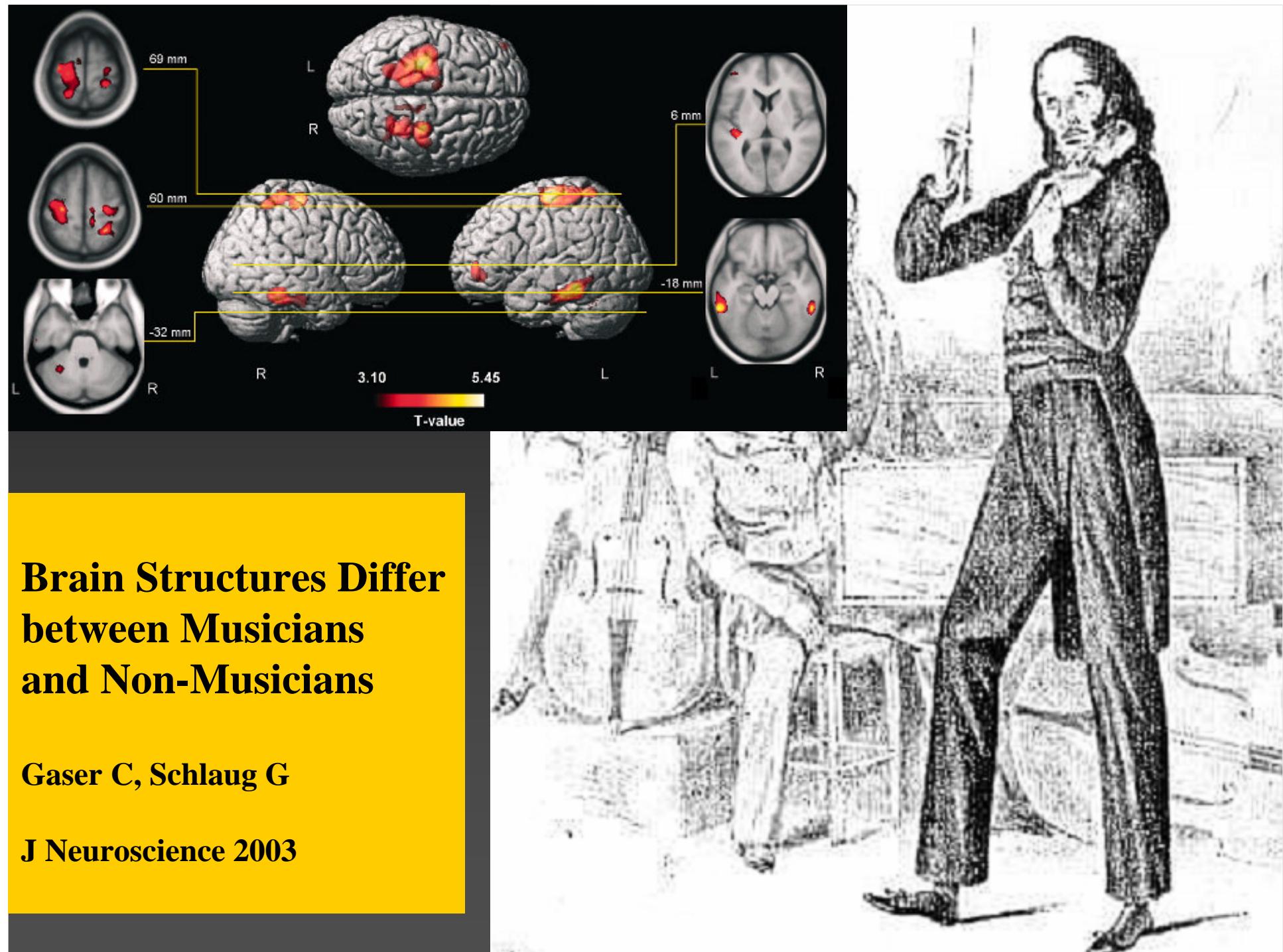
“Nei centri cerebrali dell’adulto i percorsi nervosi sono qualcosa di fissato, stabilito, immutabile.

Tutto può morire, nulla può essere rigenerato.”

Santiago Ramon y Cajal, 1914

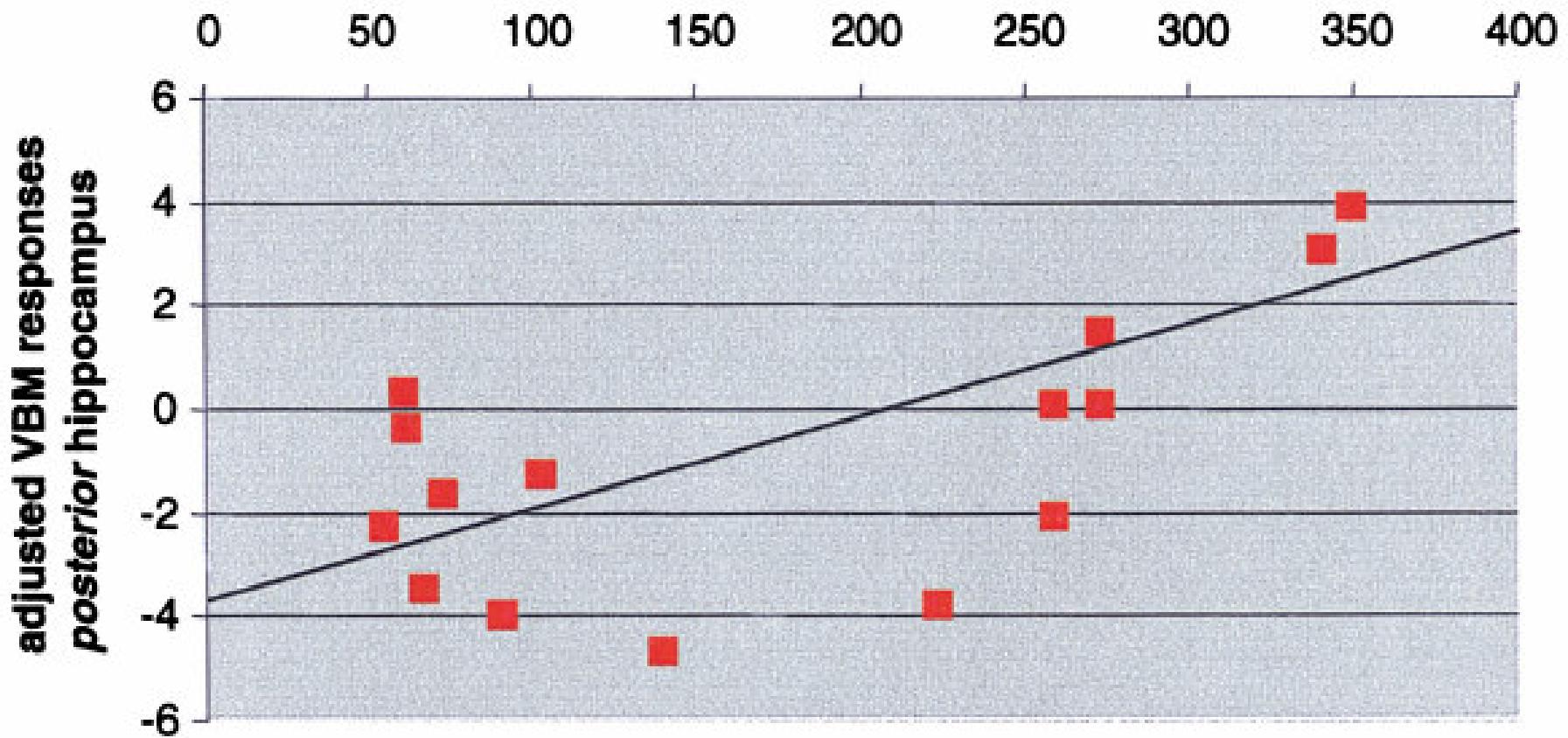
(*Estudios sobre la degeneration y regeneration del sistema nervioso*)

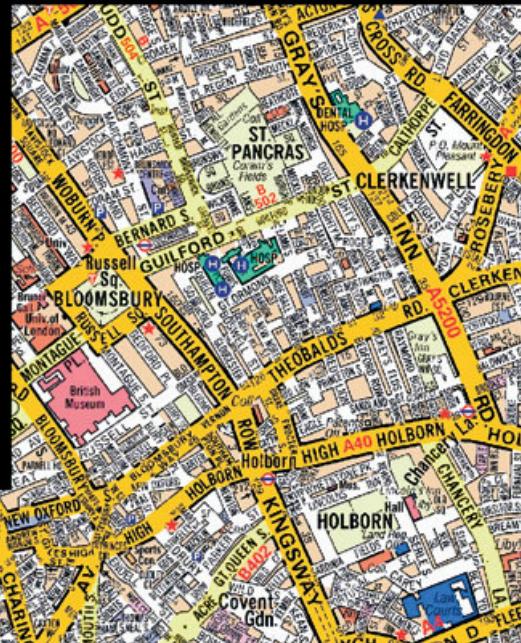
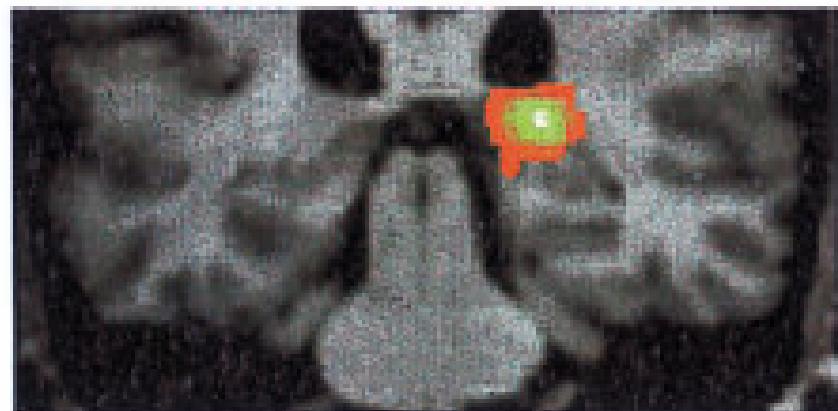
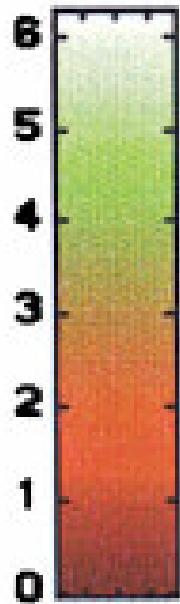
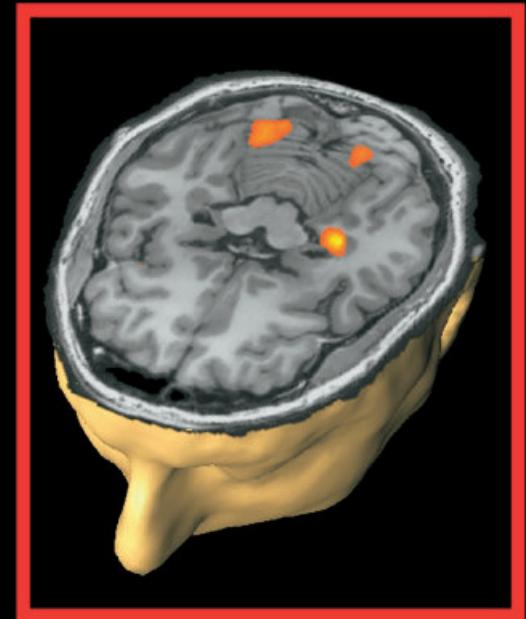


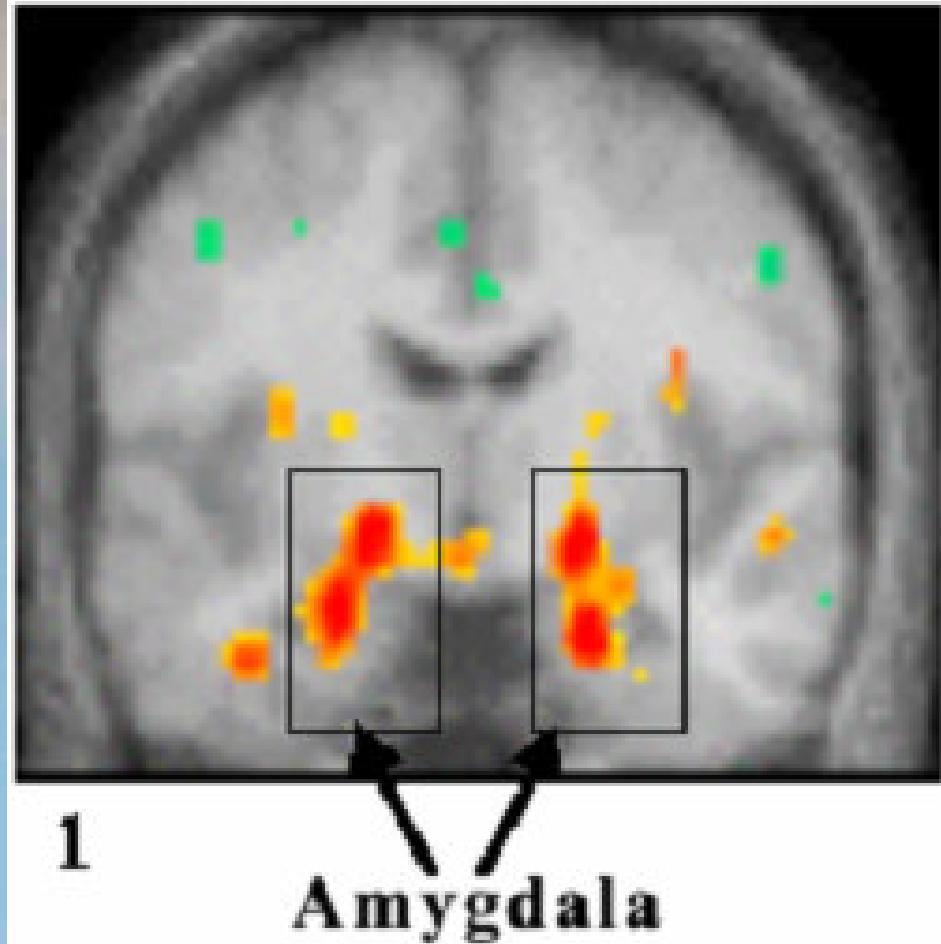


b.

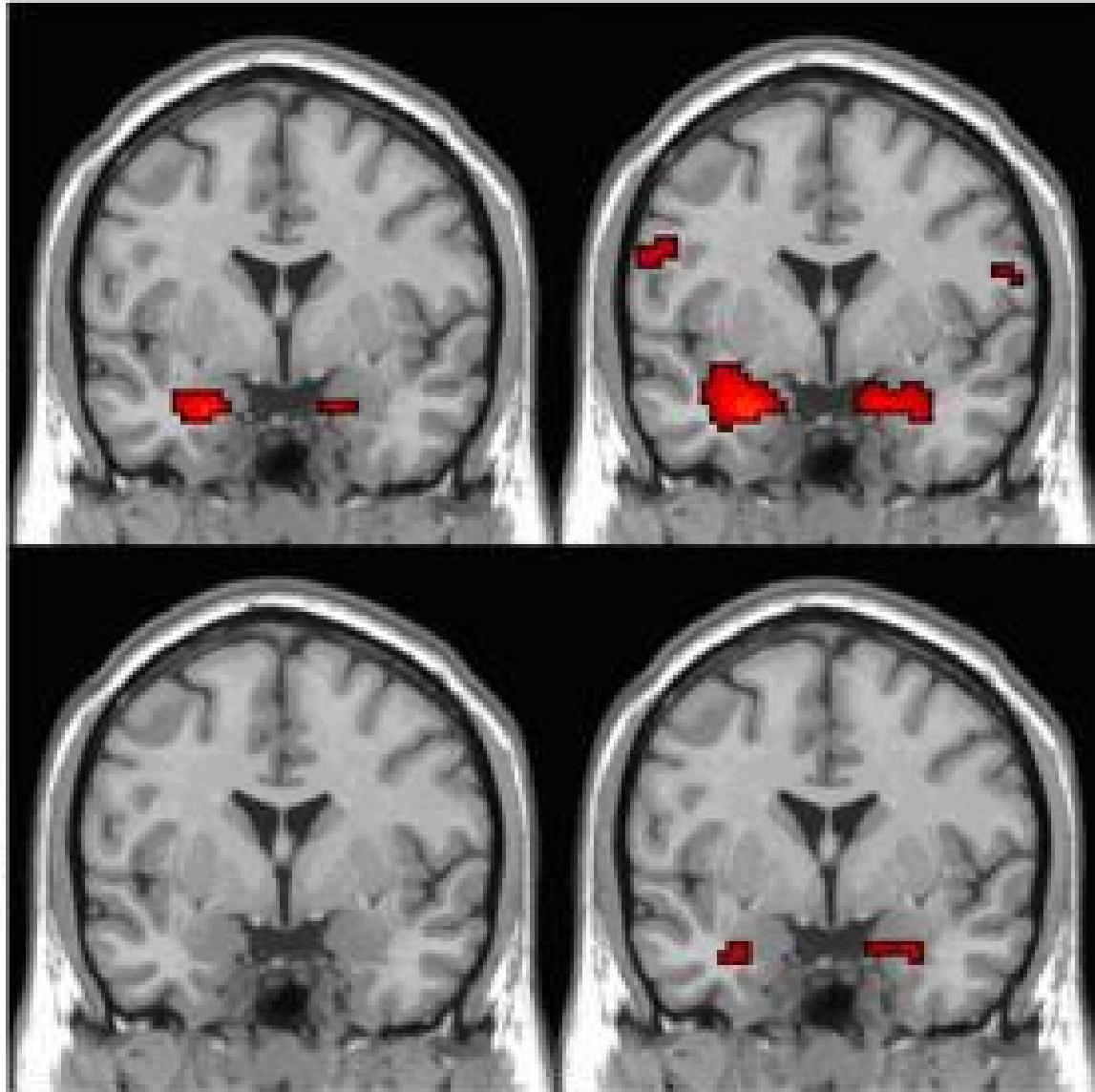
time as taxi driver (months)



A**D**



Placebo



faces

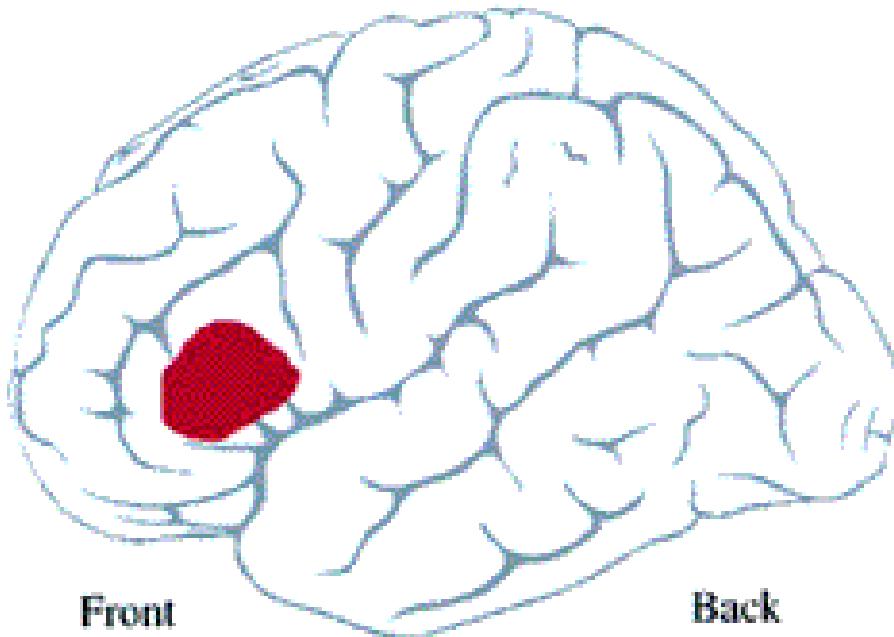
scenes

Frightful faces triggered a dramatic reduction in amygdala activity in subjects who had sniffed oxytocin,

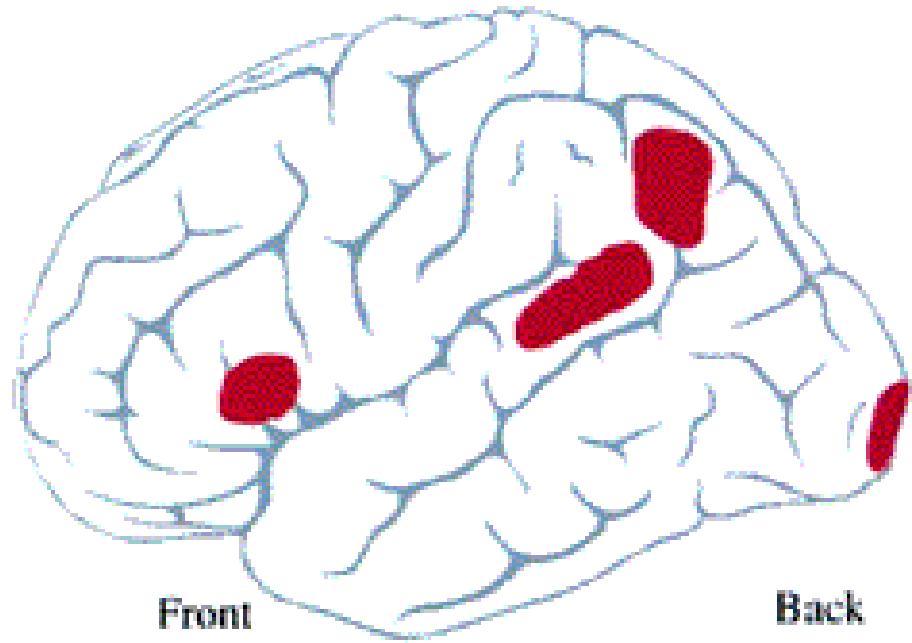
suggesting that oxytocin mediates social fear and trust

via the amygdala and related circuitry.

READING



DYSLEXIC



NONIMPAIRED

Disruption of posterior brain systems for reading in children with developmental dyslexia

Bennett A. Shaywitz, Sally E. Shaywitz, Kenneth R. Pugh, W. Einar Mencl, Robert K. Fulbright, Pawel Skudlarski, R. Todd Constable, Karen E. Marchione, Jack M. Fletcher, G. Reid Lyon, John C. Gore
(1998-2002)



Dyslexia-specific brain activation profile becomes normal following successful remedial training

P.G. Simos, J.M. Fletcher et al

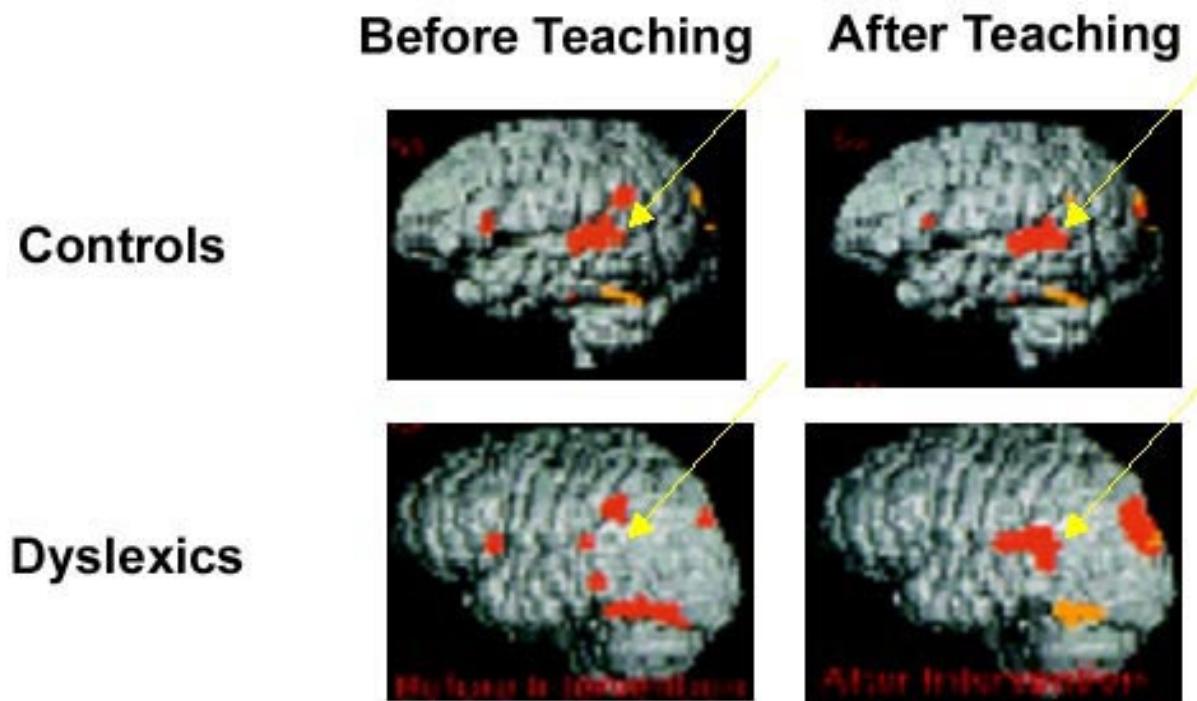
Plastic neural changes and reading improvement caused by audiovisual training in reading-impaired children

T. Reijntjes^a, K. Karmil^b, L. Goossens^a, S. Dehaene^c, R. Turckin^b, M. Tsvetkov^a, and R. Krikorian^{a,b}

Development of left occipitotemporal systems for skilled reading in children after a phonologically-based intervention

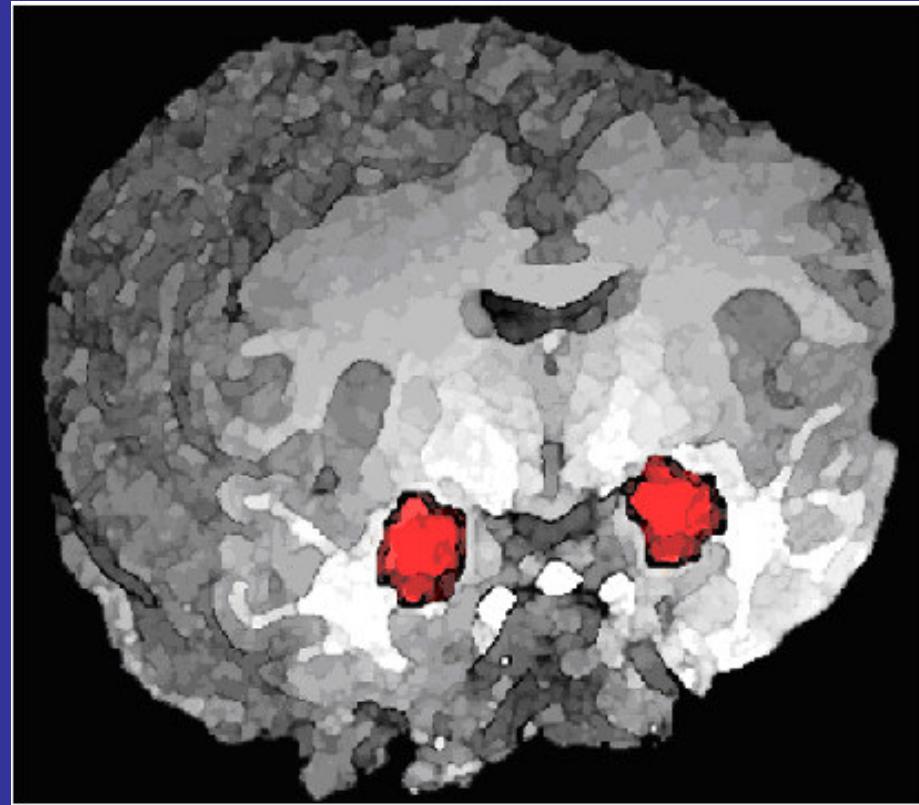
Bennett A. Shaywitz, Sally E. Shaywitz et al

Teaching Corrects Dyslexia Pattern By MRI



**80 hrs (1-2 hrs / day) one-on-one instruction
Phonological Processing & Decoding
Multisensory & Visual Imagery Instruction**

Simos, U Texas



“Change the mind and you change the brain”: effects of cognitive-behavioral therapy on the neural correlates of spider phobia

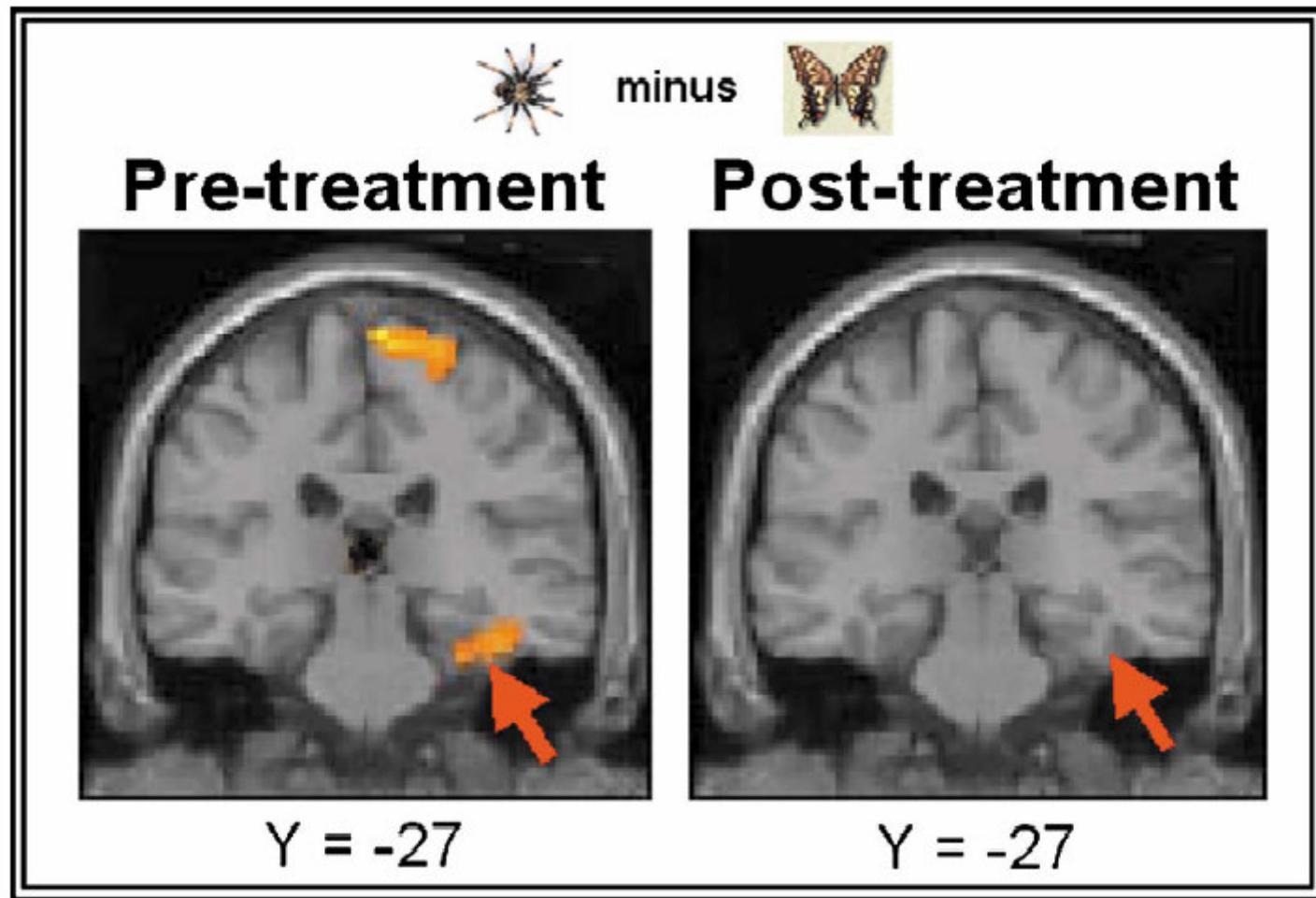
Vincent Paquette,^{a,d} Johanne Lévesque,^a Boualem Mensour,^b Jean-Maxime Leroux,^b Gilles Beaudoin,^{b,c} Pierre Bourgouin,^{b,c} and Mario Beauregard^{a,b,c,d,*}

^a Centre de Recherche, Institut Universitaire de Gériatrie de Montréal, Montréal, Canada

^b Département de Radiologie, Centre Hospitalier de l'Université de Montréal (CHUM), Hôpital Notre-Dame, Montréal, Canada

^d Centre

^a



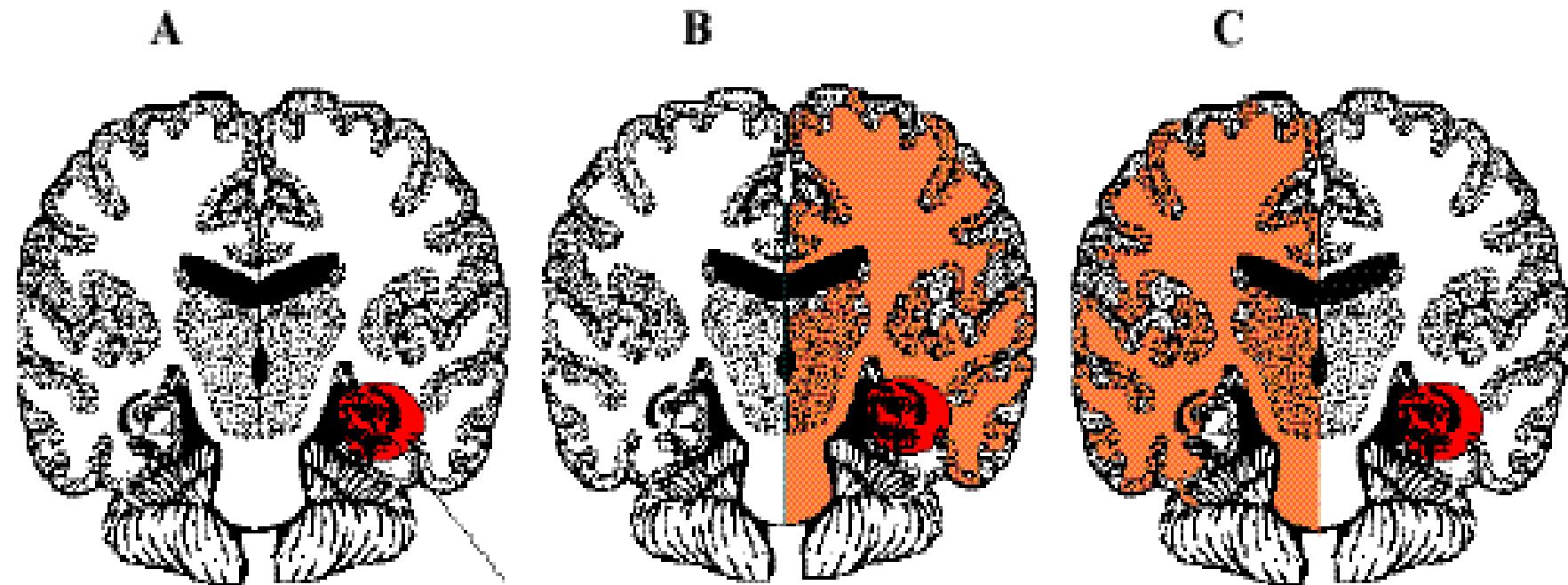
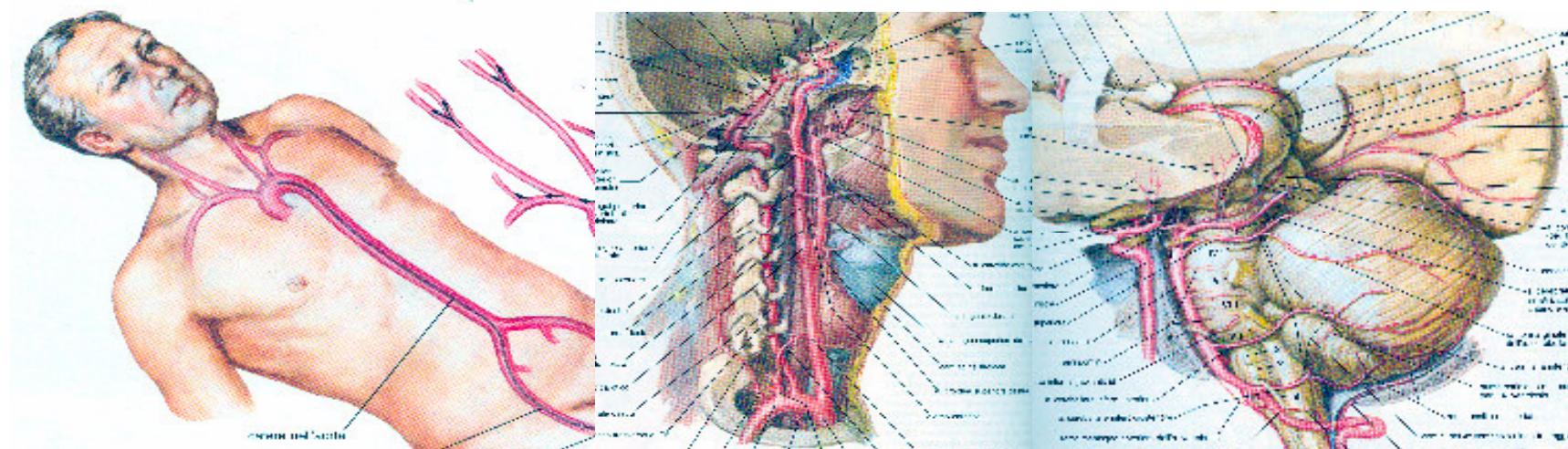
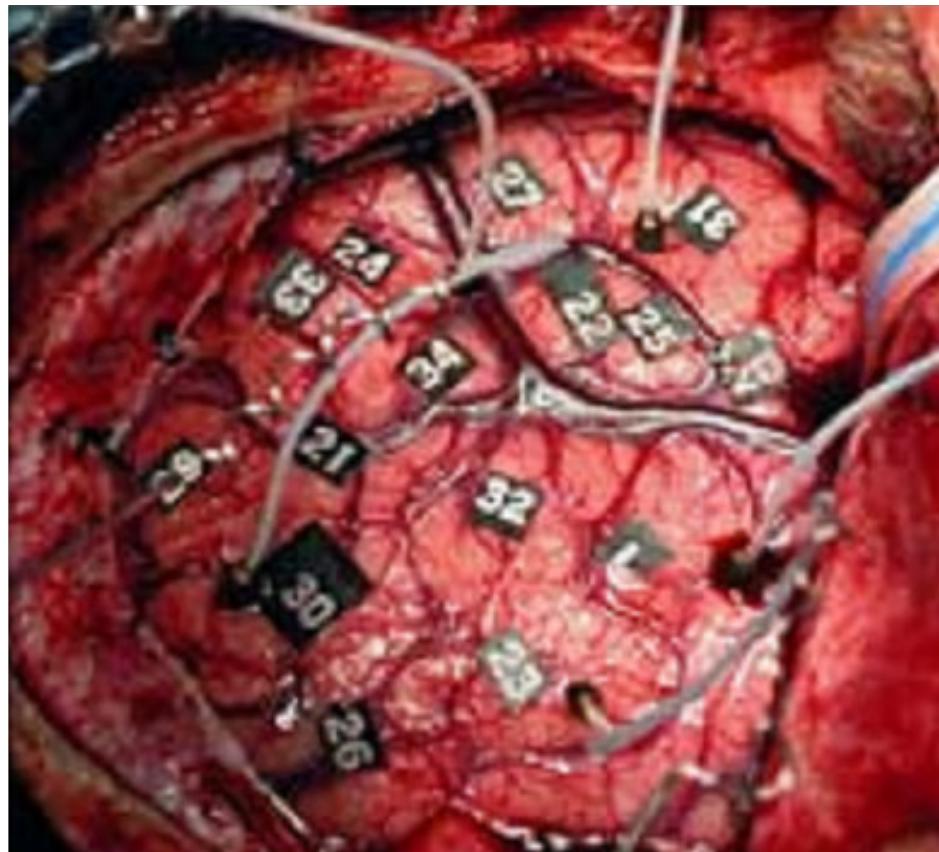


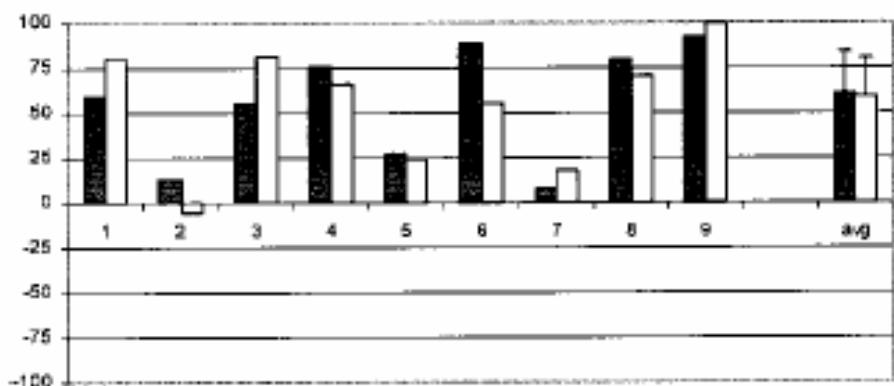
Fig1. Diagrammatic representation of the intracarotid amobarbital procedure.





Neuroradiology. 2005 Nov;
47(11):835-44.

Evaluating functional MRI procedures for assessing hemispheric language dominance in neurosurgical patients.



Baciu MV, Watson JM, Maccotta L,
McDermott KB, Buckner RL, Gilliam FG, Ojemann JG.

Laboratory of Psychology and Neurocognition, UMR CNRS 5105, Pierre Mendes-France University, BP 47, 38040, Grenoble Cedex 09

Brain-computer interface using fMRI: spatial navigation by thoughts

Seung-Schik Yoo,^{1,2,CA} Ty Fairmeny,³ Nan-Kuei Chen,¹ Seh-Eun Choo,⁴ Lawrence P. Panych,¹ HyunWook Park,⁵ Soo-Young Lee² and Ferenc A. Jolesz¹

¹Department of Radiology, Brigham and Women's Hospital, Harvard Medical School, 75 Francis St, Boston, MA 02115, USA; ²Department of BioSystems;

⁵Department of Electrical Engineering, Korea Advanced Institute of Science and Technology, Daejeon, Korea; ³Department of Biomedical Engineering;

⁴College of Communication, Boston University, Boston, MA, USA

^{CA} Corresponding Author and Address: yoo@bwh.harvard.edu

Received 8 April 2004; accepted 28 April 2004

DOI: [10.1097/01.wnr.0000133296.39160.fe](https://doi.org/10.1097/01.wnr.0000133296.39160.fe)

A brain-computer interface (BCI) is a way of conveying an individual's thoughts to control computer or electromechanical hardware. Capitalizing on the ability to characterize brain activity in a reproducible manner, we explored the possibility of using real-time fMRI to interpret the spatial distribution of brain function as BCI commands. Using a high-field (3 T) MRI scanner, brain activities

associated with four distinct covert functional tasks were detected and subsequently translated into predetermined computer commands for moving four directional cursors. The proposed fMRI-BCI method allowed volunteer subjects to navigate through a simple 2D maze solely through their thought processes. NeuroReport 15:000–000 © 2004 Lippincott Williams & Wilkins.

Key words: Biofeed; Cognition; fMRI; Imagery; Mental task; Rehabilitation

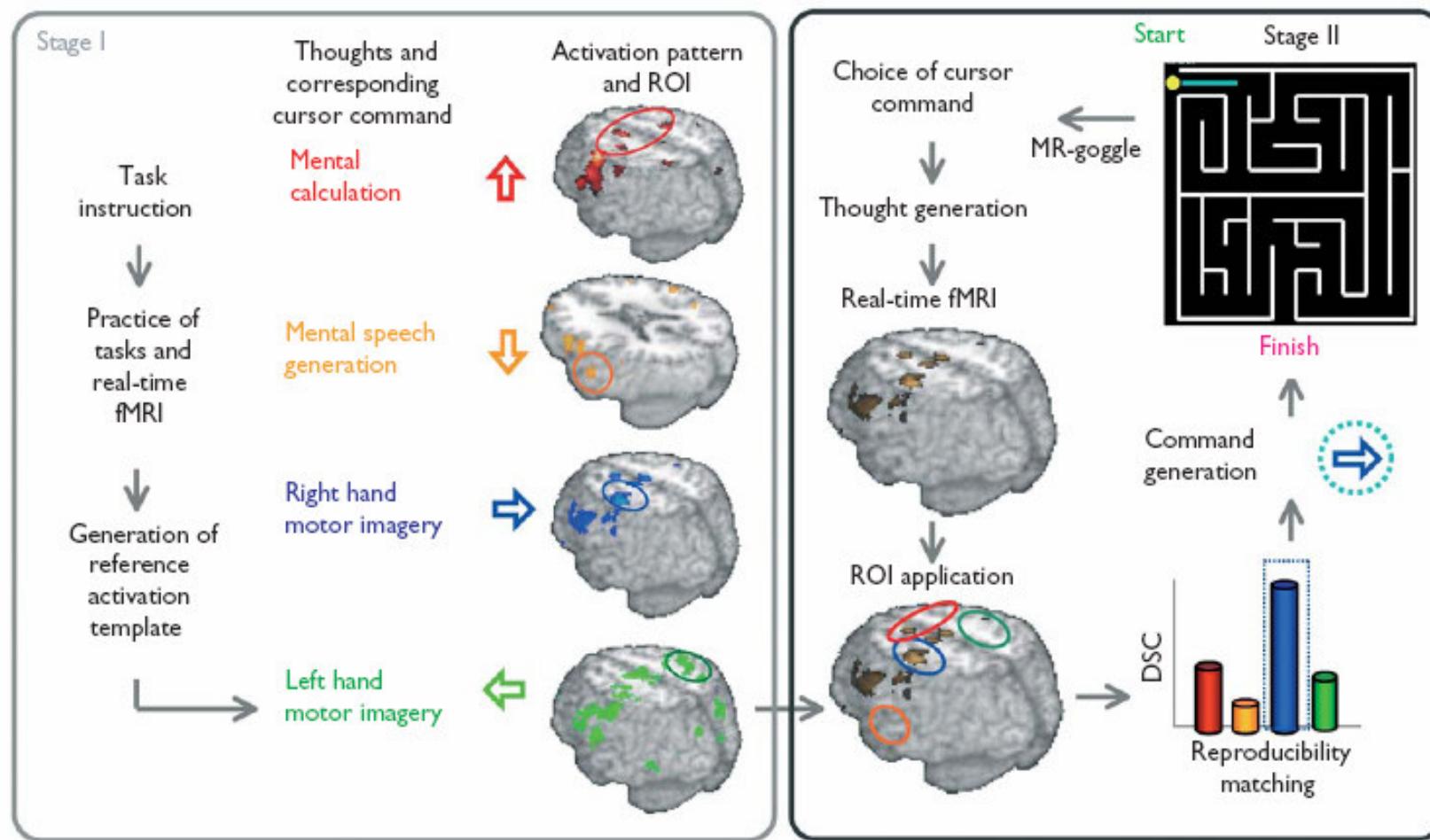


Fig. I. Overall schematics of the fMRI procedure for the BCI. The procedure is split up into two stages. The first stage is data calibration and subject preparation. The second stage is the BCI experiment.

September 16, 2002

Controlling Robots with the Mind

By Miguel A. L. Nicolelis and John K. Chapin



People may one day be able to command wheelchairs, prosthetics and even paralyzed arms and legs by "thinking them through" the motions

Massimo Piccirilli

Dal *cervello* alla *mente*

appunti di neuropsicologia



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- . Valutazione neuropsicologica
- . Paradigma sperimentale
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- . Elaborazione dati
- . Interpretazione risultati