

Chiaramente scienza

Le basi biologiche del linguaggio

Istituto Veneto di Scienze, Lettere ed Arti
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Origine del linguaggio

Si tratta di una funzione completamente nuova emersa nell'uomo o è il risultato di un'evoluzione graduale?

Le principali teorie evolutive suggeriscono una possibile derivazione del linguaggio dalle vocalizzazioni delle scimmie o dai gesti.

Vocalizzazioni o gesti?

Un certo grado di referenzialità è probabilmente l'aspetto più rilevante in favore delle vocalizzazioni.

MA

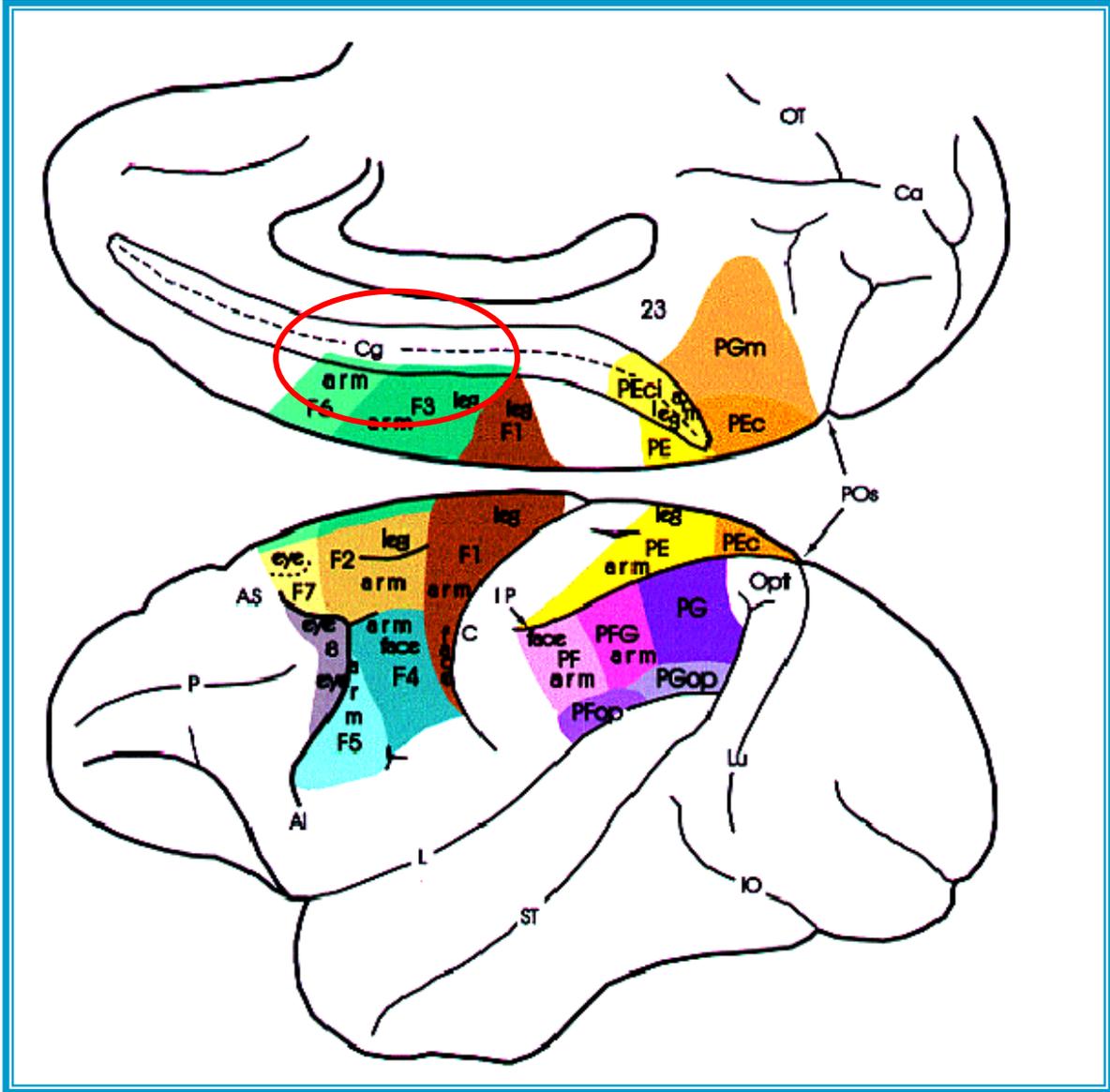
Le vocalizzazioni sono il più delle volte rivolte al gruppo

Fortemente correlate al comportamento emotivo

Mostrano poca flessibilità

Il numero dei segnali è ridotto

Sono controllate da una zona di corteccia più antica

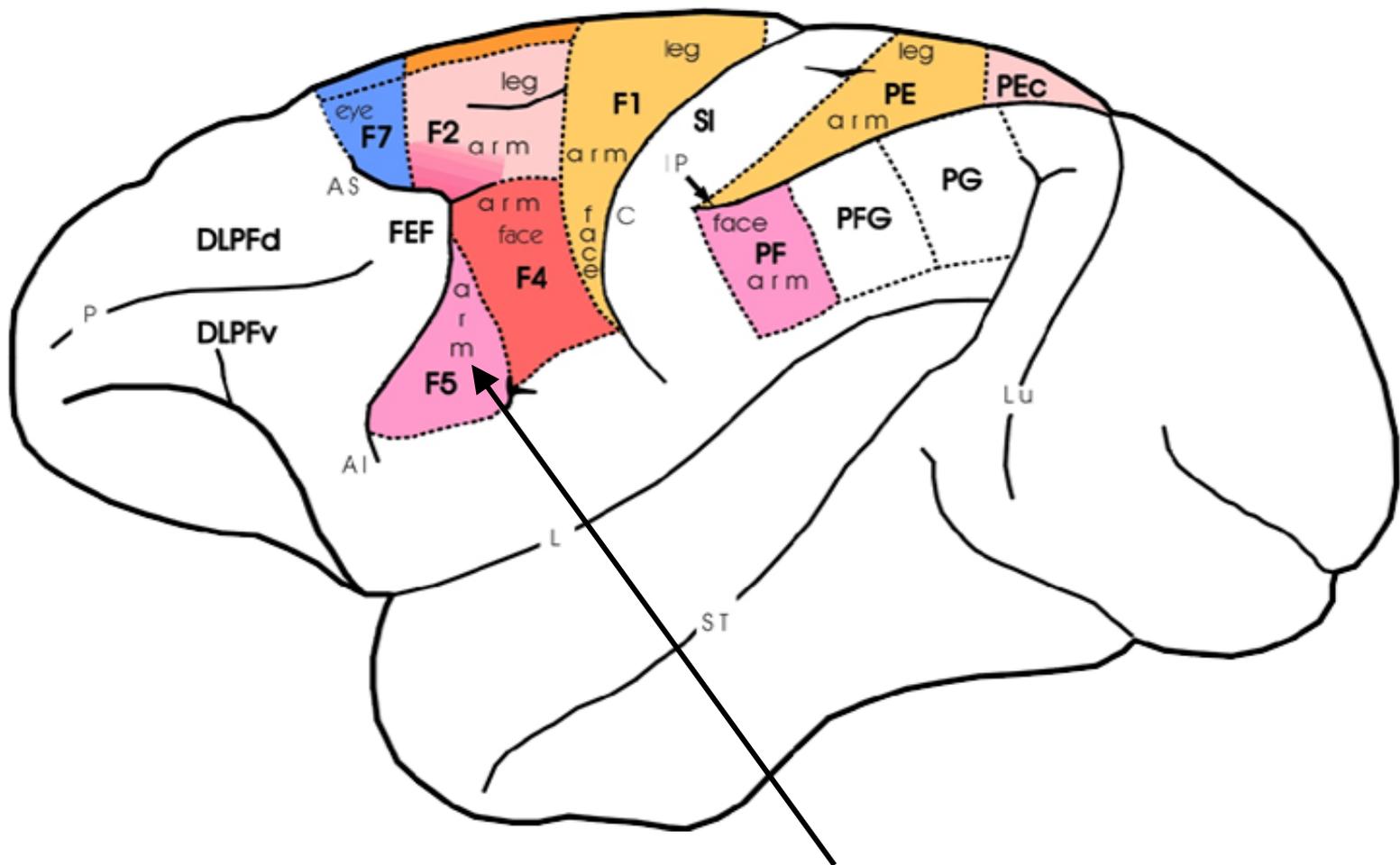


I gesti sono spesso usati per la comunicazione inter-individuale

Possono convogliare segnali con minor contenuto emotivo

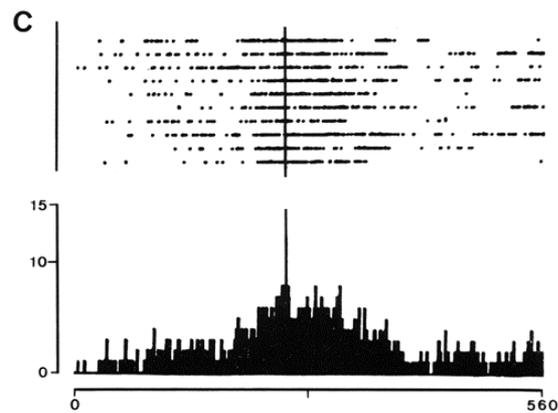
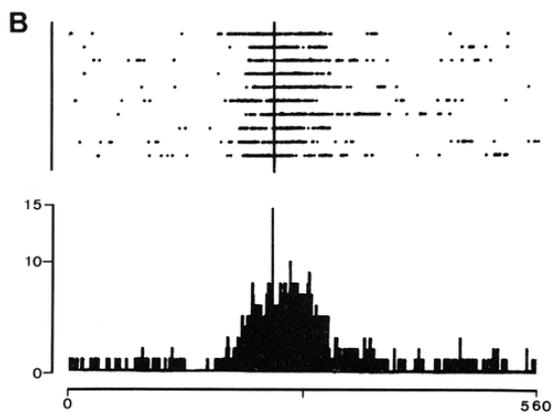
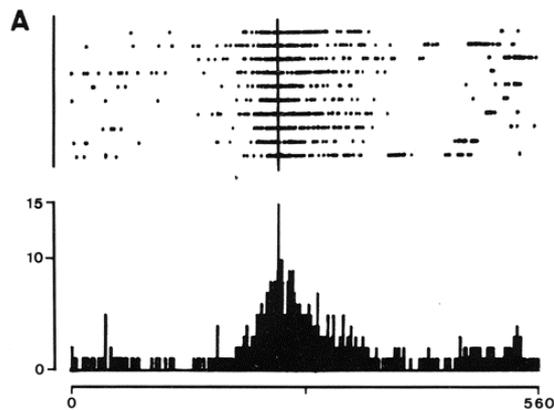
Coinvolgono spesso movimenti brachiomaneali che sono più flessibili e ricchi nel creare nuovi gesti

Sono controllati da una zona di corteccia evolutivamente più recente. Verosimilmente si sono evoluti dalle azioni finalizzate



Corteccia premotoria ventrale della scimmia

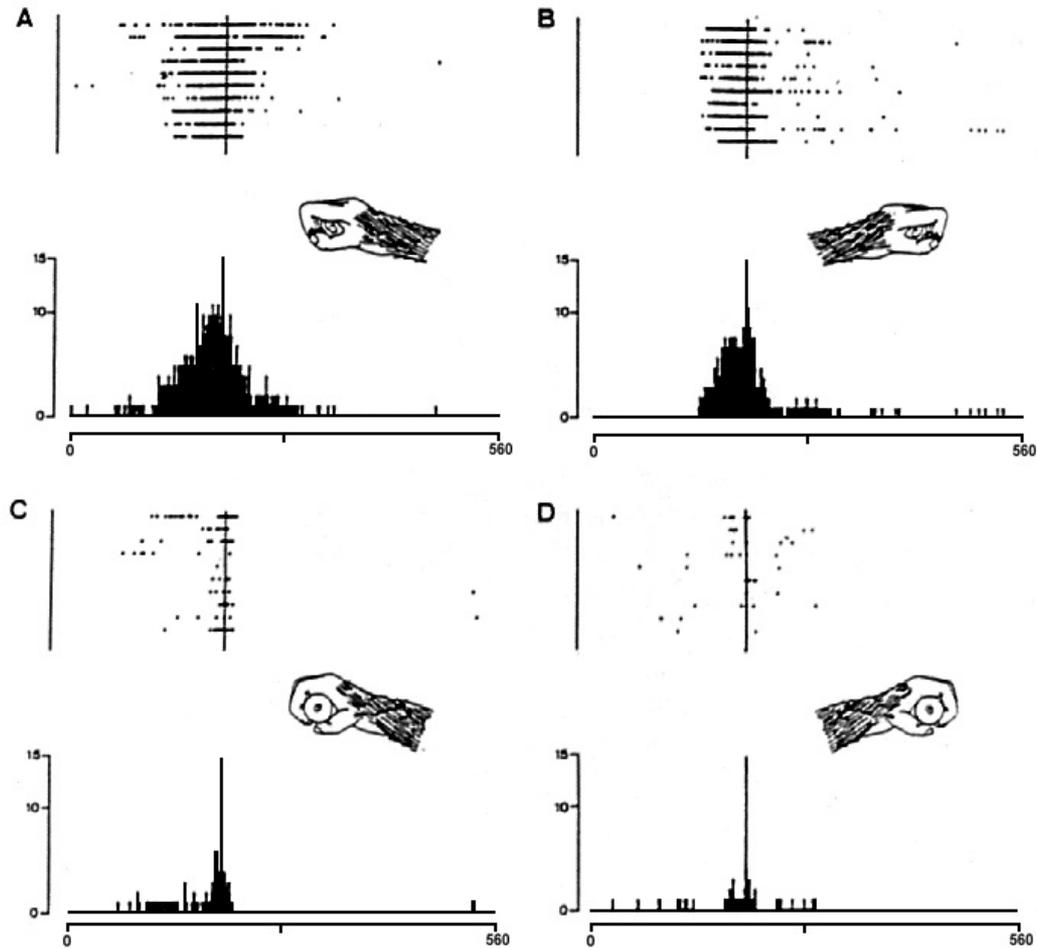
Neurone dell'afferramento

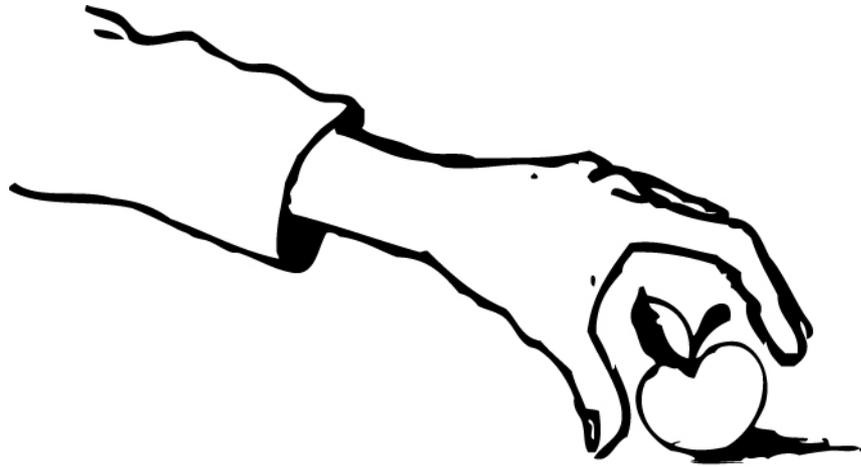


1 sec

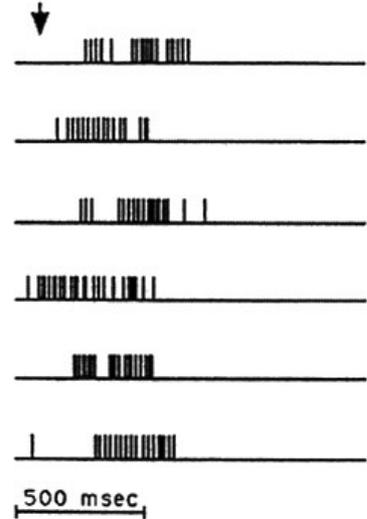
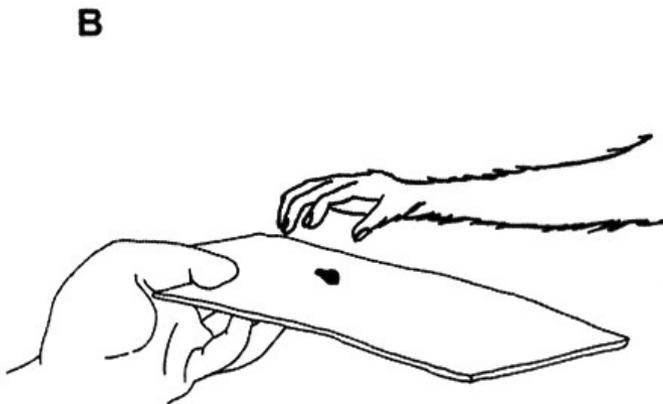
Neurone che si attiva per un particolare tipo di prensione

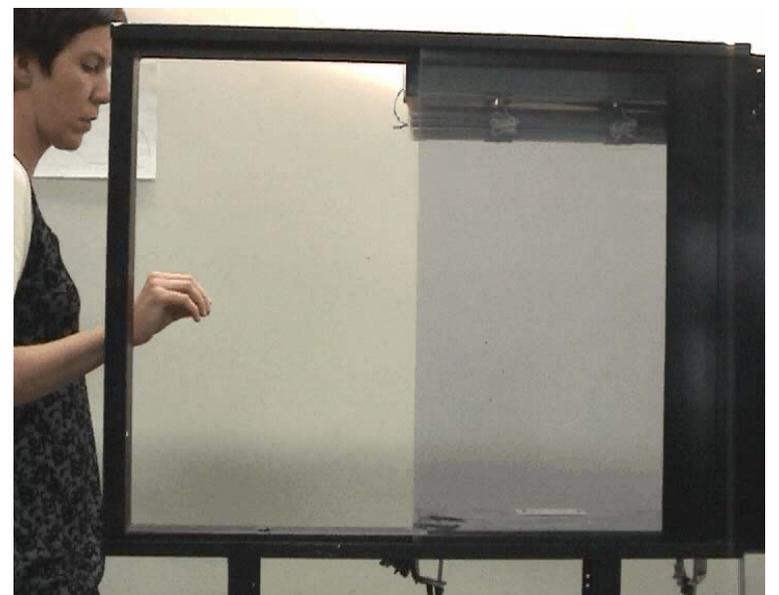
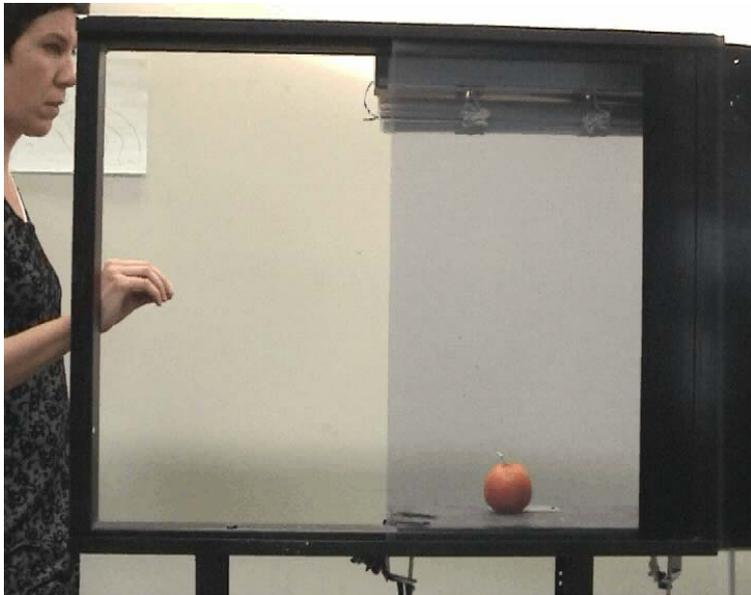
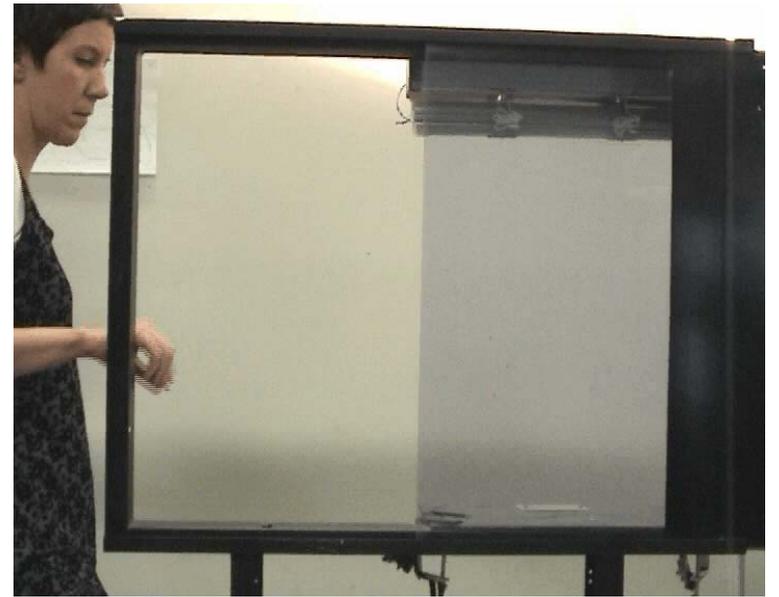
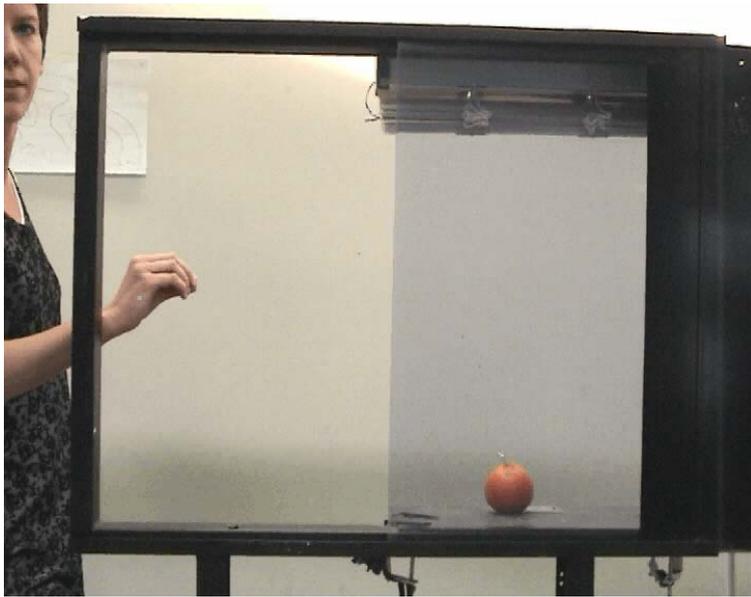
U 108-3

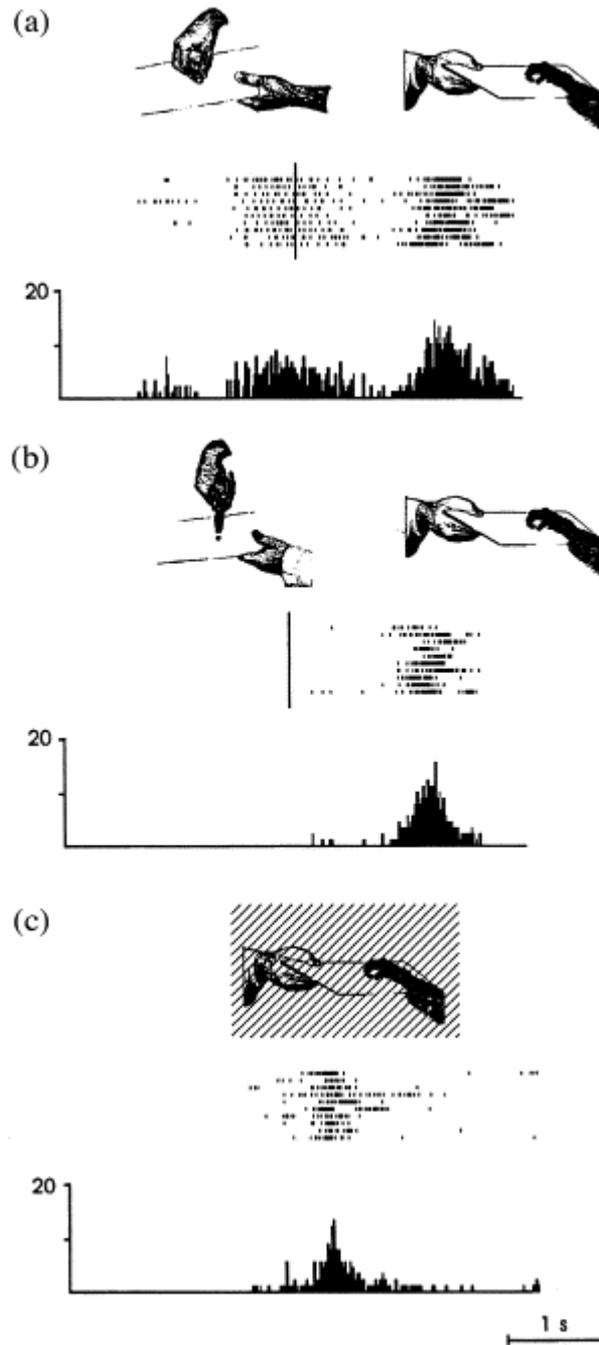




Neuroni specchio







A



**Neurone specchio
congruente in senso stretto**

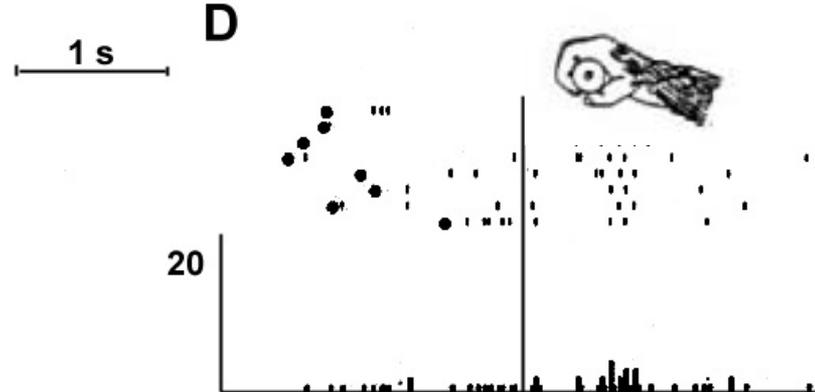
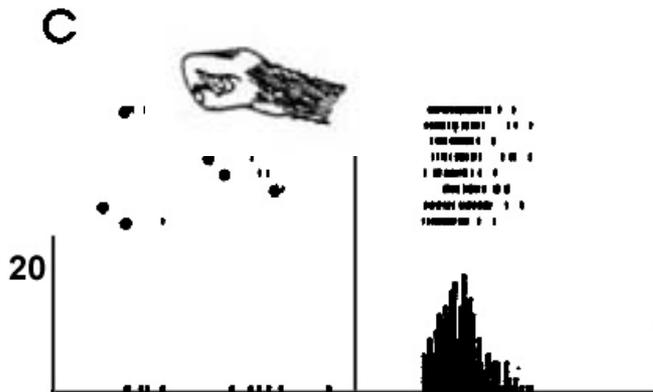
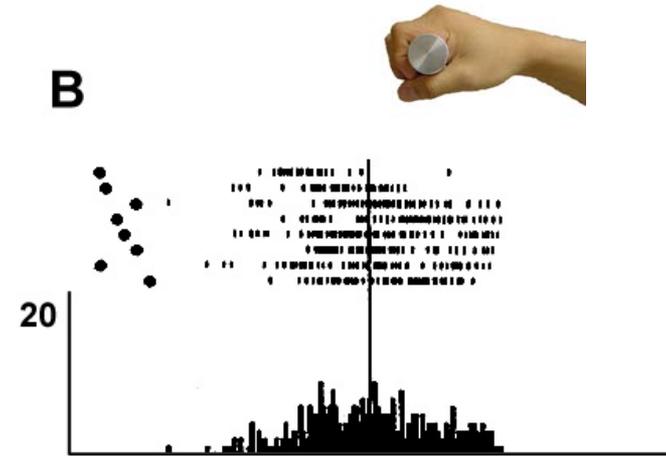
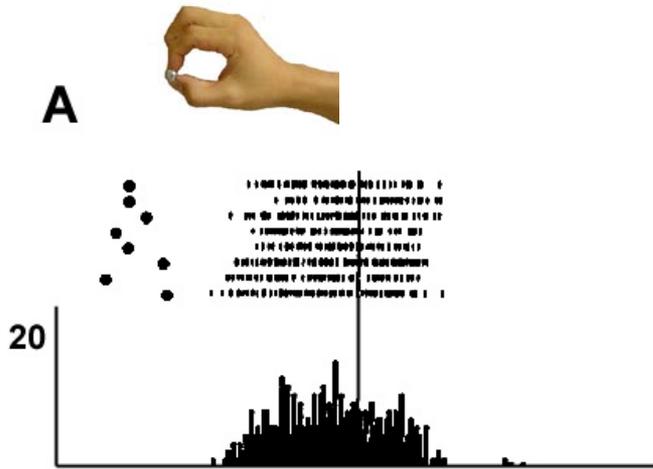
B

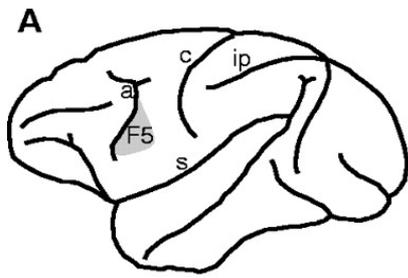


C

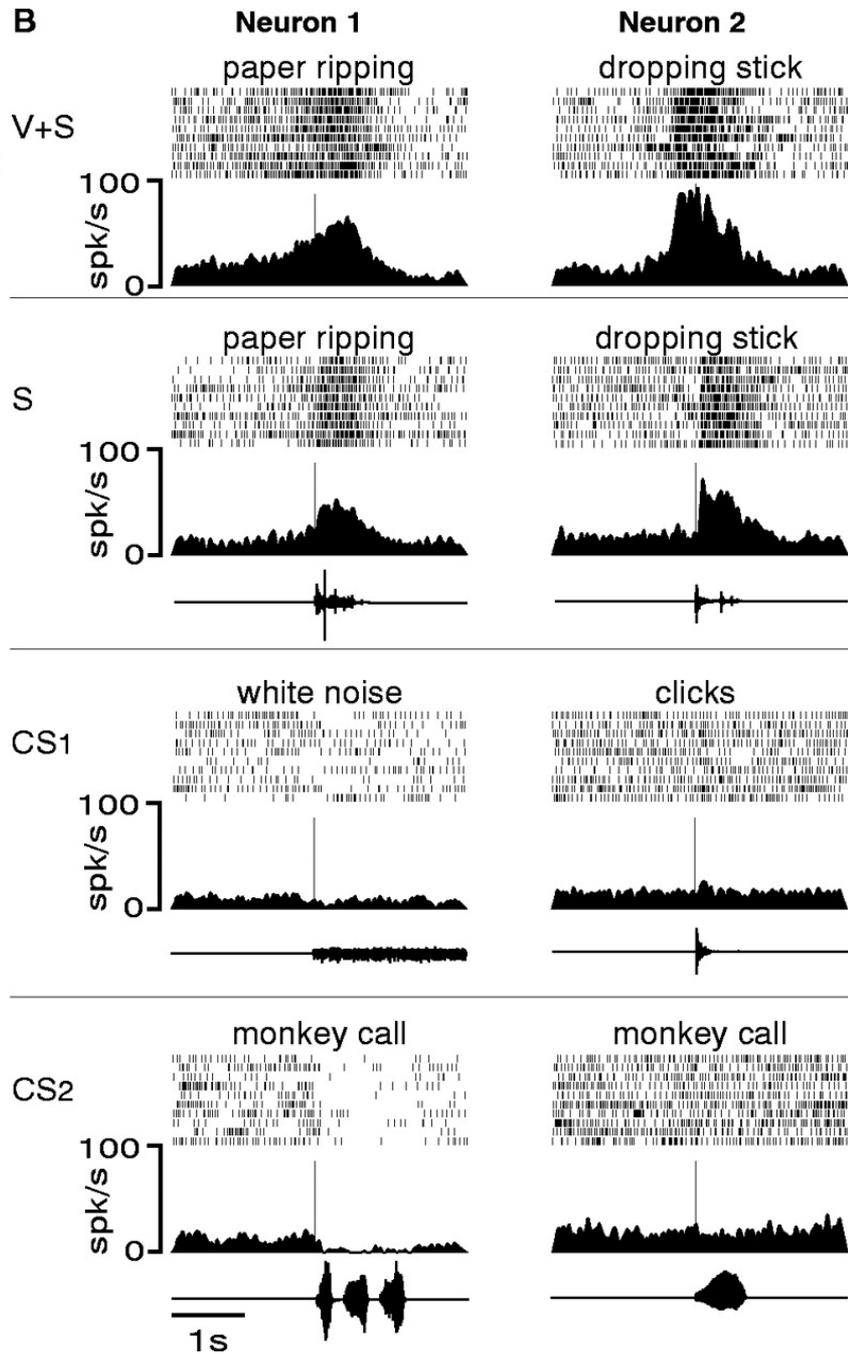


Neurone specchio congruente in senso lato





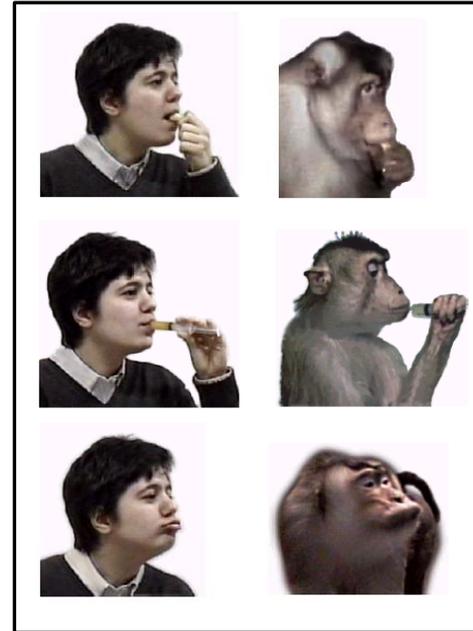
Neuroni specchio audio-visivi



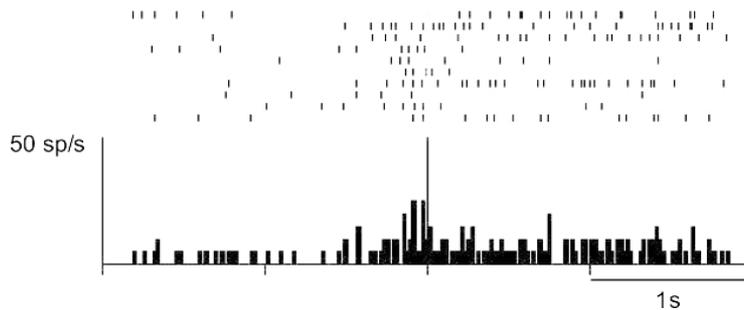
Neuroni specchio comunicativi

Atti motori ingestivi

Atti motori comunicativi

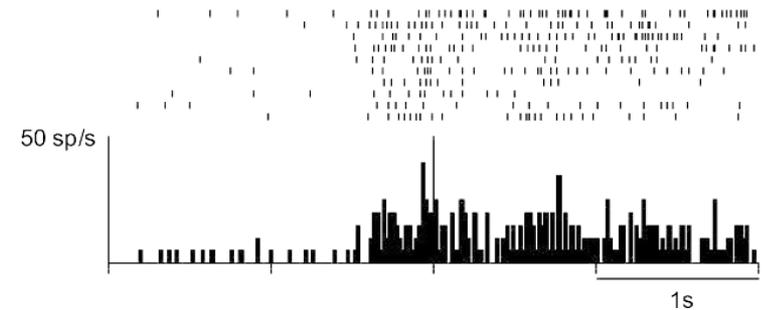


A) Experimenter protrudes his lips

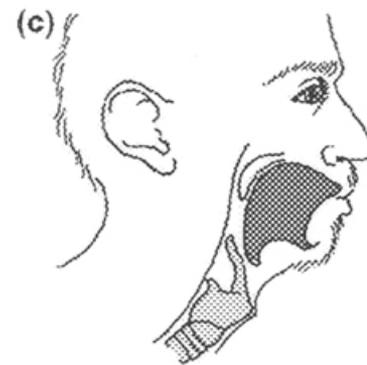
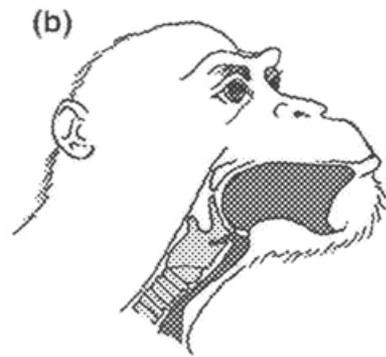
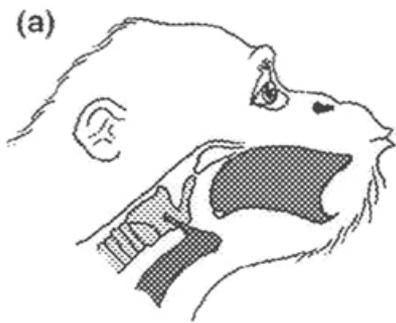
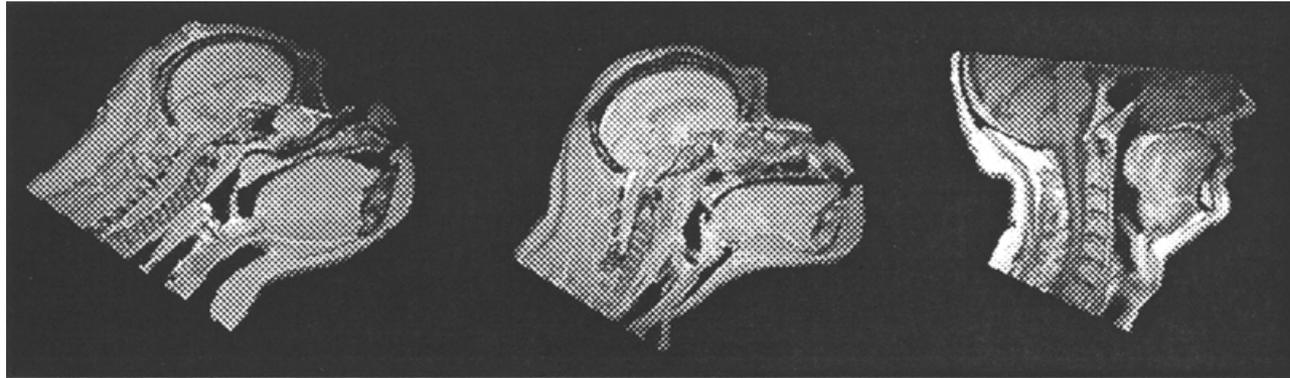


Unit 033

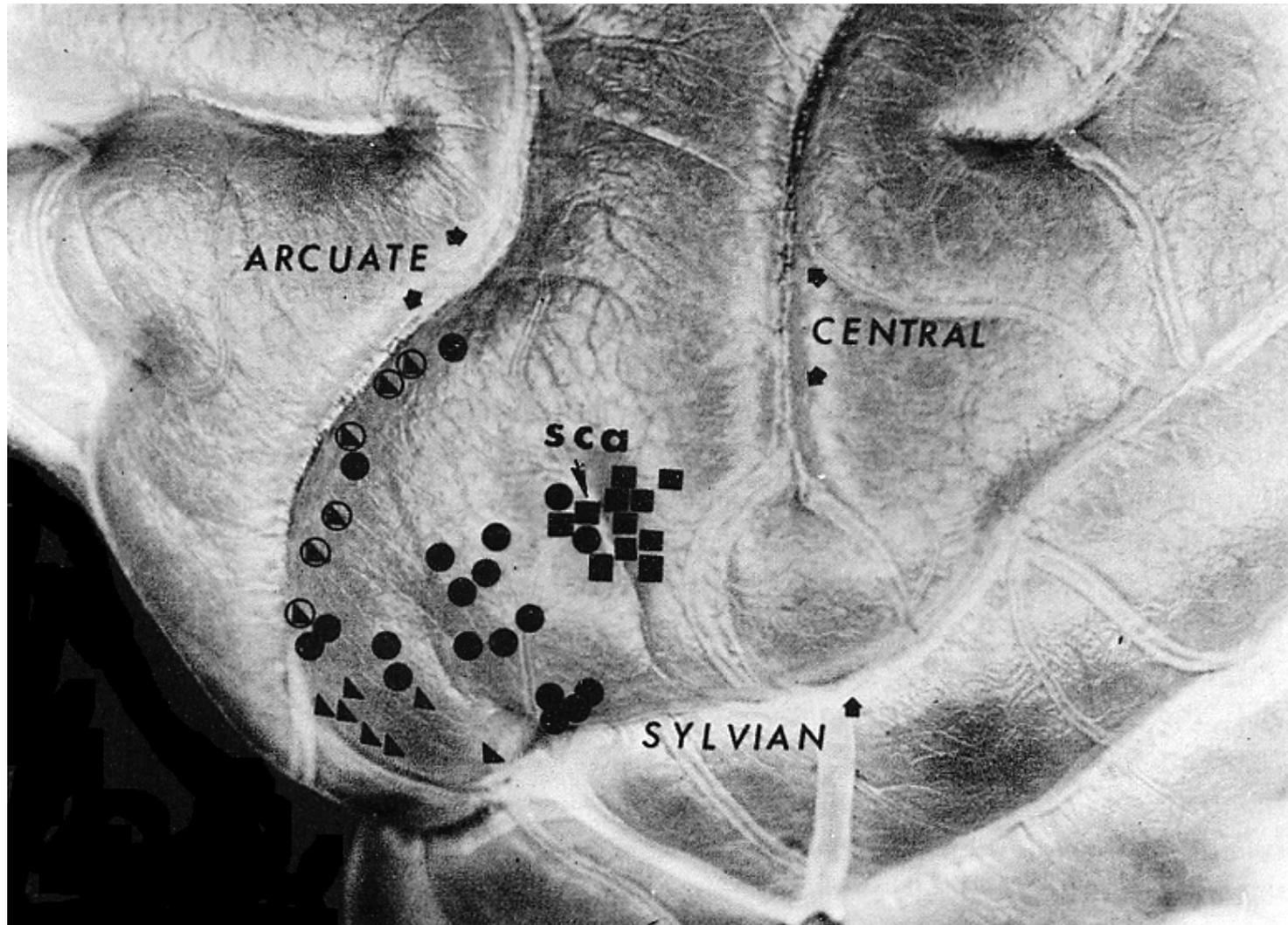
B) Monkey lip-smacking



Posizione della laringe nelle scimmie antropomorfe e nell'uomo



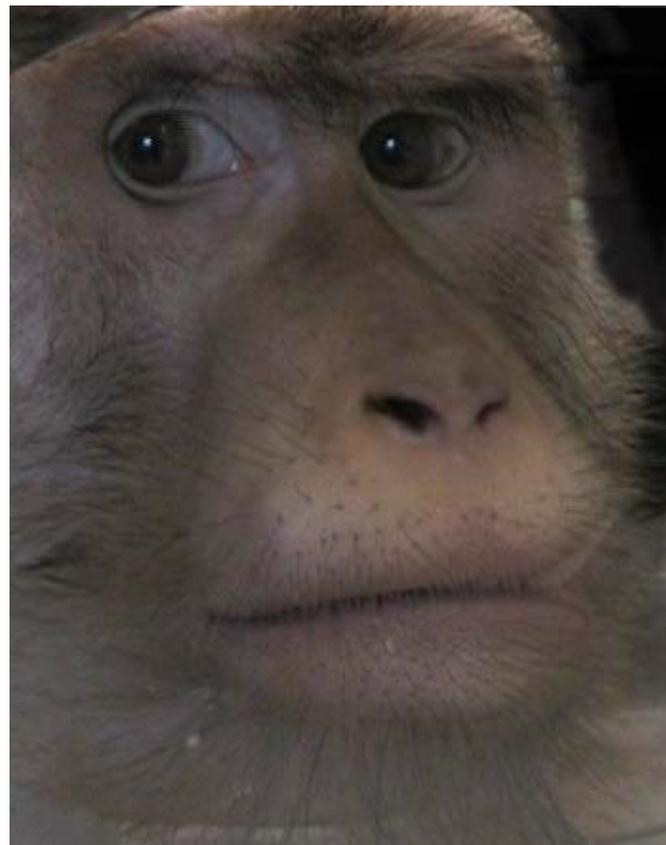
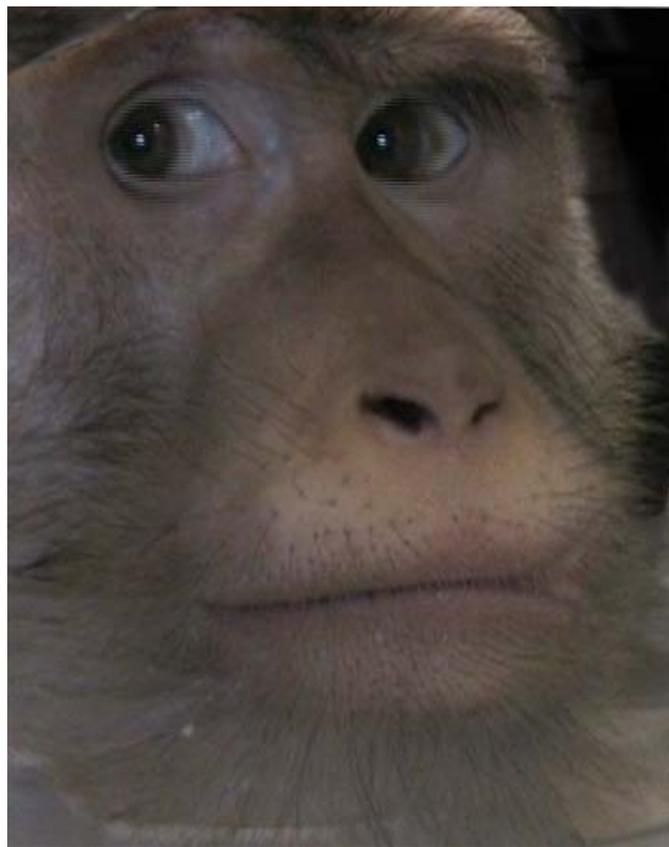
Rappresentazione della laringe nella corteccia premotoria



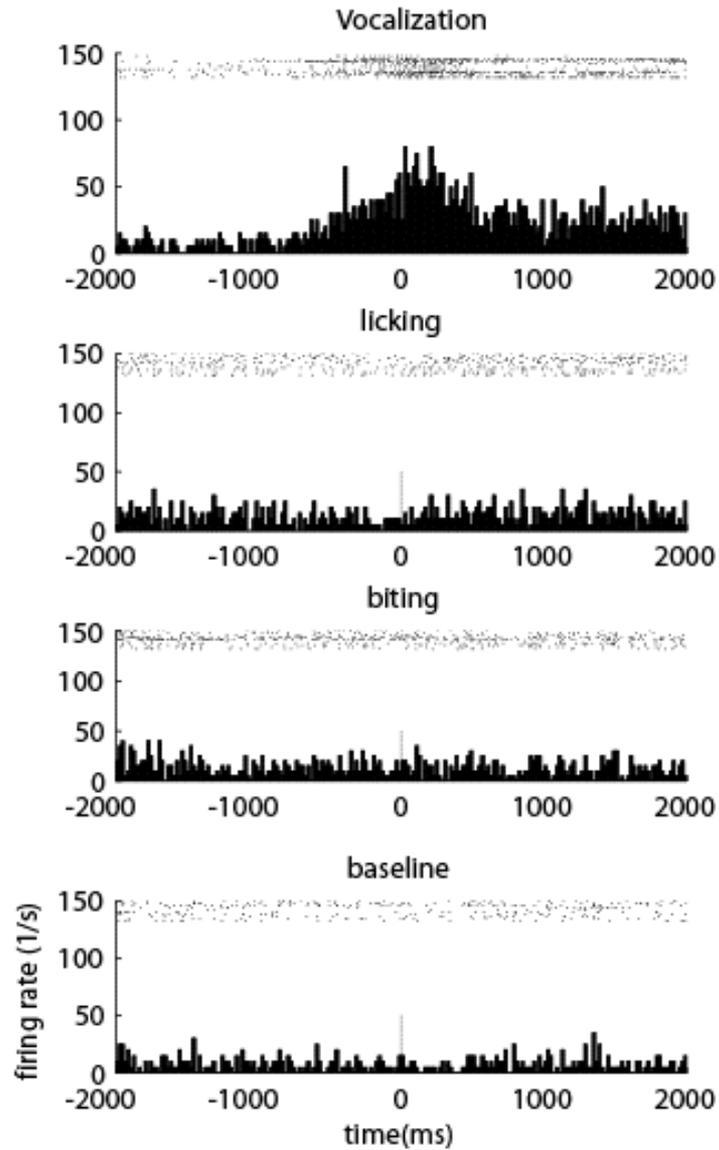
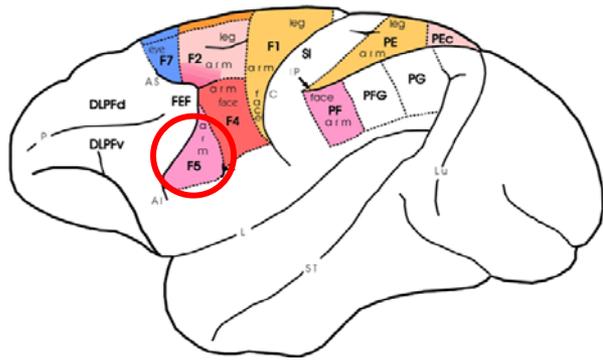
Hast et al. (1974)

▲ Cricotiroide; ● tiroaritenoidi; ◐ ▲ combinati; ■ estrinseci

Vocalizzazioni e tentativi



Neuroni legati alla vocalizzazione nell'area F5



La corteccia motoria può avere assunto a poco a poco un controllo sempre più ricco della vocalizzazione

La vocalizzazione potrebbe essersi associata a gesti del braccio

Questa associazione si può notare nello scimpanzé

Nonostante nell'uomo il gesto abbia normalmente una funzione vicaria esso

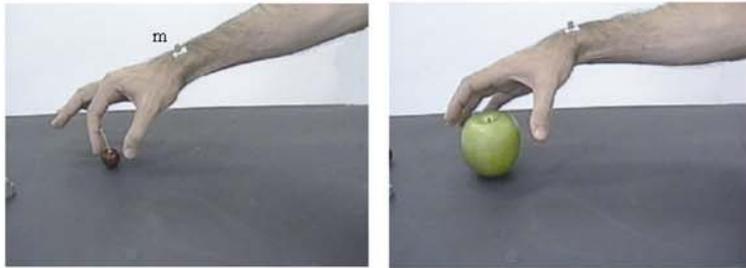
Si accompagna molto spesso alla parola

Riemerge con ruolo primario nel linguaggio dei segni

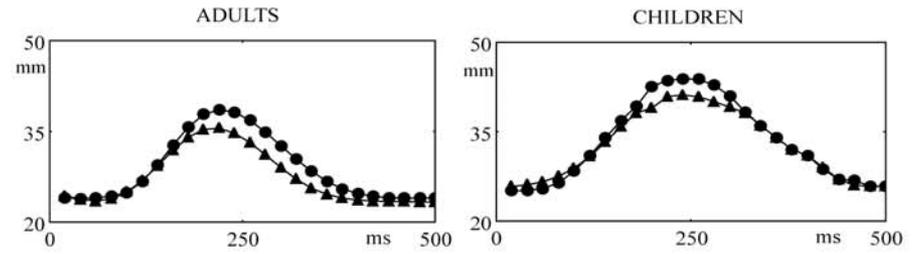
Influenza la funzione vocale

Correlazione azione-produzione vocale

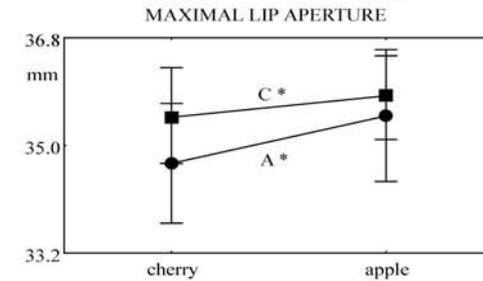
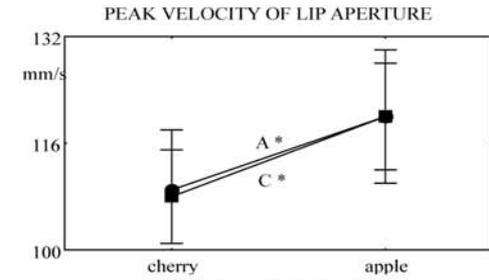
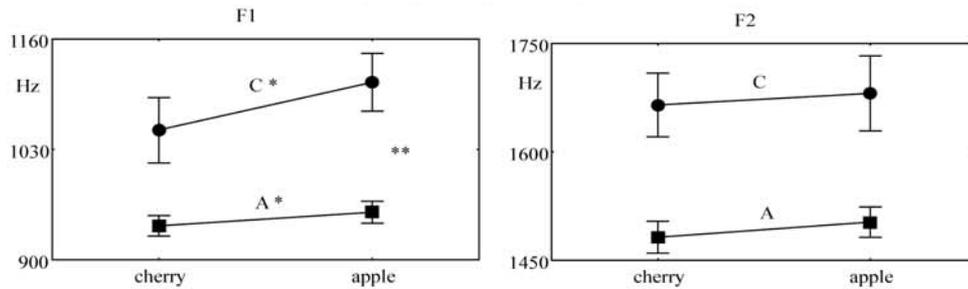
GRASP OBSERVATION



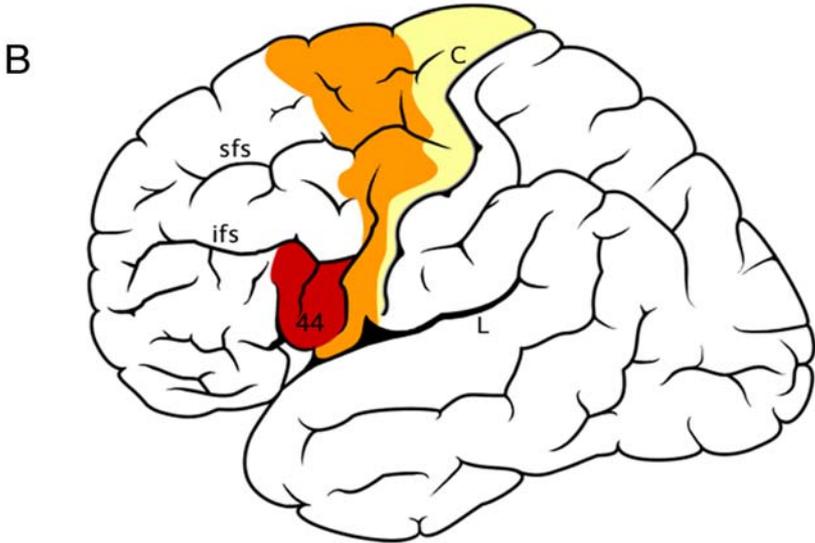
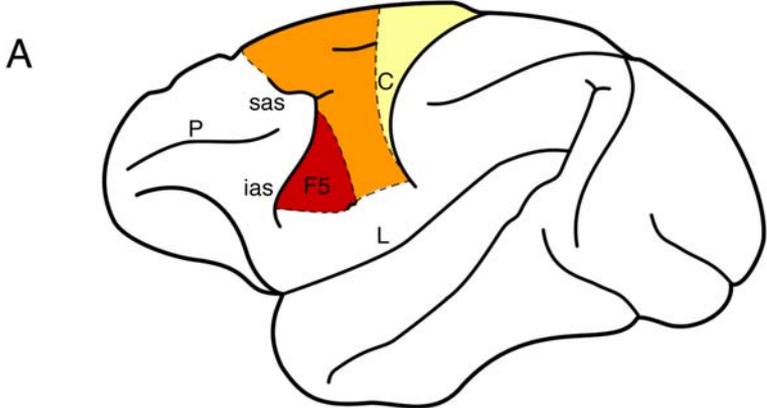
LIP KINEMATICS

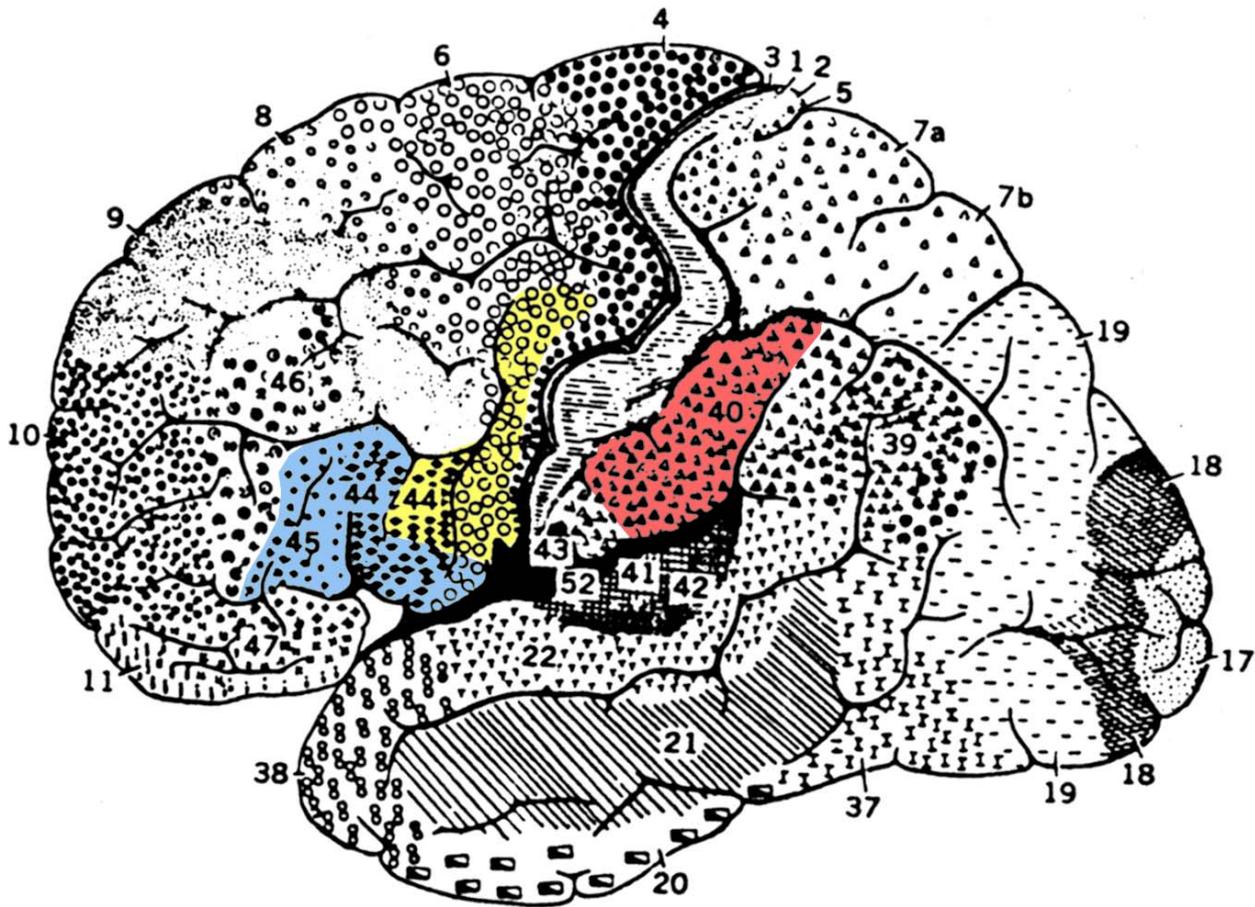


VOICE SPECTRA



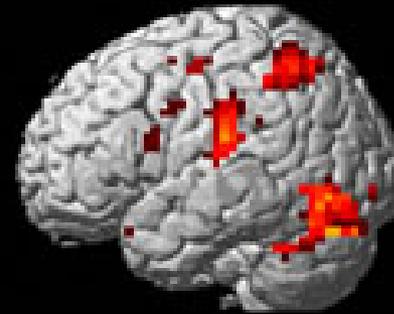
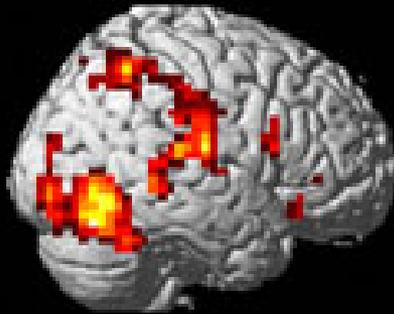
Omologia tra area F5 e area di Broca



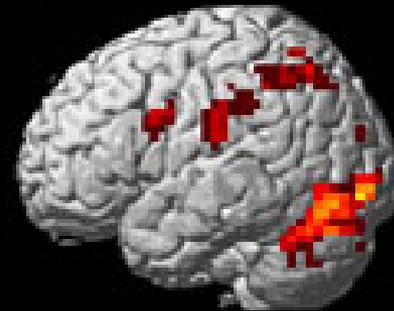
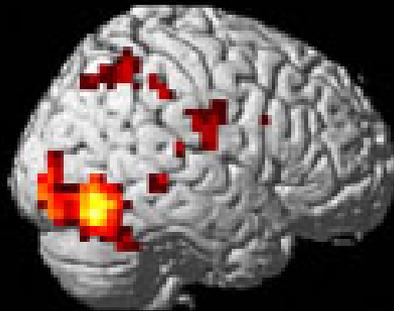


Il circuito fronto-parietale dell'uomo coinvolto nella comprensione delle azioni altrui

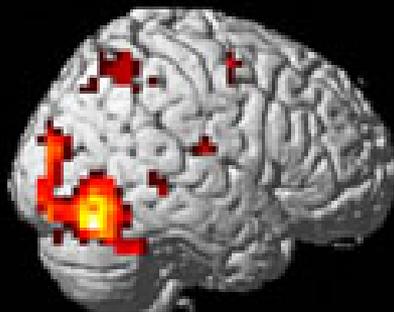
BITING



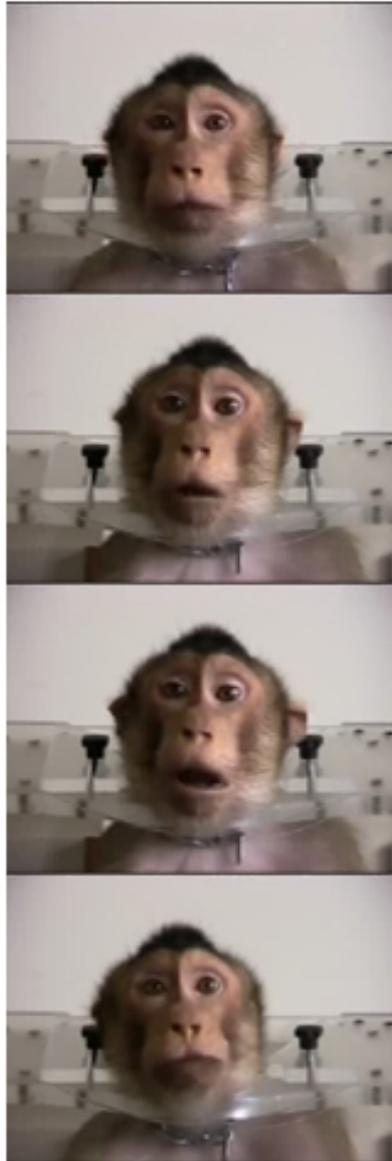
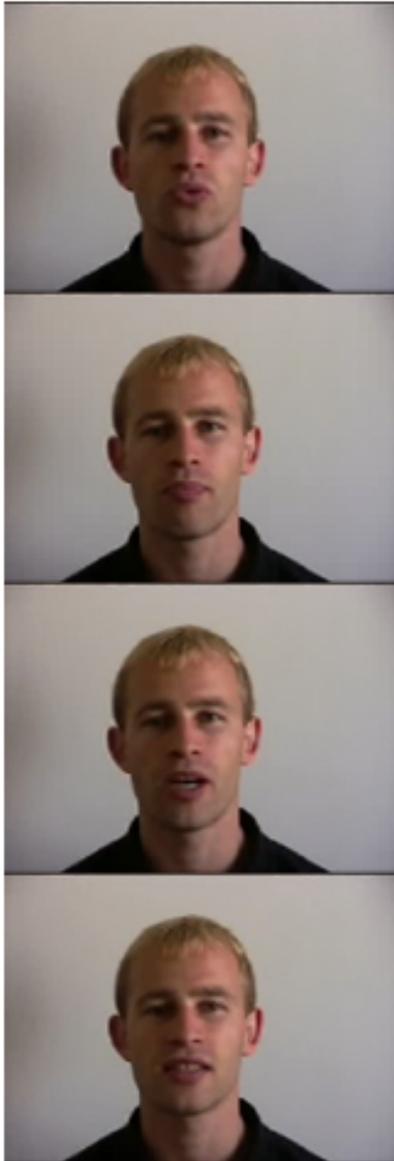
MAN



MONKEY



DOG

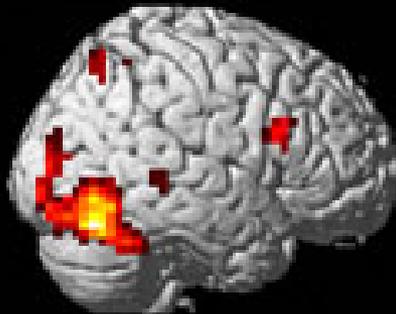
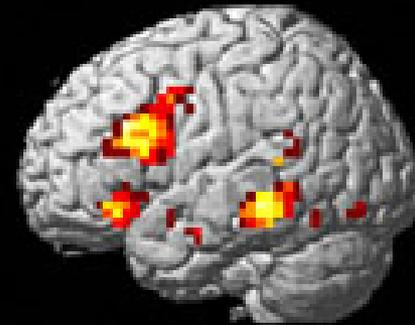


Buccino et al. 2004

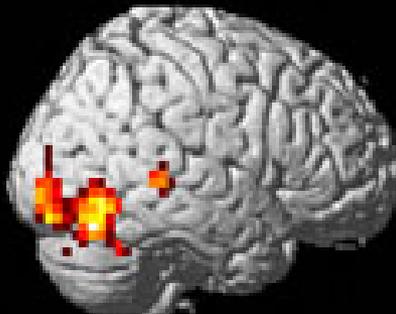
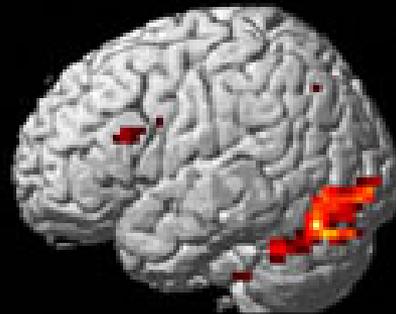
ORAL COMMUNICATIVE ACTIONS



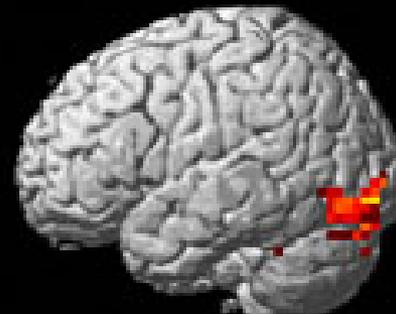
MAN
(LIPREADING)



MONKEY
(LIPSMACKING)



DOG
(BARKING)



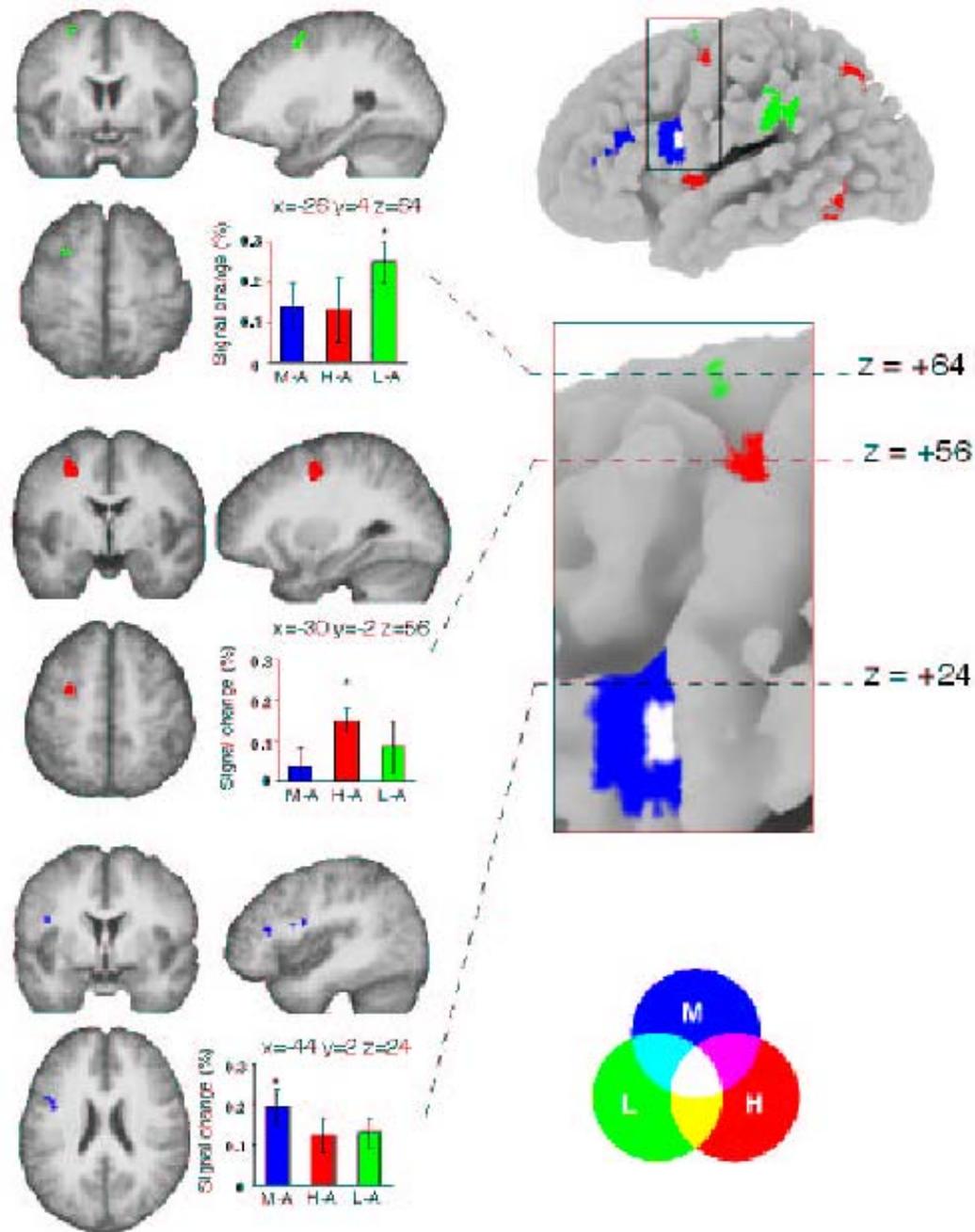
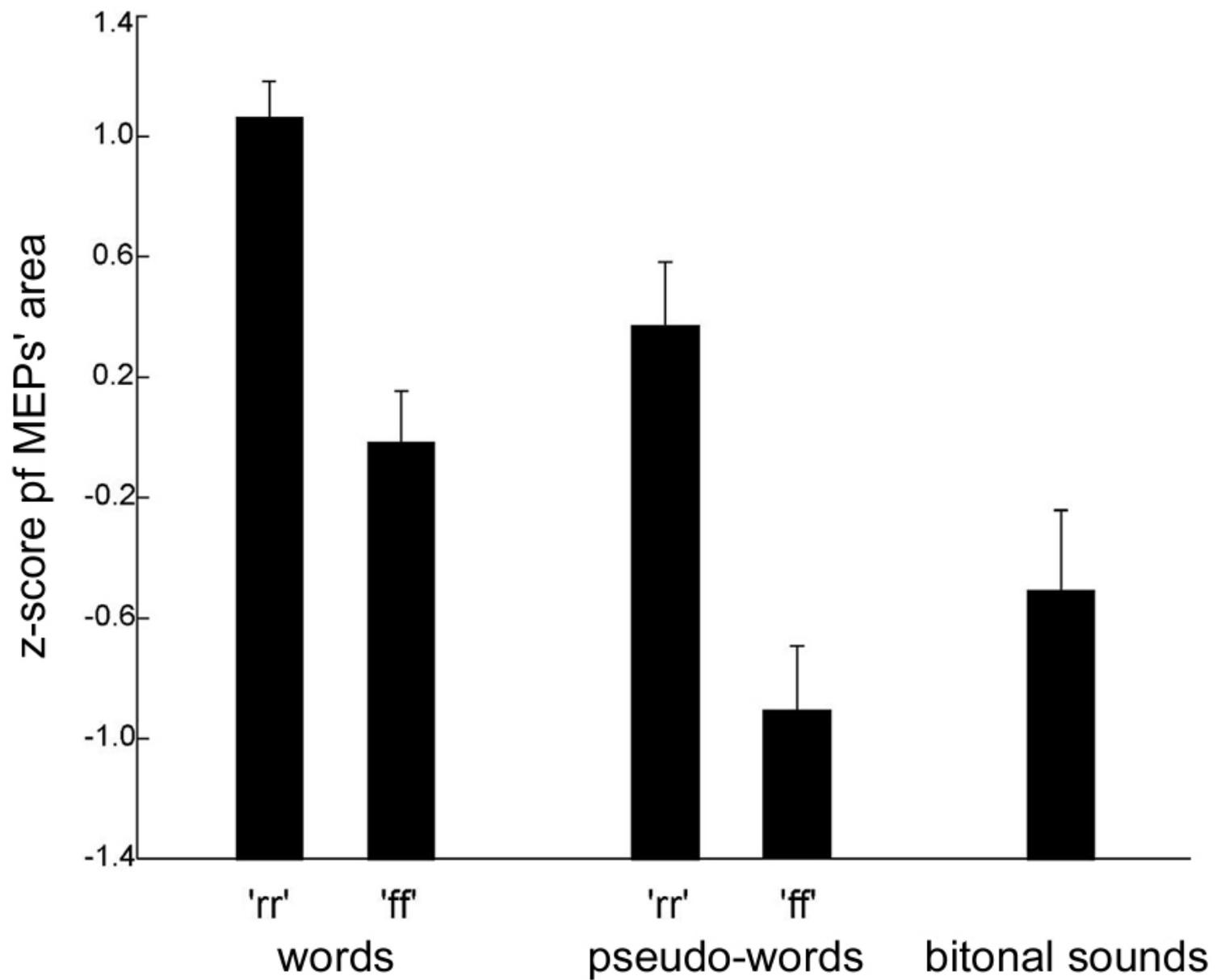
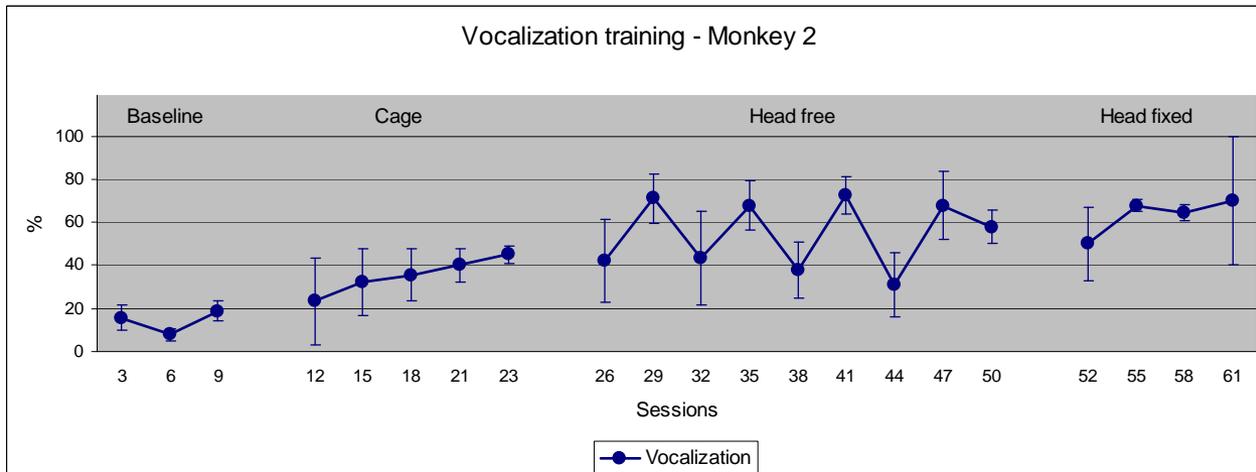
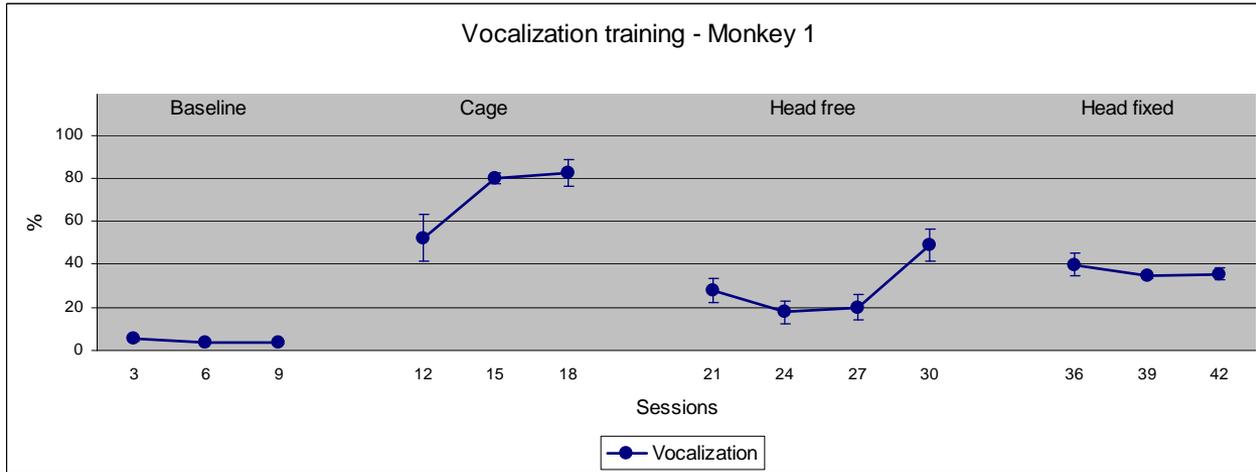


TABLE 1. Verbal stimuli used in the experiment

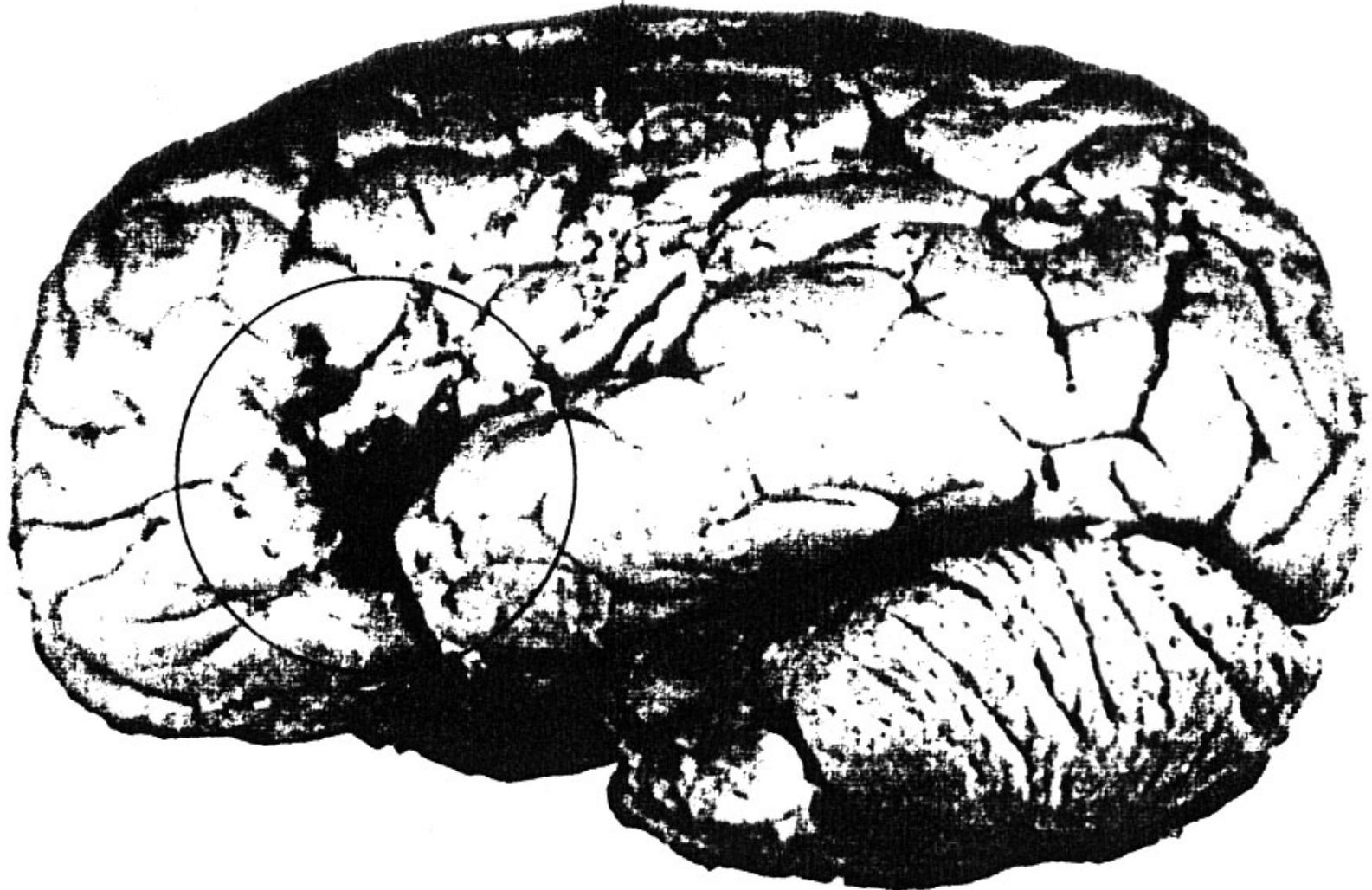
Lingua-palatal fricative consonants	
Words	Pseudo-words
birra (bier)	berro
carro (cart)	firra
cirro (cirrus)	forro
farro (spelt)	furra
ferro (iron)	marro
mirra (myrrh)	merro
morra (morra)	parro
porro (leek)	perro
serra (greenhouse)	vorro
terra (ground)	vurro
Labiodental fricative consonants	
Words	Pseudo-words
baffo (moustache)	biffo
beffa (hoax)	ciffo
buffo (funny)	leffa
ceffo (snout)	meffa
coffa (crow's nest)	paffo
goffo (clumsy)	peffa
muffa (mold)	poffa
puffo (smurf)	seffa
tuffo (dive)	viffo
zaffo (plug)	voffo



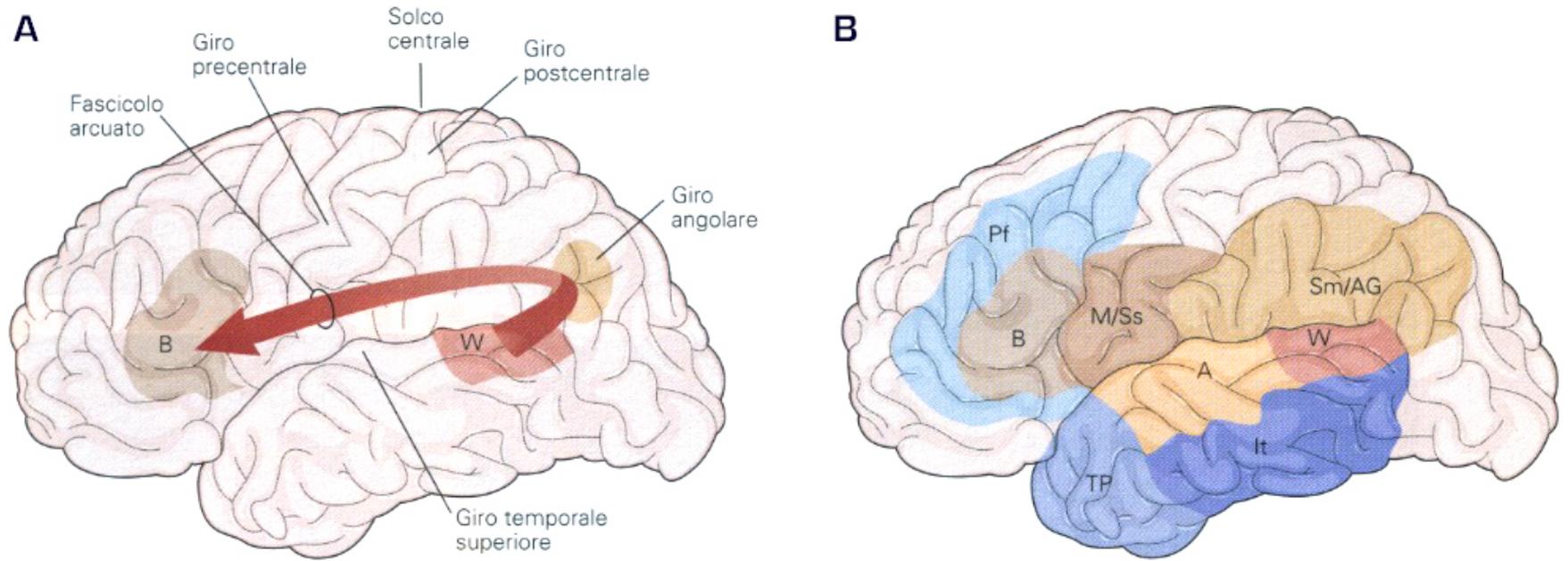
Training di vocalizzazione

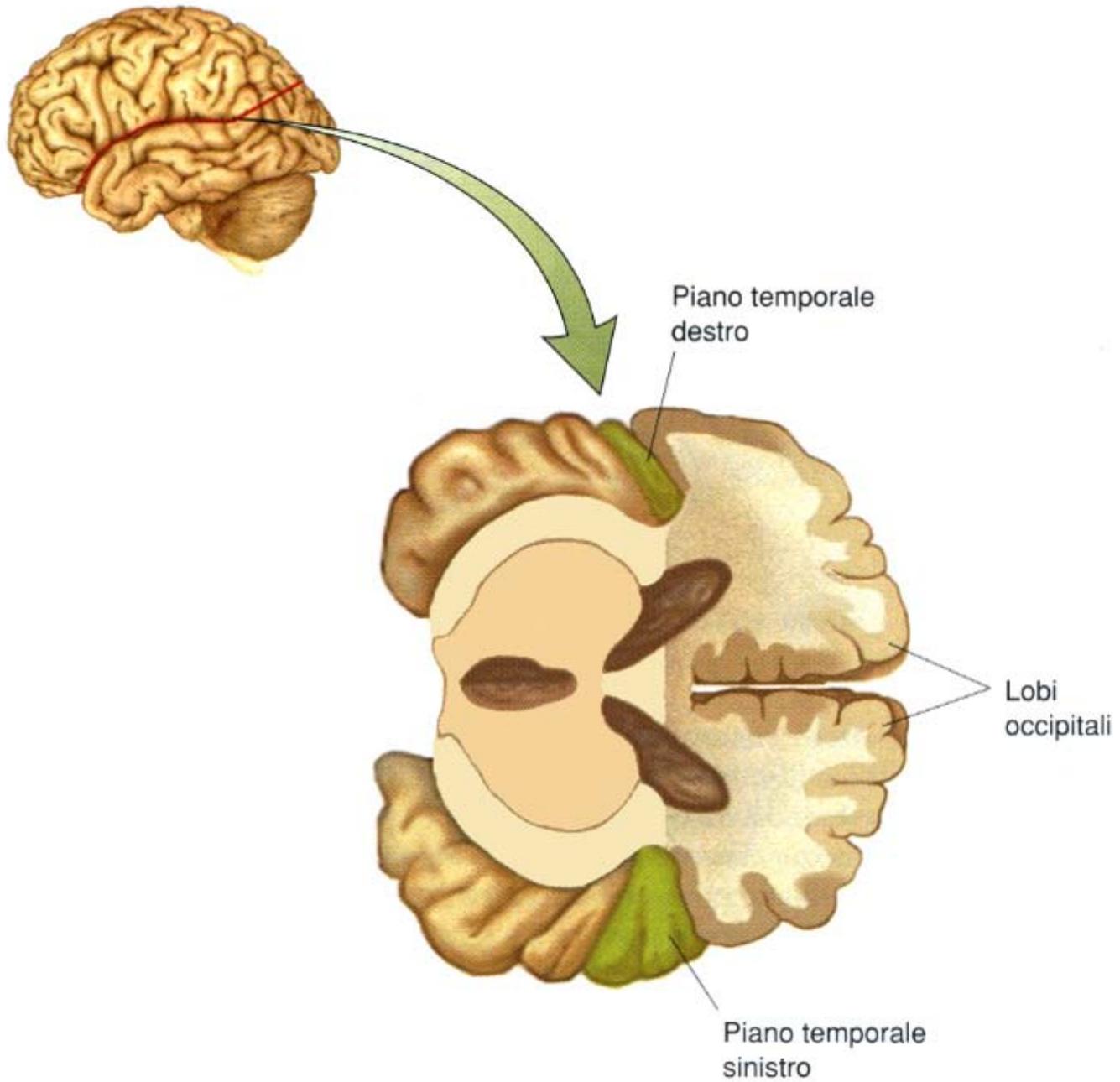


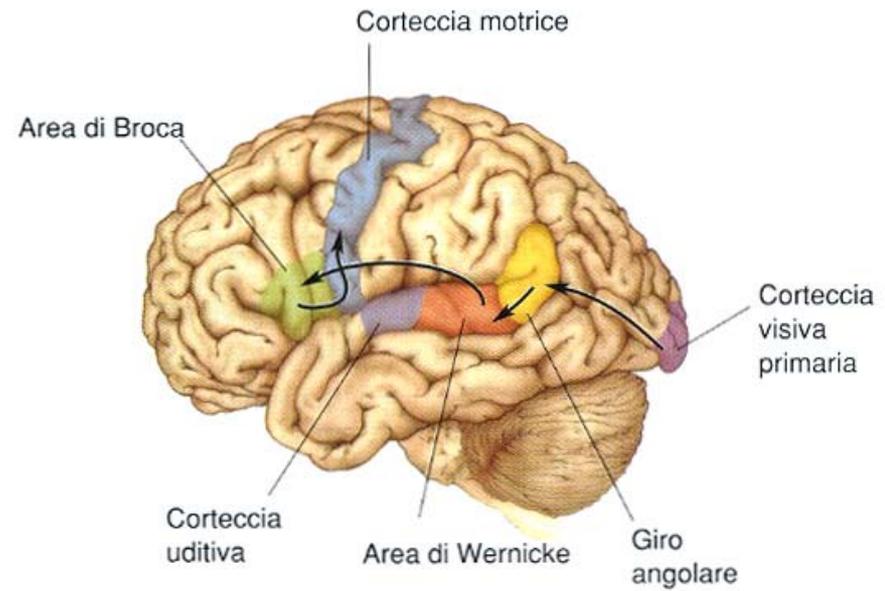
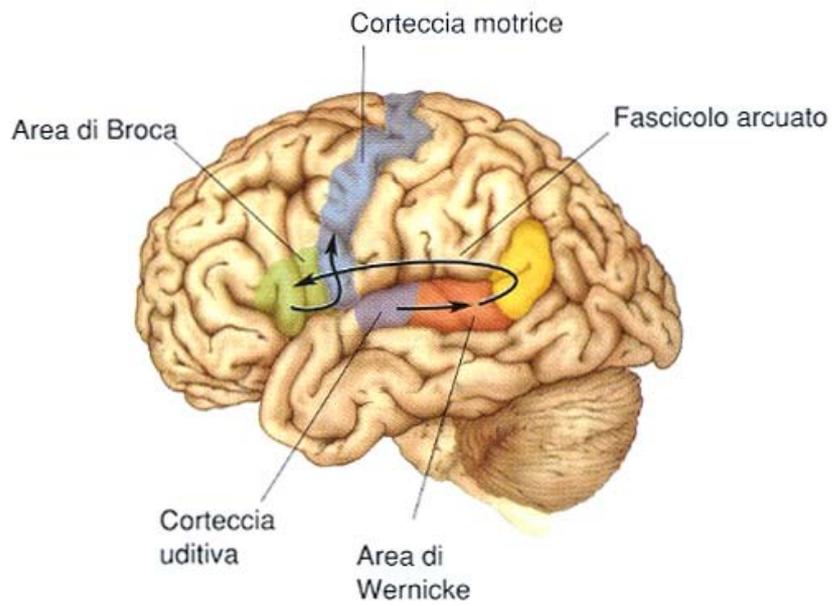
Solco centrale

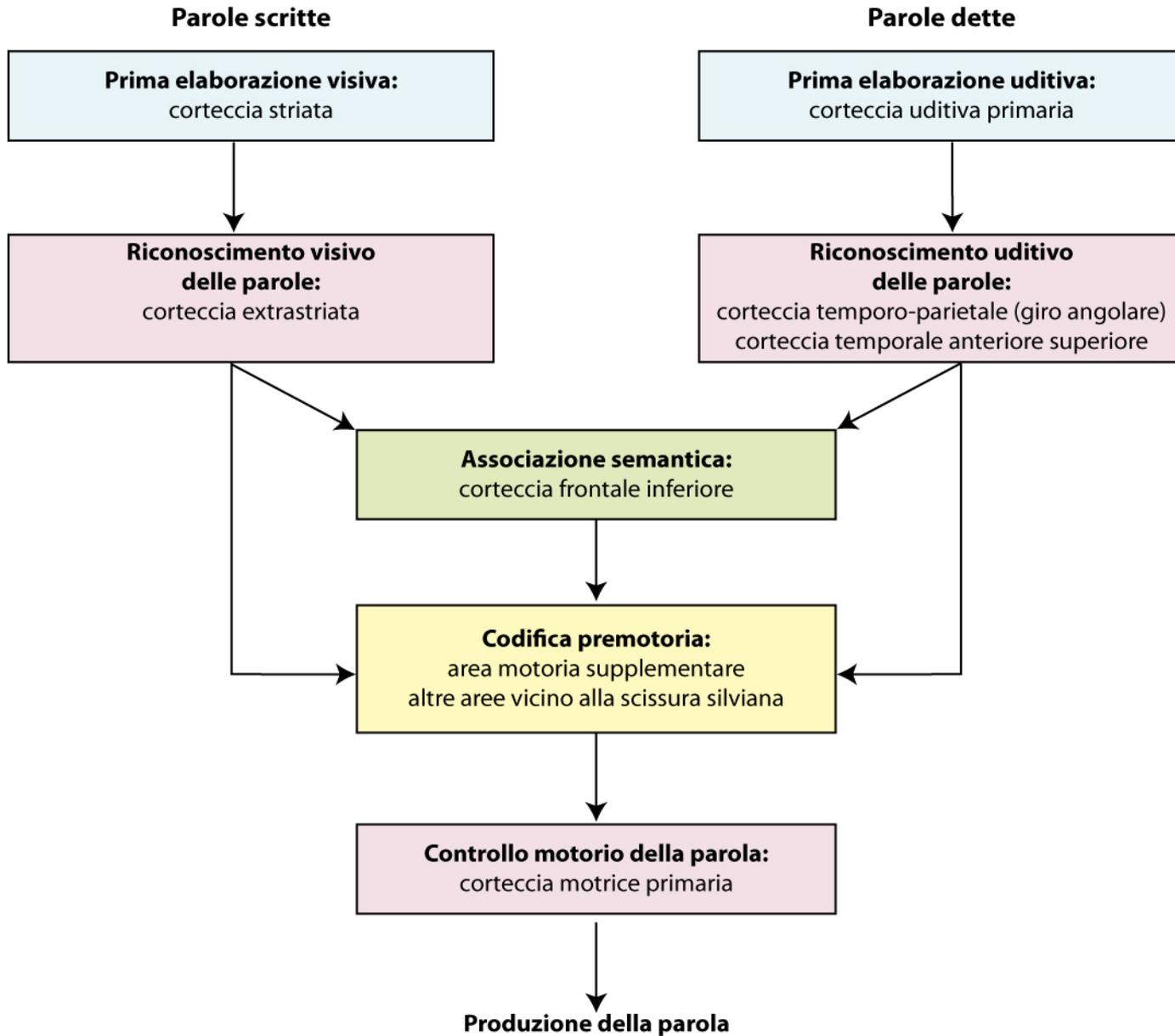


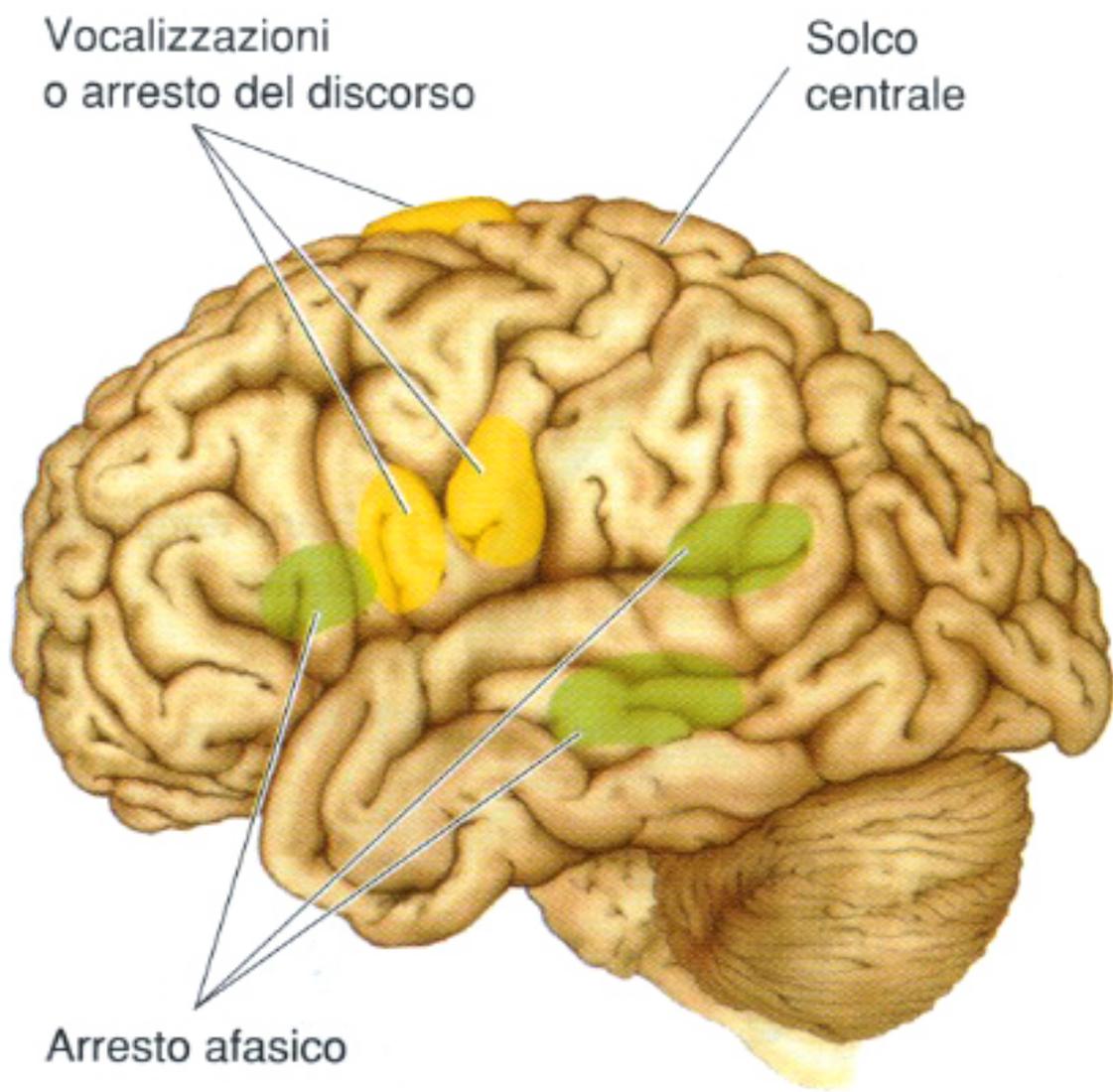
Le aree coinvolte nella funzione linguistica











Imitazione neonatale



Meltzoff & Moore 1977



Ferrari et al. 2006

Lipsmacking



Mouth Opening



Tongue Protrusion



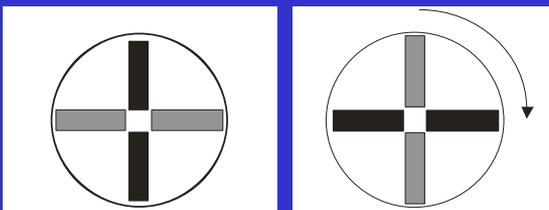
Eye



Hand

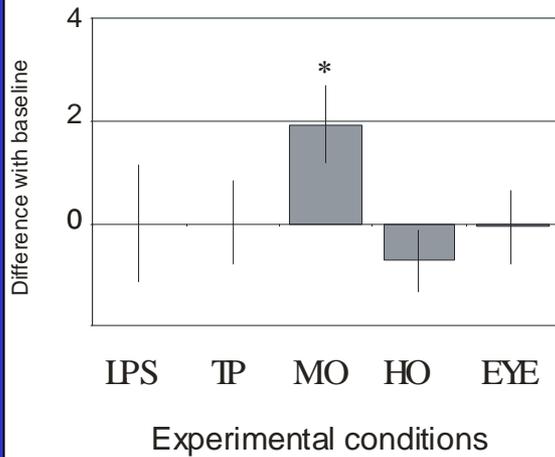


Disk



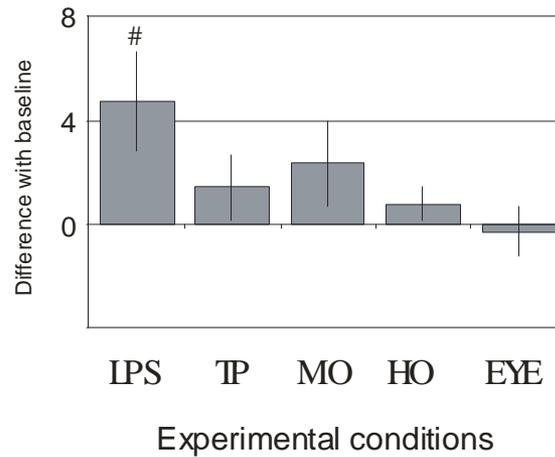
Day 1

Lip smacking

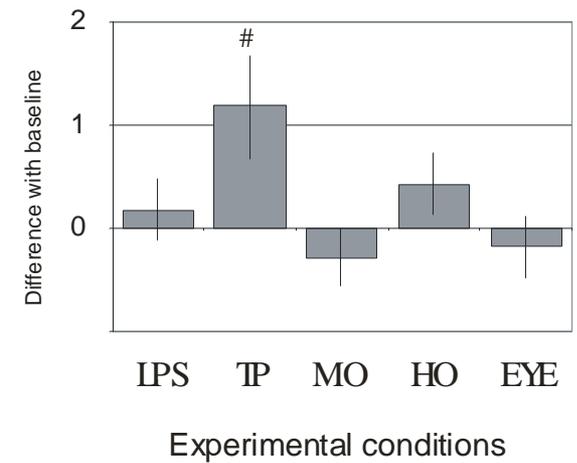


Day 3

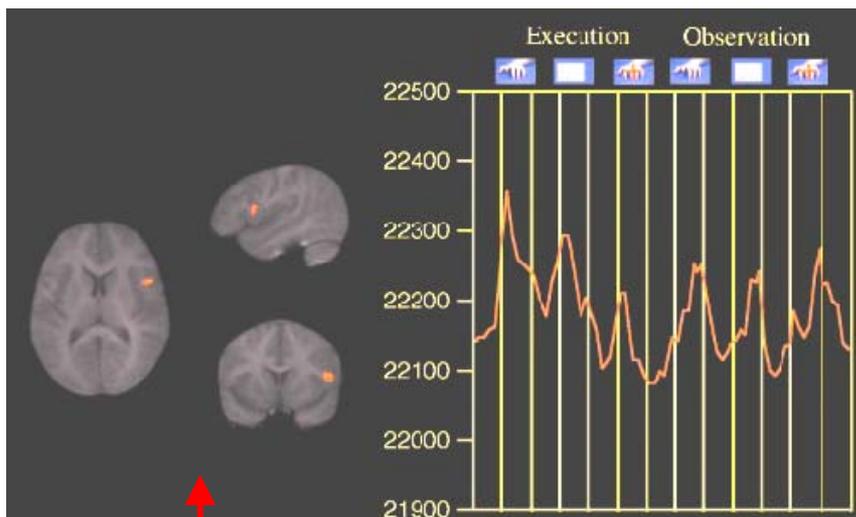
Lip smacking



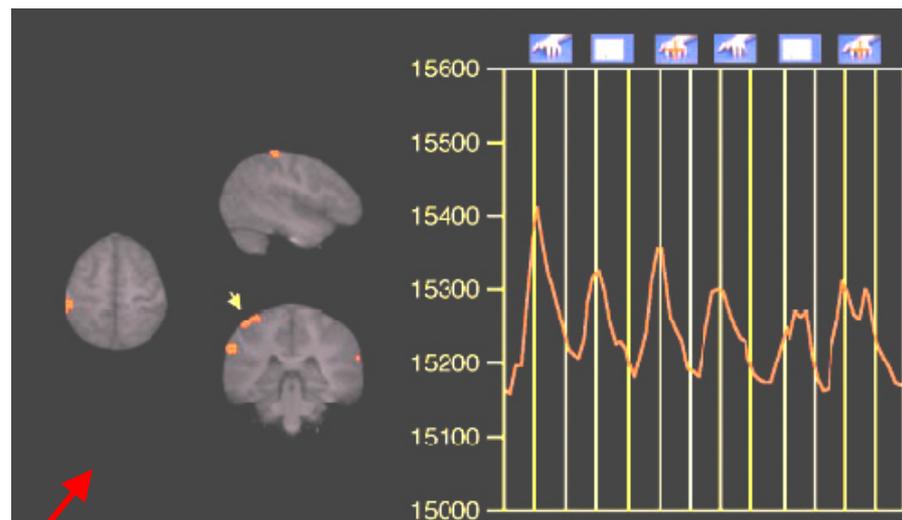
Tongue protrusion



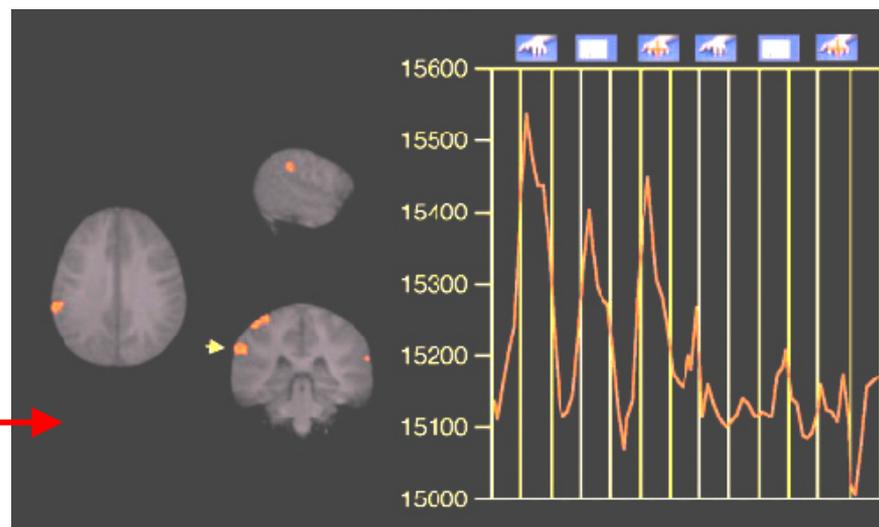
Imitazione di movimenti semplici



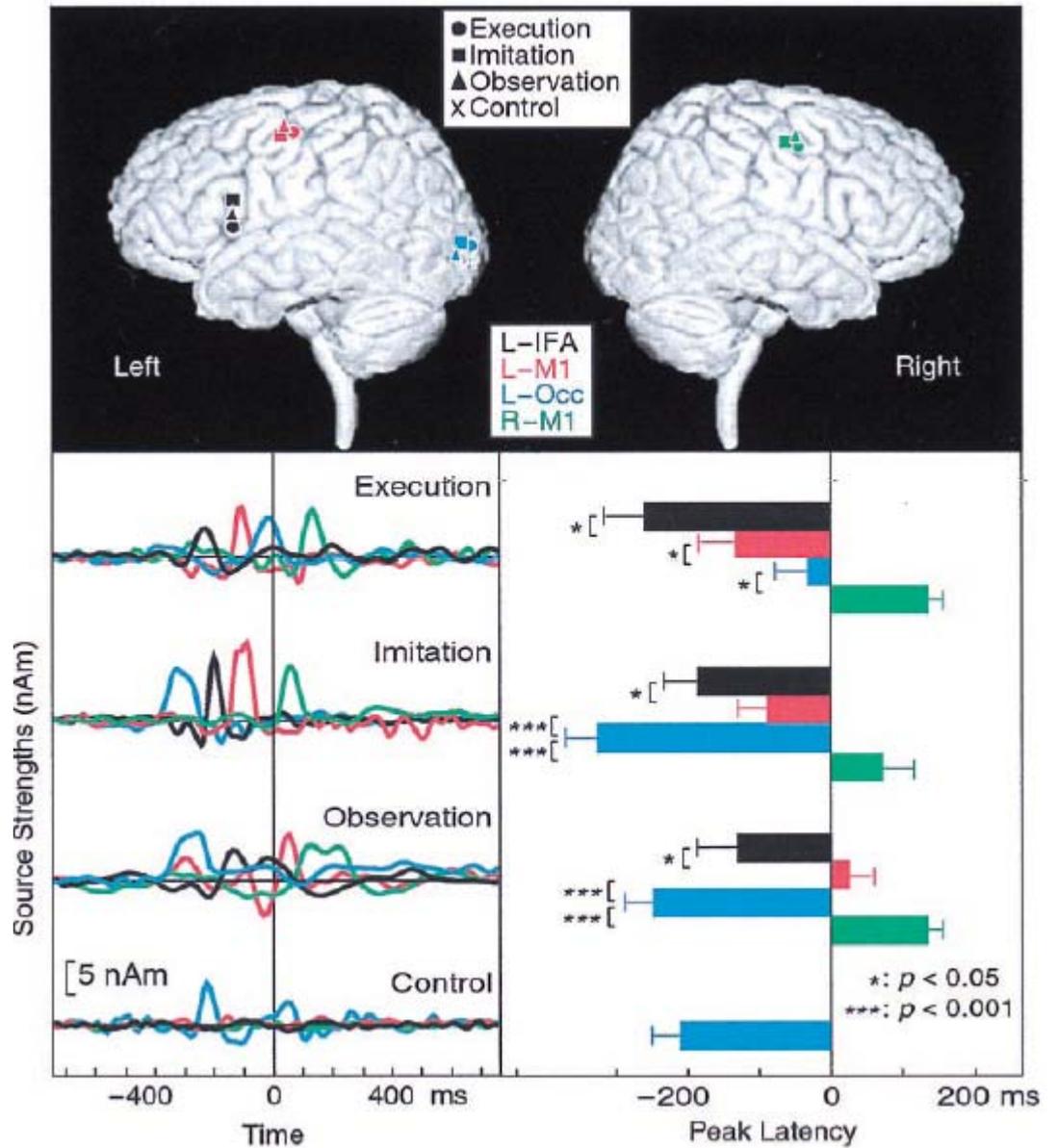
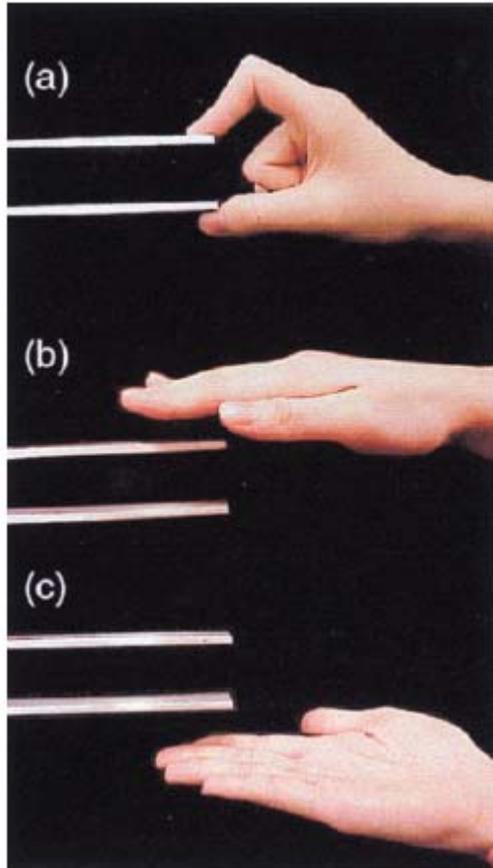
Area 44



Parietale superiore



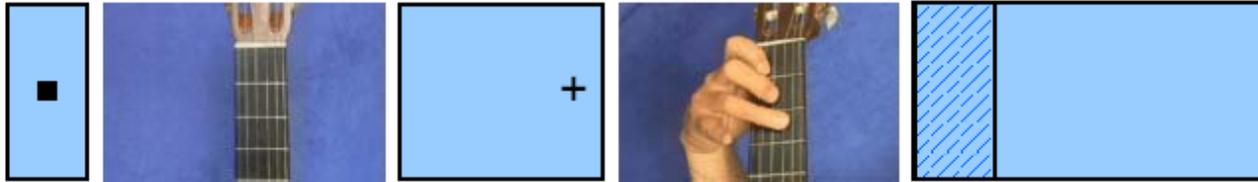
Parietale opercolare



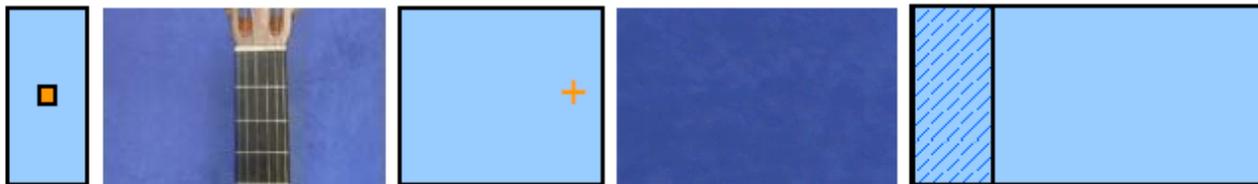
Nishitani and Hari, 2000

Apprendimento per imitazione

OBS: "just watch"



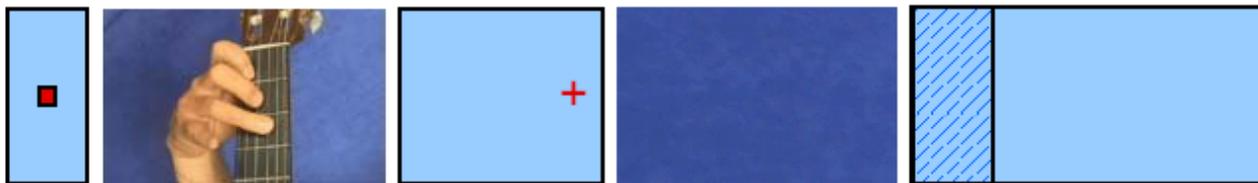
EXE: "play a chord of your choice"



IMI: "observe the model, then imitate"



NON-IMI: "observe the model, then perform a hand action"



Cue
(2 s)

Event 1
(4, 6, 8 or 10 s)

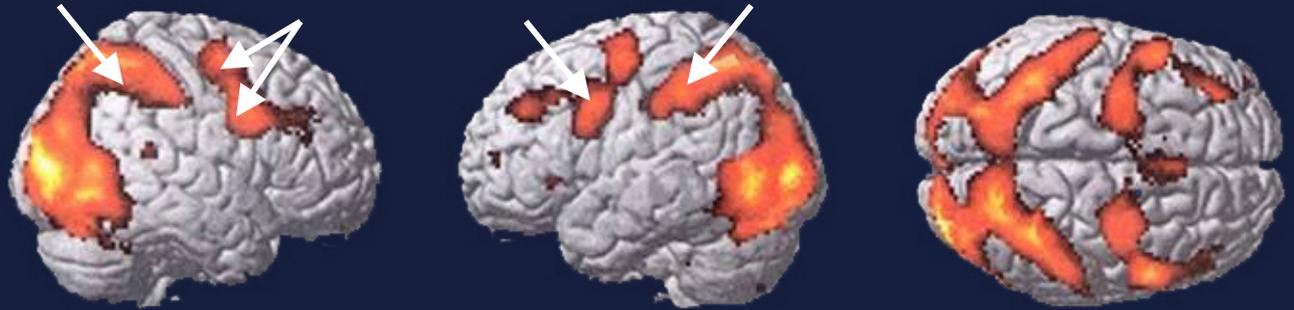
Event 2: pause
(2, 4, 6 or 8 s)

Event 3
(7 s)

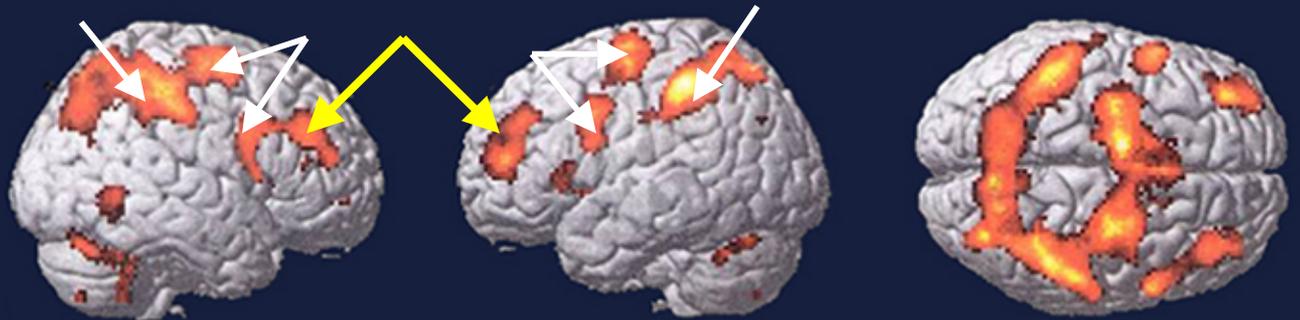
Event 4: baseline
(6, 8, 10 or 12 s)

Attivazione corticale durante i tre eventi della condizione "Imitazione"

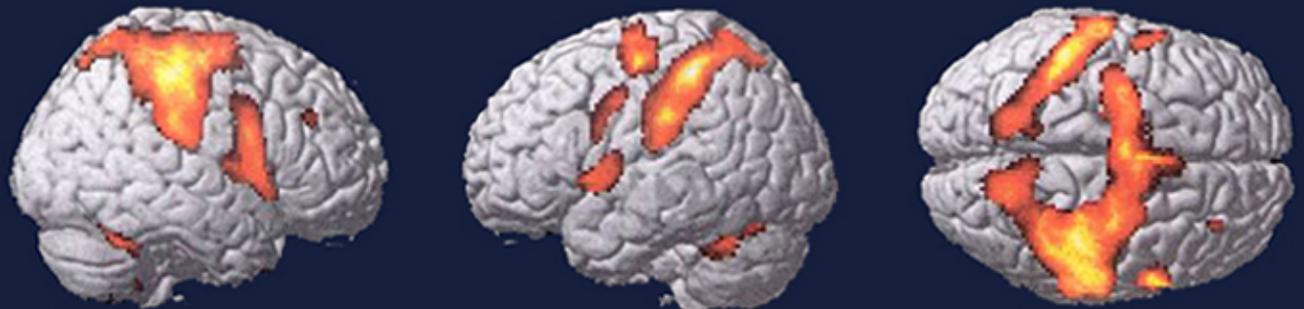
IMI-1



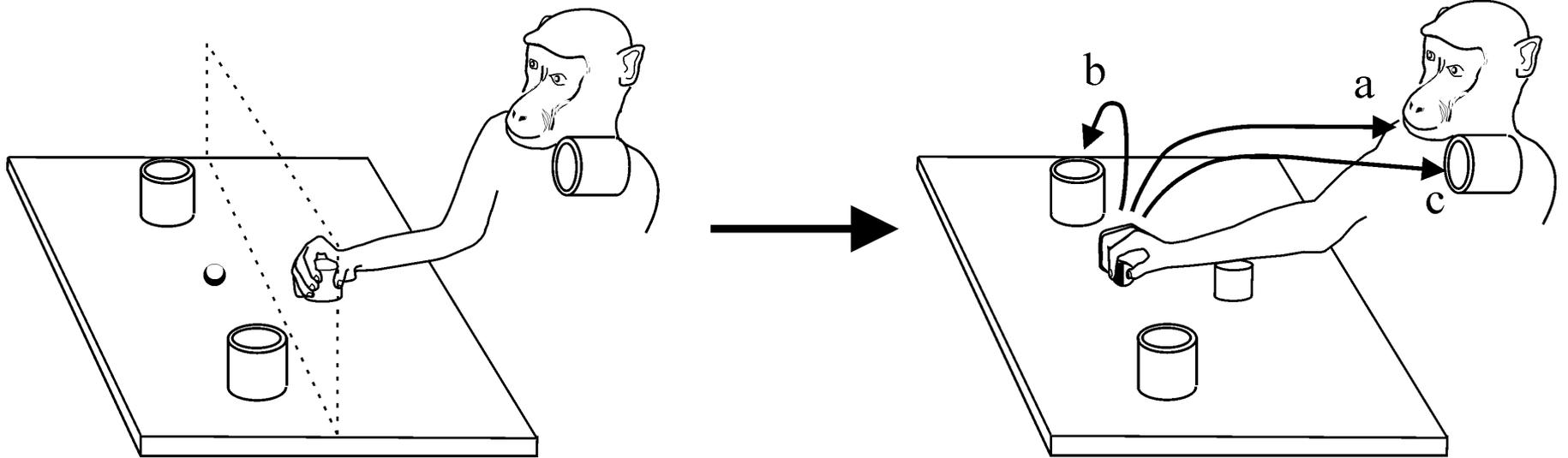
IMI-2

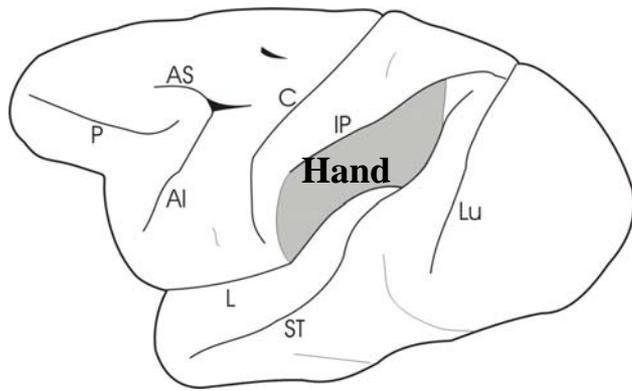


IMI-3

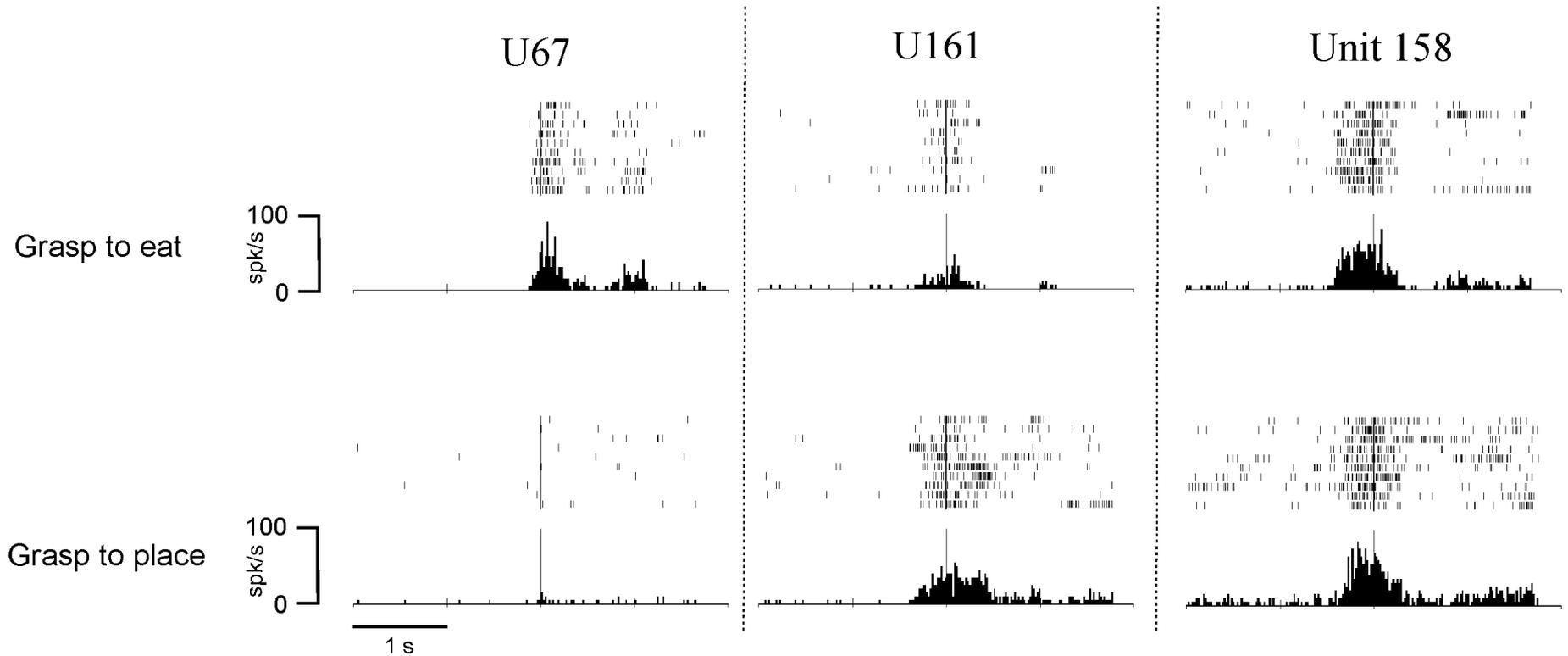


Compito motorio

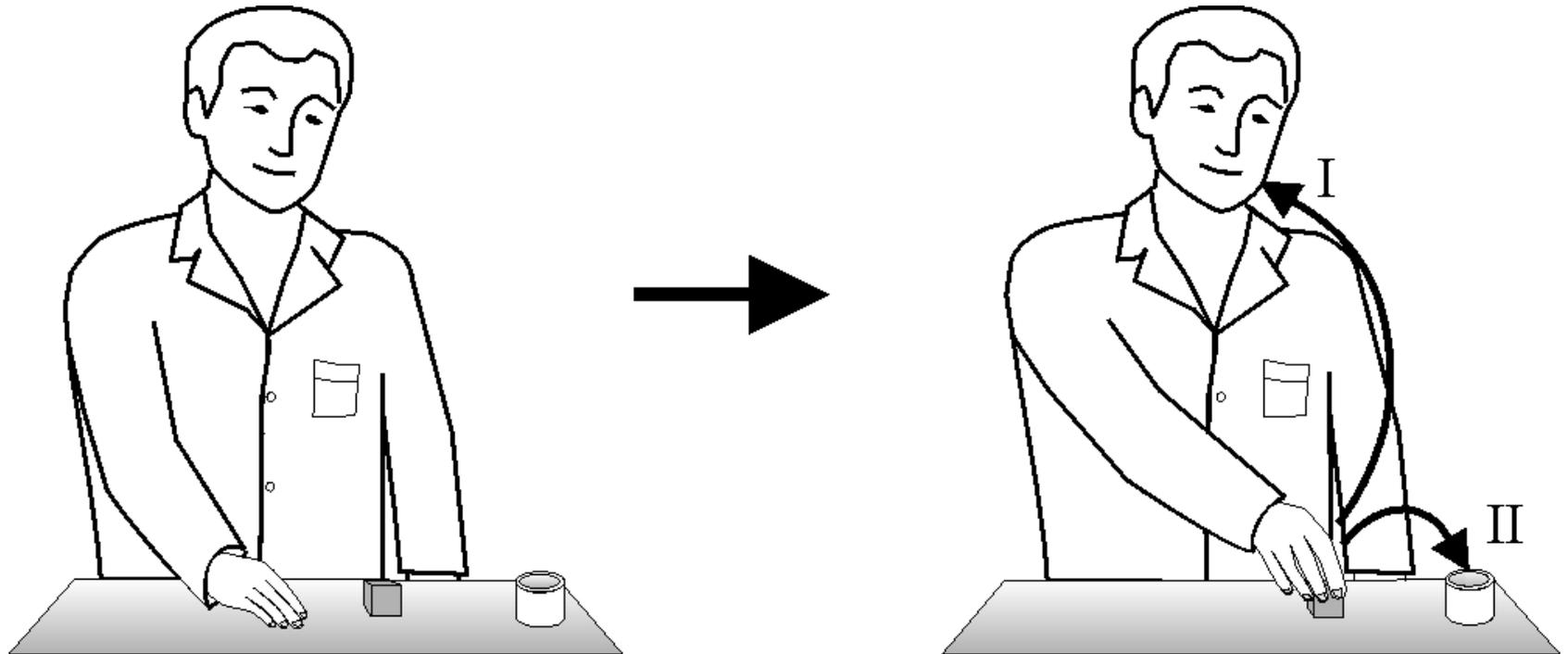




Risposte motorie dei neuroni parietali



Compito visivo



Risposte visive dei neuroni mirror parietali

