The Mirror Neuron System

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COS 598

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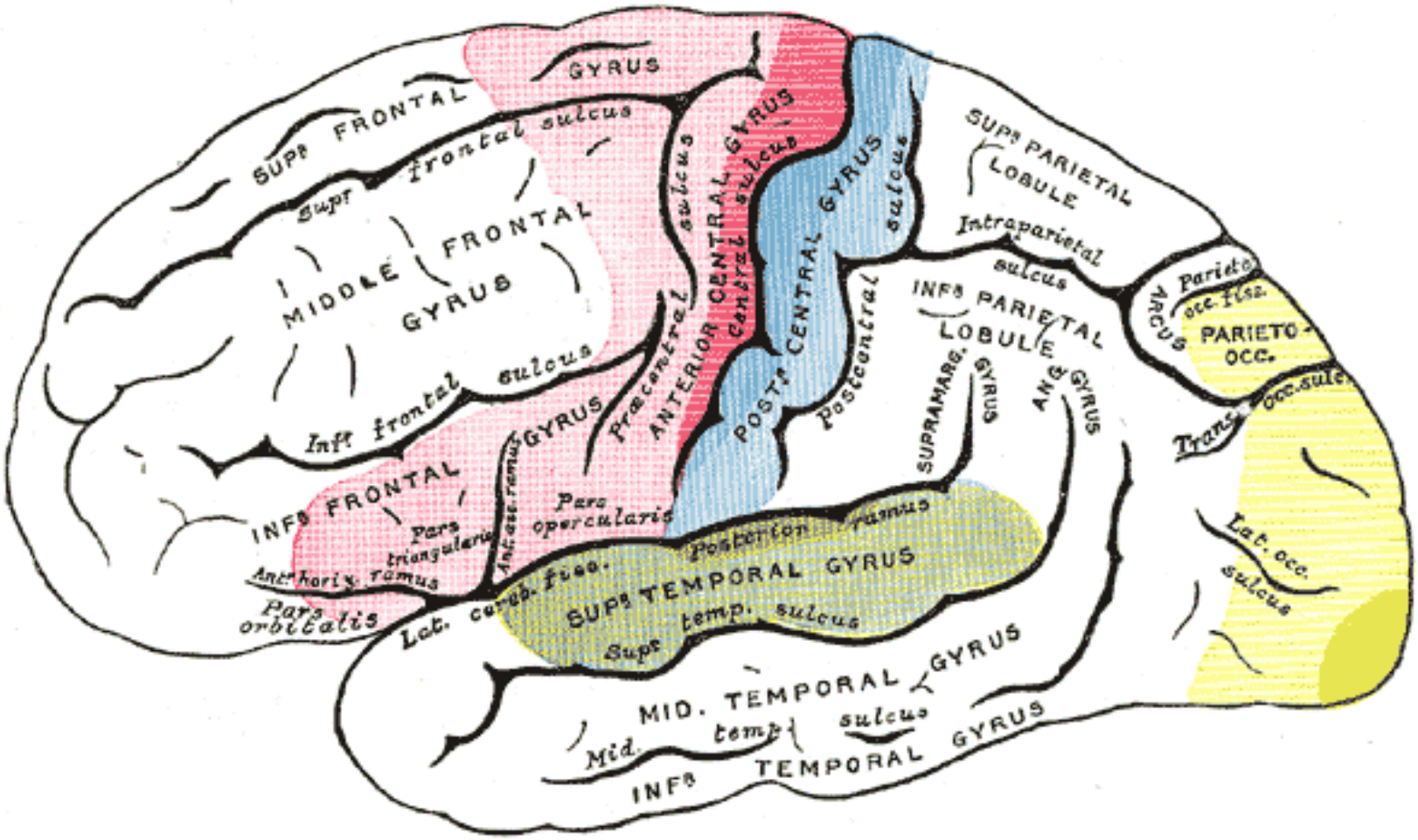
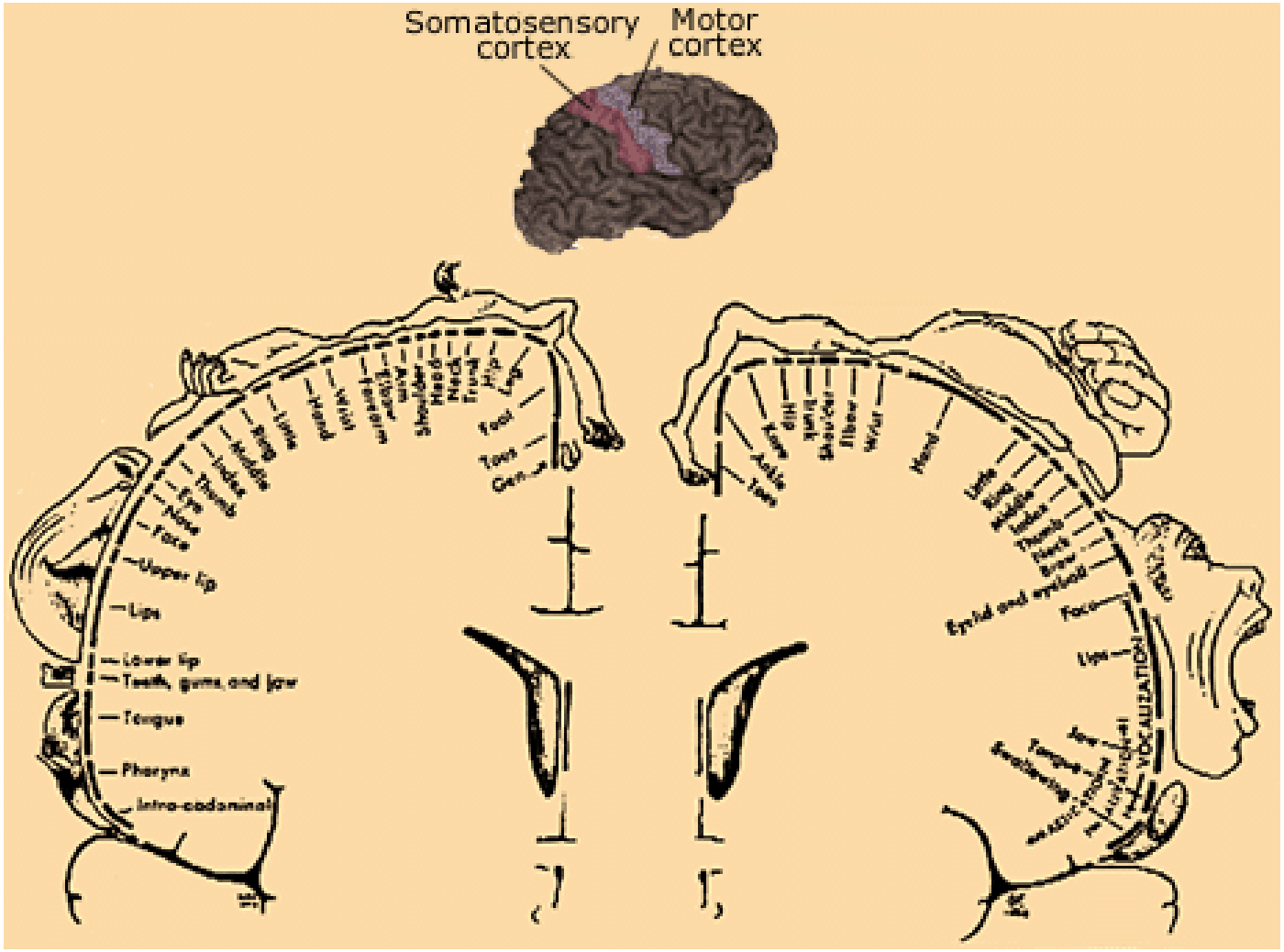
Censored!

Images of Graphic Violence

The Sensory Brain

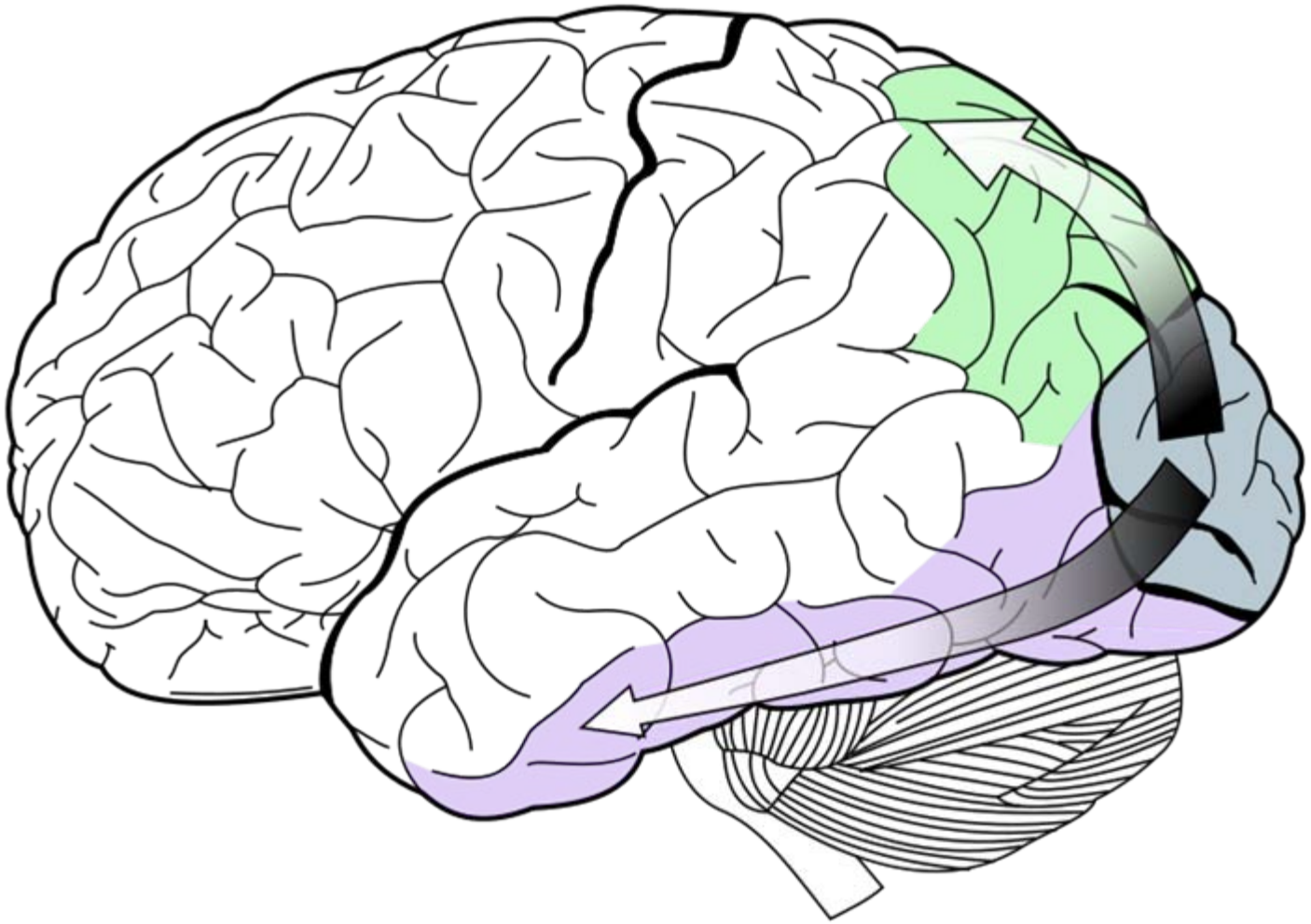


Somatosensory and Motor Maps

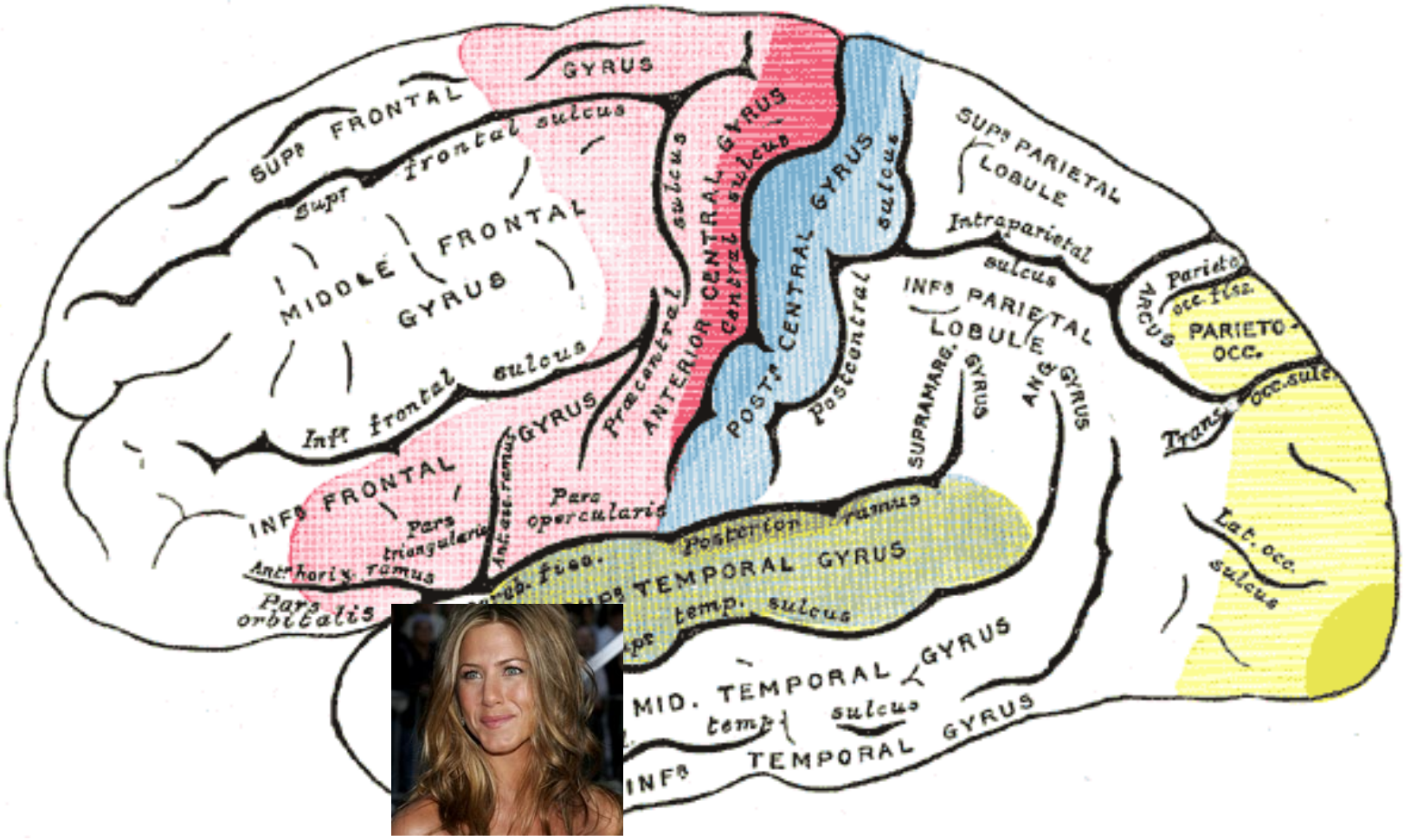


The Cerebral Cortex of Man by Wilder Penfield and Theodore Rasmussen

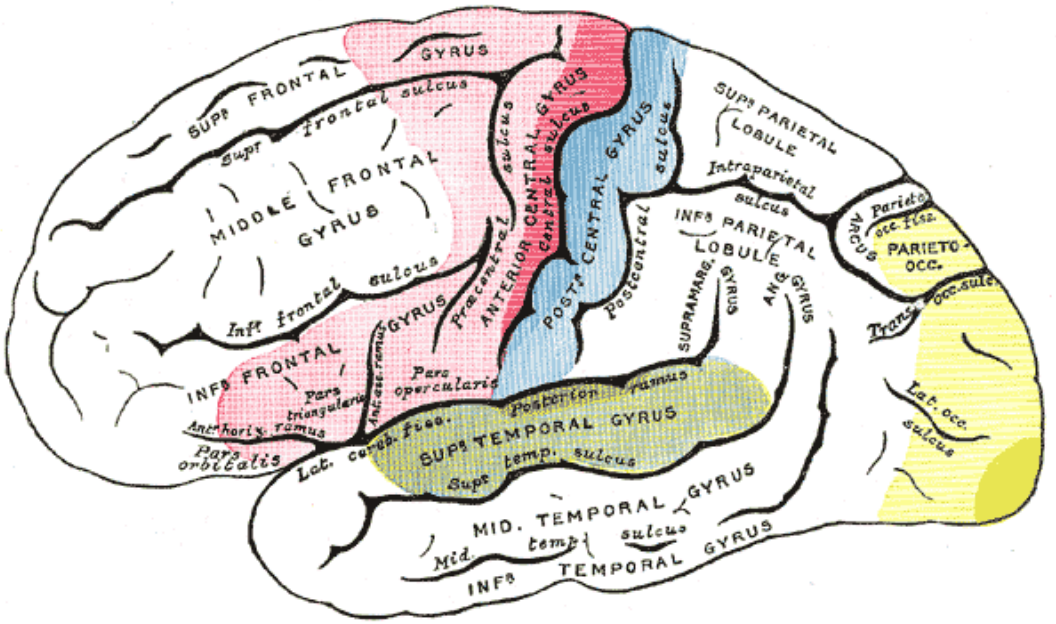
The Visual Pathways



Specificity



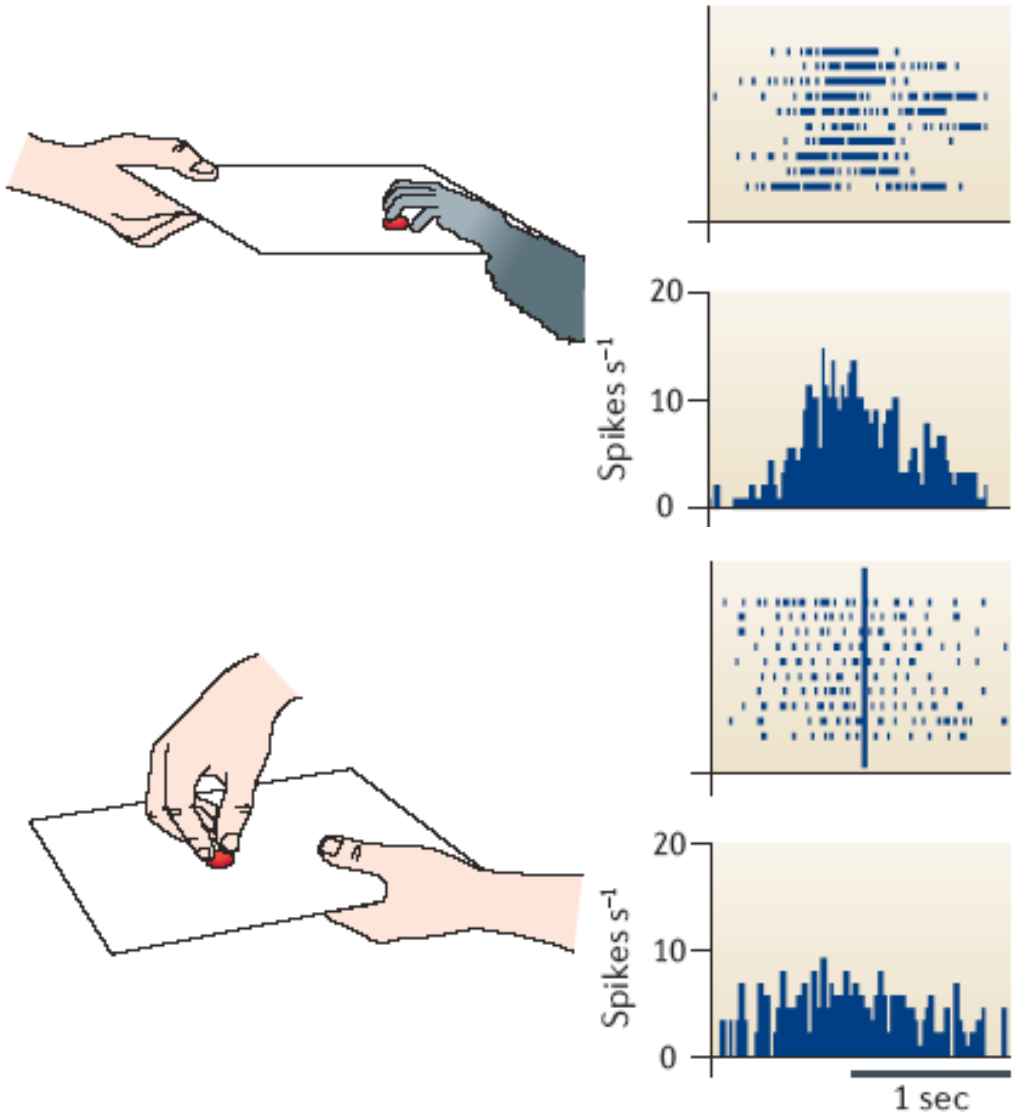
Connectivity



- F4 and VIP
  - Head orientation, peri-personal space, defensive movements
- F5 and AIP
  - grasping
- Types of neurons:
  - visually dominant
  - visuomotor (canonical)
  - motor dominant

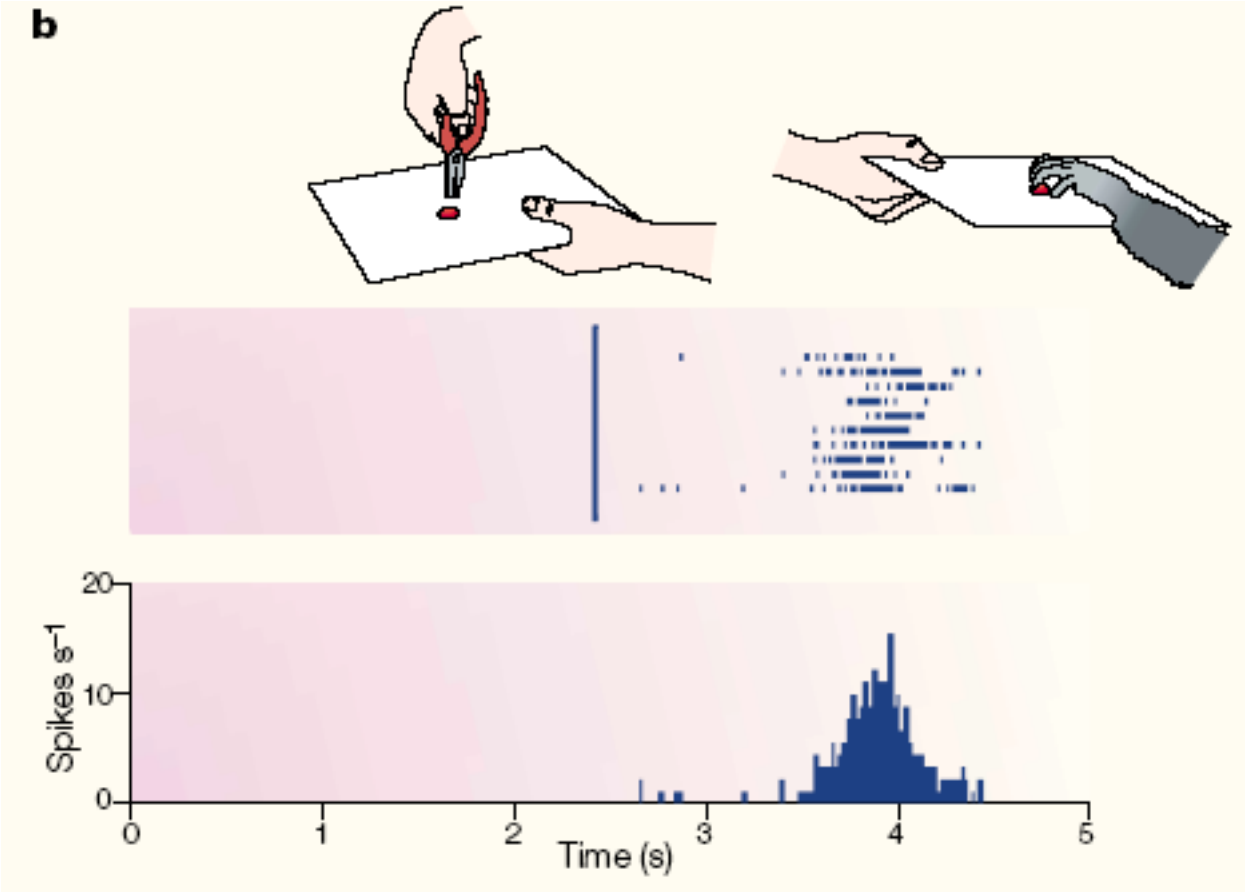
Mirror Neurons

Understanding Ourselves, Understanding Others



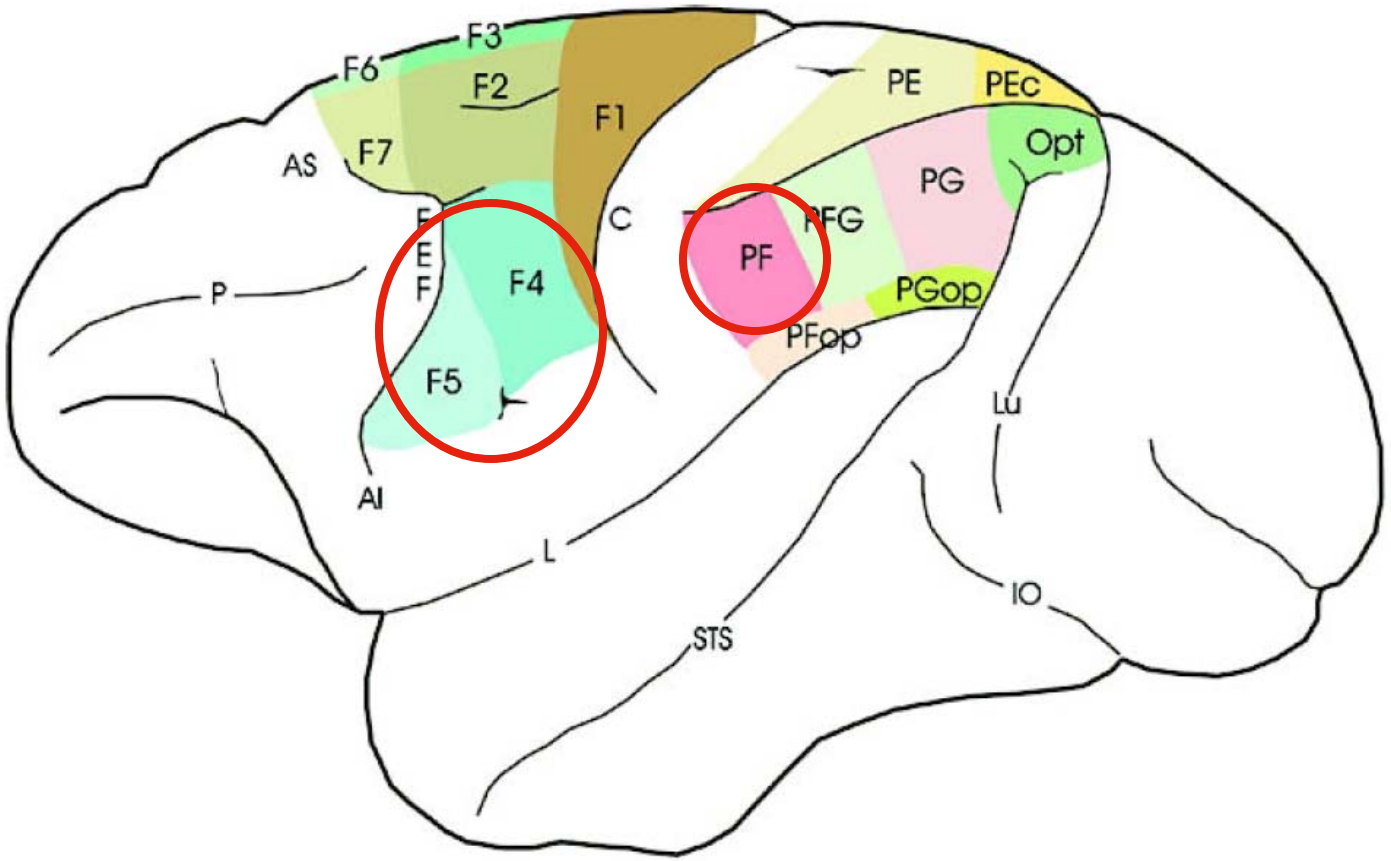
Rizzolatti et al. 2001

Mirror Neurons & Tools



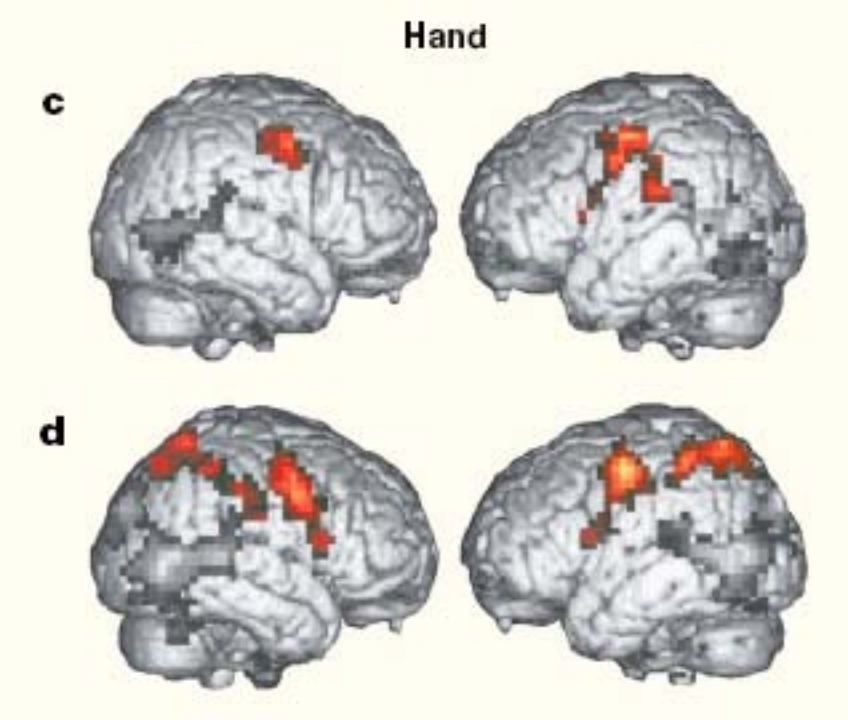
Rizzolatti et al. 2001

Locations of Mirror Neurons

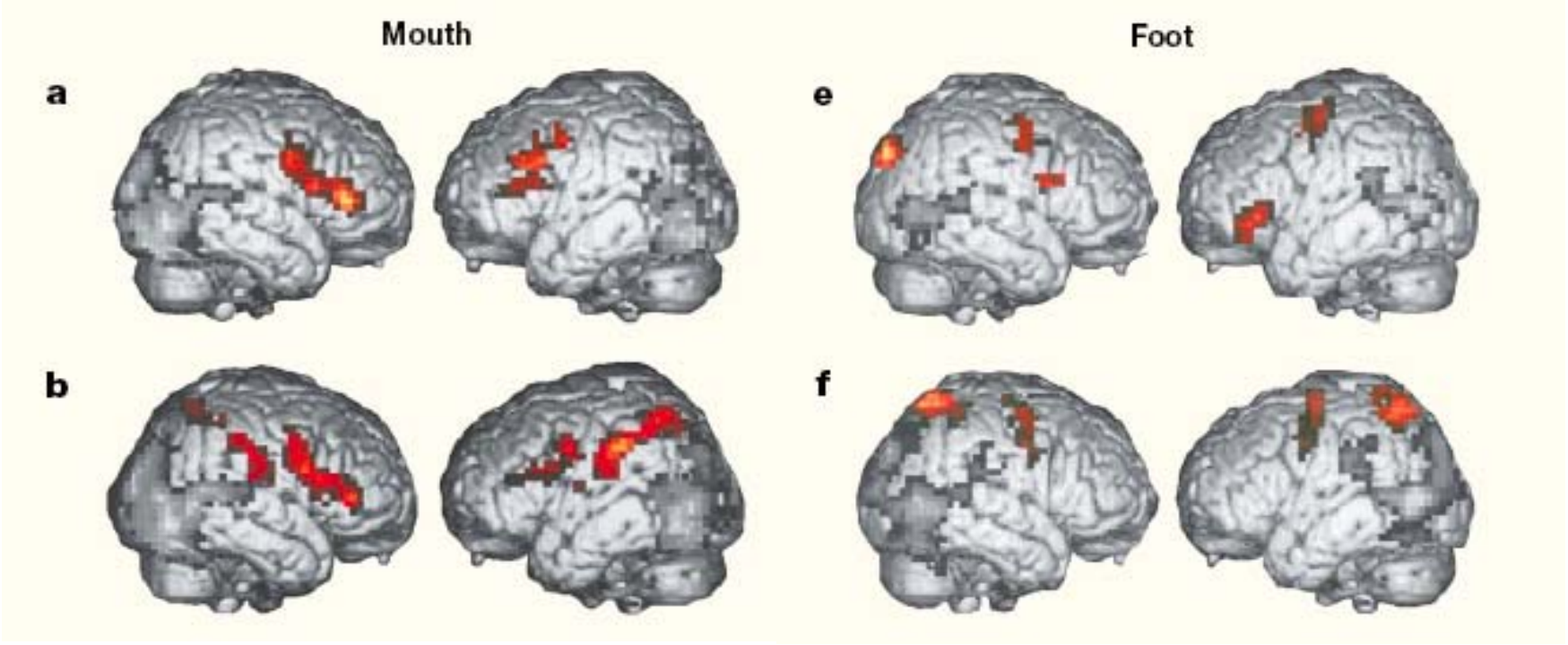


Mirror Activity

Observation of motor activity with and without an object



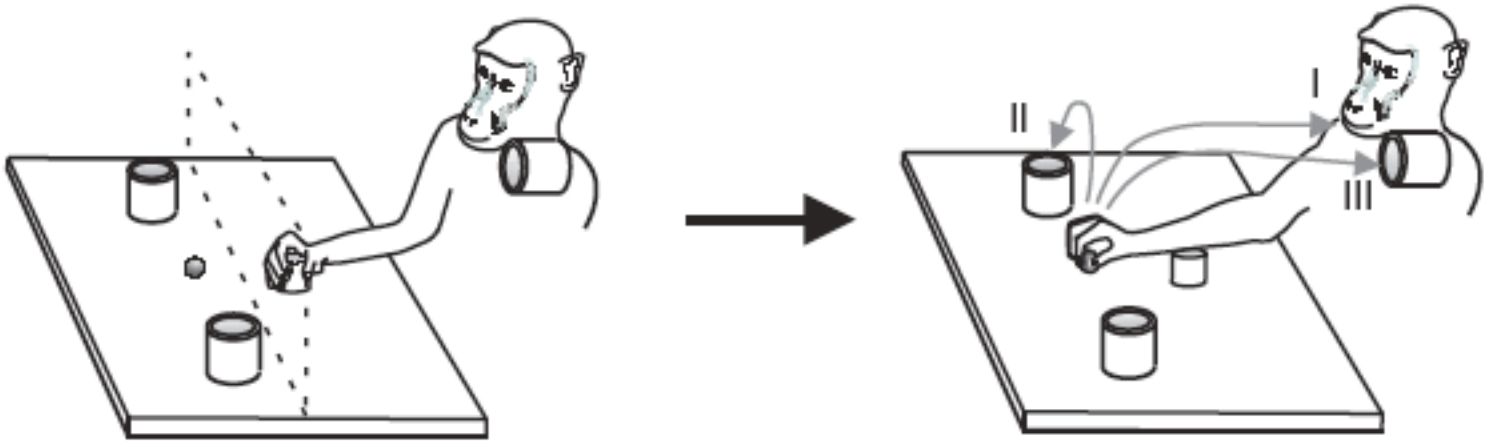
Rizzolatti et al. 2001



Types of Neurons

- Canonical
  - Sensory *or* motor
- Mirror
  - Strictly congruent
    - Precise mirror activity
  - Broadly congruent
    - Do not require precise sensory mirror of motor activity

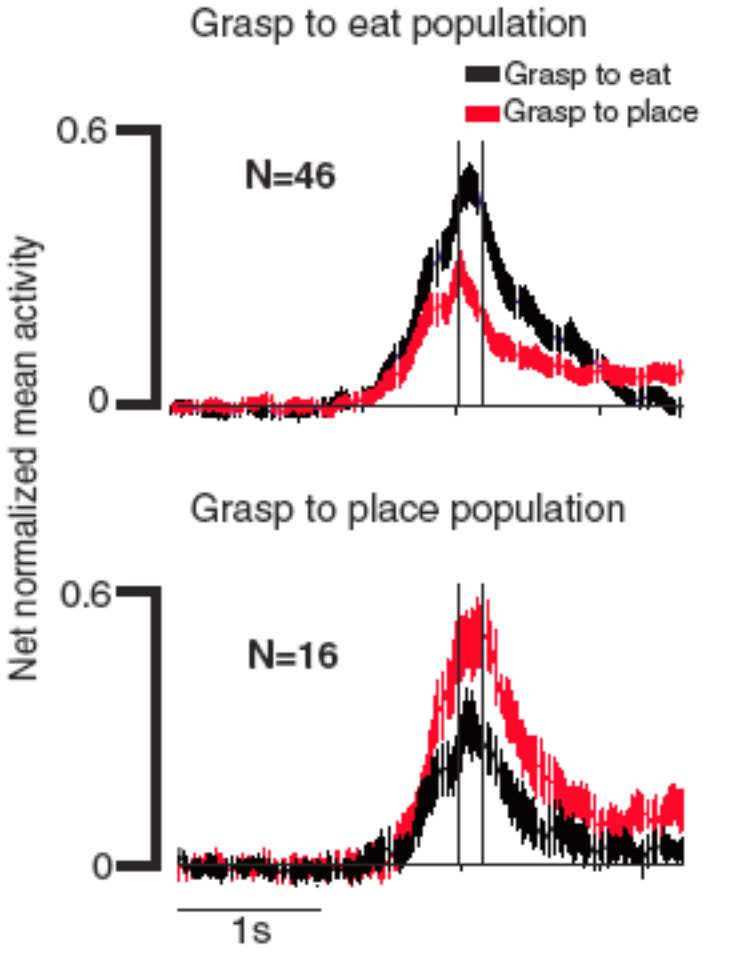
Sensory or “Goal Directed?”



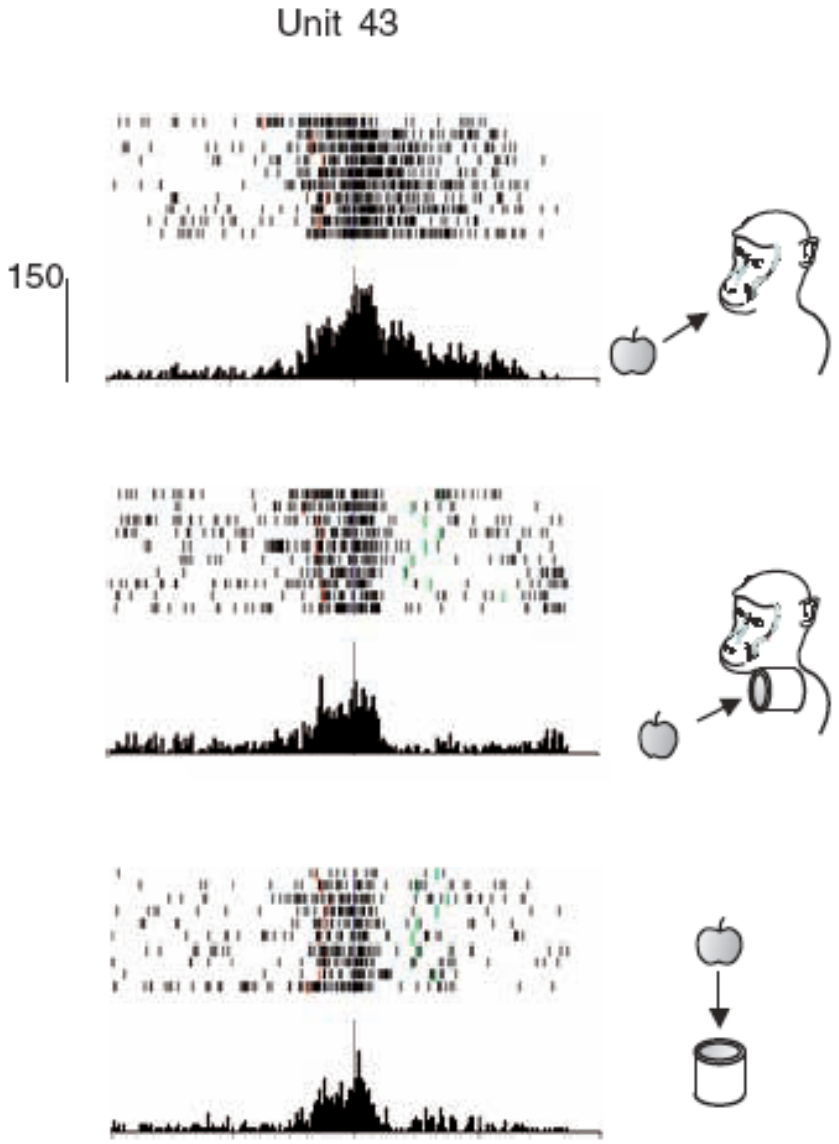
Fogassi et al. 2005

Sensory or "Goal Directed?"

Broadly Congruent Cell

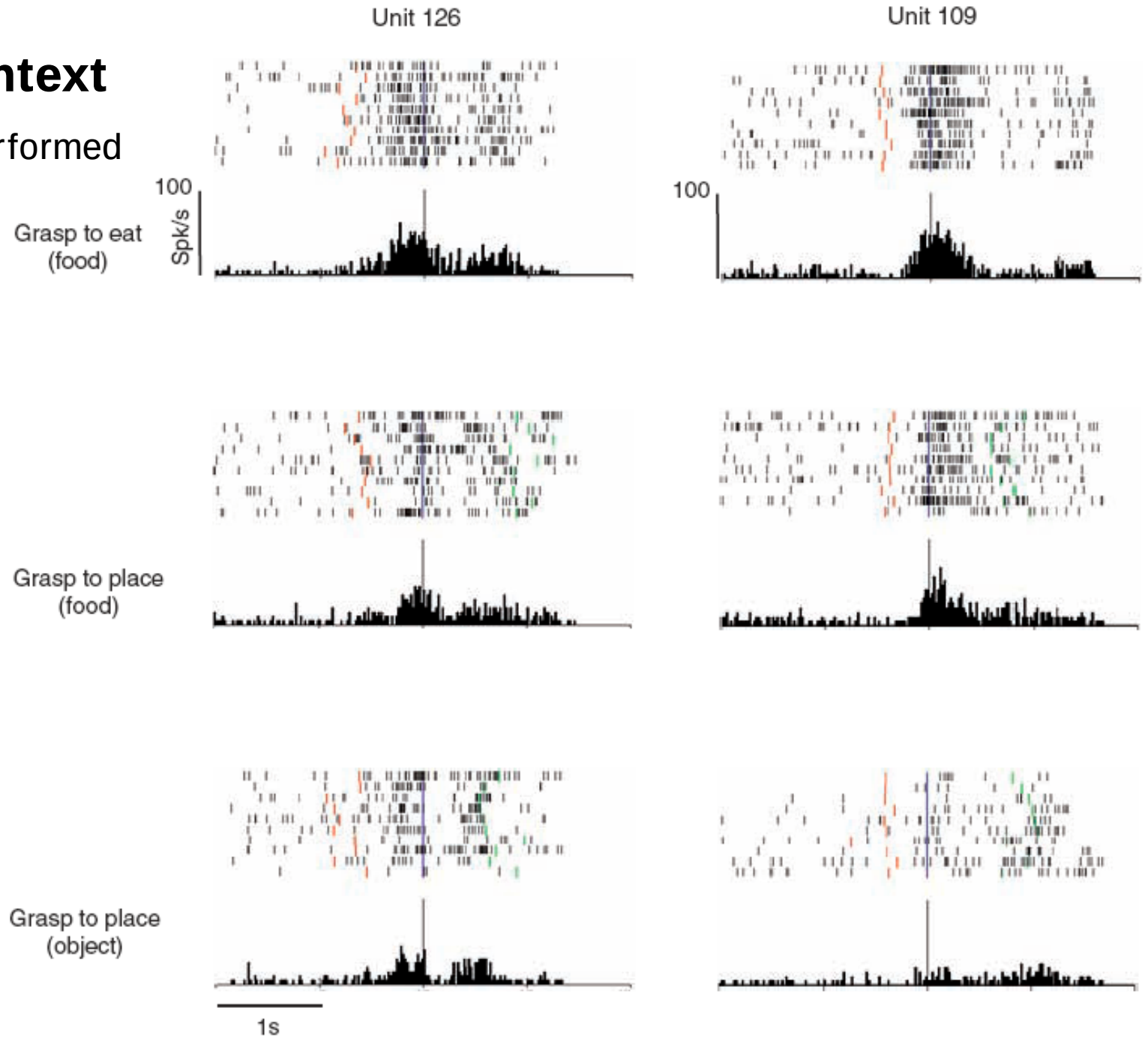


Fogassi et al. 2005



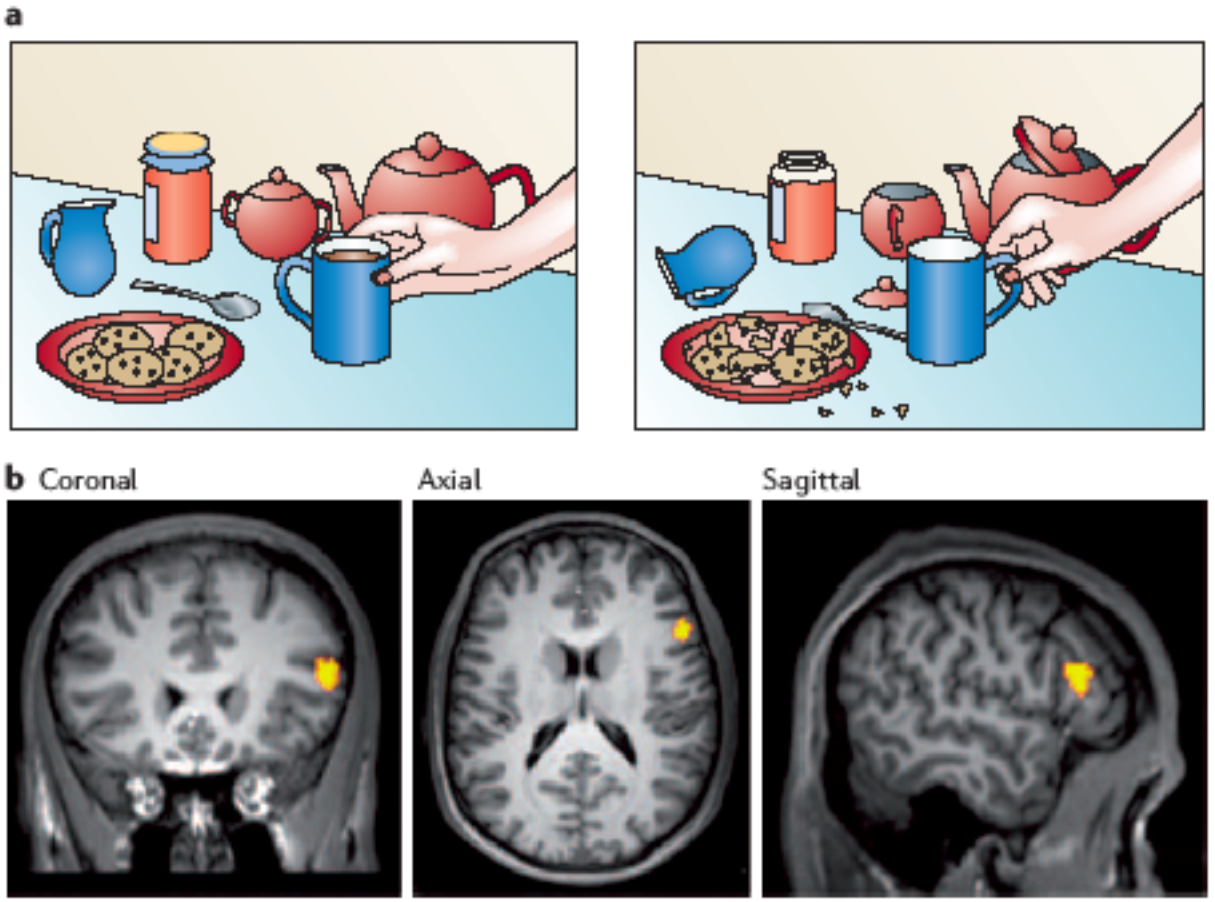
Effect of Context

Experimenter performed tasks



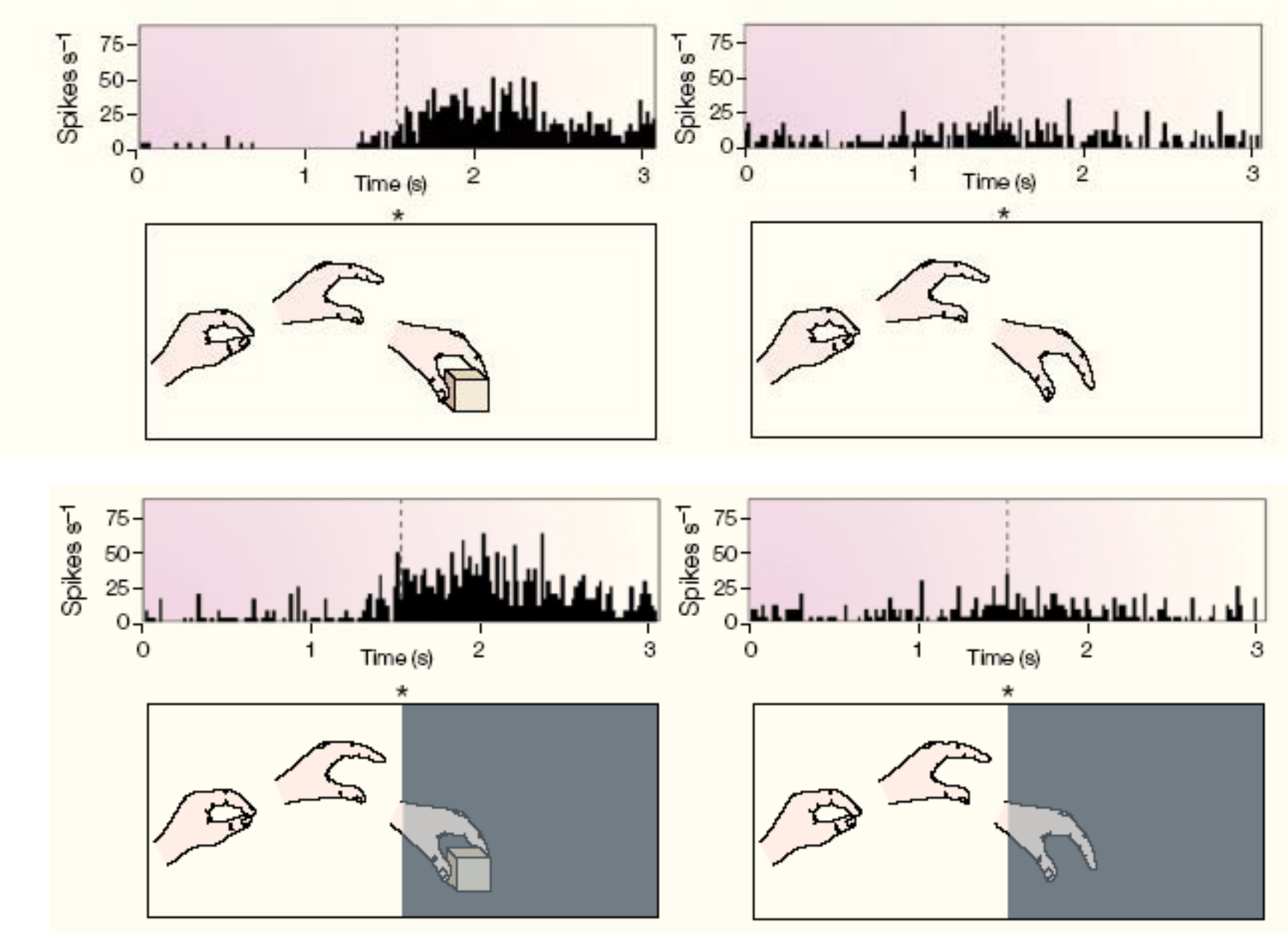
Fogassi et al. 2005

The Effect of Context



Iacoboni et al. 2006

Hidden Placement: Goal Directed

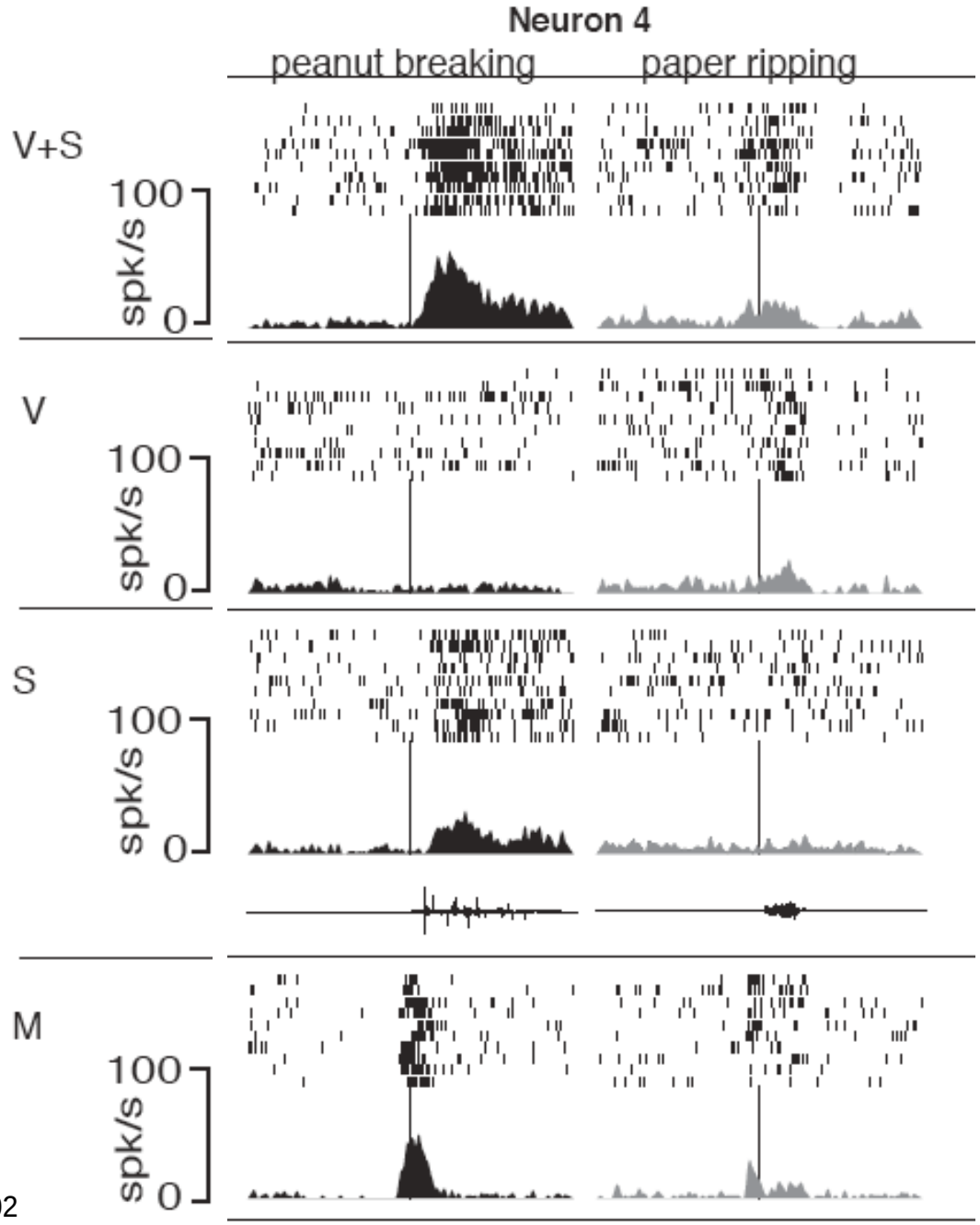


Rizzolatti et al. 2001

Auditory modality

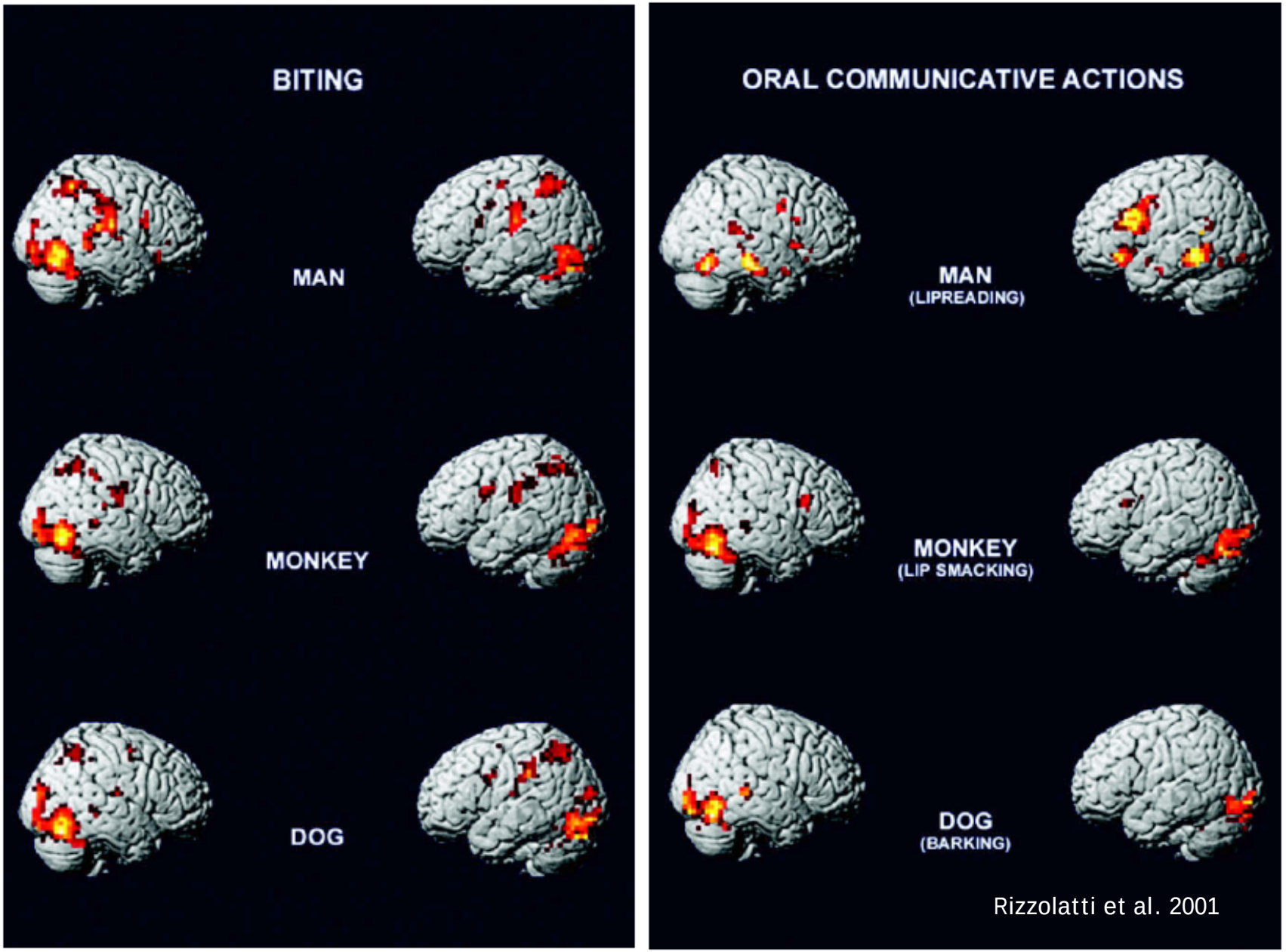
The effects of sound

13% of neurons recorded in F5



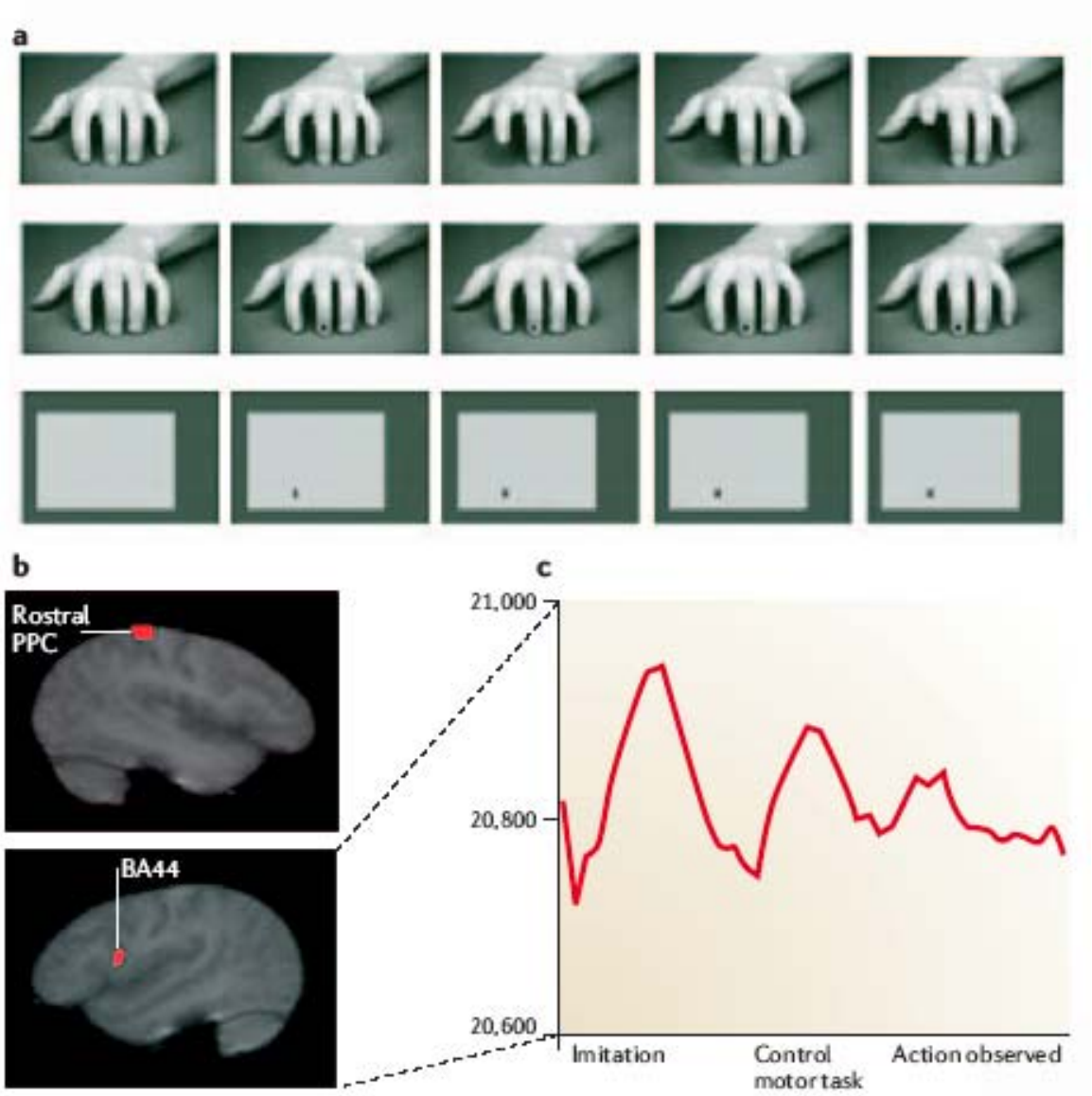
Kohler et al. 2002

Mirror Neurons and Action Understanding



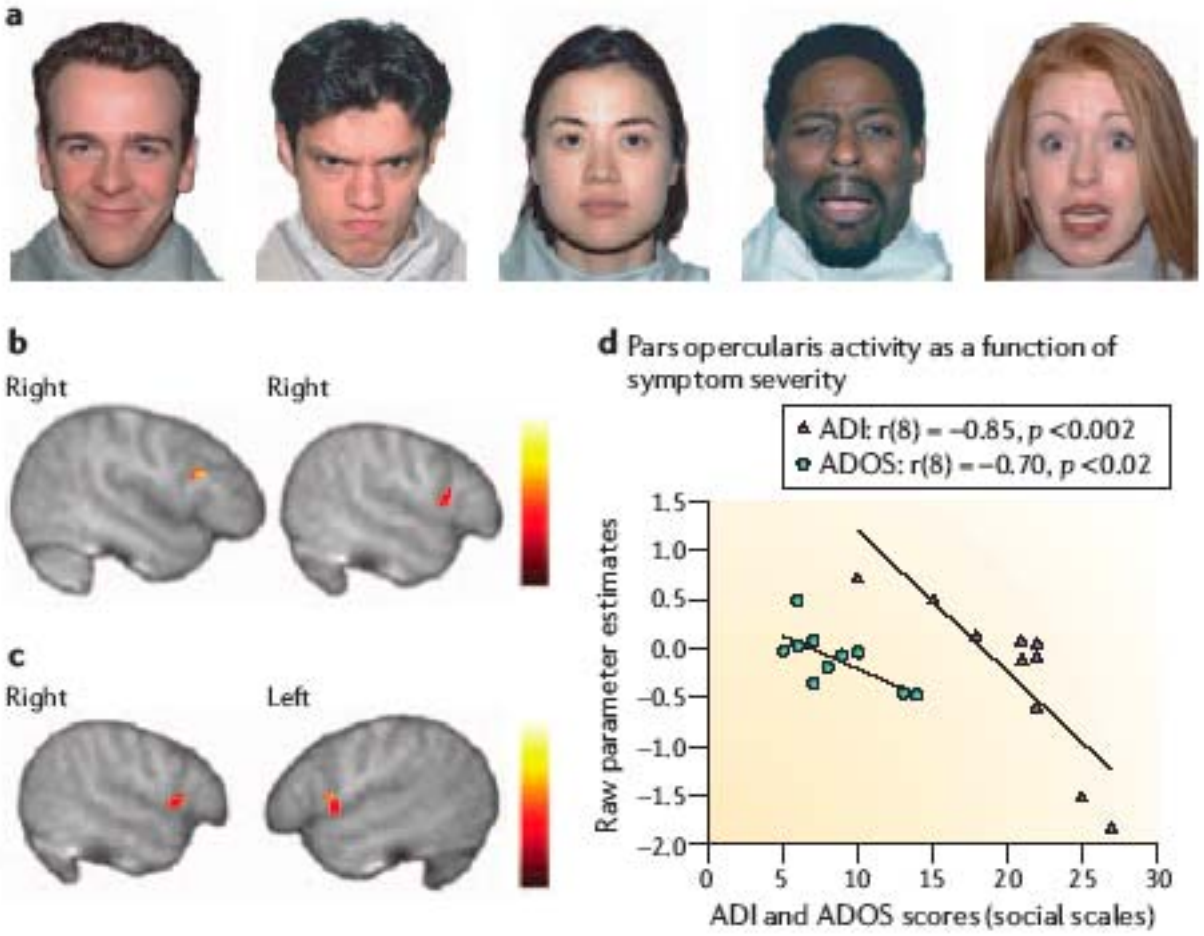
Rizzolatti et al. 2001

The MNS and Action Imitation



Iacoboni et al. 2006

The MNS and Social Cognition



Iacoboni et al. 2006

The MNS Summary

- Confluence of sensory modalities and premotor systems
- Mapping of observation to intent
- Role in imitative learning