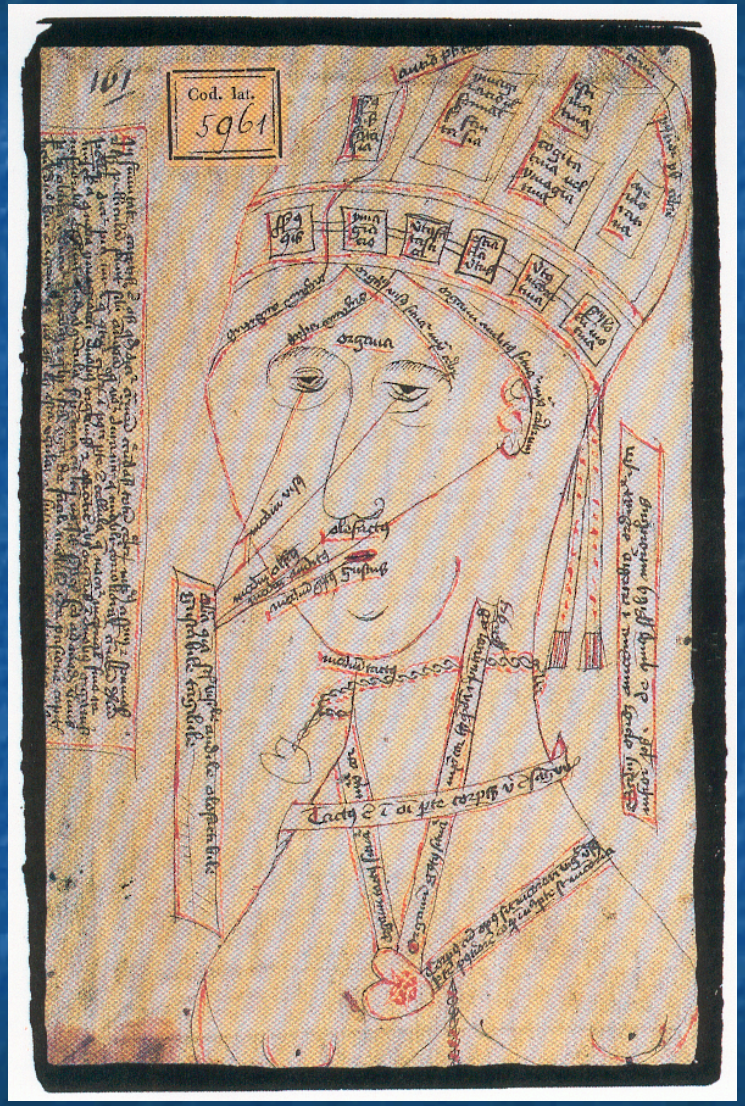
Cognitive Neuroscience of Language: 2: Language, Modularity and Brain Location

Richard Shillcock

Goals



Understand some of the implications of the idea of modularity

Assess the notion of localised, specifically linguistic processing in different regions of the brain

Reading

Swinney, D. (1979). Lexical access during sentence comprehension: (re)consideration of context effects. Journal of Verbal Learning and Verbal Behavior, 15, 545-69.

[The listener seemingly activates all meanings of an ambiguous word like "bug", even when it occurs in an apparently disambiguating sentential context]

Modularity

Computational metaphor

Fast

Automatic

Mandatory

Informationally encapsulated

De-buggable

Contrast this with a system where everything is connected to everything else

Modularity

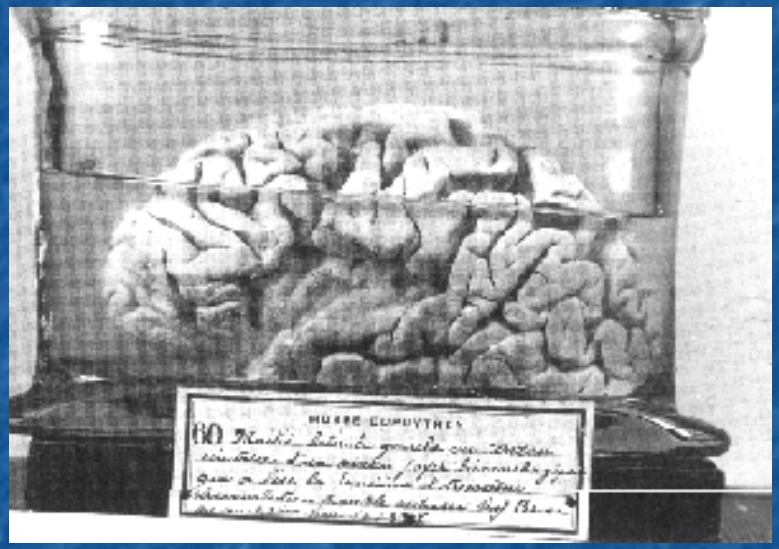
Fodor (1983)

Physical modularity in the brain

Functional modularity in processing (*cf.* Forster)

Syntax has been a major preoccupation in the field

Paul Broca (1861) and "Tan"



Grodzinsky and syntactic theorizing

"Syntacto-Topic Conjecture:

(a) Major syntactic operations are neurologically individuated.

(b) The organization of these operations in brain space is linguistically significant"

(Grodzinsky & Friederici, 2006)

Grodzinsky and syntactic theorizing

MOVE$_{XP}$

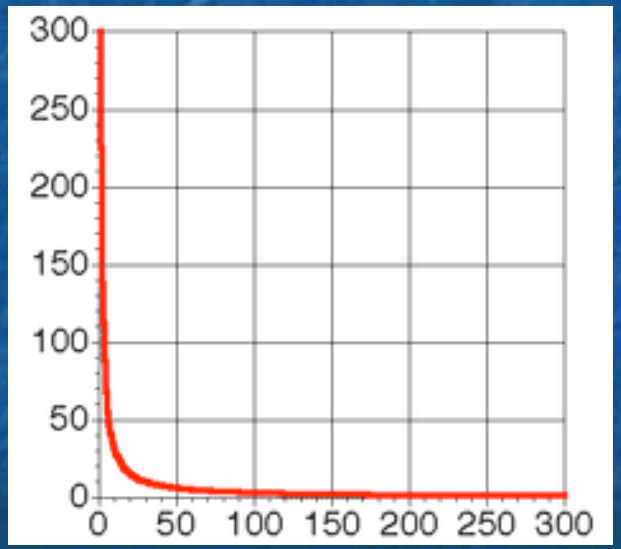
Sam knows that he saw the ballet dancer on Monday
Which dancer does Sam know that he saw △ on Monday?

MOVE$_{V}$

John is tall ..... Is John □ tall?

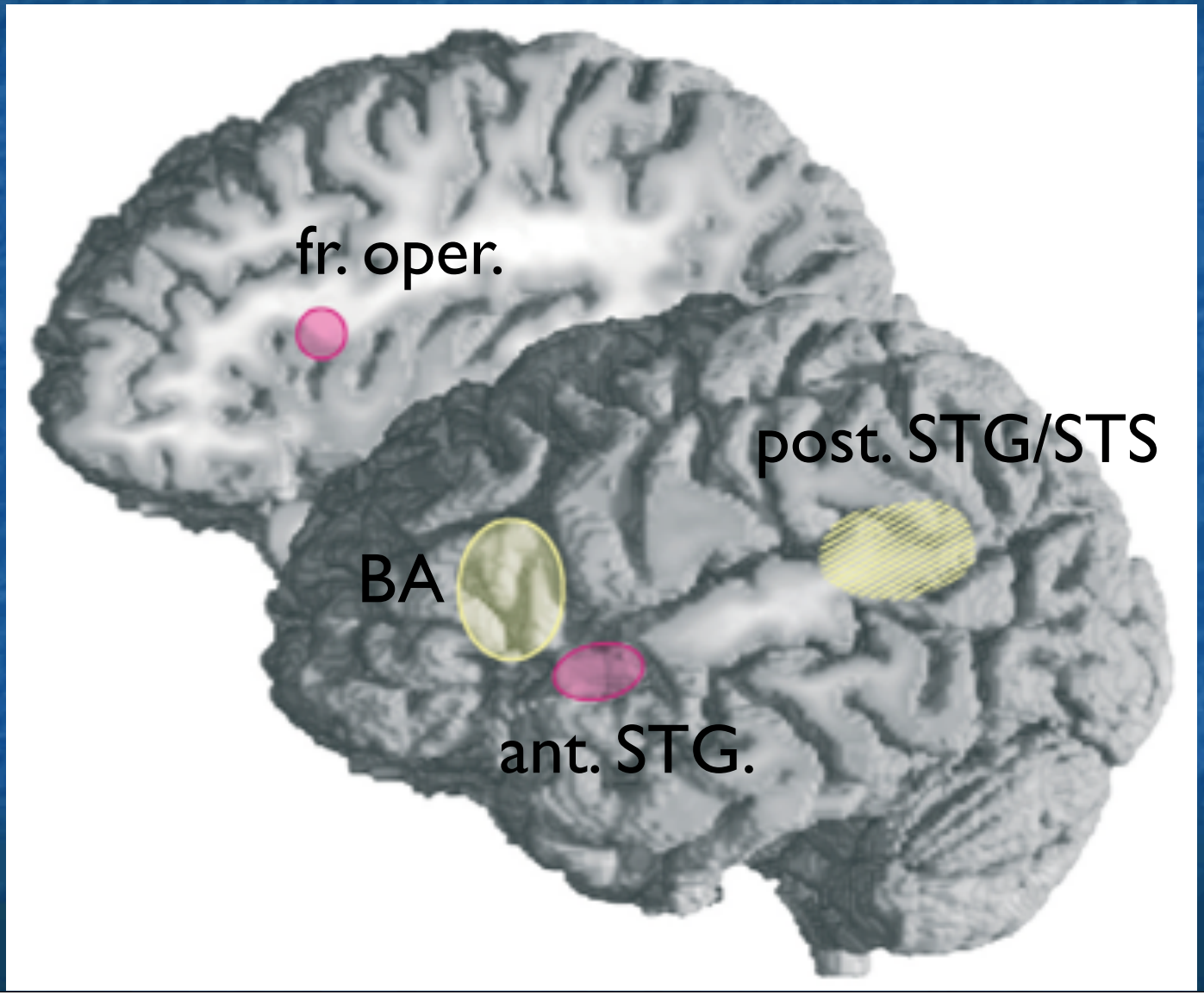
BIND

John looked at himself



Zipf curve

Grodzinsky and syntactic theorizing



Friederici and syntactic processing

Friederici et al. (2006)

Local phrase structure

Identifying noun phrases, ... frontal operculum, left IFG, anterior STG

Dependency relations

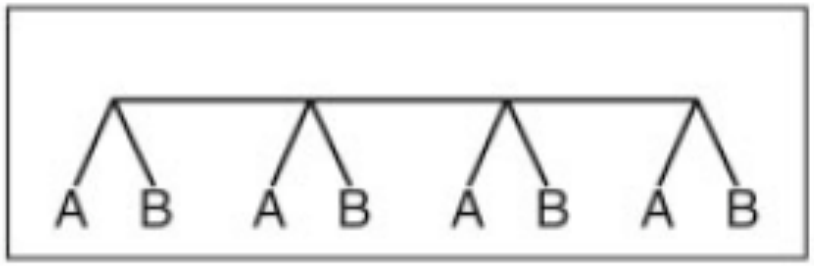
Cats that dogs chase .... BA 45 (STM?), LAN

Syntactic integration

... with lexical information; garden paths ... left posterior STG, P600

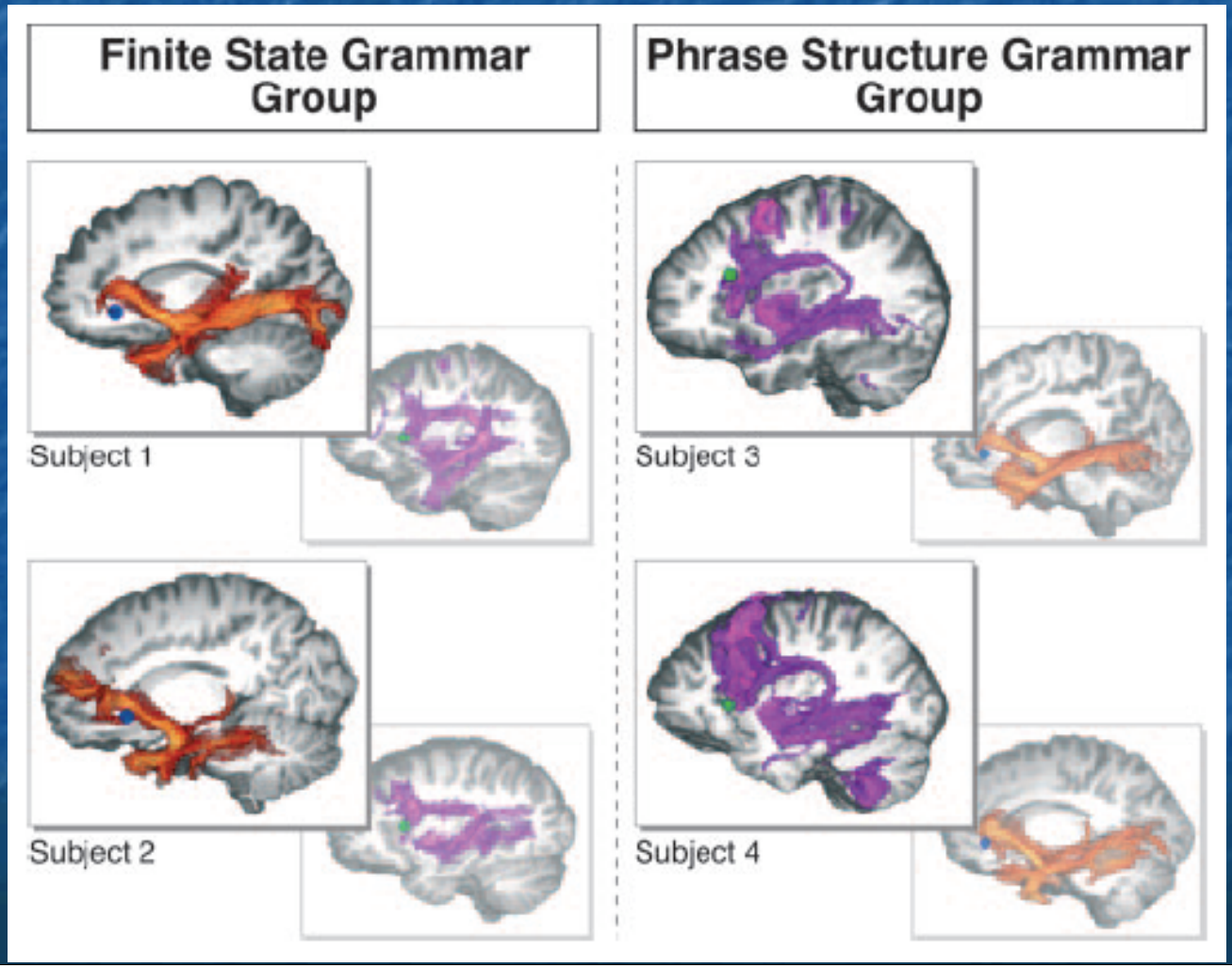
Friederici and syntactic processing

Friederici et al. (2006)

Finite State Grammar $(AB)^n$	Phrase Structure Grammar A^nB^n
	
cor/short: A B A B de bo gi fo	cor/short: A A B B ti le mo gu
viol/short: A B A **A** de bo gi **le**	viol/short: A A B **A** ti le mo **de**
cor/long: A B A B A B A B le ku ri tu ne wo ti mo	cor/long: A A A A B B B B le ri se de ku bo fo tu
viol/long: A B A B A B A **A** le ku ri tu ne wo ti **se**	viol/long: A A A A B B B **A** le ri se de ku bo fo **gi**

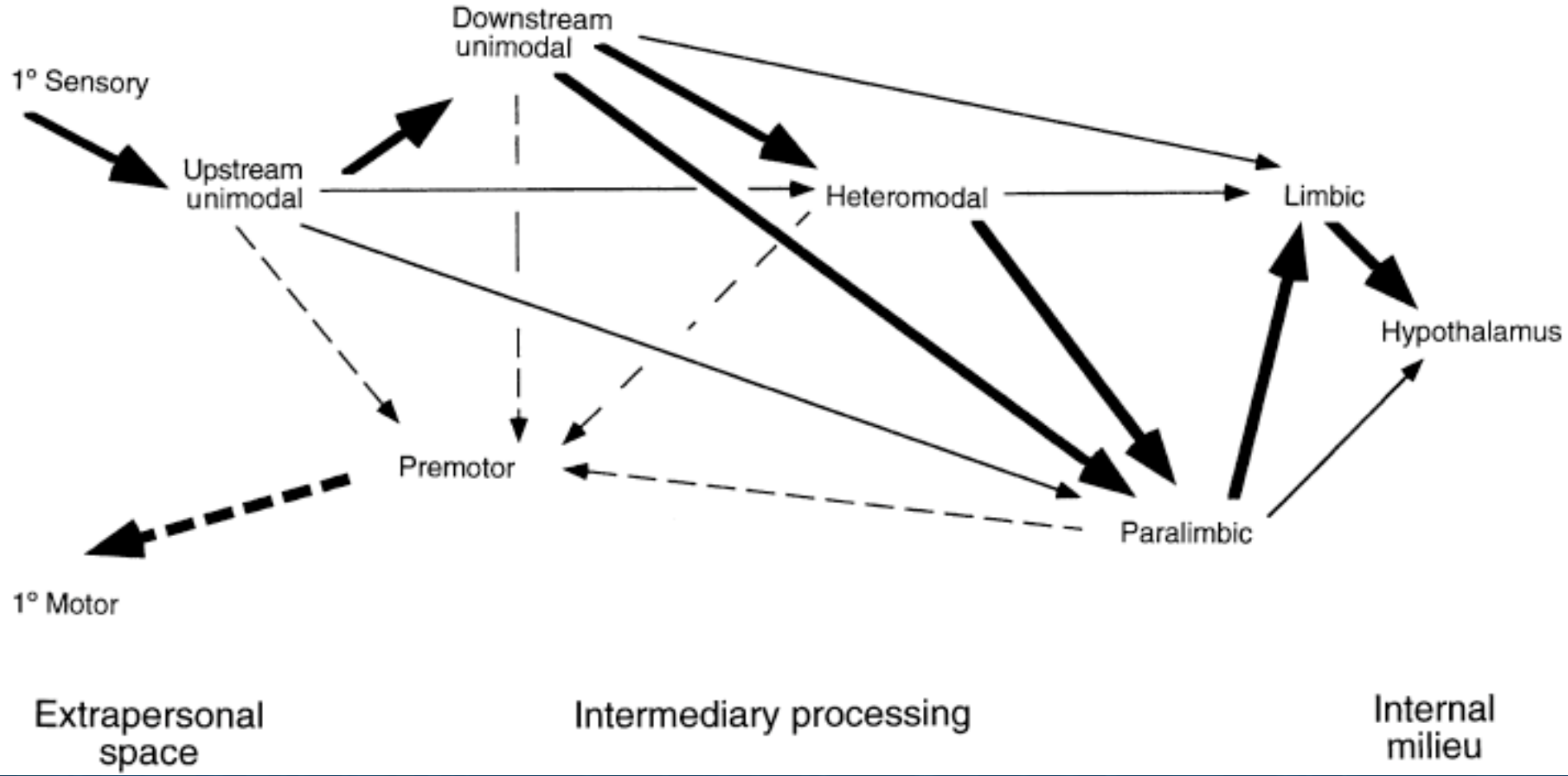
FOP *vs.* BA

Friederici et al. (2006)



Broadcasting

Mesulam (1998)



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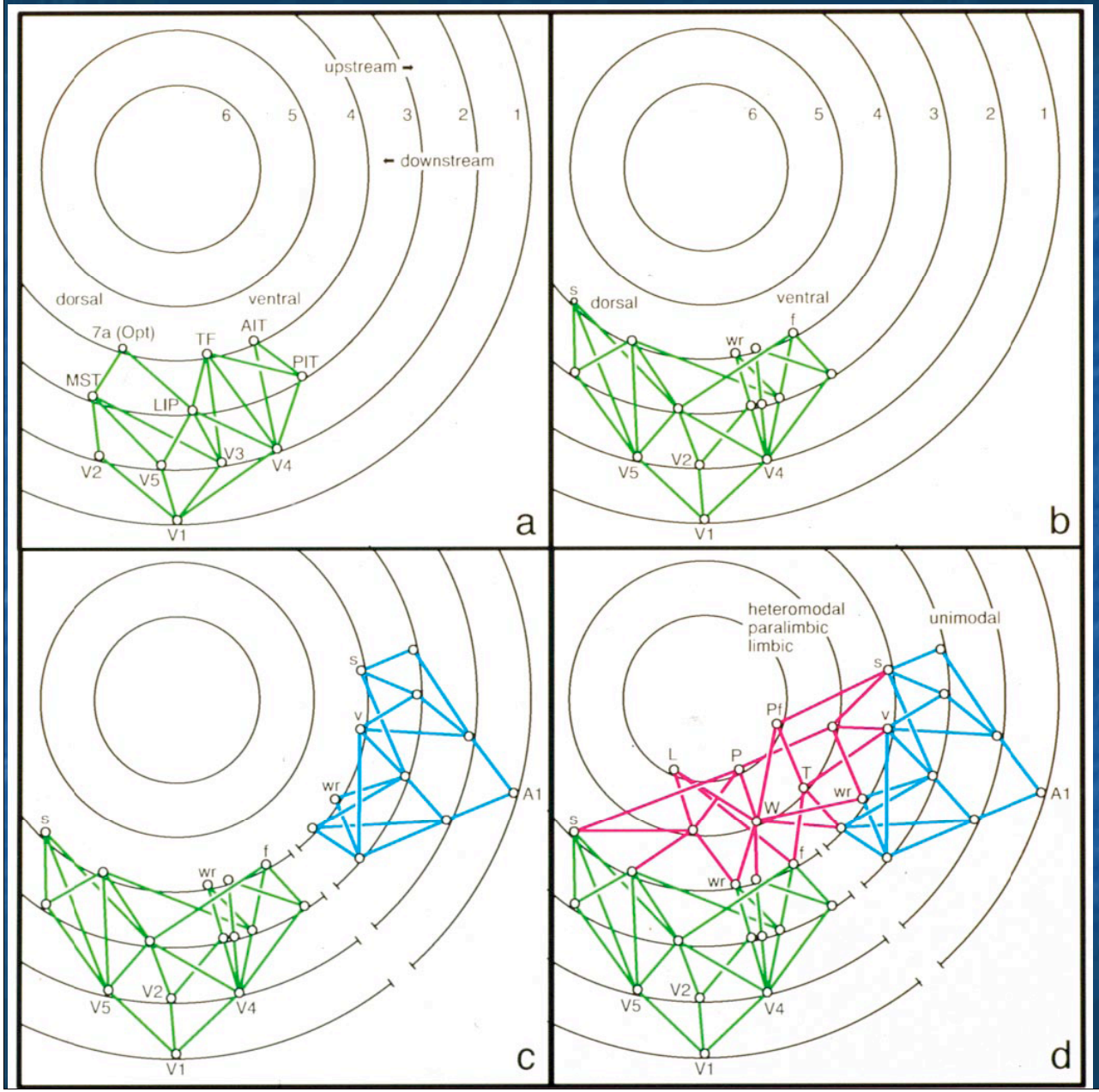
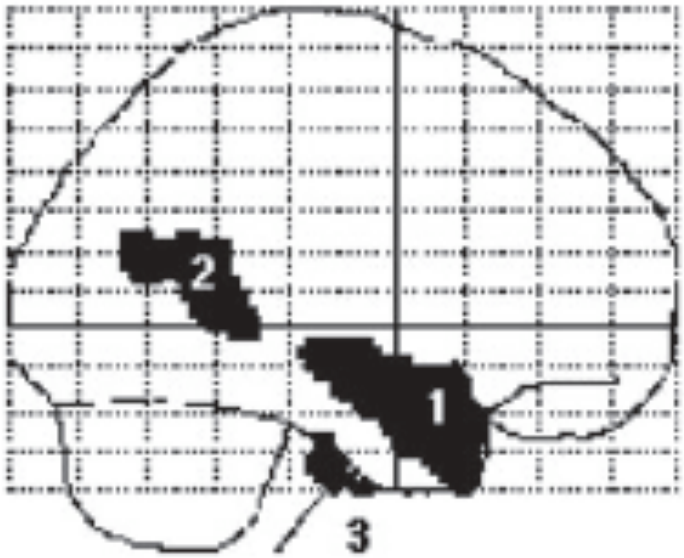
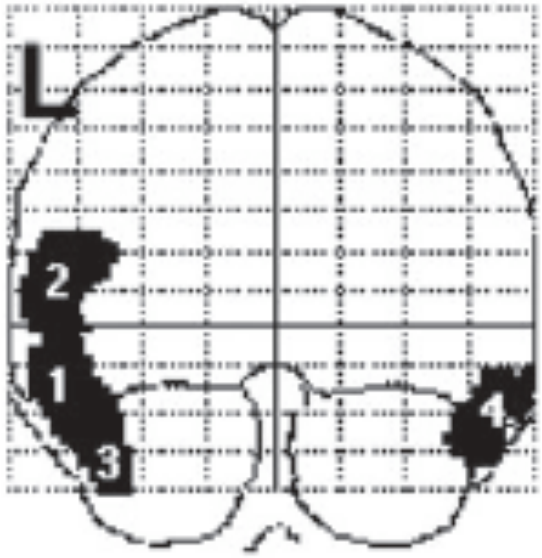
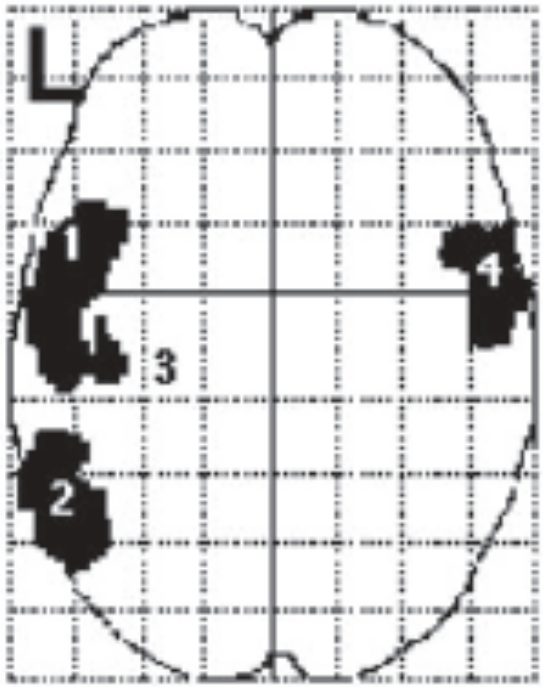


Broadcasting and the STS

Crinion *et al.* (2005)

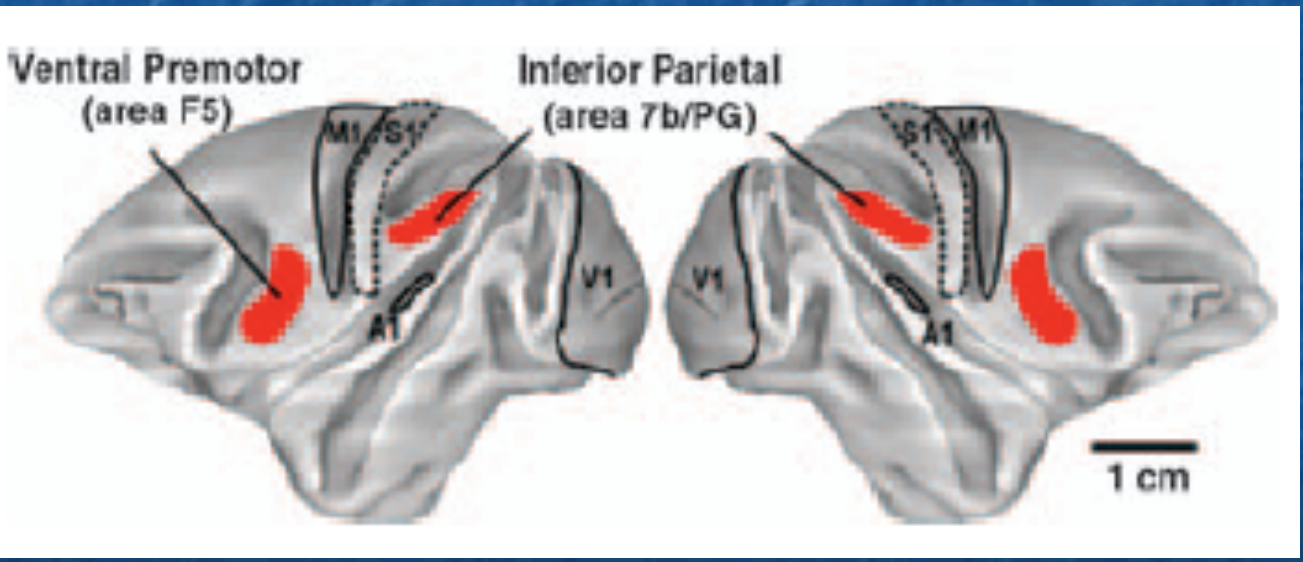




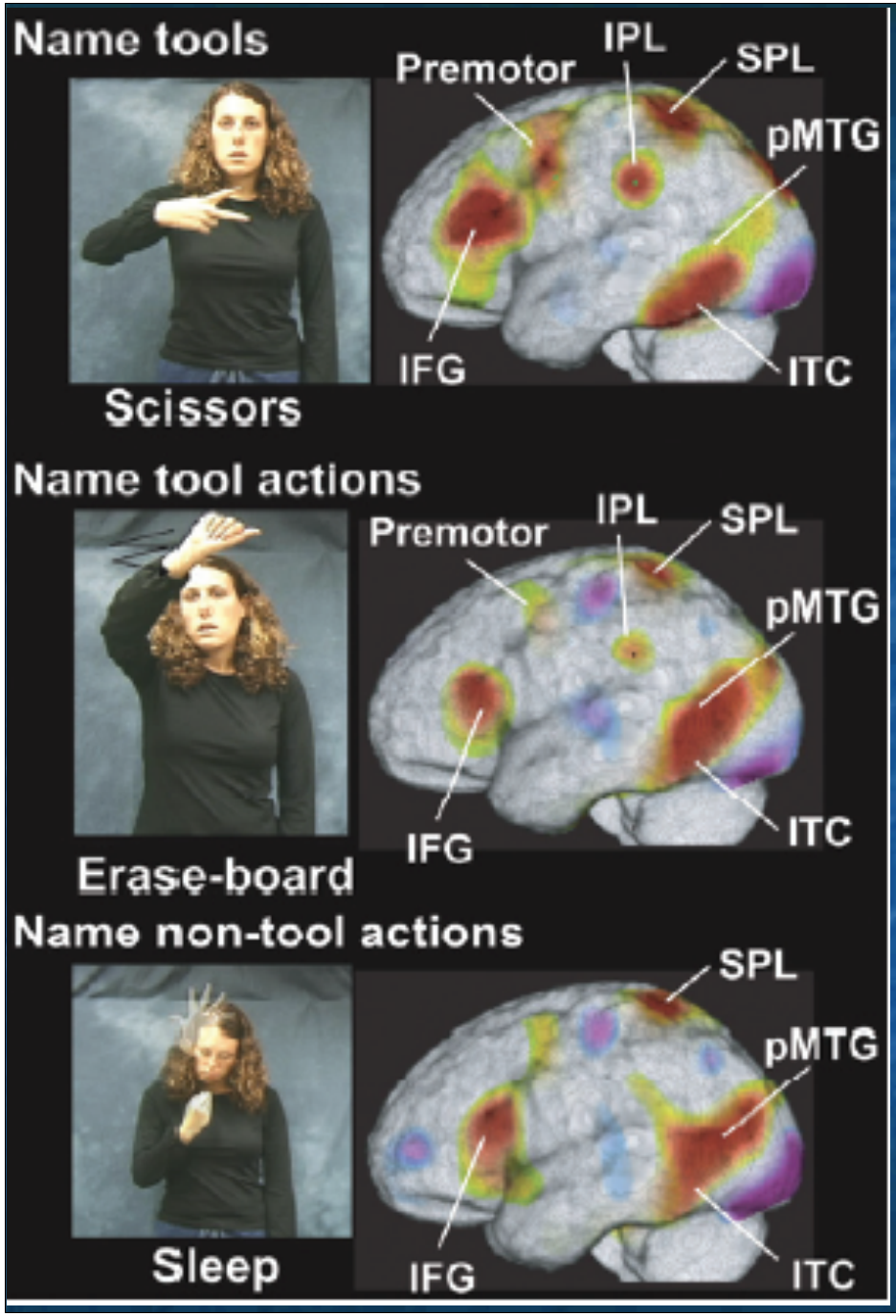


Tool use

Tsukamoto (2000)



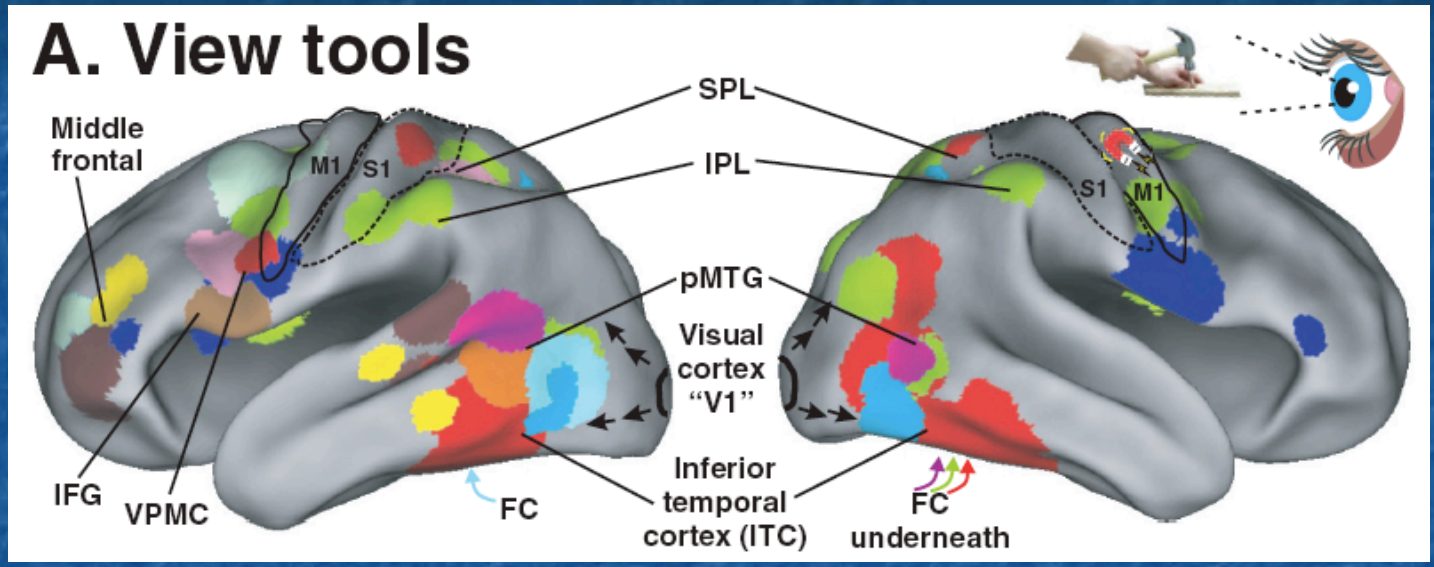
Lewis (2006)

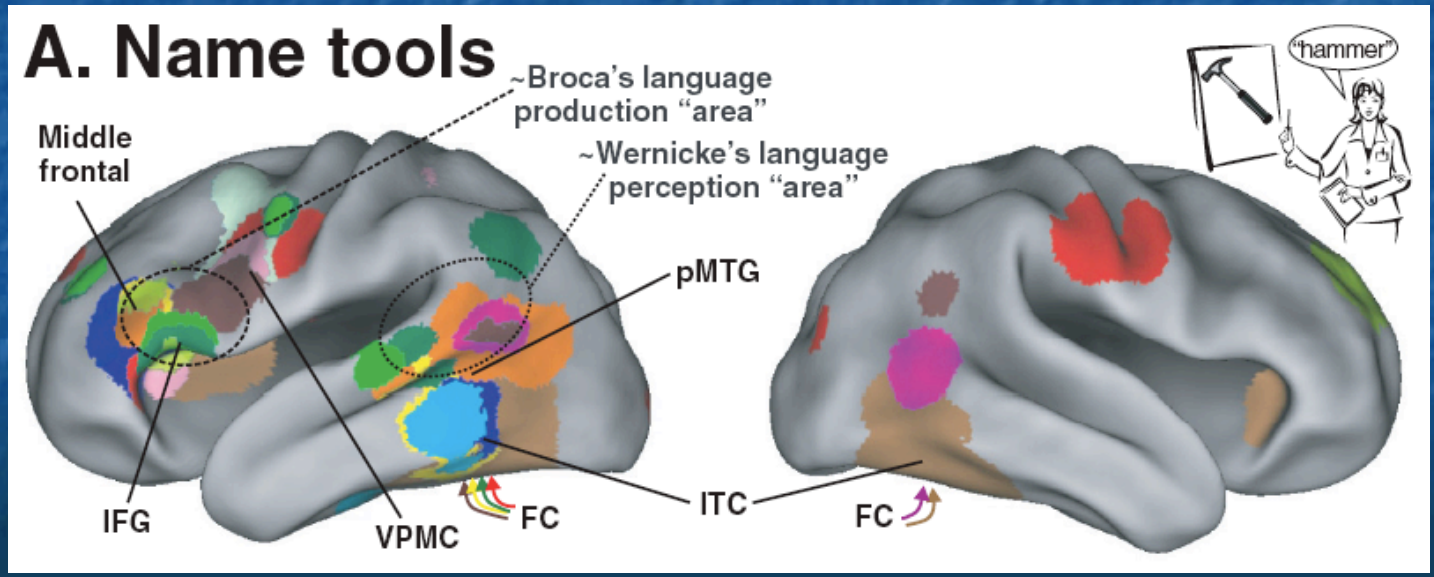


Tool use

Emmorey et al. (2004)

Tool use





Lewis (2006)

Tool use as a metaphor

Don't need to be grounded out

No necessary inside/outside distinction

No homunculus

Tools need to "fit" existing cognition

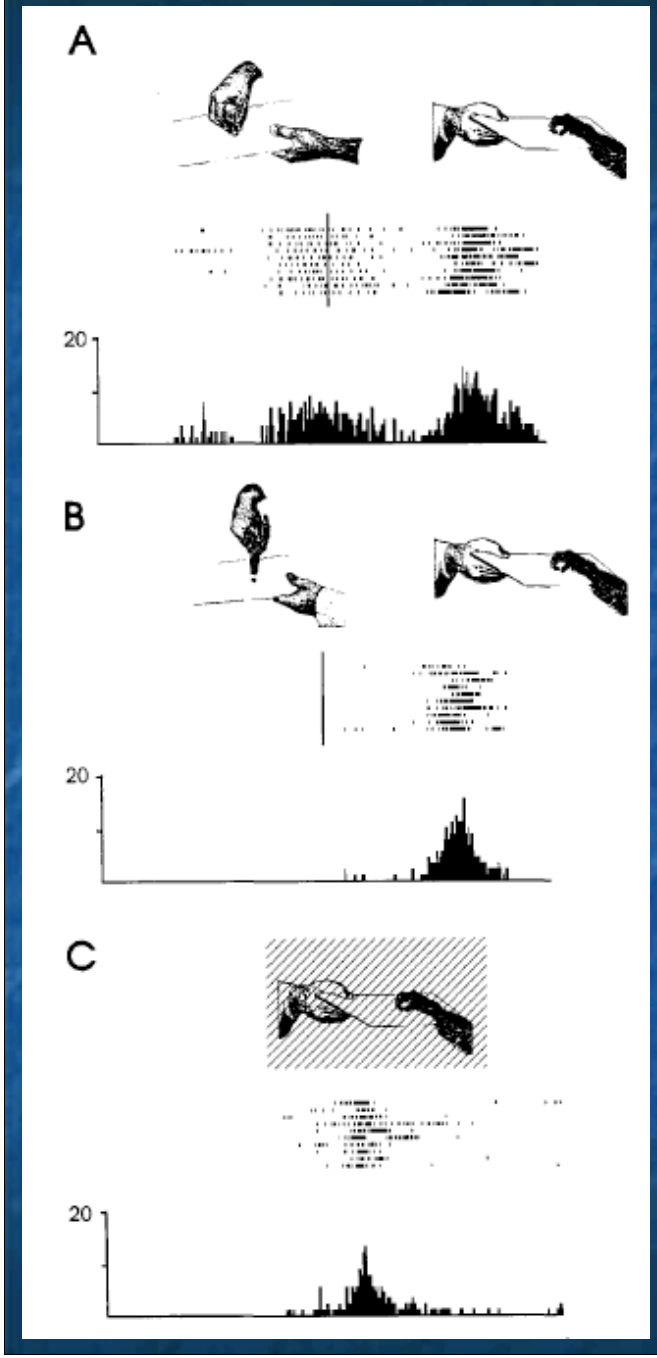
Distributed, emergent effects; no local "aboutness"

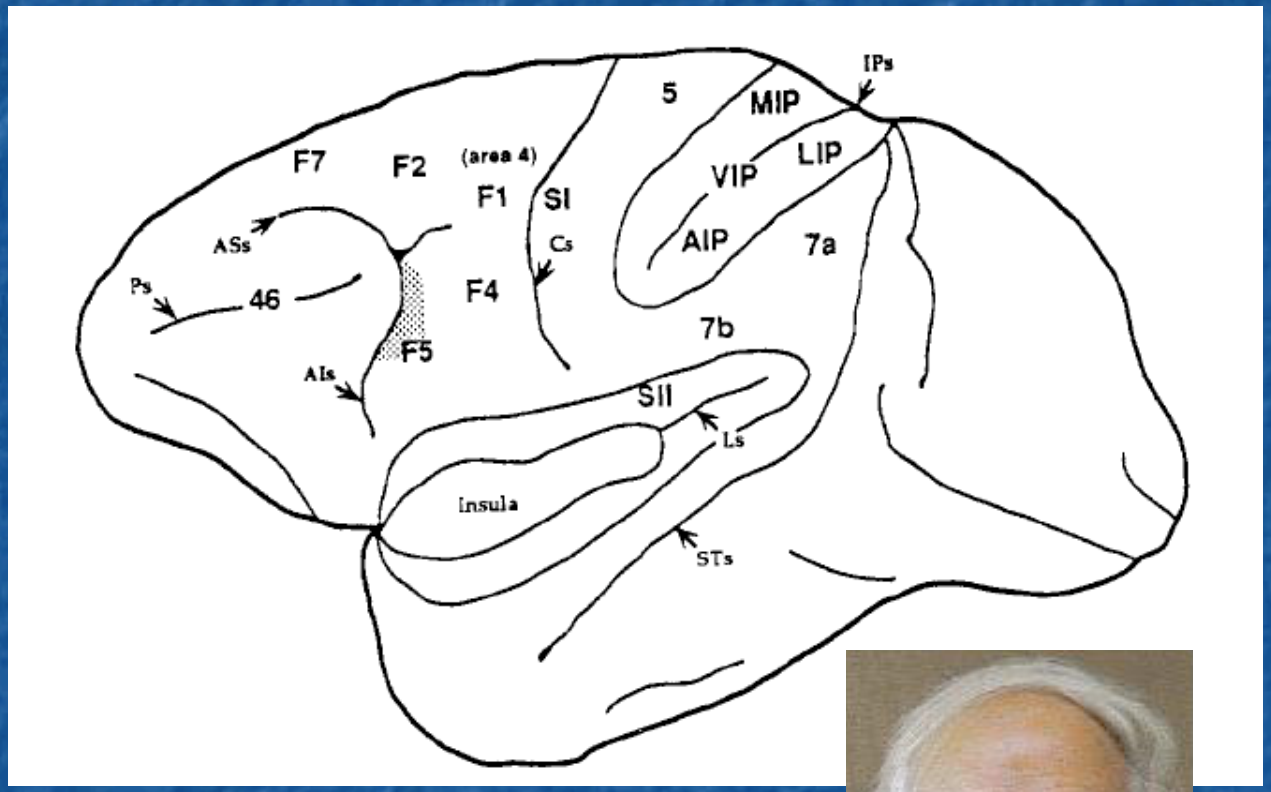
Andy Clark

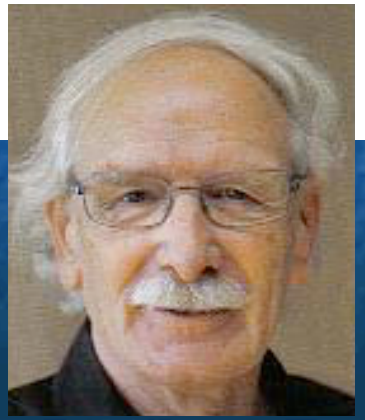
Dan Dennett

Mirror neurons

Rizzolatti et al. (1996)







Summary

Neuro-imaging and data from impairment can provide detailed information about language processing.

Many component activities in these tasks are not inherently linguistic.

Language use is grounded in tool-use.

The notion of modularity may be understood anatomically, behaviourally and functionally.