《脑神经视角下的口笔译研究：欧洲前沿动态》
Neurological Aspects of T&I: Latest Developments *in Europe*

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Fribourg < Switzerland <Shanghai

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freiburger spital

Freiburg

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Plan

- ***Principle of Brain and language***
- ***Two languages share a common brain network but modulated by proficiency / age of acquisition***
- ***Language control is achieved by a specific cognitive control***
  - ***Implication for Translator and Interpreter.***
- ***Language disorders***
  - ***Language control has an effect on language recovery***

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Contents lists available at SciVerse ScienceDirect

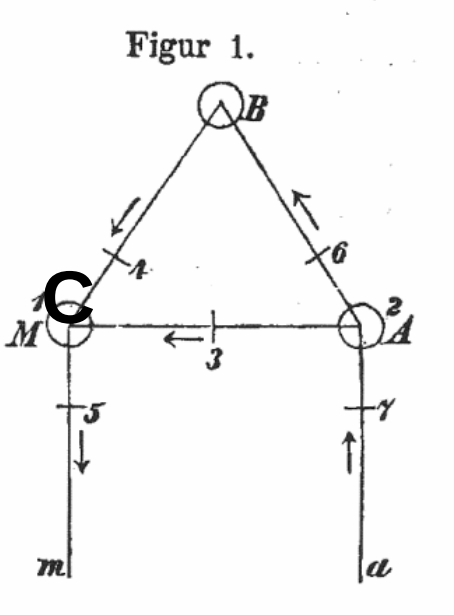
Brain & Language

journal homepage: www.elsevier.com/locate/b&l

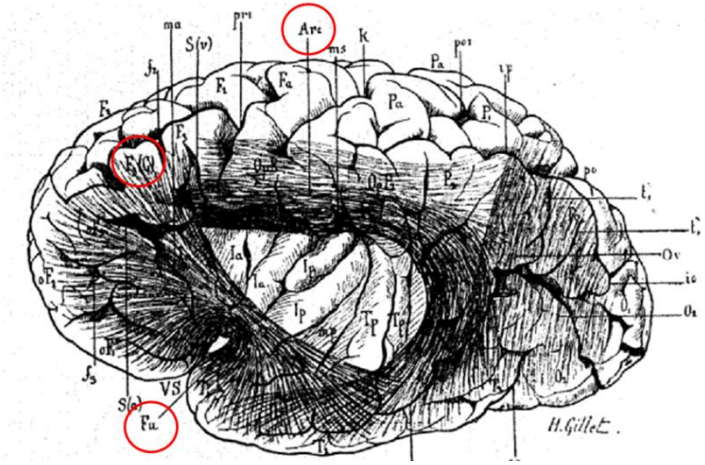
Short Communication

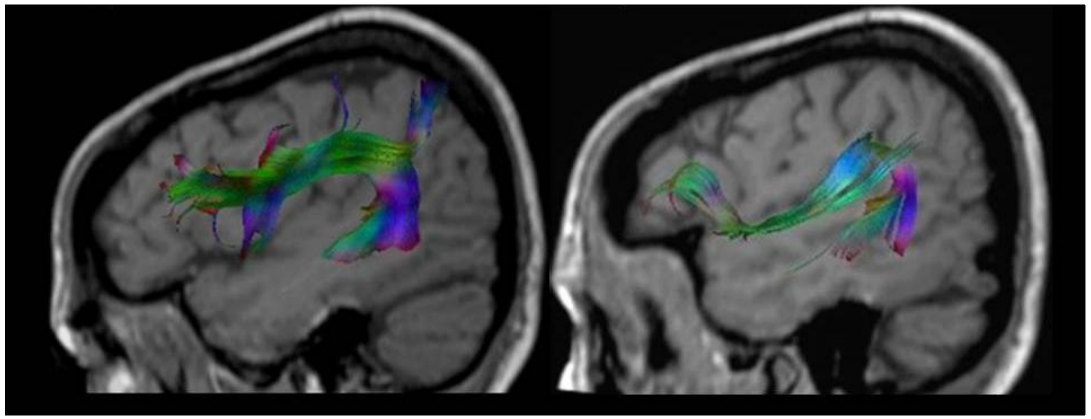
White matter in aphasia: A historical review of the Dejerines' studies ☆

Heinz Krestel [a,b,*], Jean-Marie Annoni [c], Caroline Jagella [d,*]



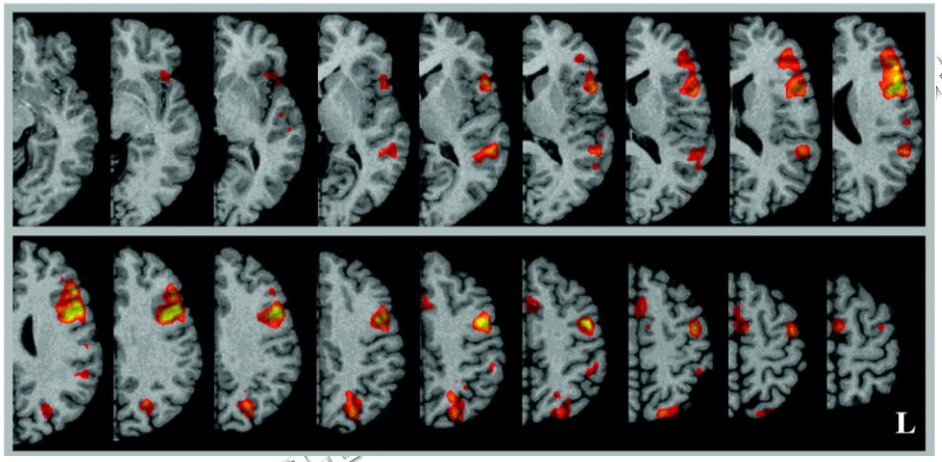
Models of language
Charcot 1870
Dejerines 1908
Catani 2013



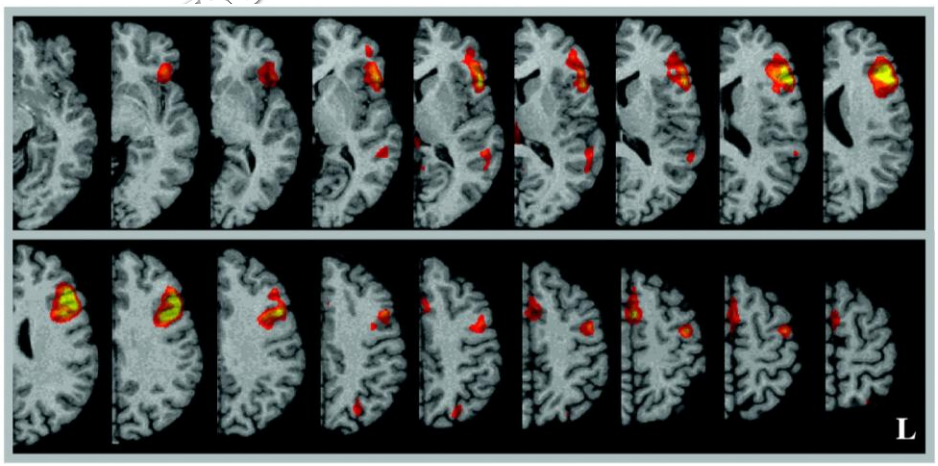


Brain and Language: Cognitive Neurosciences

Détection de rimes



Catégorisation sémantique



Seghier et al., 2004

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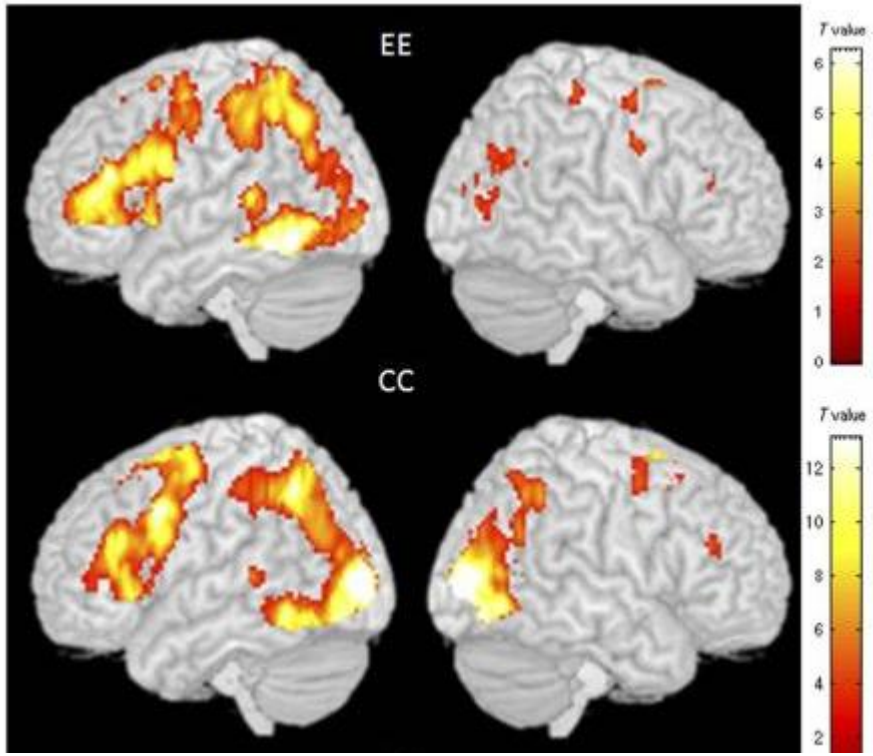
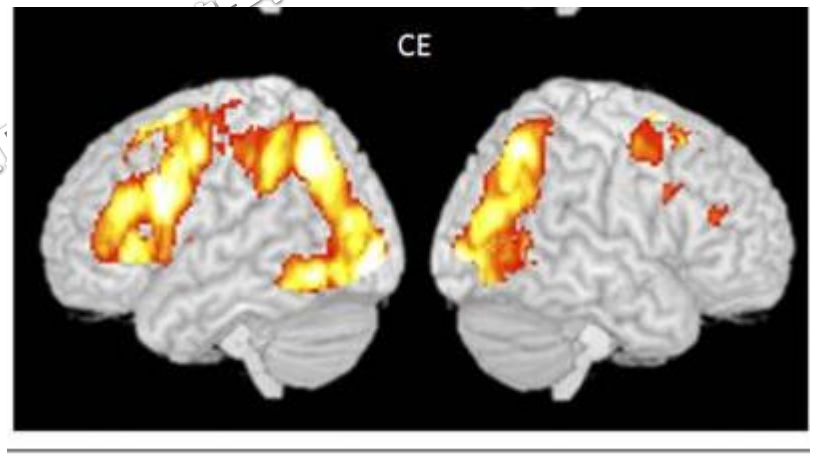
Vanderberg et al 1996

No fundamental difference between English and Chinese





Brain activation maps for the contrast of rhyming > baseline in the EE, CC, and CE groups.
Cao , J Cogn Neurosciences 2013

Definition of the bilingualism

Several definitions have been proposed, for examples:

- **Restrictive definition**
  - *Simultaneous acquisition during childhood (Bloomfield 1933)*

- **Permissive definition**
  - *Management of at least one linguistic ability in another language (Macnamara 1967)*

- **Psycholinguistic definition**
  - *Express himself in a mother tongue (called L1) and at least in a second learned language (called L2) in the daily life (Grosjean 1998).*

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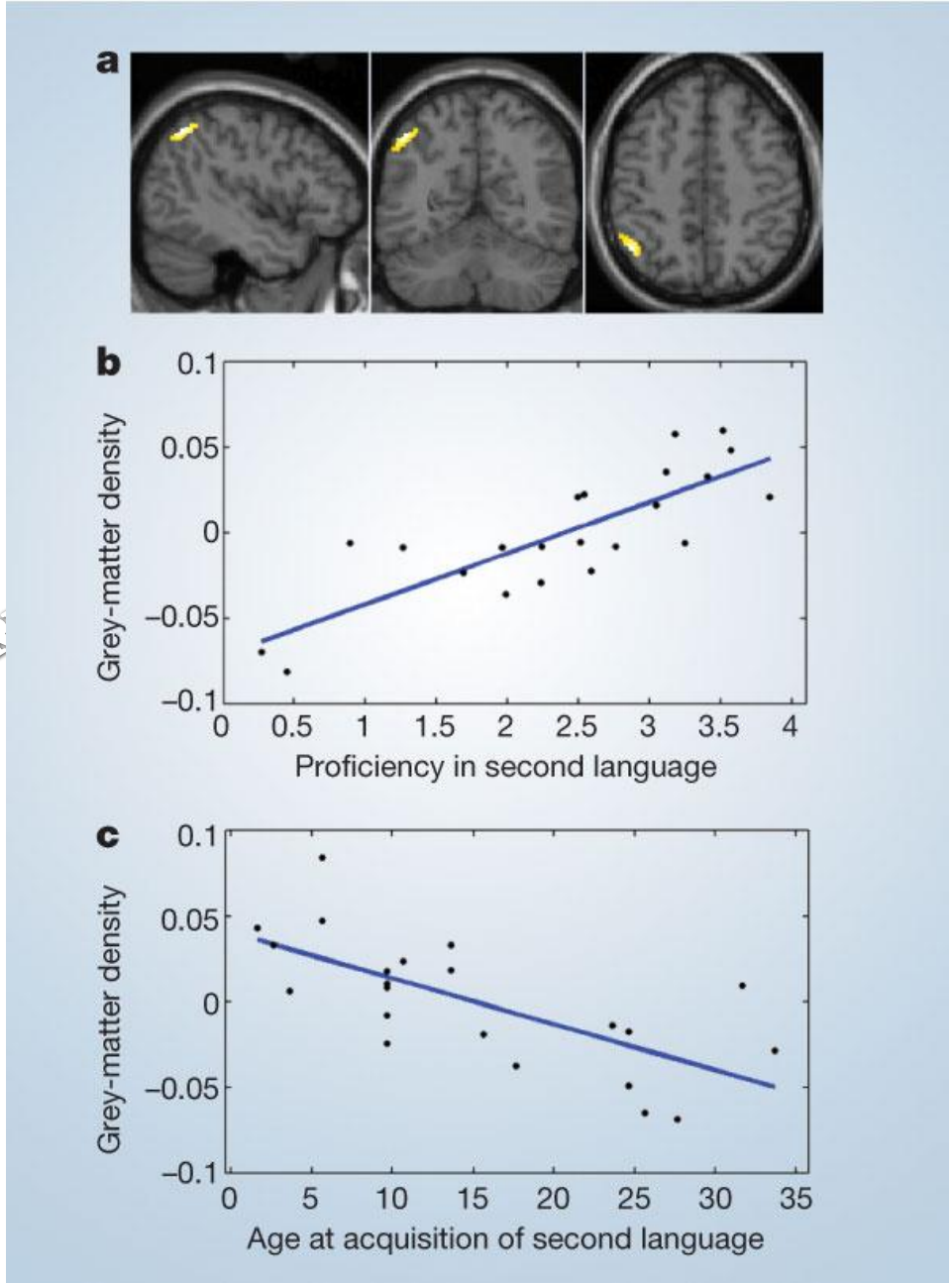
Language and Brain Structure

Language learning modulates brain

Nature **431**, 757 (2004) |
Neurolinguistics: Structural plasticity in the bilingual brain

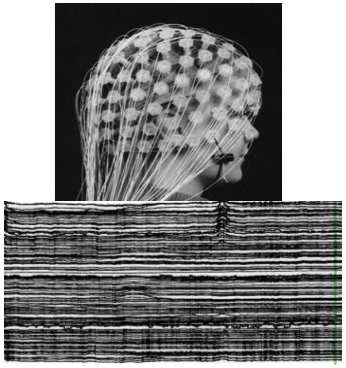
Andrea Mechelli, Jenny T. Crinion, Uta Noppeney , John O'Doherty[1], John Ashburner Richard S. Frackowiak[1] & Cathy J. Price

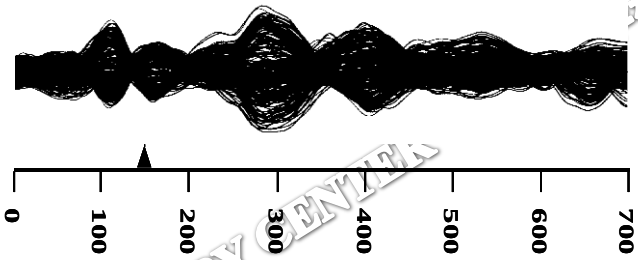
Learning a second language increases the density of grey matter in the left inferior parietal cortex

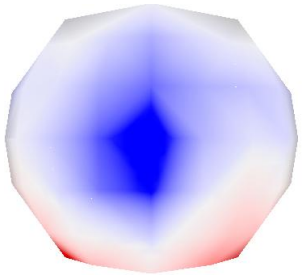


How to study the brain

1- Electric activity: Evoked potential during the 700 milliseconds which follow a stimulus







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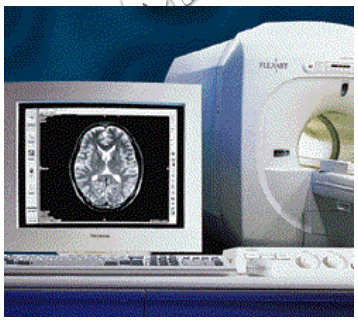
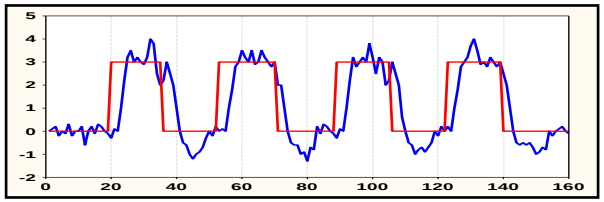
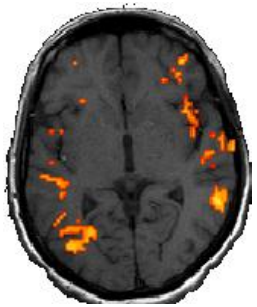
2- Hemodynamic changes: Magnetic Resonance Imaging : changes in the blood activity during the 6 seconds after a stimulus/ action





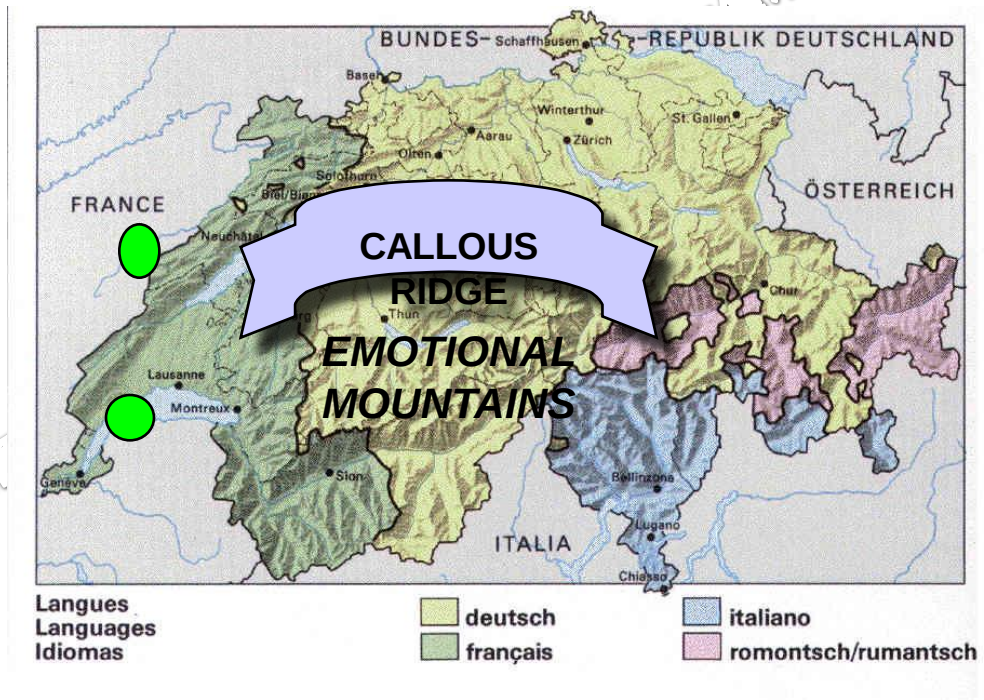


?

Partie I

One thought : Two languages, two brains ?

Left Hemisphere



Right Hemisphere

- **Mental lexicons used in language**
  - Phonetic information (sound and pronunciation of words)
  - Orthographic information (words' spelling)
  - Semantic information (meaning)

- **Language representations of L1 and L2 in the brain**

Are they divergent or convergent ?

  - Evidence of divergence:
    - *Unequal pattern of impairment in bilingual aphasic patie (e.g. Aglioti and Fabbro 1993)*

  - Evidence of convergence:
    - *Overlapping brain activation during L1 and L2 pictures naming observed in several studies (e.g. Hernandez et al. 2001).*

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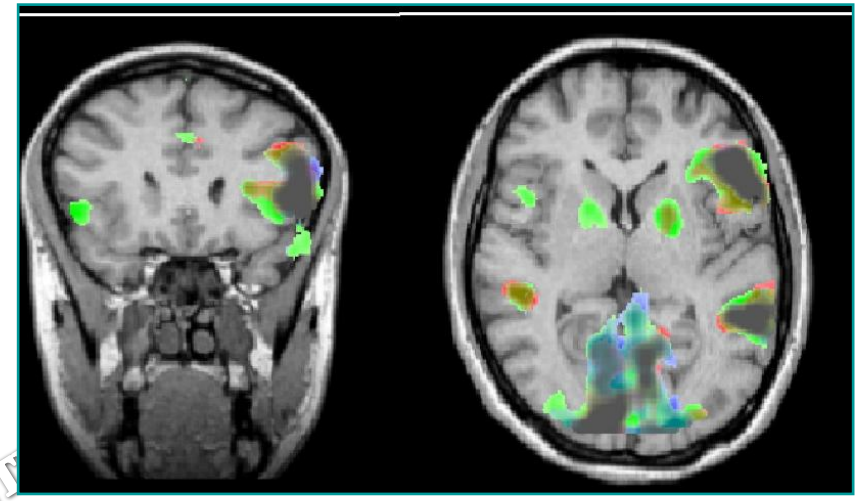
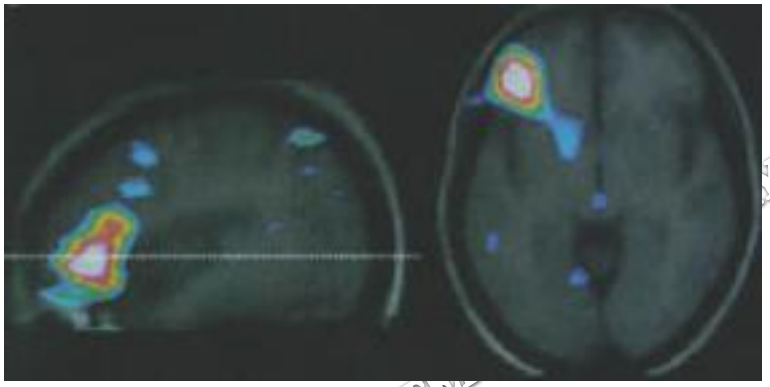
Neuroimaging :

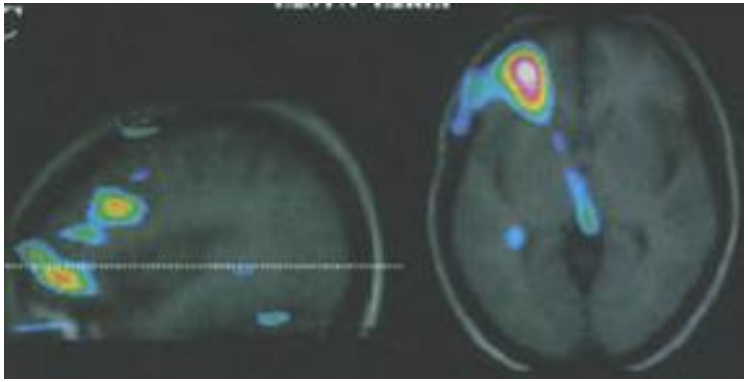
Activations in L1 = activations in L2



L1: Generation of synonyms



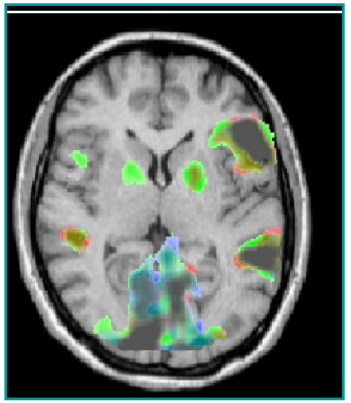
L2: Generation of synonyms



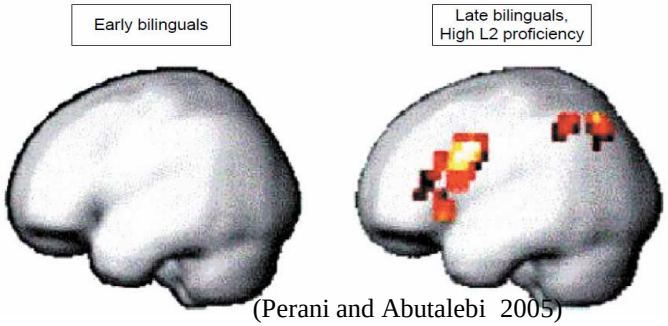
Klein et al., 1995, Bloch 2009

L2 proficiency and AoA ⟹ language representation

- **Language proficiency**
  - Supplementary cognitive needs for L2 < L1.
  - Convergence of brain's representation for L1 and L2 when L2 proficiency ↑.



- **L2 acquisition age**
  - L2 vs. L1 grammatical judgment required more brain resources for late learners



(Perani and Abutalebi 2005)
based on (Wartenburger et al. 2003)

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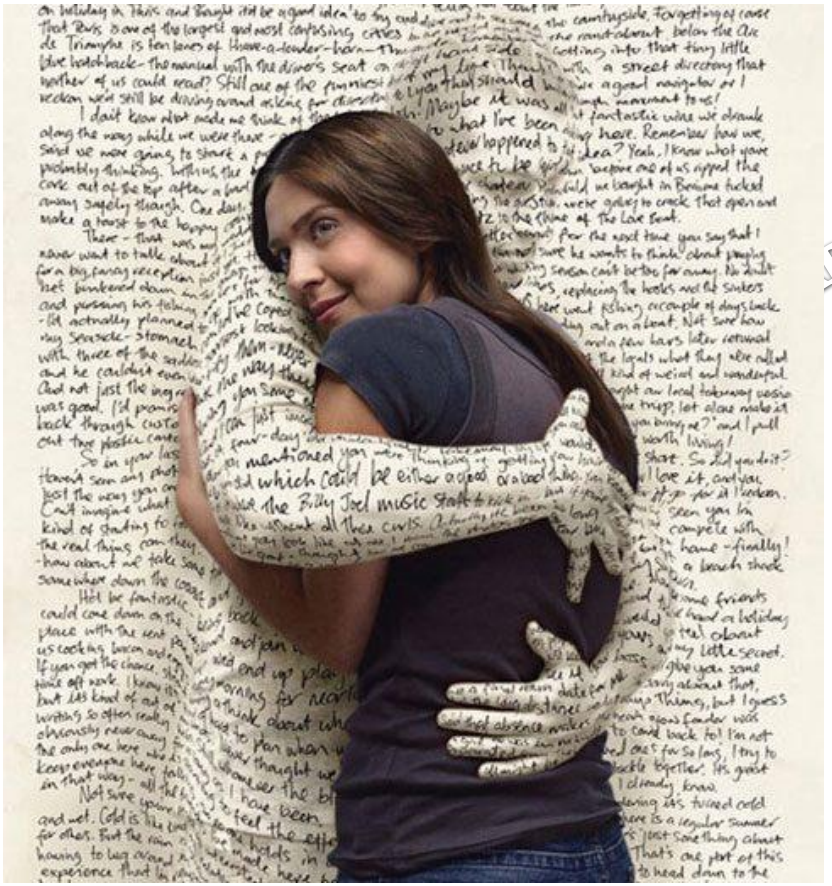
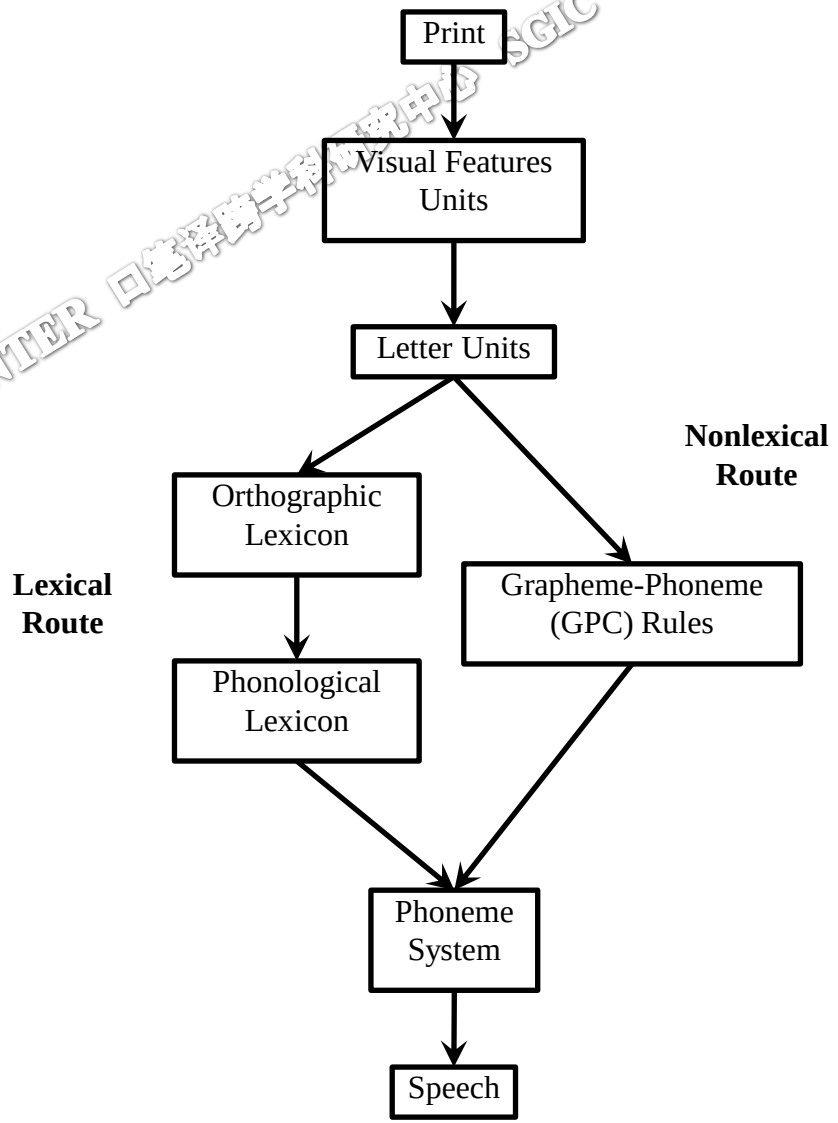
Reading in bilinguals

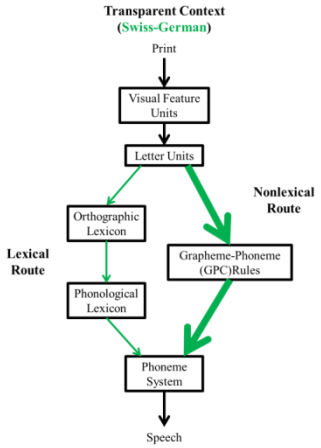
Dual Route Cascade Model Reading

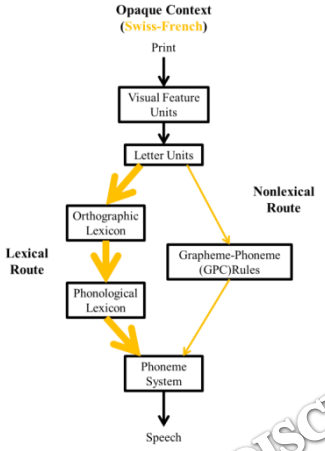
(Coltheart et al., 2001)

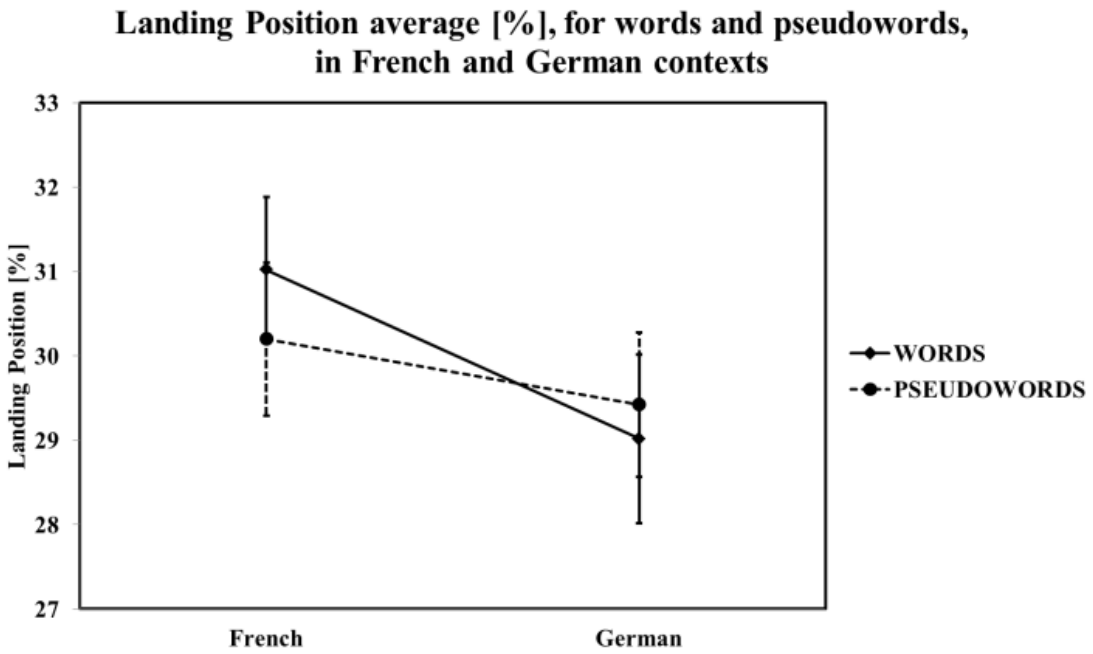


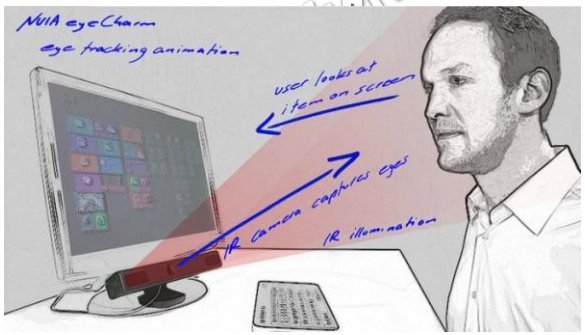


Plasticity of the bilinguals brain









Reading strategies across languages in early bilinguals : An eye-movement study

D. deLeón Rodríguez[1],et al

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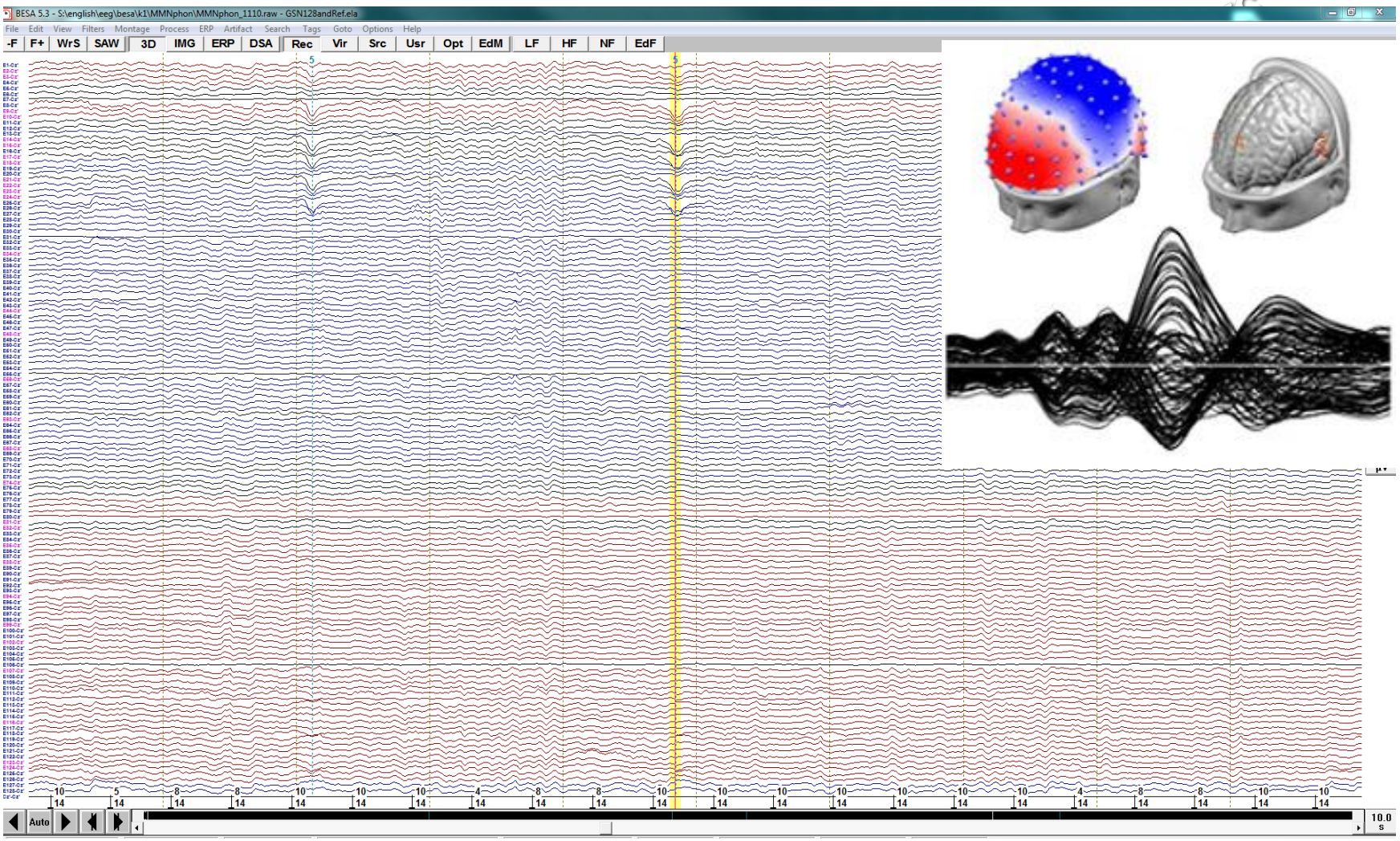
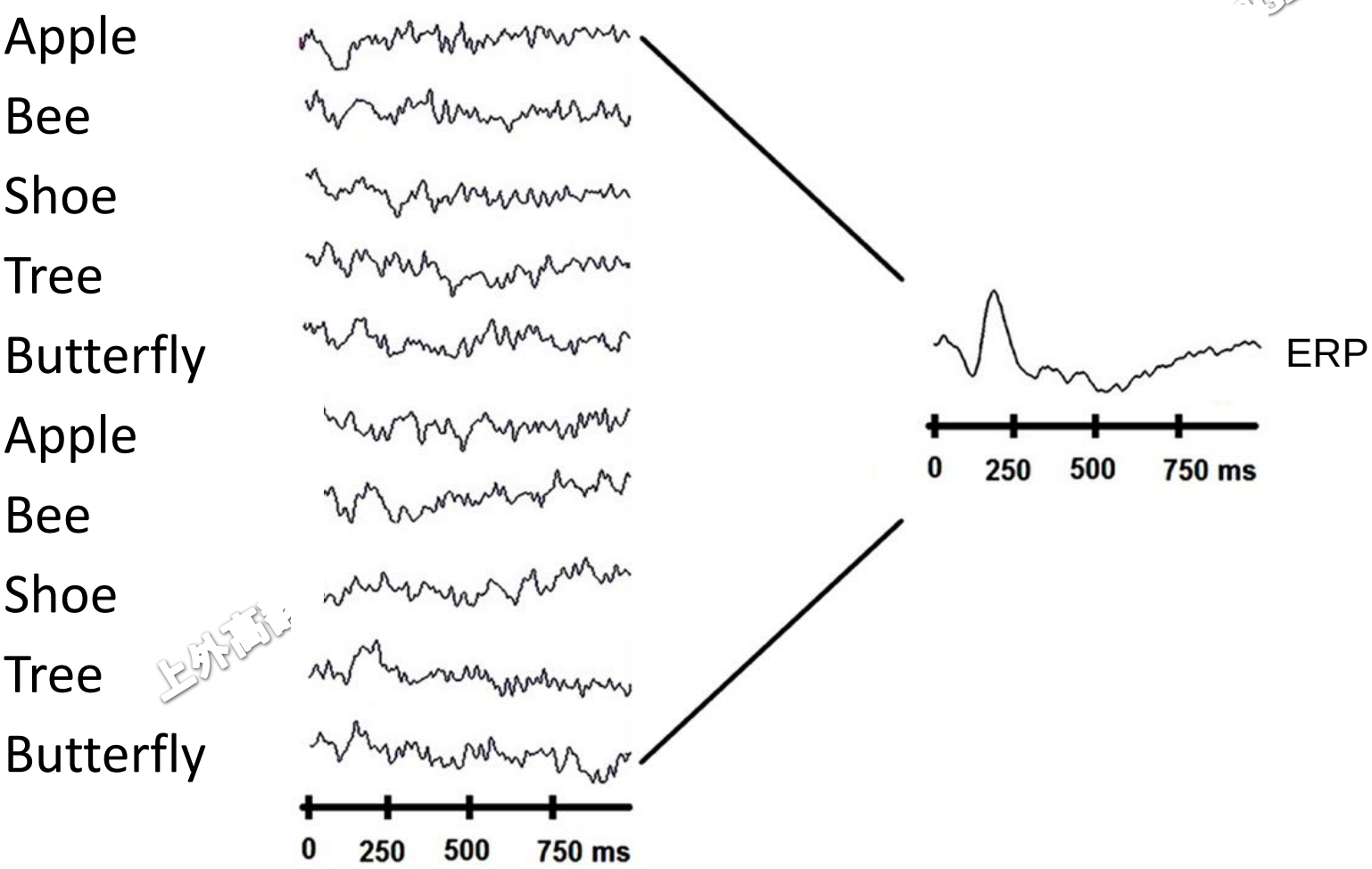
ongoing EEG



Averaging



adapted from: http://www.frontiersin.org/files/Articles/65595/fpsyg-04-00984-r2/image_m/fpsyg-04-00984-g

Balanced bilinguals favor lexical processing in their opaque language and conversion system in their shallow language

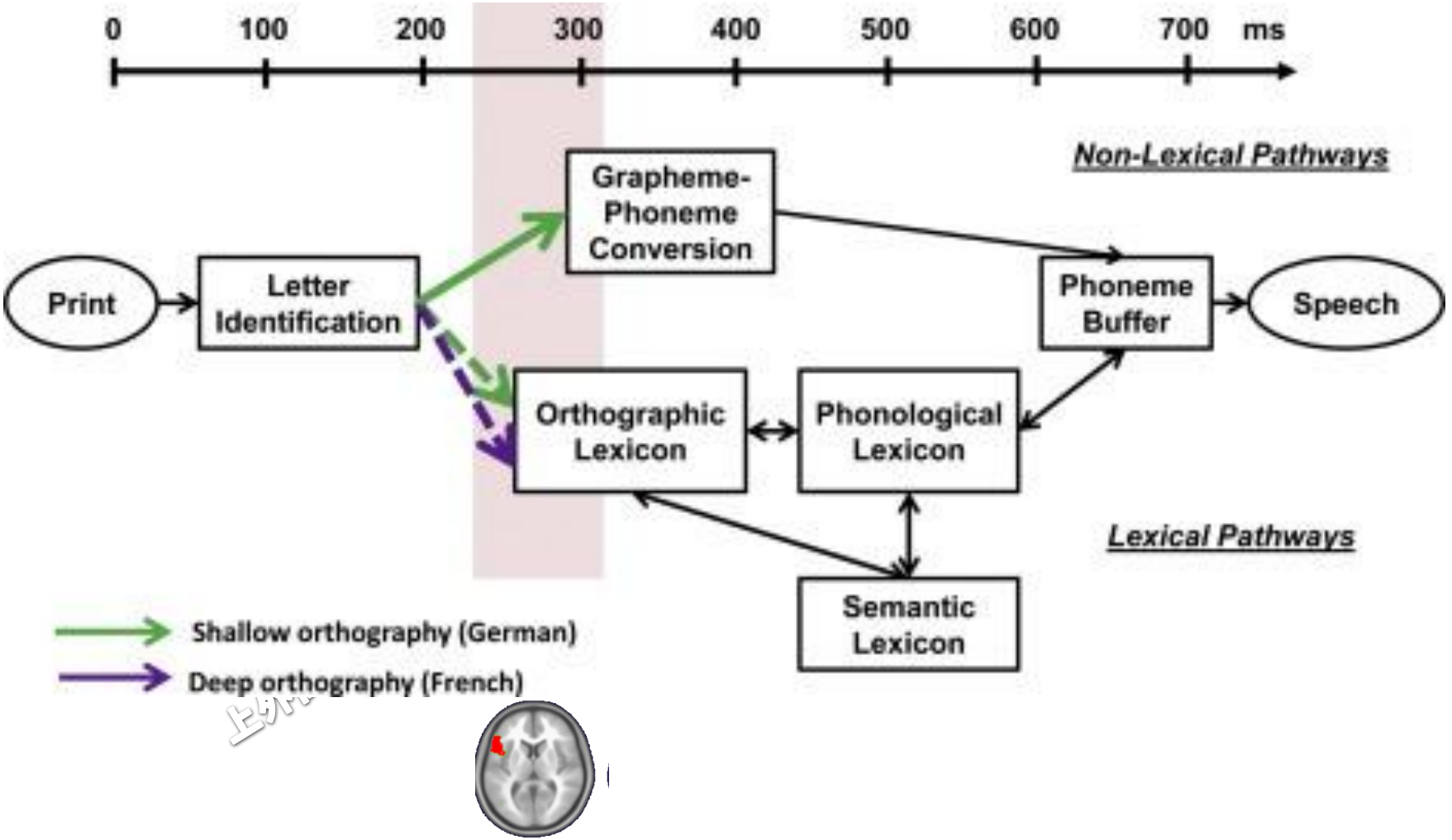


Fig. 3. Integration of the Dual Route Cascade Model and Orthographic Depth Hypothesis. According to the Orthographic Depth Hypothesis (Katz & Feldman, 1983), reading an orthographically irregular language should rely more strongly on lexical pathways than ...

Karin A. Buetler, et al 2015

Effect of Non-invasive brain stimulation on language

Transcranial direct current stimulation (tDCS):

http://www.neuroconn.de/dc-stimulator_plus_en/

- non-invasive and painless brain stimulation tool

- the cerebral cortex is stimulated through a weak constant electric current (1-2 mA) through two electrodes (an “active” electrode which targets a special region of the brain and a “return” electrode).

- this weak current induces focal changes of cortical excitability that lasts beyond the period of stimulation, resulting in after-effects lasting up to one hour (Nitsche et al., 2008).

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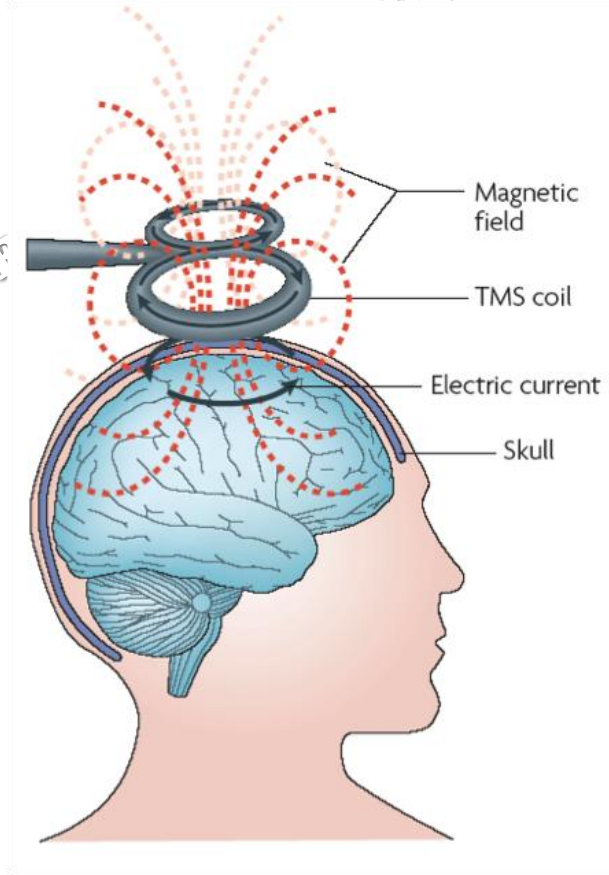
Non-invasive brain stimulation

TMS –Transcranial magnetic stimulation



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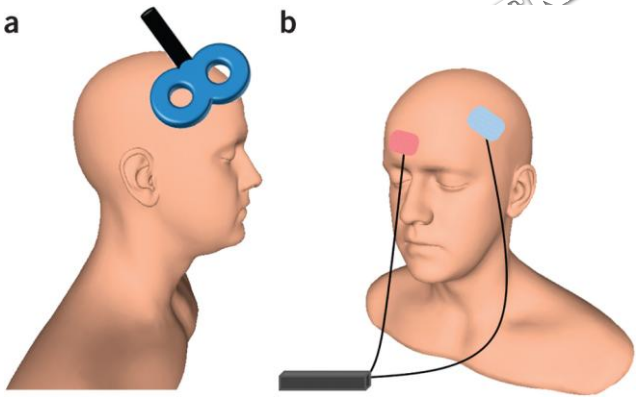
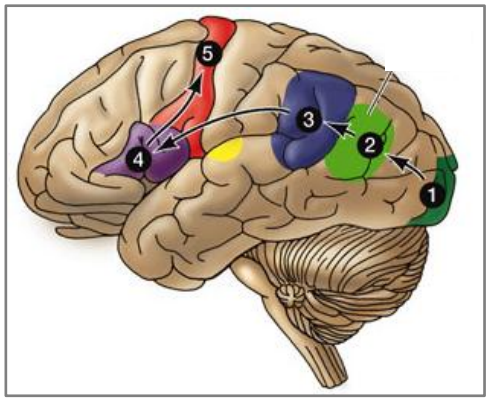
Effect of prefrontal stimulation on language production

- Healthy participants (a)
- Aphasic patients (b)
- Prefrontal stimulation ⇒ effects on language production
  - Picture Naming (accuracy and RT)
  - Translation (accuracy and RT)



http://www.nature.com/neuro/journal/v16/n7/abs/nn.3422.html

http://www.psychologie.uzh.ch/en/fachrichtungen/plasti/Labor.html



Adapted from: http://www.tedxsalford.co.uk/learning-languages-breaking-frontiers

But electrophysiological effects

Executive function involvement

Cat

0 175 270 450 600 ms

Visual & conceptual processing | Lexical selection | Phonological processing | Phonetic encoding

Main effect of Stimulation

P Value

1
0.5
0

Image onset

100 200 300 400 500 600 ms

Differences L2 / L1

- L1 and L2 share a common network
- L2 network tends to be
  - smaller in comprehension
  - larger in production
  - Differences in reading
- depending on proficiency and age of acquisition.
- *Notion of critical period (3-5 y.o.)*

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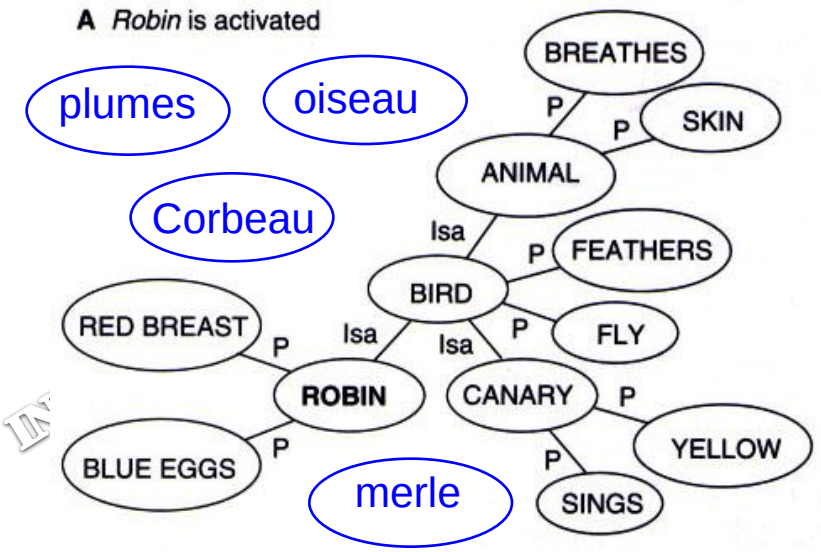
Bilingualism and language context

(J Kroll, F Grosjean, D Green, 2011)



Language Selection

Brain & Language 122 (2012) 55–63

Contents lists available at SciVerse ScienceDirect

Brain & Language

journal homepage: www.elsevier.com/locate/b&l

Regular Article

Cognitive control of language production in bilinguals involves a partly independent process within the domain-general cognitive control network: Evidence from task-switching and electrical brain activity

David A. Magezi [a,1], Asaid Khateb [b,c], Michael Mouthon [a,b], Lucas Spierer [a], Jean-Marie Annoni [a,b,d,*]

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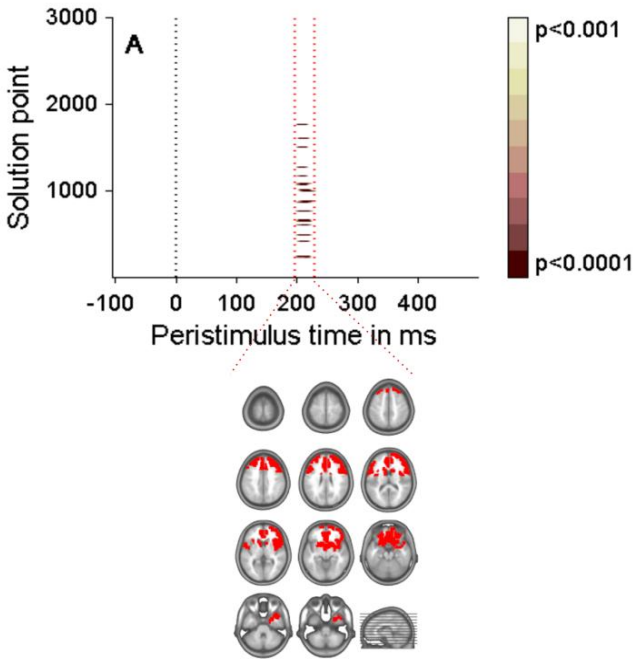
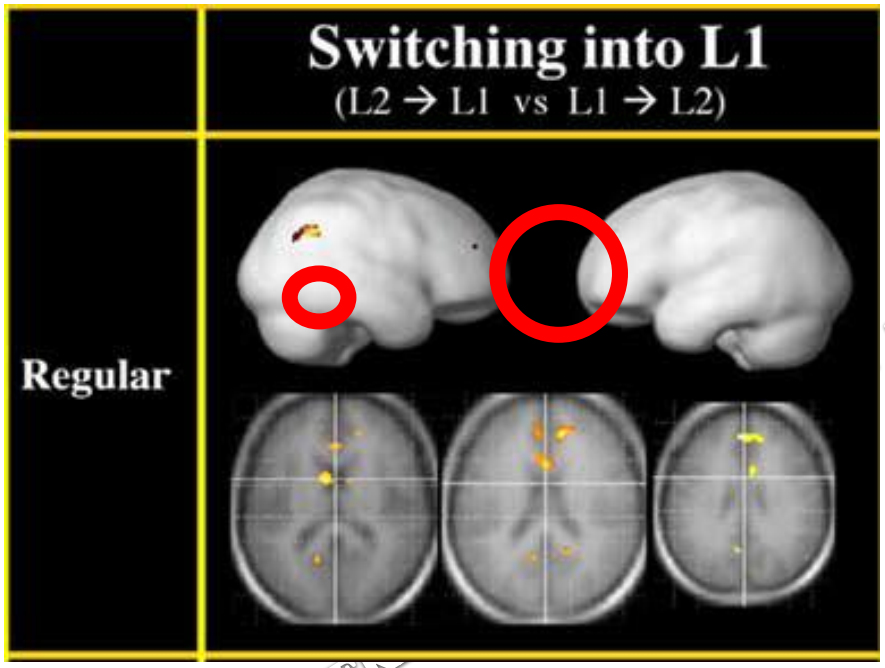
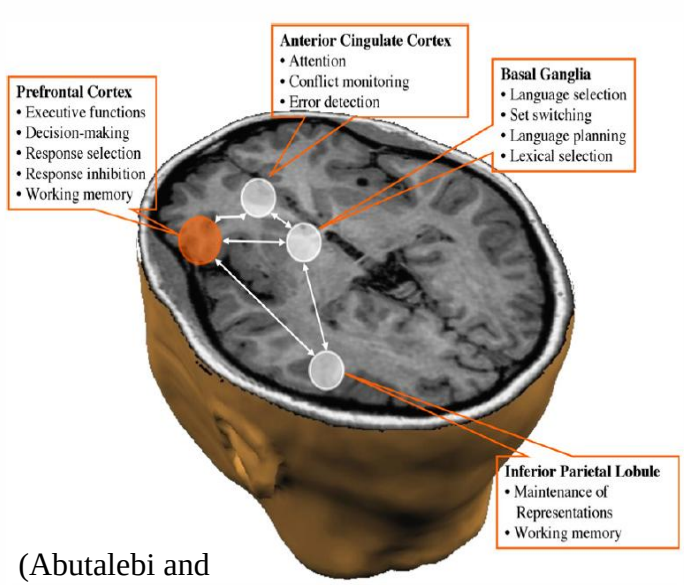
Compare

- task switch
- language switch



Language Selection System





(Abutalebi and Green 2007)

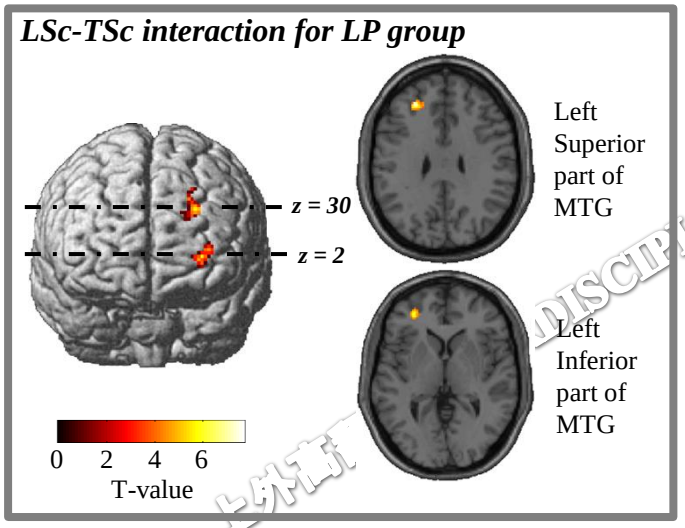
The Neural Cost of the Auditory Perception of Language Switches: An Event-Related Functional Magnetic Resonance Imaging Study in Bilinguals

Jubin Abutalebi,[1] Simona M. Brambati,[2] Jean-Marie Annoni,[3] Andrea Moro,[1] Stefano F. Cappa,[1] and Daniela Perani[1]

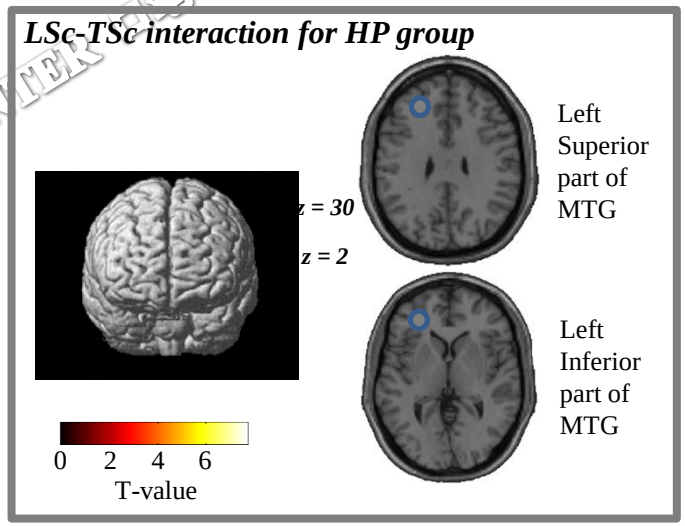
J Neurosciences, 2007

Compared to task schitch

Language switch in Low Proficiency



Language switch in High Proficiency



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Mouthon et al, submitted

Interpreters -Translators

- Experts in task Switching
- Expert in working memory
- Experts in Language

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Correlation between working memory and simultaneous interpretation (2015)

Expertise, Working Memory and Articulatory Suppression Effect: Their Relation with Simultaneous Interpreting Performance

Irene Injoque-Ricle[1,2], Juan Pablo Barreyro[1,2], Jesica Formoso[1], Virginia I. Jaichenco[1]

[1] Psychology Research Institute, Faculty of Psychology, University of Buenos Aires (UBA)
[2] National Scientific and Technical Research Council (CONICET)

TABLE 2.

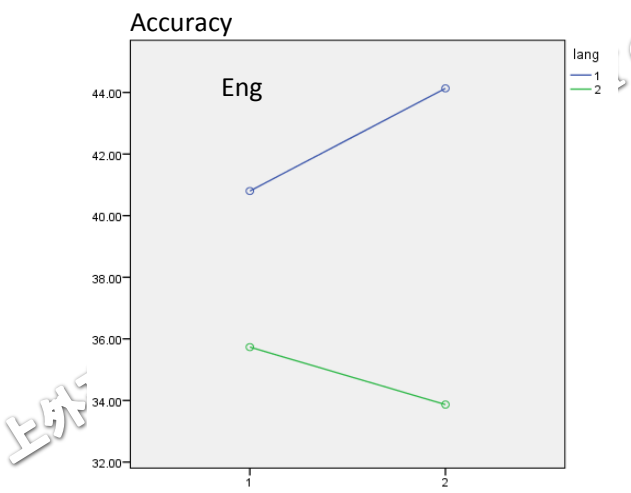
Pearson Correlations Among Simultaneous Interpreting (SI) Performance, Expertise Variables, and Working Memory Variables

	Years of experience	*Worked days per month*	*SI performance*
		r	
Years of experience	-	-	-
Worked days per month	271	-	-
SI performance	.151	.500*	-
Digit Span	.207	.205	.428
Digit Span with AS	.349	.252	.543*
Listening Span	.454	.238	.410
Listening Span with AS	.226	.081	.540*

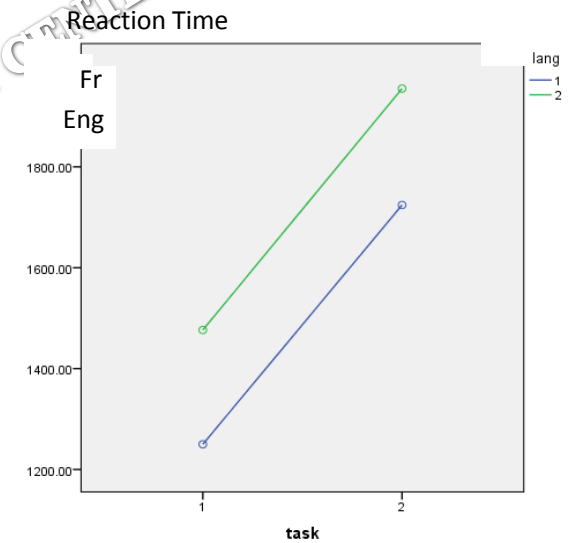
Interpreters : How does the brain work in translation

Synonym **Translation**

Behavioral results



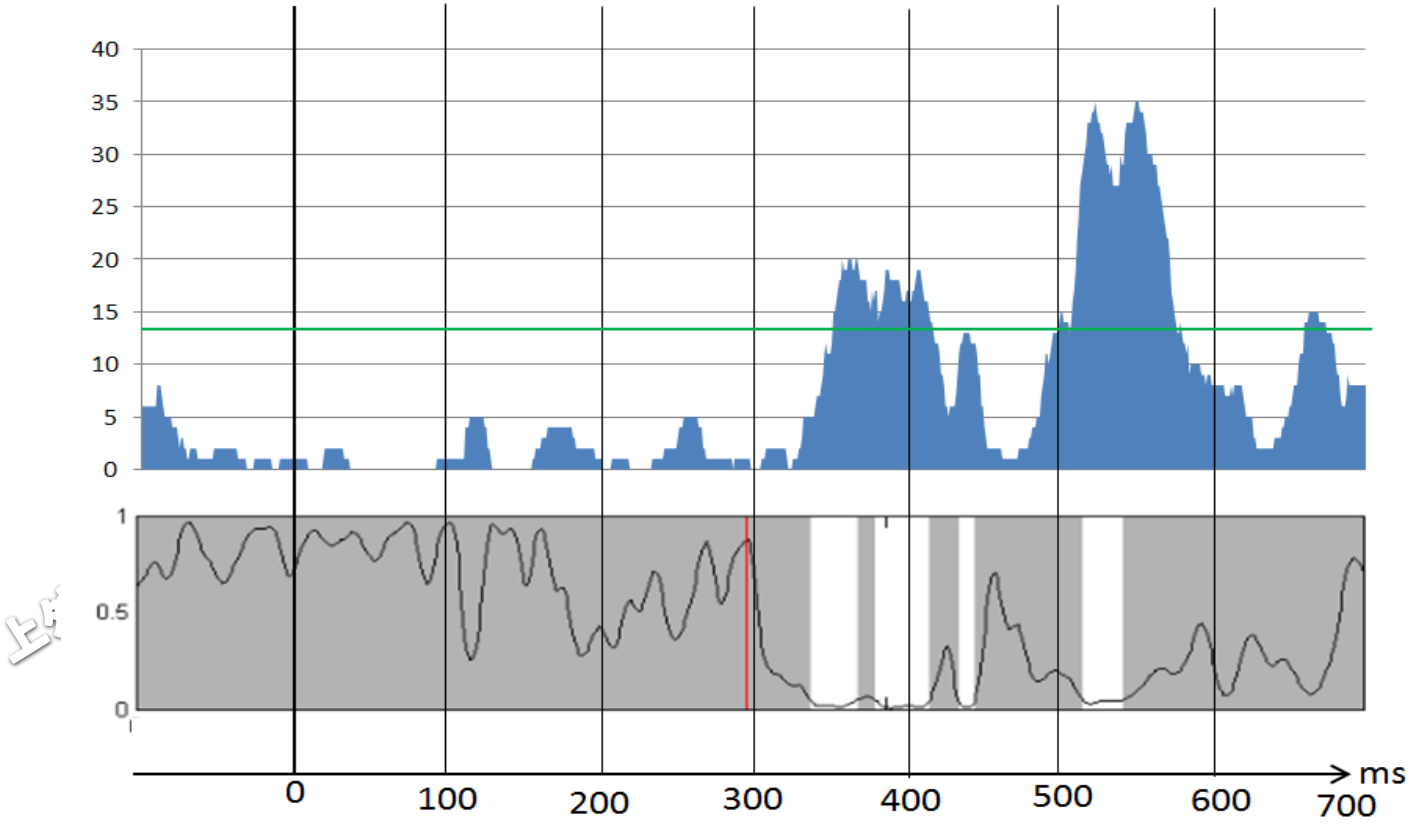
Lang: p=.451, partial η2 = 0.41
Task: p=.000, partial η2 = 0.84
Task * Lang: p=.006, partial η2 = .431



Lang: p=.000, partial η2 = 0.87
Task: p=.000, partial η2 = 0.90
Task * Lang: p=.955, partial η2 = .00

Jost et al in preparation

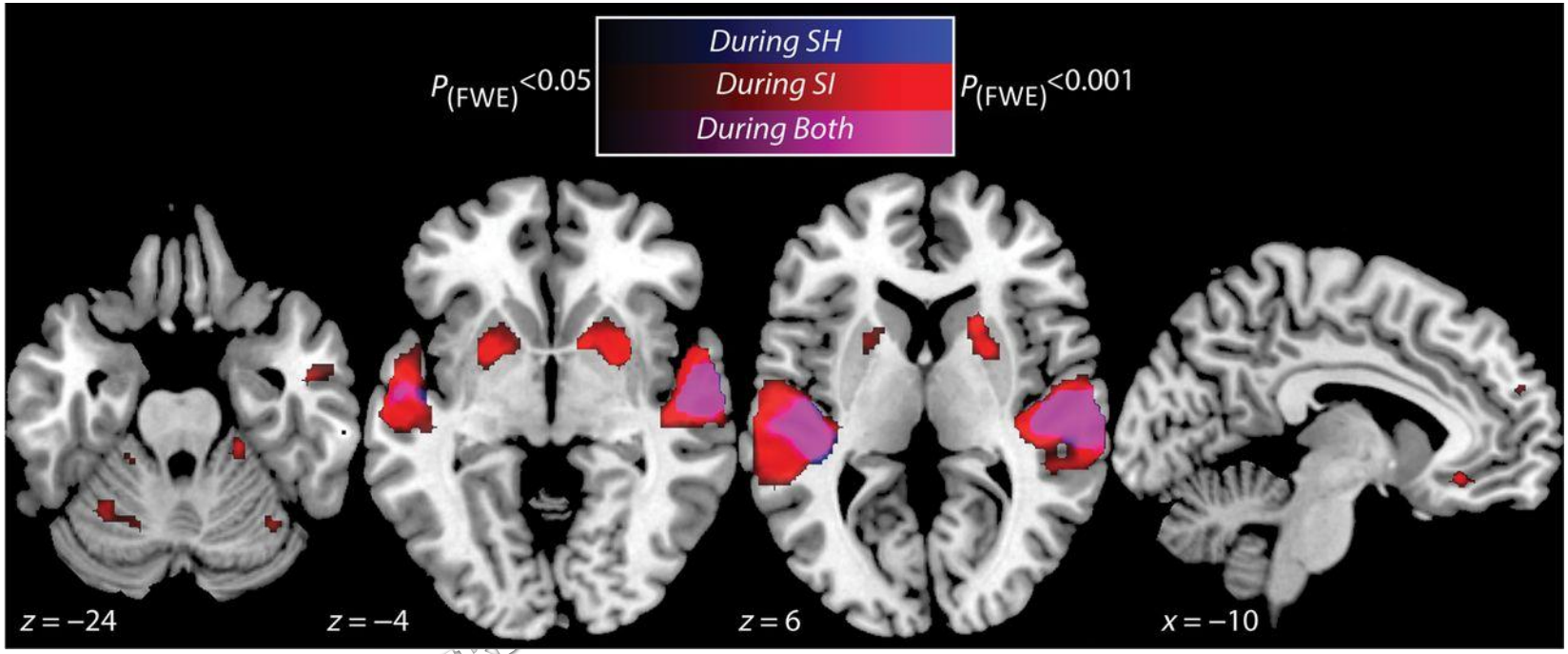
15 Participants: mean age 23.6y, L1 =French, L2 English learned after age 7
Task: Translation Eng-Fr, Translation Fr – Eng
Control : finding semantically related nouns



tart

gateau

How the brain is activated in experts interpreters.



Regions showing significant modulation of BOLD response as a function of the duration of overlapping speaking and listening during shadowing (blue) and interpretation (red) and both (magenta),

Alexis Hervais-Adelman et al. Cereb. Cortex 2015;25:4727-4739

Cerebral CORTEX

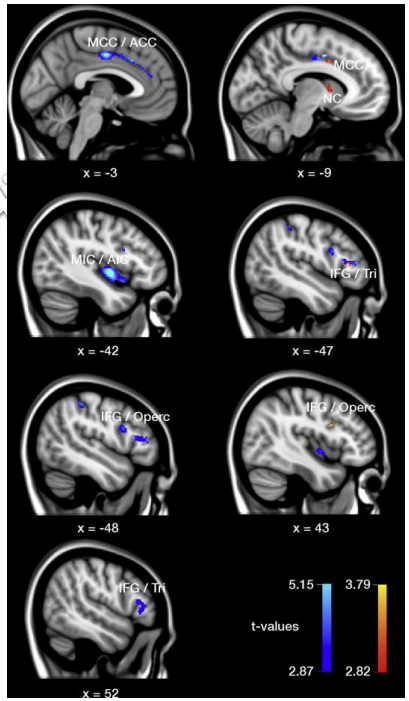
Processing demands upon cognitive, linguistic, and articulatory functions promote grey matter plasticity in the adult multilingual brain: Insights from simultaneous interpreters

Broca Pars Triangularis Constitutes a "Hub" of the Language-Control Network during Simultaneous Language Translation

Stefan Elmer *

Auditory Research Group Zurich, Division Neuropsychology, Institute of Psychology, University of Zurich, Zurich, Switzerland

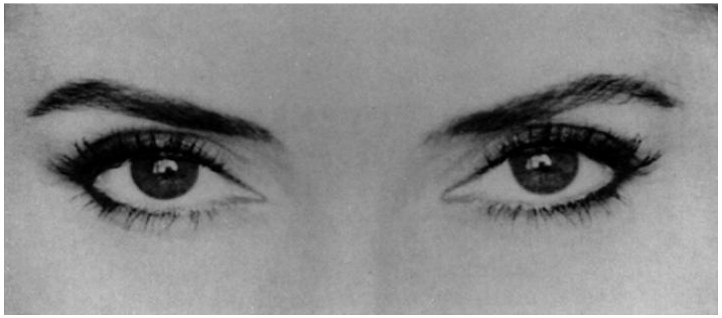
Until now, several branches of research have fundamentally contributed to a better understanding of the ramifications of bilingualism, multilingualism, and language expertise on psycholinguistic-, cognitive-, and neural implications. In this context, it is noteworthy to mention that from a cognitive perspective, there is a strong convergence of data pointing to an influence of multilingual speech competence on a variety of cognitive functions, including attention, short-term- and working memory, set shifting, switching, and inhibition. In addition, complementary neuroimaging findings have highlighted a specific set of cortical and subcortical brain regions which fundamentally contribute to administrate cognitive control in the multilingual brain, namely Broca's area, the middle-anterior cingulate cortex, the inferior parietal lobe, and the basal ganglia. However,



Stefan Elmer, Jürgen Hänggi, Lutz Jäncke, cortex 2014

Theory of mind Verbal component

Non Verbal



Verbal

It is windy: I have tears in my eyes

It is beautiful: I have tears in my eyes

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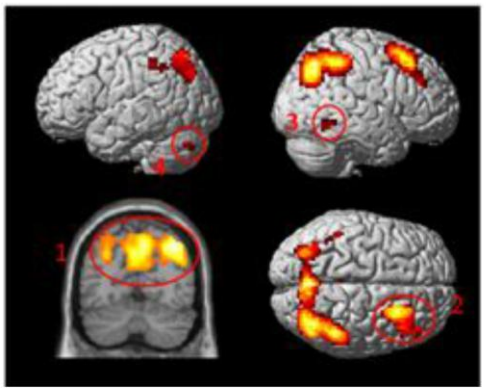

Interaction between ToM and noToM condition across verbal and non-verbal modality

Interpreters/Translators

- Experts in languages
- Expert in Switching
- Expert in social Cognition

- Adapt their brain in
  - Language system
  - Control system
  - Social System?

上外高翻 INTERDISCIPLINARY CENTER 口笔译跨学科研究中心 SGIC

Part III
Recovery of language and connectivity

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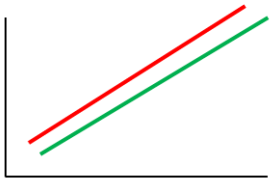
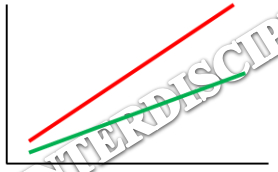
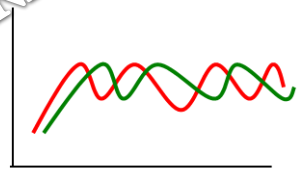


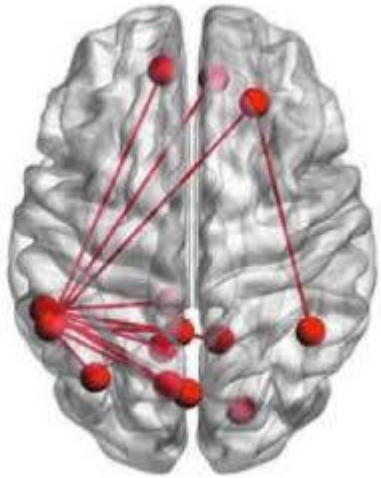
Parallel Recovery (61%)
Both impaired languages improve to a similar extent and concurrently



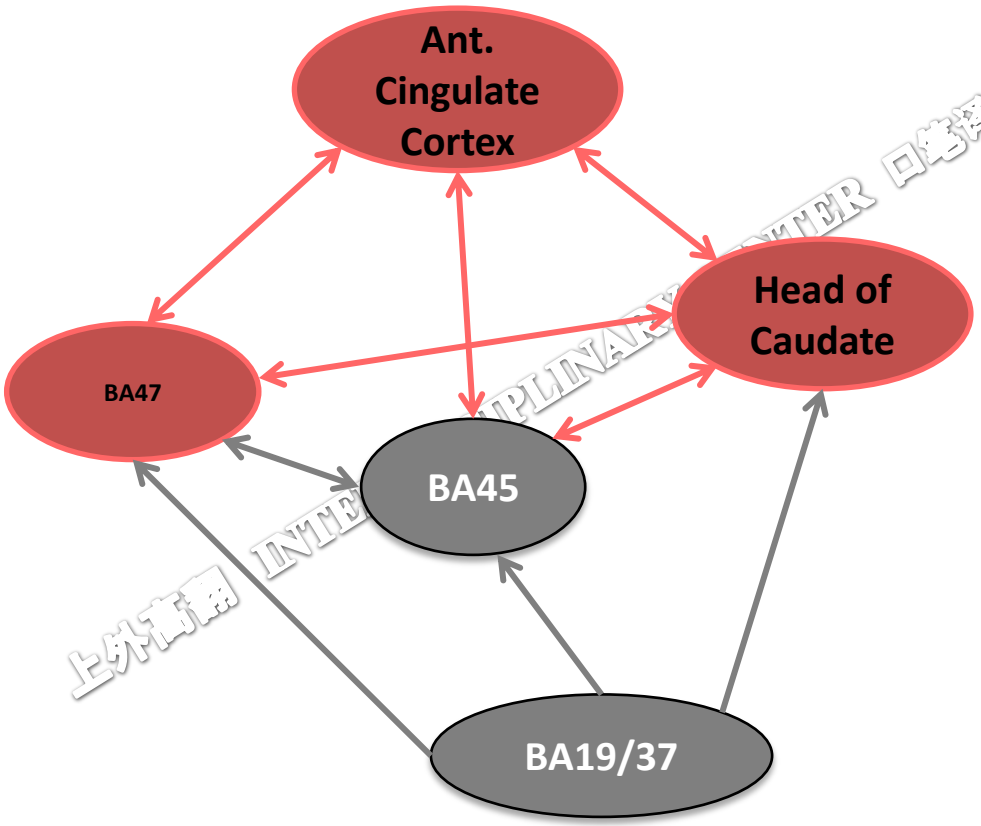
Differential Recovery (18%)
One language is recovered better (usually L1)



Pathological Mixing or Blended Recovery (9%)
Elements of the 2 languages are involuntary mixed during language production.



Recovery in L1 and L2 correlates with connectivity between control and language system



Control Network ⟷ Naming network

N Radman, neural repair, 2016

Take Home

- *Two languages share a common network modulated by proficiency / age of acquisition*

- *Language control is achieved by a specific cognitive /inhibitory control*

-

- *Language connectivity between control system and language system associated to language recovery after lesion*

- *I&T are experts of control –language network*

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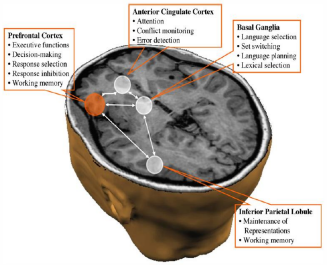

Thanks to

- lcns team (www.unifr.ch/Neurology)
- Patients and Controls

Thank you for attention

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