Genes, medio ambiente y desarrollo cerebral

Contribuciones recientes de las imágenes cerebrales

Plan del curso

- ¿Un gen para el lenguaje humano?
- Estudios en gemelos y algunas condiciones clasicas (sindrome de Williams, X fragil…)
- El músico profesional : un modelo privilegiado
- Efecto de la lengua materna en el desarrollo cerebral
- Aportes recientes de estudios trans-lingüisticos

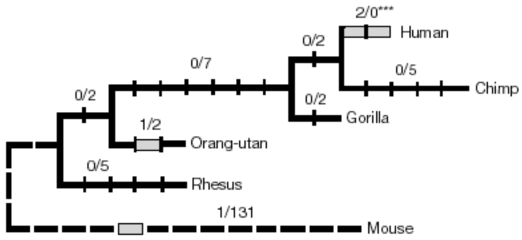
Molecular evolution of *FOXP2*, a gene involved in speech and language

Wolfgang Enard*, Molly Przeworski*, Simon E. Fisher†, Cecilia S. L. Lai†, Victor Wiebe*, Takashi Kitano*, Anthony P. Monaco† & Svante Pääbo*

* *Max Planck Institute for Evolutionary Anthropology, Inselstrasse 22, D-04103 Leipzig, Germany*

NATURE | 14 AUGUST 2002 | doi:10.1038/nature01025 |

Language is a uniquely human trait likely to have been a prerequisite for the development of human culture. The ability to develop articulate speech relies on capabilities, such as fine control of the larynx and mouth[1], that are absent in chimpanzees and other great apes. *FOXP2* is the first gene relevant to the human ability to develop language[2]. A point mutation in *FOXP2* co-segregates with a disorder in a family in which half of the members have severe articulation difficulties accompanied by linguistic and grammatical impairment[3]. This gene is disrupted by translocation in an unrelated individual who has a similar disorder. Thus, two functional copies of *FOXP2* seem to be required for acquisition of normal spoken language. We sequenced the complementary DNAs that encode the FOXP2 protein in the chimpanzee, gorilla, orang-utan, rhesus macaque and mouse, and compared them with the human cDNA. We also investigated intraspecific variation of the human *FOXP2* gene. Here we show that human *FOXP2* contains changes in amino-acid coding and a pattern of nucleotide polymorphism, which strongly suggest that this gene has been the target of selection during recent human evolution.



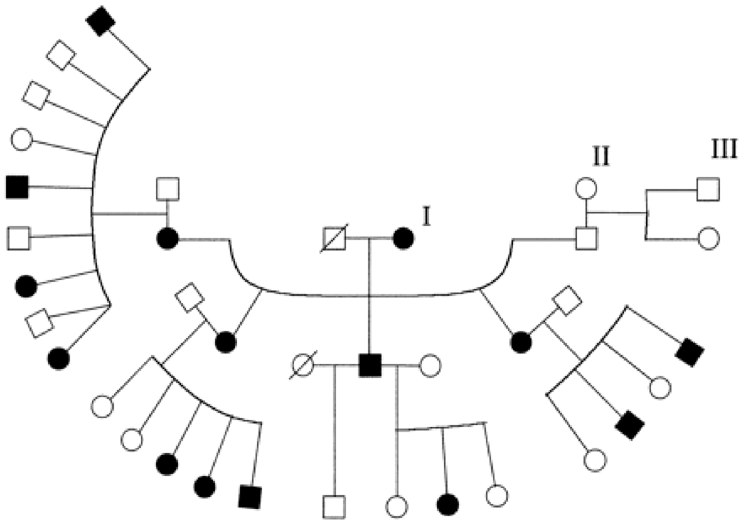
Brain (2002), **125**, 465–478

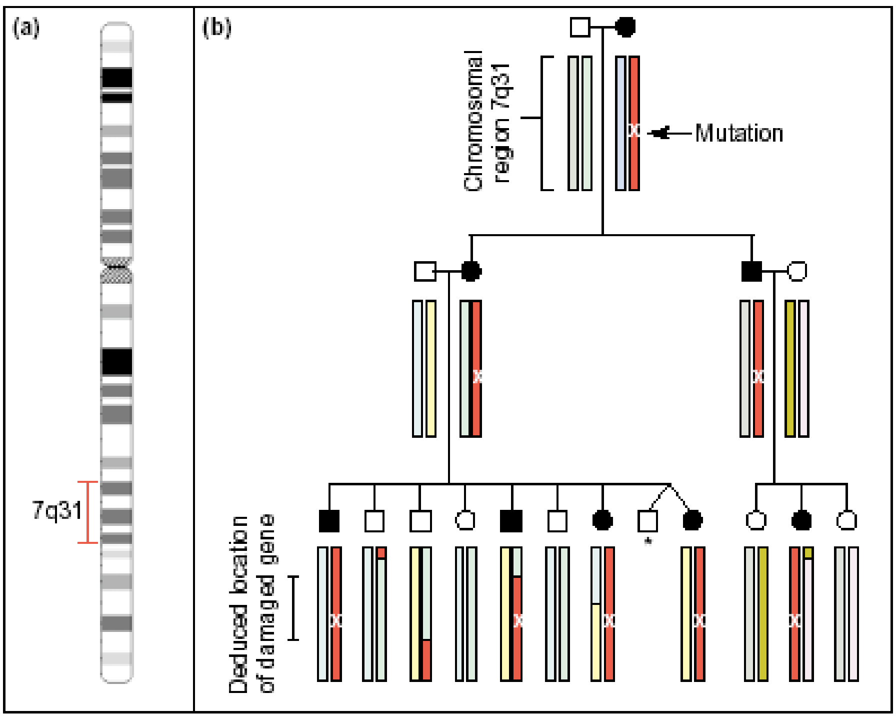
MRI analysis of an inherited speech and language disorder: structural brain abnormalities

K. E. Watkins,[1] F. Vargha-Khadem,[1] J. Ashburner,[3] R. E. Passingham,[4] A. Connelly,[2] K. J. Friston,[3] R. S. J. Frackowiak,[3] M. Mishkin[5] and D. G. Gadian[2]

[1]*Developmental Cognitive Neuroscience Unit and* [2]*Radiology and Physics Unit, Institute of Child Health,* [3]*Wellcome Department of Cognitive Neurology, Institute of Neurology, University College London Medical School, London,* [4]*Department of Experimental Psychology, University of Oxford, Oxford, UK and* [5]*Laboratory of Neuropsychology, National Institutes of Mental Health, Bethesda, Maryland, USA*

Correspondence to: Kate Watkins, Cognitive Neuroscience Unit, Montreal Neurological Institute, 3801 University Street, Montreal, QC, Canada H3A 2B4
E-mail: kwatkins@bic.mni.mcgill.ca





Language fMRI abnormalities associated with *FOXP2* gene mutation

Frédérique Liégeois[1,2], Torsten Baldeweg[1,2], Alan Connelly[2,3], David G Gadian[2,3], Mortimer Mishkin[4] & Faraneh Vargha-Khadem[1,2]

Half the members of the KE family suffer from a speech and language disorder caused by a mutation in the *FOXP2* gene. We examined functional brain abnormalities associated with this mutation using two fMRI language experiments, one involving covert (silent) verb generation and the other overt (spoken) verb generation and word repetition. The unaffected family members showed a typical left-dominant distribution of activation involving Broca's area in the generation tasks and a more bilateral distribution in the repetition task, whereas the affected members showed a more posterior and more extensively bilateral pattern of activation in all tasks. Consistent with previously reported bilateral morphological abnormalities, the affected members showed significant underactivation relative to the unaffected members in Broca's area and its right homolog, as well as in other cortical language-related regions and in the putamen. Our findings suggest that the *FOXP2* gene is critically involved in the development of the neural systems that mediate speech and language.

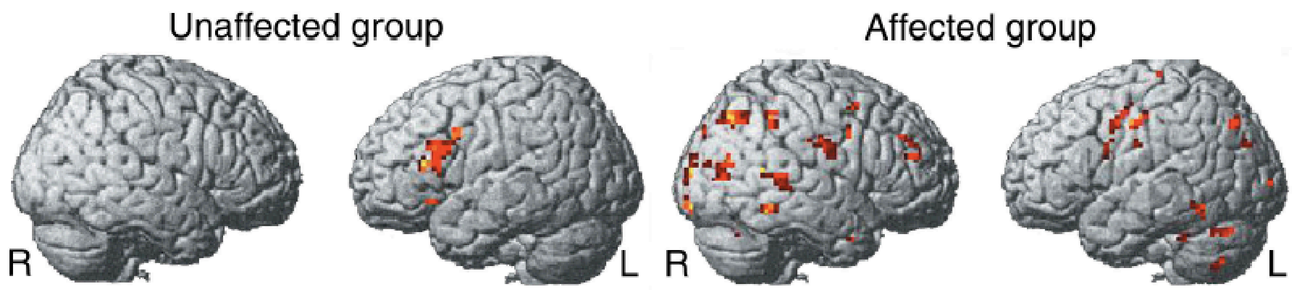


Figure 1 Covert language task: group average fMRI activation in the unaffected and affected members of the KE family. Activated regions are projected onto the surface rendering of a typical 3D individual brain (within SPM99), displayed at a statistical threshold of $P < 0.05$, corrected for multiple comparisons. See Table 1 for detailed list of activated regions. L, left hemisphere; R, right hemisphere.

A Twin MRI Study of Size Variations in the Human Brain

Bruce F. Pennington
University of Denver

Pauline A. Filipek
University of California-Irvine

Dianne Lefly and Nomita Chhabildas
University of Denver

David N. Kennedy
Harvard Medical School

Jack H. Simon
University of Colorado

Christopher M. Filley
University of Colorado and Denver Veterans Affairs Medical Center

Albert Galaburda
Harvard Medical School

John C. DeFries
University of Colorado

Table 1. Description of the Sample

	RD Sample		*Control Sample*	
	(MZ) 25 pairs	*(DZ) 23 pairs*	*(MZ) 9 pairs*	*(DZ) 9 pairs*
Mean Age	17.10[a]	16.82[a]	19.41[b]	18.71[a,b]
SD	4.59	3.66	5.00	2.40
Gender Ratio (M:F)	12:13[a]	16:7[b]	4:5[a,b]	4:5[a,b]

The volumes of seven structures comprising all the gray matter in the neocortex, and the volumes of six other structures comprising most of the rest of the brain were factor-analyzed using data from the entire sample.

Estudio morfológico de 132 individuos perteneciendo a 66 pares de gemelos.
Correlaciones de 7 diferentes medidas del cerebro entre pares de gemelos mono- o dicigotos : herencia da cuenta de 56 a 90% de la varianza

Journal of Cognitive Neuroscience 12:1, pp. 223–232

Table 4. Intraclass Correlations (SE) in the Control Sample

	MZ (9 pairs)	*DZ (9 pairs)*	*Fisher's Z*
Factor 1	0.78[a] (0.24)	0.34 (0.36)	1.20
Factor 2	0.84[a] (0.20)	0.32 (0.36)	1.54
Cerebral Total	0.98[a] (0.08)	0.58 (0.31)	2.84[a]
Right Neocortex	0.93[a] (0.14)	0.60 (0.30)	1.67
Left Neocortex	0.93[a] (0.14)	0.65 (0.29)	1.53

[a]p<0.01 [alpha was set at 0.01 using Dunn's multiple comparison procedure].

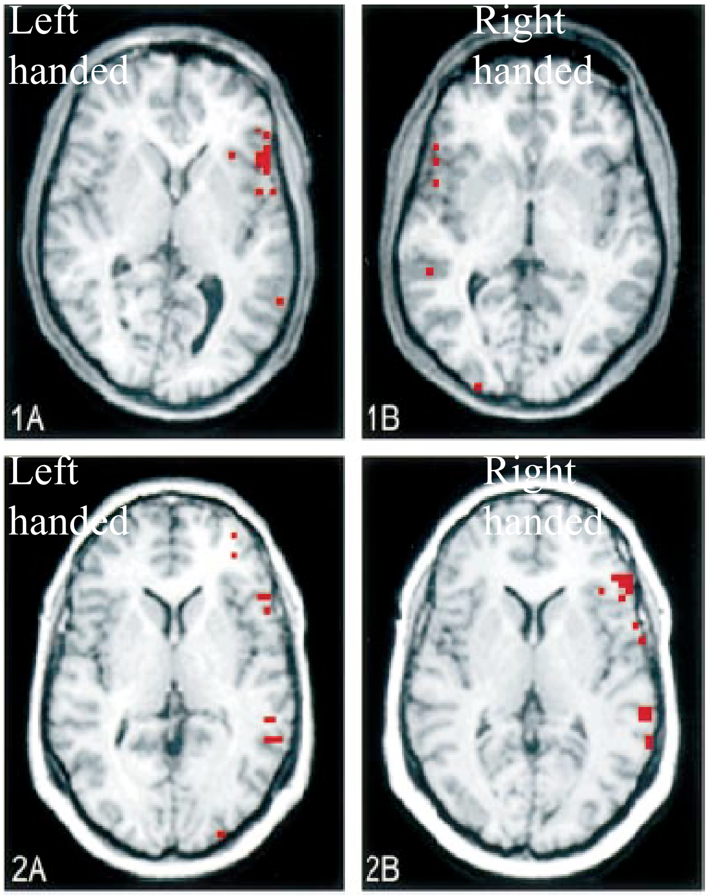
Brain (2002), **125**, 2710–2718

Language lateralization in monozygotic twin pairs concordant and discordant for handedness

I. E. C. Sommer, N. F. Ramsey, R. C. W. Mandl and R. S. Kahn

1-

2-



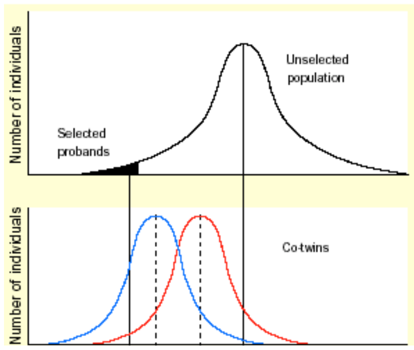
Monozygotic twins discordant for handedness
1) discordant for language laterality
2) concordant language laterality

Genética de los trastornos de aprendizaje

Dislexia :

- hasta 65% : uno de sus padres es disléxico
- 40% de los familiares son disléxicos

Nivel de concordancia en pares de gemelos 68% DZ, 38%MZ (Colorado Twin Study of Reading Disability), Olson et al.

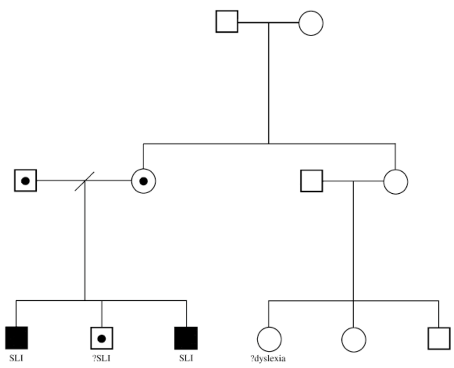


SLI : 90 pares de gemelos (Bishop, 1995)

-70% concordancia en pares MZ, 46% en DZ

- Hasta 100% concordancia por MZ con criterios más amplios

-Variancia compartida entre déficit oral y lectura



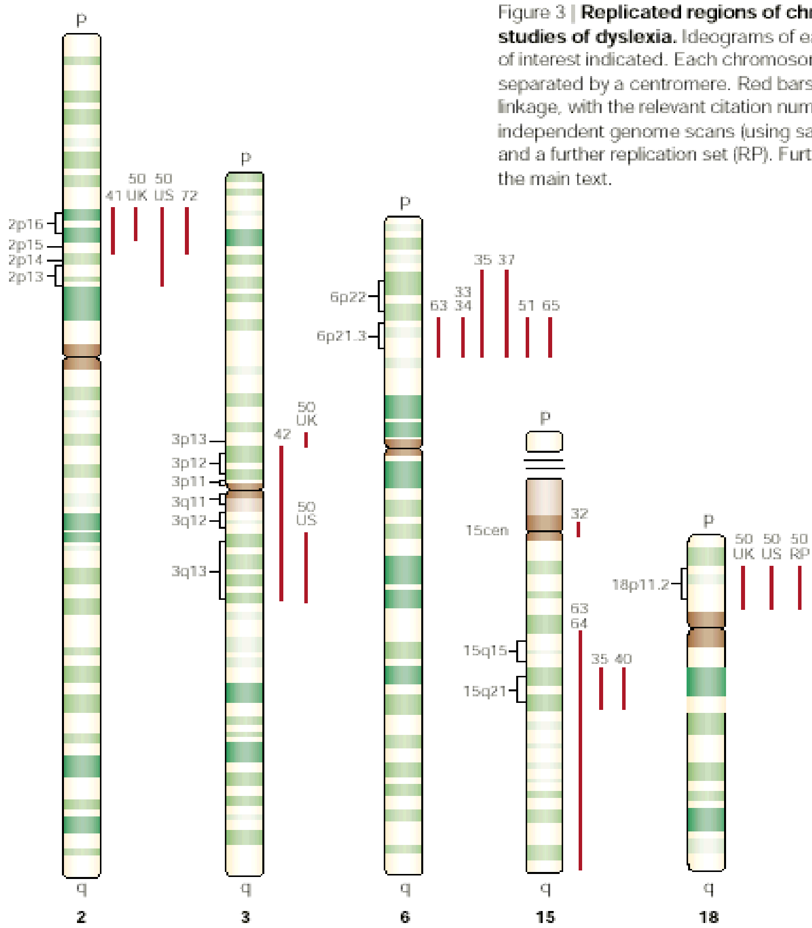
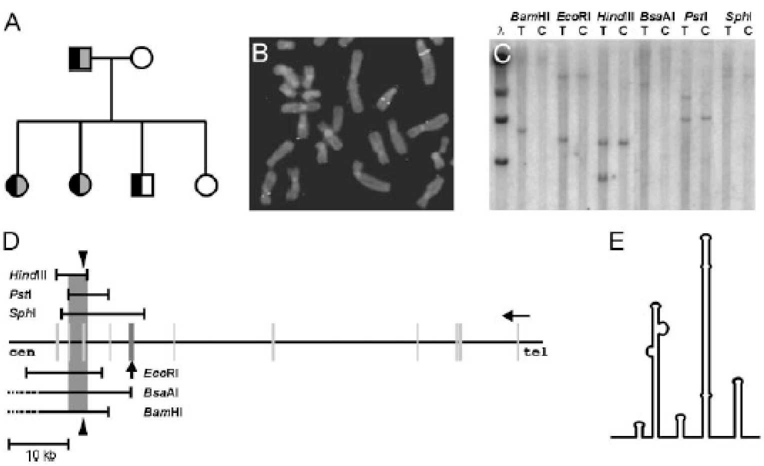


Figure 3 | **Replicated regions of chromosomes 2, 3, 6, 15 and 18 implicated by linkage studies of dyslexia.** Ideograms of each chromosome are shown with the cytogenetic bands of interest indicated. Each chromosome has a short (p) arm and a long (q) arm, which are separated by a centromere. Red bars indicate approximate positions of positive regions of linkage, with the relevant citation number of the study shown above. REF. 50 included two independent genome scans (using samples from the United Kingdom and the United States) and a further replication set (RP). Further details of each study are given in TABLES 2–4 and in the main text.

PNAS | September 30, 2003 | vol. 100 | no. 20 | 11553–11558

A candidate gene for developmental dyslexia encodes a nuclear tetratricopeptide repeat domain protein dynamically regulated in brain

Mikko Taipale*†, Nina Kaminen*‡, Jaana Nopola-Hemmi*‡§¶, Tuomas Haltia‖, Birgitta Myllyluoma§, Heikki Lyytinen**, Kurt Muller**, Minna Kaaranen**, Perttu J. Lindsberg††, Katariina Hannula-Jouppi*, and Juha Kere*‡§§



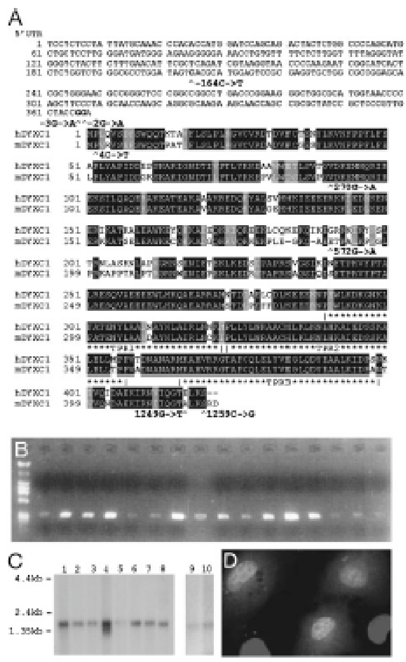


Fig. 2. (A) Comparison of the protein sequences of human (h) *DYX1C1* and mouse (m) *Dyx1c1*. The SNPs found in this study are marked with arrowheads,

Translocación en el gen DYX1C1 situado cerca del locus DYX1 sobre el cromosoma 15q21

Article

Neuroanatomic Variation in Monozygotic Twin Pairs Discordant for the Narrow Phenotype for Autism

Wendy R. Kates, Ph.D.
Courtney P. Burnette, M.S.
Stephan Eliez, M.D.
Leslie Abbott Strunge, M.A.
Desmond Kaplan, M.D.
Rebecca Landa, Ph.D.
Allan L. Reiss, M.D.
Godfrey D. Pearlson, M.D.

TABLE 1. Scores on the Autism Diagnostic Inventory and Autism Diagnostic Observational Scale of Monozygotic Twin Pairs Who Were Concordant or Discordant for Autism

	Score									
	Concordant Twin Pairs (seven pairs)				Discordant Twin Pairs (nine pairs)					
	Autistic Twin A		Autistic Twin B		Autistic Twin A		Broad-Phenotype Twin B[a]		ANOVA (3, 26)	
Scale and Domain	Mean	SD	Mean	SD	Mean	SD	Mean	SD	F	p
Autism Diagnostic Inventory—Revised (22)										
Reciprocal social interaction	21.5	2.2	21.3	6.5	19.7	5.2	5.2	7.1	15.0	<0.0001
Communication	15.7	4.2	15.9	4.9	14.7	3.5	6.3	6.6	6.6	0.002
Stereotyped behavior	6.2	1.7	5.2	1.7	5.9	1.2	1.9	2.0	11.5	0.001
Abnormal development	3.7	2.0	3.3	1.2	3.9	1.4	1.9	2.1	2.3	n.s.
Autism Diagnostic Observational Scale—Generic (23)										
Social	10.2	2.1	8.0	1.9	9.0	2.2	3.4	3.9	9.0	0.0003
Communication	6.0	1.3	4.3	1.0	5.8	2.0	2.9	2.1	5.3	0.006
Stereotyped behavior	1.7	1.2	0.3	0.5	1.4	1.0	0.2	0.4	5.8	0.004

TABLE 2. Within-Twin-Pair Correlations in Volumes of Cerebral and Cerebellar Gray and White Matter and Ventricles for Monozygotic Twin Pairs Who Were Concordant or Discordant for Autism

	Intraclass Correlation Coefficient[a]				
Type of Twin Pair	Cerebral White	Cerebral Gray	Cerebellar White	Cerebellar Gray	Ventricles
Clinically concordant (seven pairs)	0.90	0.84	0.86	0.92	0.71
Clinically discordant (nine pairs)	0.86	0.74	0.11[b]	0.50[b]	0.49

[a] Compared by means of the r-to-z transformation.
[b] Significantly lower than the value for the clinically concordant twin pairs (p≤0.05, one-tailed).

Comparación de 2 grupos de gemelos monocigotos concordantes o discordantes por autismo :
Solo el volumen del cerebelo parece específico del fenotipo autístico

(Am J Psychiatry 2004; 161:539–546)

BRITISH JOURNAL OF PSYCHIATRY (2004), 184, 128–135

Language activation in monozygotic twins discordant for schizophrenia

IRIS E. C. SOMMER, NICK F. RAMSEY, RENÉ C. W. MANDL, CLARINE J. VAN OEL and RENÉ S. KAHN

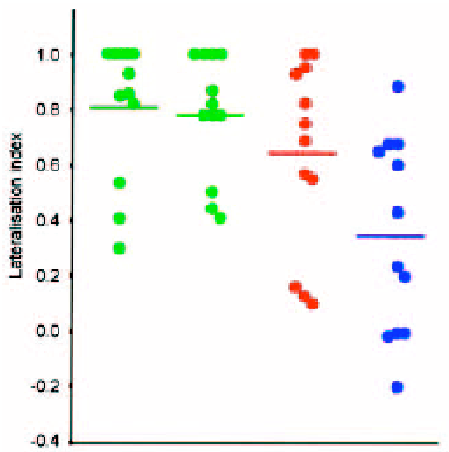


Fig. 1 Language lateralisation indices in 12 control twin pairs (●) and in 12 twin pairs discordant for schizophrenia: (●) probands; (●) unaffected co-twin.

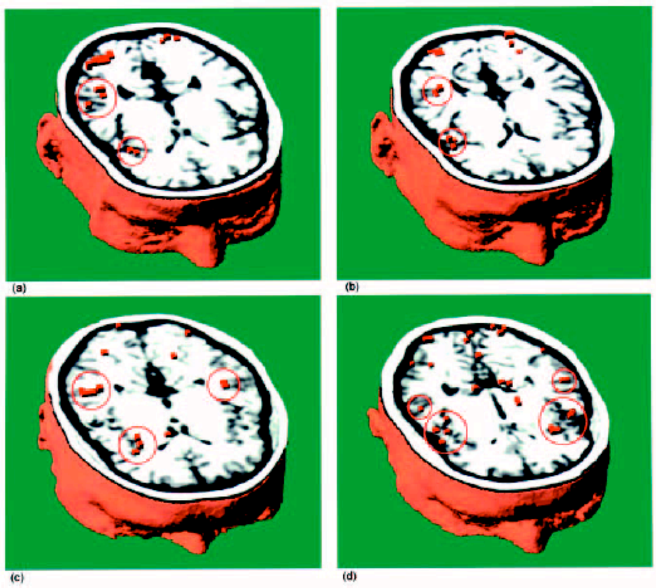


Fig. 2 Examples of language activation patterns in a healthy monozygotic twin pair (a,b), in an unaffected co-twin (c) and in the twin with schizophrenia (d); language-related activation is encircled.

Tendencia por activación bilateral en gemelos discordantes por esquizofrenia

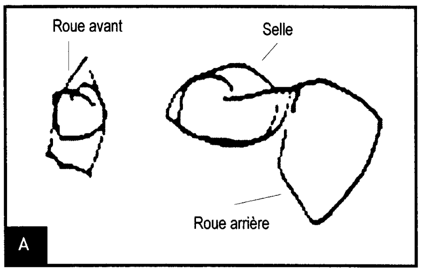
No diferencia entre el gemelo afectado y no afectado

Syndrome de Williams

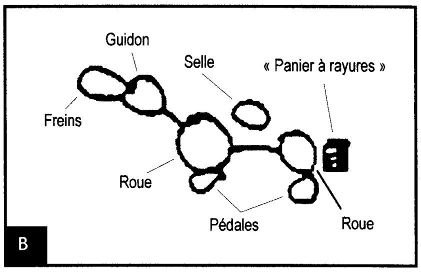
- Syndrome génétique dû à la microdélétion du bras long du chromosome 7
- Syndrome dysmorphique (hauteur de la partie moyenne du visage, oreilles larges et inclinées, base du nez fine et courte
- Profil neuropsychologique caractéristique : déficit spatial, surtout dans le dessin, supériorité relative du langage
- Mais difficultés dans certains aspects du langage (syntaxe des verbes, sémantique complexe)
- Seraient bons en musique

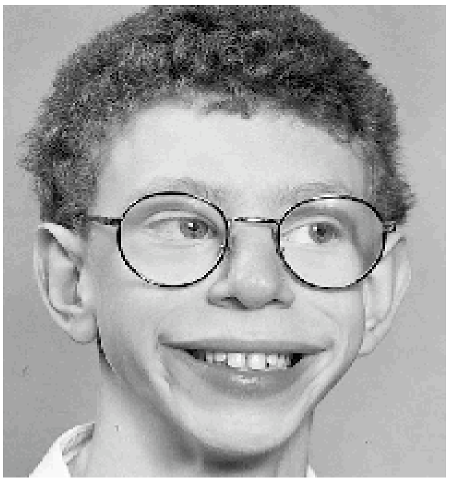
Syndrome de Williams :
Dessin d'un vélo

12 ans

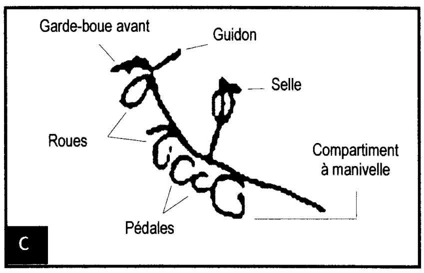


15 ans

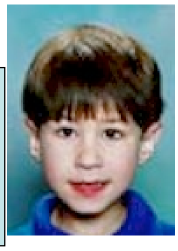




16 ans



Le syndrome du retard mental avec X fragile
Clinique: caractères physiques



- **Particularités faciales**, évolutives avec l'âge:

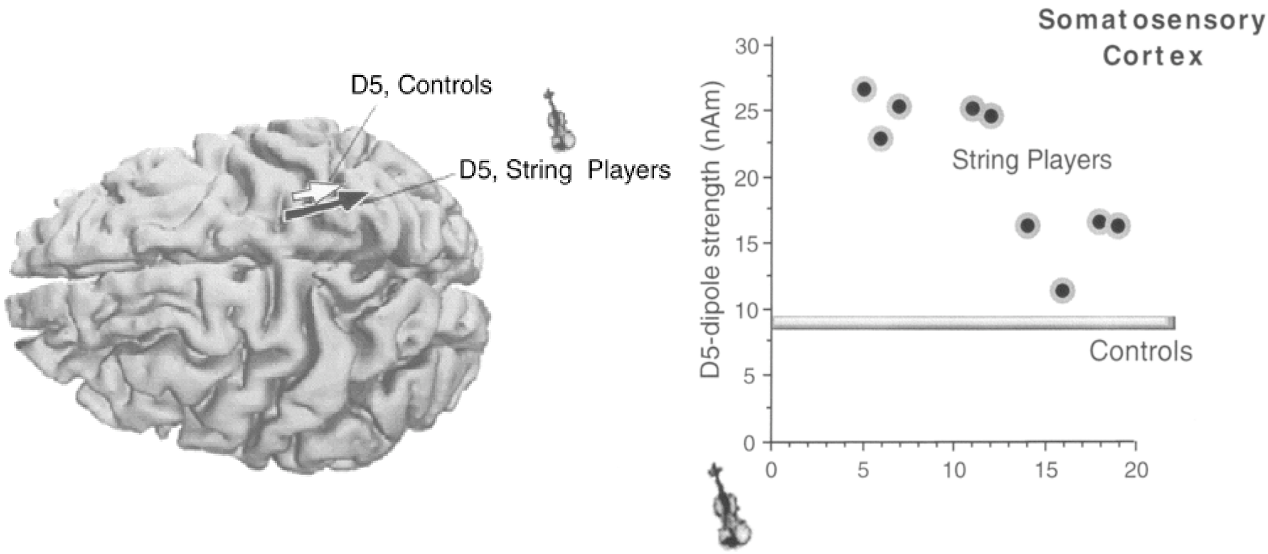
visage allongé, front haut, lèvres épaisses, **grandes oreilles**

- **Macroencéphalie**
- Tissu conjonctif anormal: **hyperlaxité**, peau 'souple', plis palmaires et plantaires anx
- **Macroorchidie**, après 8-10 ans
- Parfois grande taille, obésité, pilosité diminuée

Le syndrome X fragile chez le garçon
Signes d'appel, problème de développement et de comportement

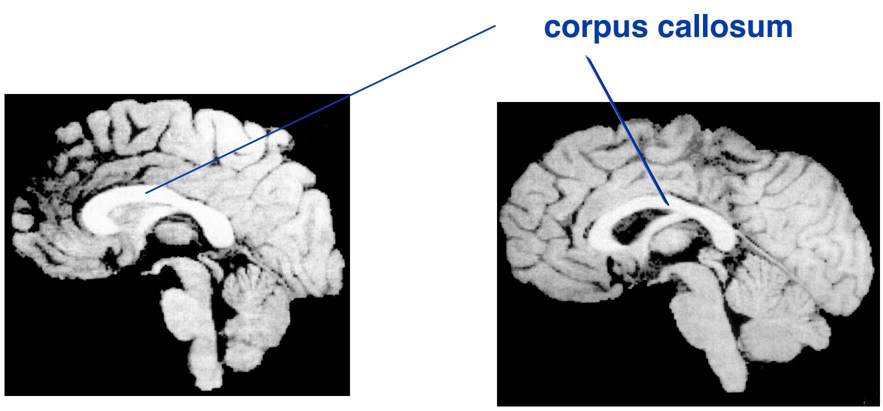
- Retard mental moyen à sévère (QI: 50)
- Retard de langage, **langage persévératif**
- Hyperactivité, troubles d'attention…
- Fuite du regard, timidité, angoisse
- Battements des mains, auto- agressivité
- Colères fréquentes, sautes d'humeur

'Traits autistiques', mais sans autisme typique



Elbert et al., 1998 (estudio con MEG=magnetoencefalografía).
El quinto dedo de la mano izquierda en músicos de instrumentos a cuerdas posee una representación funcional distinta. Efecto de la edad de aprendizaje.

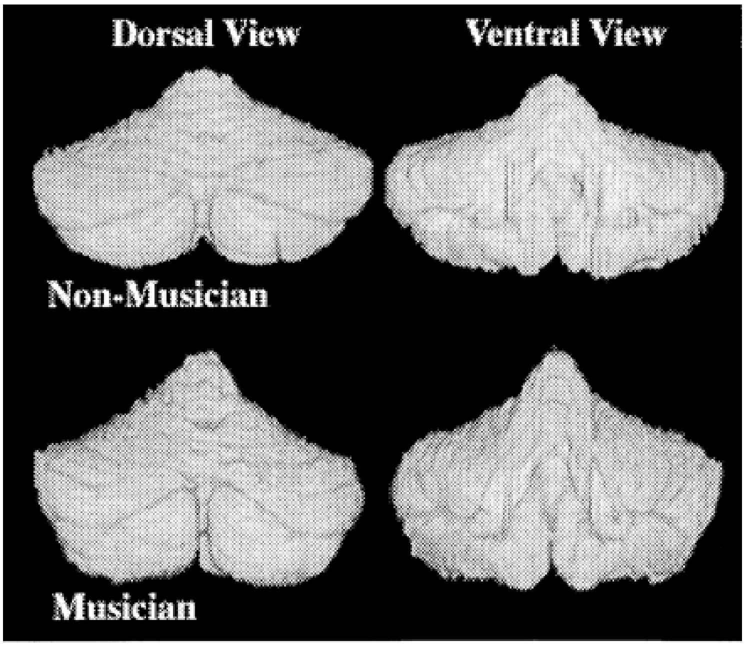
Anterior part of the callosum is larger in early-trained musicians



MUSICIAN **NON- MUSICIAN**

(Schlaug et al., 1995)

Le cervelet de musiciens (mâles) est plus volumineux de 5% (Schlaug et al., 2001)



	%CV	aCV (in cc)
Male musicians (n = 32)	10.30 (0.64)	145.3 (9.7)
Male nonmusicians (n = 24)	9.85 (0.68)[a]	139.6 (15.4)
Female musicians (n = 24)	10.43 (0.65)	134.7 (12.1)
Female nonmusicians (n = 15)	10.43 (0.82)	131.8 (12.9)
All males (n = 56)	10.11 (0.69)	142.8 (12.6)
All females (n = 34)	10.43 (0.72)	133.3 (12.3)

ABBREVIATIONS: %CV = % cerebellar volume of total brain volume; aCV = absolute cerebellar volume in cubic centimeters.
[a]Significant differences between the groups of male nonmusicians and musicians in relative cerebellar volume.

Cerebellar Volume of Musicians

Siobhan Hutchinson, Leslie Hui-Lin Lee, Nadine Gaab and Gottfried Schlaug

Department of Neurology, Beth Israel Deaconess Medical Center and Harvard Medical School, Boston, MA 02215, USA

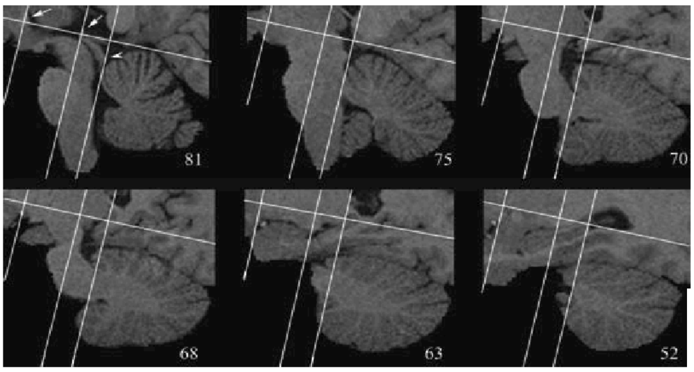


Table 3
Mean (± SD) for the measures of musicianship in each musician subgroup[a]

	Age of commencement	Intensity of practice	Years of practice
Male musicians (30)	6.40 (1.96)[+]	2.62 (1.06)	19.90 (4.35)
Female musicians (30)	4.81 (1.83)[+]	2.29 (1.06)	19.25 (4.87)

[a]In each subgroup (n =); Age of commencement of musical training (years of age); Intensity of practice (average hours per day over lifetime of practice); Years of practice (years of practice since commencement of musical training). [+]Significant difference $P < 0.005$.

Relative cerebellar volume is proportional to intensity of practice

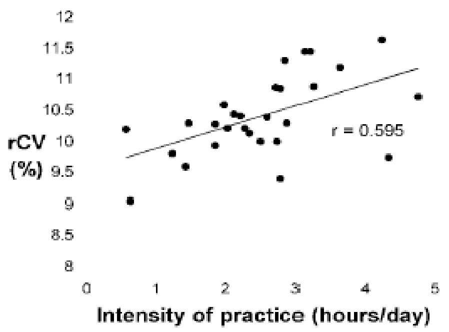
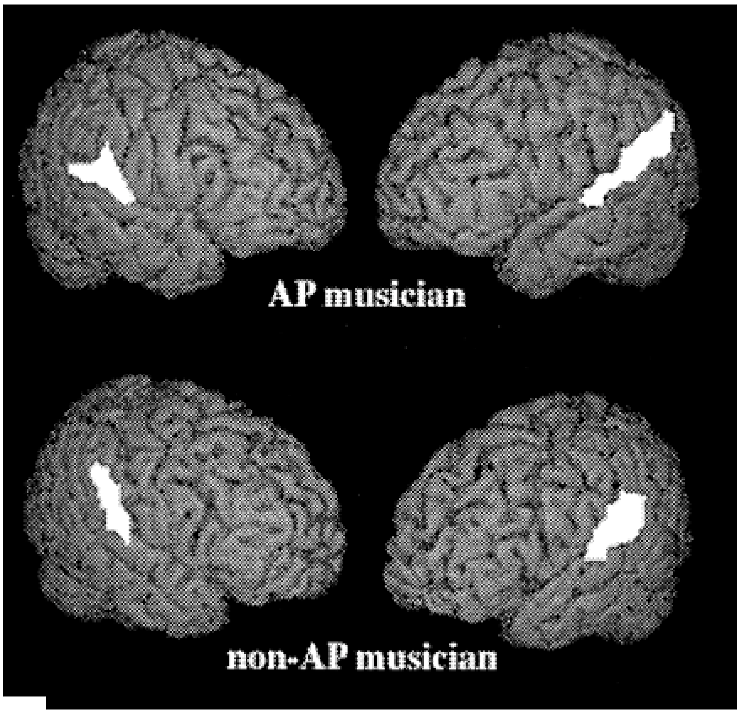


Figure 2. The relationship between relative cerebellar volume (rCV as a % of total brain volume) and lifelong intensity of practice (hours per day averaged over years of practice) for the male musician group. Bivariate Pearson correlation analysis revealed a significant positive correlation between the variables ($r = 0.595$, $P = 0.001$, two-tailed).

Cerebral Cortex Sep 2003;13:943–949; 1047–3211/03/$4.00

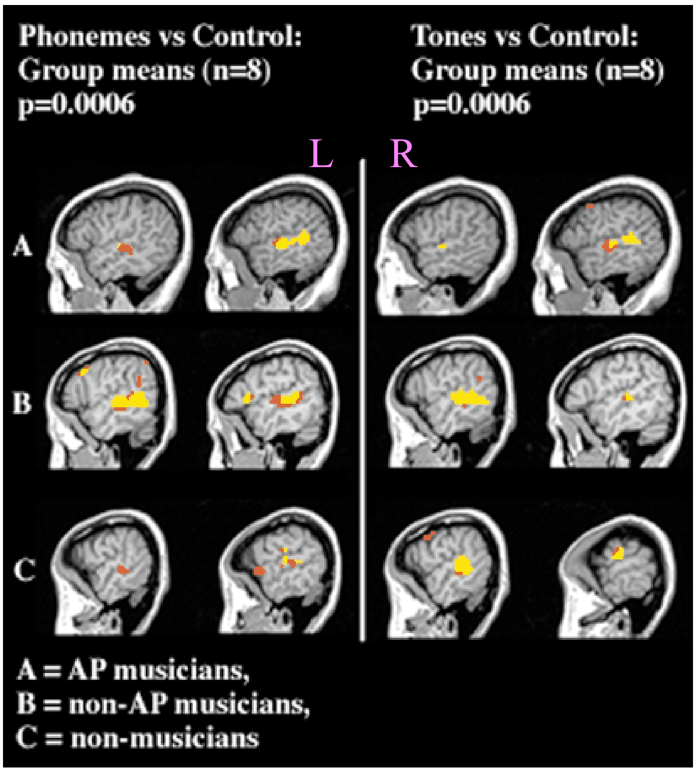
La asimetría del planum temporal es más fuerte en músicos con oído absoluto



Subject	δPT	PT size (mm^2)	
		Left	Right
AP musicians (n = 27)	−0.50 (0.27)[a]	1381 (449)	822 (236)
Non-AP musicians (n = 24)	−0.24 (0.14)	1350 (340)	1062 (267)
Nonmusicians (n = 27)	−0.28 (0.24)	1341 (306)	008 (285)

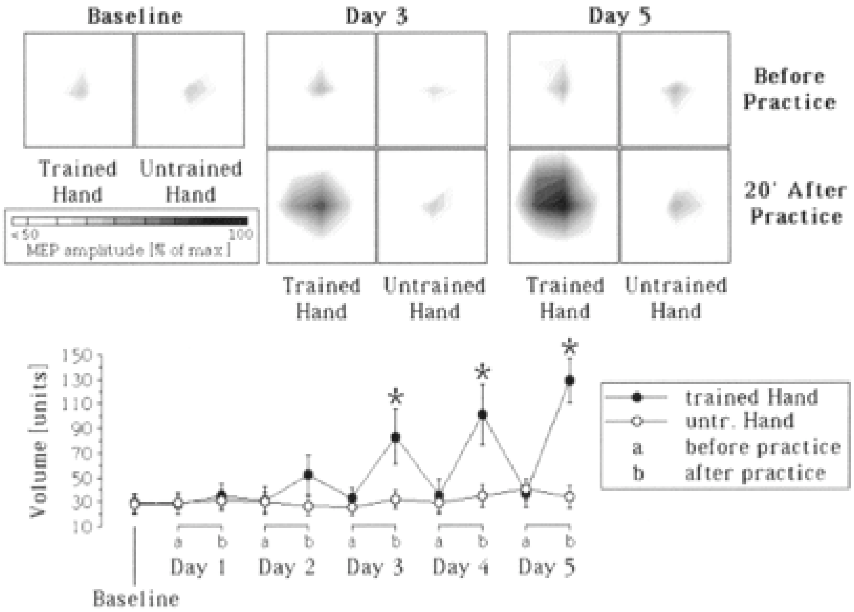
[a]Significant differences between AP musicians and non-AP musicians as well as between AP-musicians and nonmusicians.

GOTTFRIED SCHLAUG
The Brain of Musicians: A Model for Functional and Structural Adaptation
Ann NY Acad Sci 2001 930: 281-299.

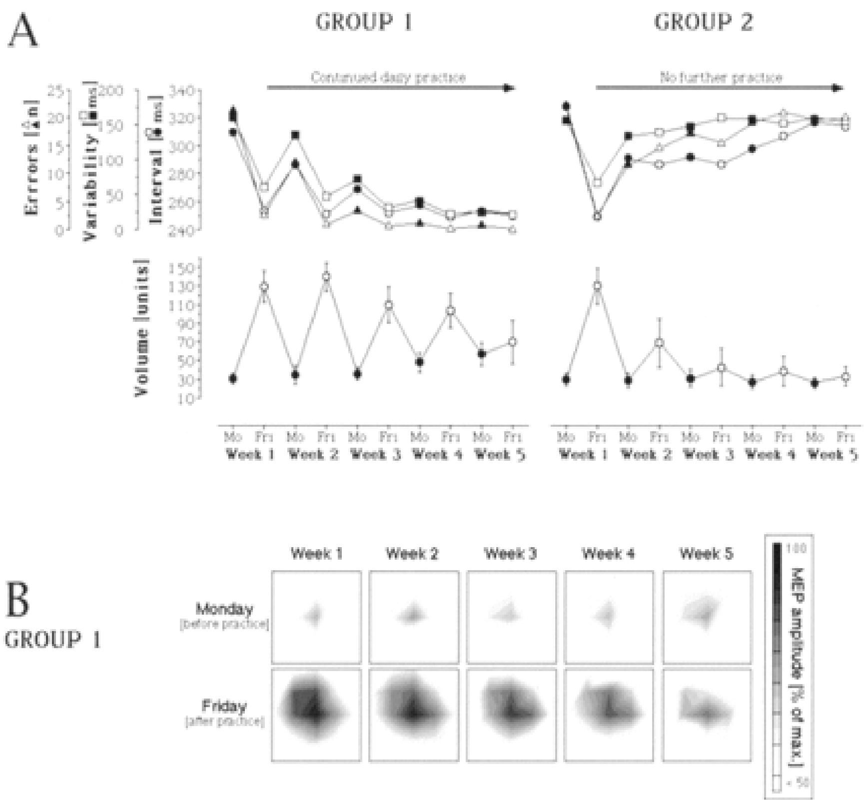


Le langage comme la musique sont localisés à gauche chez le musicien, la musique à droite chez les non musiciens

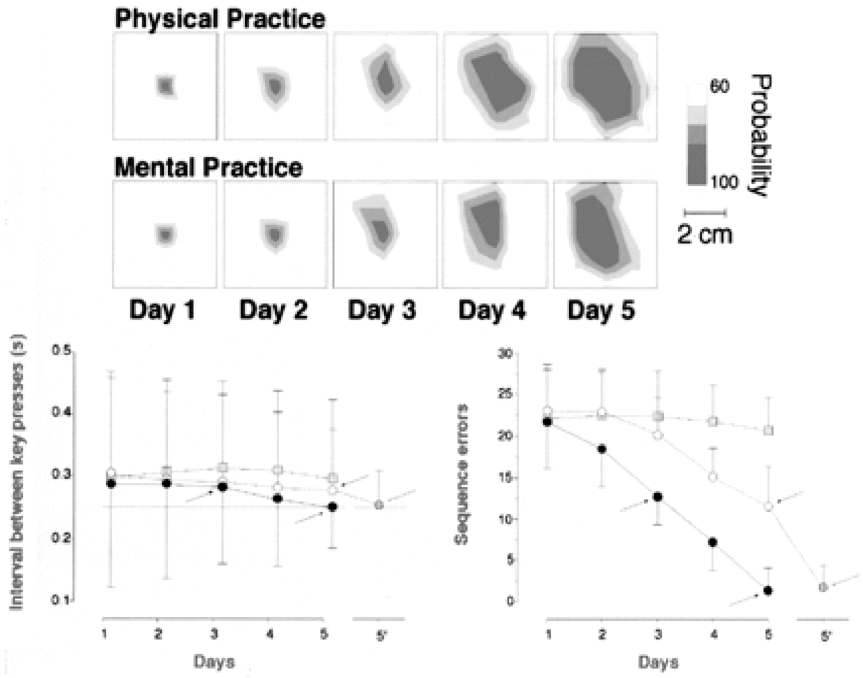
Aprendizaje de un gesto pianistico por no músicos : aumento de tamaño de la zona cortical de actividad



ALVARO PASCUAL-LEONE
The Brain That Plays Music and Is Changed by It
Ann NY Acad Sci 2001 930: 315-329



Al cabo de 5 semanas, la ventaja de fin de semana se transfiere al primer dia



Similitud entre práctica fisica y mental : mejoración proporcional de las medidas comportamentales

Enhancement of auditory cortical development by musical experience in children

Antoine Shahin,[2] Larry E. Roberts[1] and Laurel J. Trainor[1,CA]

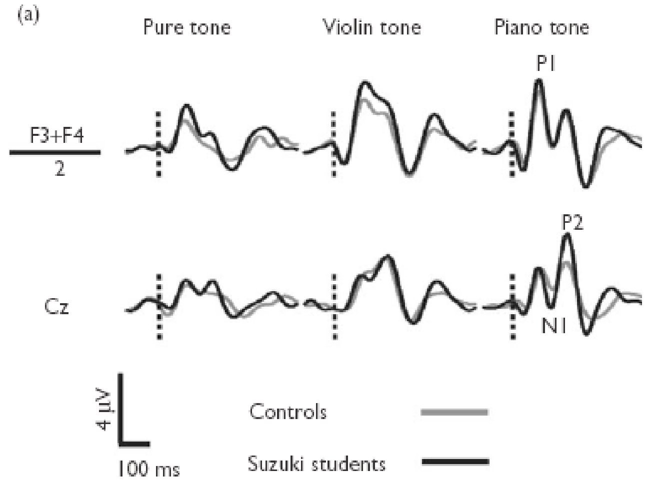
Unit of Medical Physics and Applied Radiation Sciences and [1]Department of Psychology, McMaster University, Hamilton, ON, L8S 4K1 Canada
[2]Present Address: The Rotman Research Institute, Baycrest Centre for Geriatric Care, 3560 Bathurst Street, Toronto, ON, M6A 2E1 Canada

[CA]Corresponding Author: LJT@mcmaster.ca

Received 24 May 2004; accepted 19 June 2004

6 Suzuki trained 5 year-old children

-5 pianists
-1 violinist



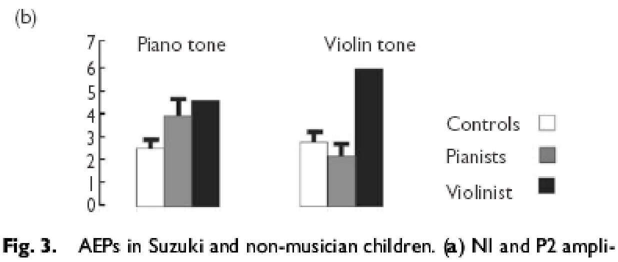


Fig. 3. AEPs in Suzuki and non-musician children. (a) N1 and P2 amplitude are enhanced in the Suzuki group only for piano tones (6 of the 7 Suzuki students played piano). The dotted vertical line denotes tone onset. (b) Timbre specificity. P2 amplitude evoked by the piano tones is larger in the Suzuki pianists ($n=6$) than in the non-musicians ($n=6$), but P2 evoked by the violin tones is not. P2 amplitude evoked by the violin tone is largest in the violinist ($n=1$) compared to the other groups and to P2 evoked by piano tones.

El modelo del músico : conlusiones

- Interés debido al carácter excepcional de la situación ofrecida por esa población especial
- Constituyen las primeras y tal vez más convincentes pruebas de modificaciones tanto morfológicas como funcionales del cerebro, como efecto de un entrenamiento
- No hay todavía un acuerdo total respecto a los mecanismos (adquirido o constitucional)
- El tema ofrece perspectivas muy interesantes a través de la comparación lenguaje/música

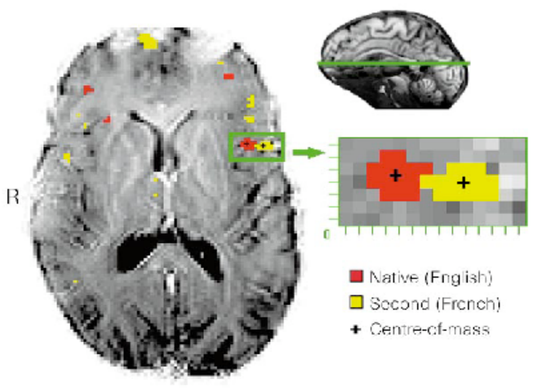


Figure 1 A representative axial slice from a 'late' bilingual subject (A) shows all

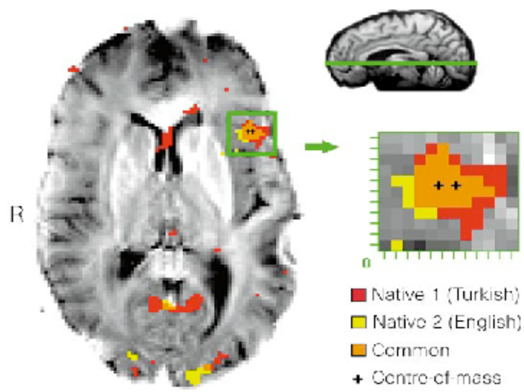
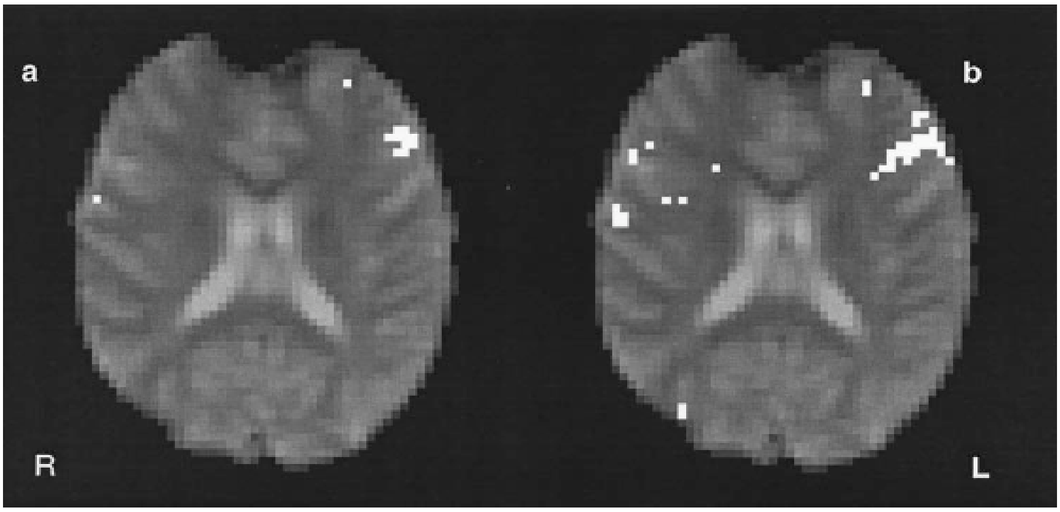


Figure 5 A representative axial slice from an 'early' bilingual subject (G) who learned English and Turkish simultaneously during early childhood shows all

Distinct cortical areas associated with native and second languages

Karl H. S. Kim*†, Norman R. Relkin†, Kyoung-Min Lee*† & Joy Hirsch*†

Magnetic Resonance Imaging 19 (2001) 643–647



English Chinese

(verb generation)

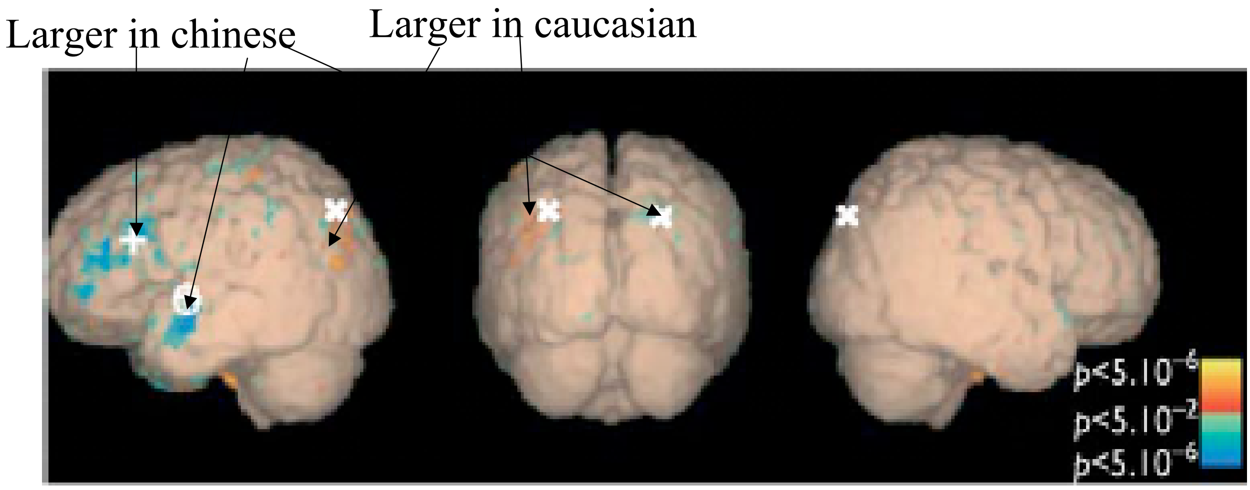
Cerebral hemodynamic response in Chinese (first) and English (second) language processing revealed by event-related functional MRI

Yonglin Pu[a], Ho-Ling Liu[b], John A. Spinks[c], Srikanth Mahankali[a], Jinhu Xiong[a], Ching-Mei Feng[a], Li Hai Tan[d], Peter T. Fox[a], Jia-Hong Gao[a]*

DEVELOPMENTAL NEUROSCIENCE NEUROREPORT

Localized morphological brain differences between English-speaking Caucasians and Chinese-speaking Asians: new evidence of anatomical plasticity

P. Kochunov, P. Fox[CA], J. Lancaster, L. H. Tan,[1] K. Amunts,[2] K. Zilles,[2,3] J. Mazziotta[4] and J. H. Gao

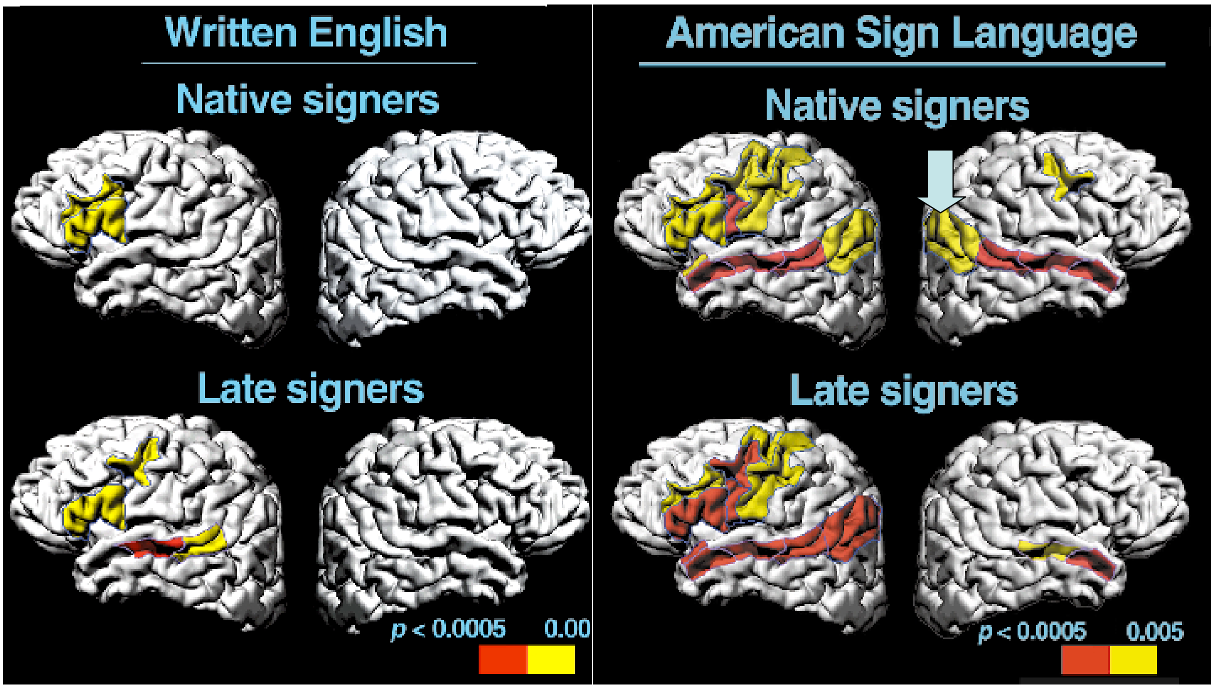


"Deformation field morphometry" 3D automatized measurement of cortical area

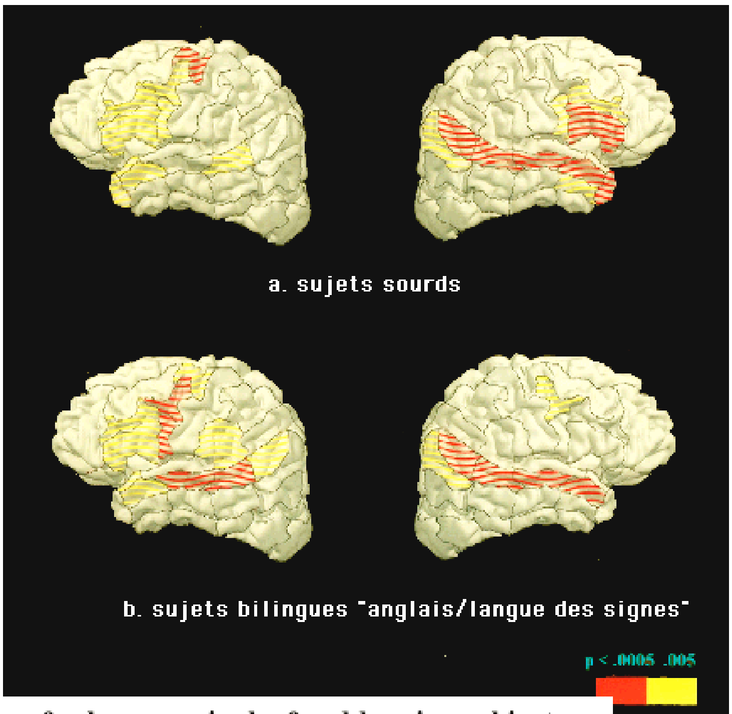
A critical period for right hemisphere recruitment in American Sign Language processing

Aaron J. Newman[1], Daphne Bavelier[2], David Corina[3], Peter Jezzard[4] and Helen J. Neville[1]

Signed languages such as American Sign Language (ASL) are natural languages that are formally similar to spoken languages, and thus present an opportunity to examine the effects of language structure and modality on the neural organization for language. Native learners of spoken languages show predominantly left-lateralized patterns of neural activation for language processing, whereas native learners of ASL show extensive right hemisphere (RH) and LH activation. We demonstrate that the RH angular gyrus is active during ASL processing only in native signers (hearing, ASL-English bilinguals) but not in those who acquired ASL after puberty (hearing, native English speakers). This is the first demonstration of a 'sensitive' or 'critical' period for language in an RH structure. This has implications for language acquisition and for understanding age-related changes in neuroplasticity more generally.

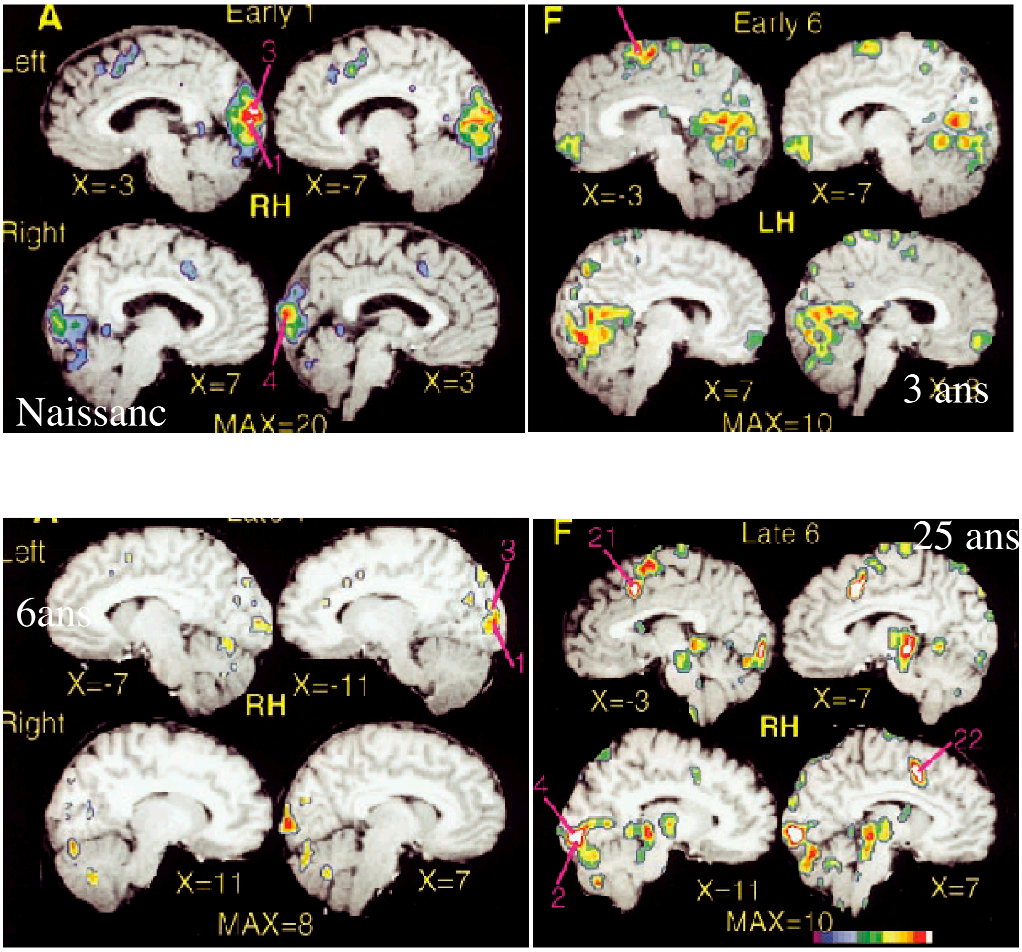


Compréhension de la langue des signes (Neville et al., 1998)



Cerebral organization for language in deaf and hearing subjects: Biological constraints and effects of experience

Helen J. Neville*†, Daphne Bavelier‡, David Corina§, Josef Rauschecker‡, Avi Karni¶, Anil Lalwani||**, Allen Braun||, Vince Clark||, Peter Jezzard||, and Robert Turner††



Lectura del Braille
Efecto de edad de ocurrencia de la ceguera

Bilingual corpus callosum variability

Porter E. Coggins III,[a,*,1] Teresa J. Kennedy,[b,2] and Terry A. Armstrong[c]

Available online at www.sciencedirect.com
SCIENCE DIRECT®
Brain and Language xxx (2003) xxx–xxx
Brain and Language
www.elsevier.com/locate/b&l

La zona media del C.C. es más vasta en los bilingües : ¿mayor capacidad fonética y/o actividad articulatoria?
(región dejando paso a las fibras motoras y pre-motoras)

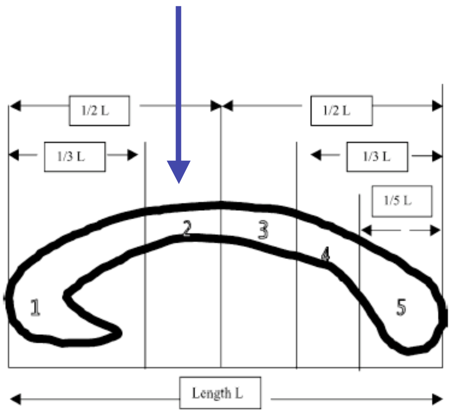
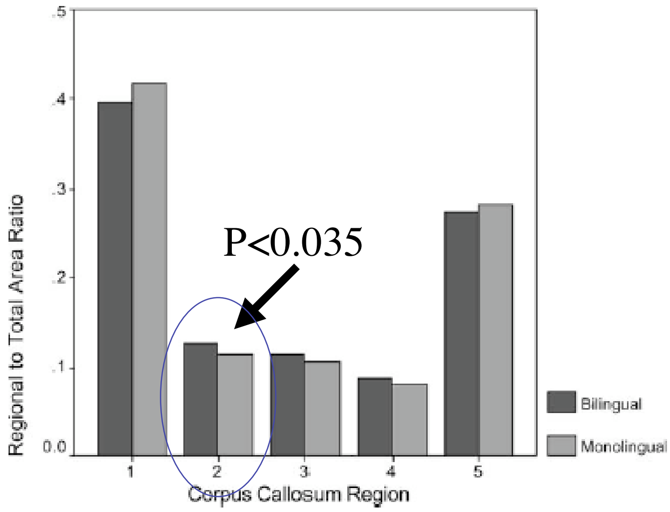


Fig. 1. Regional subdivision of the midsagittal corpus callosum. Region 1, anterior third; Region 2, anterior midbody; Region 3, posterior midbody; Region 4, isthmus; Region 5, splenium. Adapted from Witelson (1989).



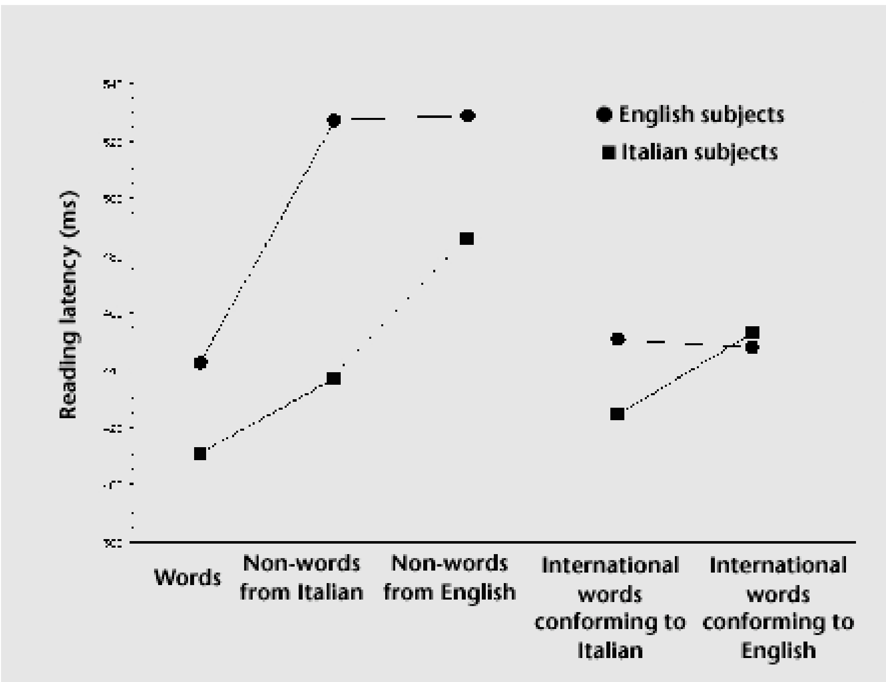
A cultural effect on brain function

E. Paulesu, E. McCrory, F. Fazio, L. Menoncello, N. Brunswick, S. F. Cappa, M. Cotelli, G. Cossu, F. Corte, M. Lorusso, S. Pesenti, A. Gallagher, D. Perani, C. Price, C. D. Frith, and U. Frith.

- Scientific Institute H S. Raffaele, INB-CNR, University of Milan-Bicocca, Milan, Italy
- Institute of Cognitive Neuroscience, University College London, 7 Queen Square, London WC1N 3AR, UK
- Wellcome Department of Cognitive Neurology, Institute of Neurology, 12 Queen Square, London WC1N 3GB, UK
- Neurology Department, University of Brescia, Brescia, Italy
- Psychology Department, University Vita e Salute H San Raffaele, Milan, Italy
- Istituto di Fisiologia Umana, University of Parma, Parma, Italy
- Scientific Institute Eugenio Medea-La Nostra Famiglia, Bosisio Parini, Italy

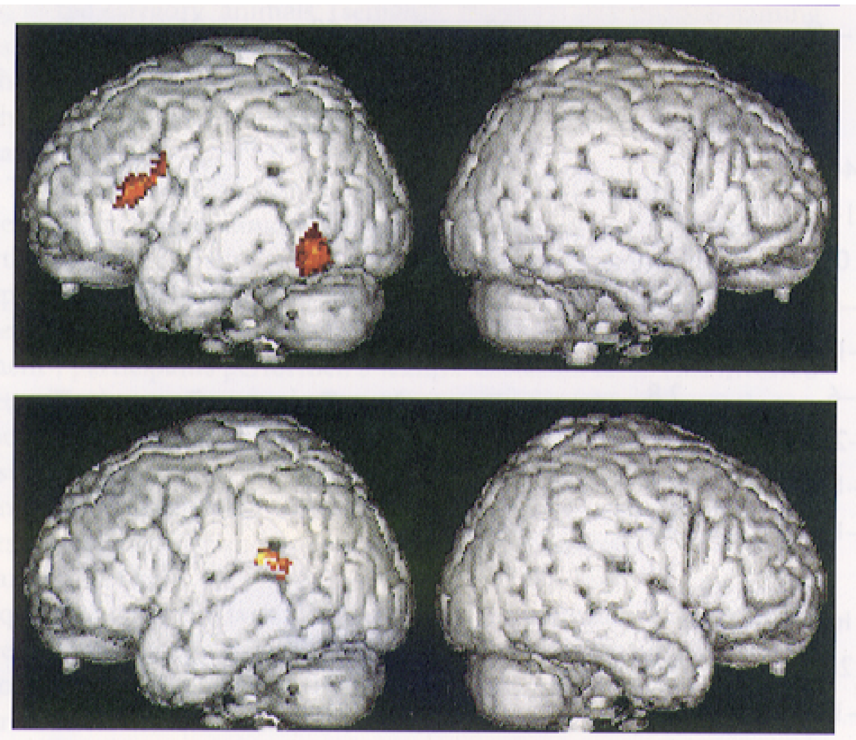
Correspondence should be addressed to U.F. (u.frith@ucl.ac.uk)

We present behavioral and anatomical evidence for a multi-component reading system in which different components are differentially weighted depending on culture-specific demands of orthography. Italian orthography is consistent, enabling reliable conversion of graphemes to phonemes to yield correct pronunciation of the word. English orthography is inconsistent, complicating mapping of letters to word sounds. In behavioral studies, Italian students showed faster word and non-word reading than English students. In two PET studies, Italians showed greater activation in left superior temporal regions associated with phoneme processing. In contrast, English readers showed greater activations, particularly for non-words, in left posterior inferior temporal gyrus and anterior inferior frontal gyrus, areas associated with word retrieval during both reading and naming tasks.



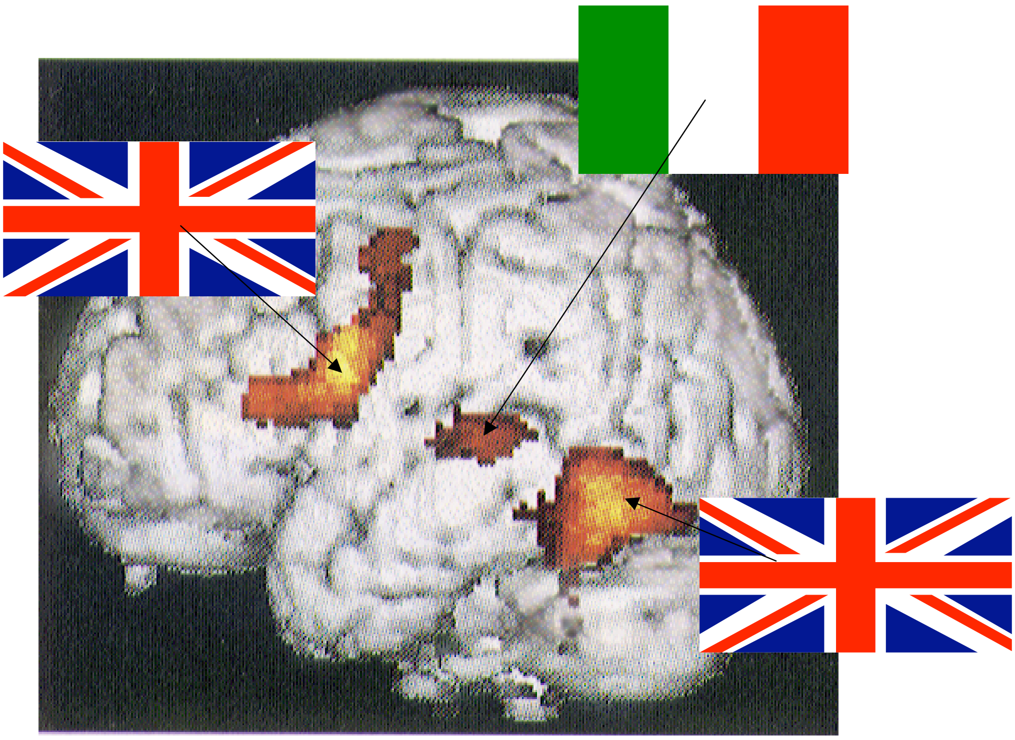
Vocal reaction times in single word and non-word reading (Paulesu et al. 2000)

Paulesu et al. (2000)
A cultural effect on brain function

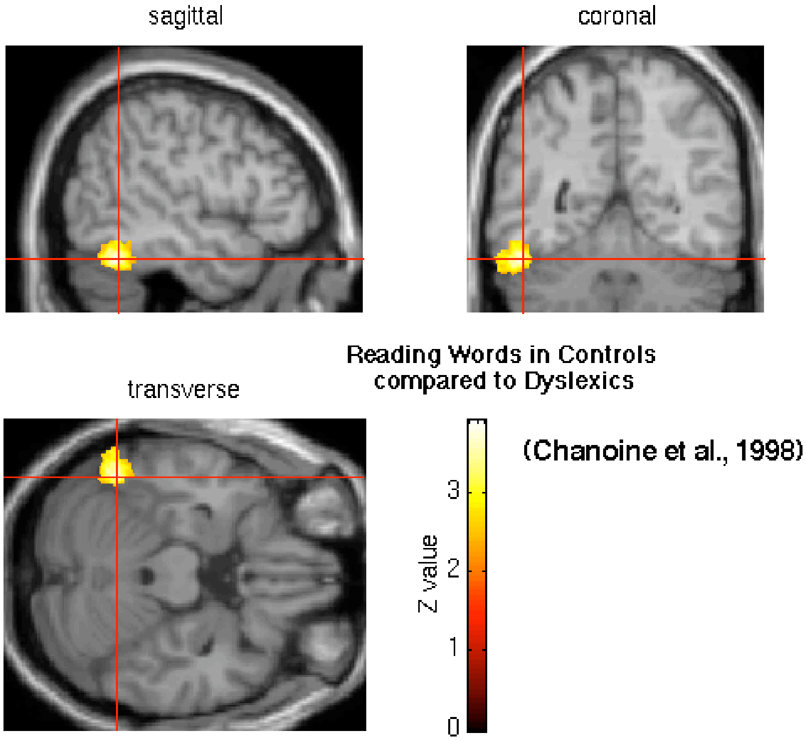


English > Italians :
(non-words)

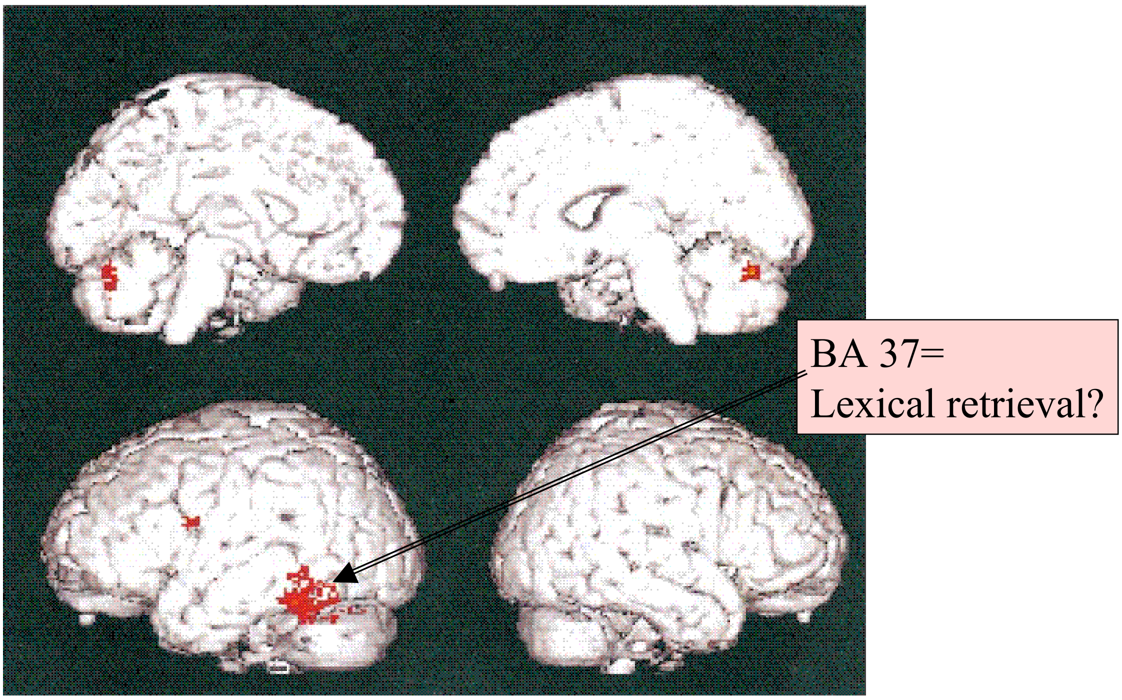
Italians > English
(all word types)



Paulesu et al. (2000)
A cultural effect on brain function



Pixels of maximal difference between dyslexics and controls



Areas of reduced activation in dyslexics relative to controls reading aloud words and non-words (Brunswick et al., 1999)

Dyslexia: Cultural Diversity and Biological Unity

E. Paulesu,[1,2]* J.-F. Démonet,[3] F. Fazio,[2,4] E. McCrory,[5] V. Chanoine,[3] N. Brunswick,[6] S. F. Cappa,[7] G. Cossu,[8] M. Habib,[9] C. D. Frith,[6] U. Frith[5]

The recognition of dyslexia as a neurodevelopmental disorder has been hampered by the belief that it is not a specific diagnostic entity because it has variable and culture-specific manifestations. In line with this belief, we found that Italian dyslexics, using a shallow orthography which facilitates reading, performed better on reading tasks than did English and French dyslexics. However, all dyslexics were equally impaired relative to their controls on reading and phonological tasks. Positron emission tomography scans during explicit and implicit reading showed the same reduced activity in a region of the left hemisphere in dyslexics from all three countries, with the maximum peak in the middle temporal gyrus and additional peaks in the inferior and superior temporal gyri and middle occipital gyrus. We conclude that there is a universal neurocognitive basis for dyslexia and that differences in reading performance among dyslexics of different countries are due to different orthographies.

[1]Psychology Department, University of Milan Bicocca, Milan, Italy. [2]INB-CNR, Scientific Institute H San Raffaele, Milan, Italy. [3]INSERM U455, Hôpital Purpan, Toulouse, France. [4]Neuroscience and Biomedical Technologies Department, University of Milan Bicocca, Milan, Italy. [5]Institute of Cognitive Neuroscience, University College London, London, UK. [6]Wellcome Department of Cognitive Neurology, Institute of Neurology, London, UK. [7]Psychology Department, University "Vita e Salute H San Raffaele", Milan, Italy. [8]Institute of Human Physiology, University of Parma, Parma, Italy. [9]Centre de Recherche Institut Universitaire de Gériatrie, Montréal, Quebec, Canada.

*To whom correspondence should be addressed at University of Milan Bicocca. E-mail: eraldo.paulesu@unimib.it

www.sciencemag.org SCIENCE VOL 291 16 MARCH 2001

NeuroImage 13, 836–846 (2001)
doi:10.1006/nimg.2001.0749, available online at http://www.idealibrary.com on IDEAL®

The Neural System Underlying Chinese Logograph Reading

Li Hai Tan,* Ho-Ling Liu,† Charles A. Perfetti,‡ John A. Spinks,§ Peter T. Fox,¶ and Jia-Hong Gao¶

pronounc		meaning	pronounc		meaning
/yue/	阅	"view","read"	/hua/	画	"draw"
	+			+	
/kan/,	看	"look","view."	/hua/	话	"talk", "words"

Semantic similarity judgment

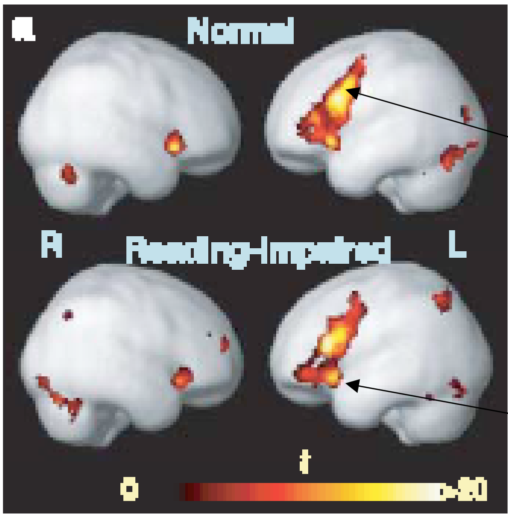
Homophone judgment

Biological abnormality of impaired reading is constrained by culture

NATURE | VOL 431 | 2 SEPTEMBER 2004 | www.nature.com/nature

Wai Ting Siok[1], Charles A. Perfetti[2], Zhen Jin[3] & Li Hai Tan[1,4]

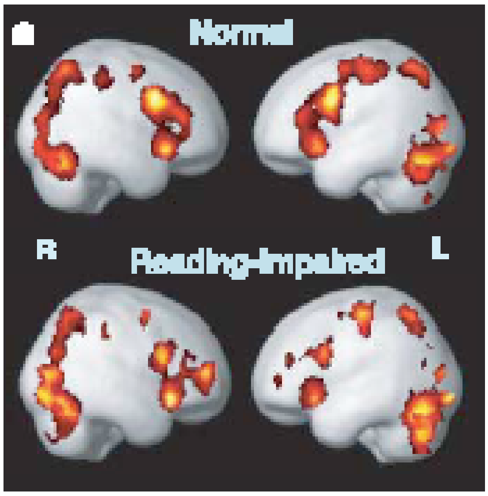
Orthography - to-phonology mapping
Homophone judgm - letter size decision



LMFG (9)
<activation

LIFG (44)
>activation

Orthography -to-semantic mapping
Chinese character decision - fixation

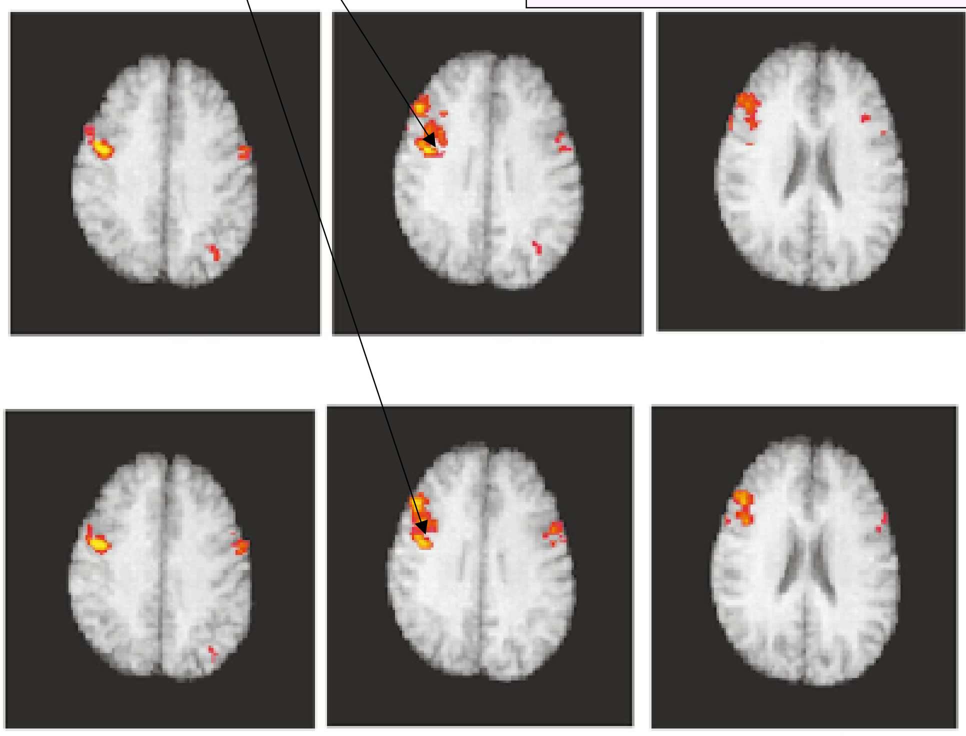


Bilateral < activation M+IFG
+left inf temporal

Chinese dyslexia : different biological basis

Left middle
frontal gyrus

" this region may act as a central executive system of working memory that is responsible for coordination of cognitive resources "???

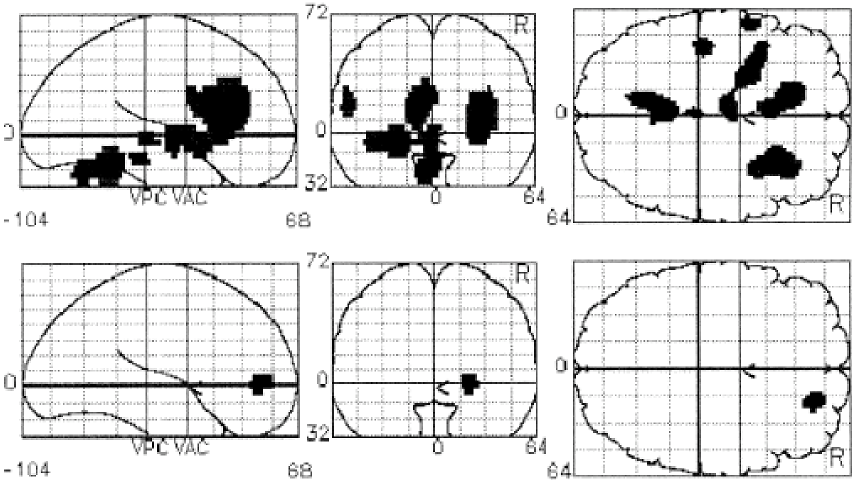


Homophone decision

Semantic decision

literates

illiterates



Non-words-words (repetition)

Brain (1998), **121**, 1053–1063

The illiterate brain

Learning to read and write during childhood influences the functional organization of the adult brain

A. Castro-Caldas,[1] K. M. Petersson,[2] A. Reis,[1] S. Stone-Elander[2] and M. Ingvar[2]

[1]Centro de Estudos Egas Moniz, Hospital de Santa Maria, Lisbon, Portugal and [2]Cognitive Neurophysiology, Department of Clinical Neuroscience, Karolinska Hospital, Stockholm, Sweden

Correspondence to: Professor A. Castro-Caldas, Centro Estudos Egas Moniz, Hospital Santa Maria, 1600 Lisbon, Portugal. E-mail: labling@mail.telepac.pt

JOSÉ MORAIS

L'ART DE LIRE

EDITIONS ODILE JACOB

1. Dizes que em mim gosto fazes
2. Na presença da minha mãe
3. Por enquanto ainda estou bem
4. Ainda não penso em rapazes
5. Grande vontade tu trazes
6. De ires comigo pró jardim
7. Moço não penses assim
8. E tu não gastes calçado
9. Porque não dá resultado
10. Passos que dês por mim.

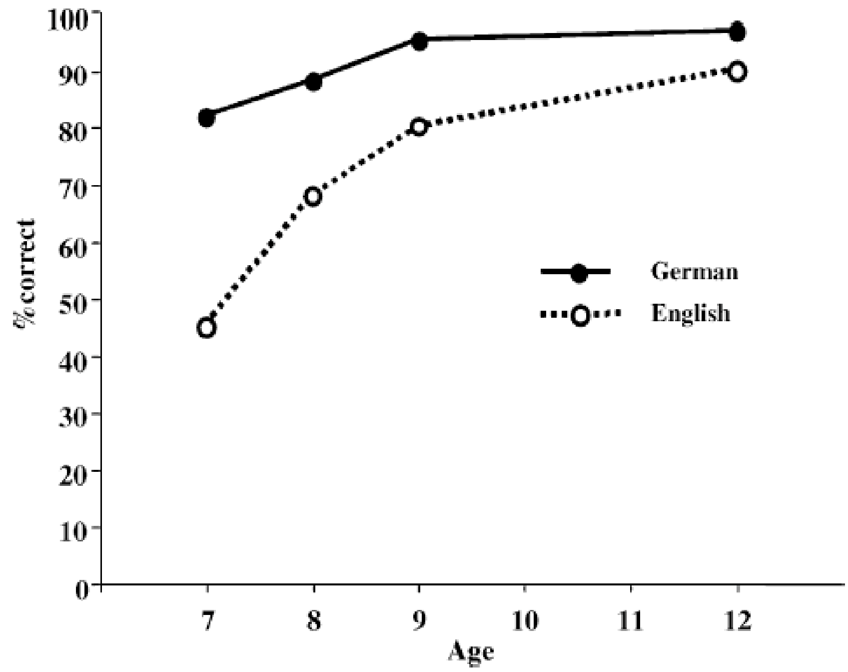
[1. Tu dis que je suis à ton goût
2. En présence de ma mère
3. Pour l'instant je m'en moque
4. Je ne pense pas aux garçons
5. Grande envie tu portes
6. De me mener au jardin
7. Jeune homme n'y pense pas
8. Et n'use pas tes souliers
9. Car ne mèneraient à rien
10. Les pas que tu feras pour moi.]

Francisco de Jesus Calado

Comparación entre lenguas

- En Inglés : 40 fonemas - 1120 grafemas
- En Italiano : 25 fonemas - 33 grafemas
- Lectores prinicipiantes italianos : 92% de exactitud en lectura de palabras despues de 6 meses de aprendizaje
- Exactitud tiempo de lectura despues de 3 años de aprendizaje muy superiores en niños alemanes que ingleses.
- Lectura de no-palabras significativamente más lenta en ingleses que italianos o serbo-croates

LECTURA DE PSEUDO-PALABRAS : NIÑOS INGLESES VS ALEMANES



Frith, U., Wimmer, H., & Landerl, K. (1998). Differences in phonological recoding in German- and English-speaking children. *Scientific Studies of Reading*, *2*, 31–54.

Applied Psycholinguistics **24** (2003), 621–635
Printed in the United States of America
DOI: 10.1017.S0142716403000316

Learning to read: English in comparison to six more regular orthographies

MIKKO ARO
University of Jyväskylä and Niilo Mäki Institute

HEINZ WIMMER
University of Salzburg

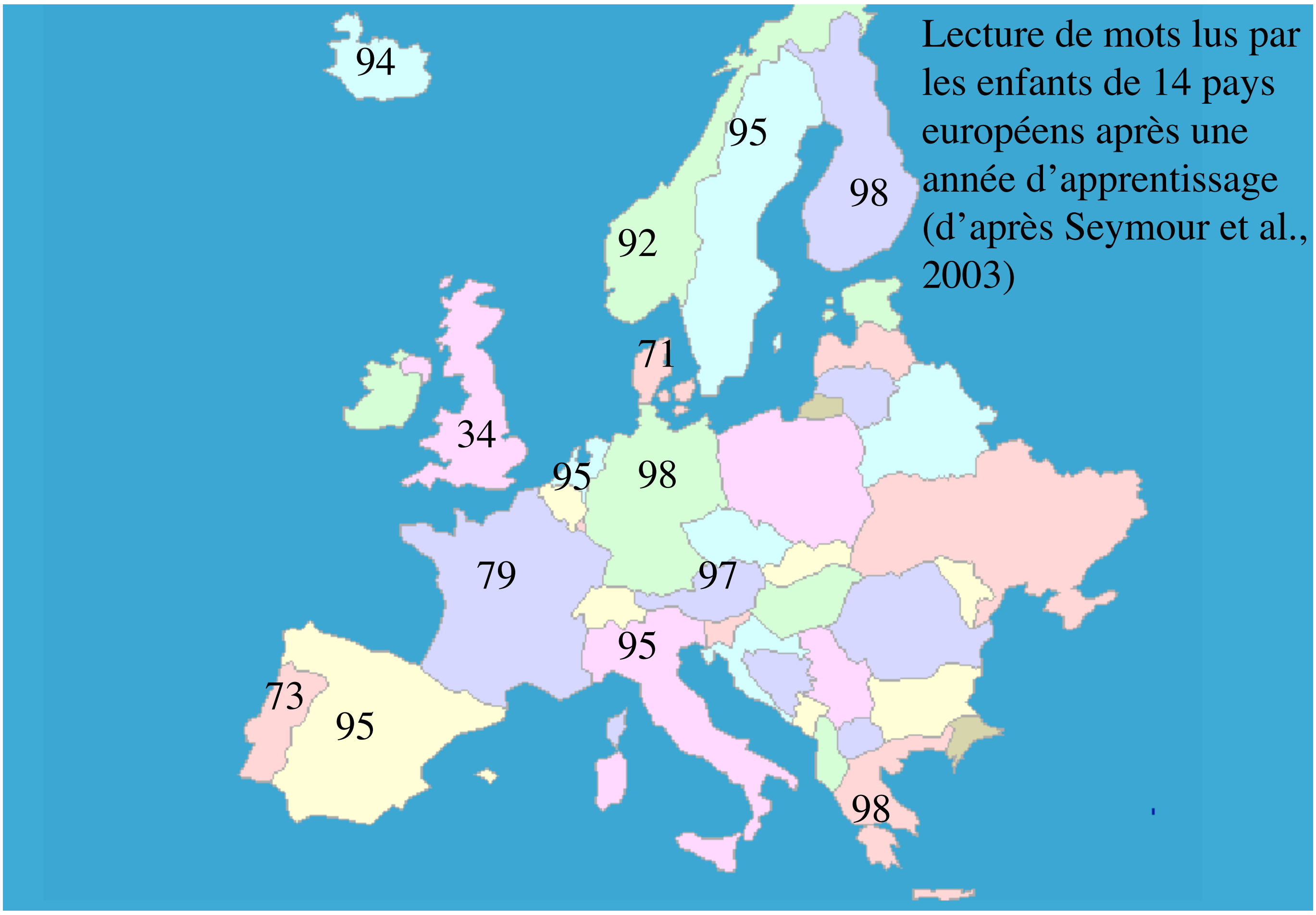
Table 3. *Percentage of accurately read pseudowords (means and standard deviations)*

	Grade 1		Grade 2		Grade 3		Grade 4	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
English	50.3	32.8	71.0	32.5	73.5	28.8	88.2	15.2
French	86.7	5.9	96.7	3.5	98.4	2.4	98.5	2.7
German	88.0	12.4	87.3	9.5	86.0	15.2	87.2	19.5
Dutch	85.2	8.0	88.9	9.1	91.2	8.1	95.1	5.8
Spanish	87.3	12.2	90.4	8.1	90.9	6.8	90.6	8.2
Swedish	93.2	9.6	90.8	10.5	95.4	8.2	97.4	4.3
Finnish	84.9	13.6	89.6	10.1	88.4	8.1	93.7	8.3

Number word and pseudoword items in each language

English		German		Dutch	
Two	Thro	Zwei	Nei	Twee	Tee
Three	Nee	Drei	Fei	Drie	Nie
Four	Nour	Vier	Zwier	Vier	Twier
Five	Twive	Fünf	Sünf	Vijf	Zijf
Six	Tix	Sechs	Vechs	Zes	Twes
Seven	Feven	Sieben	Zieben	Zeven	Veven
Nine	Thrine	Neun	Dreun	Negen	Dregen
Ten	Sen	Zehn	Zwehn	Tien	Vien
Twelve	Felve	Zwölf	Sölf	Twaalf	Zaalf

Swedish		French		Spanish	
Två	Sjå	Deux	Seux	Dos	Sos
Tre	Ne	Trois	Dois	Tres	Ces
Fyra	Tvyra	Quatre	Datre	Cuatro	Duatro
Fem	Tem	Cinq	Dinq	Cinco	Ninco
Sex	Tex	Six	Nix	Seis	Ceis
Sju	Tru	Sept	Trept	Siete	Diete
Nio	Sio	Neuf	Seuf	Nueve	Dueve



« irrégularités » du Portugais

Quelques consonnes

/gɛRɑ/ *guerra*

/kɛtə/ *quente*

/lĩngwɑ/ *língua*

/kwɑ̃dru/ *quando*

5 voyelles nasales

(/ɑ̃/, /ẽ/, /ĩ/, /õ/, /ũ/)

En plus des 9 orales

(/a/, /ɑ/, /e/, /ɛ/, /ə/, /i/, /o/, /ɔ/, /u/)

Applied Psycholinguistics 23:1 143
Defior et al.: Reading acquisition in two shallow orthographies

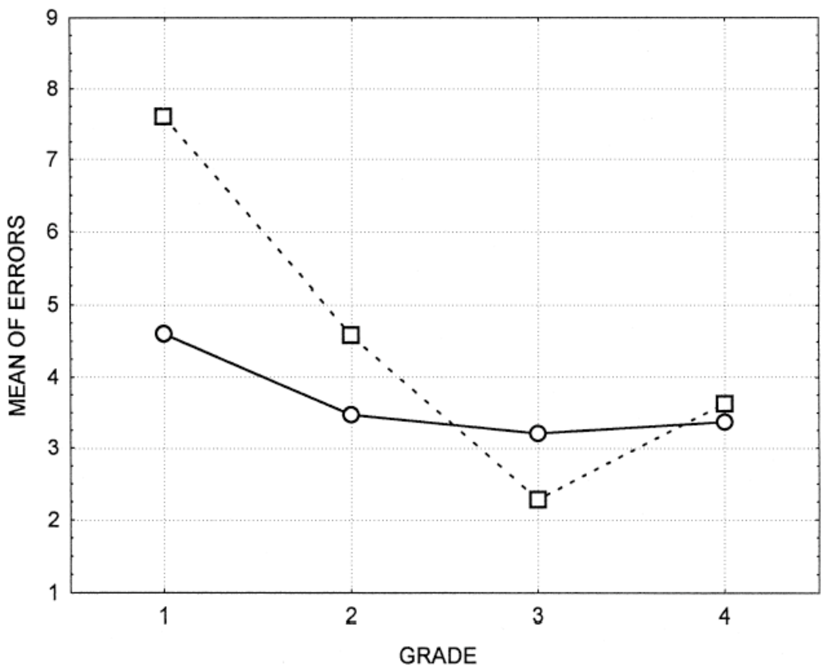


Figure 2. The mean number of errors in the pseudoword reading list as a function of grade and orthography for (○) Spanish and (□) Portuguese.

Comparaison de deux langues transparentes (portugais et espagnol)

Applied Psycholinguistics **23** (2002), 135–148
Printed in the United States of America
DOI: 10.1017.S0142716402000073

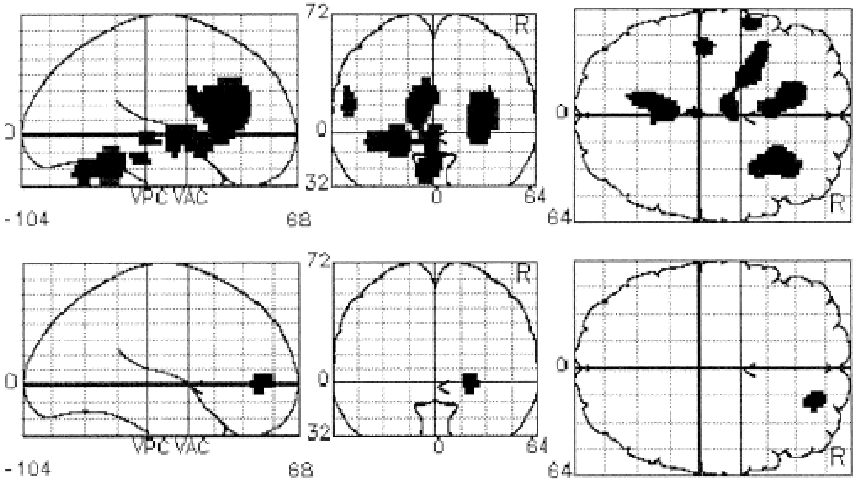
Differences in reading acquisition development in two shallow orthographies: Portuguese and Spanish

SYLVIA DEFIOR and FRANCISCO MARTOS
University of Granada, Spain

LUZ CARY
University of Lisbon, Portugal

literates

illiterates



Non-words-words (repetition)

Brain (1998), **121**, 1053–1063

The illiterate brain

Learning to read and write during childhood influences the functional organization of the adult brain

A. Castro-Caldas,[1] K. M. Petersson,[2] A. Reis,[1] S. Stone-Elander[2] and M. Ingvar[2]

[1]*Centro de Estudos Egas Moniz, Hospital de Santa Maria, Lisbon, Portugal and* [2]*Cognitive Neurophysiology, Department of Clinical Neuroscience, Karolinska Hospital, Stockholm, Sweden*

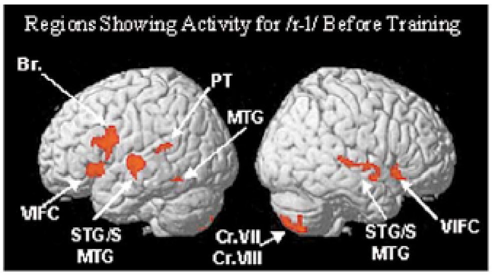
Correspondence to: Professor A. Castro-Caldas, Centro Estudos Egas Moniz, Hospital Santa Maria, 1600 Lisbon, Portugal. E-mail: labling@mail.telepac.pt

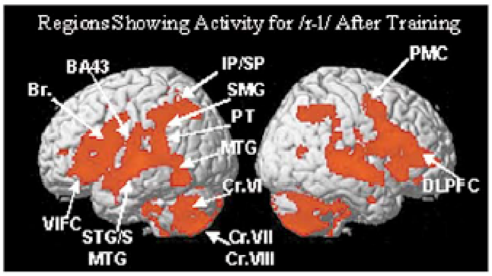
NeuroImage 19 (2003) 113–124 www.elsevier.com/locate/ynimg

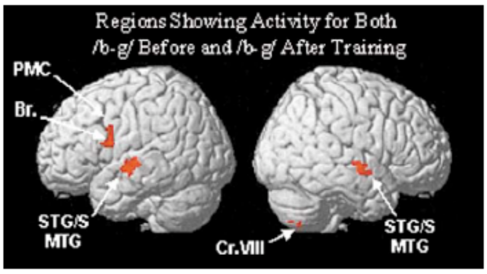
Learning-induced neural plasticity associated with improved identification performance after training of a difficult second-language phonetic contrast

Daniel E. Callan,[a,*] Keiichi Tajima,[a] Akiko M. Callan,[b] Rieko Kubo,[a] Shinobu Masaki,[b] and Reiko Akahane-Yamada[a]

[a] Human Information Science Laboratories, ATR International, Kyoto 619-0288, Japan
[b] Brain Activity Imaging Center, ATR International, Kyoto 619-0288, Japan







L'apprentissage intensif pendant un mois du contraste /r-l/ chez des japonais se manifeste par une activation massive des deux régions périsylviennes et du cervelet, bien au-delà de l'effet d'un contraste facile (/b-g/)

Representation of Sound Categories in Auditory Cortical Maps

Frank H. Guenther*†, Alfonso Nieto-Castanon*, Satrajit S. Ghosh* & Jason A. Tourville*‡

Journal of Speech, Language, and Hearing Research, 2004, 47(1), pp. 46-57

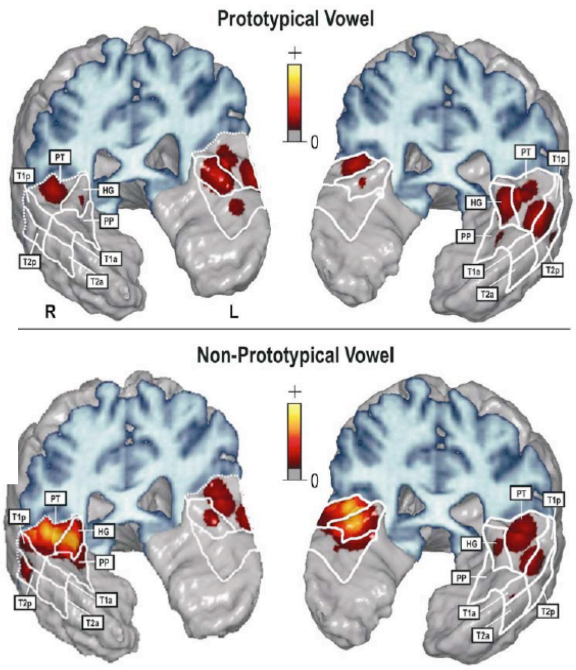


Figure 2. Average temporal lobe activations for the prototypical vowel (upper panels) and non-prototypical vowel (lower panels) conditions in Experiment 1. The frontal and parietal lobes have been removed to the posterior end of the sylvian fissure to expose the intrasylvian regions of the temporal lobe. Listening to the prototypical example of a vowel /i/ results in less activation than listening to the non-prototypical example in auditory cortical areas in the temporal lobe and supratemporal plane. HG = Heschl's gyrus; PT = planum temporale; PP = planum polare; T1a,T1p = anterior/posterior superior temporal gyrus; T2a,T2p = anterior/posterior middle temporal gyrus.

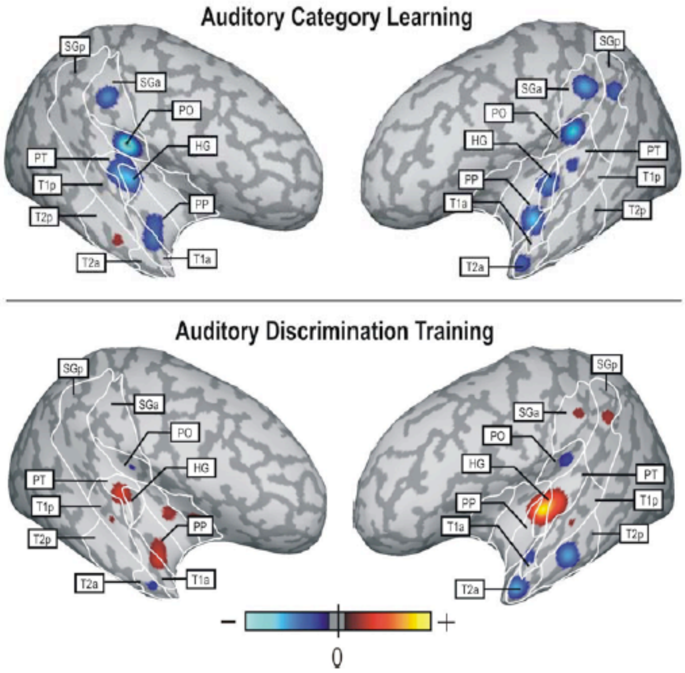


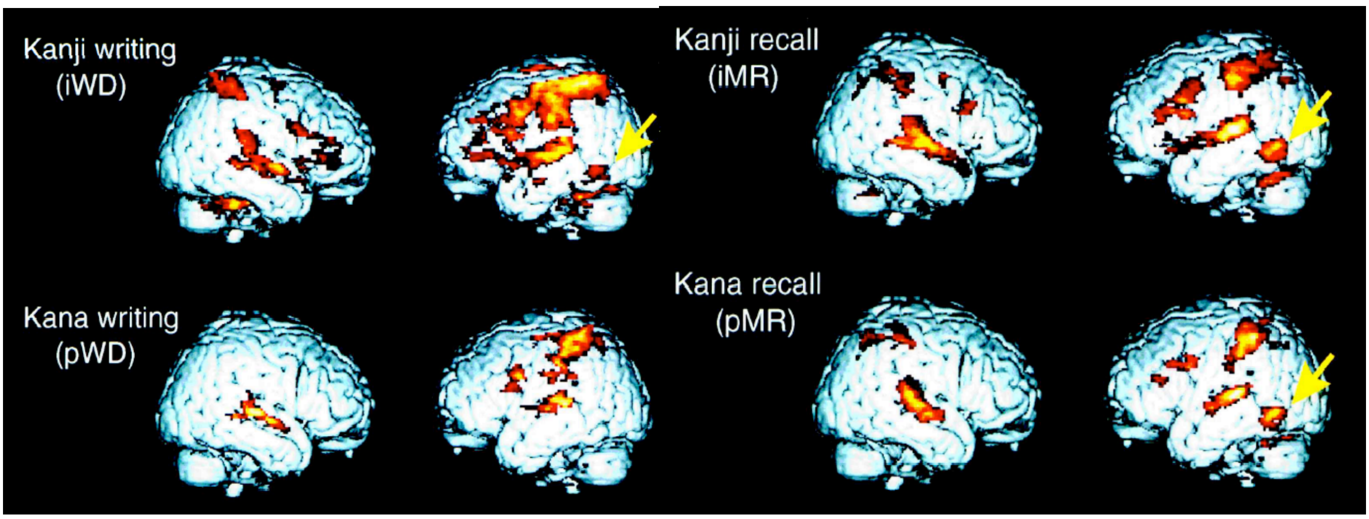
Figure 5. Results of Experiments 2 and 3 displayed on an inflated cortical surface. Plots show difference between post- and pre-training activations for the training stimuli minus the control stimuli in each region of interest. **Upper panels:** Effects of learning a novel auditory category (Experiment 2). Blue activations indicate regions in which training has led to a relative decrease in activation for stimuli from within the newly learned category. **Lower panels:** Effects of discrimination training (Experiment 3). In contrast to category learning, discrimination training leads to a relative increase of activation (red) for the training stimuli in the peri-sylvian cortical regions. HG = Heschl's gyrus; PT = planum temporale; PP = planum polare; T1a,T1p = anterior/posterior superior temporal gyrus; T2a,T2p = anterior/posterior middle temporal gyrus; PO = parietal operculum; SGa,SGp = anterior/posterior supramarginal gyrus.

Modulation of the Visual Word Retrieval System in Writing: A Functional MRI Study on the Japanese Orthographies

Kimihiro Nakamura[1], Manabu Honda[2], Shigeru Hirano[1], Tatsuhide Oga[1], Nobukatsu Sawamoto[1], Takashi Hanakawa[1], Hiroshi Inoue[3], Jin Ito[3], Tetsu Matsuda[1], Hidenao Fukuyama[1], and Hiroshi Shibasaki[1]

Left inferior temporal area activated with kanji (ideogram) more than kana (phonogram)

/to-ke-i/
時計 (kanji)
とけい (kana)



2002 Massachusetts Institute of Technology
Journal of Cognitive Neuroscience 14:1, pp. 104-115

Brain imaging of language plasticity in adopted adults: can a second language replace the first?
Pallier et al., sous presse

confidence that the sentences were in Korean (7= 100% sure it is Korean; 4=totally unsure, 1= sure it is not Korean).