ASSOCIAZIONE ITALIANA DISLESSIA ONLUS

9° Congresso Nazionale

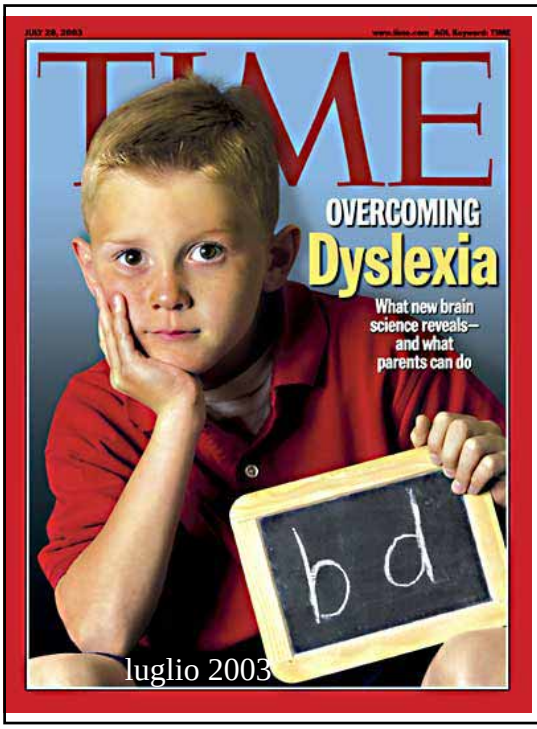
I dislessici crescono:

strategie e criticità per adolescenti e adulti

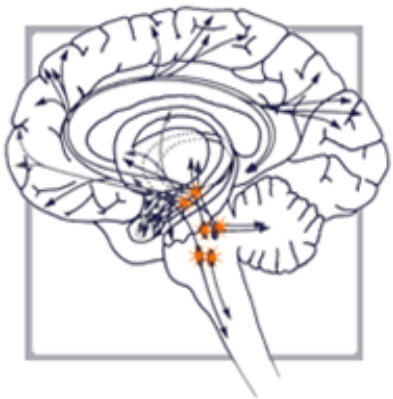
ASSISI
26-27 maggio 2006

Neuropsicologia della lettura e scrittura nei DSA

Massimo Piccirilli

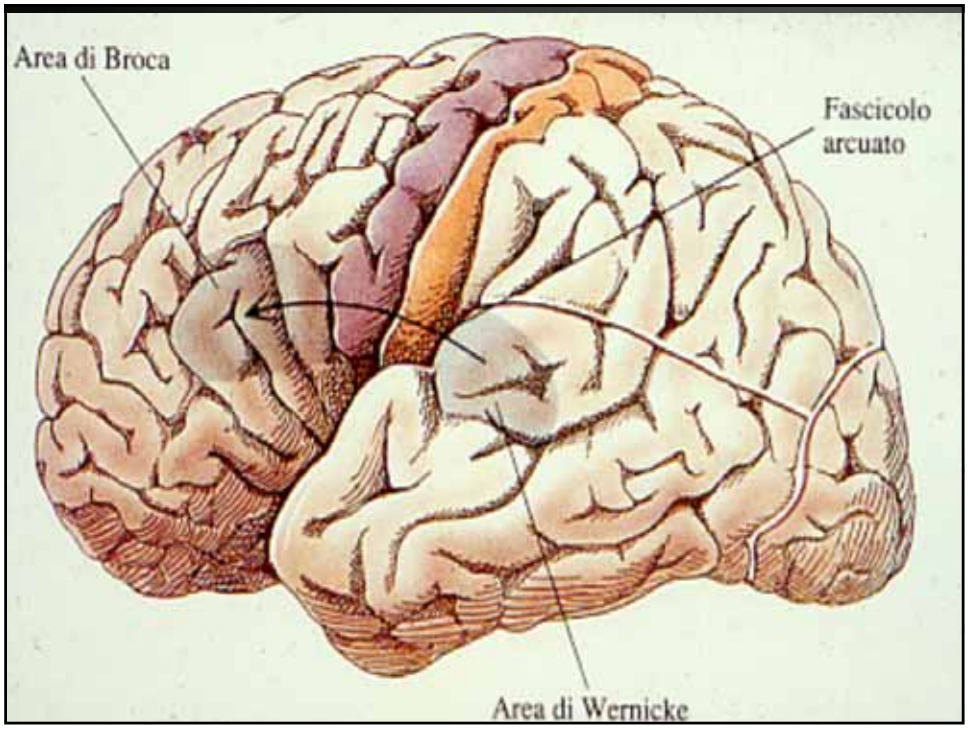


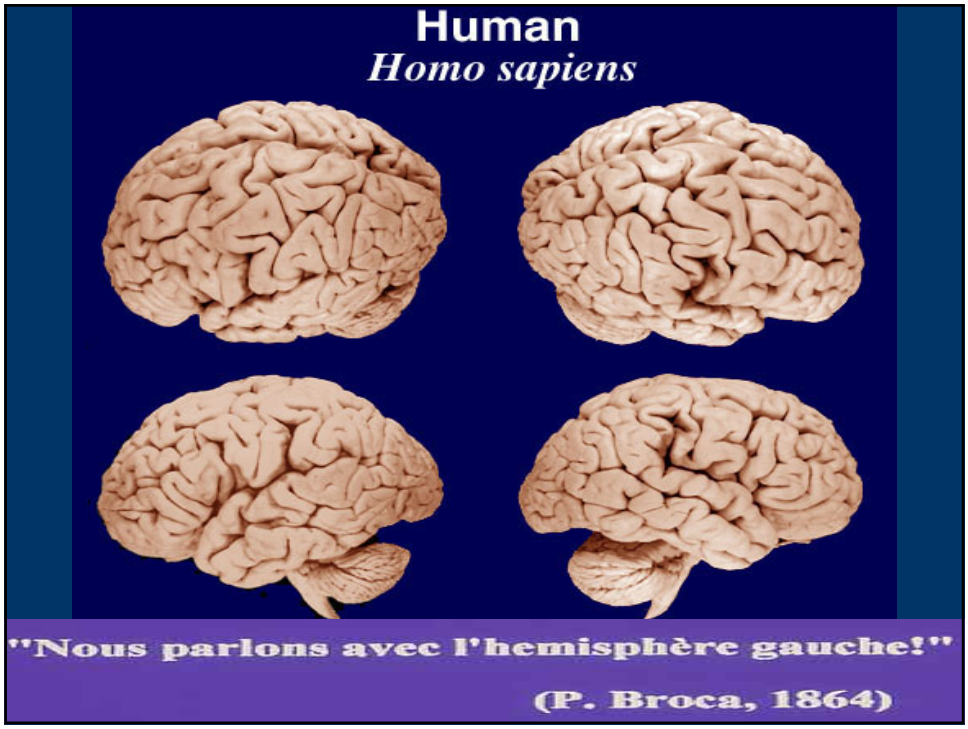
luglio 2003



Neuropsicologia:
settore delle neuroscienze che
studia la relazione
fra cervello e comportamento

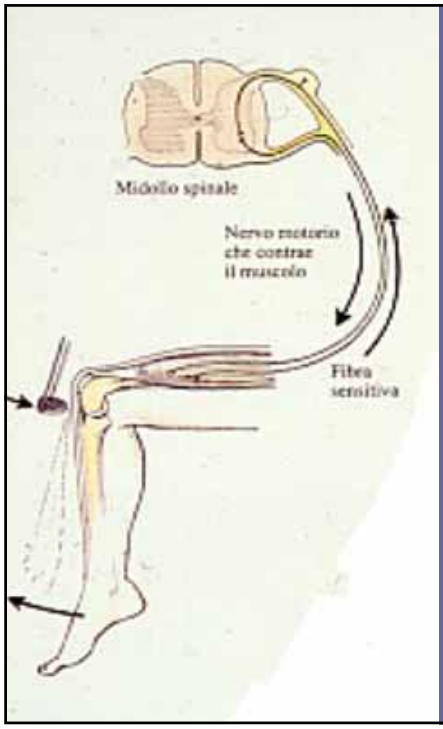
Disturbi del comportamento
conseguenti ad una lesione cerebrale





Valutazione psicometrica

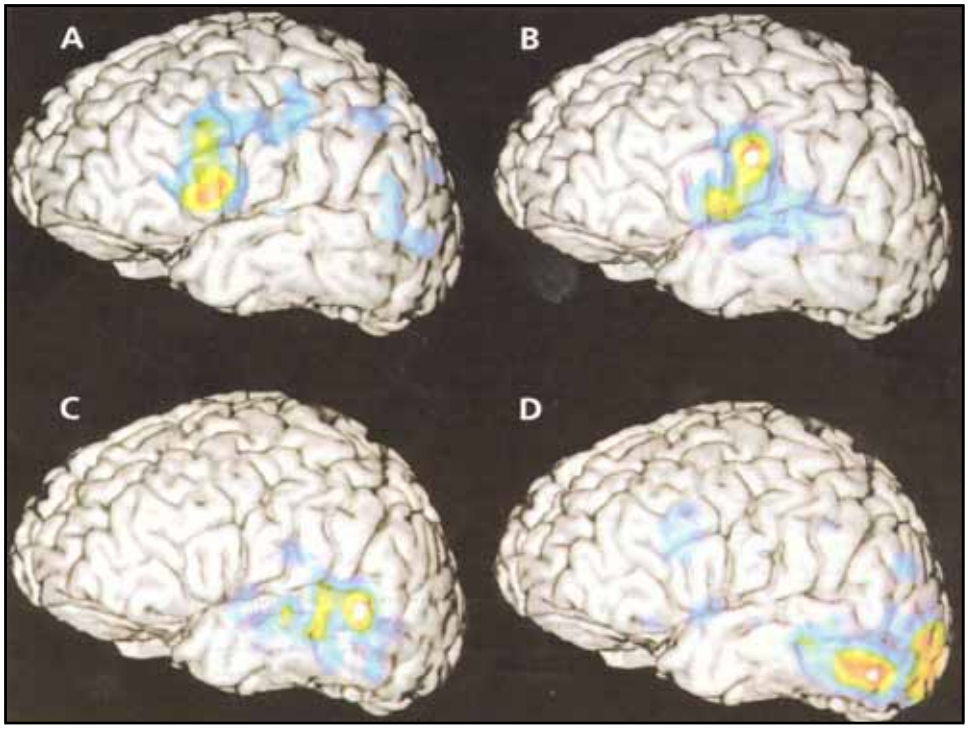
misurare una prestazione
e collocare il soggetto
lungo una scala di valori
che ne identifica il livello
nell'ambito di una
popolazione di riferimento

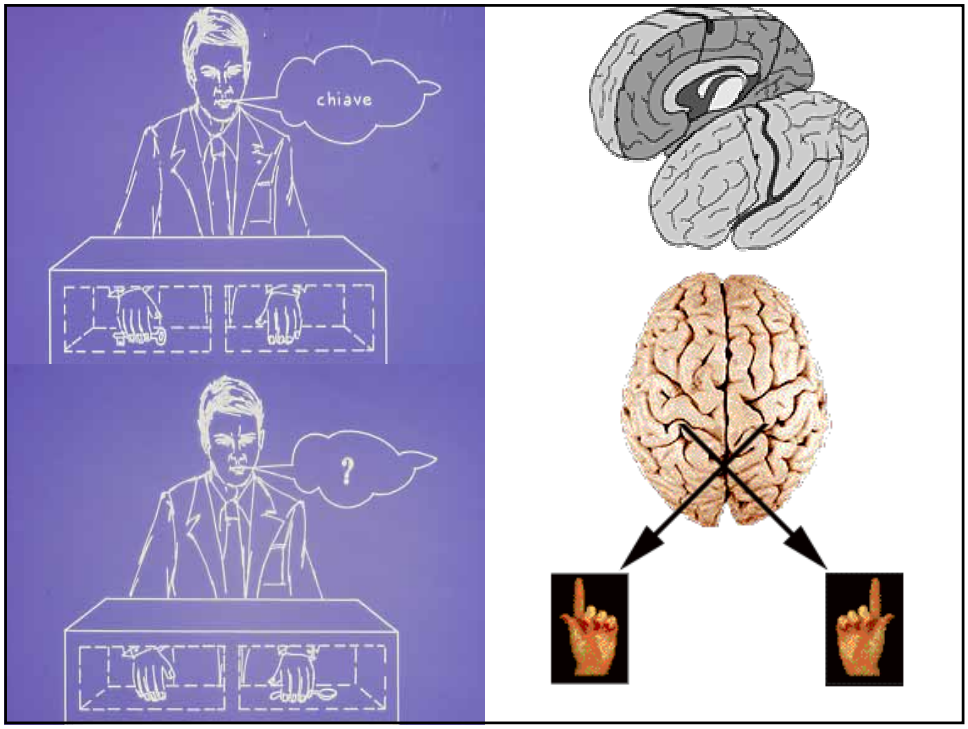


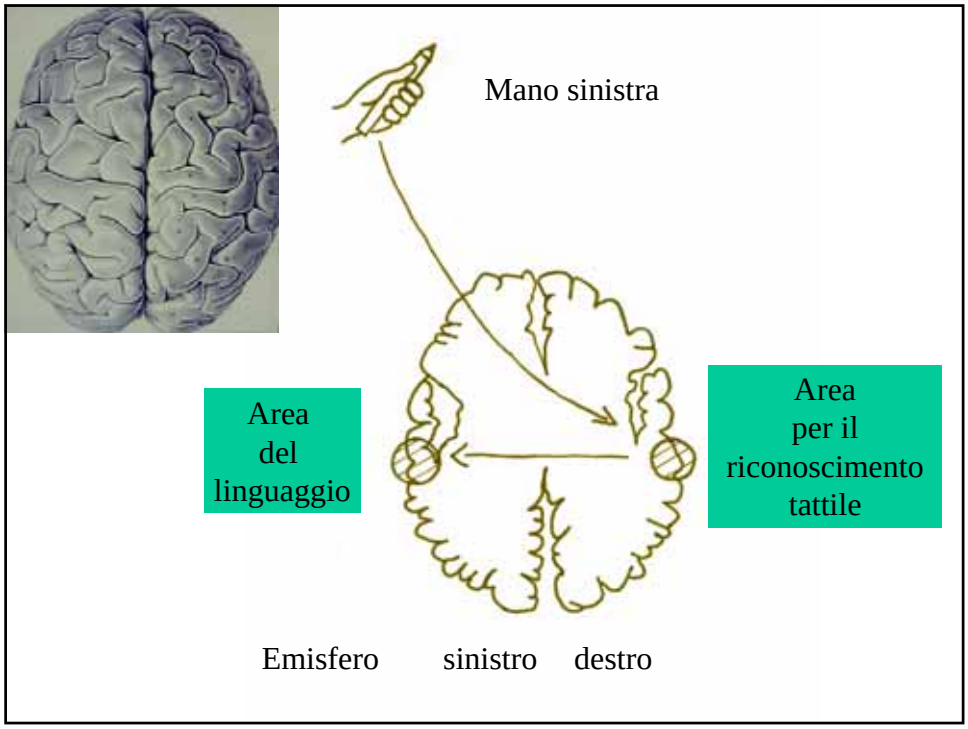
Valutazione neuropsicologica

interpretare il comportamento
al fine di valutare
l'integrità anatomofunzionale
delle corrispondenti
strutture nervose

analisi della modalità
e delle strategie
che il soggetto mette in atto
per ottenere quella
determinata prestazione

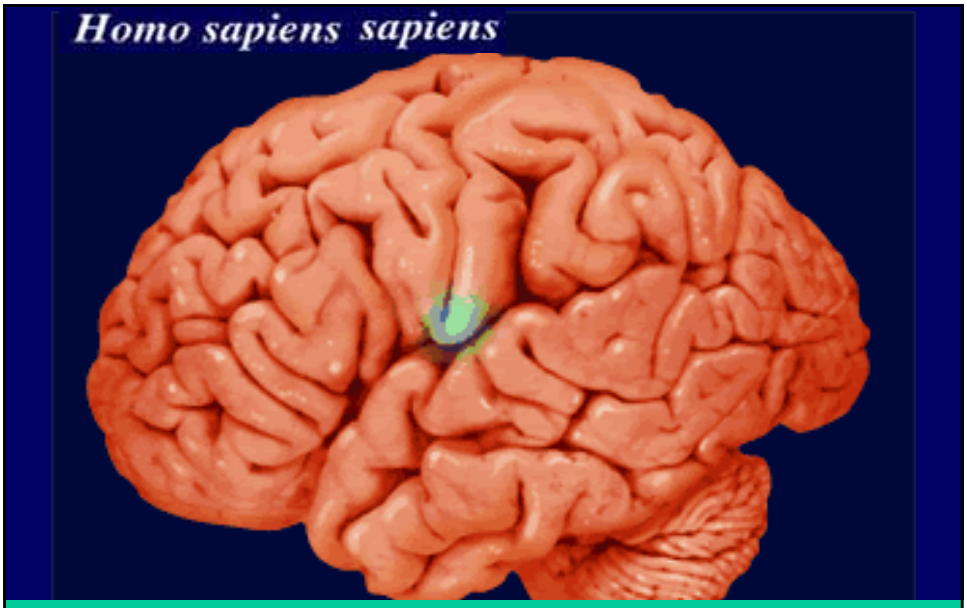



chiave
?

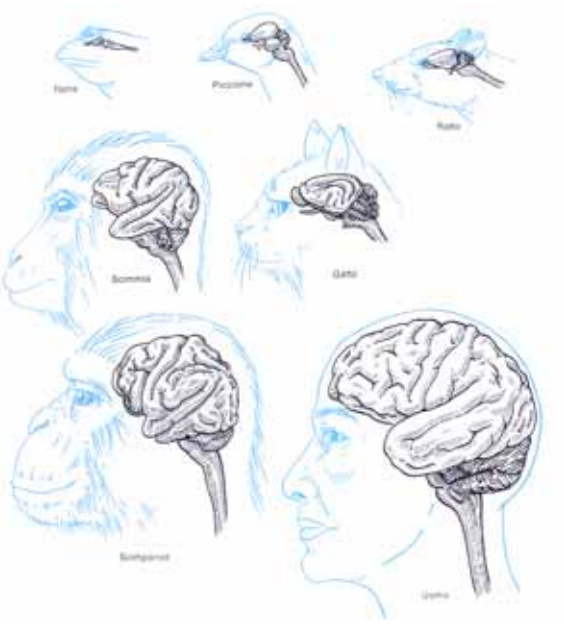

Mano sinistra
Area del linguaggio
Area per il riconoscimento tattile
Emisfero sinistro destro

Le funzioni cognitive non hanno sede in un “centro nervoso” inteso come raggruppamento neuronale direttamente responsabile di una specifica funzione.

Per l’espletamento di qualunque processo mentale è necessario un intero sistema di aree corticali intimamente collegate tra loro, che lavorano in sintonia e si integrano.



Il sistema nervoso può essere pensato come un mosaico di dispositivi (un insieme di strutture altamente specializzate) che funzionano come un tutto unico e inscindibile

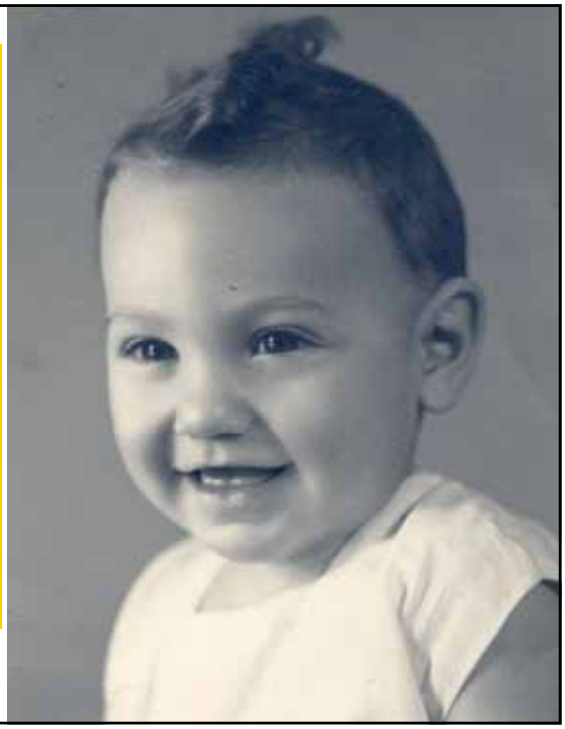


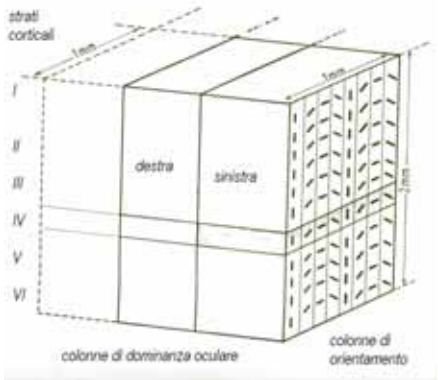
Tali dispositivi sono stati perfezionati dal processo evolutivo in quanto si sono dimostrati i più adeguati a risolvere i problemi posti dall'ambiente alla sopravvivenza dell'organismo

Alla nascita il sistema nervoso non è già pronto, è solo predisposto
e, per formarsi, necessita della interazione con l'ambiente

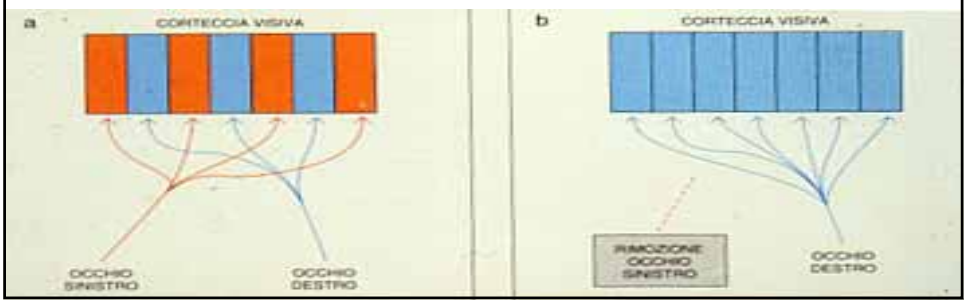
il patrimonio ereditario definisce solo le condizioni di base del progetto

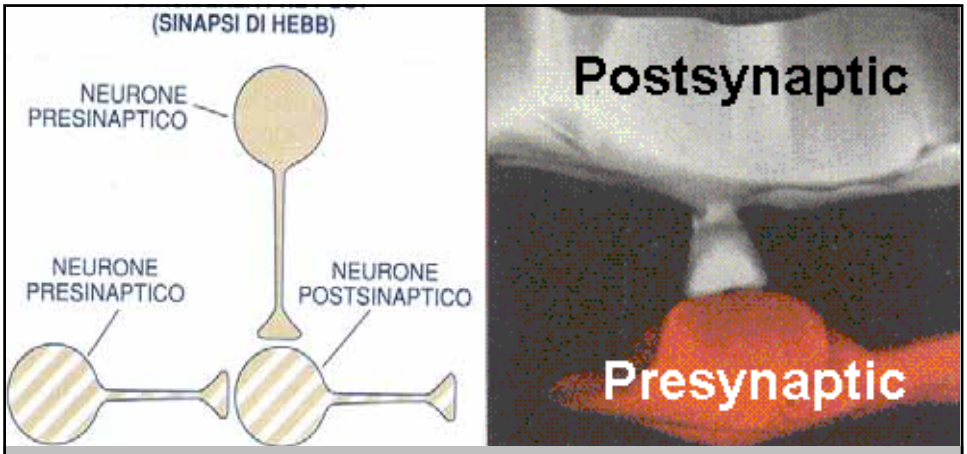
l'afflusso di informazioni provenienti dagli organi sensoriali e la continua interazione con l'ambiente determinano poi in che modo il cervello prenda forma





Sono le esperienze a realizzare l'organizzazione cerebrale utilizzando i meccanismi resi possibili dal corredo genetico





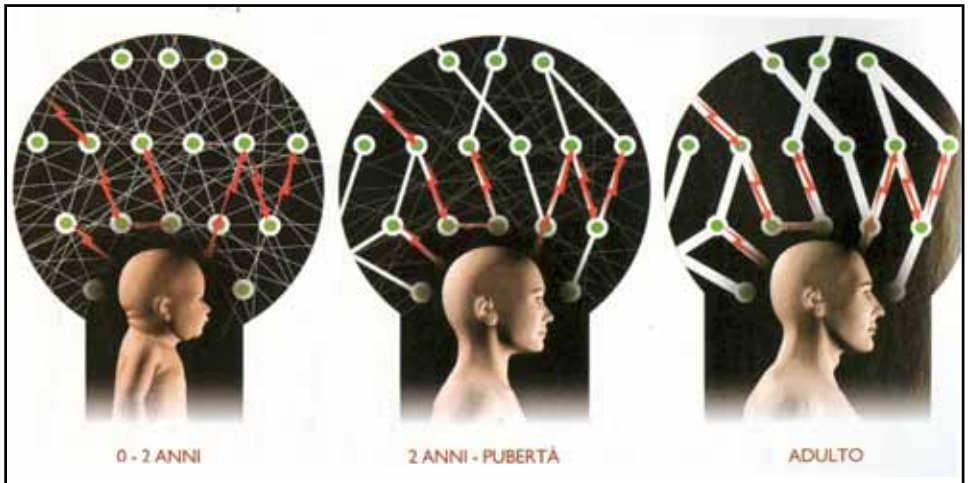
Plasticità cerebrale

* Neuroni che si attivano contemporaneamente formano una connessione privilegiata
* Neuroni che non si attivano vicendevolmente perdono la loro connessione

le informazioni ambientali innescano una sorta di competizione attivando le connessioni sinaptiche più appropriate e disattivando le connessioni che non si sono rivelate utili

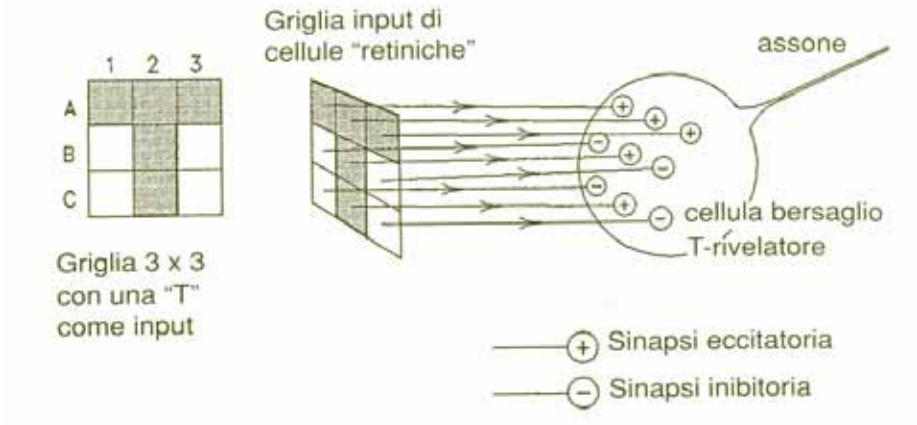
L’evoluzione culturale diviene prevalente rispetto all’evoluzione biologica

La mente è uno strumento per gestire la complessità

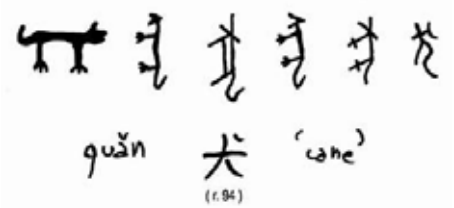


Il dono e la maledizione

Il risultato finale del processo che porta alla costruzione di un sistema nervoso sempre pronto ad adattarsi alle nuove esigenze dell’ambiente non è mai certo: sono sempre possibili soluzioni diverse da quella standard



Un semplice sistema per riconoscere configurazioni.
La cellula si attiva in modo massimale quando – e solo quando – viene proiettata una T sulla griglia di cellule "retiniche"



Le prime vaghe testimonianze di un essere dotato di facoltà mentali risalgono a 2.5 milioni di anni

I primi esempi di un uso convenzionale di simboli scritti compaiono su tavolette d'argilla risalenti al 3500 aC

Dapprima una serie di figure vennero adottate per rappresentare il concetto da comunicare

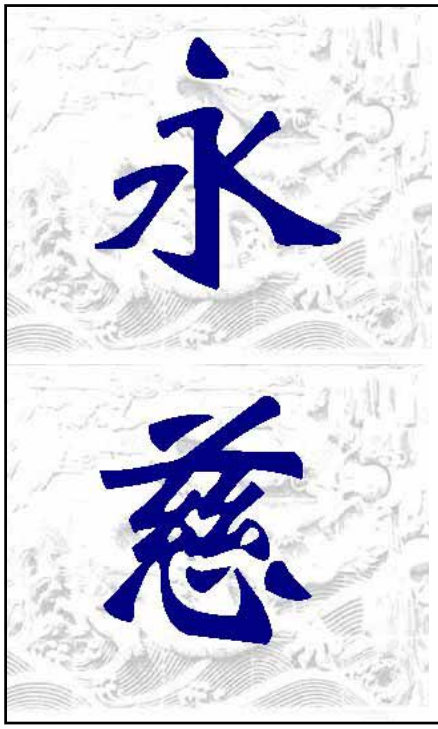
Poi progressivamente le figure furono utilizzate non più per indicare le «cose», ma i loro «nomi» e i suoni relativi

Phoenician abjad		Greek alphabet		
Name	*ca. 900 B.C.E.*	*800–600*	*Attic (400)*	*Name*
ʾālef	𐤀	Α	Α	alpha
bēt	𐤁	Β	Β	bēta
gīmel	𐤂	Γ	Γ	gamma
dālet	𐤃	Δ	Δ	delta
hē	𐤄	Ε	Ε	e psilon
wāw	𐤅	Ϝ		(digamma
zajin	𐤆	Ι	Ι	zēta
ḥēt	𐤇	Η	Η	ēta
ṭēt	𐤈	Θ	Θ	thēta
yōd	𐤉	Ι	Ι	iōta
kaf	𐤊	Κ	Κ	kappa
lāmed	𐤋	Λ	Λ	lambda
mēm	𐤌	Μ	Μ	mu
nūn	𐤍	Ν	Ν	nu
sāmek	𐤎	Ξ	Ξ	ksi
ʿayin	𐤏	Ο	Ο	o mikron
pē	𐤐	Π	Π	pi
ṣādē	𐤑	Μ		(san)
qōf	𐤒	Ϙ		(qoppa)
rēš	𐤓	Ρ	Ρ	rhō
šin/šin	𐤔	Σ	Σ	sigma
tāw	𐤕	Τ	Τ	tau
		Υ	Υ	u psilon
		Φ	Φ	phi
		Χ	Χ	chi
		Ψ	Ψ	psi
		Ω	Ω	ō mega

“Cippo di Perugia”

Ma sopra tutte le invenzioni stupende, qual eminenza di mente fu quella di colui che si immaginò di trovare modo di comunicare i suoi più reconditi pensieri a qualsivoglia altra persona, benché distante per lunghissimo intervallo?
Parlare a quelli che sono nelle Indie, parlare a quelli che non sono ancora nati né saranno da qui a mille a diecimila anni?
E con qual facilità?
Con i vari accozzamenti di venti caratteruzzi sopra una carta!

Galileo Galilei



Nu pianefforte 'e notte

sona luntanamente,

e 'a museca se sente

pe ll'aria suspirà.

[...]

Ma sulitario e lento

more 'o mutivo antico;

se fa cchiù cupo 'o vico

dint'a ll'oscurità.

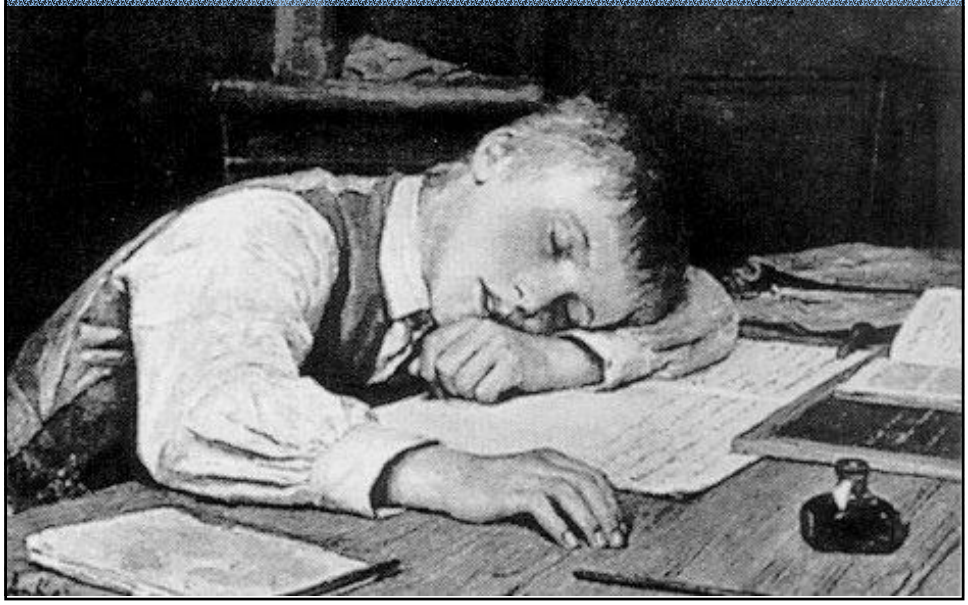
[...].

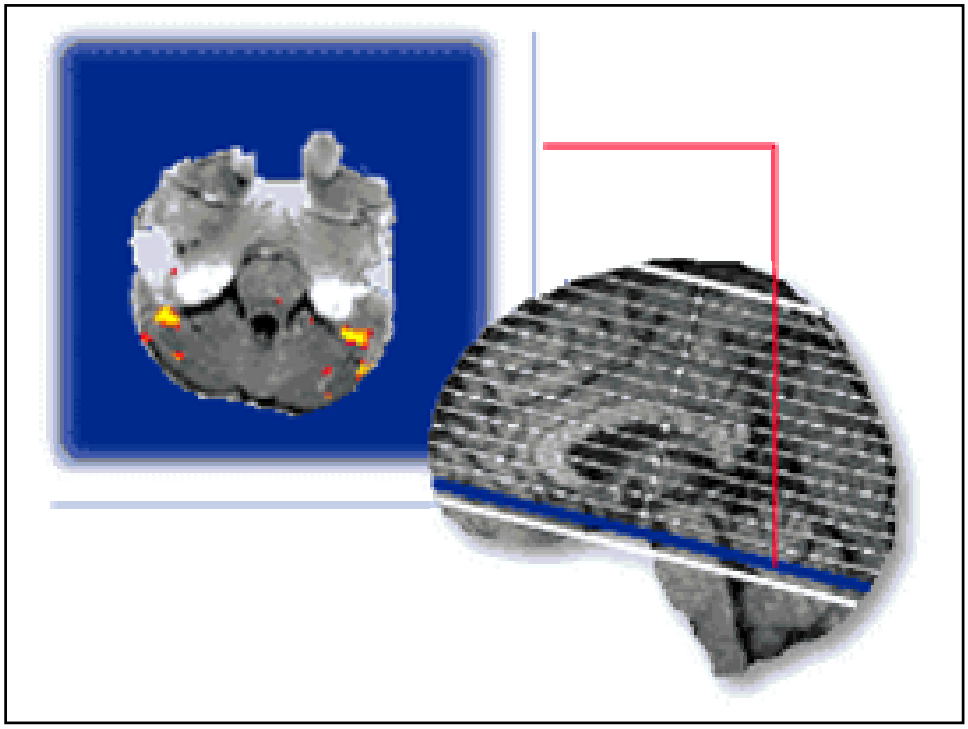
Consapevolezza fonologica

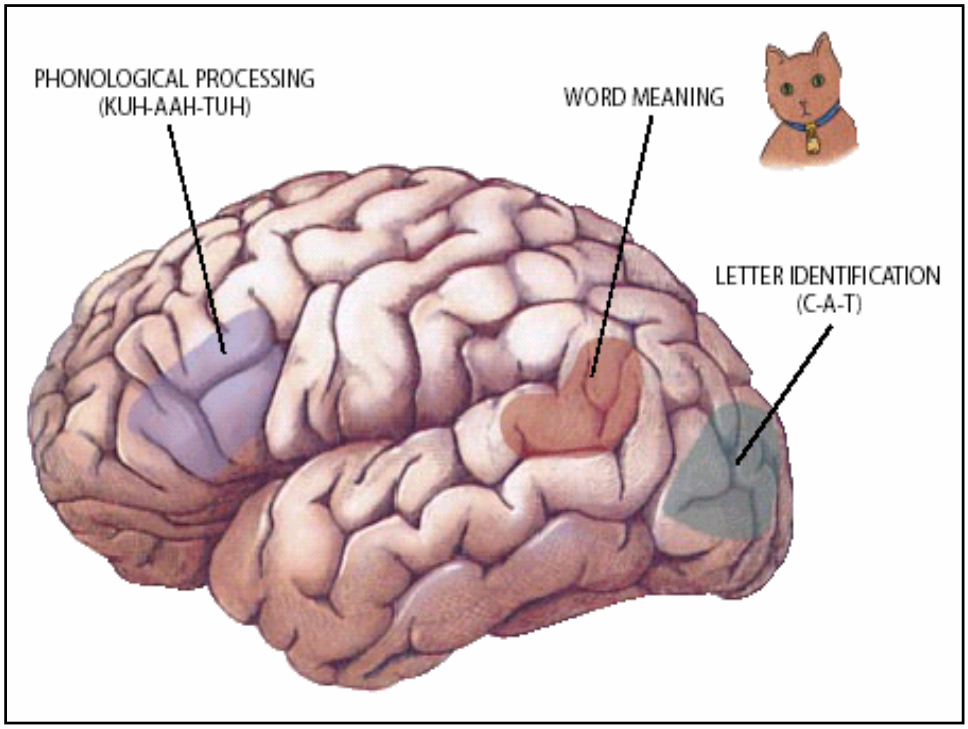
Capacità di elaborazione e manipolazione dei suoni linguistici

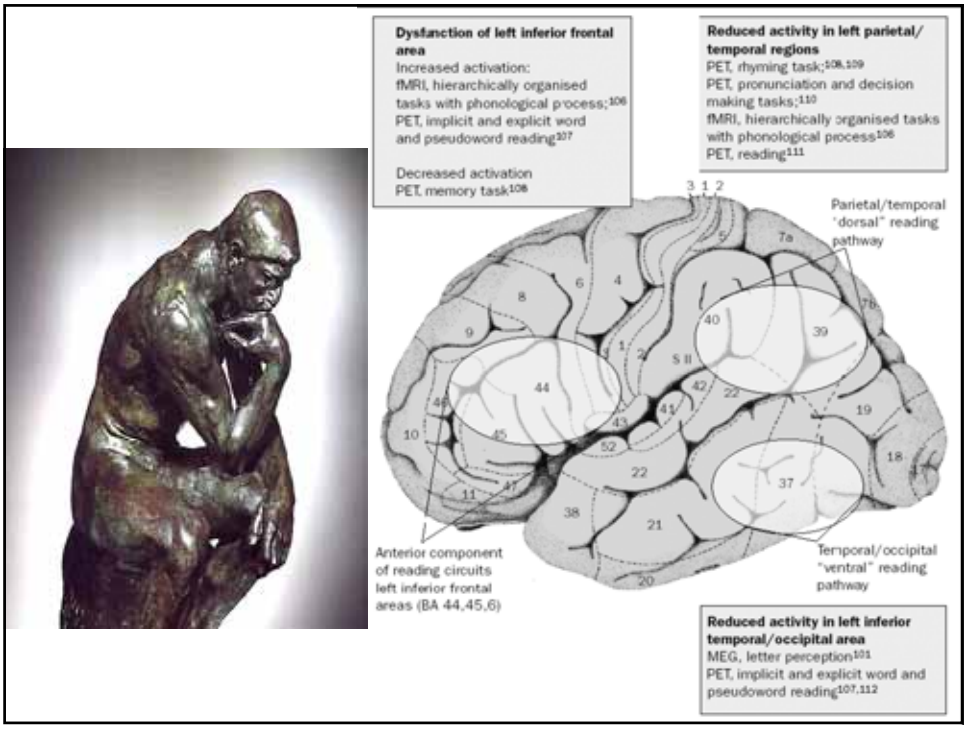
(prove di
fusione,
segmentazione,
elisione,
….)

Pringle Morton (1896)"He would be the smartest lad in the school if instruction were entirely oral"
Percy F. "A Case of Congenital Word Blindness" British Medical Journal

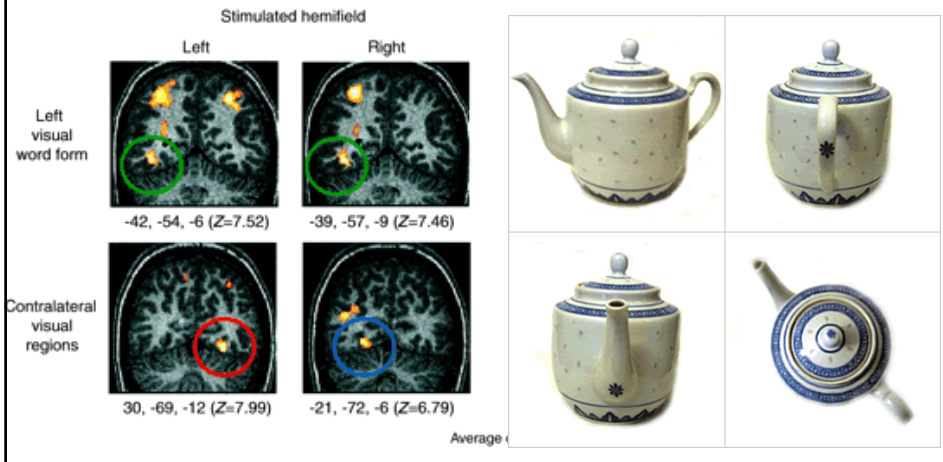




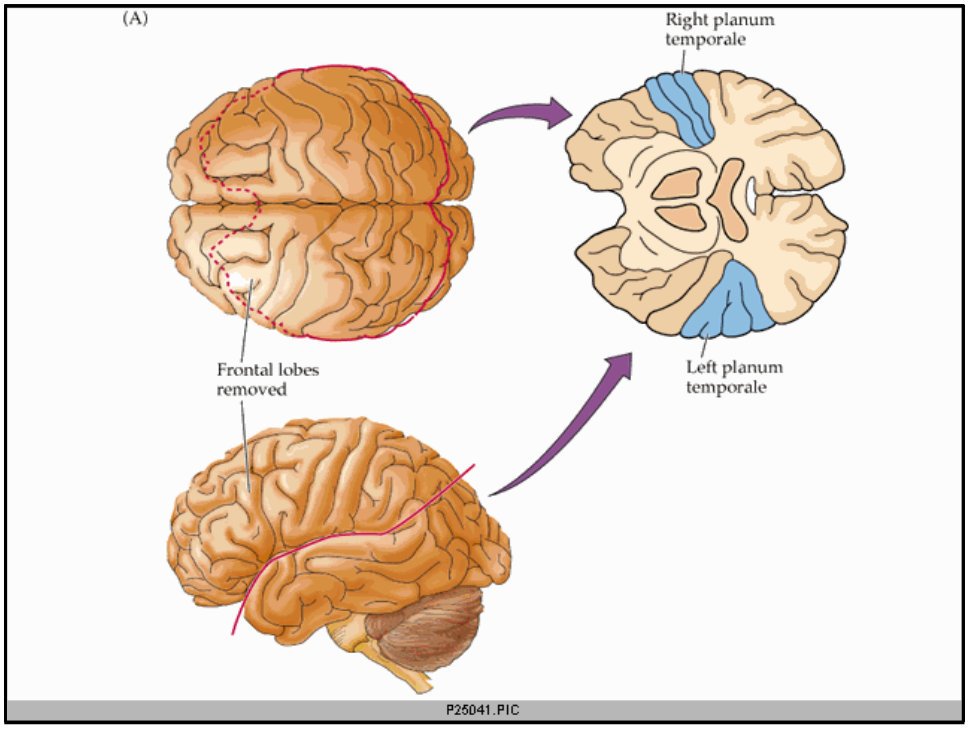

PHONOLOGICAL PROCESSING
(KUH-AAH-TUH)
WORD MEANING
LETTER IDENTIFICATION
(C-A-T)



Visual Word Form Area (VWFA)



T T t T t t T


(A)
Right planum temporale
Frontal lobes removed
Left planum temporale
P25041.PIC


L
ant
R
post

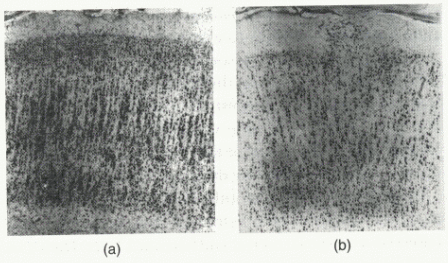
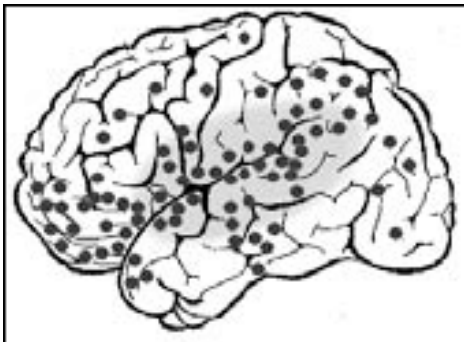


Figure 16.27
Photomicrographs of the left planum temporale (a portion of Wernicke's area). (a) A control subject. (b) A person with developmental dyslexia. Nissl stain.
(Photographs courtesy of A. Galaburda.)



Norman Geschwind

Albert Galaburda

-non preferenza manuale destra

-disturbi di apprendimento

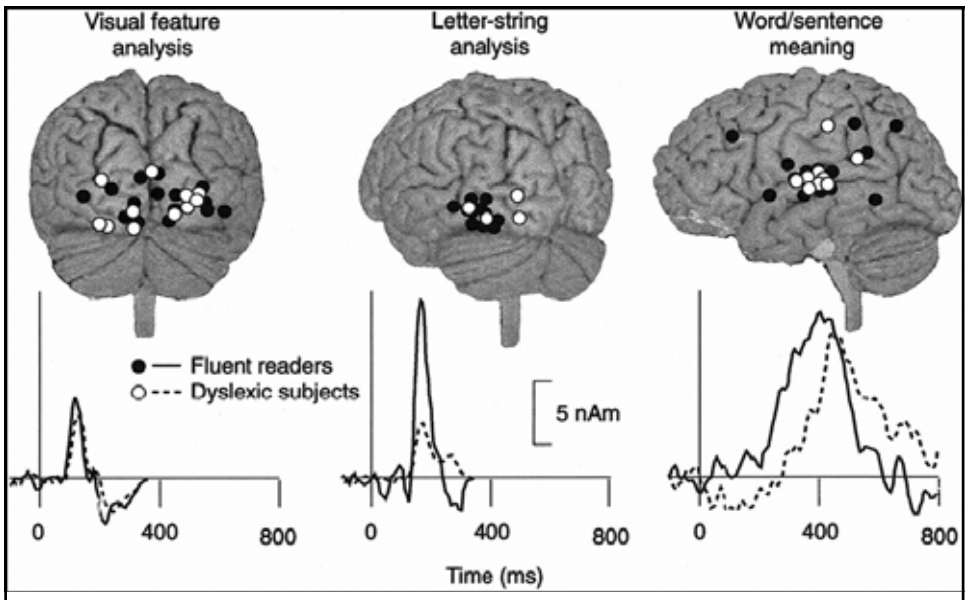
-malattie autoimmuni

"During fetal development, there is superior development of the RIGHT hemisphere"

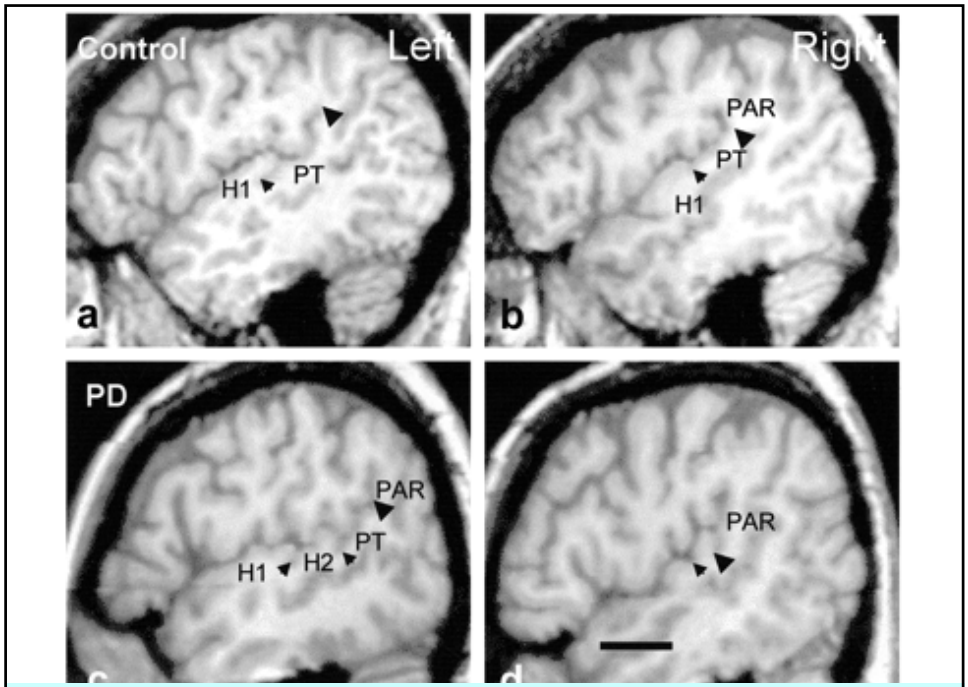
Samuel Orton (1925)
"esiste una relazione tra il mancinismo e alcune caratteristiche della lettura e della scrittura dei dislessici, quali
-inversione di lettere graficamente simmetriche
-inversione di lettere all'interno della parola
-scrittura e lettura speculare"

Anna Gillingham (1936)
"Remedial training for children with specific disabilities in reading, spelling and penmanship"

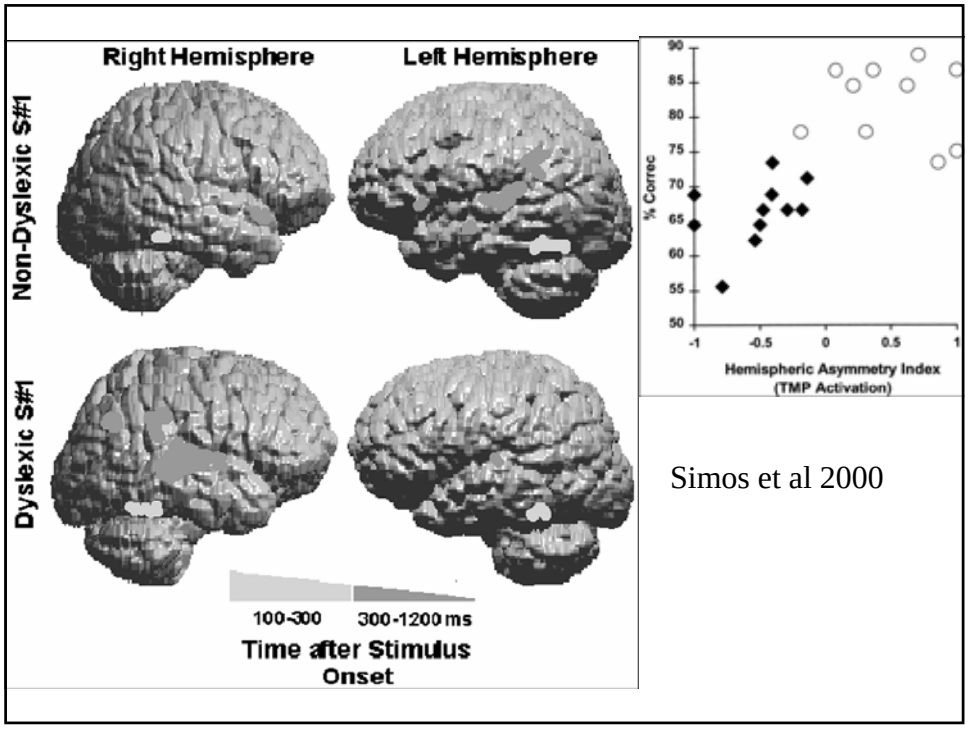
Mc Donald Critchley (1970)
"Non sono molti i dislessici che sembrano possedere una dominanza netta"



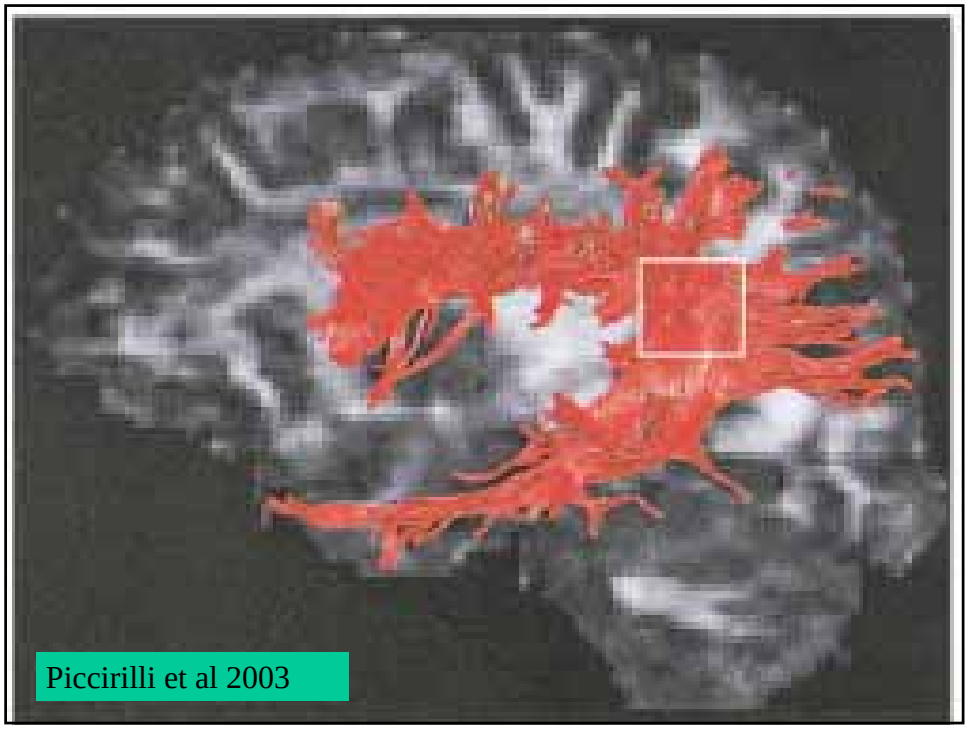
Magnetoencephalography (MEG) during word reading :
intact perceptual processing, decreased VWFA activation,
delayed semantic- temporal activation (Salmelin et al., 2000)



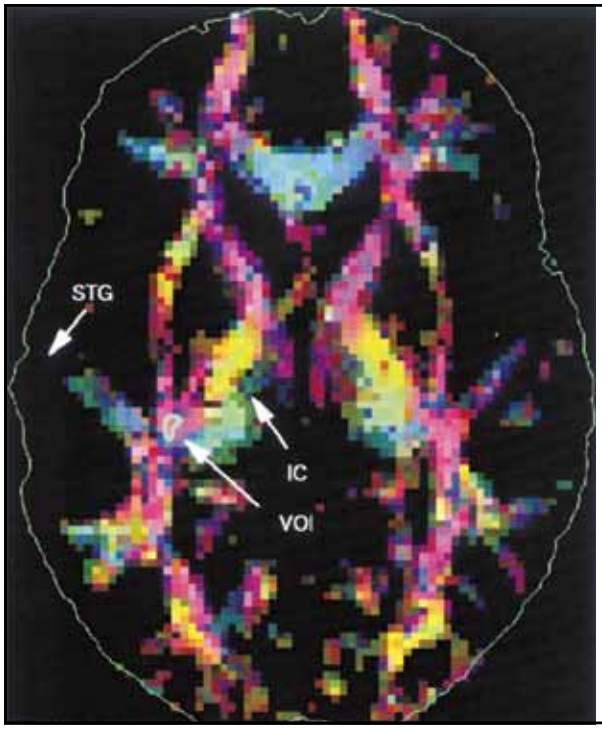
Leonard et al. (2001) : extreme asymmetry of temporal and parietal cortices



Simos et al 2000



Piccirilli et al 2003



Microstructure of Temporo-Parietal White Matter as a Basis for Reading Ability:

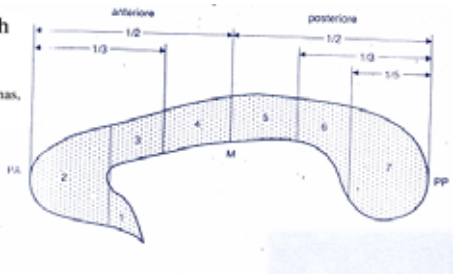
Evidence from Diffusion Tensor Magnetic Resonance Imaging

Torkel Klingberg,*§ Maj Hedehus,† Elise Temple,* Talya Salz,*‡ John D. E. Gabrieli,*† Michael E. Moseley,† and Russell A. Poldrack*

Neuron, 25: 493–500, 2000,

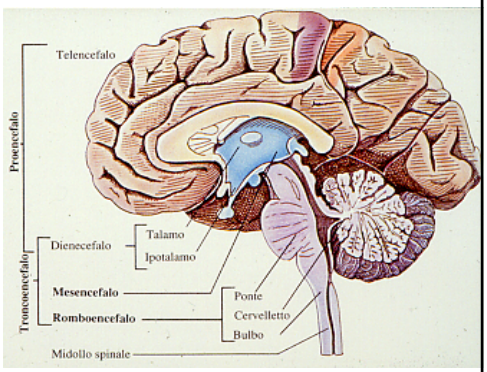
Corpus Callosum Morphology, as Measured with MRI, in Dyslexic Men

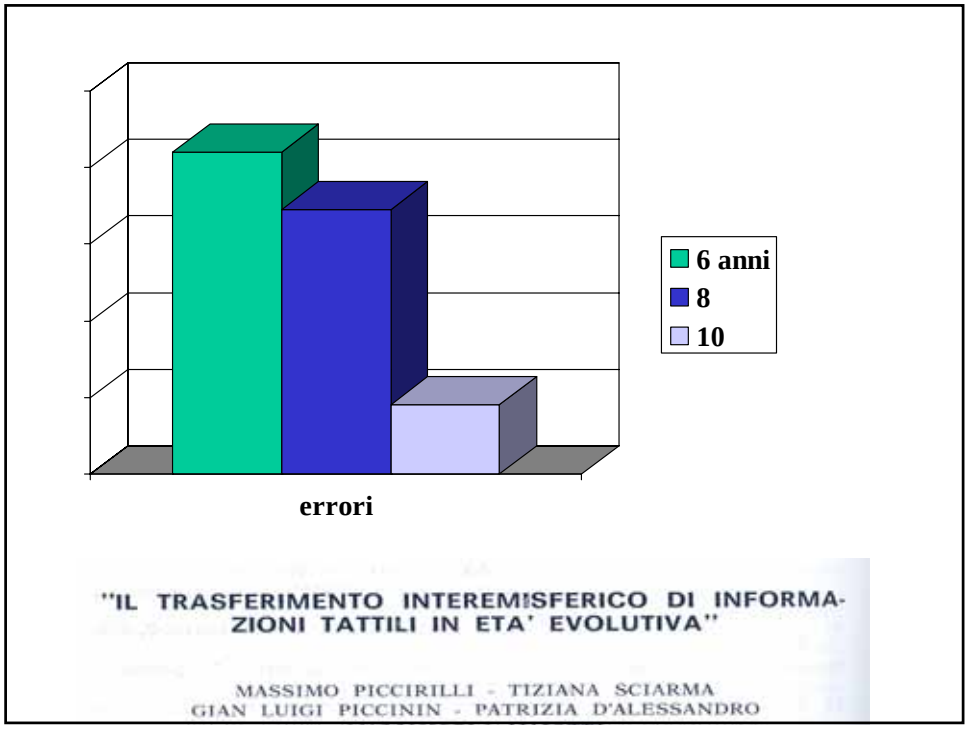
Judith M. Rumsey, Manuel Casanova, Glenn B. Mannheim, Nicholas Patronas, Nathan DeVaughn, Susan D. Hamburger, and Tracy Aquino

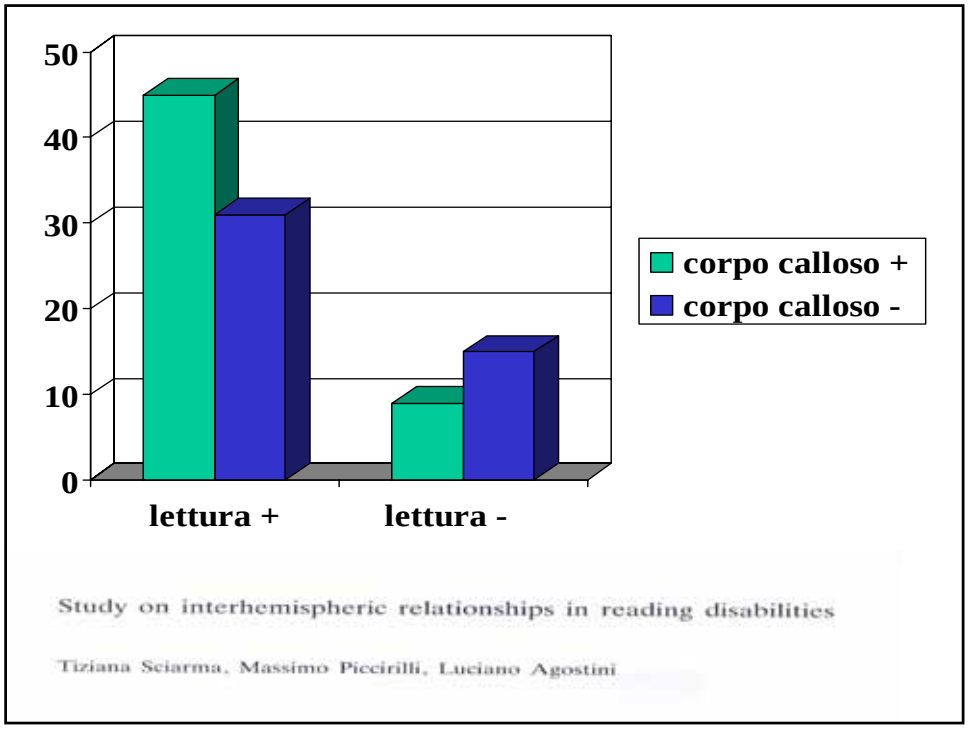


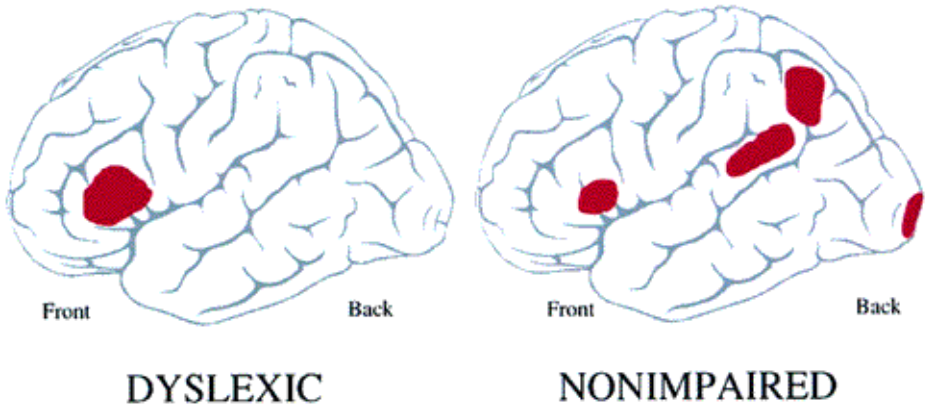
Regione N.	Denominazione anatomica	Regioni corticali di origine e terminazione
1	Rostro	Regioni prefrontale caudo-orbitale e premotoria inferiore
2	Ginocchio	Regione prefrontale
3	Parte rostrale del corpo	Regioni premotorie e supplementari motorie
4	Parte anteriore della regione mediana del corpo	Regioni motorie
5	Parte posteriore della regione mediana del corpo	Regioni somatosensoriche e parietali posteriori
6	Istmo	Regioni temporale superiore e parietale posteriore
7	Splenio	Regioni occipitali ed infero-parietali

Modificata da Witelson (1989)




6 anni
8
10
errori
"IL TRASFERIMENTO INTEREMISFERICO DI INFORMA-
ZIONI TATTILI IN ETA' EVOLUTIVA"
MASSIMO PICCIRILLI - TIZIANA SCIARMA
GIAN LUIGI PICCININ - PATRIZIA D'ALESSANDRO


50
40
30
20
10
0
corpo calloso +
corpo calloso -
lettura +
lettura -
Study on interhemispheric relationships in reading disabilities
Tiziana Sciarma, Massimo Piccirilli, Luciano Agostini



Disruption of posterior brain systems for reading in children with developmental dyslexia

Bennett A. Shaywitz, Sally E. Shaywitz, Kenneth R. Pugh , W. Einar Mencl , Robert K. Fulbright, Pawel Skudlarski, R. Todd Constable, Karen E. Marchione, Jack M. Fletcher, G. Reid Lyon, John C. Gore (1998-2002)

DOI: 10.1093/brain/awg076 *Brain* (2003), **126,** 841–865

Theories of developmental dyslexia: insights from a multiple case study of dyslexic adults

Franck Ramus,[1,5] Stuart Rosen,[2] Steven C. Dakin,[3] Brian L. Day,[4] Juan M. Castellote,[4,6] Sarah White[1] and Uta Frith[1]

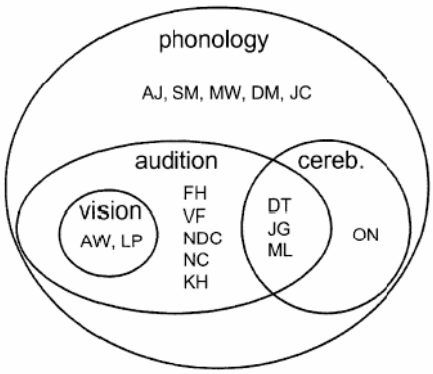
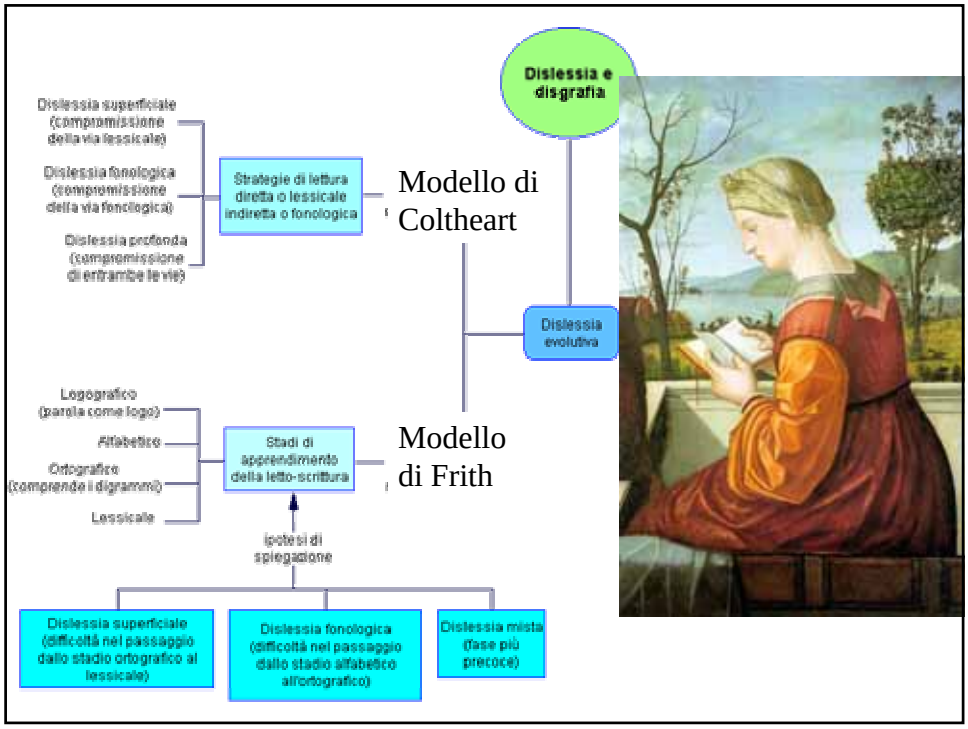
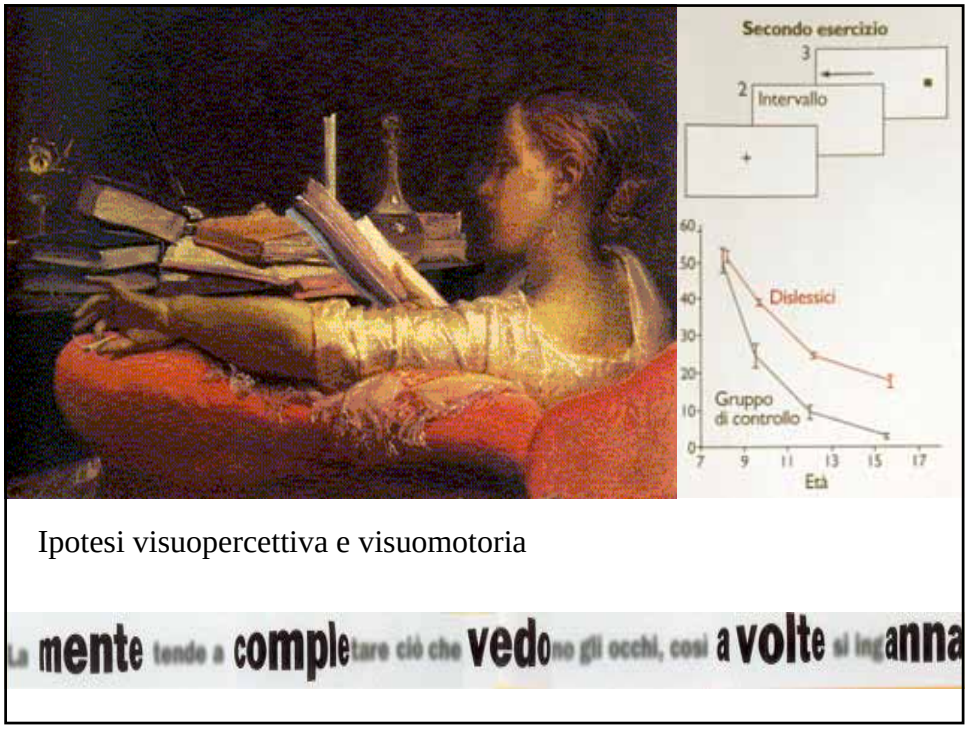
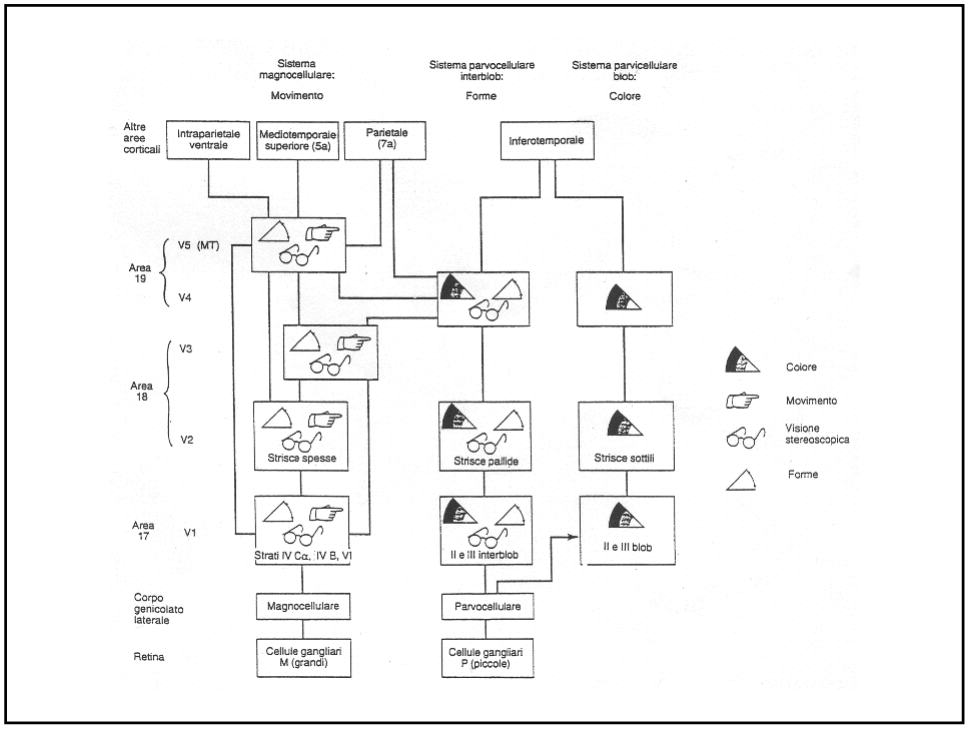


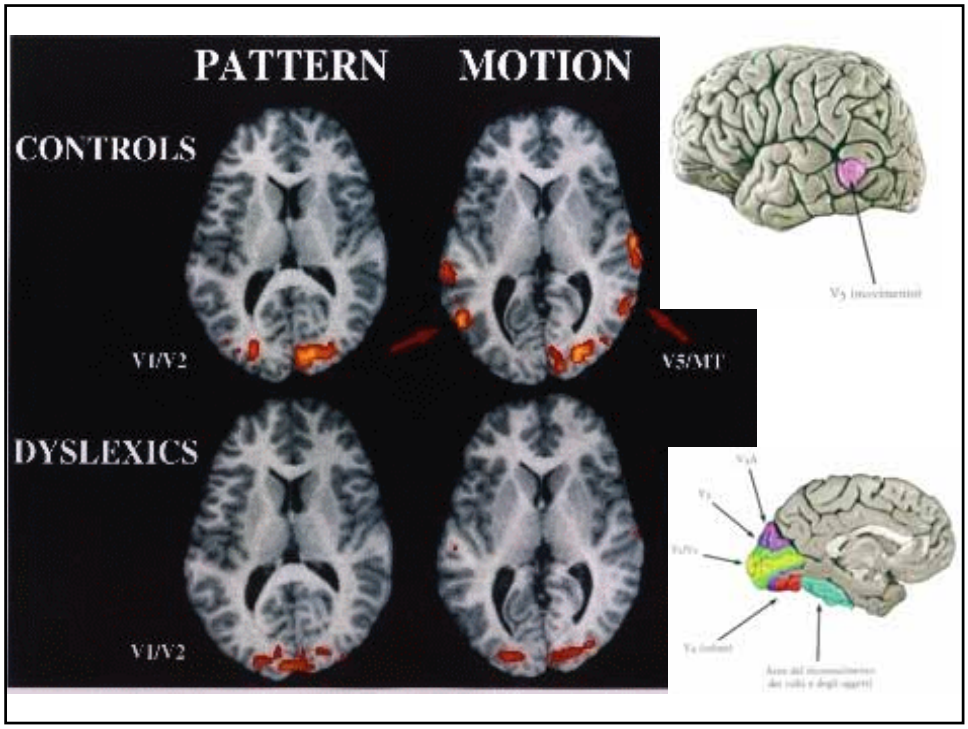
Fig. 4 Distribution of phonological, auditory, visual and cerebellar disorders in the sample of 16 dyslexic adults. Initials refer to individual dyslexic subjects.





Ipotesi visuopercettiva e visuomotoria

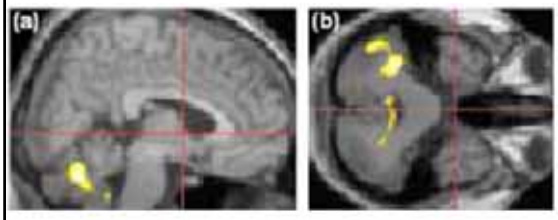

Sistema magnocellulare:
Movimento
Sistema parvocellulare interblob:
Forme
Sistema parvicellulare blob:
Colore
Altre aree corticali
Intraparietale ventrale
Mediotemporale superiore (5a)
Parietale (7a)
Inferotemporale
Area 19
V5 (MT)
V4
Area 18
V3
V2
Area 17
V1
Strisce spesse
Strisce pallide
Strisce sottili
Strati IV Cα, IV B, VI
II e III interblob
II e III blob
Corpo genicolato laterale
Magnocellulare
Parvocellulare
Retina
Cellule gangliari M (grandi)
Cellule gangliari P (piccole)
Colore
Movimento
Visione stereoscopica
Forme

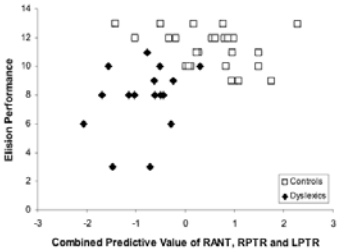

PATTERN
MOTION
CONTROLS
V1/V2
V5/MT
DYSLEXICS
V1/V2

Developmental dyslexia: the cerebellar deficit hypothesis

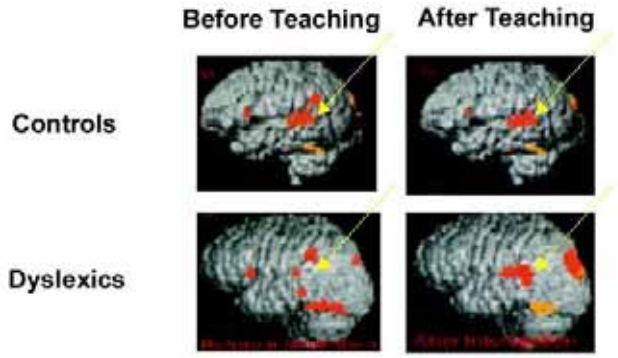
Roderick I. Nicolson, Angela J. Fawcett and Paul Dean

Surprisingly, the problems faced by many dyslexic children are by no means confined to reading and spelling.
There appears to be a general impairment in the ability to perform skills automatically, an ability thought to be dependent upon the cerebellum.
… dyslexia is indeed associated with cerebellar impairment in about 80% of cases.





Teaching Corrects Dyslexia Pattern By MRI



80 hrs (1-2 hrs / day) one-on-one instruction
Phonological Processing & Decoding
Multisensory & Visual Imagery Instruction

Dyslexia-specific brain activation profile becomes normal following successful remedial training

P.G. Simos, PhD, J.M. Fletcher, PhD, E. Bergman, MD, J.I. Breier, PhD, B.R. Foorman, PhD, E.M. Castillo, PhD, R.N. Davis, MA, M. Fitzgerald, BA and A.C. Papanicolaou, PhD

Plastic neural changes and reading improvement caused by audiovisual training in reading-impaired children

T. Kujala*†, K. Karma‡, R. Ceponiene*, S. Belitz*, P. Turkkila‡, M. Tervaniemi*, and R. Näätänen*§

*Cognitive Brain Research Unit, Department of Psychology, P.O. Box 13, University of Helsinki, FIN-00014 Helsinki, Finland; ‡Sibelius Academy, Department of Music Education, FIN-00251 Helsinki, Finland; and §BioMag Laboratory, Meilahti, P.O. Box 340, 00029 HUS, Finland

Development of left occipitotemporal systems for skilled reading in children after a phonologically-based intervention

Bennett A. Shaywitz, Sally E. Shaywitz, Benita Blachman, Kenneth R. Pugh, Robert K. Fulbright, Pawel Skudlarski, W. Einar Mencl, R. Todd Constable, John M. Holahan, Karen E. Marchione, Jack M. Fletcher, G. Reid Lyon, John C. Gore

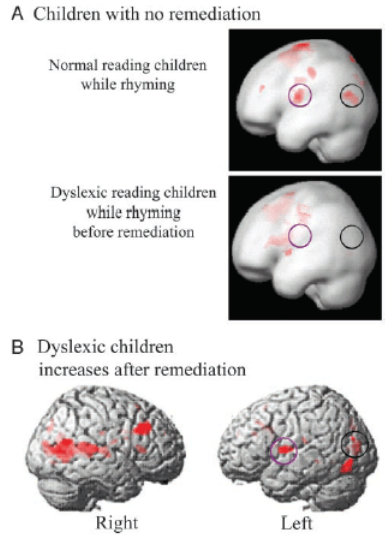
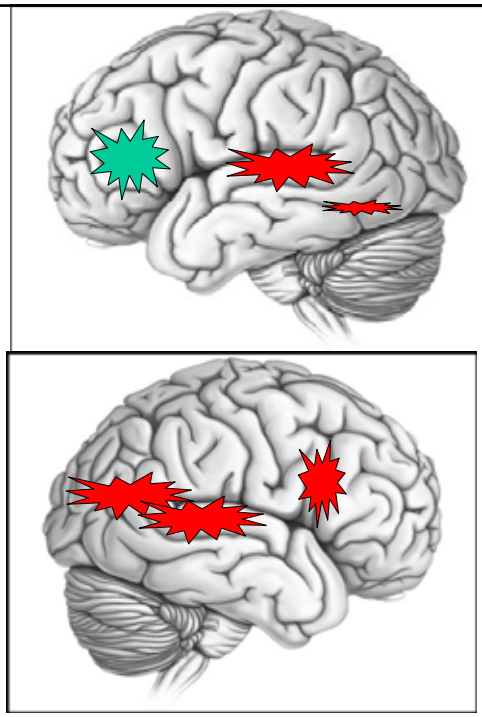
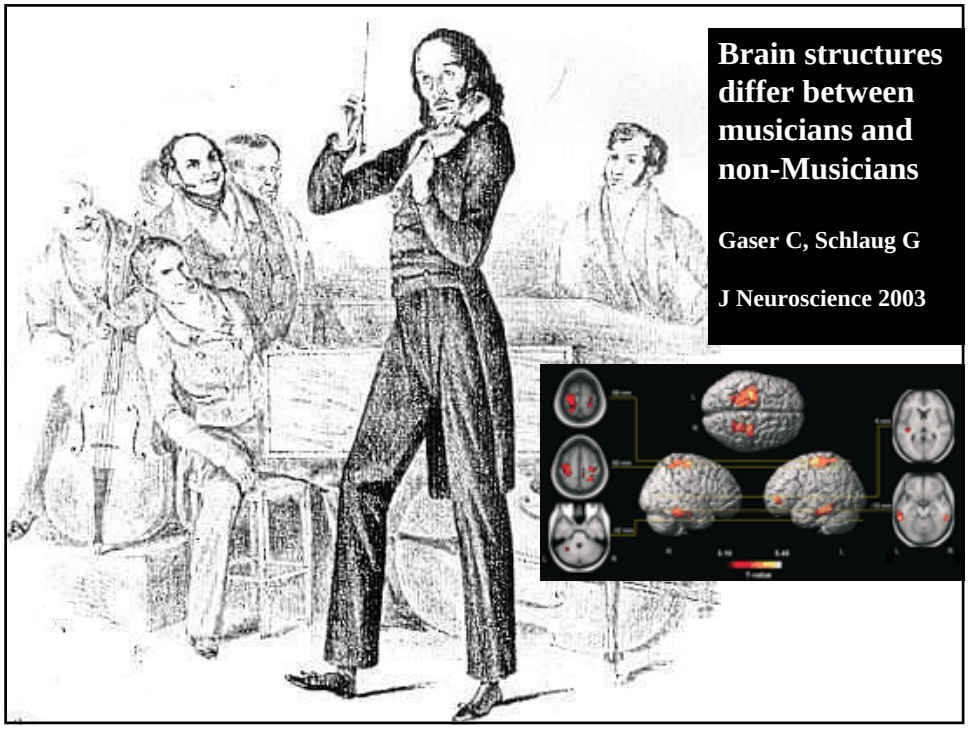
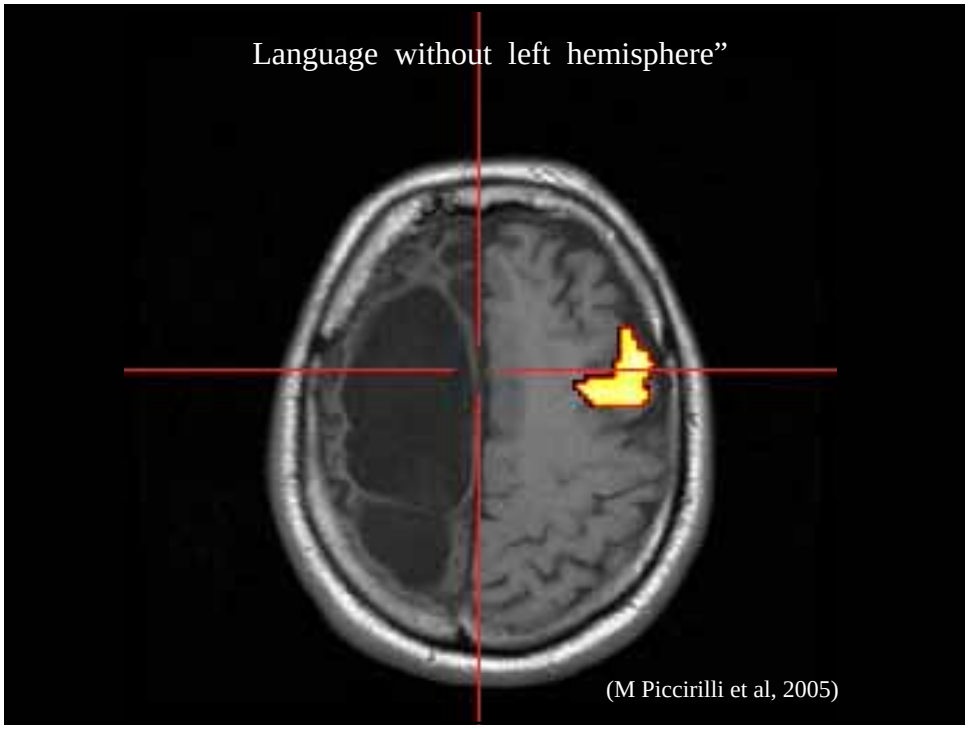
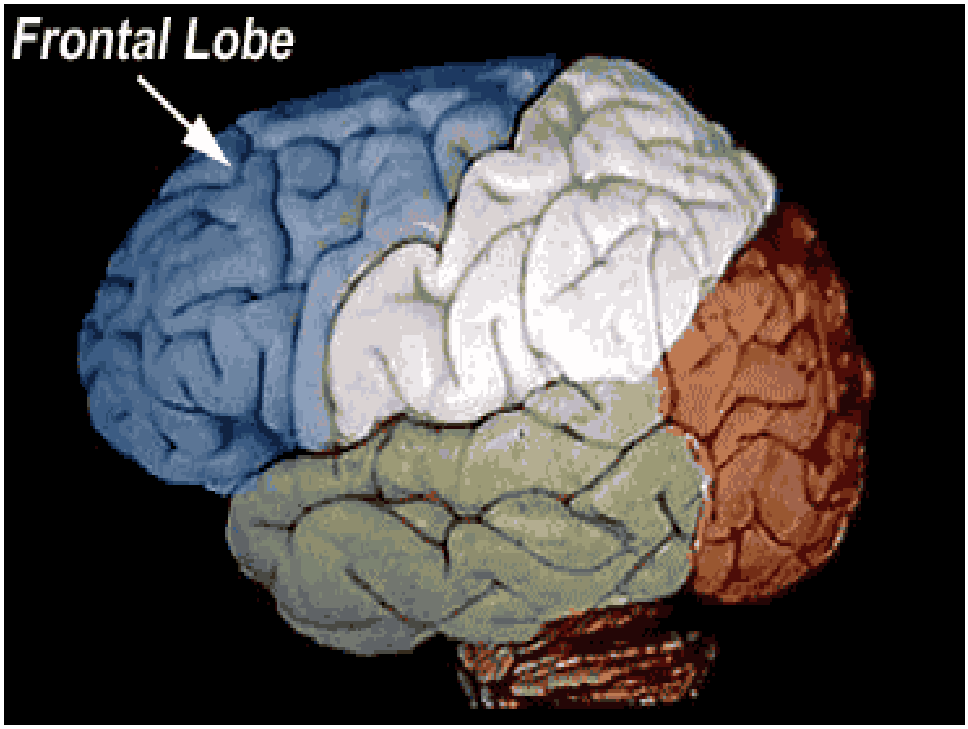


Fig. 1. Neural effects of remediation in children with developmental dyslexia. (*A*) Left hemisphere activations of control children and children with dyslexia are shown during rhyming (as compared with matching) letters ($P < 0.025$, 20-voxel threshold; ref. 12). (*B*) Brain areas that showed increased activity during phonological processing in the dyslexic group after remediation. Shown at $P < 0.01$, 20-voxel threshold. Black circles highlight left temporo-parietal region, which is disrupted in children with dyslexia and affected by remediation. Purple circles highlight the left frontal region that is active in control children and is affected by remediation in children with dyslexia.

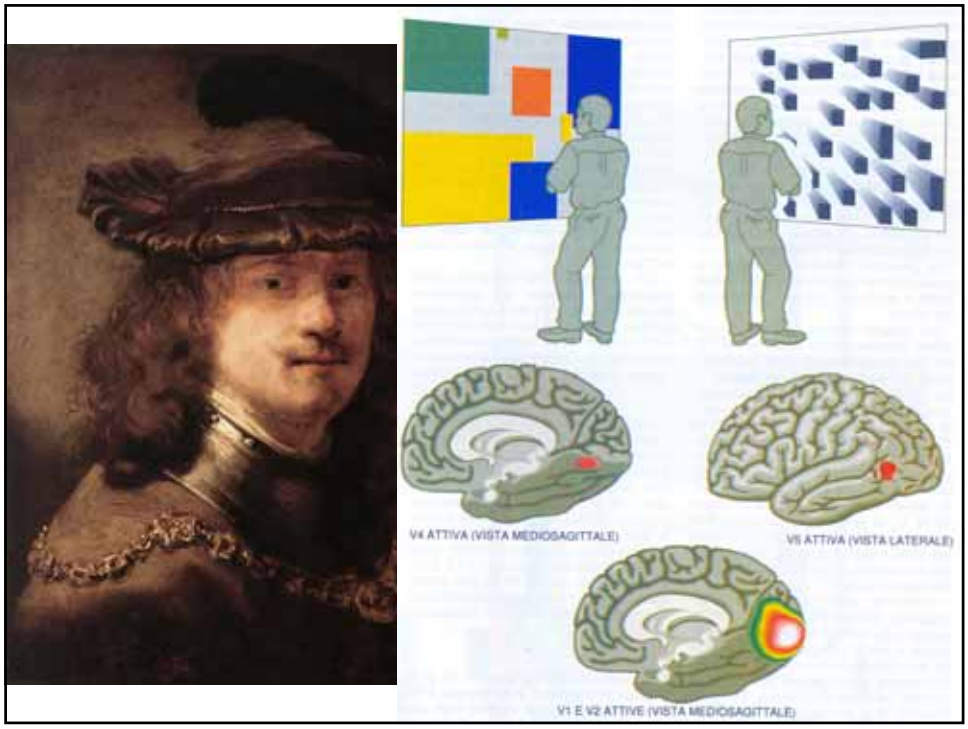


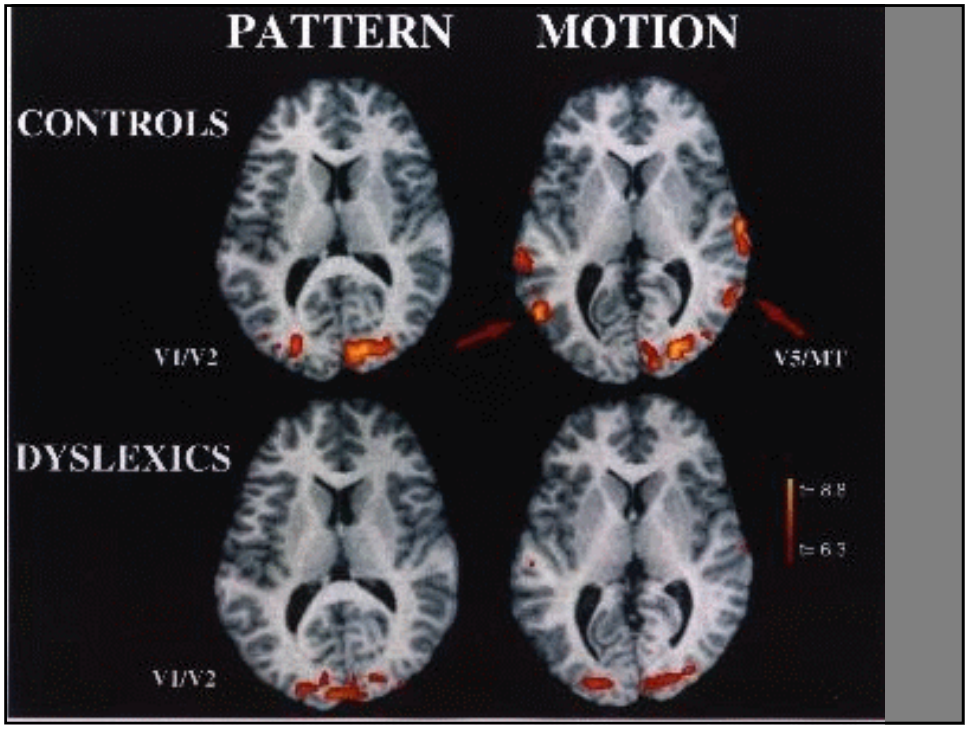

Brain structures differ between musicians and non-Musicians
Gaser C, Schlaug G
J Neuroscience 2003

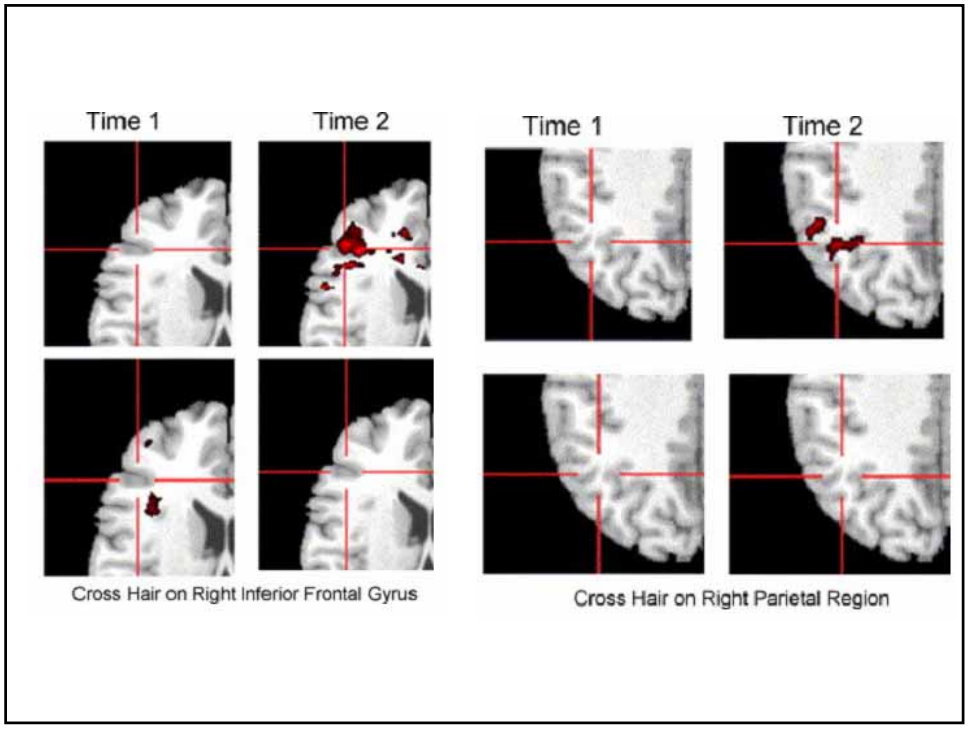

Language without left hemisphere”
(M Piccirilli et al, 2005)

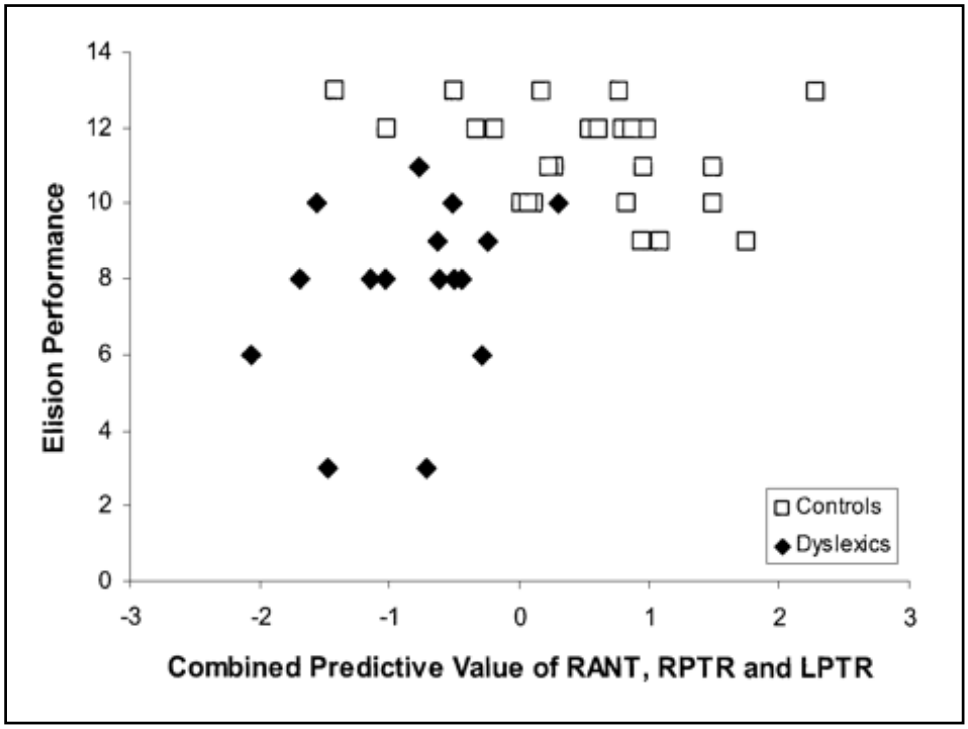


grazie per l'attenzione


V4 ATTIVA (VISTA MEDIOSAGITTALE)
V5 ATTIVA (VISTA LATERALE)
V1 E V2 ATTIVE (VISTA MEDIOSAGITTALE)


PATTERN
MOTION
CONTROLS
V1/V2
V5/MT
DYSLEXICS
V1/V2


Time 1
Time 2
Time 1
Time 2
Cross Hair on Right Inferior Frontal Gyrus
Cross Hair on Right Parietal Region


Elision Performance
Combined Predictive Value of RANT, RPTR and LPTR
Controls
Dyslexics
0
2
4
6
8
10
12
14
-3
-2
-1
0
1
2
3

Ipotesi

fonologia

visuopercezione

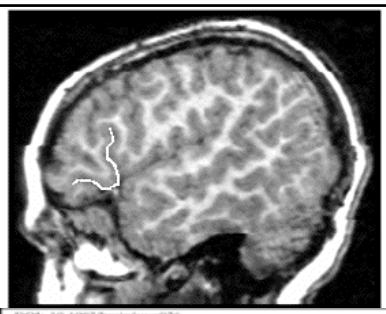
automatizzazione

elaborazione rapida dei dati

integrazione multisensoriale

working and implicit memory

processi cognitivi generali
sfera emozionale-relazionale
opportunità di apprendimento



DOI: 10.1093/brain/awg026 *Brain* (2003), **126**, 482–494

Anatomical correlates of dyslexia: frontal and cerebellar findings

Mark A. Eckert,[1] Christiana M. Leonard,[1] Todd L. Richards,[2] Elizabeth H. Aylward,[2] Jennifer Thomson[3] and Virginia W. Berninger[3]