An introduction to the cognitive neuroscience of bilingualism and L2 learning

Andrea Marini

Universita' degli Studi di Udine
IRCCS "E. Medea", Ass.ne "La Nostra Famiglia"
Landesfachhochschule für Gesundheitsberufe , Bozen

andrea.marini@uniud.it

Overview

- An operational definition of Bilingual Competence
- Cognitive and environmental factors affecting L2 learning
- Cognitive effects of bilingualism
- Neural correlates of L2 learning

An operational definition of Bilingual Competence

There are different ways to be bilingual

An operational definition of bilingual competence

Knowledge and use of two or more languages/ dialects independently from the age of acquisition and the level proficiency

Clinical Neurolinguistics of Bilingualism

Andrea Marini, Cosimo Urgesi, and Franco Fabbro

The Handbook of the Neuropsychology of Language, First Edition. Edited by Miriam Faust.

Cognitive and environmental factors affect second language learning

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Social and interactional factors affect L2 processing and learning

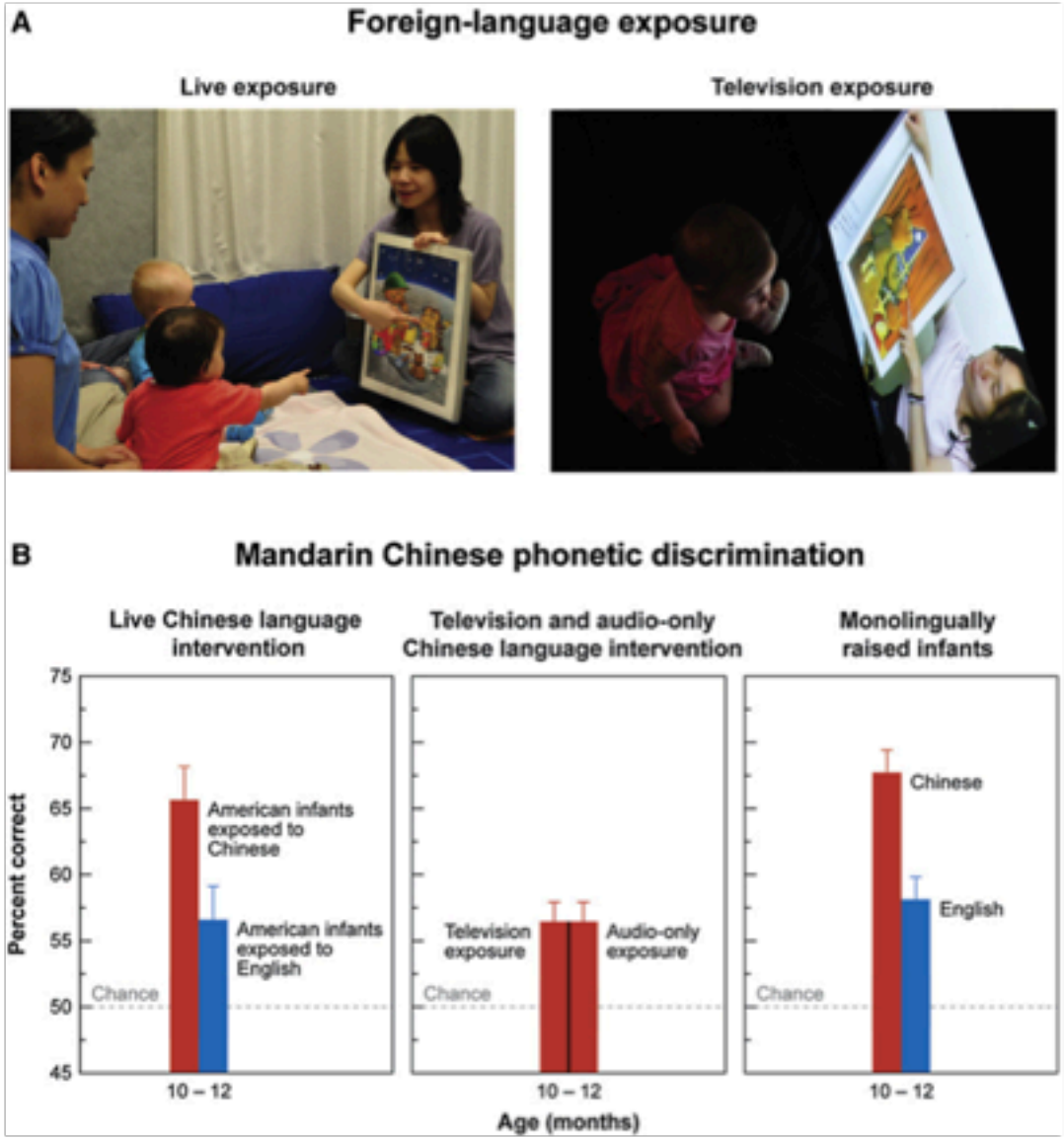


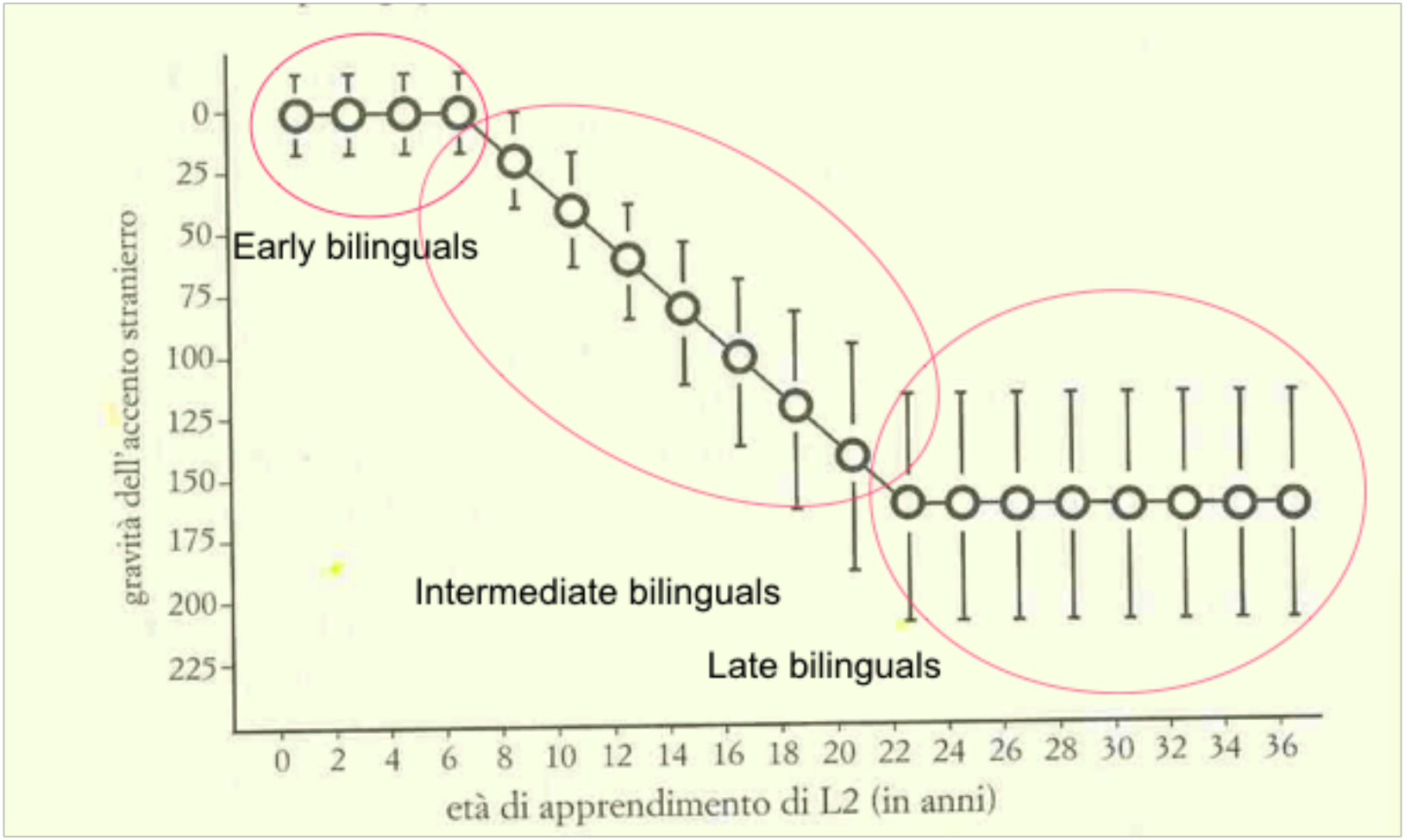
Figure 5. Social Interaction Facilitates Foreign Language Learning

The need for social interaction in language acquisition is shown by foreign-language learning experiments. Nine-month-old infants experienced 12 sessions of Mandarin Chinese through (A) natural interaction with a Chinese speaker (left) or the identical linguistic information delivered via television (right) or audiotape (data not shown). (B) Natural interaction resulted in significant learning of Mandarin phonemes when compared with a control group who participated in interaction using English (left). No learning occurred from television or audiotaped presentations (middle). Data for age-matched Chinese and American infants learning their native languages are shown for comparison (right) (adapted from Kuhl et al., 2003).

(Kuhl et al., 2003)

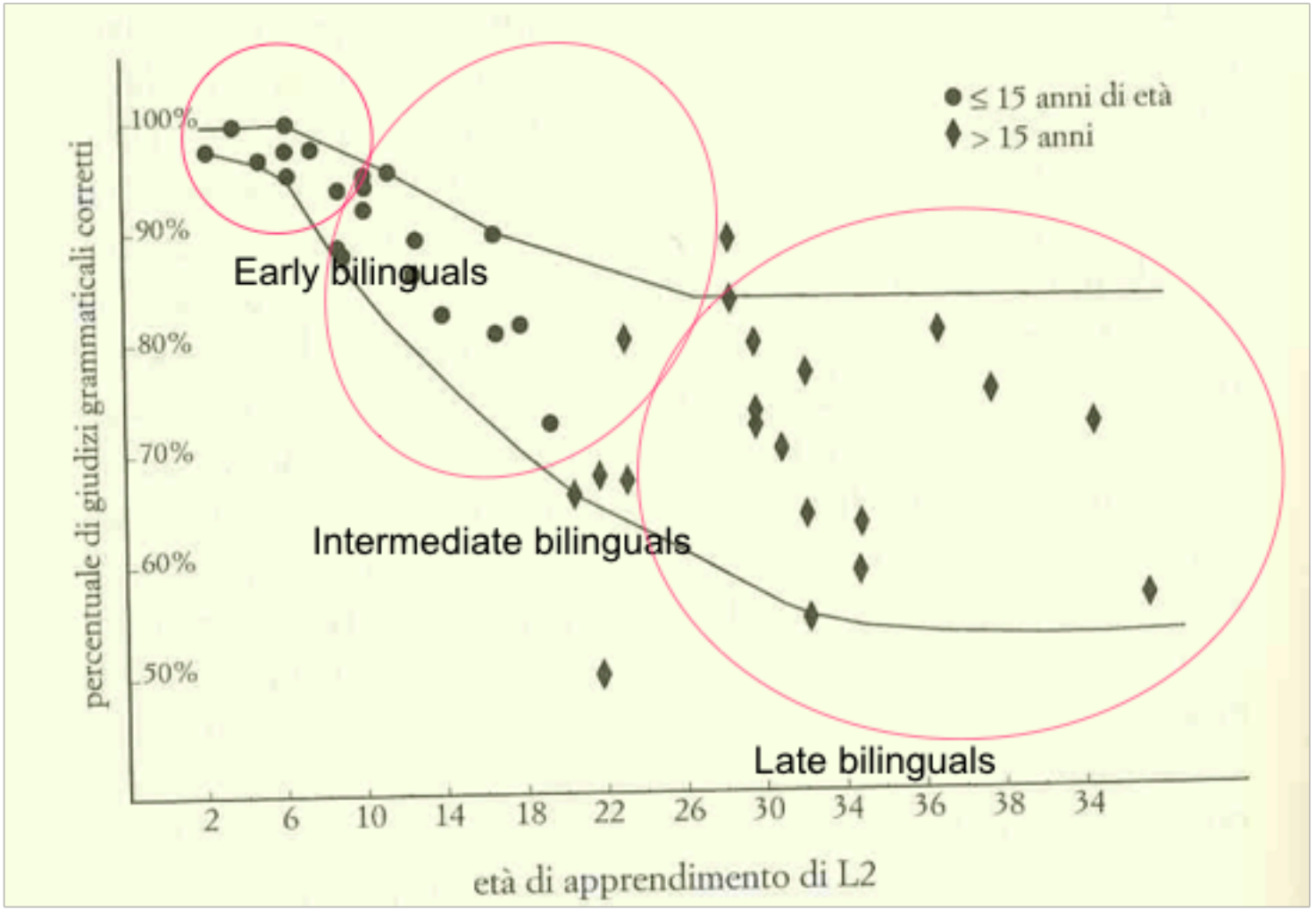
AoA affects L2 processing and learning

Phonological competence



(Flege, 1999)

Morphosyntactic competence



(Johnson & Newport, 1989)

Cognitive effects of bilingualism

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There is a diffuse prejudice ...

... the development of language is a complicated stuff ...

... therefore, bilingualism complicates the process of language acquisition

(Kay-Raining Bird et al., 2005; 2009)

However…

The role of phonological working memory and environmental factors in lexical development in Italian-speaking late talkers: A one year follow up study

	Late Talkers (N=33)	TLD (N=260)
General information		
Age (months)	32.49 (2.29); Range: 28-35	32.27 (2.60); Range: 26-35
Sex	Males: N = 22 (66.7%)	Males: N = 140 (53.8%)
Socio-Economic Status (SES)	High: N=11 (33.3%); Middle: N=17 (51.5%); Low: N=4 (12.1%)	High: N=116 (44.6%); Middle: N=113 (43.5%); Low: N=21 (8.1%)
Weight at birth (gr.)	3287.10 (401.33); Range: 2360-4350	3239.84 (530.91); Range: 1010-4540
Weeks at birth	38.82 (1.74); Range: 35-41	39.18 (2.21); Range: 28-42
Language exposure	Bilinguals: N=10 (30.3%)	Bilinguals: N=60 (23.1%)
Family history of language delay*	At risk: N=11 (33.3%)	At risk: N=34 (13.1%)
Breastfeeding	Yes: N=14 (42.4%)	Yes: N=106 (40.8%)
Complications during delivery	Yes: N=6 (18.2%)	Yes: N=30 (11.5%)
Complications during pregnancy	Yes: N=6 (18.2%)	Yes: N=54 (20.8%)
HLEQ*	41.53 (6.34); Range: 29-56	47.52 (6.82); Range: 26-62
Cognitive and linguistic profile		
Cube Design (WIPPSI)	9.55 (4.82); Range: 1-19	9.84 (3.71); Range: 1-26
Information (WIPPSI)*	8.12 (2.83); Range: 0-13	10.94 (2.44); Range: 4-19
Non-word repetition*	3.76 (3.08); Range: 0-11	7.36 (3.90); Range: 0-15
LDS_Words_scores*	104.67 (49.74); Range: 0-166	259.29 (46.13); Range: 95-310

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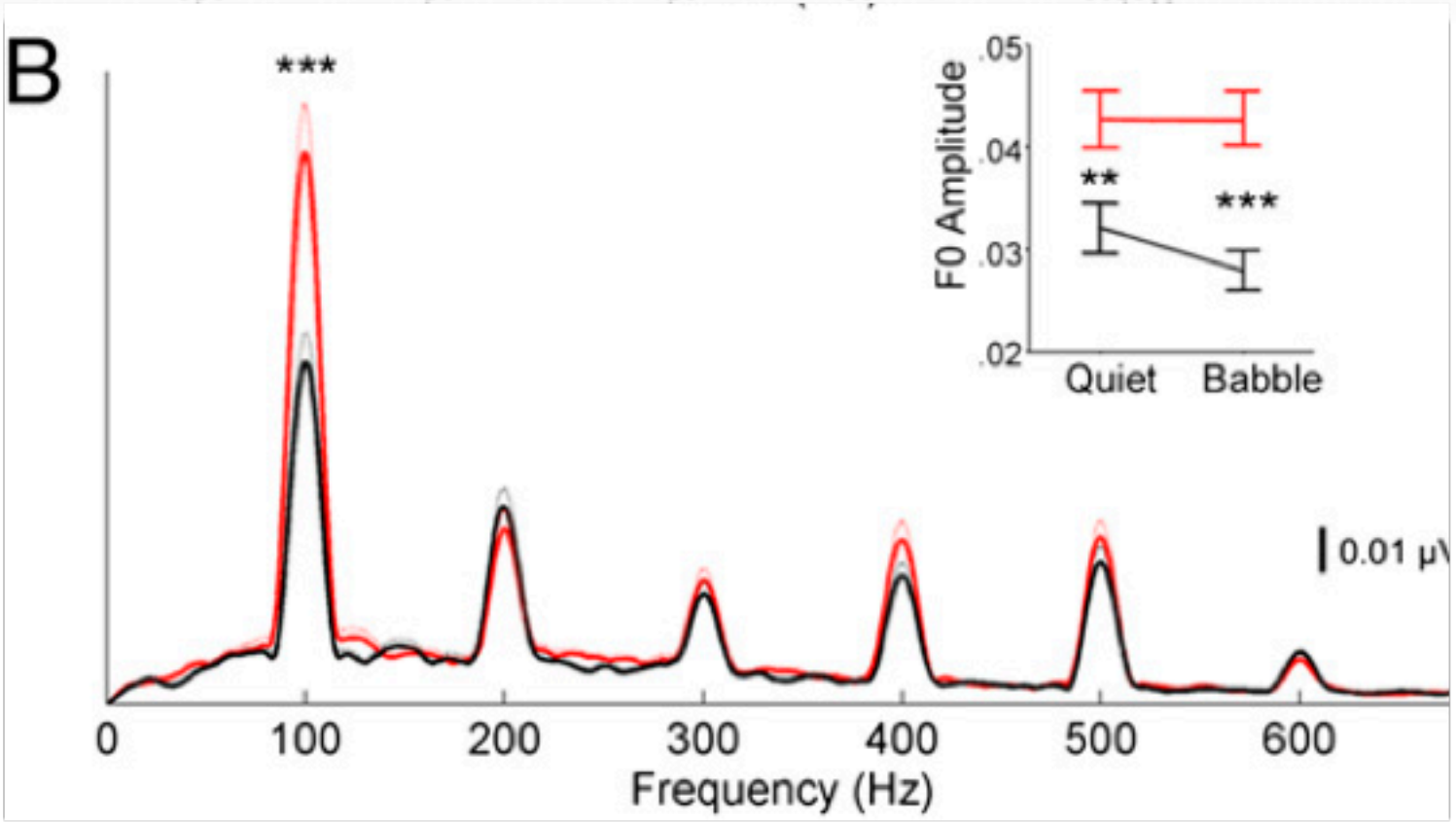
Better skills in auditory discrimination

Subcortical encoding of sound is enhanced in bilinguals and relates to executive function advantages

Jennifer Krizman[a,b,c], Viorica Marian[b,c], Anthony Shook[b,c], Erika Skoe[a,c], and Nina Kraus[a,c,d,e,f,1]



PNAS Early Edition

Enhanced Working Memory

Impact of early second-language acquisition on the development of first language and verbal short-term and working memory

Andrea Marini[a,b], Nadezda Eliseeva[a] and Franco Fabbro[b,c]

	Monolingual School ($N = 31$)	Bilingual School ($N = 31$)
Age	4.61 (.50) – Range: 4.02–5.11	4.60 (.50) – Range: 4.02–5.11
Years of formal education	2.48 (.51) – Range: 2–3	2.48 (.51) – Range: 2–3
Parental education	16.71 (2.22) – Range: 13–18	16.71 (2.22) – Range: 13–18
Sex	$M = 12$ (38.7%)	$M = 13$ (41.9%)
Handedness	Right-handed = 28 (90.3%)	Right-handed = 28 (90.3%)
Raven's matrices	17.48 (3.88) – Range: 12–26	15.61 (3.92) – Range: 8–26

Verbal short-term and working memory	Monolingual school	Bilingual school
Forward Digit Recall*	5.15 (2.09) – Range: 0–11	7.16 (1.46) – Range: 5–10
Non-word repetition*	13.23 (2.31) – Range: 7–15	14.55 (1.34) – Range: 8–15
Backward digit recall*	1.10 (1.33) – Range: 0–4	1.55 (1.34) – Range: 0–4

Note: Asterisks (*) show when the group-related differences were significant.

INTERNATIONAL JOURNAL OF BILINGUAL EDUCATION AND BILINGUALISM, 2016
http://dx.doi.org/10.1080/13670050.2016.1238865

Neural underpinnings of L2 processing and learning

Feature Review

Bilingualism: consequences for mind and brain

Ellen Bialystok[1,2], Fergus I.M. Craik[2] and Gigi Luk[3]

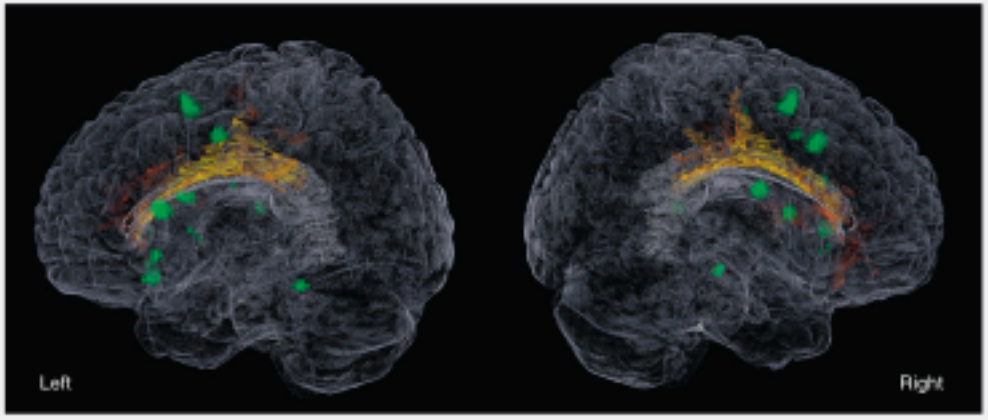


Figure 1. Bilingual influence on brain function and structure. Transparent brains showing the left and right hemispheres. Green voxels depict gray matter regions showing high activation during bilingual language switching in a meta-analysis [90]. Red–yellow voxels indicate regions of higher white matter integrity in bilingual older adults relative to monolinguals [107]. Together, the functional and structural data indicate that neural correlates of bilingualism are observed in the frontal lobes, generally responsible for higher cognition such as executive functions.

Trends in Cognitive Sciences April 2012, Vol. 16, No. 4

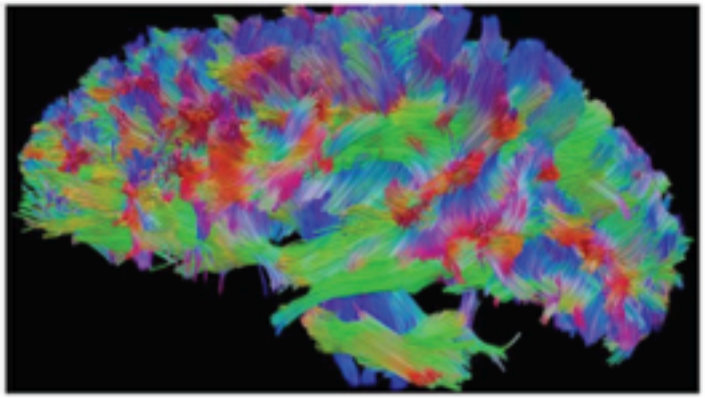
This improves resilience

Recovering two languages with the right hemisphere

Andrea Marini [a,b,c,*], Valentina Galetto [d,e], Karina Tatu [f,g], Sergio Duca [g], Giuliano Geminiani [e,f], Katiuscia Sacco [e,f,g,h], Marina Zettin [d,e,f,*]

R.it | Scienze

"Switch" cerebrale per salvare il cervello: è il primo caso al mondo



Un 19enne italo-romeno, dopo un incidente stradale, aveva perso l'uso della parola. Una ricerca italiana mostra che l'emisfero destro del suo cervello ha supplito alle funzioni di quello sinistro, consentendogli di tornare a parlare

Brain & Language 159 (2016) 35–44

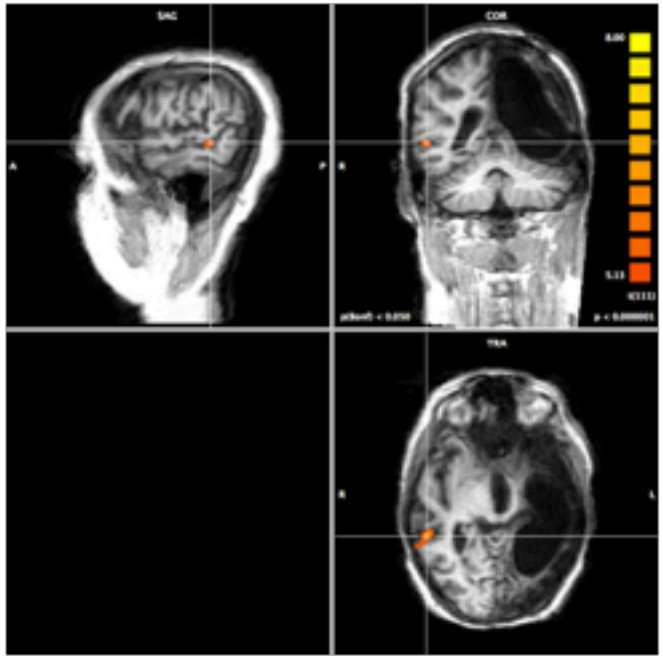
Recovering two languages with the right hemisphere

Andrea Marini [a,b,c,*], Valentina Galetto [d,e], Karina Tatu [f,g], Sergio Duca [g], Giuliano Geminiani [e,f], Katiuscia Sacco [e,f,g,h], Marina Zettin [d,e,f,*]

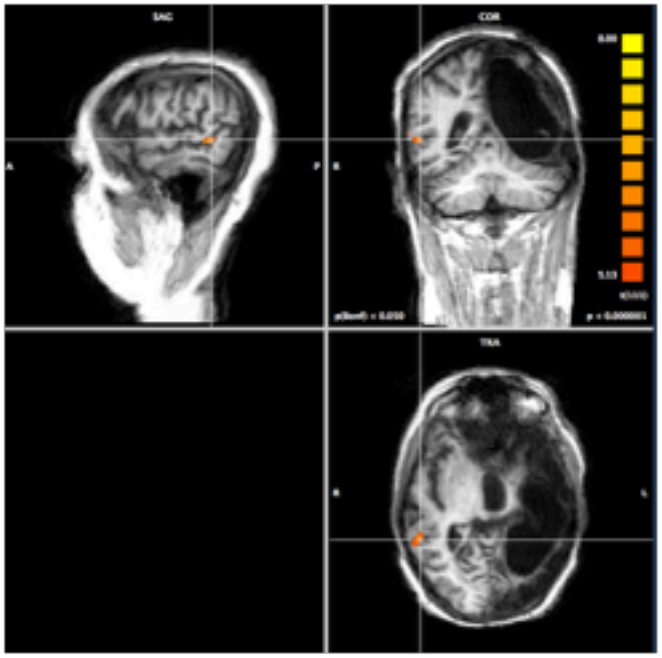
- Study → TBI (single case description of bilingual patient)
- Subject: Alex (23 y.o., in Italy since 7 y.o.)
  - L1 Romanian
  - L2 Italian
- Proficiency→ High in both languages

Brain & Language 159 (2016) 35–44

fMRI: Verb generation task



Italian



Romenian

Cluster of activation in the right middle temporal gyrus (MTG; BA 22)

Longer protection from neurodegeneration

Delaying the onset of Alzheimer disease

Bilingualism as a form of cognitive reserve

Fergus I.M. Craik, PhD
Ellen Bialystok, PhD
Morris Freedman, MD

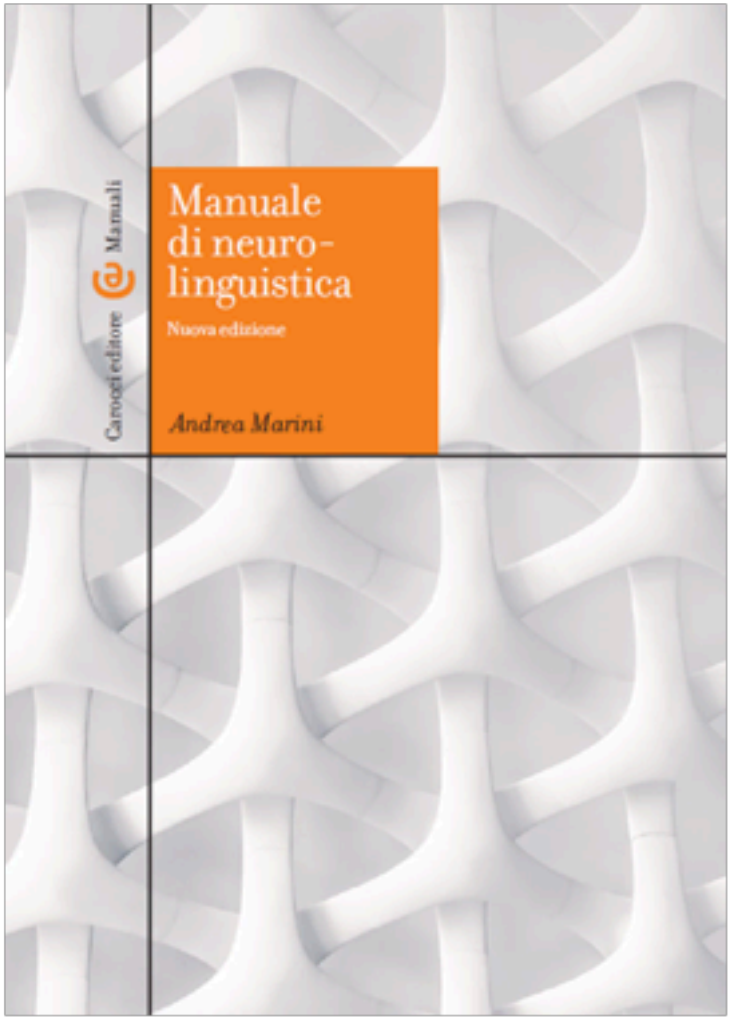
Table Mean value (SD) for descriptors for each language group

Language group	No.	Age at onset, y[a]	Age at first appointment, y[b]	Duration, y[c]	MMSE[d] at first appointment	Years of education	Occupation status[e]
Monolingual	109	72.6 (10.0)	76.5 (10.0)	3.8 (2.9)	21.5 (5.7)	12.6 (4.1)	2.8 (1.3)
Men	49	73.3 (9.4)	77.3 (8.9)	3.9 (2.9)	22.1 (5.7)	13.2 (4.4)	3.2 (1.0)
Women	60	72.1 (10.4)	75.9 (10.8)	3.7 (2.9)	21.0 (5.7)	12.0 (3.8)	2.5 (1.3)
Bilingual	102	77.7 (7.9)	80.8 (7.7)	3.1 (1.9)	20.4 (5.6)	10.6 (5.1)	2.5 (1.1)
Men	42	77.6 (7.8)	80.4 (7.8)	2.8 (1.8)	21.0 (4.8)	11.1 (6.1)	3.0 (0.9)
Women	60	77.8 (8.1)	81.1 (7.6)	3.3 (1.9)	20.0 (6.0)	10.3 (4.3)	2.2 (1.2)

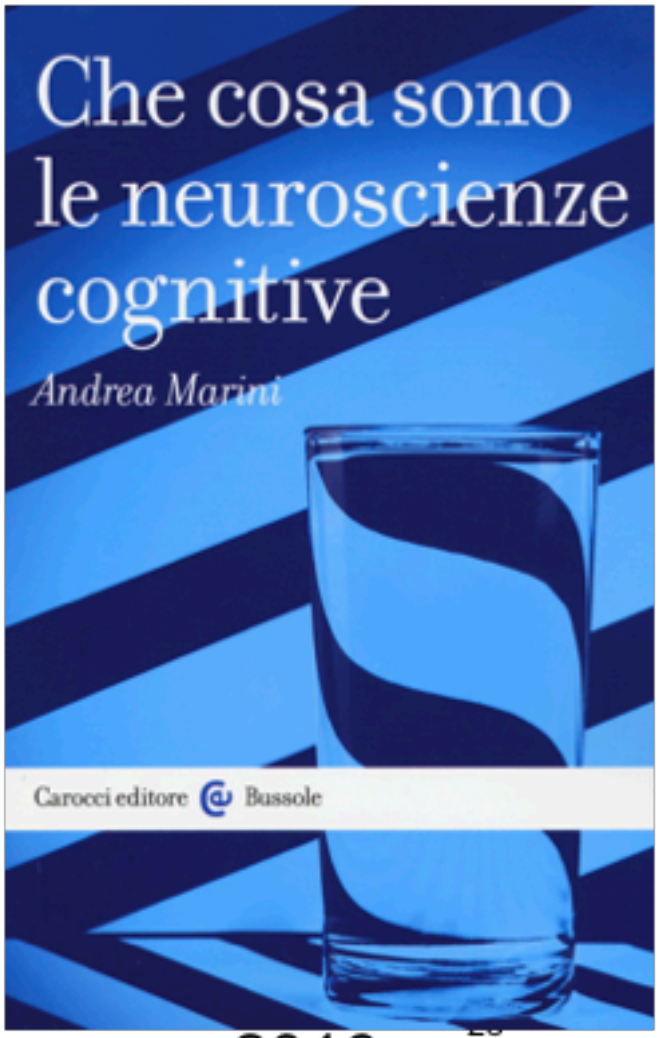
Abbreviation: MMSE = Mini-Mental State Examination.
[a] Age at which symptoms were first reported by family.
[b] Age at first visit to clinic.
[c] Duration of elapsed time between [a] and [b].
[d] Scores out of 30.
[e] Based on 4-point scale developed by Human Resources and Skills Development, Canada, in which higher numbers signify higher status.

Neurology 75 November 9, 2010

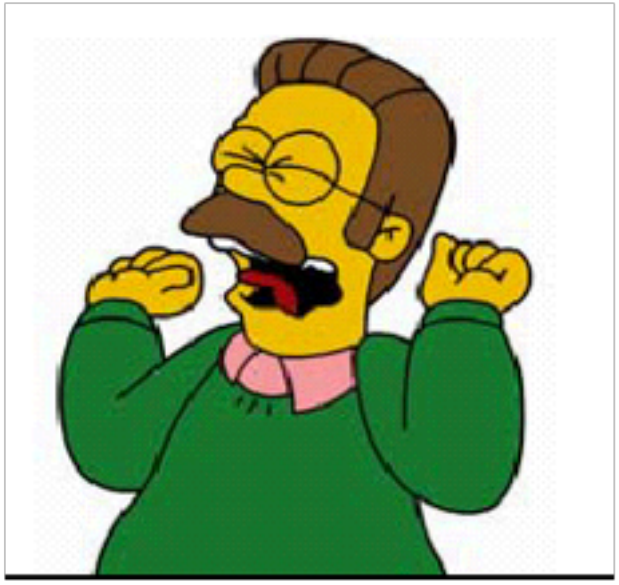
Ne volete sapere di più sui rapporti tra comunicazione e cervello?



2018



2016



Thanks for your attention!!!

andrea.marini@uniud.it