ACTIVE BILINGUALISM AS A COGNITIVE RESERVE MECHANISM IN MILD COGNITIVE IMPAIRMENT

Marco Calabria, PhD
Pompeu Fabra University (Spain)

DISCLOSURES

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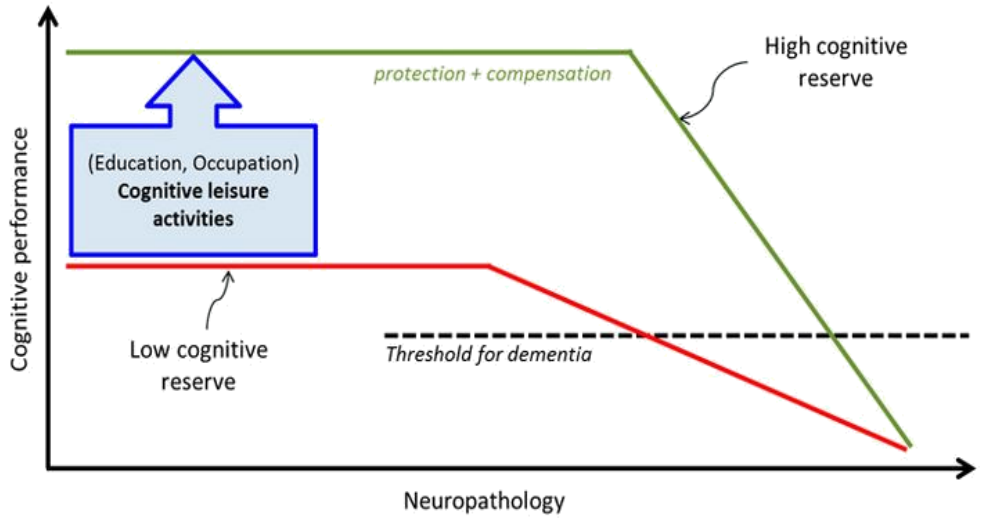
'*Bilingualism as a contributor to cognitive reserve in healthy and pathological aging*'

Cognitive reserve: mechanisms



Individual differences in how people cope better than others with brain pathology (Stern, 2009)

higher efficiency, greater capacity, or more flexibility

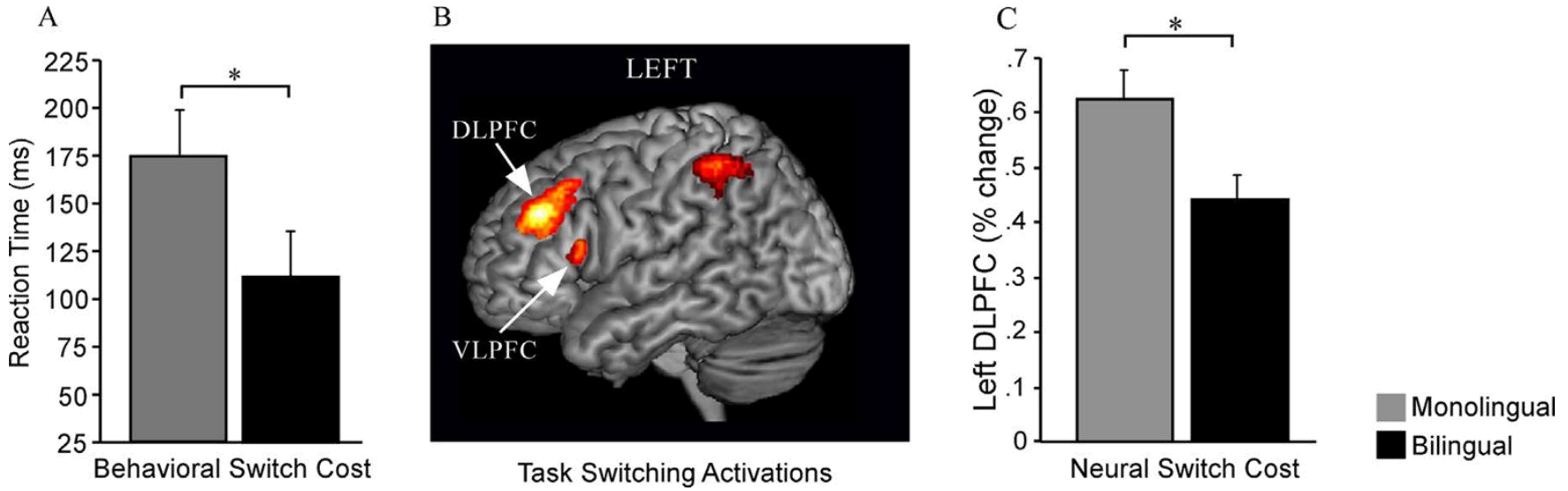
compensation by using alternative and spared brain structures

lifelong bilingualism?

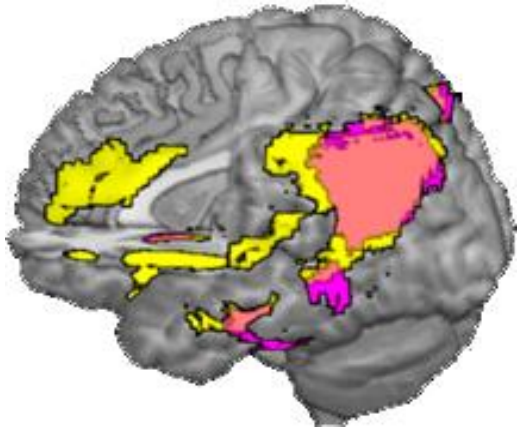
Cognitive reserve and bilingualism: **cognitive aging**

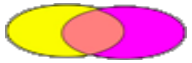
Higher efficiency in executive control and at neural level

Gold et al., 2013



Cognitive reserve and bilingualism: **dementia**



BILINGUALS  MONOLINGUALS

Perani et al., 2017

Decreased metabolism (bilinguals < monolinguals)

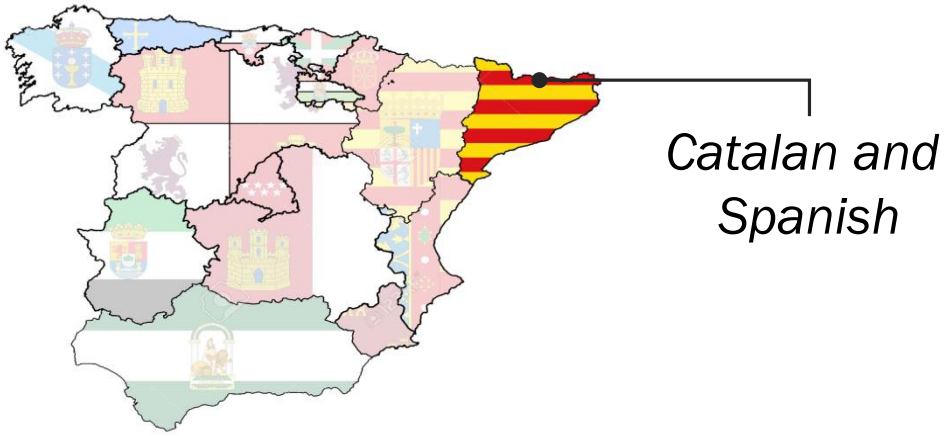
Region	Coordinates
L frontal inferior operculum	[−52;4;6]
L inferior frontal gyrus	[−48;12;12]
L orbitofrontal cortex	[−6;14;−26]
L superior temporal gyrus	[−49;−11;−3]
L parietal operculum	[−56;−14;26]
L inferior parietal lobule	[−48;−32;30]
L insula	[−38;2;0]
L parahippocampal gyrus	[−16;−26;−16]
L putamen	[−23;−9;15]
L cerebellum	[−34;−42;−44]
R putamen	[26;−8;15]
R cerebellum	[32;−76;−26]

But bilinguals compared to monolinguals
a. were better for **short- and long-term verbal memory and visuo-spatial tasks**
b. had **increased metabolic connectivity** both in the fronto-parietal executive control network

*…bilingual individuals with AD **compensate** better for the loss of brain structure and function.*

Efficiency and compensation: study approach

Does the **higher efficiency of cognition in bilinguals** act as a compensatory mechanism against cognitive decline?



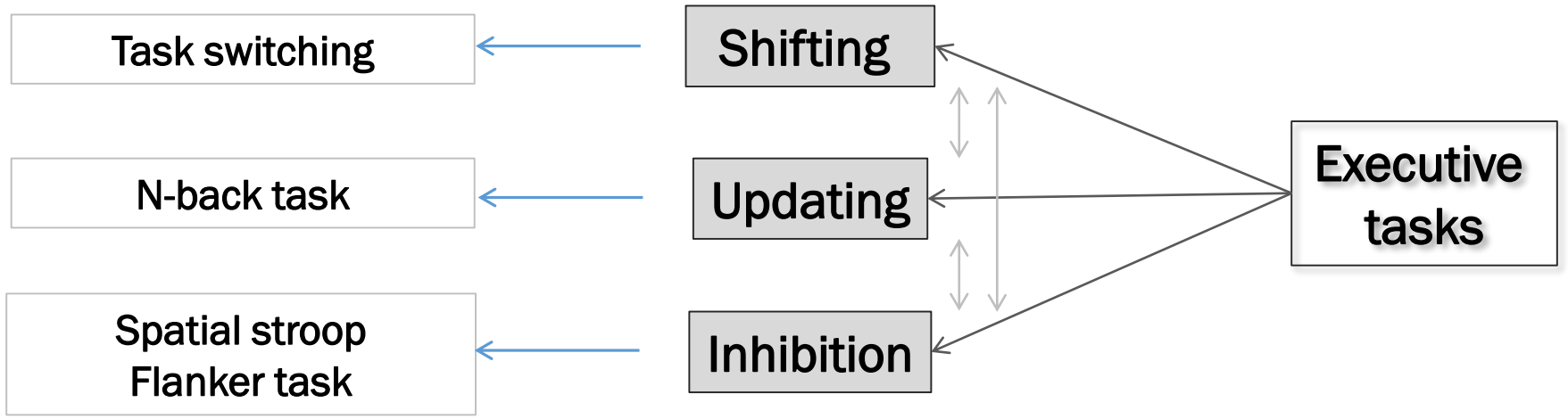
a. **Active vs. passive** bilinguals: is the use of the two languages?

b. Confounding **immigration:** active bilinguals are not immigrants

c. **Pre-clinical stage of dementia:** people with **M**ild **C**ognitive **I**mpairment

Two languages, higher efficiency of executive control?

Miyake's model of executive control (2000)



Non-executive control tasks

- Face recognition memory task
- Neuropsychological measures for short-term and long-term memory

Classification of patients based on language skills

Age of L2 acquisition and Frequency of L2 use

Older adults (n=50)	
Active bilinguals *n=23*	*Passive bilinguals* *n=27*
Frequency of L2 use (%)	
35.5 (14.6)	7.0 (8.7)
Age of L2 acquisition	
.9 (2.5)	17.2 (1.7)

MCI (n=120)	
Active bilinguals *n=40*	*Passive bilinguals* *n=80*
Frequency of L2 use (%)	
49.6 (11.3)	8.6 (17.7)
Age of L2 acquisition	
1.0 (2.3)	19.7 (1.2)

AD (n=67)	
Active bilinguals *n=31*	*Passive bilinguals* *n=36*
Frequency of L2 use (%)	
46.2 (10.8)	4.9 (8.8)
Age of L2 acquisition	
.8 (2.1)	23.7 (1.7)

Classification of patients based on language skills

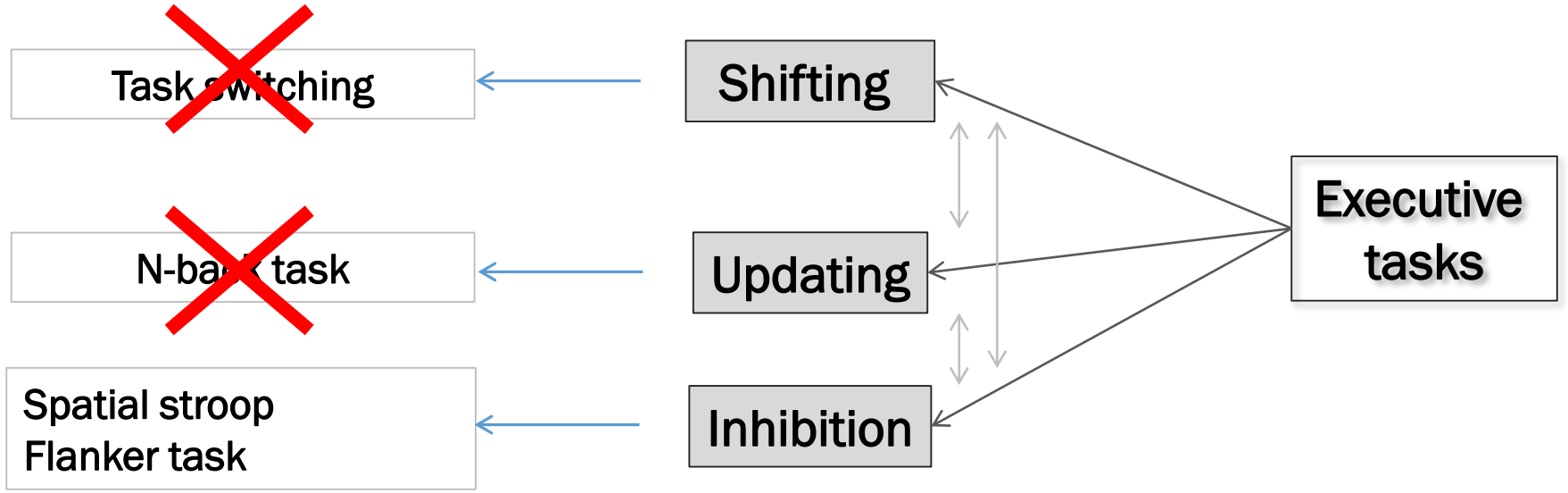
	Older adults		MCI		AD	
	Active	Passive	Active	Passive	Active	Passive
Education	7.7 (.8)	6.4 (.7)	9.3 (.9)	6.1 (.5)	8.1 (.9)	7.1 (.7)
Cogn. Reserve Index Nucci, Mapelli, & Mondini (2012)	**118** (17)	**108** (16)	**111** (22)	**89** (15)	100 (18)	99 (18)
Neuropsychology						
MMSE	27.8 (.9)	28.6 (1.1)	27.3 (1.6)	27.1 (2.0)	24.0 (2.9)	22.8 (4.8)
CERAD (Episodic memory)						
Free recall	5.1 (2.0)	4.3 (1.7)	1.9 (1.6)	1.9 (1.4)	.9 (1.3)	.3 (.9)
Recognition	18.8 (.7)	18.3 (1.6)	15.9 (2.4)	16.2 (2.4)	13.5 (3.0)	12.4 (4.3)
Forward digit span	5.1 (.9)	4.8 (.9)	5.1 (.9)	5.0 (.6)	4.2 (.8)	4.5 (.8)
Backward digit span	3.9 (.6)	3.6 (.5)	3.5 (.8)	3.5 (.1)	2.9 (.7)	3.1 (.8)
Trail Making Test A	50.0 (17.0)	56.3 (17.2)	77.3 (48)	83.1 (46.3)	95.8 (39.2)	119 (65.2)

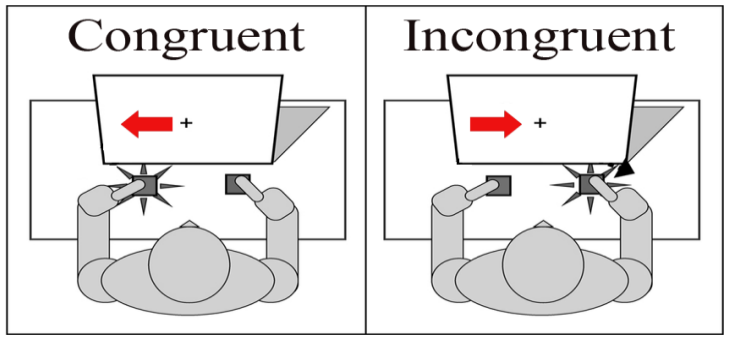
Delay of cognitive symptoms?

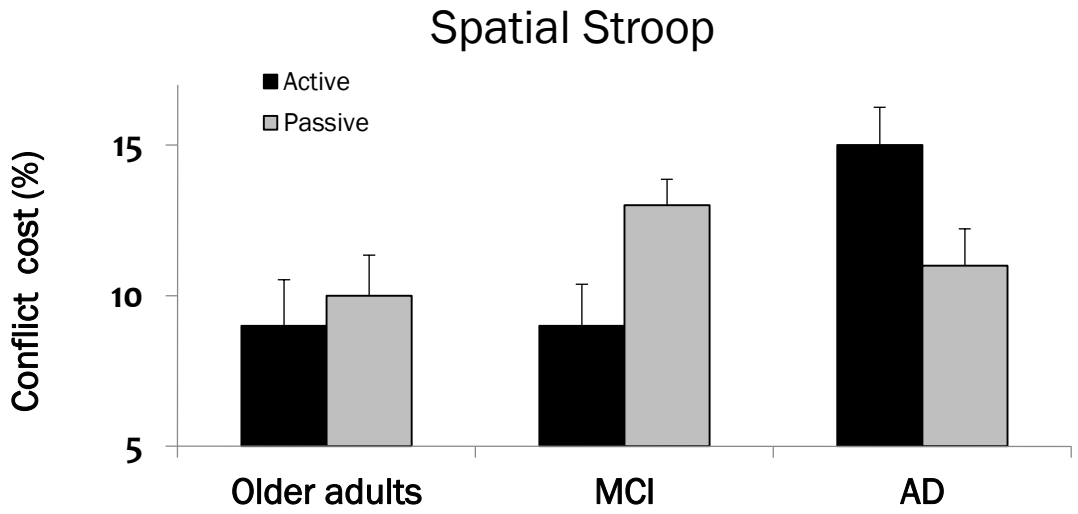
	MCI		AD	
	Active	Passive	Active	Passive
Age at testing	**76.0** (6.2)	**73.1** (4.2)	**77.5** (4.8)	**76.0** (5.2)
Age of diagnosis	**75.6** (6.3)	**72.1** (4.5)	**75.9** (6.3)	**76.8** (4.9)
Age of first visit	**73.2** (6.5)	**69.7** (4.8)	**74.7** (5.4)	**73.9** (5.1)
Age of symptom onset	**71.8** (5.5)	**69.3** (4.6)	72.4 (5.4)	72.9 (5.3)

	MCI		
	Active	Passive	Monolinguals (Madrid)
Age of diagnosis	**75.6** (6.3)	**72.1** (4.5)	**70.9**(3.9)
Age of first visit	**73.2** (6.5)	**69.7** (4.8)	**69.9**(4.2)

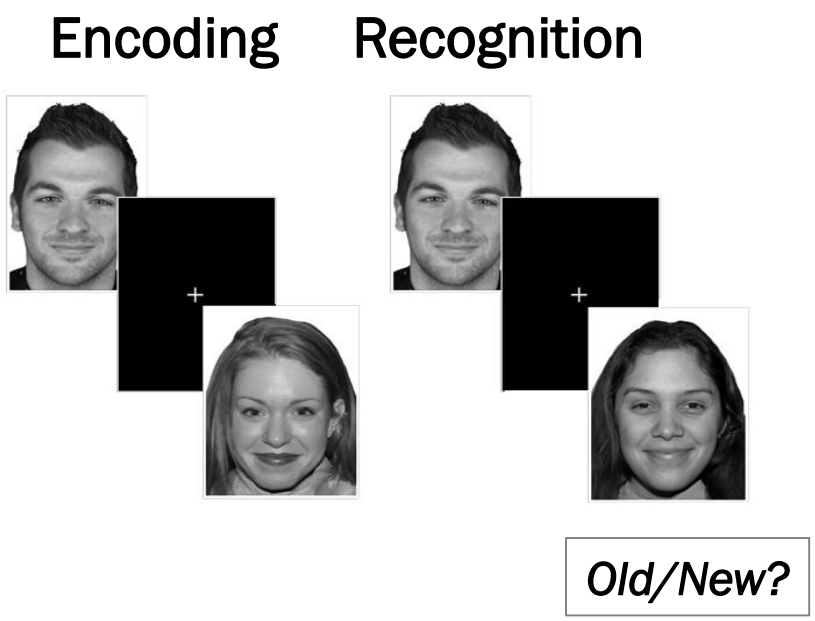
Higher efficiency of executive control?

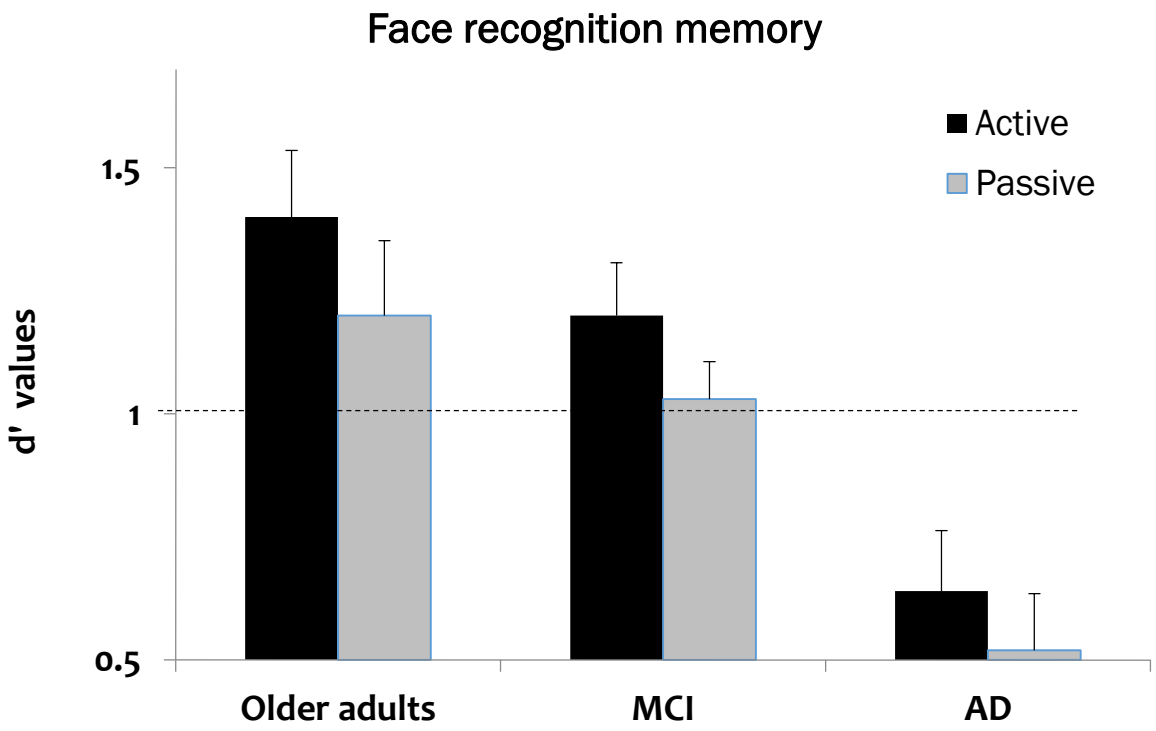






Higher efficiency of memory?





Conclusions: efficiency and compensatory mechanisms

1. Delays the onset of cognitive symptoms especially in the **pre-clinical stage of dementia (MCI)**

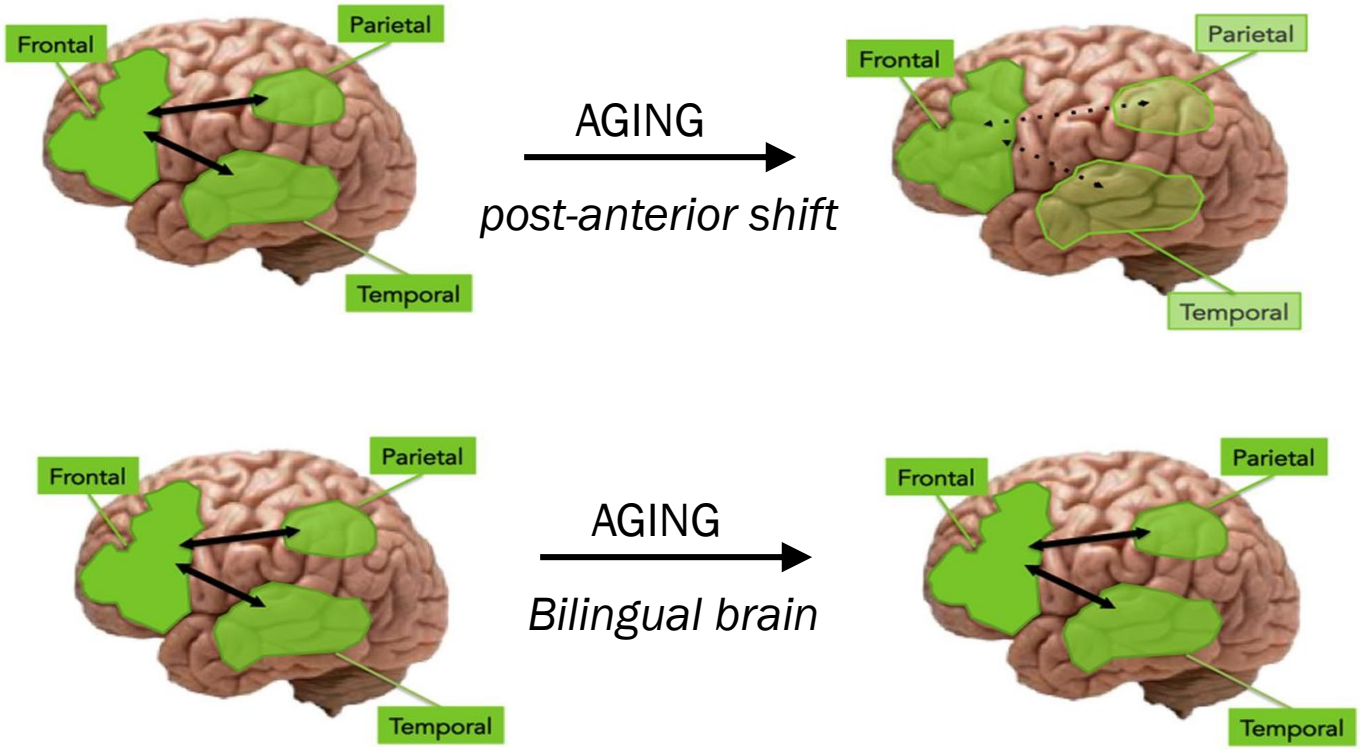
2. On executive control: not consistent across tasks and specific to **inhibitory system or conflict monitoring,** only for MCI patients

3. Also on **long-term episodic memory** (Back et al., 2014; Perani, 2017)

Conclusions

Compensation of executive control and more efficient memory?

Grant, Dennis, & Li, 2014 (see also Cabeza et al., PASA/ELSA models)



CBC
Center for Brain and Cognition

Speech Production and Bilingualism
Pompeu Fabra University (Barcelona, Spain)

Collaborations

Bellvitge Hospital Universitari

Consorci Sanitari Integral

Hospital General de Granollers
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Sant Pau

AfAB
Associació de Familiars d'Alzheimer de Barcelona

...and thanks for your attention!