Culture, Bilingualism, Neuropsychological Tests, and Biomarkers in MCI and early AD.

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1 Florida ADRC

Prevalence of MCI & AD

- Varies as a function of education: higher rates of dementia reported in low educated individuals compared to highly educated groups
- Age, education, Apolipoprotein E (APOE) ε4 have been identified as risks factor for MCI and AD
- Differs among ethnic groups

Sachdev et al., 2012; Kryscio et al., 2006; Petersen et al., 2010

Prevalence of MCI & AD in Hispanics

- Risk factors for MCI among non-Hispanic cohorts are not the same for specific groups of Hispanic-Americans

O'Bryant et al., 2013

Prevalence of MCI & AD in Hispanics

- Age but not education increases risk for MCI (O'Bryant et al., 2013)
- Depression and diabetes add to this risk (Johnson, 2015)
- Dementia onset at a younger age (O'Bryant et al., 2007; Fitten, 2014)

Biomarkers of MCI & AD in Hispanics

- Less likely to carry the APOE ε4 allele [Haan, Mungas, et al., 2003 ; Tang et al., 1998)
- The biomarker profile of MCI (proteomic profile in fasting serum) has shown to be different to previously generated MCI/AD profile
- These findings implicate a possible interplay between inflammatory and metabolic processes (Edwards, 2016)

Biomarkers of MCI & AD in Hispanics

MRI predictors of cognition differed across ethnic groups.

- Larger hippocampal volume was more strongly associated with better memory among non-Hispanic whites compared with Hispanics (Zahodne, Manly et al., 2015)

Biomarkers of MCI & AD in Hispanics

At the 1Florida ADRC (Burke et al. -submitted)

- For equivalent levels of performance on culturally fair neuropsychological tests, WNHs participants had greater volumes of the inferior lateral ventricle than Hispanics, indicating more atrophy surrounding this structure.

- Suggesting less atrophy in the regions surrounding the ILV, which include the hippocampus, para-hippocampal, lingual and inferior temporal gyri,

Biomarkers of MCI & AD in Hispanics

- Unmeasured cultural and language factors (such as bilingualism) influenced the neuropsychological tests used to assess cognitive and functional performance

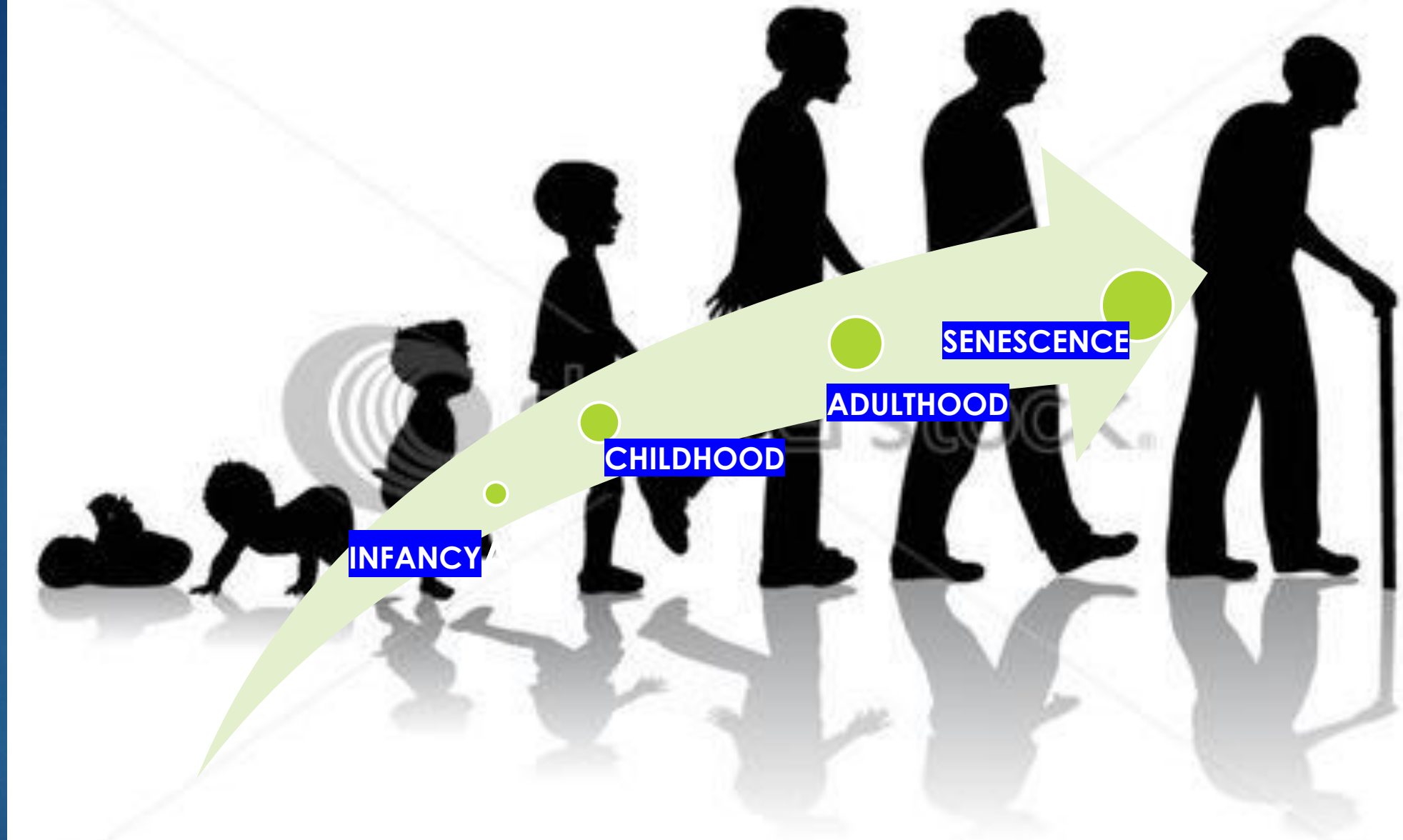
- Do these factors modify brain structures?

Hispanics/Latinos culture: variables

- Immigration: bi/multicultural, stress
- Culture factors: perception of assessment
- Education
- Language experience: Bilingualism

(Ardila, 2013)

BILINGUALISM



BILINGÜISMO

BILINGUALISM

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Bilingual experience

- keeps the window of brain flexibility (plasticity) open for a longer period of time postponing the perceptual narrowing
- keeping the universal perception of phonemes

BILINGUALISM

- Increased mental flexibility
- Superior selective attention
- Diverse cognitive strategies
- Metalinguistic awareness

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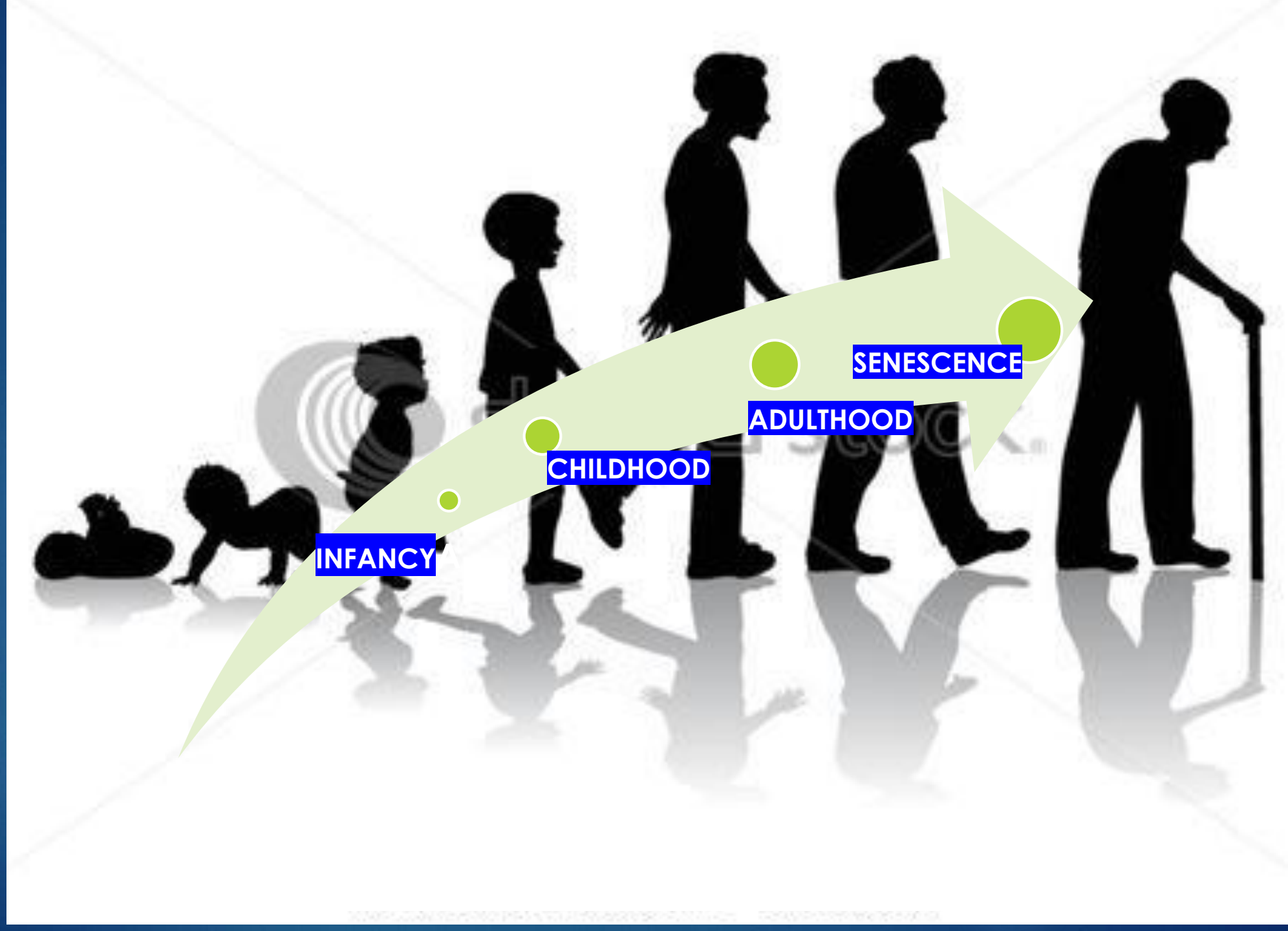

BILINGÜISMO

Bilingualism: ADVANTAGES

- Bialystok et al., 2008; Bialystok, Martin, 2004; Rosselli, et al., 2000)

Article

The International Journal of Bilingualism

The effect of bilingualism and age on inhibitory control

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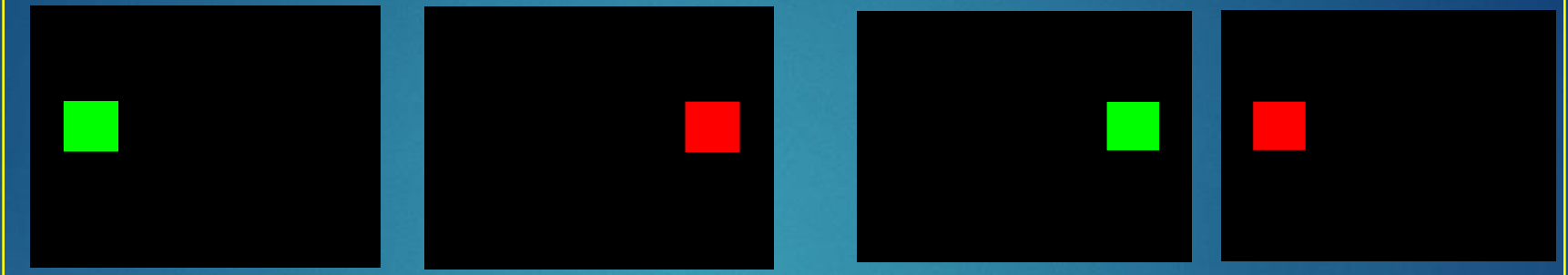
Bilingualism: ADVANTAGES

Bilinguals show less response cost in reaction time (RT) when response changes are required in a control inhibitory task

(Prior, 2010)

Simon Effect: Incongruent - Congruent



Congruent trials: stimulus and response are in the same location

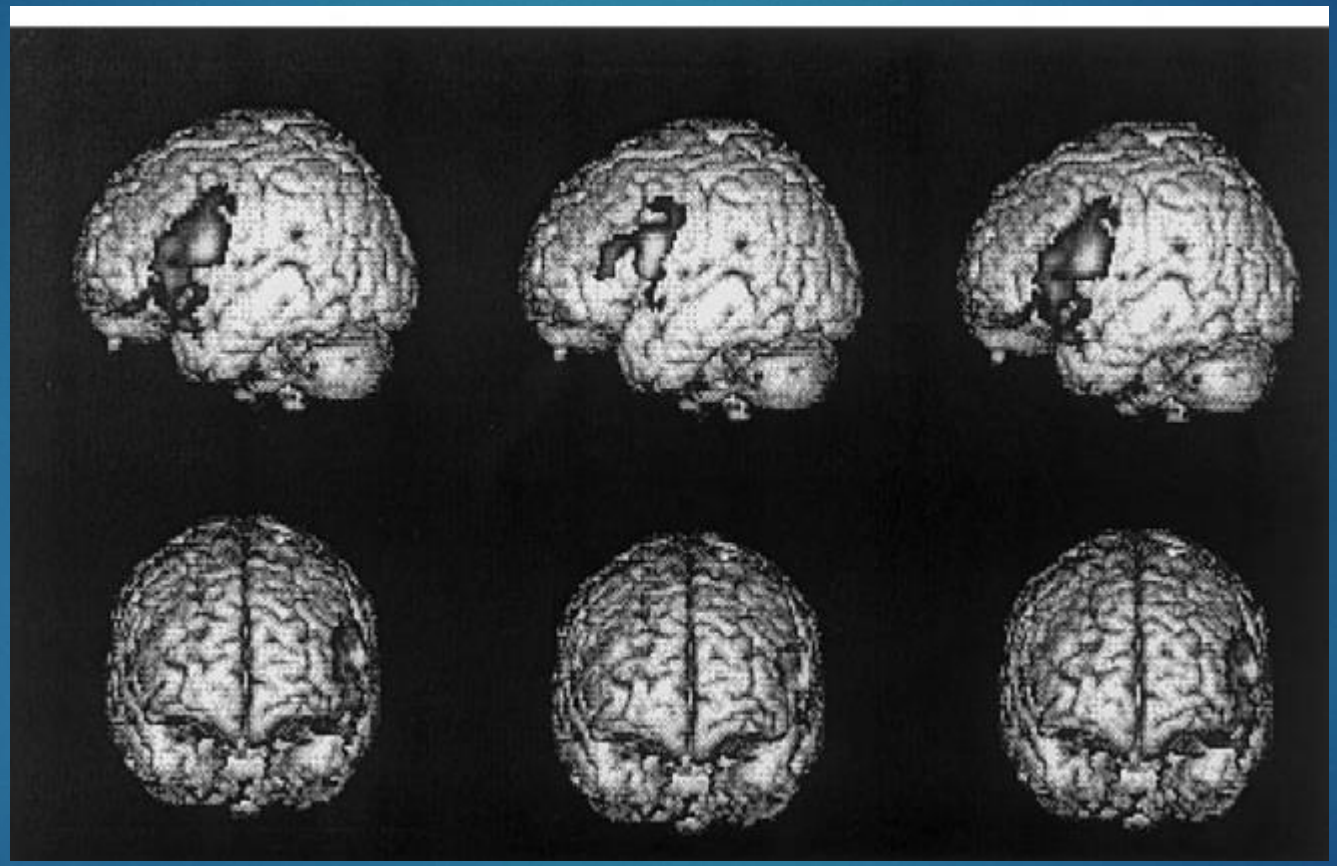
Incongruent trials: stimulus and response are in different location

Significant increases in reaction latency in the incongruent trials

How does bilingualism improve executive control?

- Permanent need to monitor their two languages (van Heuven, et al., 2008).
- Language switching (Hernandez et al., 2001)

Switching between the two languages: increase activation of the dorsolateral **prefrontal**



Hernandez et al., 2001)

How does bilingualism improve executive control?

- Same brain network is used in language switching and in inhibitory control tasks (Abutalebi & Green 2007; Luk et al. 2012)
- Attentional control of inhibition and activation of each language
- Monitoring and selecting the language in use

Current Topics in Research

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Verbal Fluency in Bilingual Spanish/English Alzheimer's Disease Patients

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Studies have demonstrated that in verbal fluency tests, monolinguals with Alzheimer's disease (AD) show greater difficulties retrieving words based on semantic rather than phonemic rules. The present study aimed to determine whether this difficulty was

Cognitively normal subjects retrieved significantly more items under the semantic condition compared to the phonemic, whereas the performance of AD patients was similar under both conditions, suggesting greater decline in semantic verbal fluency tests. This

Bilingualism and dementia

- Protective effects from abnormal aging decline of EFs (Bialystok, et al., 2004, 2006, 2012)

- AD is diagnosed at a more advanced age in bilinguals compared to monolinguals (Bialystok et al. 2007; Craik et al. 2010)

The advantage of bilingualism not always found

- N=1,067 Spanish English bilinguals
- Neuropsychological follow up: 23 years
- 18-24 months intervals

- Heights Inwood Columbia Aging Project (WHICAP)
- (Zahodne et al., *2014*)

The advantage of bilingualism not always found

- Bilingualism was associated with better cognitive function at baseline.
- With covariates (level of education, years of immigration) no differences in the dementia conversion

- (Zahodne et al., *2014*)

The advantage of bilingualism not always found

Protection:

- Kowoll, et al. Journal of Alzheimer's Disease vol. 45, no. 4, pp. 1257-1268, 2015
- Lawton, et al. *Cortex*. 2015 May
- Zahodne, Neuropsychology, 2014 Mar;28(2):238-46.

Advantage:

- Gathercole et al., 2014;
- Kirk, Fiala, Scott-Brown, & Kempe, 2014;
- Kousaie, Sheppard, Lemieux, Monetta, & Taler, 2014;
- Morton & Harper, 2007;
- Paap & Greenberg, 2013;
- Paap, Johnson, & Sawi, 2014)

Publication bias favoring the report of significant effects (de Bruin, Treccani, & Della Sala, 2015)

Methodological problems (Paap, 2014; Valian, 2015).

The effect of bilingualism is complex: interacts with other variables

Bilingualism: Language and Cognition: page 1 of 15 © Cambridge University Press 2015 doi:10.1017/S1366728915000309

The effect of language proficiency on executive functions in balanced and unbalanced Spanish–English bilinguals*

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This study analyzed the association between levels of language proficiency and levels of bilingualism and performance on verbal and nonverbal executive functions (working memory, updating, shifting, and inhibition tasks) in young bilinguals. Forty balanced (high and low proficiency), 34 unbalanced bilinguals, and 40 English monolinguals, were selected. The Bilingual Verbal Ability Test was used as a measure of language proficiency; WAIS Block design test was used as a measure of non-verbal intelligence. High proficiency balanced bilinguals performed better than low proficiency balanced bilinguals; unbalanced bilinguals scored in between both balanced groups. High proficiency monolinguals scored higher than low proficiency monolinguals and similar to high proficiency bilinguals. Regression analyses demonstrated that nonverbal intelligence significantly predicted performances on verbal working memory and verbal and nonverbal inhibition tasks. It was concluded that nonverbal intelligence scores are better predictors of executive function performance than bilingualism or language proficiency.

Keywords: Bilingualism, proficiency, balance, executive functions, working memory, Spanish

Verbal executive function

Table 4. *Regression of the z score composite BVSAT score on the composite z score on verbal executive function tasks*

	Unstandardized Coefficients		Standardized Coefficients		
Model	*B*	Std. Error	Beta	*t*	*p*
Age	−0.07	0.03	−0.21	−2.57	0.012
BVAT Composite	0.24	0.10	0.22	2.35	0.021
Block design	0.74	0.20	0.35	3.78	<0.01
R^2	0.28				
Adjusted R^2	0.26				
F	14.38				<.001

Note. BVAT = Bilingual Verbal Ability Test. Verbal composite score included the scores on the following tests: digits forward, the digits backwards and the Stroop inhibition cost

(Rosselli et al., 2015)

The effect of bilingualism is complex: interacts with other variables

Bilingualism alone may be insufficient to explain the protective effect; other variables probably have to be taken into consideration (level of education, language proficiency, type of bilingualism)

Bilingualism costs

Applied Neuropsychology
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Verbal Fluency and Repetition Skills in Healthy Older Spanish–English Bilinguals

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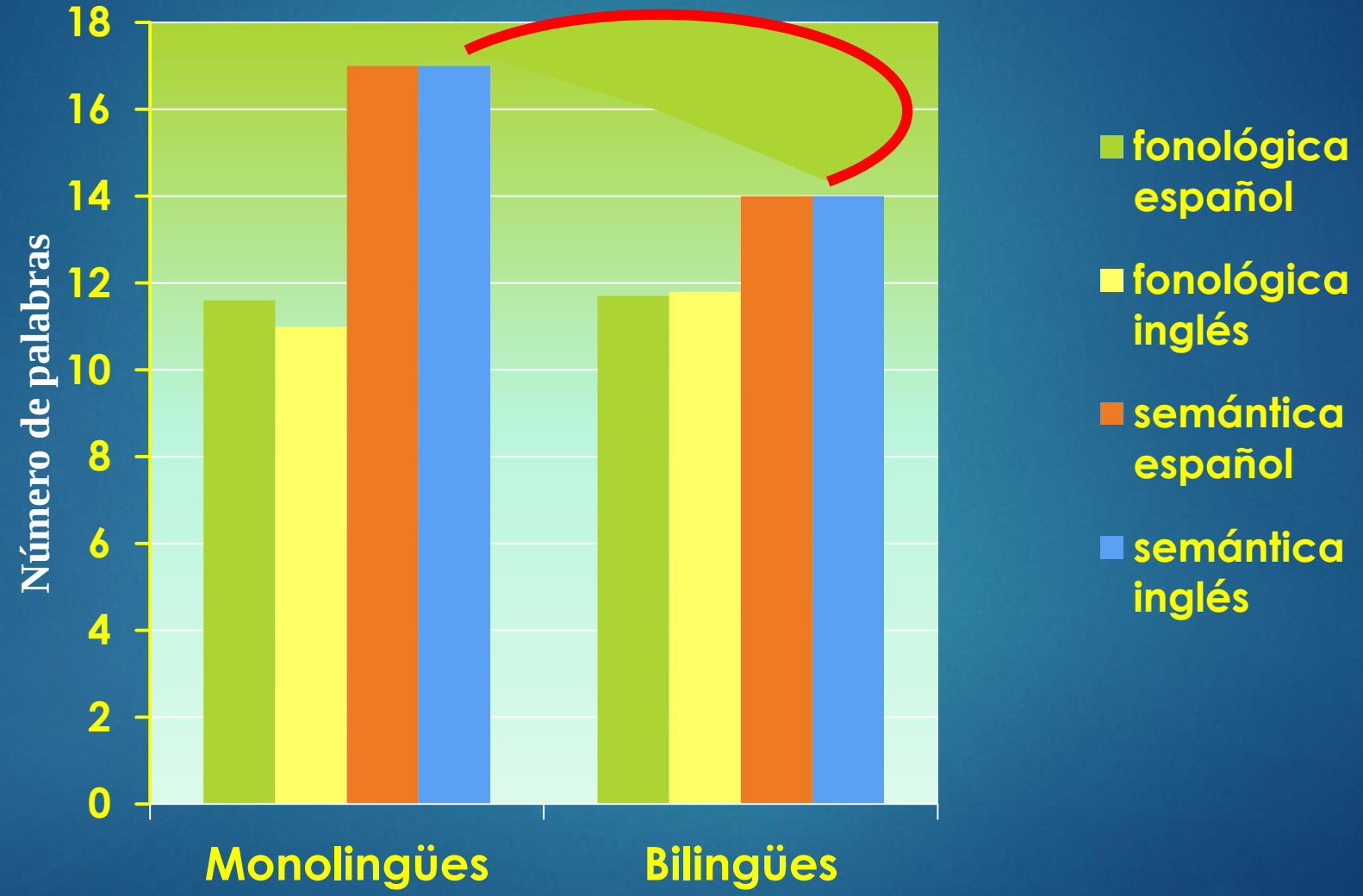
Inter linguistic interference (Rosselli, et al 2000; Gollan, et al.,, 2002)



(Rosselli et al., 2000)

Currently at the Florida 1 Alzheimer's Disease Center

- Further analyses of the effect of bilingualism over cognitive and brain function in pre-MCI, MCI and early AD using a longitudinal design (5 years follow up)

LASSI-L

Loewenstein-Acevedo Scales of Semantic Interference and Learning

Regression Model:
DV: Delayed free recall list A and B
Predictors: Dx, bilingualism, age, education

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	808.934	4	202.234	7.929	.001[b]
Residual	357.066	14	25.505		
Total	1166.000	18		$R^2 = .684$	

The language experience and proficiency questionnaire (LEAP-Q).

Regression Model:
DV: Delayed free recall list A and B

Model	B	Std. Error	Beta	t	p
(Constant)	39.398	16.568		2.378	.032
Education	.002	.413	.001	.006	.995
Bilingualism index	-1.332	.436	-.490	-3.056	.009
Age	-.174	.187	-.155	-.931	.368
Dx	-6.461	1.500	-.672	-4.307	.001

Education and BI = Correlation -.38 p=.094

Conclusions

- Critical need for more diverse samples in the study of cognitive aging
- Better cross-cultural neuro-cognitive paradigms
- The relation of neurobiological substrates of cognitive functioning may be different for different groups

Conclusions

- Bilingualism has a complex effect in cognition may be one of the contributing factors to cognitive and brain differences in the Hispanic groups

- Culture and language mismatch between the examiner and the participant is a confounding variable; not controlled in most studies

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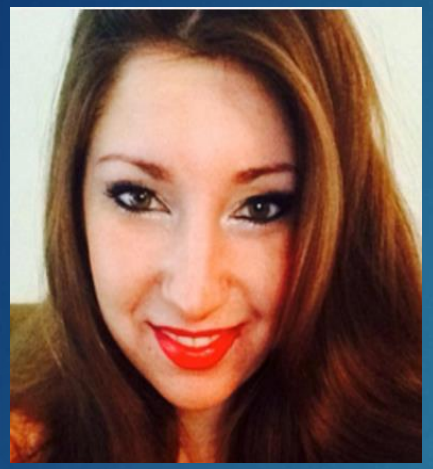

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Thank you very much!
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