

# How Learning Two Languages Positively Impacts Cognitive Development

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# Bilingual Experience

Monolingual

Bilingual



## Factors:

- Proficiency
- Usage
- Age of Acquisition
- Language Dominance
- And many more!

# Bilingualism in Society



Spanish-English bilinguals  
Recent immigrants



Many languages  
Many heritage language speakers

## **Greater Toronto Area:**

5.8 million people

63% of households use a non-English/non-French language

224 languages

Top 5: Cantonese (9.5%), Mandarin (8.5%), Punjabi (6.8%),  
Italian (6.0%), Tagalog (5.9%)

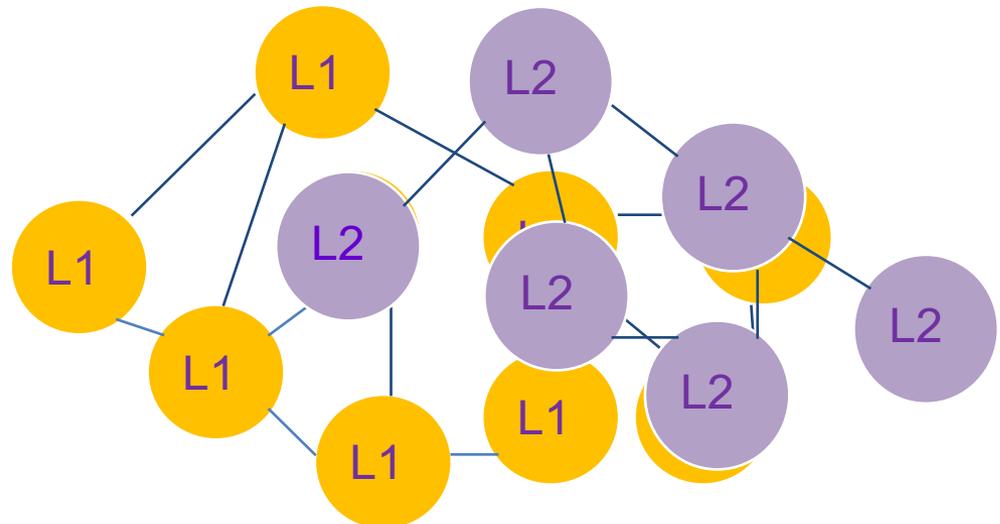
# Common Myths in Childhood

*Grosjean (2010)*

- ✘ Bilingualism will delay language acquisition in children
- ✘ The language spoken in the home will negatively impact the school language
- ✘ Bilingualism will confuse the child and they will always mix their languages!

# The Bilingual Mind

- Bilinguals have two interacting systems
- Both languages always active to some degree
  - Joint activation
  - Need to select target language
- The executive functions (selective attention) recruited for language processing



# Executive Functions

- A set of mental cognitive processes that are important for goal-oriented behavior
  - Ability to initiate and stop actions
  - Monitor and change behavior as needed
  - Plan future behaviors when faced with novel tasks

# Selective Attention



# Lifespan

Preverbal Infants



Adolescents



Older Adults



Children



Young Adults



INFANCY

# Pre-Verbal Infants

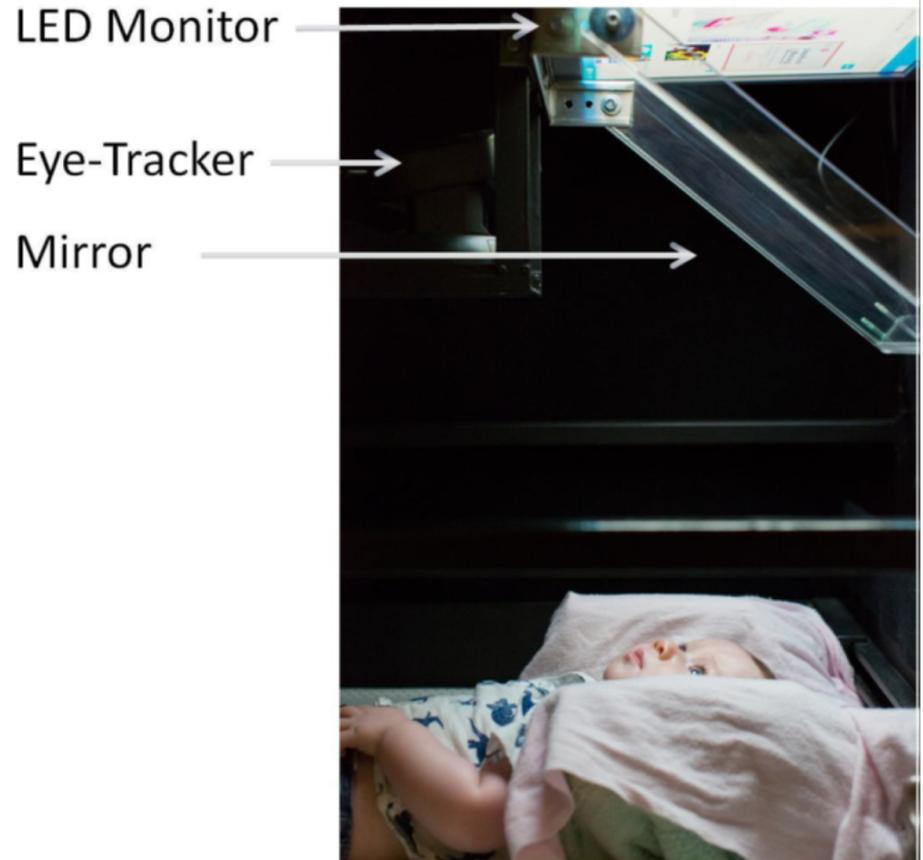
In the first year of life, bilingually-raised infants are able to:

- Detect language switches
- Strategically look at the eyes and mouths of a speaker
- Override habitual responses

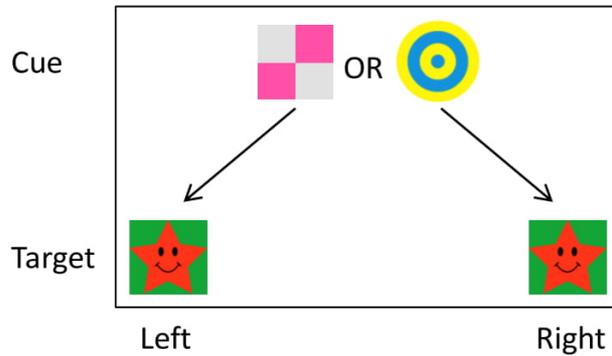
# Attention in Infancy

*Comishen, Bialystok, & Adler, under review*

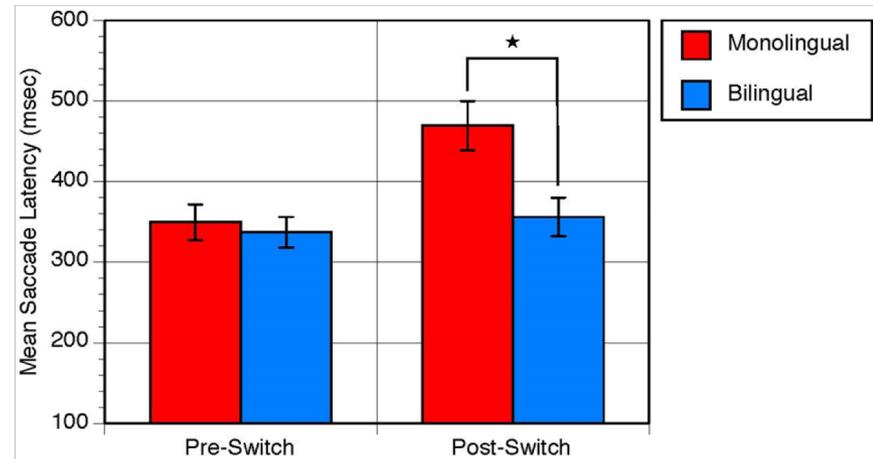
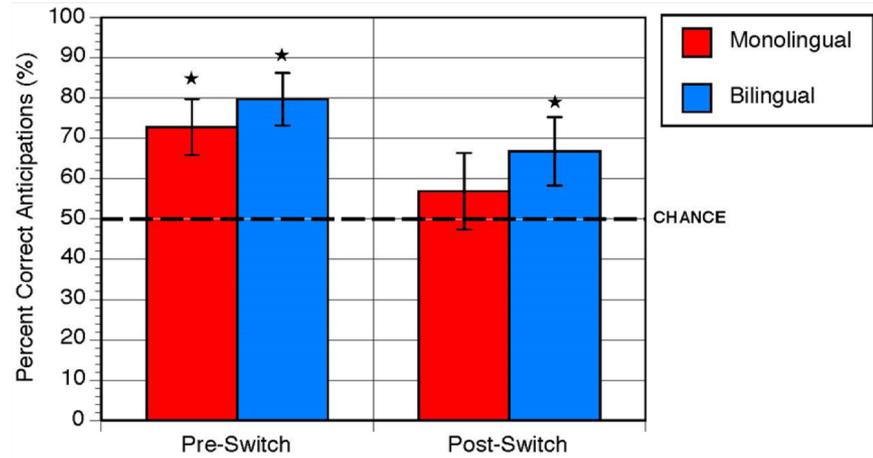
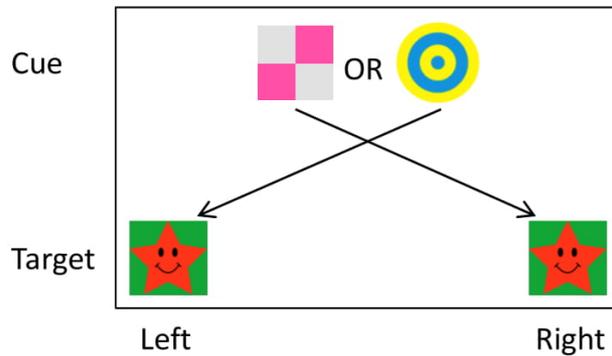
- Attention is fundamental to cognitive ability and is the key to **Executive Functioning**
- Linguistic environment more complex in bilingual homes
- Does this affect their developing attention systems?
- Test attention in 6-month old infants



### Pre-Switch



### Post-Switch



20 monolingual infants  
20 bilingual infants  
6 month-olds

Bilingual infants at 6 months learn associations better than monolingual infants

# Summary

- The effects of bilingualism can be detected quite early
- Infants raised in a bilingual household show greater **attentional control** to stimuli in their surroundings than those raised in a monolingual household

*Are these effects detected in school-aged children who are now able to produce language?*



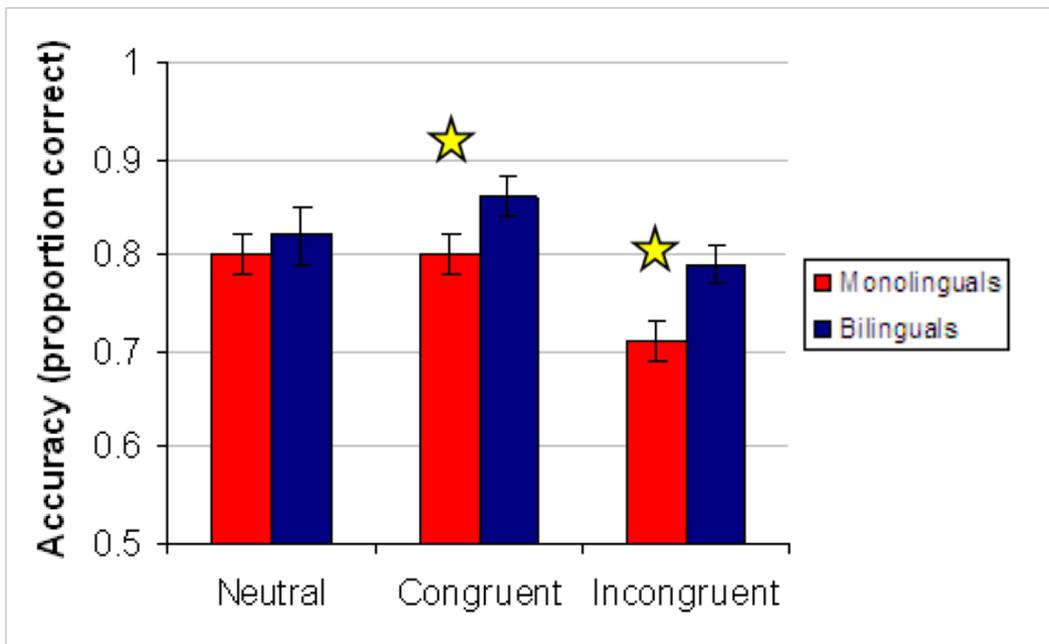
CHILDHOOD

# Children

*Barac and Bialystok, 2016, Child Development*

- Equivalent on age, SES, IQ, English vocabulary

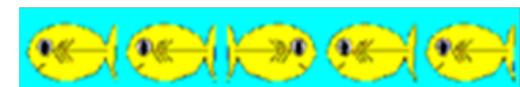
37 monolinguals  
25 bilinguals  
5 year-olds



Neutral



Congruent

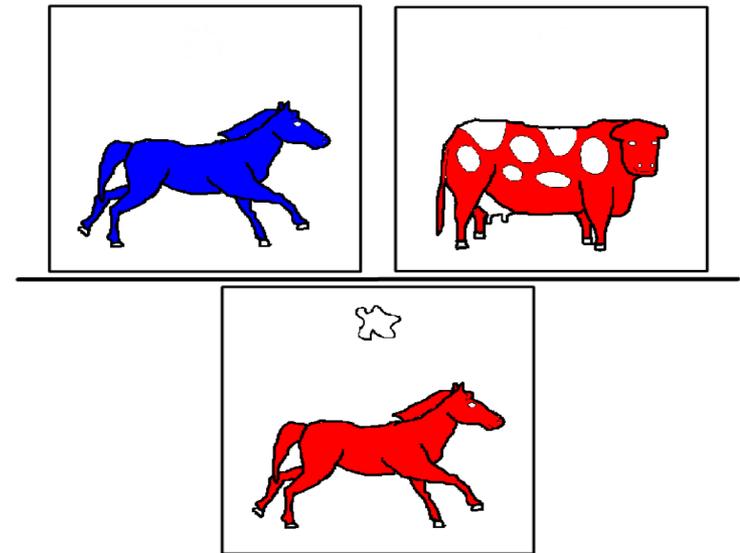


Incongruent

# How about culture?

*Barac & Bialystok, 2012, Child Dev*

- Matched on age, SES, and IQ
  - 26 English monolinguals
  - 30 Chinese-English bilinguals
  - 28 French-English bilinguals
  - 20 Spanish-English bilinguals
  - 5 years of age



## Task-Switching

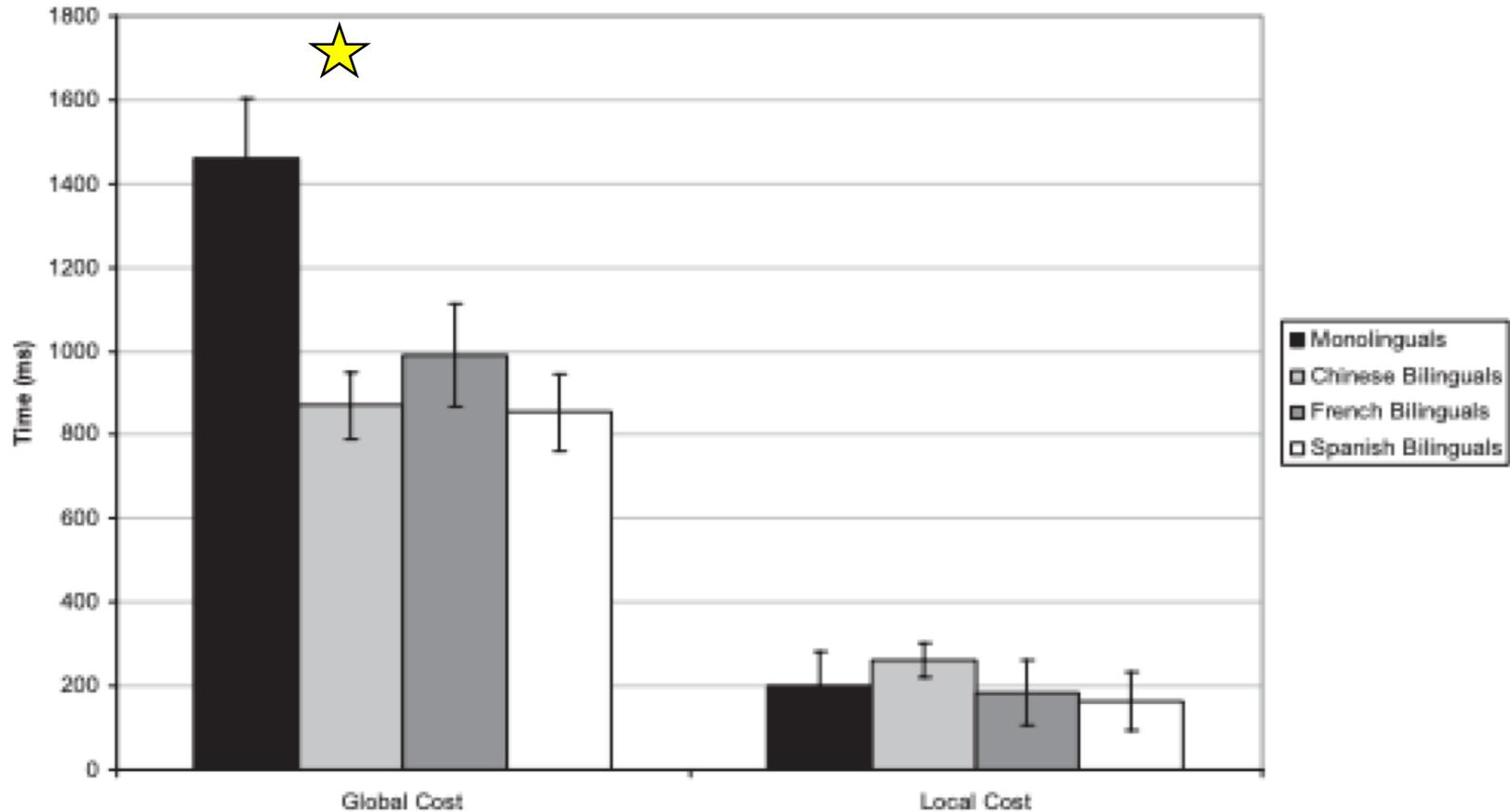
- Pure Block
  - Non-switch trials (only color or only shape)
- Mixed Block
  - Non-switch trials
  - Switch trials

Global Cost

Local Cost

# How about culture?

*Barac & Bialystok, 2012, Child Dev*

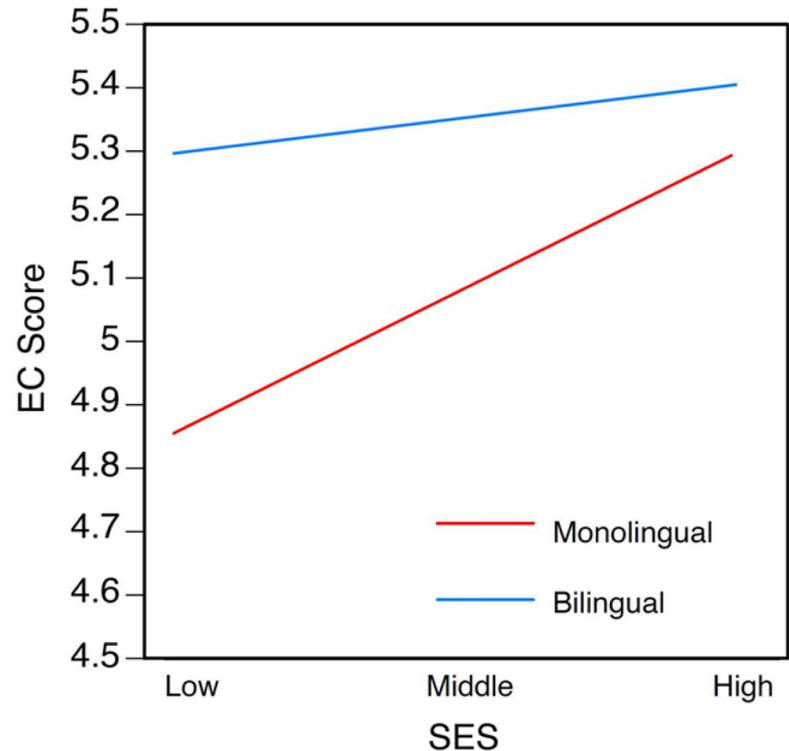


*Bilinguals are better at maintaining a task set across the mixed block, an advantage found across all three bilingual groups*

# Socioeconomic Status (SES) and Bilingualism

*Hartanto et al., 2018, Child Dev*

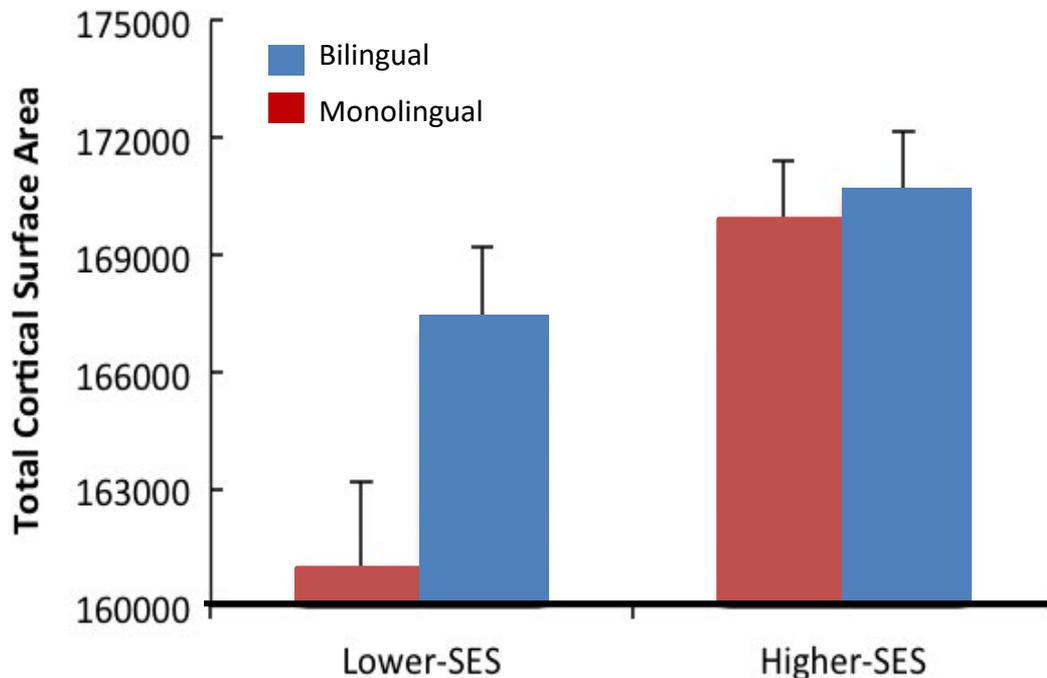
- SES is an important predictor of EF
- 18,200 children tracked from 5 – 7 years old (ECLS-K: 2011)
- Full range of SES
- Does bilingualism affect Executive Functioning independently of SES?



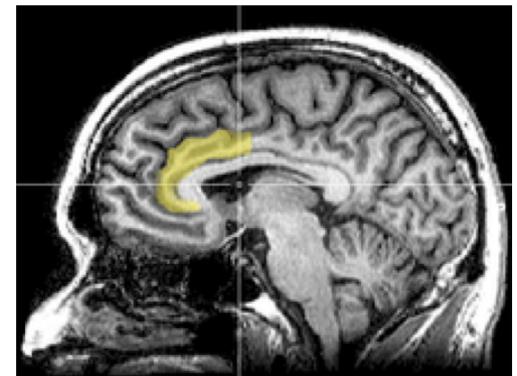
# Socioeconomic Status and Brain Development

*Brito & Noble, 2018, Dev Sci*

- Cortical volume (brain size) modified by SES
- 562 children and adolescents (3 – 20 years) across range of SES
  - 281 bilinguals and 281 monolinguals (MATCHED sample)



- More total cortical surface area in ACC



# Summary

- Bilingual children outperform monolingual children on a variety of EF tasks
- Bilingualism can narrow socioeconomic disparities in EF during early childhood!
  - Mitigates the negative effect of low SES by providing an enriched linguistic environment

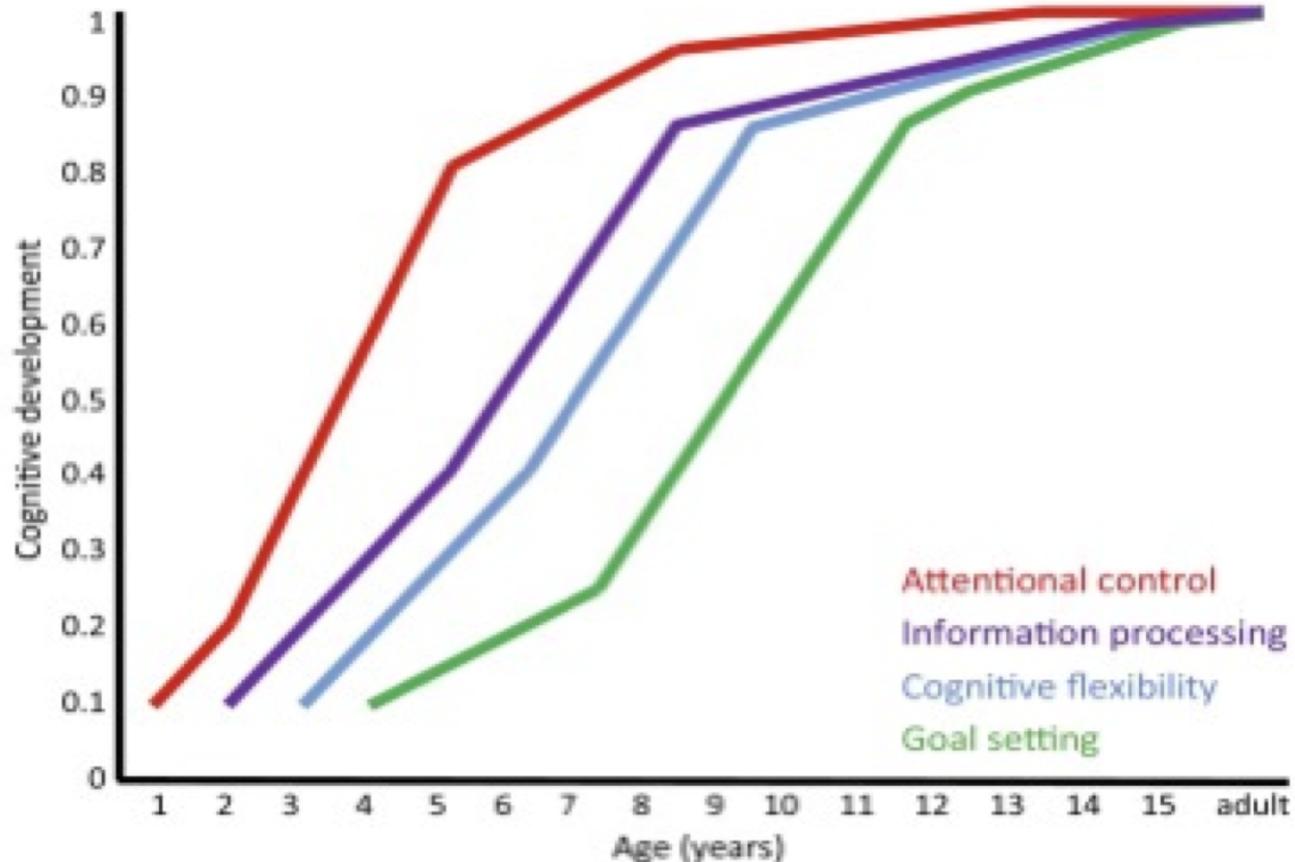
*How long do these effects last? Can we detect these differences in adolescence?*



# ADOLESCENCE

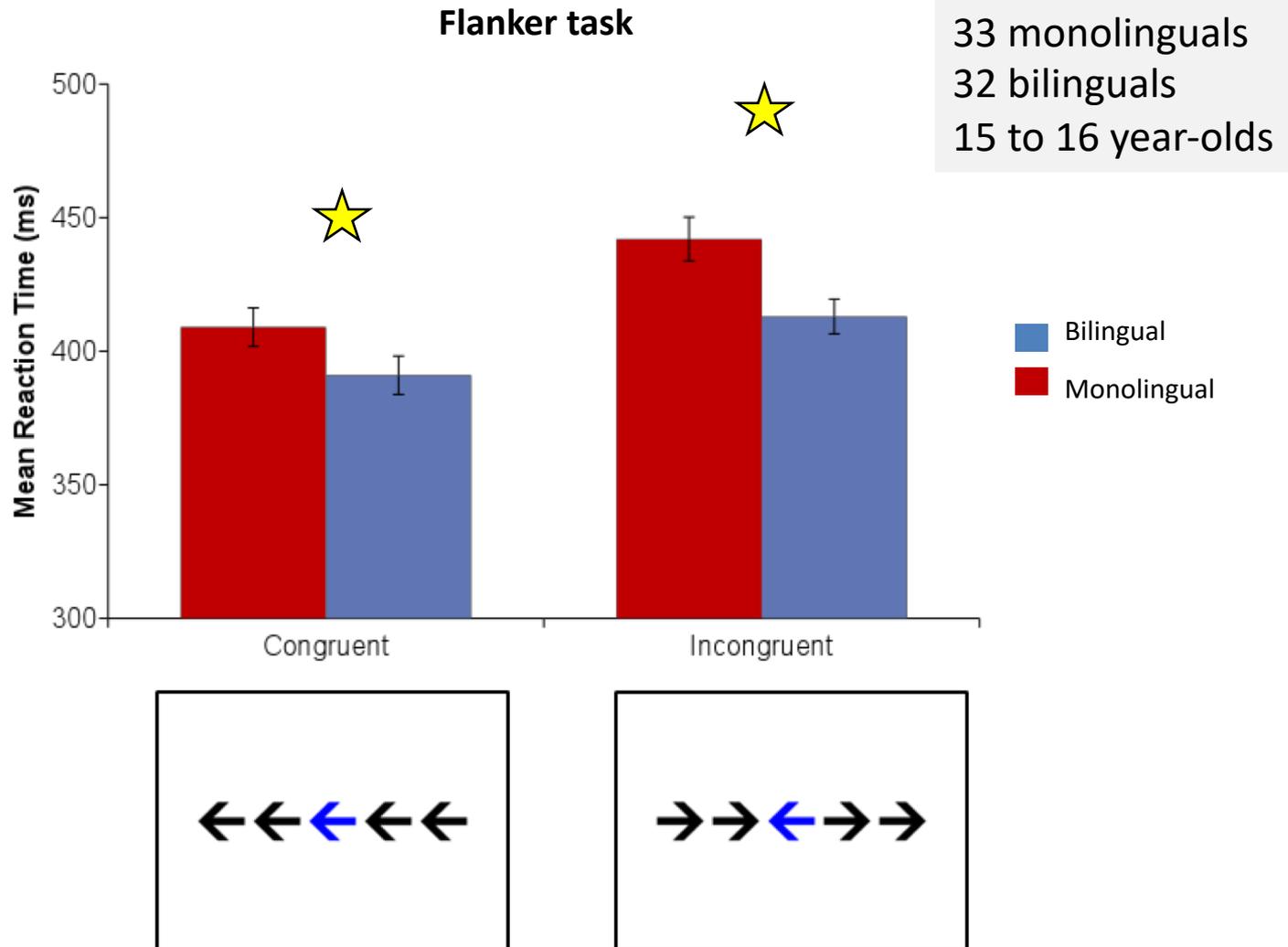
# Adolescence

Developmental trajectories of cognitive flexibility and its component executive functions



# Adolescence

*Chung-Fat-Yim, Himel, & Bialystok (2018) IJB*



# Summary

- Across childhood and adolescence, bilingualism *positively* impacts performance on non-verbal EF tasks

*How about in dual-language programs?*

*Are the effects the same if the child acquires the second language through formal education versus in the home?*

**DUAL LANGUAGE**



**IMMERSION PROGRAM**

# Dual Language Programs

*Esposito and Bauer, 2018, JCD*



Six public schools in Southeastern United States

- Low income with racial, ethnic, and linguistic diversity
- 87% children qualify for federally funded lunch assistance
- 10% of adult population has a college degree
- Spanish/English dual-language two-way immersion program from kindergarten to Gr. 5

# Dual-Language Programs and EF

*Esposito and Baker-Ward, 2013, BRJ*

Trail-Making Test

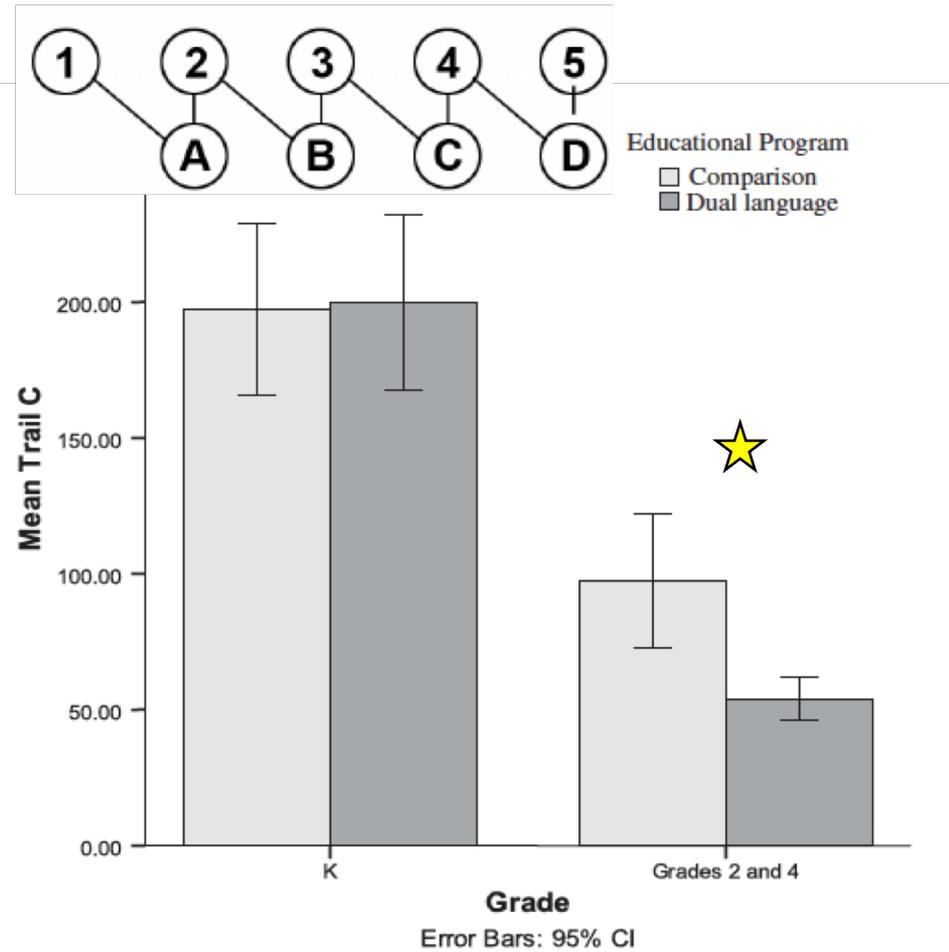
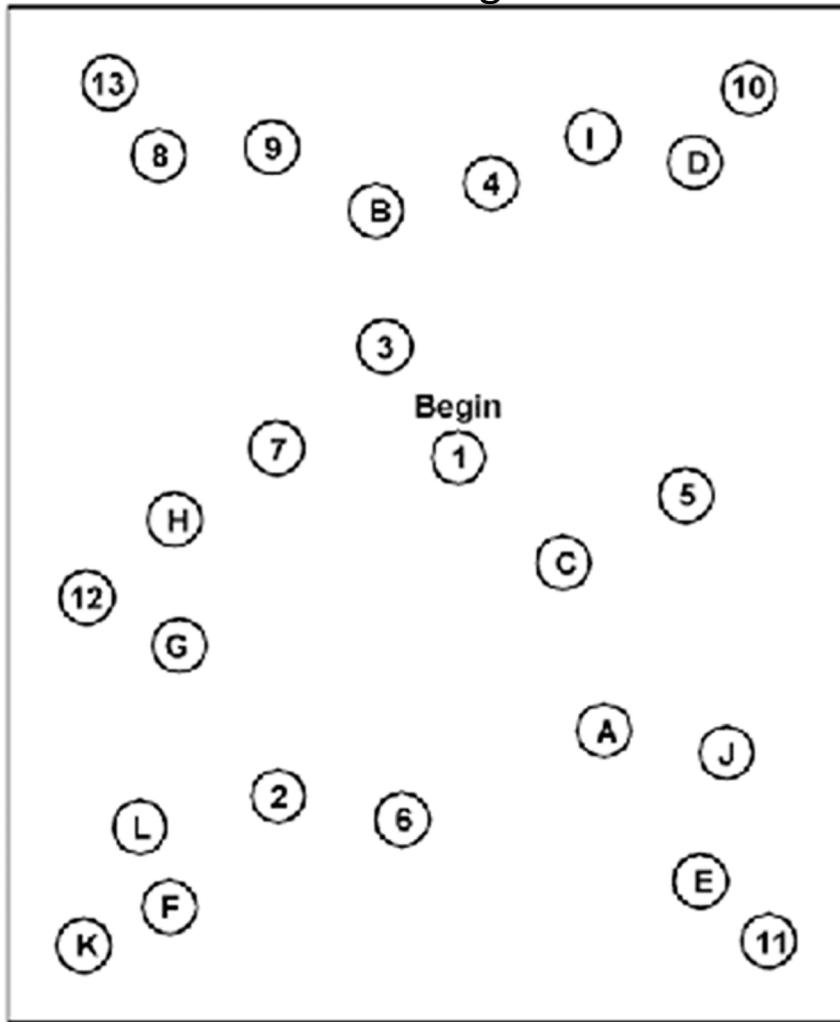


FIGURE 1 Mean time to completion of Trail C.

# Dual-Language Programs and Academic Performance

*Esposito, 2018, JCD*

- Grades 4 and 5
  - No differences on state-wide standardized tests
  - Dual-language program students had better grades

# Why continue using two languages?

- Social
- Cognitive
- Neurodegenerative

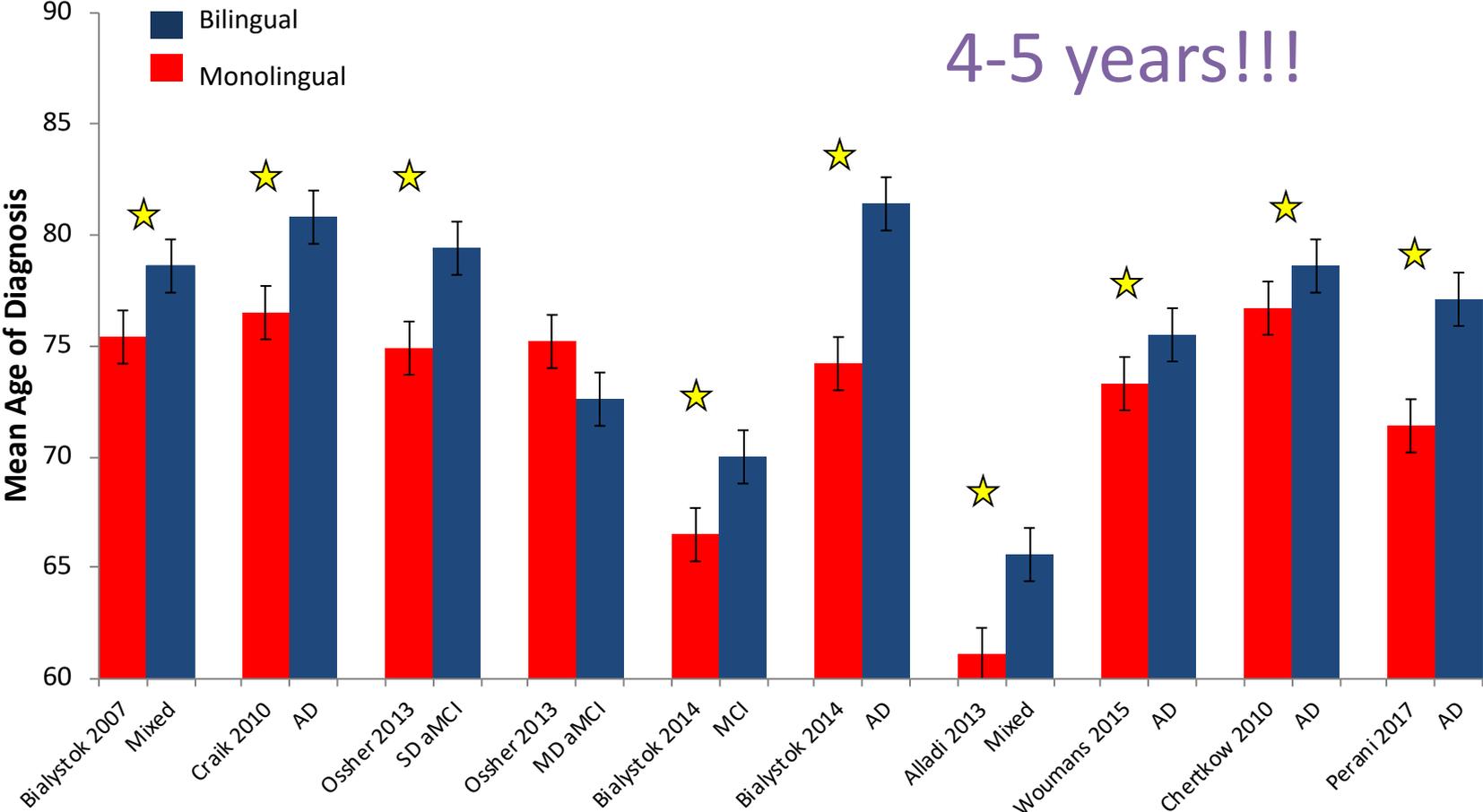
# Social Benefits

- Greater acceptance of other cultures
  - Bicultural
- Better self-control and emotional regulation
- Creativity, multi-tasking, and problem-solving
- More job opportunities inside and outside of the US
  - Studies show that bilinguals earn more money on average in the United States.
- **YOU WILL BE ABLE TO SPEAK ANOTHER LANGUAGE!**

# Neurodegenerative

- What happens when cognitive aging is not typical?
  - Accompanied by impairment
- Primary symptom of dementia is memory failure
- Can bilingualism protect against dementia?

# Age of Diagnosis of Dementia in Retrospective Studies



# Effect of Bilingualism Across the Lifespan

- Infants raised with two languages in the environment develop **different attention networks**
- Bilingual children and adolescents are more adept at **nonverbal tasks based on conflict**
- Bilinguals are more **resilient against cognitive decline** and the symptoms of dementia

# Never too late!



[Front Psychol.](#) 2014; 5: 485.

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PMCID: PMC4033267

PMID: [24904498](https://pubmed.ncbi.nlm.nih.gov/24904498/)

## Never too late? An advantage on tests of auditory attention extends to late bilinguals

[Thomas H. Bak](#),<sup>1,\*</sup> [Mariana Vega-Mendoza](#),<sup>1</sup> and [Antonella Sorace](#)<sup>2</sup>

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YOU!

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