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Cognitive Advantages of Bilingualism in Early Childhood

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Workshop on Bilingualism and Language Acquisition
Hong Kong: March 17, 2010

Linguistic and Cognitive Outcomes

- Learning two languages from childhood modifies typical developmental trajectory
- Consequences for
  - Language acquisition
  - Metalinguistic awareness
  - Acquisition of literacy

  } Mixed outcomes

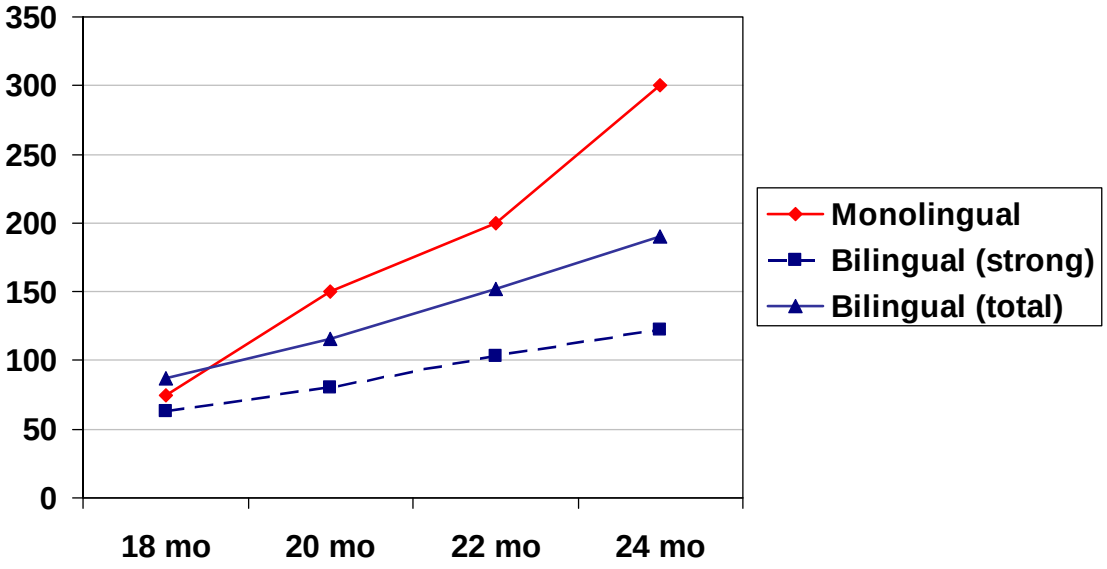
  - Nonverbal cognitive ability

  } Clear benefits
- Differences can be in either direction

Language Acquisition in Bilingual Children

- Developmental milestones comparable in monolingual and bilingual children
- Subsequent progress not identical – strategies, rate, errors may differ
- Bilingual children have smaller vocabulary in each language than monolinguals
- Total vocabulary smaller at first (because they take longer to get started)

Vocabulary Growth in Two Languages

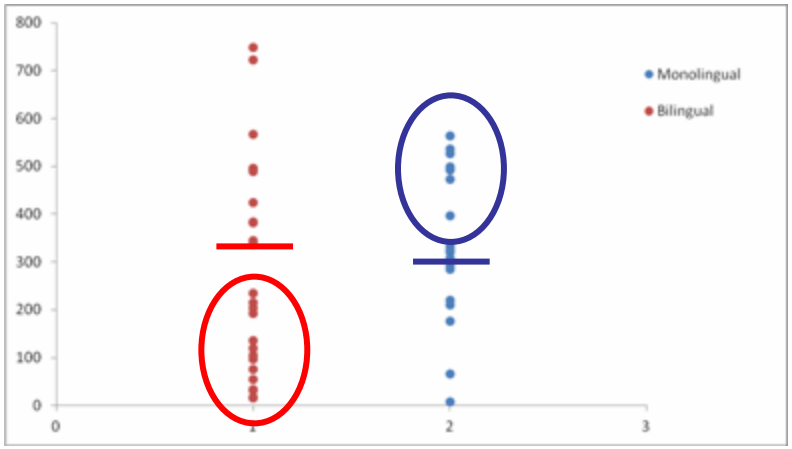


Bilingual data: Adapted from Pearson and Fernández (1994)

Monolingual data: Adapted from Fenson et al. (1994)

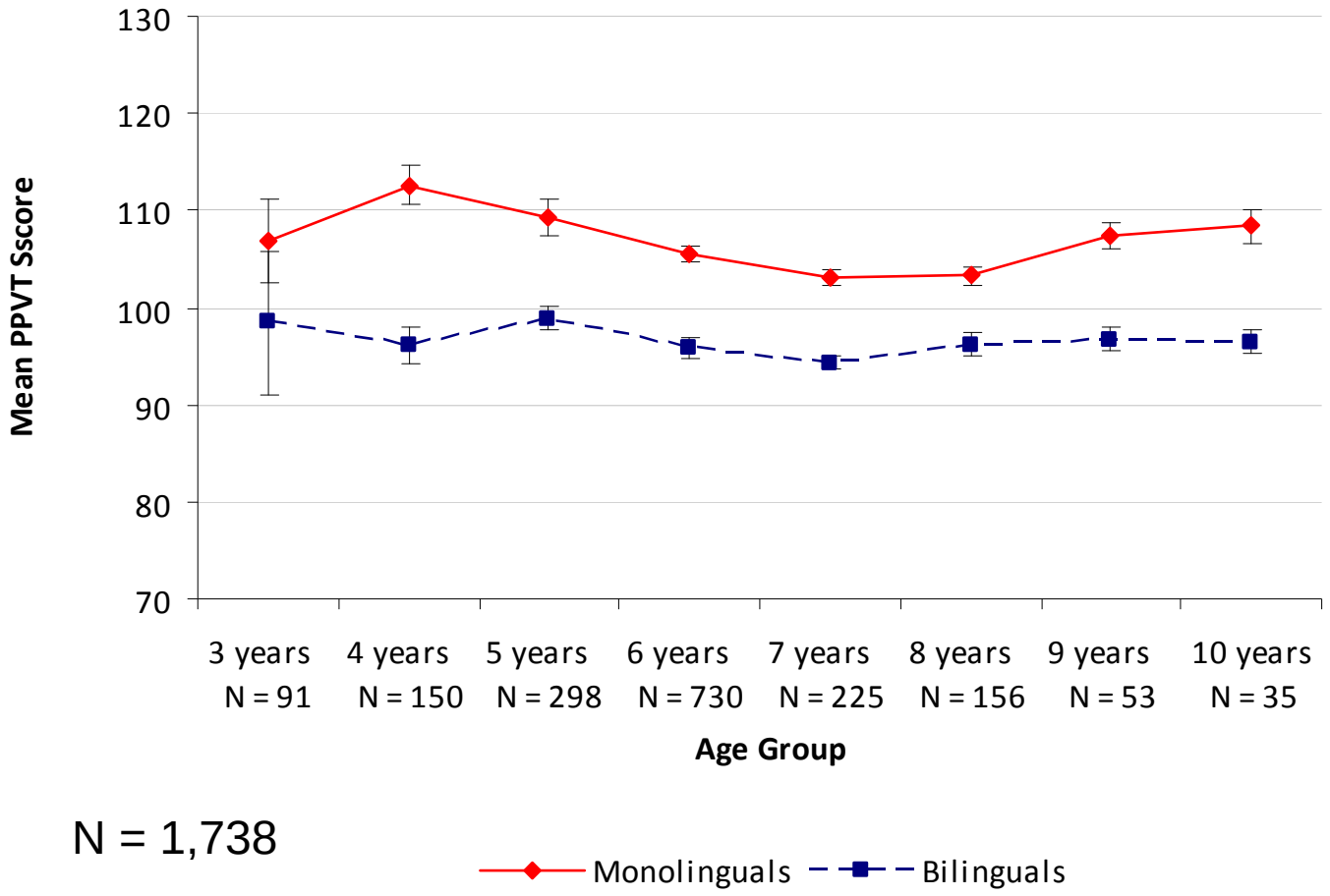
Poulin-Dubois et al. (submitted)

24 month olds
Mean total vocabulary
Monolinguals = 335 words
Bilinguals = 276 words
No significant difference

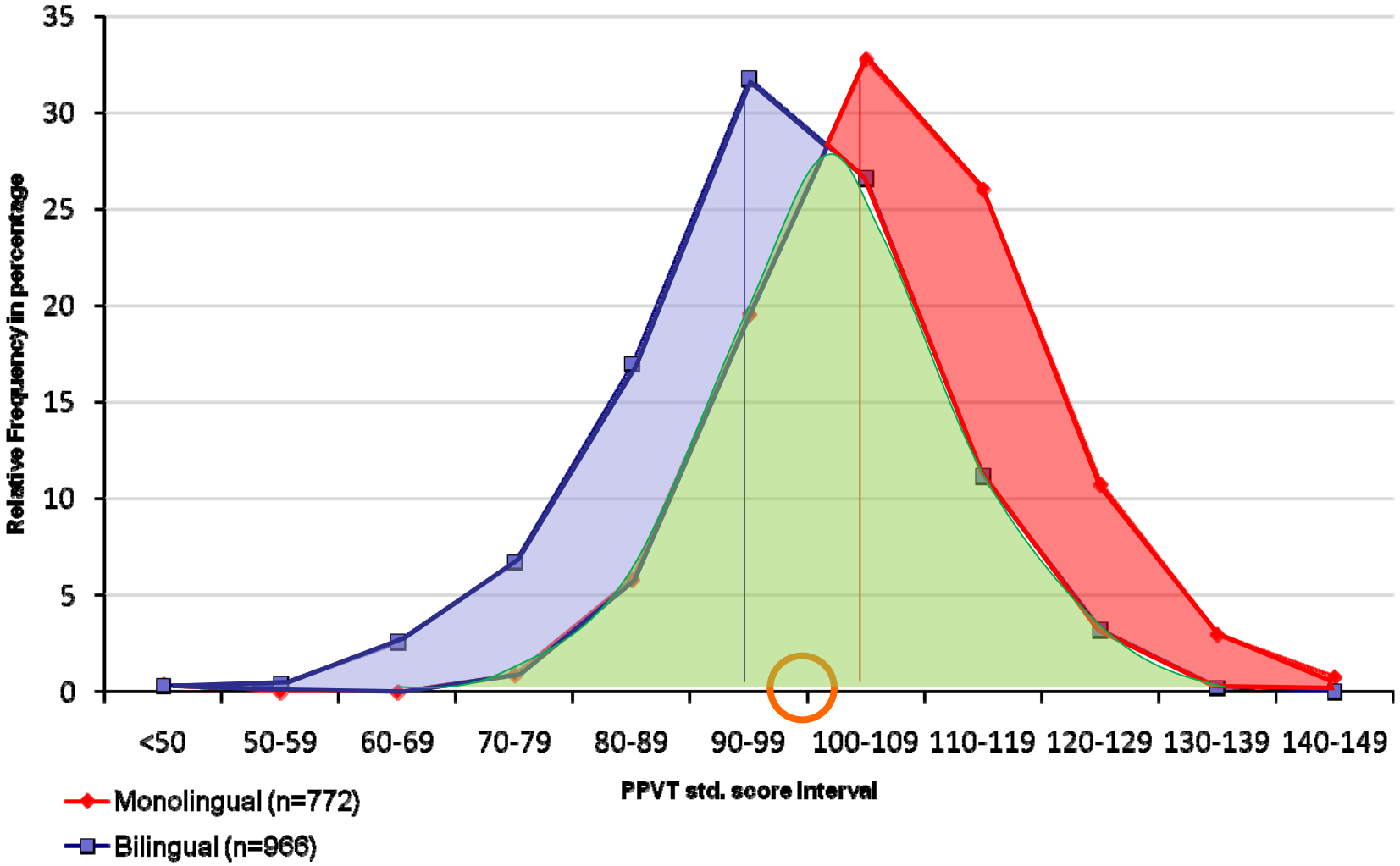


Receptive Vocabulary (PPVT) for Children

Bialystok et al., in press, BLC

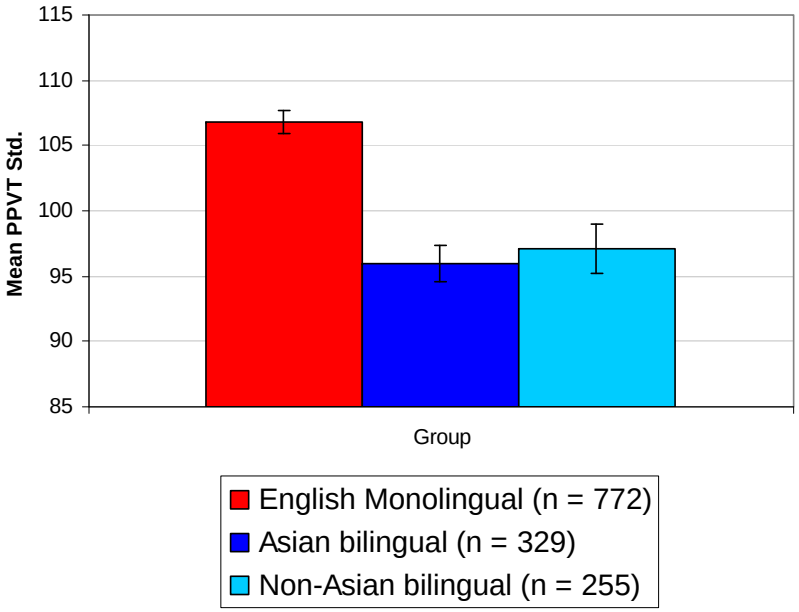


Distribution of PPVT Scores

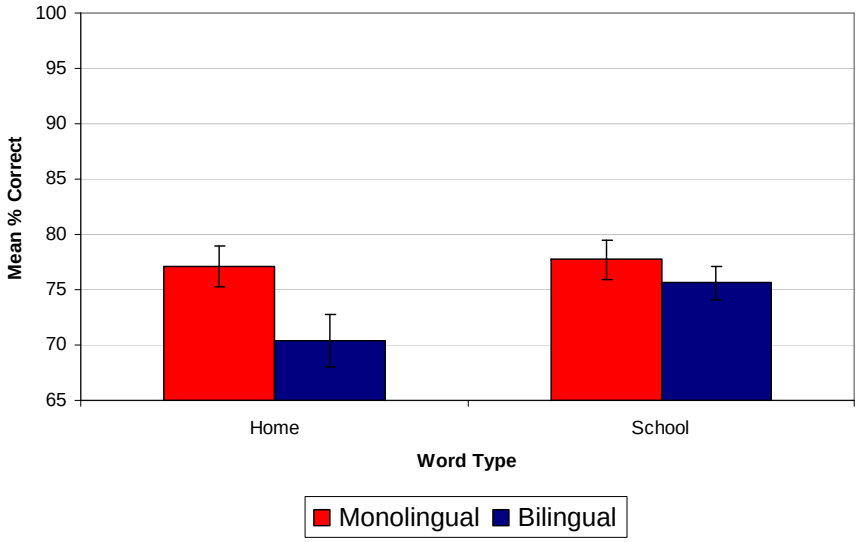


Differences in the Distributions

Language Pairs



Word Types



Language in Use

Peets & Bialystok, 2009

- Compare formal proficiency and language use
- 24 monolingual, 25 bilingual, 5 years old
- Equivalent on background, IQ, SES

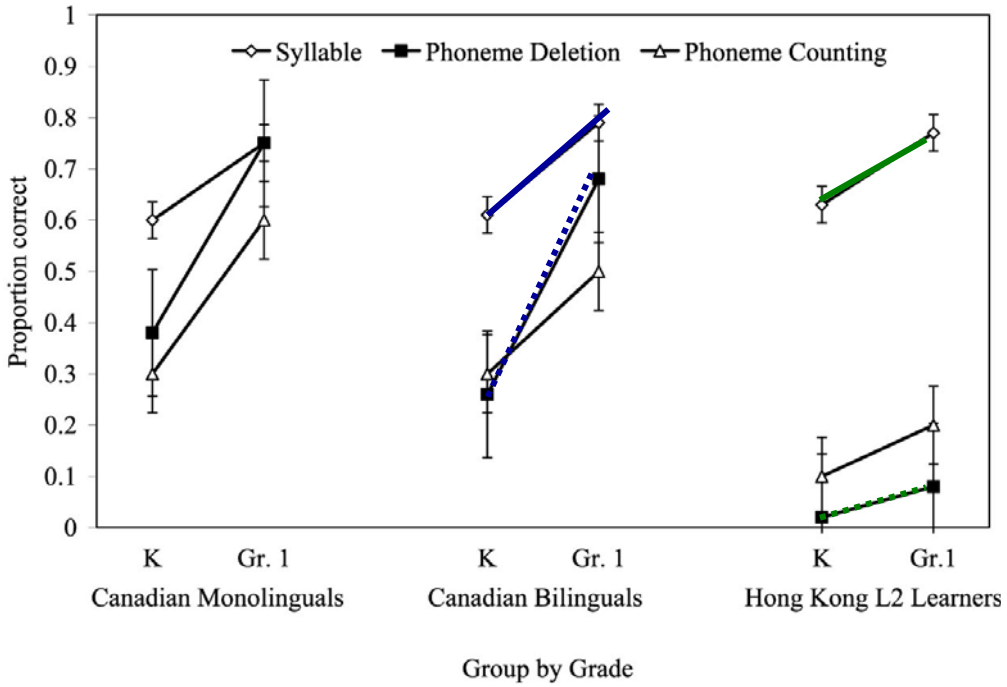
	Formal		Use	
	Mono	Bilingual	Mono	Bilingual
Vocabulary	108.5	97.0	244.9	224.0
Grammar	23.2	15.2	5.8	5.8
Morphology	13.3	7.7	3.5	6.7

Phonological Awareness

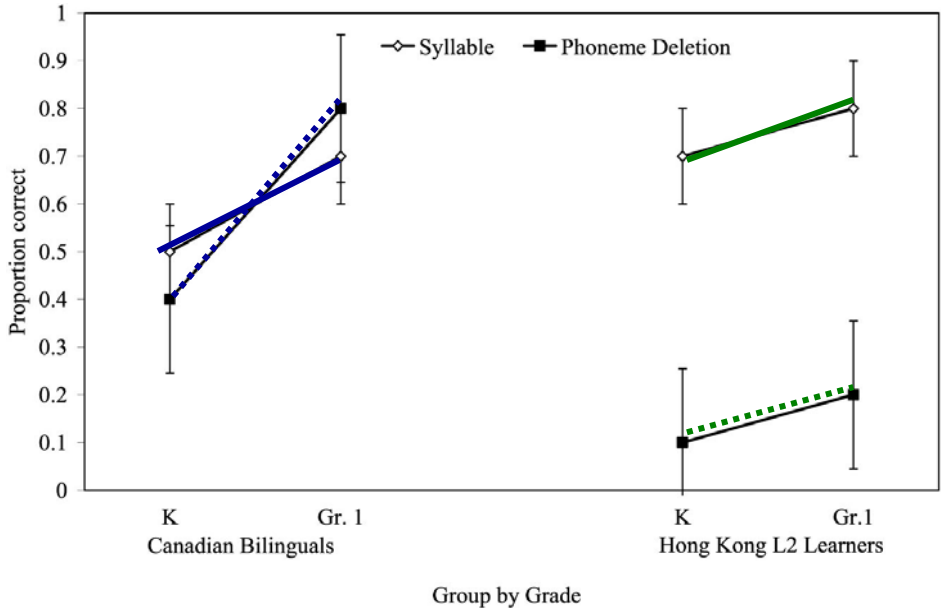
Bialystok, McBride-Chang, & Luk, 2005

- Bilingual advantage on many metalinguistic tasks but phonological awareness more mixed
- Depends on languages (Bialystok et al., 2003).
- Compared bilinguals in Canada to L2 learners in Hong Kong (L2HK)
- English and Cantonese tests
- English vocabulary: Bilinguals > L2HK
- Cantonese vocabulary: L2HK > Bilinguals

English tasks



Chinese tasks



Factors:
Task difficulty
Linguistic structure
Not proficiency

Learning to Read in Two Languages

- Bilinguals have lower vocabulary in language of reading instruction
- Distinguish between general effects of bilingualism and specific experience with written languages on reading outcomes
- Manipulate type of bilingual experience

Participants

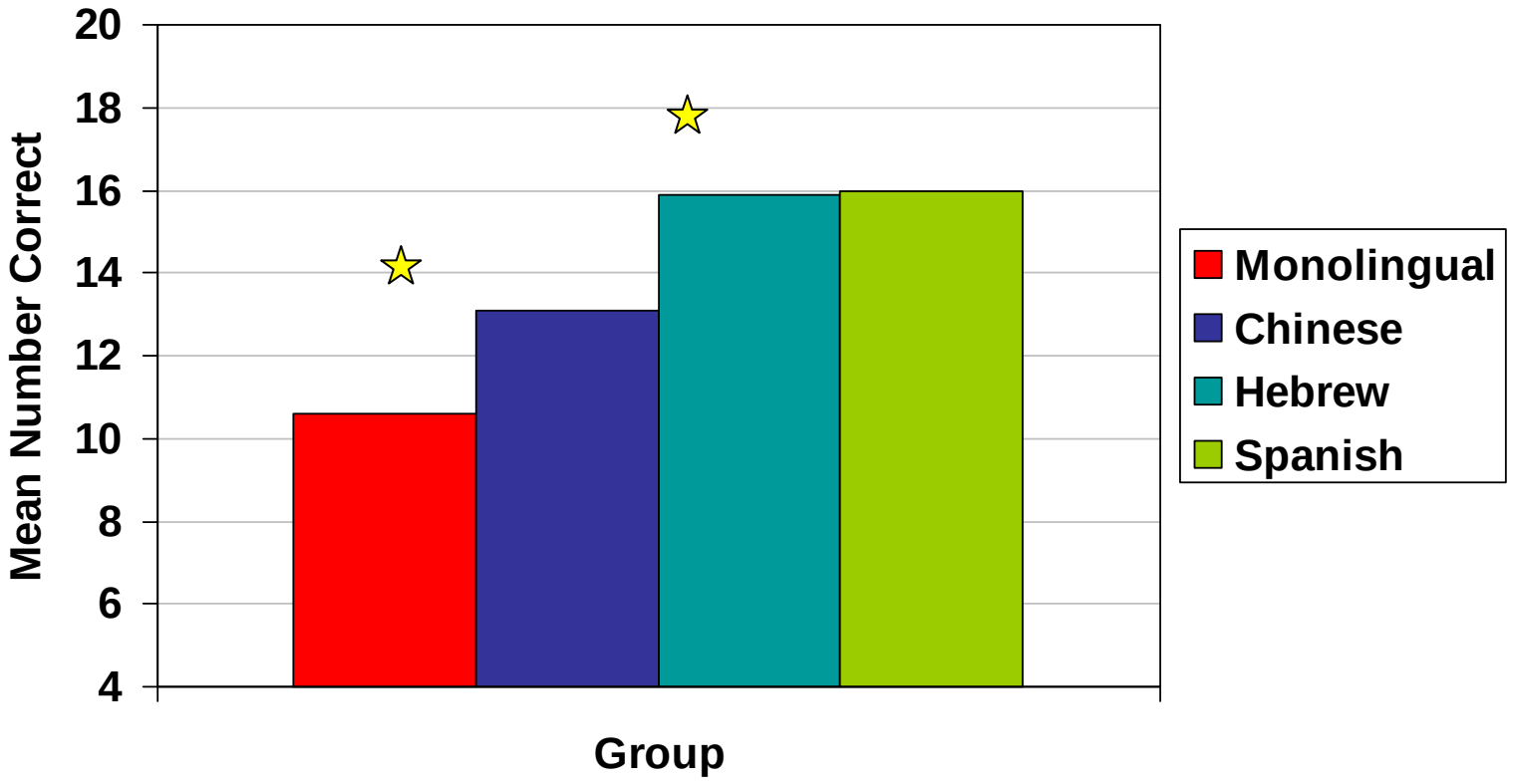
1. Monolinguals (N=40)
2. Spanish-English bilinguals (N=33)
   - Related languages, same writing system, same script
3. Hebrew-English bilinguals (N=30)
   - Unrelated languages, same writing system, different script
4. Cantonese-English bilinguals (N=29)
   - Unrelated languages, different writing system, different script

Relation between Languages and Writing Systems

Non-English Language	Oral languages	Writing systems	Scripts
Spanish	Related	Same	Same
Hebrew	Unrelated	Same	Different
Chinese	Unrelated	Different	Different

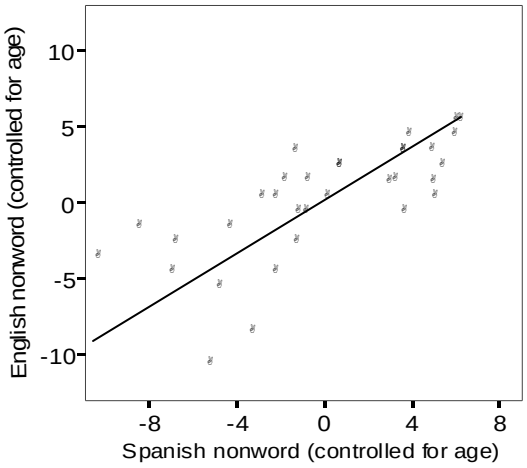
Scores on English Reading Task

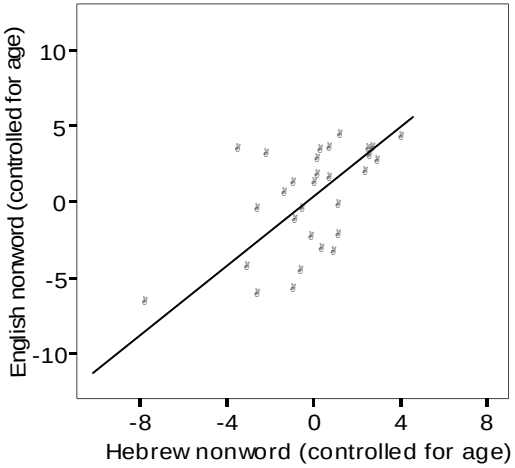
Bialystok, Luk, & Kwan, 2005

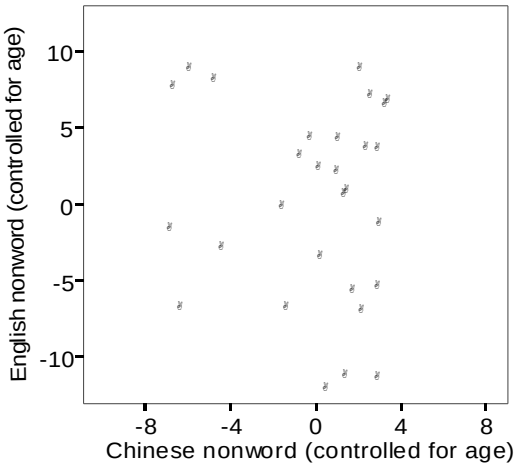


Reading in Two Languages

English-Spanish English-Hebrew English-Chinese







$r = 0.73$, $p < .01$ $r = 0.57$, $p < .01$ $r = -0.10$, $p = .60$

Summary of Language Ability in Bilingual Children

- Delays in vocabulary acquisition
- Some evidence for different strategies
  - Less use of disambiguation (B et al and others)
  - Less use of phonology for word learning (Werker)
  - Greater awareness of word structure (Kovacs)
- Metalinguistic awareness and literacy acquisition depend on specific factors
- Home and school support different aspects of language

Language Use in Bilinguals

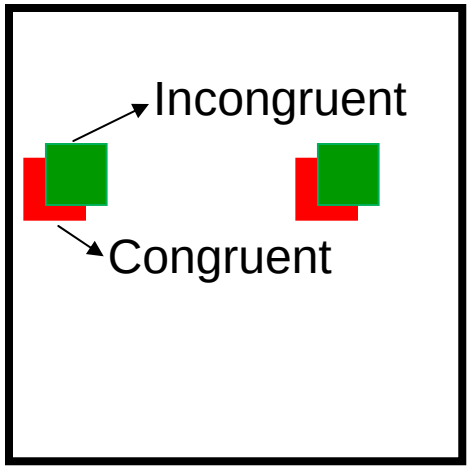
- Both languages of bilinguals are constantly active
- Evidence from behavioural, imaging, and patient studies
- Therefore, mechanism required for appropriate selection
- Carried out by cognitive control system (part of the executive function)

Bilingualism and Executive Control

- Interrelated processes in frontal lobes
  - ➢attention, inhibition, monitoring, switching
- Domain-general: develop late, decline early
- Evidence from imaging and patient studies for EC in language switching & selecting

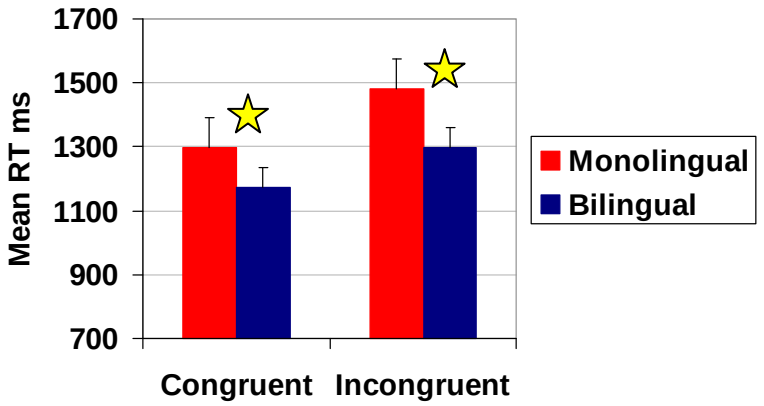
→ Enhanced for bilinguals if used to resolve lexical conflict

Simon Task

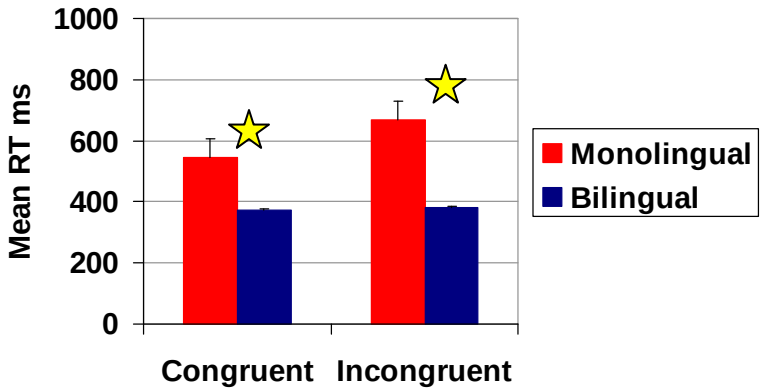


Red → Left
Green → Right

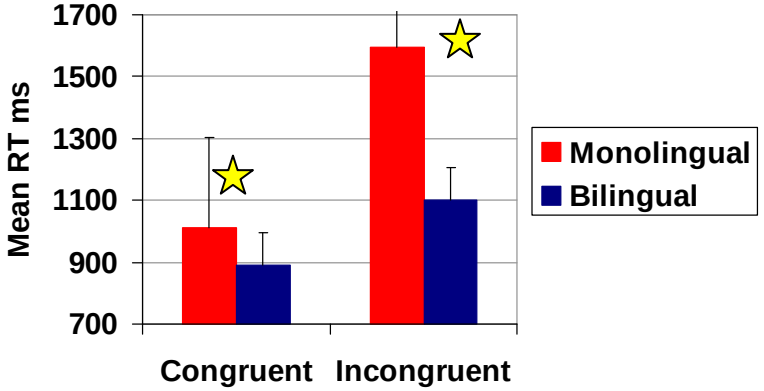
Children (Martin-Rhee & Bialystok, 2007)



Middle-aged (Bialystok et al, 2004)



Older adults (Bialystok et al., 2004)



Bilinguals faster on congruent and incongruent trials

Global-Local Attention Task

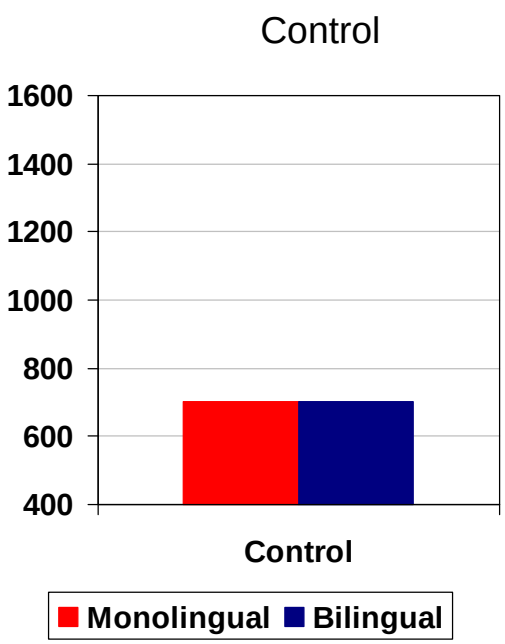
Bialystok, 2010

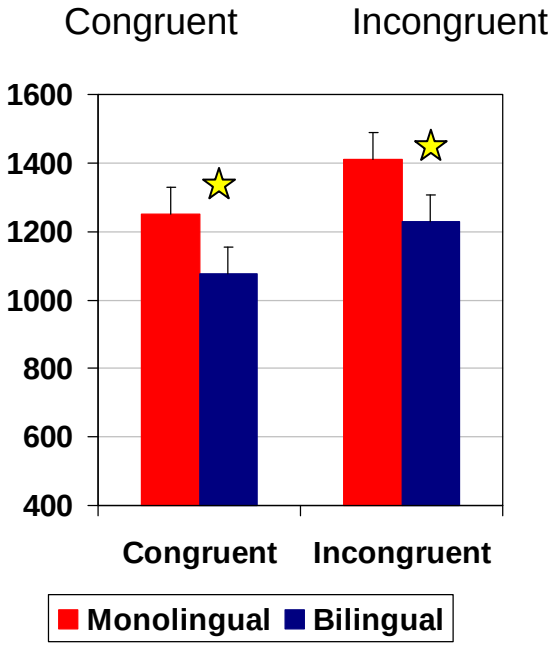
Participants: 6-yrs old

- 25 Monolingual
- 26 Bilinguals

H S

H H S S
H H S S
H H H H S S S S
H H S S
H H S S





Bilinguals faster on congruent and incongruent trials

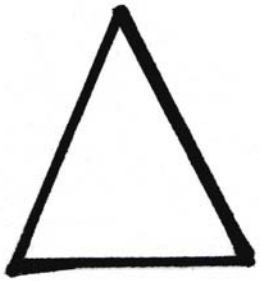
Perceptual Organization and Meaning

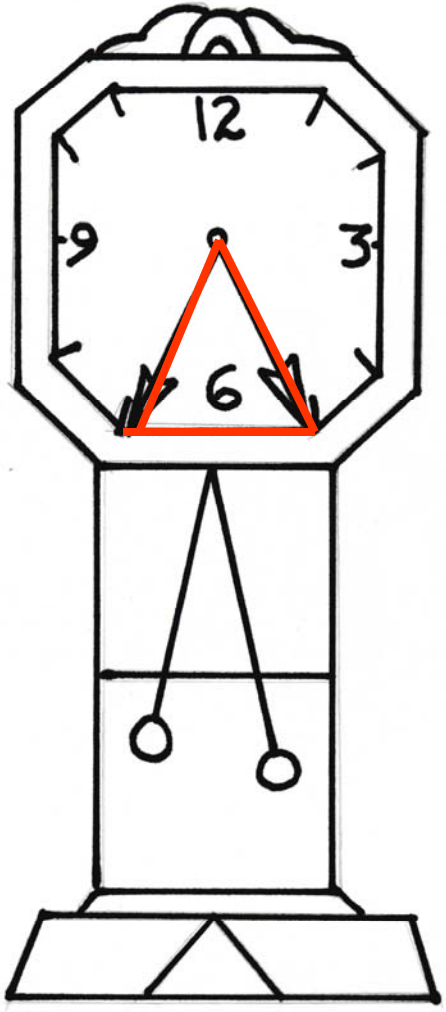
- Standard measure of intelligence: Embedded Figures Test of field-dependence/field-independence
- Compare to misleading context of ambiguous figures
- Participants – 5 ½ years olds
  - 27 Monolinguals
  - 26 Bilinguals

Children's Embedded Figures Test

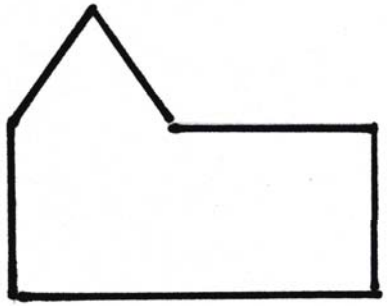
- Analyse complex figure to find simple component
- Ignore overall perceptual configuration to interpret parts
- Two item types: tent (triangle) and house
- Score is total of two sections

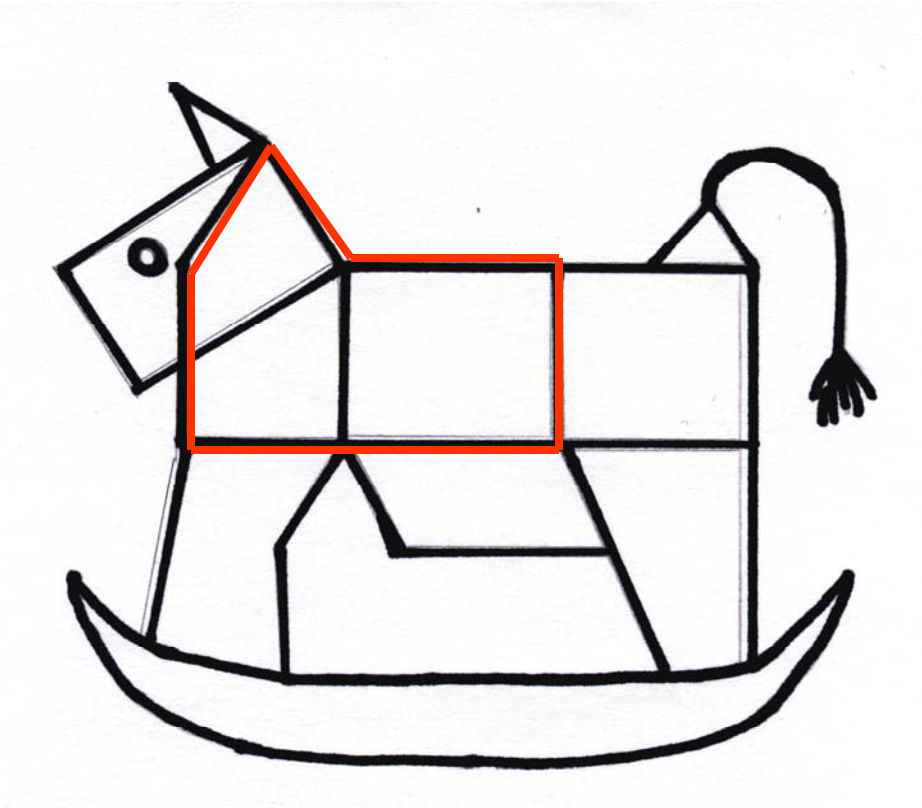
Embedded Figures Test: Tent





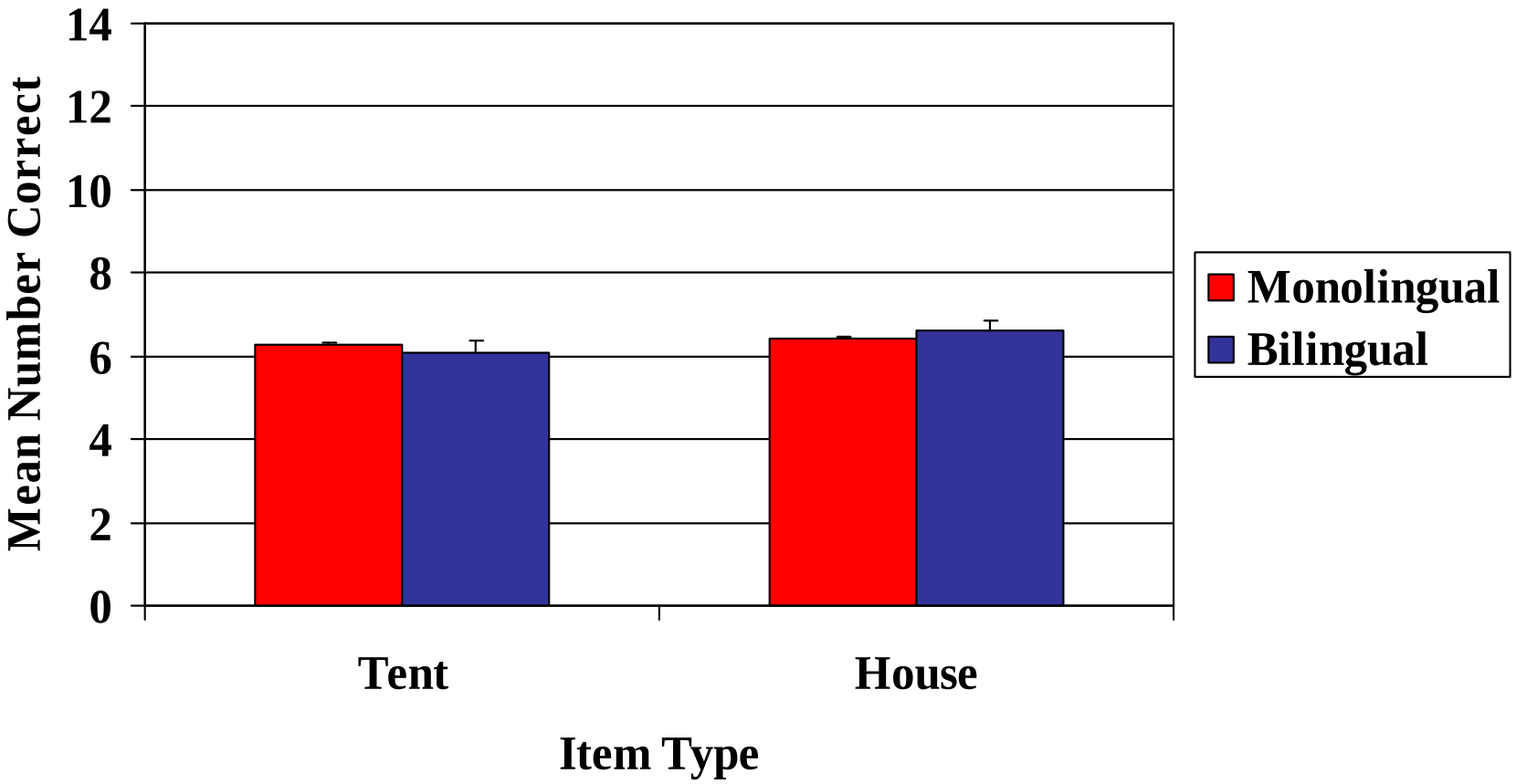
Embedded Figures Test: House





Embedded Figures Task

Bialystok & Shapero, 2005



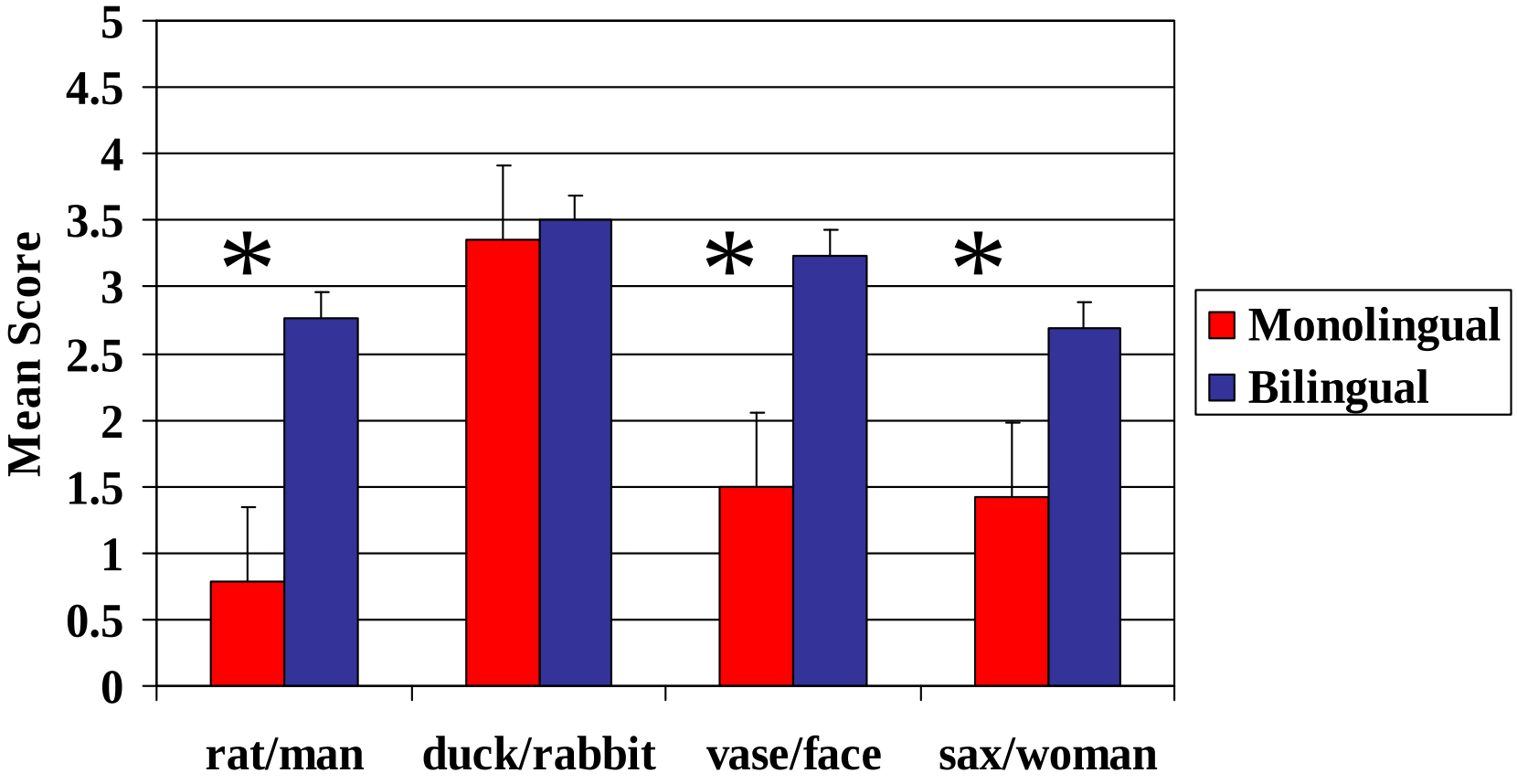
Ambiguous Figure Reversals

- Ability to see alternative in an ambiguous figure develops at around 6 years
- Need to assign new interpretation to perceptual stimulus, so inhibit previous interpretation (cf. Embedded Figures?)
- Scored on graduated scale based on number of clues needed

Ambiguous Images

Reversibility Scores

Bialystok & Shapero, 2005



Why the Difference?

- CEFT: No conflict between seeing that a shape is part of the overall design
- Ambiguous figures: Conflict between the image being a duck or a rabbit – it can’t be both!
- Bilingual advantage is for resolving perceptual conflict

Is it Bilingualism?

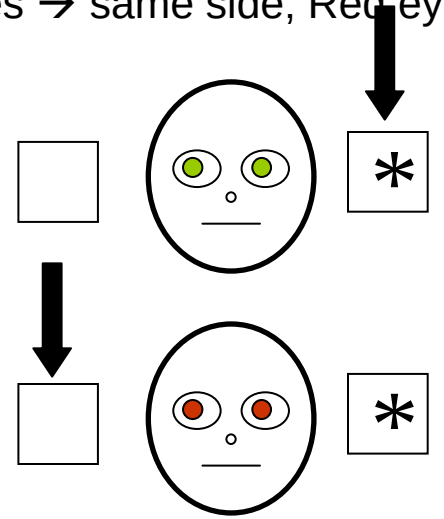
- Natural bilingualism generally correlated with other significant factors:
  - Immigration
  - Socio-economic status
  - Different language pairs
- Can the results be attributable to these factors?

Immigration

Bialystok & Viswanathan, 2009

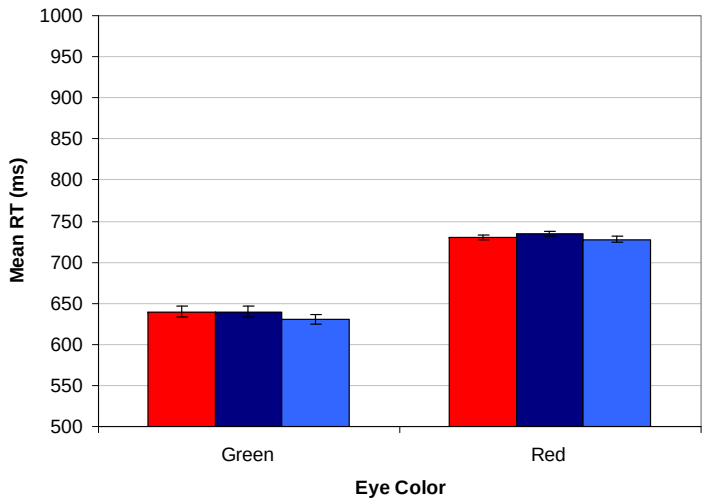
Behavioral anti-saccade

Green eyes → same side; Red eyes → opposite

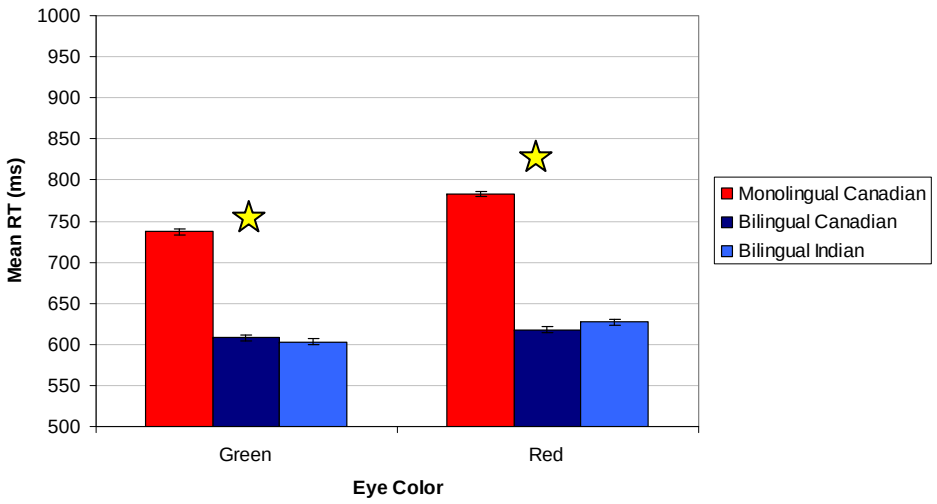


	N	Age (yrs)	PPVT Std	Sequence Span	Alpha Span	Corsi Block
Monolingual	30	8.5	112	18	21	18
Bi-Canadian	30	8.5	100	18	22	21
Bi-Indian	30	8.6	96	17	21	23

Blocked Presentation



Mixed Presentation



Socioeconomic Status

Calvo & Bialystok, 2009

Group	N	Maternal Education (1-5)	Age (mo)	K-BIT (std.)	PPVT-III (std.)
Working Class (WC) Monolingual	22	1.9	80	101.4	101.9
Working Class (WC) Bilingual	44	1.7	82	101.0	94.7
Middle Class (MC) Monolingual	52	3.5	81	102.2	104.0
Middle Class (MC) Bilingual	67	3.7	80	106.6	99.7

Maternal Ed Values

1.00 No high school diploma

2.00 High school graduate

3.00 Some University or College Diploma

4.00 bachelor's degree

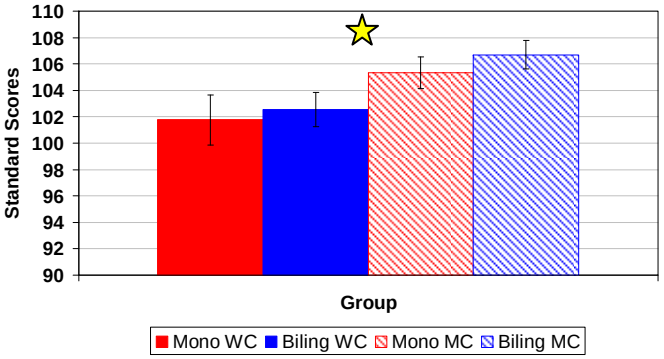
5.00 graduate degree

Socioeconomic Status

Calvo & Bialystok, 2009

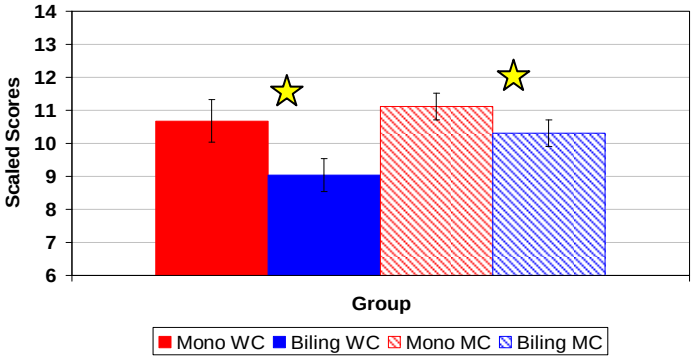
Simple Visual Search (Speed)

Group effect: SES

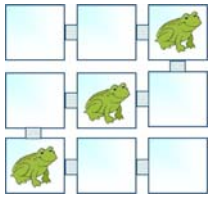


Complex Visual Search (Naming)

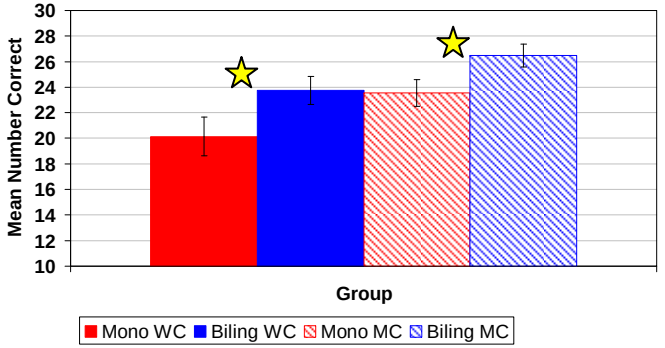
Group effect: Language



Working Memory



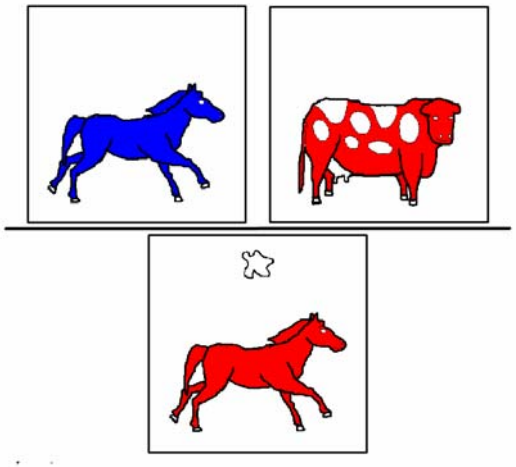
Group effect: SES and Language



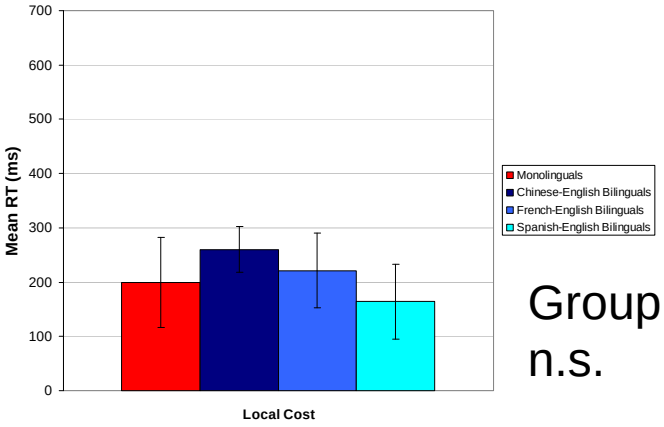
Language Pairs

Barac & Bialystok, submitted

Group	N	Age (Mo)	SES	Home Use (1-5)	K-Bit Matrix	Box Comp-letion
Monolingual	26	72	0.81	1.0	107	45.7
Chinese-English	30	72	0.76	2.9	108	44.4
French-English	28	74	0.84	3.0	105	44.8
Spanish-English	20	74	0.84	2.7	108	42.2

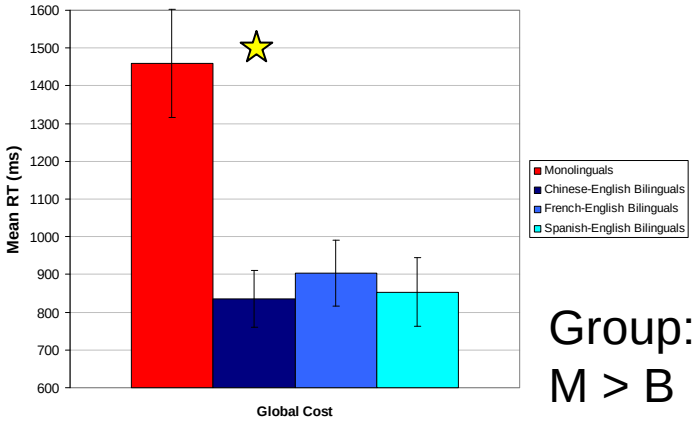


Local Switch Cost



Group: n.s.

Global Switch Cost



Group: M > B

Summary of Cognitive Development in Bilingual Children

- No developmental differences for tasks not involving EC
- However, nonverbal EC develops earlier in bilingual children than monolinguals
- Some evidence for this difference before 1 year old (Kovacs & Mehler, 2009)
- Provides foundation for attention, multitasking, and cognitive flexibility

Bilingualism and Development

- Early bilingualism has profound effect on language and cognitive development
- Some delays in language, but minor
- Cognitive advantages are broadly based
- Effects seen very early – possibly in first year well before productive language
- Bilingualism is a powerful experience that shapes development!

Credits