Mixed Language Use & Cognitive Flexibility in Young Bilinguals

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ABSTRACT

Bilingual children in the U.S. grow up in diverse linguistic environments. Dichotomous group comparisons of bilinguals with monolinguals may thus mask meaningful variation in experience (Luk & Bialystok, 2013). Daily use of more than one language at home is one dimension of bilingualism that may support the development of executive functions (EF), in particular cognitive flexibility—the ability to switch between changing goals (Barac et al., 2014). We examined variation in home language usage and cognitive flexibility (as measured by switching cost to accuracy in an experimental trails task) in 123 fourth-grade children. We found (1) no group differences in switching cost between monolinguals and broadly defined bilinguals, and (2) a polynomial relationship between home language usage and switching cost for subgroups with different proportions of bilingual home language use. Children who spoke a more balanced proportion of two languages at home displayed greater cognitive flexibility. These differential results between dichotomous and polytomous analyses persisted even after propensity score matching to reduce covariate effects of age, family income, and mother's education. Results suggest that multidimensional, rather than dichotomous, measurement of bilingualism can aid in understanding how this life experience interacts with EF development during childhood.

RESEARCH QUESTION

Does a specific form of bilingual experience—the daily use of more than one language at home—support cognitive flexibility, a dimension of EF that is characterized by discrimination among inputs and switching between rules and/or goals?

Hypotheses

① No group difference in cognitive flexibility measures between monolinguals and broadly defined bilinguals

② Differential outcomes in cognitive flexibility measures of EF among language subgroups with different proportions of bilingual home language use

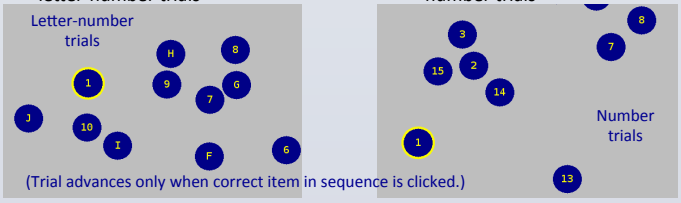
METHODS

PARTICIPANTS:

- 123 fourth-grade children (9 - 13 yrs. old, m= 10.4 yrs.) attending public schools in Massachusetts
- Range of language exposure: 19 languages, incl. Spanish, Portuguese, Creole
- Heterogeneous demographic background:
  - low to high income (median = USD 24-45K)
  - low to high maternal education (median = high school graduate)

MEASURES:

- Home Language Questionnaire (modified from Luk & Bialystok, 2013):
  - proportion of English spoken by child at home in 5 categories: (0, 25, 50, 75 & 100%)
- Trails-making task from the Psychology Experimental Building Language (PEBL, Mueller, 2012)
  - cost of switching = average clicks to target for letter-number trials – average clicks to target for number trials

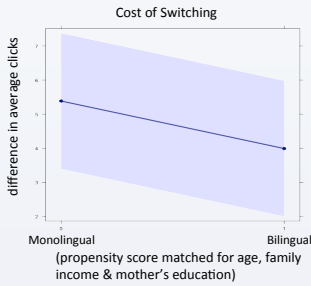


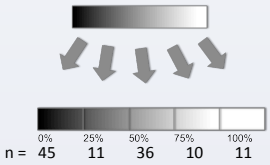
ANALYSIS:

- general linear regression models with linear & quadratic terms
- control & binomial/multinomial propensity score matching for age, family income, & mother's education

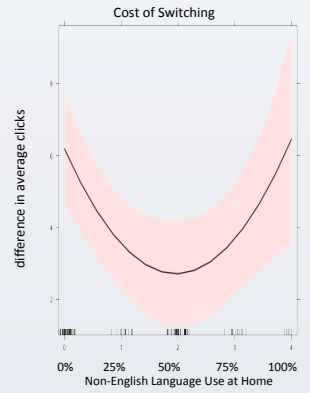
RESULTS

① Although bilinguals displayed a lower cost of switching, this effect was not statistically significant (b=-1.39, s.e.=1.41, 95%C.I. = [-4.17, 1.48]).





② Subgroups who spoke more balanced proportions of two languages at home incurred lower switching costs to accuracy. Children who spoke 50% English and 50% of another language displayed the lowest cost of switching (b=2.69, se=0.75, 95%C.I. = [1.20,4.19) .



(sample subset of children with full home language data)

CONCLUSIONS

- Speaking relatively balanced proportions of two languages at home may support the development of cognitive flexibility. Childhood language experience considered broadly as the ability to speak two languages is heterogeneous and may not support EFs in the same way. These results support prior research in adults showing that language switching is associated with better task-switching performance (Prior & Gollan, 2011).
- Multidimensional measurement of language and the consideration of nonlinear relationships can help elucidate ways in which bilingual life experience interacts with EF development during childhood.

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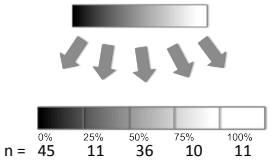
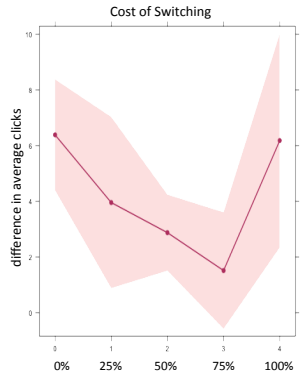
RESULTS 2



n = 45 11 36 10 11

③ Subgroups who spoke more balanced proportions of two languages at home incurred lower switching costs when compared to all-English speakers.

nonEnglish	b	s.e.	p
1 (25%)	-3.89	2.01	0.055
2 (50%)	-4.62	1.52	0.003
3 (75%)	-5.75	1.59	<.001
4 (100%)	-1.47	2.49	0.556



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