



#401.08

Dual Language Exposure in Infancy Can Change Neural and Language Processing in the Developing Brain: An fNIRS Investigation

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QUESTION

Are bilingual infants delayed or has early bilingualism afforded them a language processing advantage?

Monolingual babies begin life as "citizens of the world." At birth, they have the capacity to pick out the core language distinctions found in all human languages, specifically phonetic distinctions. Yet they lose this universal capacity by around 14 months old.

New finding in bilingual infants

We found that Bilingual infants show greater and longer sensitivity to Non-Native phonetic contrasts at an age when monolingual infants can no longer do so¹

New Question: Does a bilingual infant's resilient sensitivity to Non-Native phonetic contrasts occur at the expense of their capacity to process their Native contrasts?

HYPOTHESES

Infants recruit classic language areas for phonological processing
Superior Temporal Gyrus (STG; BA 21/22), Left Inferior Frontal Gyrus (LIFG; BA 44/45)^{2,3} See Box 1

H1 Bilingual infants' resilient sensitivity to Non-Native phonetic contrasts delays their capacity to attenuate to Native phonetic contrasts

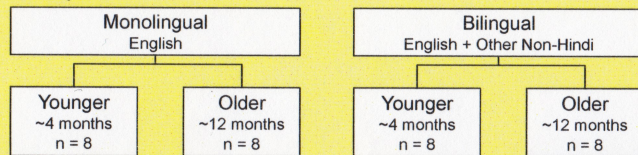
Monolingual infants recruit LIFG for Native phonetic contrasts at 12 months, whereas bilingual infants fail to do so

H2 Bilingual infants' resilient sensitivity to Non-Native phonetic contrasts does not delay or disrupt their capacity to attenuate to Native phonetic contrasts

Both monolingual and bilingual infants recruit LIFG for Native contrasts at 12 months, additionally, bilingual infants recruit STG for Non-Native contrasts

METHOD

Participants



Task

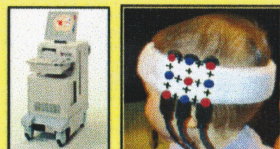
Near Infrared Spectroscopy (fNIRS)^{4,5}

Phonetic Discrimination

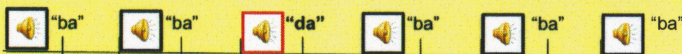
Oddball Event-Related Paradigm

Native (English) Syllables [ba] and [da]

Non-Native (Hindi) Syllables [ta] and [ta]

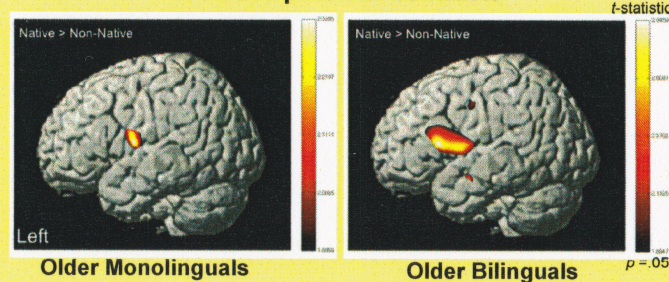


Hitachi ETG 4000 24 Channel

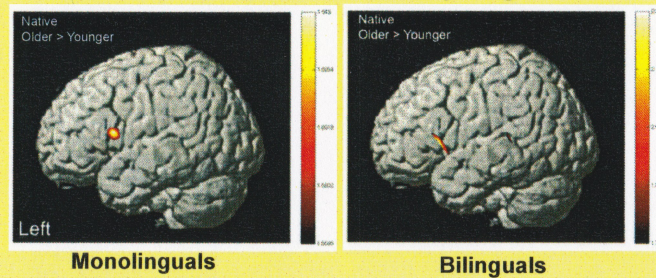


NEUROIMAGING RESULTS

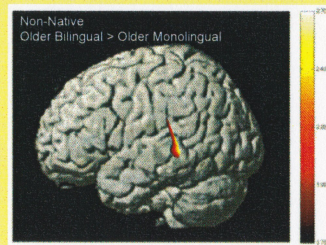
Both monolingual and bilingual infants are sensitive to Native phonetic contrasts



Older infants show greater neural sensitivity to Native phonetic contrasts than younger infants



Older bilingual infants show greater neural sensitivity to Non-Native phonetic contrasts than older monolingual infants



CONCLUSION

Similarity: Older bilingual and monolingual infants show similar robust neural activation in LIFG for Native vs Non-Native phonetic contrasts at 12 months. The bilingual infant's typical, healthy attenuation to their Native contrasts is not interrupted

Difference: Older bilinguals infants show robust neural activation in STG for Non-Native phonetic units relative to monolinguals

Significance: Dual language experience affords the bilingual infant resilient/open sensitivity to Non-Native phonetic contrasts at an age when monolingual infants can no longer do so

Supports H2

Bilinguals' increased phonological capacity does not delay nor disrupt language development, and instead supports language processing advantages in infancy that may later aid language and reading development in childhood², giving the bilingual a linguistic advantage over their monolingual peers

*"Perceptual Wedge Hypothesis"*¹

Early bilingual exposure may provide a linguistic "Perceptual Wedge" that extends infants' sensitivity to Non-Native language phonetic contrasts thereby rendering them more linguistically open to new language learning

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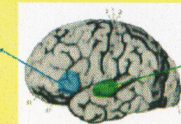
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BOX 1

Left Inferior Frontal Gyrus (LIFG)
Word meanings, morphology, syntax



Superior Temporal Gyrus (STG)
Phonology

Mediates infants' sensitivity to Native language phonetic contrasts as infants enter the first-word milestone

Mediates bilingual infants' resilient sensitivity to Non-Native phonetic contrasts