B21

# Inside the Baby's Brain: New Insights Into How Bilingual & Monolingual Babies Discover Language

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## INTRODUCTION

From birth, babies have the capacity to discriminate categorically the smallest "building blocks" of language—*the phonetic units such as in [ba] [da]*—from any of the world's languages. By 10-12 months, they lose this universal capacity, and, instead, hone in on the phonetic inventory of their native language with increased precision[1-2]

### LIVELY CONTROVERSY

Decades of behavioral research has not been able to adjudicate whether infants use **auditory-general**[3-4] or **language-dedicated**[5-8] mechanisms to learn the sounds of their native language

### NEW QUESTIONS - BILINGUAL BABIES

**1** Do infants recruit auditory-general or language-dedicated neural tissue for learning the sounds of their native language?

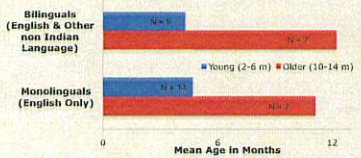
**2** Do infants learning TWO languages show a similar pattern and developmental trajectory in their neural tissue recruitment for learning the sounds of their native language?

### HYPOTHESIS

Infants use language-dedicated brain mechanisms to learn the sounds of their native language

## METHODS

### PARTICIPANTS




## INNOVATIVE PROCEDURES

**Infant Brains & functional Near-Infrared Spectroscopy (fNIRS) - *ADVANTAGES OVER fMRI***

✓ Closer measure of hemodynamic change (HbOxy, HbDeoxy, HbT)
✓ Used with INFANTS, and up (Quiet, tolerant of movement)
✓ Excellent spatial (~4 cm) and temporal (10 Hz) resolution

***Ideal for Language/Cognitive Studies across the lifespan***

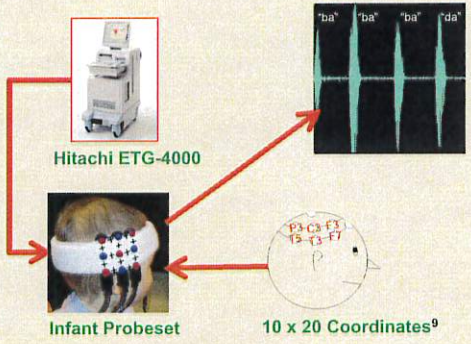
**New Oddball Paradigm**

**TWO Language Conditions**

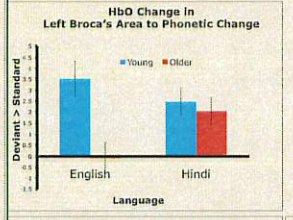
**NATIVE** (English) Syllables
[ba] and [da][10]
**NON-NATIVE** (Hindi) Syllables
[ta] and [ţa][10]

60% - Standard Syllables
10% - Deviant Syllables
30% - Catch

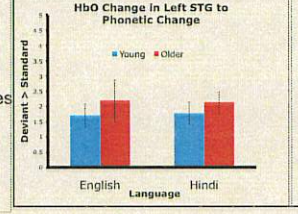
## INNOVATIVE PROCEDURES

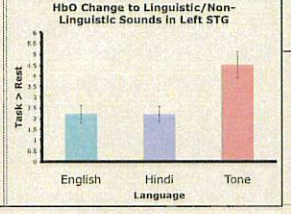



## RESULTS




**All babies use language-dedicated neural tissue, and early!**

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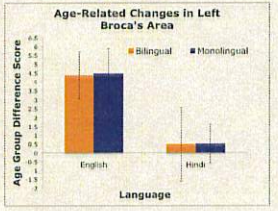


**Same Developmental time scale for Bilingual and Monolingual babies**

## CONCLUSIONS

**Do infants use auditory-general or language-dedicated brain mechanisms to learn native language sounds?**

**Language-dedicated & Early!**

- Brain changes were seen dependent on baby's age + language milestone
- Superior Temporal Gyrus (STG) is on-line very early (~2-6 m) from the get go, (i.e., the universal phonetic discrimination milestone)
- Broca's area comes on-line later (~10-14 m), (i.e., the first word milestone)

**Do bilingual infants show the same developmental trajectory as monolingual infants? YES!**

- Bilingual and monolingual infants showed the same recruitment of language-dedicated neural tissue, suggesting that infants hone in on their native language on the same time-table when they receive language input from multiple languages

### ADVANCES IN SCIENCE FROM fNIRS

- For the first time, fNIRS brain imaging permits us to see into a baby's brain and to observe the relationship between neural processing and language acquisition milestones
- Here we observed
  - Which brain structures mediate specific parts of language organization
    - When they come on line, and
      - How they change and develop over time!

## References

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