Effects of Age & Experience on Neural aspects of Language Learning.

Cognitive Science,
SE367.

Being presented by:
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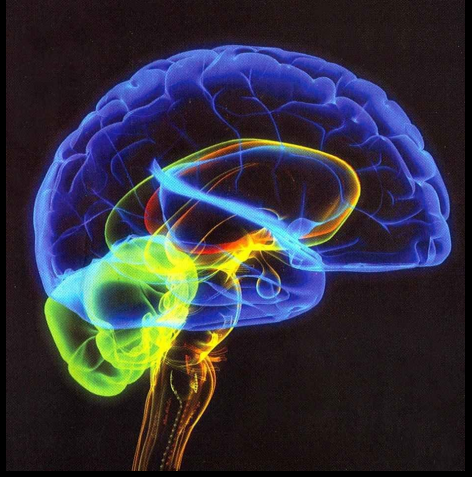
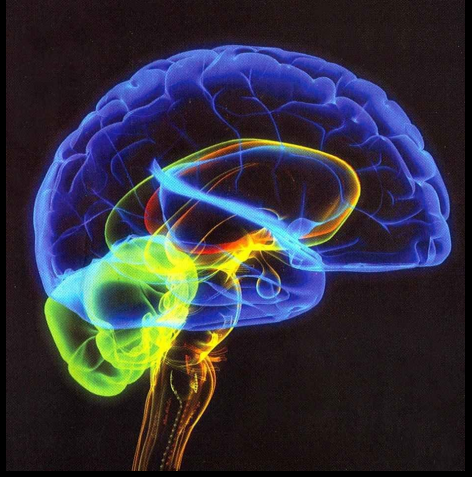


Word Segmentation

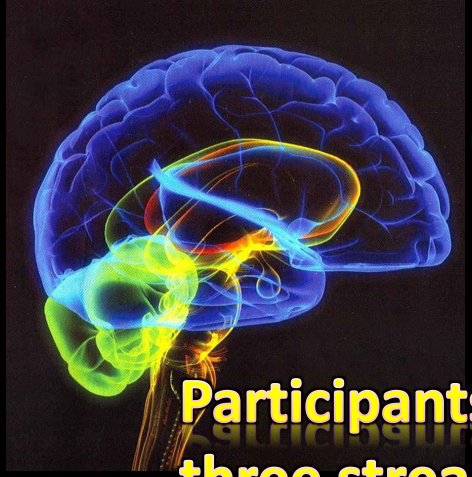
- Identification of word boundries in contiguous speech .
  Ex: Thisisatree.



Ways of word Segmentation

- Computing information about the distributional frequency of occurence of syllables relative to others.

- Speech cues such as stress patterns to mark word boundaries. Ex: longer duration, increased amplitude and higher pitch on certain syllables.



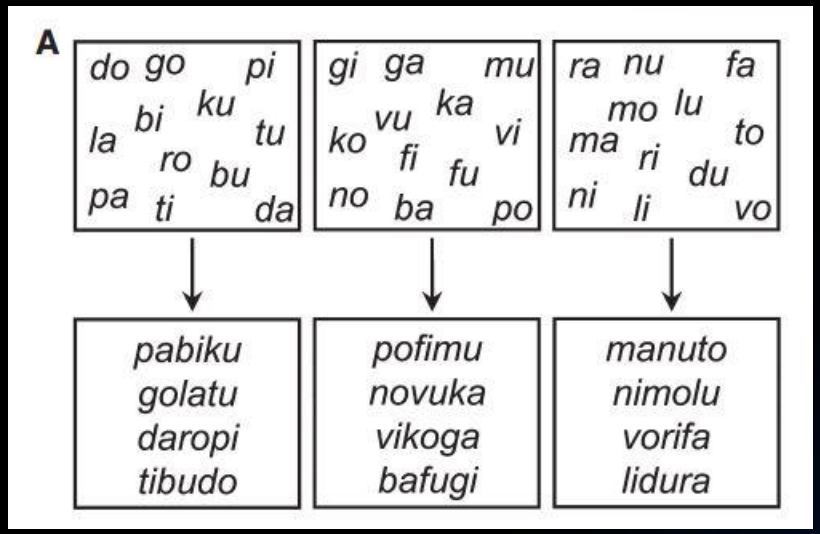
The Experiment:

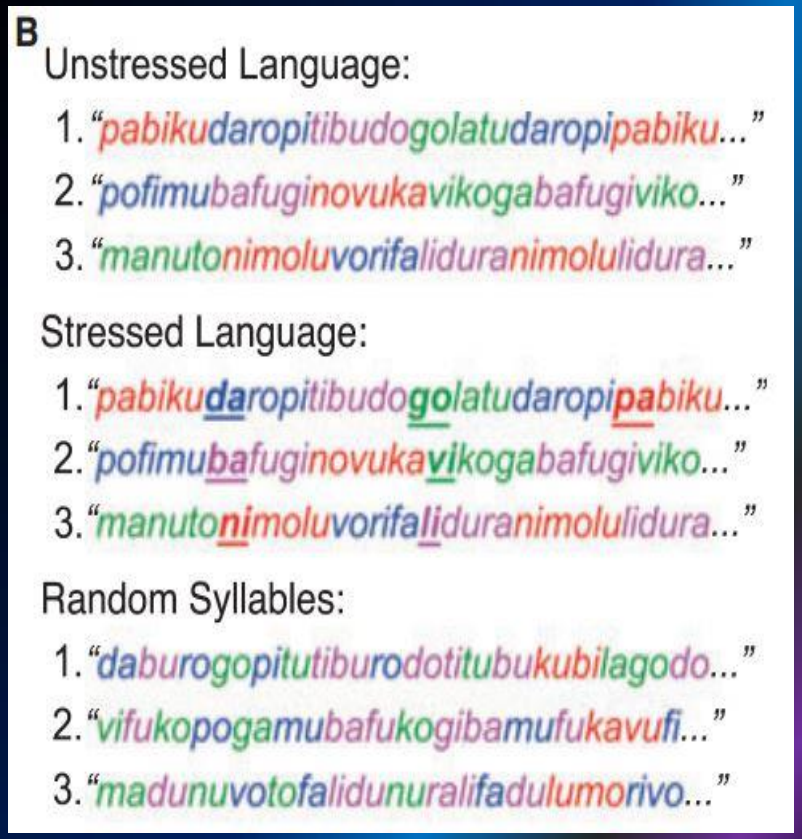
Participants, while undergoing fMRI listened to following three streams of concattenated syllables containing:

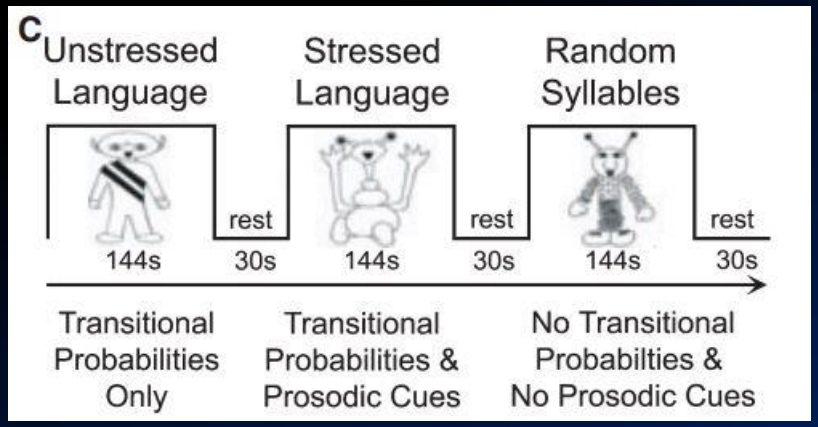
- Strong statistical cues to word boundries
- Strong statistical and speech cues
- Weak statistical regularities (Not readily providing word boundaries)

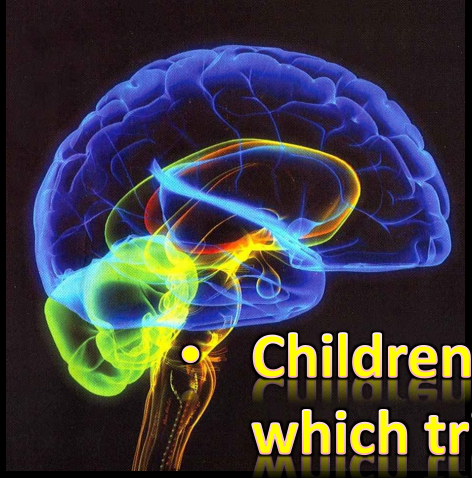
Functional MRI Signal increases over time from different regions of brains of the subjects were monitored.

The experiment…





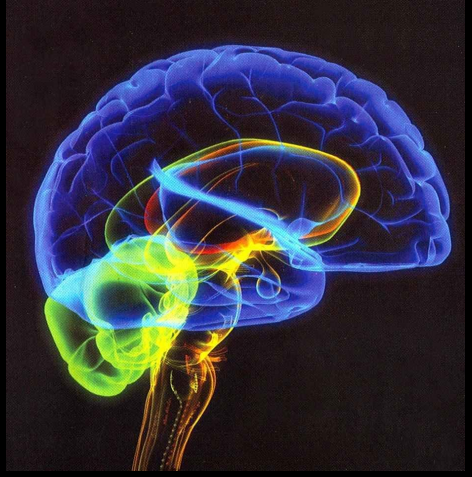




Observations

- Children of all ages were unable to explicitly recognize which trisyllabic words were part of the artificial languages, (accuracy were around 50%, no differences in accuracy between words and partwords)
- there were no significant differences in response times to either words or part-words

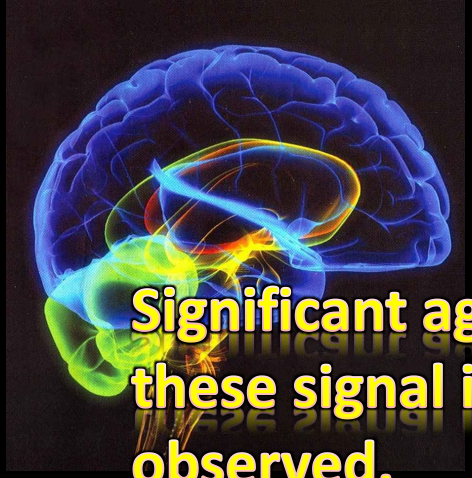
RESULT: These observations are in line with behavioral findings of prior word segmentation studies
(e.g. McNealy et al., 2006, 2010; Saffran et al., 1996b; Sanderset al., 2002)



Observations..

- The signal intensity measured from the brain of the subjects increased over time along the superior temporal gyri region.

RESULT: This might mean that frequencies of syllable co-occurrence and transitional probabilities between neighboring syllables were being calculated here.

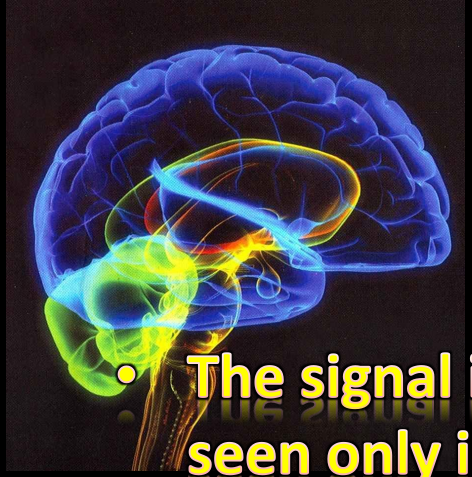


Observations…

Significant age related changes in the left or right-sidedness of these signal increases in temporal cortices over time were observed.

- Left-lateralized signal increases in adults(McNealyet al., 2006).
- Bilateral increases in 10-year-old children (McNealyet al., 2010).
- Bilateral signal increases were observed in 13-year-old children too.
- Right-lateralized increases in 6-year-olds were observed.

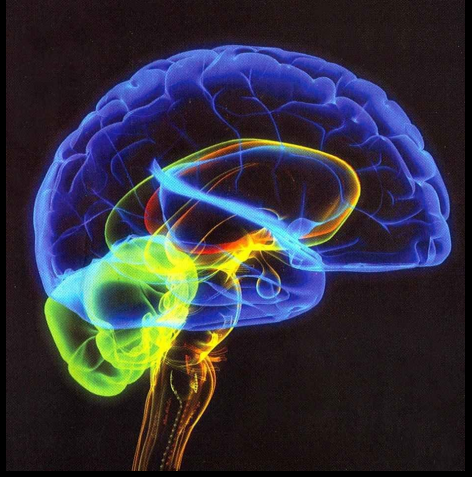
RESULT: The computation of occurrences of "words" in a NEW speech stream shifts from temporal cortices of greater right to those of left hemisphere with age.



Observations…

- The signal increases for the random syllables stream, were seen only in the 6 and 10-year-old children and not in 13 year children and adults.
- It means the way the brain processes weak statistical cues changes significantly as children transition from childhood into adolescence.

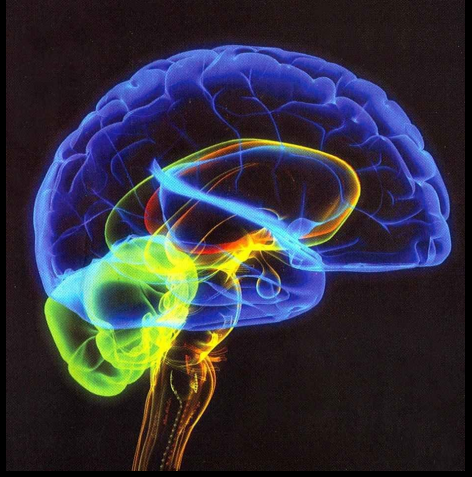
RESULT: Since a real ‘novel’ language will contain low statistical relationships* , it was suggested that this type of change in sensitivity to weak cues might be related to the decrease in the ability to acquire another language with native-like proficiency after puberty



Observations…

- Children with some/high second language proficiency exhibited greater signal increases in superior temporal cortices than children with no/low second language proficiency

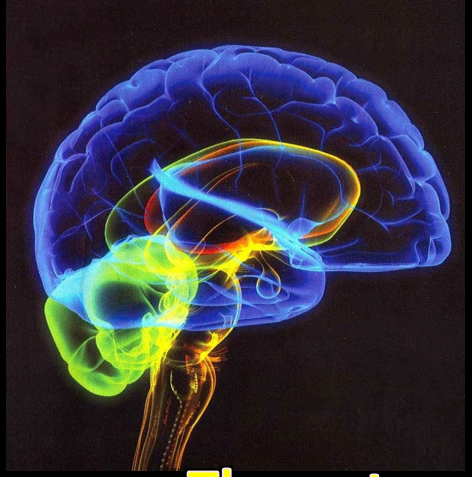
RESULT:This suggests that being exposed to more than one language during childhood may influence the ease with which another language is learned.



Observations…

- More advanced pubertal status was associated with greater signal increases in left supramarginal gyrus
- Less advanced pubertal status was associated with greater signal increases in the right superior temporal gyrus

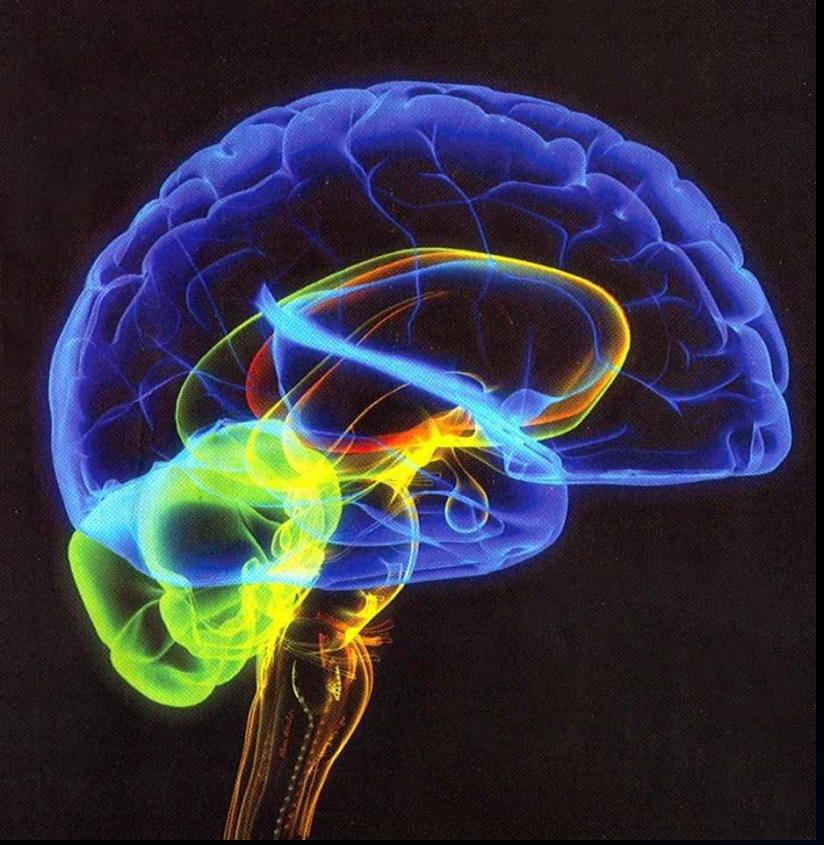
RESULT: This suggests that pubertal maturation may significantly contribute to the observed pattern of increasing left-lateralization of learning-related signal increases over time



Conclusion

- The natural underpinnings of language learning are not fixed across development but rather undergo continued changes and refinement as a function of both biological maturation and relevant learning experiences.

- No single factor is likely to account for the differial ability to learn a new language as a function of age.



THANK YOU