Functional Neuroimaging of Speech Perception in Infants

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Introduction

- Why infants?
  - To understand the development of specialization in the adult brain
- Past studies:
  - Language learning starts in the first year of life
  - Brain mechanisms?
  - Event Related Potentials (ERP’s)

Method

- Subjects
  - 20 healthy, nonsedated infants (2 to 3 months old)
- Procedure
  - fMRI
  - 20 s of speech stimuli alternating with 20 s of silence
  - Alternate blocks: forward or backward speech in native language

Results

- Stimulus-induced activation in a large extent of the left temporal lobe

Results

- Planum Temporale
  - Activation was significantly greater in the left than in the right temporal lobe

Results

- Forward vs. Backward speech:
  - Greater activation by forward speech in:
    - Left angular gyrus
    - Left mesial parietal lobe (precuneus)
**Results**

- **Effect of wakefulness**
  - 6 infants stayed awake during the entire session
  - 5 infants were deeply asleep

- Compared activation patterns

**Discussion**

- **Activation in left angular gyrus, left precuneus and right prefrontal cortex for native language (forward)**
  - Same for adults
  - Indicates early engagement of active memory retrieval mechanisms

**Discussion**

- **No difference between forward and backward speech in infant temporal lobe**
  - Suggests that this area has not yet acquired full competence for native language by 3 months

**Conclusion**

- **Two mechanisms of language acquisition**
  1. Infant brain is equipped with genetically determined mechanisms of language processing
  2. Infant brain is initially immature and plastic, and exposure to speech shapes mechanism of language processing

- Results provide evidence for both

**Opinions & Further Research**

- **Strengths**
  - fMRI
    - shows function and structure
    - High external validity
- **Weaknesses**
  - fMRI
    - Too noisy
- **Further Research**
  - Speech perception in children with autism
Questions?