Summary

- This investigation seeks to understand the differences in activation between deaf individual TRR and hearing controls using an passive reading task performed in an fMRI scanner.

- TRR exhibits a pattern of brain activity in response to written word forms that is different from hearing individuals and from other deaf individuals that have been studied.

- These differences seem to be due to neuroplasticity, where brain areas that typically respond to one kind of input to begin to respond to other types of stimulation if they are denied the input for which they are specialized.

- TRR shows activation in primary auditory cortex in response to visual word form stimuli greater than control participants studied; data collection for matched controls in progress.

Background

- In deaf individuals, auditory regions are activated in response to basic, non-linguistic visual stimuli (Finney et al., 2001).

- Areas activated in highly proficient deaf readers in response to written word forms reported as being consistent with those activated in hearing readers (Corina et al., 2013).

- Corina et al. did not report activation in auditory areas to a greater extent in deaf individuals than in hearing individuals.

- For hearing individuals, learning to read requires learning to map auditory units (speech sounds) to visual units (letters).

- Profoundly congenitally deaf individuals do not have access to phonological knowledge; if they are using a different strategy for reading, a different pattern of activation should be observed.

Methods

- TRR: 48 years old, highly educated (Ph.D.), right-handed, and congenitally deaf.

- Experiment carried out in Phillips 3T fMRI Scanner.

- Block-design passive viewing task: participants look at and read stimuli in the scanner.

- Compare activation for words to other stimuli to see which brain areas are uniquely active in response to words.

- Functional data pre-processed, transformed into Talairach space, and aligned with anatomical scan using BrainVoyager QX 2.3.0.

References


Preliminary Analysis

- Activation in auditory cortex and seventeen other areas: Bonferroni-corrected p-value < .05 and a 400 voxel cluster size threshold for words > checkerboards.

- Comparison to 47 unmatched control subjects using IPPC program (Purcell & Rapp, 2013), a type of meta-analysis, suggests activation in this area is unique to TRR relative to hearing controls (p < .05).

Discussion

- Data collection in progress for eight control participants matched to TRR in age, education level, and handedness.

- Activation in auditory cortex is novel and robust in TRR in the preliminary analyses.

- Corina et al. reported clusters of activation characteristic of groups of proficient and less-proficient readers and posit two different strategies used by deaf readers.

- Proficient readers use similar strategies to hearing English readers while less proficient readers use strategies like those employed by logographic script readers.

- Of his 17 active areas in response to words, TRR shows activation in 3 of the areas reported for proficient readers in Corina et al. and 2 areas reported for less-proficient readers.

- These discrepancies combined with the activation in auditory cortex not seen in the deaf readers in Corina et al. suggest that TRR has recruited different brain areas through neuroplasticity for reading and is probably using an alternative strategy.

- It is also possible in the Corina et al. study they did not have sufficient power to detect this activity.

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