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An fMRI study comparing reading and repetition in children and adults

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Language

Abstract

Introduction

An important issue in cognitive neuroscience is how the brain matures to accommodate specific language skills including more recent skills (in an evolutionary sense) such as reading. This study attempts to increase our understanding of the reading process as it develops from children to adults by comparing simple single-word reading and repetition.

Methods

The brain activation differences between reading aloud printed words and repeating aloud aurally presented words were compared in 50 normal right-handed subjects: 25 children (7-10 yrs, 16 female) and 25 adults (18-35 yrs, 14 female). Task vocabulary was appropriate for 6-7 year-old readers. Each child was tested with Wechsler Abbreviated Scale of Intelligence to screen for unsuspected learning disabilities. Children were also rigorously screened for the absence of neurological or psychological problems. Behavioral data were collected through a voice recorder. Subjects were performance-matched for accuracy and reaction time on both tasks. Event-related fMRI was performed on a Siemens MAGNETOM Vision 1.5T scanner using a standard EPI-BOLD sequence. Correct trials were analyzed according to standardized protocols. Imaging data were analyzed using repeated-measure ANOVAs for the within subject factors of *time* and *task*, and the between subject factor of *age*. Post-hoc ANOVAs used region as a factor.

Results

For this study, analysis focused on 4 left hemisphere locations deemed important for the functional anatomy of reading: the angular and supramarginal gyri, and anterior and posterior extrastriate cortex. A region in the left angular gyrus was significantly activated only by children for both tasks (A in Fig); adults did not engage this region. A region in the left supramarginal gyrus was activated significantly more by children than adults, though both groups showed significant activations for the region (B in Fig). As expected, a left anterior extrastriate region showed a task effect with greater activation for the read task than for the repeat task, and also showed a significant age effect with children having greater activation than adults (C in Fig). Surprisingly, a left posterior extrastriate region was significantly activated by both children and adults for both tasks; no significant differences were found for task or group (D in Fig).

Discussion

These findings suggest a systematic functional differentiation among these brain regions during simple word-processing tasks. The age-related decreasing use of regions in the angular and supramarginal gyri may reflect a more general increase in linguistic skill during development, while the decrease in the anterior extrastriate region may reflect increasing specialization in the visual system as reading becomes more skilled. The surprising pattern of activation in the posterior extrastriate region may suggest that this region has “close ties” to auditory processing.

Acknowledgments

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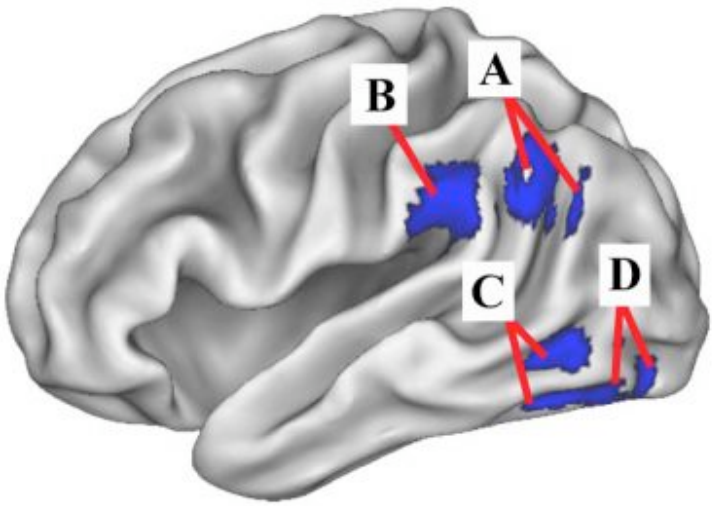

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