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## Functional MRI assessment of modality-related and age-related effects during passive presentation of written and spoken words

Monica V. Baciú<sup>1</sup>, Rebecca S. Coalson<sup>2,3</sup>, Steven E. Petersen<sup>2,3,4,5</sup>, Bradley L. Schlaggar<sup>2,3,4,6</sup>  
<sup>1</sup>Pierre Mendes-France University, Grenoble, France; Department of Psychology, <sup>2</sup>Washington University School of Medicine, St. Louis, MO, USA; Department of Neurology, <sup>3</sup>Washington University School of Medicine, St. Louis, MO, USA; Department of Radiology, <sup>4</sup>Washington University School of Medicine, St. Louis, MO, USA; Department of Anatomy and Neurobiology, <sup>5</sup>Washington University School of Medicine, St. Louis, MO, USA; Department of Psychology, <sup>6</sup>Washington University School of Medicine, St. Louis, MO, USA; Department of Pediatrics

### Language

#### Abstract

**Introduction.** Past studies have investigated the developmental functional neuroanatomy of simple and controlled lexical processing tasks requiring active responses. Here, our goal was to investigate simple *passive lexical tasks*, including silent reading of, and passive listening to, single words. We evaluated the effect on cerebral activity of 1) modality (visual or auditory) and 2) development (adults vs 7-10 year old children).

**Methods. Subjects.** Thirty-one children (mean age 9.1 y, 21 female) and seventeen adults (mean age 27.0 y, 10 female) were examined. **Tasks.** Subjects performed one fMRI run each of passive reading of printed words (without reading aloud) and passive listening to spoken words (without repeating). Each 210 sec. run presented 21 words in an event-related design with the stimulus onsets jittered by 6, 9 or 12 sec. **MR acquisition.** A Siemens MAGNETOM Vision 1.5 Tesla scanner (Erlangen, Germany) using a standard EPI sequence gathered 73 whole brain acquisitions per run. **Data processing.** In-house software (1) did pre-processing and statistical analysis. A voxel-wise ANOVA used correlations to stimuli (GLM) from all subjects to generate Z images, a region-finding algorithm found coordinates of the peak-voxel from these images, and a random effects ANOVA generated time courses and statistics for each set of regions.

**Results** Most importantly, we identified regions activated by passive language, regardless of modality (*Table*), many of which (e.g. inferior frontal and superior temporal regions) are commonly found in more active lexical processing tasks. Interestingly, no age-related effect met our statistical threshold for these simple lexical tasks (Monte Carlo corrected  $Z > 3.5$ , at least 24 contiguous voxels). Also, as expected, we found visual regions selectively activated during passive reading and auditory regions for passive listening to spoken words.

**Conclusions.** Results suggest that passive reading of printed words and passive listening to spoken words (1) activate an expected constellation of regions involved in word recognition, (2) involve both modality-specific and modality-independent regions, and (3) are supported by a common functional anatomy in adults and children, suggesting that visual input automatically activates a lexical processing network even in early readers.

**Reference.** (1) *Miezin et al.* (2000), *Neuroimage*, 11, 735-59.

MODALITY INDEPENDENT REGIONS						
x	y	z	x	y	z	

Left hemisphere				anterior and posterior insula	-34	19	10				
inferior frontal (BA 44)	-47	8	30		-46	5	11				
	-52	13	22		-36	7	10				
superior temporal (BA 22)	-56	-37	6	lentiform nucleus	-20	-12	10				
	-53	-48	10								
	-49	-30	5	Right hemisphere							
middle frontal (BA 10, 46)	-44	23	22	superior temporal (BA 22)	48	-43	11				
	-39	41	18	anterior cingulate (BA 24)	9	1	42				
supramarginal (BA 40)	-49	-41	26	inferior frontal (BA 45, 46, 47)	50	18	20				
anterior cingulate (BA 24)	-1	-21	27		43	13	-4				
posterior cingulate (BA 31)	0	-33	39		30	33	15				
superior parietal lobule (BA 5)	-20	-41	61	middle frontal (BA 46)	36	40	29				
parahippocampal	-20	-21	-10	precuneus (BA 31)	11	-53	36				

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