

Neural Systems for Reading Aloud: A Multiparametric Approach

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recognition in the lexical decision task (James 1975; Kroll and Merves 1986; Kounios and Holcomb 1994; Binder, Westbury,

Medler, et al. 2005), despite modeling and behavioral evidence that semantic information plays a role in this task. We predicted 2 effects concerning the semantic system. First, increasing values of word frequency and imageability were expected to produce increasing activation in semantic regions such as the angular gyrus, ventral temporal lobe, and precuneus/posterior cingulate, indicating more extensive activation of semantic information with increasing concept familiarity and image-

Data Processing and Analysis

Image analysis was performed using AFNI (<http://afni.nimh.nih.gov/afni>) (Cox 1996). For each subject, the first 6 images in each time series were discarded prior to regression analysis to avoid initial saturation effects. Images were slice timing corrected and spatially coregistered.

activity with increasing RT (i.e., positive correlations). These included broadly similar patterns in left and right hemispheres, with somewhat greater activation on the left. This pattern was seen in the IFG extending both to the middle frontal gyrus and anterior insula, the inferior frontal junction (IFJ, the junction of the precentral and inferior frontal sulci), peri-Rolandic cortices,

have distorted effects of the psycholinguistic variables with

increasing activity for less consistent words also show little or no overlap with areas modulated by RT.

Discussion

Both separate and overlapping patterns of neural activity were detected for the 6 uncorrelated factors of interest. The data suggest a neural architecture in which distinct orthography-phonology and semantic pathways are engaged during reading aloud. The results also clarify the role of several left inferior frontal regions in reading aloud.

Overlapping Effects of Increasing Task Load

As illustrated in the upper part of Figure 3, effects in the

well-formed letter strings (Cohen et al. 2002; McCandliss et al. 2003; Cohen, Jobert, et al. 2004; Dehaene et al. 2005). Two reviews place the center coordinate for this area in Talairach and Tournoux (1988) space at x, y, and z = -43, -

100 ms in their study, compared with 1000 ms in ours, and they used a fixed stimulus onset asynchrony of 2.5 s, whereas our ITIs included random variation with a mean of 4.9 s. Thus, their subjects may have been less likely to engage in extensive semantic association and extralexical tasks such as mental

implicated in phonological retrieval (Indefrey and Levelt 2004).

impairment in naming biological compared with nonbiological entities that becomes more discrepant with increasing degree of overall naming impairment (Whatmough et al. 2003). Finally, although semantic and phonemic fluency tasks presumably

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