Individual differences in the neural correlates of reading words and passages

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Introduction

• While reading skill has often been linked to the engagement of putatively “visual” areas in the ventral pathway (e.g., Shaywitz 2002), less is known about how multimodal language system support reading.
• Multimodal language regions are crucial to reading, by providing access to underlying phonological representations of words (Liberman, 1992; Frost et al., 2009; Braze et al., 2011).

Methods

1. fMRI experimental conditions

   Event-related Block
   Table:
<table>
<thead>
<tr>
<th>Word</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>“smile”</td>
<td>“boat”</td>
</tr>
<tr>
<td>“There was a country house”</td>
<td>“There was a forest cabin” (phrase by phrase) (continuous)</td>
</tr>
</tbody>
</table>

2. ROI identification

   For each subject, 50 brain voxels (size=3mm³ per voxel) in the left hemisphere which responded to the visual and auditory word more than to the visual and auditory control were selected in search spaces listed below.

<table>
<thead>
<tr>
<th>ROI</th>
<th>Search spaces in AFNI atlas</th>
</tr>
</thead>
<tbody>
<tr>
<td>SMG</td>
<td>SMG</td>
</tr>
<tr>
<td>IFG</td>
<td>opercularis &amp; triangularis</td>
</tr>
<tr>
<td>AG</td>
<td>AG &amp; BA39</td>
</tr>
<tr>
<td>STGp</td>
<td>STG + MTG (&lt;20 in Y axis)</td>
</tr>
</tbody>
</table>

3. Beta extraction

   Beta weights were obtained within the ROIs at the contrasts of the visual word minus the visual control for the word experiment, and at the contrast of the visual story for the story experiment.

Subjects

• 52 Subjects
• Age: 16–25 years
• IQ > 85 in Wechsler Adult Intelligence Scale.

Results

Phonological awareness

Comprehension

Conclusions

• These multimodal areas were identified in the word experiment, which was independent from the story experiment. Still, the general pattern of brain/behavior correlations is largely similar, implying that the processing in these regions was similar across reading words and sentences.
• People who were better in the phonological awareness test activated more strongly the left IFG in reading sentences.
• People who were better in the comprehension test activated more strongly the left STG in reading words and sentences and the left IFG in reading sentences.

Reference


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