An examination of the neural bases of conceptual combination in stroke aphasia

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Introduction

• Natural language comprehension requires the ability to combine single words and phrases into more complex meanings, a process called conceptual combination
• There are two putatively distinct types of conceptual combination: attributive (concepts are broken down into features and an attribute of the modifier is mapped to the head noun) and relational (a relation between the concepts is identified)
• Two areas of the brain—anterior temporal lobe (ATL) and angular gyrus (AG)—have been theorized to support conceptual combination1, but it is unclear whether they are distinct hubs, such that ATL supports attributive combinations and AG supports relational2
• One alternate theory holds that AG is differentially responsible for events, such that AG damage should be correlated with difficulty with relational compounds specifically, while ATL damage might cause difficulty with both types of combinations2

CURRENT QUESTION: Will damage to either ATL or AG lead to difficulties with either attributive or relational combinations, respectively?

Participants

• 4 participants with chronic aphasia secondary to left-hemisphere stroke (2 anterior lesions including ATL, 2 posterior lesions including AG)
• 15 neurotypical age-matched controls

<table>
<thead>
<tr>
<th>% damage BA 38 (ant)</th>
<th>% damage BA 39 (post)</th>
<th>WAB AQ</th>
<th>WAB dx</th>
<th>PNT%</th>
<th>Camels &amp; Cactus%</th>
<th>PPVT%</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>95%</td>
<td>22%</td>
<td>51.6</td>
<td>41</td>
<td>78</td>
<td>77</td>
</tr>
<tr>
<td>A2</td>
<td>32%</td>
<td>0%</td>
<td>61.6</td>
<td>71</td>
<td>72</td>
<td>72</td>
</tr>
<tr>
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<td>88%</td>
<td>82.4</td>
<td>81</td>
<td>88</td>
<td>85</td>
</tr>
<tr>
<td>P2</td>
<td>1%</td>
<td>96%</td>
<td>88.5</td>
<td>78</td>
<td>89</td>
<td>85</td>
</tr>
</tbody>
</table>

Methods and Materials

Schematic of 4 trials with ambiguous compound

• Stimuli: 56 novel nominal compounds (18 attributive-biased, 19 relational-biased, and 19 ambiguous) and 57 lexicalized nominal compounds as fillers
• Design: Participants saw a compound, gave a verbal interpretation, then rated one potential cartoon image on a scale from 1-5 based on whether it matched their interpretation
• Images were (1) a target (combined interpretation), (2) a non-interacting foil with both nouns in separate pictures, or (3) a foil with the modifier alone
• Coding: Verbal interpretations were coded by two trained coders as relational, attributive, both or neither (percent agreement = 0.84)

Acknowledgments

We thank the National Institute of Health for funding our work through grant R01DC015359, our collaborators, and our participants.

References