Function Word Deficits in Broca’s Aphasia and Its Relation to Working Memory Capacity

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Introduction

- Persons with Broca’s aphasia (PWBA) often exhibit effortful verbal output with numerous semantic and syntactic errors with difficulty in word retrieval abilities
- Fragmented speech productions are manifested differentially by task and computational demands, and are readily attested in the performance of narrative-based tasks (Faroqui-Shah & Baker, 2017)
- Discourse involves higher-level planning to combine units of information in a coherent manner to convey a meaningful message (Wright et al., 2011)
- When producing utterances, persons with Broca’s aphasia may adopt a strategy based on the adaptation theory (Kolk & Heeschen, 1992), to avoid using their impaired grammar due to their limited capacity (Harsuiker & Kolk, 1998)
- → the result is simplified utterance structures with omission and/or substitution of function words (Salis & Edwards, 2004)

Purpose

- Examine grammatical and morpho-syntactical errors across narrative discourse tasks
- Examine the relationship among working memory and grammatical and morpho-syntactical errors across narrative discourse tasks

Participants

- Broca’s Aphasia (n=69) from AphasiaBank

<table>
<thead>
<tr>
<th>Age:</th>
<th>M= 58.9, SD= 12.8 (range: 25.6 – 85.4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Years of Education:</td>
<td>M= 15.1, SD=2.8 (range: 8-23)</td>
</tr>
<tr>
<td>WAB-R AQ:</td>
<td>M=51.4, SD=15.2 (range: 10.8 – 77.7)</td>
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Assessment and Measures

Marini Analysis:
- An extensive, multilevel assessment procedure for analyzing discourse
- “Traditional standardized aphasia tests may not be sensitive enough to adequately assess linguistic deficits and recovery in persons with aphasia” (Marini, et al., 2011; p. 1373)

Discourse & Working Memory Tasks:
- Discourse: three narrative discourse tasks:
  - Describing current speech skills
  - Single picture description task - “cat in the tree picture” (Nicholas & Brookshire, 1993)
  - Telling the “Cinderella” story
- Working Memory: AphasiaBank Repetition Test (Martin & Gupta, 2004):
  - Word string (increasing length), Span score (any order), Span score (serial order)

Grammatical and Morpho-syntactic Analyses

- Substitution of a Function Word: when a function word is changed for another function word
- Substitution of a Bound Morpheme: typically the incorrect tense or plurality
- Omission of Function Word: the missing of a closed class word (he, she, it, the, etc.)
- Content Omission: the missing of any content

Examples:
- The girl fall <into> [* f] the truck
- They will <eats> [* m] the sandwiches
- [* ofw] cat ran down [* ofw] hallway
- [* oc] ran into the attic

Results

- Analysis of variance (ANOVA)

<table>
<thead>
<tr>
<th>(%)</th>
<th>Substitution of Function Words</th>
<th>Substitution of Bound Morphemes</th>
<th>Omission of Function Words</th>
<th>Omission of Content Words</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cat in Tree</td>
<td>9.94</td>
<td>24.56</td>
<td>38.85</td>
<td>25.08</td>
</tr>
<tr>
<td>Spontaneous Speech</td>
<td>1.75</td>
<td>5.26</td>
<td>42.21</td>
<td>27.37</td>
</tr>
<tr>
<td>Cinderella</td>
<td>14.91</td>
<td>31.70</td>
<td>26.77</td>
<td>14.85</td>
</tr>
</tbody>
</table>

Significant differences were found:
- In proportion of function word substitutions: with more errors in the Cinderella story than the spontaneous speech task, (p< .05)
- In substitution of bound morphemes between the picture description task, the spontaneous speech task (p< .01), and the Cinderella story (p=. .001)

Discussions

- Findings support previous research (De Roo, Kolk, & Hofstede, 2003; Indefrey et al., 2001; Kolk, 1995; Salis & Edwards, 2004)
- Task variation affects function word production in narratives produced by PWBA
- We found significant correlations between working memory and proportion of function word substitutions; thus adding empirical support that working memory ability contribute to function word production (Harsuiker & Kolk 1998; Kolk & Weijts, 1996)
- Omissions were the most common error; adding support for the Adaptation theory (Kolk & Heeschen, 1990)