Impairment of function words in CP and DP in aphasic speakers

The rationale
Patients with agrammatic aphasia exhibit restricted patterns of impairments of functional morphemes (Burchert, 2008; Thompson et al., 2010) on sentence production tasks. There have been competing hypotheses that attempt to explain these impairment patterns. One of the earliest hypotheses is the Tree Pruning Hypothesis (TPH) (Friedmann and Grodzinsky, 1997), which attributes deficits in functional morphology to the hierarchical structure of sentences. Specifically, the higher the syntactic projection along the structures in (1a), the more likely that projection will be impaired. Once a projection is impaired, any node above it will also be impaired. Another hypothesis, the Distributed Morphology Hypothesis (DMH) (Dickey et al., 2008; Halle and Marantz, 1993; Thompson et al., 2002), attributes deficits to agrammatics’ difficulty in implementing rules that convert inflectional features into morphemes, rather than to the hierarchal syntactic structure. Either of these hypotheses is supported by some data but is challenged by some other data. Meanwhile, these hypotheses have been so far tested only on functional morphemes in clauses. This study attempts to test these two hypotheses on functional morphemes in nominal phrases.

It is revealed in theoretical linguistics that nominal phrases hold strong parallelism with clauses in terms of syntactic structure. Corresponding to the CP>TP>VP structure of clauses (1a), it is proposed that nominal structure consists of DP>NumP>NP (1b) (Abney, 1987; Ritter, 1991). Meanwhile, there are some crucial differences between nominals and clauses in terms of corresponding functional projections. For example, while complementizers (e.g. that and whether) that occupy CP do not alternate morphologically, demonstratives that occupy DP have the singular/plural distinction morphologically. The similarities and differences between clauses and nominal phrases provide us with a good testing ground for competing hypotheses regarding deficits of functional morphemes.

The experiment
This mixed design experiment, with five agrammatic aphasics and five healthy volunteers, examined the production abilities of these two groups in seven conditions as in (2). In each condition, fifteen written sentences with a word missing were presented and participants selected a word from a set of four candidates to complete the sentence. Percent accuracy was computed in each condition.

The predictions of TPH:
Complementizers, which occupy CP, will be more impaired than have and had, which occupy TP. This and these, which occupy DP, will be more impaired than both singular and plural numerals, which occupy NumP.

The predictions of DMH:
Function words that do not involve morphological inflection will be preserved and these include complementizers, have, this and singular and plural numerals. Function words that involve morphological inflection will be impaired, for example, had and these.

The results
A series of Wilcoxon tests were conducted to compare accuracies under all conditions, revealing the following results. Overall, patients’ accuracies were significantly lower than those of controls (Z= -3.742, p<0.001). However, the patient data did not fully support TPH. Although patients evinced significantly lower accuracies for demonstratives (this and these) that occupy DP than numerals (both singular and plural) that occupy NumP, supporting TPH (Z = -2.388, p=0.017), patients’ accuracies for complementizers (at CP) were not significantly lower than those for TP (have and had) (Z= -1.841, p=0.066), which contradicts the prediction of TPH. In addition, patients had more difficulty with inflections, as predicted by DMH. Accuracy for had was significantly lower than for have, Z= -2.032, p=0.042 and accuracy for these was significantly lower than for this, Z= -2.060, p=0.039. Conversely, performances on singular numerals and plural numerals were close to 100% as they do not involve morphological inflection.

Conclusion
These results indicate that agrammatic patients exhibit similar patterns of impairments in both clauses and nominal phrases (Rausch et al., 2005, 2007), which can be captured by DMH but not by TPH.
(1) The syntactic structures assumed in this study
   a. \([CP \text{ they [TP have [VP left home]]]}
   b. \([DP \text{ these [NumP four [NP tables]]]}\]

(2) The seven conditions in the experiment

<table>
<thead>
<tr>
<th>Conditions</th>
<th>Lexical items</th>
<th>Stimuli</th>
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<tbody>
<tr>
<td>Comp</td>
<td><em>if, that</em></td>
<td>They wonder ___ the man is covering the box. (on, if, too, but)</td>
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<tr>
<td>TP</td>
<td><em>have</em></td>
<td>Today the girls ___ covered the box. (have, in, and, had)</td>
</tr>
<tr>
<td></td>
<td><em>had</em></td>
<td>By yesterday the girls ___ covered the box. (have, in, and, had)</td>
</tr>
<tr>
<td>DP</td>
<td><em>this</em></td>
<td>The man covered ___ car. (this, for, these, on)</td>
</tr>
<tr>
<td></td>
<td><em>these</em></td>
<td>The man covered ___ cars. (this, for, these, on)</td>
</tr>
<tr>
<td>NumP</td>
<td><em>Sg</em></td>
<td>(a picture of one shirt) In this picture, we can see ___ shirt. (one, two three, four)</td>
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<tr>
<td></td>
<td><em>Pl</em></td>
<td>(a picture of three shirts) In this picture, we can see ___ shirts. (one, two three, four)</td>
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</tbody>
</table>

Patients’ accuracies under different conditions

References