Speech is a complex behavior. Cognitive impairment in one domain may affect patients’ performance, thus providing opportunities to identify disease markers. A limited number of studies have examined natural connected speech in typical and atypical Alzheimer’s disease (AD). Here we implement automated language processing to characterize some semantic properties of speech in speakers with typical AD and its language-specific variant, logopenic variant primary progressive aphasia (lvPPA).

## Participants & Methods

### Table 1: Clinical & Demographic characteristics (Means (sd))

<table>
<thead>
<tr>
<th></th>
<th>AD</th>
<th>lvPPA</th>
<th>Control</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>93</td>
<td>38</td>
<td>36</td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td>51 (54.8)</td>
<td>17 (44.7)</td>
<td>17 (47.2)</td>
<td>0.509</td>
</tr>
<tr>
<td>Education (y)</td>
<td>26.24 (102.01)</td>
<td>15.55 (3.13)</td>
<td>16.03 (2.63)</td>
<td>0.681</td>
</tr>
<tr>
<td>Age (y)</td>
<td>67.02 (9.73)</td>
<td>67.62 (8.64)</td>
<td>68.15 (6.89)</td>
<td>0.802</td>
</tr>
<tr>
<td>MMSE (0-30)</td>
<td>21.05 (5.37)</td>
<td>22.21 (5.85)</td>
<td>29.14 (0.99)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

- We analyzed transcripts of natural speech elicited by a picture description task from AD, lvPPA and matched control speakers (Table1).
- We automatically parsed and tagged each word and then automatically scored for word length (in phonemes and morphemes), frequency, familiarity, semantic diversity and concreteness based on published norms.
- We compared these features across groups, covarying for age, sex, education and Mini Mental Status Examination (MMSE) score.
- We correlated each acoustic measure with MMSE scores collected within 6 months of the speech samples.

## Results

### Word length & semantic scores in AD and lvPPA

- AD and lvPPA speakers used higher frequency words (p<0.001) that were shorter (phoneme count, p<0.001; morpheme count, p<0.001), more ambiguous (p=0.028) and abstract (p=0.005) and acquired at a younger age compared to control speakers.
- lvPPA speakers’ words had fewer morphemes (mean 1.104 ± 0.037) compared to AD (mean 1.129 ± 0.038, p=0.002).
- lvPPA speakers showed a trend towards using higher frequency words (p=0.057), acquired at a younger age (p=0.05) compared to AD speakers.
- lvPPA speakers differed from controls in their semantic diversity (p=0.02).
- Lower MMSE scores in patient speakers are correlated with greater word frequency, shorter word length, younger age of acquisition, greater semantic diversity, and lower concreteness scores.

## Conclusions

- In natural speech, AD and lvPPA speakers select words that are shorter, more frequent, more semantically ambiguous and less concrete.
- lvPPA speakers show a specific predilection for words with fewer morphemes and higher frequency, acquired at an earlier age.
- These deficits correlate with the degree of cognitive impairment.

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