LOCAL PROMINENCE OF ACOUSTIC AND PSYCHOCOUSTIC FUNCTIONS AND PERCEIVED STRESS IN FRENCH

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Abstract

Syllable duration, pitch, loudness, pause length, pitch change, and local difference values for the first 3 parameters, were studied for their ability to predict perceived stress as measured in a listening task. The best cues were duration increase relative to preceding and following syllables, followed by nucleus duration.

1. Introduction

Syllabic stress is a linguistic attribute realized in various prosodic parameter. Prominence is an abstract linguistic category, which can be realized in various ways, with or without prominence. It can not be observed directly. A measure of perceived prominence has to be established in order to classify the syllables. A brief review of terminology will clarify this point.

(1) A syllable is prominent when it stands out from its context due to a local difference for some prosodic parameter. Prominence is continuous (not categorical) and contributions of multiple parameters can interact.

(2) Stress is an abstract linguistic category, which can be realized by several types of prominence, in a way which is language-specific.

(a) In French, an intra-syllabic pitch glide of a given interval suffices to signal stress. Prominence by duration or loudness will be functionally redundant although very common.

(b) For static syllables prominence will results from an inter-syllabic change of a parameter.

(c) Finally, stress can result from tone level itself, on the basis of tone distribution [3,6].

(3) Word stress (lexical stress) indicates the syllable in a word which can receive stress.

(4) French has two stress types: final (word stress position) and initial stress (emphatic), with a different distribution.

In a listening task, the stress judgment will be based on a mixture of heterogeneous factors: acoustic, structural, lexical. Subjects may focus on an isolated word or sentence, and decide whether a given syllable can receive stress.


Six extracts (277 syll.) were selected from a corpus [3] in such a way that the test contained at least 2 occurrences of each stressed tone. A male and a female speaker each provided 3 extracts. The mean length of 46 syll/test was 3.66.

1.2.1. Perceptual experiment.

The 20 untrained subjects heard each passage once (with 75% silence) and 6 times (with 5 intervals) during which they had to indicate the stressed syllables on the test sheet. Each syllable was judged either stressed or unstressed; so, it was assigned to 1 of 2 categories. The kappa statistic [9] was used. The proportion of agreement (P(A)) to the raters could agree, both corrected where necessary. The kappa coefficient is the ratio of P(A) to the maximum proportion of times that raters could agree, both corrected for chance agreement. A 0 indicates complete agreement, a 1 indicates no agreement other than chance.

The kappa statistic of [10] was used. P(A), the proportion of agreement among the listeners, although systematically different from 0. The relation with prosodic complexity is obvious.

2.2. Acoustic measurements.

For each syllable 5 primary attributes are obtained, using an interactive analysis program [3,5]: nucleus DURATION, PITCH peak, LOUDNESS peak, intrasyllable GLIDE, PAUSE duration.
(because of speaker's range, declination line, etc.) and so does LOUDNESS. There are too few cases of glides and pauses to find a relation with SCORE.

Although no clear linear relation was found, Pearson correlation coefficient r was used to estimate the amount of information that could be gained from each variable (Table 2). r varies considerably from one passage to another: for DURATION, from .65 to .18. Test 4 (with high complexity) gives very poor correlation for all attributes with relatively high r:.

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The best prominence estimates are obtained for the stressed syllables. The relative agreement between the raters indicates the perceptual reality of prominence. The importance of acoustic parameters as well as of four prominence measures were studied. The stress scores by the listeners are best predicted by duration.


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Tab. 3. Mean value for 7 variables cross-tabulated with ranges for SCORE. N is the number of syllables in a group.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Range</th>
<th>N</th>
<th>DUR</th>
<th>DL1</th>
<th>DR1</th>
<th>PL1</th>
<th>PH1</th>
<th>LL1</th>
<th>LR1</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-20</td>
<td>177</td>
<td>68</td>
<td>0</td>
<td>0</td>
<td>0.1</td>
<td>0.2</td>
<td>0</td>
<td>0.2</td>
<td>0.2</td>
</tr>
<tr>
<td>0-3</td>
<td>184</td>
<td>72</td>
<td>-25</td>
<td>-1.2</td>
<td>-2.0</td>
<td>-2.1</td>
<td>-0.0</td>
<td>0.1</td>
<td>0.2</td>
</tr>
<tr>
<td>4-11</td>
<td>50</td>
<td>46</td>
<td>15</td>
<td>1.6</td>
<td>1.7</td>
<td>2.1</td>
<td>1.6</td>
<td>2.1</td>
<td>1.6</td>
</tr>
<tr>
<td>8-10</td>
<td>44</td>
<td>44</td>
<td>25</td>
<td>1.6</td>
<td>1.7</td>
<td>2.1</td>
<td>1.6</td>
<td>2.1</td>
<td>1.6</td>
</tr>
<tr>
<td>12-20</td>
<td>33</td>
<td>50</td>
<td>48</td>
<td>2.5</td>
<td>4.3</td>
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<td>4.3</td>
</tr>
<tr>
<td>20-40</td>
<td>26</td>
<td>40</td>
<td>40</td>
<td>2.5</td>
<td>4.3</td>
<td>4.0</td>
<td>2.5</td>
<td>2.5</td>
<td>4.3</td>
</tr>
</tbody>
</table>

4. Conclusion

A listening task provided ratings of perceptual prominence for 277 syllables. The relative agreement between the raters indicates the perceptual reality of prominence. The importance of acoustic parameters as well as of four prominence measures were studied. The stress scores by the listeners are best predicted by duration.

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5. References


