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journal: STL-QPSR
volume: 30
number: 1
year: 1989
pages: 027-031

http://www.speech.kth.se/qpsr
PAUSE PATTERNS IN SWEDISH: A PROJECT PRESENTATION
AND SOME DATA

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Abstract

The occurrence of perceived pauses in news texts read aloud by ten
speakers were analyzed with respect to syntactic and textual structure,
acoustic factors and breathing. Data for two of the speakers are pre-
sented and differences and similarities between them are discussed.

OUTLINE OF THE PROJECT

Our starting point when studying pauses is perceptual. We are interested in those parts
of the speech stream at which listeners perceive a pause or a break of any kind. Thus, by
"pause" is meant "perceived" pause.

There are important reasons for choosing a perceptual rather than an acoustic defini-
tion of pauses. Defined acoustically, "pause" generally means "silent interval" (an inter-
val of a certain minimum duration - usually 200 msec - with intensity below a certain
level). Such a definition obviously excludes pauses with silent intervals shorter than 200
msec. And a pause may sometimes be perceived even if there is no silent interval at all,
which points to the existence of other cues to pauses. These other cues should be con-
sidered, too.

Our purpose is to study a number of aspects of pauses: (a) where they occur in rela-
tion to syntactic and textual structure, or more specifically, to boundaries of different
kinds, (b) how they are related to breathing, (c) how they are manifested acoustically,
and (d) how they are affected by changes of speech tempo. Some of these aspects were
investigated by Gårding (1967).

The material consists of two separate but related texts totalling 810 words. Both are
typical news cables reporting a dramatic incident that occurred in Libya. Both of the
texts are authentic, but one of them has been modified in some respects. Some of the
original words have been exchanged for specific test words. For example, the word
"Tripoli" has been inserted at 21 different positions in the modified text. One reason for
including test words is that it enables us to study prepausal lengthening at different
types of boundaries.

The recordings were made from ten male speakers, five representing the speech of
the Stockholm region and five the Umeå region in the northern part of Sweden. The
texts were read at three rates: fast, normal and slow. All ten speakers received the same
instructions before reading the material.

So far we have only just started analysing the data. Pauses have been identified inde-
dependently by two listeners. All positions where at least one of the listeners perceived a
pause have been marked. The texts have been analysed syntactically and a first catego-
rization of boundaries has been made. At present we distinguish between paragraph,
sentence, clause, and phrase boundaries.
Mingograms of the recorded material have been analysed to enable us to:

(a) detect inhalation at perceived pause positions (as a complement to auditory judgements)
(b) measure silent intervals
(c) measure test word durations
(d) measure Fo before and after pauses
(e) identify voice quality irregularities before pauses.

DATA: SOME CORRELATES OF PERCEIVED PAUSES AT DIFFERENT TYPES OF BOUNDARIES

Data for two of the Stockholm speakers, BS and IL, reading the texts at normal speech rate will be presented.

General speaker characteristics

The total time of delivery for both texts was 6 minutes 4 seconds for BS and 6 minutes 16 seconds for IL. However, although the two speakers took about the same time to read the texts, the distribution of speech and pauses differed between them. BS made fewer but longer pauses than IL. The reading of BS contained 107 pauses with a mean silent interval of 740 msec, while that of IL contained 144 pauses with a mean silent interval of 425 msec. The total duration of silence was longer for BS.

Analysis procedure

Pauses noted at paragraph ($$), sentence ($), clause (/), and phrase (/) boundaries, respectively, were studied separately. A category containing pauses within a phrase (o) was also included. The number of pauses for each category is shown in Table I.

<table>
<thead>
<tr>
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<th>/</th>
<th>O</th>
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</thead>
<tbody>
<tr>
<td>Potential pause positions</td>
<td>23</td>
<td>35</td>
<td>90</td>
<td>159</td>
<td>505</td>
</tr>
<tr>
<td>Actual pauses BS</td>
<td>21</td>
<td>28</td>
<td>32</td>
<td>27</td>
<td>1</td>
</tr>
<tr>
<td>Actual pauses IL</td>
<td>21</td>
<td>29</td>
<td>37</td>
<td>53</td>
<td>6</td>
</tr>
</tbody>
</table>

Table I. *Number of potential pause positions at each type of boundary and pauses actually occurring pauses at these positions for BS and IL.*

The analysis included five potential correlates of pauses: (a) presence of inhalation, (b) silent interval, (c) prepausal lengthening, (d) Fo before and after a pause, and (e) voice quality irregularities.

Inhalation

The presence of inhalation in pauses at different types of boundaries is presented in Table II. As shown, inhalation occurs in almost every pause except for pauses at phrase boundaries.
|$| $ | // | / |

P I P I P I P I P I

BS 21 18 28 24 32 31 27 18 1 0
IL 21 18 29 26 37 26 53 27 6 1

Table II. Occurrence of inhalation in pauses. \( P = \) total pauses; \( I = \) pauses with inhalation.

Silent intervals
Fig. 1 gives the silent intervals (means and standard deviations) for pauses at different boundary and non-boundary positions.

![Silent intervals graph](image)

**Fig. 1.** Silent intervals (means and standard deviations) for pauses at different boundary and non-boundary positions for BS and IL.

As shown, the silent intervals group into three distinct categories. The pattern is the same for both speakers even if the intervals are generally longer for BS. The longest intervals occur at paragraph boundaries, the intermediate intervals at sentence boundaries, and the shortest intervals at clause and phrase boundaries and at non-boundary positions. However, although the intervals at clause and phrase boundaries overlap to a great extent, the mean interval is somewhat longer at clause boundaries. Also the mean intervals for both these categories are longer than the mean interval at non-boundary positions. Thus the length of the silent interval matches the order of rank of the boundary.

Prepausal lengthening
Fig. 2 presents mean durations and standard deviations of the 21 instances of the word "Tripoli" at different pause and non-pause positions for the two speakers. The duration at non-pause positions (the right part of the figure) sets the base-line, the reference to which the other durations may be compared.
Fig. 2. The duration of the word "Tripoli" (means and standard deviations) at different pause and non-pause (-P) positions.

For BS, lengthening is greatest before a sentence boundary, while for IL, the greatest lengthening occurs before phrase boundaries. Somewhat surprisingly lengthening is very moderate at paragraph boundaries. In fact this is the boundary position with the least lengthening for both BS and IL.

Fo before and after pauses

Fig. 3 shows paired Fo values (before and after a pause). The two speakers exhibit very similar patterns: Fo before a pause tends to be inversely proportional to the order of the boundary at that pause. Fo after a pause, on the other hand, varies little between different boundaries. Thus the extent of resetting is greater, the higher the order of the boundary.

Fig. 3. Paired Fo values (means and standard deviations) at different pause positions. Fo1 = Fo minimum in the last syllable before a pause; Fo2 = initial Fo value immediately after a pause.
Voice quality irregularities before pauses

By "irregular voice quality" we refer to different kinds of irregularities frequently occurring before a pause (see Huber, 1988, for details of such "vocal offset phenomena"). The instances of two degrees of irregular voice quality (Q and Q+) presented in Table III were identified by inspection of mangograms in conjunction with auditory judgments.

<table>
<thead>
<tr>
<th></th>
<th>P Q+ Q</th>
<th>P Q+ Q</th>
<th>P Q+ Q</th>
<th>P Q+ Q</th>
<th>P Q+ Q</th>
</tr>
</thead>
<tbody>
<tr>
<td>BS</td>
<td>21 10 8</td>
<td>28 6 10</td>
<td>32 0 1</td>
<td>27 0 1</td>
<td>1 0 1</td>
</tr>
<tr>
<td>IL</td>
<td>21 15 5</td>
<td>29 15 8</td>
<td>37 6 15</td>
<td>53 0 8</td>
<td>6 0 1</td>
</tr>
</tbody>
</table>

Table III. Occurrence of voice quality irregularities in the last syllable before a pause.

As shown, the majority of pauses with irregular voice quality occur at paragraph and sentence boundaries, at least for BS. IL also has many cases of irregular voice quality at clause boundaries. However, for both speakers Q+ is more frequent the higher the order of rank of the boundary.

Conclusions

Given these data, it is evident that the different boundary categories have different manifestations. Generally, the higher the rank of the boundary, the stronger and more varied the correlates of a pause. The only exception to this pattern concerns prepausal lengthening, which is weakest at pauses at paragraph boundaries.

Acknowledgments

The texts were chosen in cooperation with Eva Ejerhed who also provided us with a syntactic analysis of them. We are indebted to Sidney Wood for helpful reading of the manuscript. The research was supported by a grant from the Swedish Council for Research in the Humanities and Social Sciences.

References
