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Individual variations in prominence correlates. Some observations from "lab-speech"

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Abstract

The present study provides data from reading of a lab sentence in Swedish, with systematic variations of accentual patterns and prominence of a test word embedded in a carrier phrase. The results are in overall agreement with established knowledge concerning accentual realisations. A major aim has been to illustrate individual variations, especially with respect to the dimension focal versus neutral prominence of the test word. The relative role of duration, F0, intensity and a voice source attribute were found to be speaker specific.

Experimental set up

Our study was initiated by one of the authors, AB, to be extended to similar conditions in other languages than Swedish. The carrier phrase was: "Klubben [sVsa] spelar bra musik", (The club [sVsa] plays good music) where V stands for one of the vowels [i:] [e:] [a:] [o:] [u:]. The test word [sVsa] was given three accentual patterns. These are accent 2 short vowel, accent 1 short vowel, and accent 2 long vowel. In the accent 2 versions the primary stress is on the vowel V and in the accent 1 version on the final vowel [a]. However at high prominence levels the second syllable of accent 2 gains prominence, referred to as sentence or focal accent.

It should be noted that accent pattern number two gave us some problems. It is not representative of Swedish. A short stressed accent 1 vowel can not terminate a word. Some speakers rightly chose a long [a:] quality others produced the intended short [a] imposed by the plan for extensions to other languages.

During the recording session the subject produced a sentence twice, first in a neutral mode, the second time with a raised prominence prompted by the investigators question "Vilken klubb spelar bra musik?" (Which club plays good music?)

Results

Figure 1 and 2 provide an overview of average data for the four subjects in the context of accent 2 long vowels.

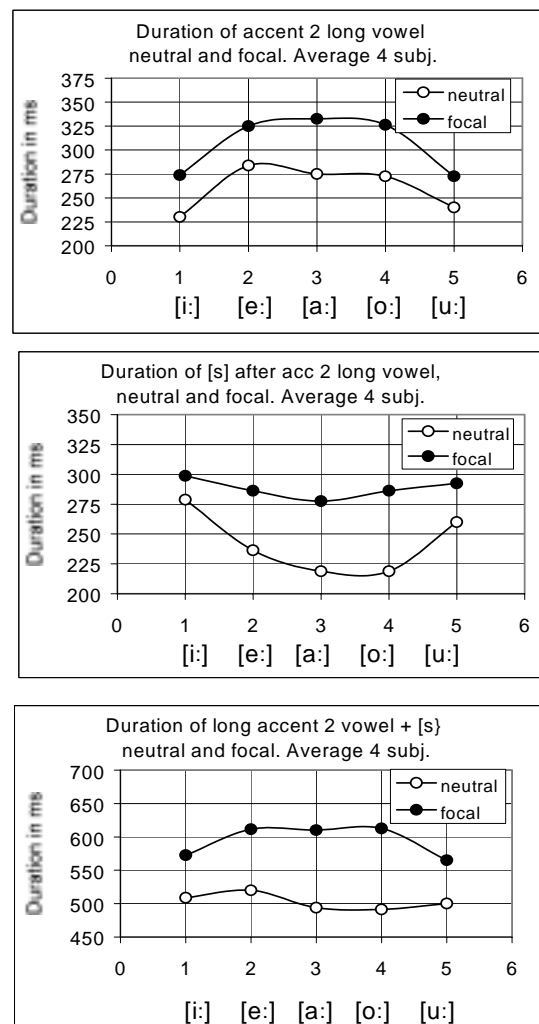


Figure 1. Duration data of long accent 2 vowel, the following consonant [s] and their sum in neutral and focal context. Average of four subjects.

Figure 3-5 show data for all the four subjects averaged over all vowels and for each of the three accent types, accent 2 short vowel, accent 1 short vowel and accent 2 long vowel. All illustrations include neutral as well as focal realisations.

Measured parameters include duration, F0 and the two intensity measures SPL and SPLH. The latter is processed with a high frequency pre-emphasis. The difference SPLH-SPL labelled dSPL increases with the relative high frequency boost of the voice source but is also sensitive to the particular formant pattern.

The duration data in Figure 1 provide evidence that the long accent 2 vowel and the following [s] have a complementary relation with respect to vowel category. The relative shortness of the closed vowels [i:] and [u:] is compensated by a corresponding lengthening of the [s] which levels out their sum.

Of some interest is the relation of long vowels to short vowels. For the subjects, MH AK GF, we noted duration ratios averaged over the five vowels close to 1,7 in neutral and 1,9 in focal context. For subject JL we noted 1,3 and 1,6 respectively. The larger long/short ratio in focal context derives essentially from the focal lengthening of the long vowel, whereas the short vowel duration is almost the same in neutral and focal context.

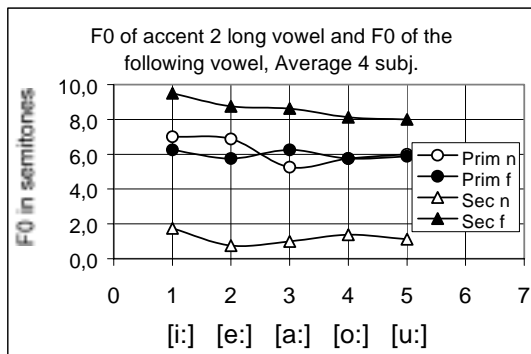


Figure 2. Vowel dependency of F0 maximum in accent 2 long vowels and F0 of the following vowel [a]. averaged over the four subjects.

Figure 2 shows that the F0 maximum of the primary accent 2 long vowel is almost the same in neutral and focal context. This is not a surprise to us. The neutral version has a level above which F0 saturates at increasing prominence (Fant et al., 2000). In contrast, F0 of the following vowel [a] spans a range of 8 semitones from the neutral to the focal version. The lower bound is interpreted as a normal low F0 associated with a phrase boundary, while the

upper bound is the F0 peak of focal accentuation. It is 2-3 semitones above the level of the primary vowel, which is typical of high level contrastive stress.

We shall now look into individual variations. Figure 3 shows duration patterns of the complete test word [s V s a] produced by the four subjects in neutral and focal pronunciation. The data pertain to averages over the five vowels and they are presented in three groups corresponding to the three accent patterns. The focal/neutral contrasts are essentially confined to the consonant [s] after short accent 2 vowel and to the long accent 2 primary vowel.

More radical individual differences appear in the F0 patterns, Figure 4. The MH data shows no significant focal increase of F0 in accented short and long vowels.

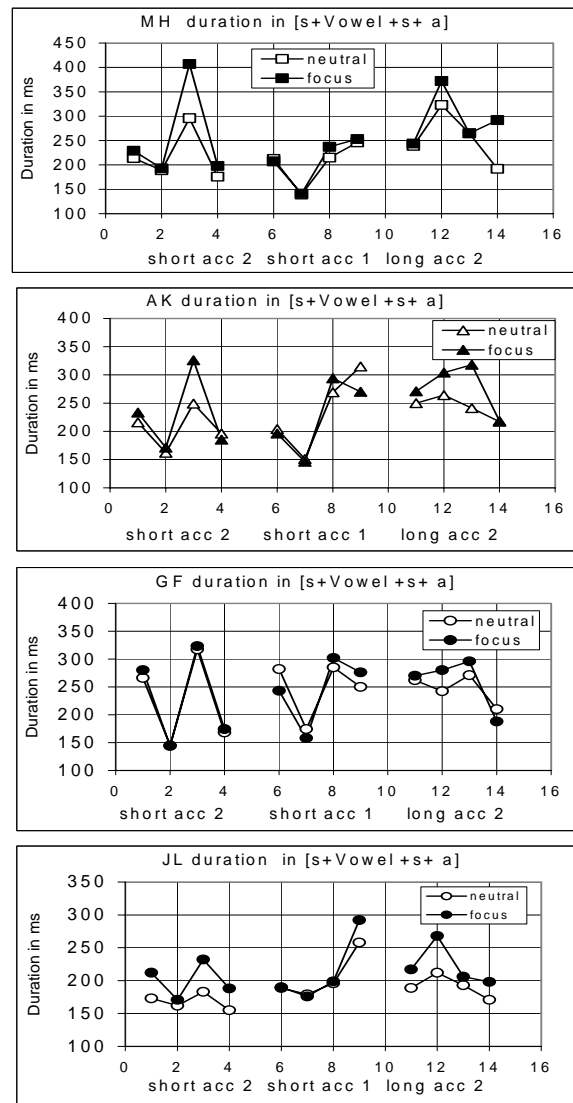


Figure 3. Individual variations in duration patterns of four subjects.

Subjects GF and JL, on the other hand, produce a distinct higher F0 level in the focal than in the neutral version of the vowel. Subject AK shows a reverse pattern; a lowering of F0 in the focal version well below that of the neutral version which creates a large step up towards the following [a] which is the accent 2 focal target. The same pattern is found in MH accent 1.

A corresponding individual display of SPL data is brought out in Figure 5. Subjects JL and GF show a distinct focal rise in SPL towards the [a] target, contrasting with a low neutral level. In the MH data the trend is the same, but not as apparent, and in the AK data it is absent. Moreover, AK produces a lower SPL in the focal than in the neutral version of the accented vowel.

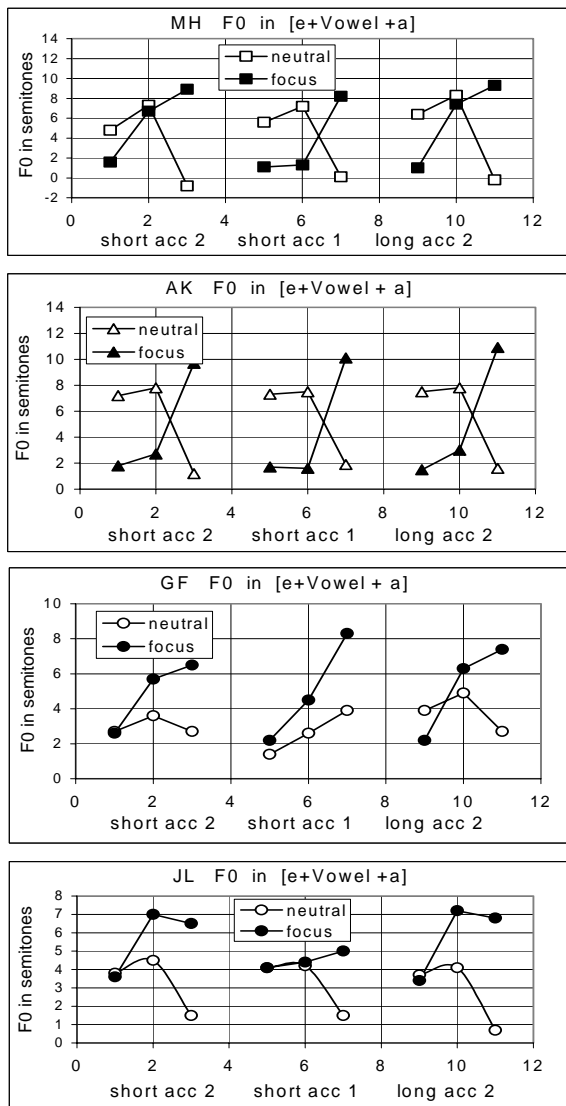


Figure 4. Individual F0 patterns. The three points in each group pertain to the preceding [e], the primary vowel and the following [a].

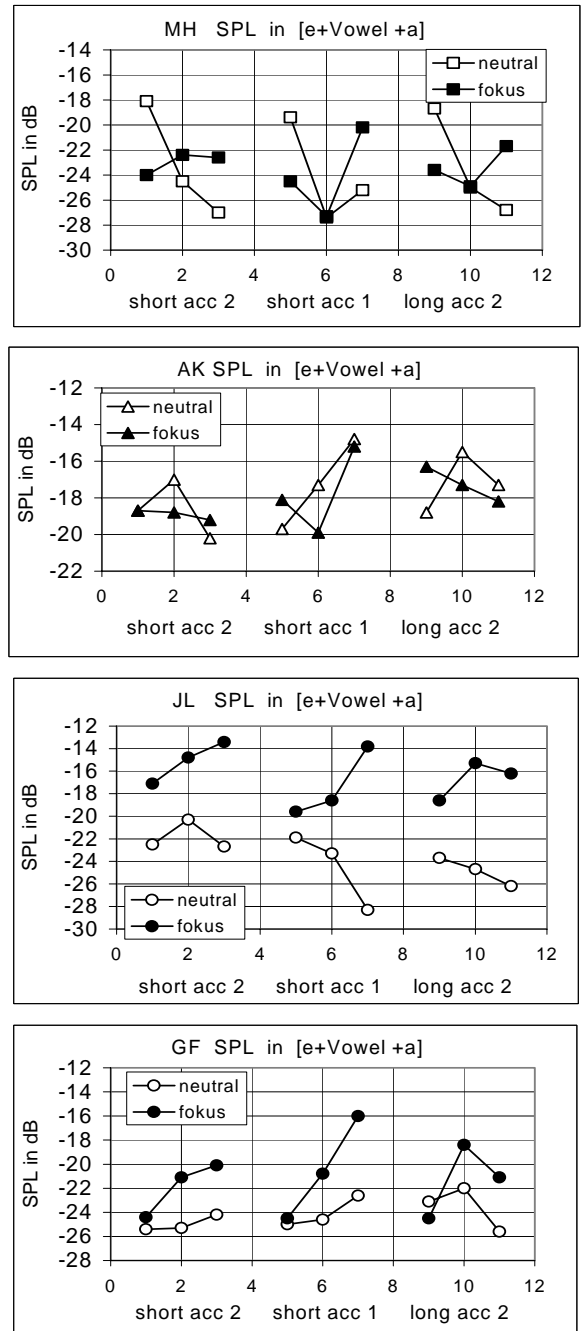


Figure 5. SPL data of the four subjects.

Finally, a summary of the focal minus neutral span of each parameter under all conditions and for each of the four subjects is brought out in Figure 6. The duration of the post-vowel consonant [s] is a major focal correlate for short vowel accent 2, but individual variations are large. The duration of the accent 2 vowel attains significance when long only. The F0 data brings out the tendency already mentioned of subjects AK and MH producing a marked increase of the focal rise toward the end of the test word.

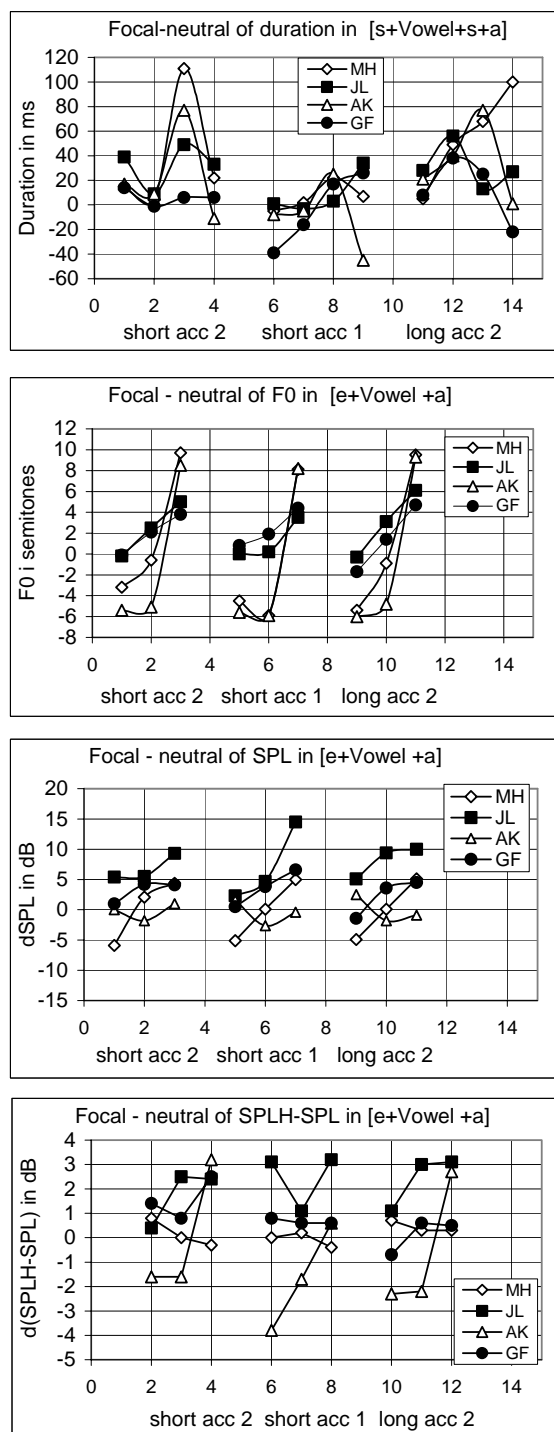


Figure 6. Focal minus neutral contrast in duration, F0, SPL and (SPLH-SPL) within the test word. All four subjects.

The dominance of the SPL parameter in the JL and GF data is apparent. These two subjects also show a significant focal rise of the (SPLH-SPL) parameter which is typical of an increase in voice effort.

Conclusions

Our study has been concerned with acoustic-phonetic analysis of test words embedded in a carrier phrase under two conditions, neutral and focal prominence. Four subjects were involved. Our data on the realisation of short/long vowel quantity and of accent 1 and 2 patterns are in substantial agreement with present knowledge. Our main interest has been devoted to individual variations in acoustic correlates of focal and neutral prominence. Except for individual variations in consonant lengthening after a stressed short vowel, duration patterns showed a uniformity with relative low degrees of focal lengthening.

A common feature of all four subjects, realised in all three accentual patterns, is a raise of F0 towards the end of the test word, in accent 2 at the secondary stressed [a] vowel as a target. Two of the subjects, MH and especially AK showed large dynamic spans of F0 up to a high final target with starting points lower in focal than in neutral production.

Subjects GF and JL produced the focal versions by increased loudness. This is to be seen both in SPL and in (SPLH-SPL), the latter indicating high frequency boost of the voice source. This feature also accompanied the high target F0 of subject AK

These data are in general agreement with findings from our earlier studies as listed in the references below. However, some of the individual variations appear to reflect a specific behaviour in the lab speech situation. We therefore recommend some caution in extending results to normal speech.

References

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