

## Segment and syllable reduction: preliminary observations

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### Abstract

Spectrographic data are presented to exemplify effects of segmental reduction on utterance length, measured in terms of number of phonetic syllables per utterance. The speculation is put forward that segmental reorganization in 'fast speech' is partly constrained to preserve speaking rate, specified as number of phonetic syllables per unit time.

### 1 Introduction

Segmental reduction is a prime characteristic of casual speech. Auditory and spectrographic analysis suggests that articulatory short cuts may also affect utterance length in the sense that the number of phonetic syllables per utterance may differ substantially between speaking styles. This paper draws attention to this little studied effect of speaking style variation and discusses its relationship with segmental reduction.

### 2 Methods

The present observations are based on unscripted monologues produced by two male native speakers of a Stockholm variety of Central Standard Swedish. At the time of the recordings, both subjects were in their early forties and staff of the Department of Linguistics. The recordings were made in an anechoic chamber using high quality professional equipment. The signal was digitized at 16 kHz, labeled and analyzed using the Soundswell 3.50 program package (Nyvalla AB 1998). The examples shown below are based on one of the two speakers (JS).

### 3 Selected observations

Figure 1 illustrates several reduction phenomena resulting in the phonetic phrase [s̃a.na.dʲẽ], a casual rendering of *så han hade ju en...* 'so, of course, he had a...'. This phrase has six 'underlying' syllables but only three discernable 'phonetic' syllables. The dots in the transcriptions represent possible syllable boundaries. The relationship between the two levels of representation can be described in terms of segmental reduction processes such as the following (not all of which change the number of syllables):

- Two initial consonant, /h/ in *han* 'he' and *hade* 'had', are deleted;
- the adjacent vowels resulting from the /h/ deletion in *så han* (phonologically /so han/) are merged into a slightly diphthongized and nasalized [a];
- the /h/ deletion in the word *hade* results in the sequence [na];

d) the final vowel of *hade* is elided, and the /j/ of the particle *ju* 'of course' appears as palatalization of the (approximantized) /d/; and

e) the phrase final nasal (from the indefinite article *en*) is heard as nasalization on the preceding vowel.

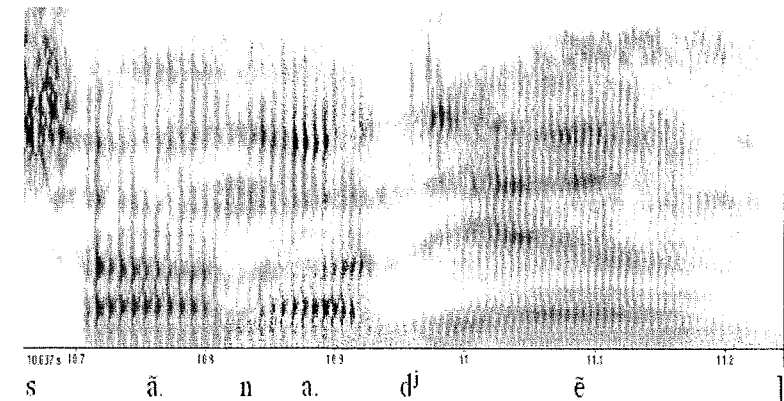


Figure 1. Spectrographic representation of the phrase *så han hade ju en...* [s̃a.na.dʲẽ] 'so, of course, he had a...'. Further explanation in text.

It is noteworthy that many reduction effects imply an internal rule order. In particular, a 'feeding' order is frequently evident such that one effect provides the necessary precondition for another effect to take place. In points b-c above, for example, dropping the /h/ causes a hiatus situation which is resolved by elision of one of the vowels.

Figure 2 provides another illustration of segmental reductions, some of which act to reduce the number of phonetic syllables. This phrase has 15 underlying syllables and 10 phonetic syllables. Again, some of these processes seem to require an internal rule order. The phrase is *därför att den var inte så tråkig som alla andra* 'because it was not so boring as all the others' [dæʰ.fʀa.tẽ.βã.tsø.tʀo.kɪ.sma.lan.dra]. The relationship with the underlying representation can be described as follows:

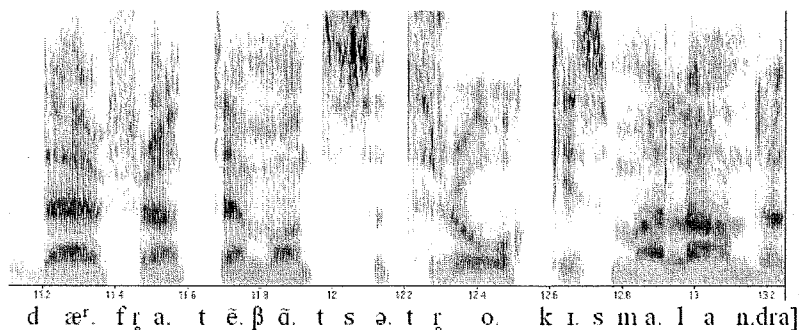
- The first /t/ (pertaining to the morpheme *där*, which is part of the word *därför* 'because') appears as a slightly rhotic quality of the final portion of the [æ] vowel resulting in the phonetic form [dæʰ];
- the vowel in *för* is deleted with the voicelessness of the /f/ spreading progressively to the now adjacent [r]; this yields the sequence [fʀa];
- stop devoicing and final nasal consonant deletion in *den* 'it' yields [tẽ];
- var inte så* 'was not so' materializes as [βã.tse] – the /t/ of *var* is dropped, resulting in [a] and [i] coming together; the [i] is elided. The [n] of *inte* appears as nasality on the /a/;

and the /t/ of the same word forms an initial affricate with the /s/ of the following word *så* 'so'; this affricate initiates the syllable-sized sequence [tsə];

e) the final /g/ of *tråkig* 'boring' is deleted (this reduction of the derivational suffix *-ig* is also met with in more formal speaking styles);

f) the word sequence *som alla andra* 'as all the others' underly the phonetic sequence [sma.lan.dra]; here the /s/ vowel of *som* 'as' is deleted resulting in [sma], where the [a] comes from *alla* 'all'; and finally,

g) the remainder of *alla* enters into [lan] which is formed by contraction of the two /a/ vowels.



**Figure 2.** Spectrographic representation of the phrase *därför att den var inte så tråkig som alla andra* [dæ'.fr̥a.tē.βã.tsə.t̥ro.ki.sma.lan.dra] 'because it was not so boring as all the others'. Further explanation in text.

#### 4 Discussion

Previous studies have demonstrated that quite drastic reduction phenomena may occur in many languages (e.g., Engstrand & Krull 1988; Engstrand 1992; Kohler 1990, 2000; Lindblom 1987, 1990). In addition, the present study has drawn attention to the fact that segmental reduction in casual speaking styles may also have a quite radical effect on utterance length as measured in terms of number of phonetic syllables per utterance.

It is possible, however, that these effects are not just fortuitous consequences of segmental reduction. Specifically, it can be speculated that segmental reorganization in 'fast speech' may be subject to the constraint that the delivery of phonetic syllables should be kept at a relatively constant, preferred rate. For example, in the above cases, mean phonetic syllable duration is approximately 200 ms. This value has frequently been cited as typical of elicited, non-casual speech suggesting the existence of an internal speech rhythm generator (e.g., Lenneberg 1967). The hypothesis that phonetic syllable rate represents a relatively constant factor across speaking styles deserves further, quantitative exploration. In particular, positive evidence would further substantiate to the generally held opinion that casual speech is formed in a principled way rather than being just a sloppy version of more elaborated speaking styles (see, e.g., Engstrand & Krull 1988, Engstrand 1992; Kohler 1990, 2000; Lindblom 1963, 1987, 1990).

An additional question to be raised in relation to these data concerns internal syllable structures. Informal listening as well as spectrographic observations frequently suggest

that syllable structures are a good deal simpler in casual speech than in more formal speaking styles. Swedish grammars usually describe words and morphemes as having a complex phonotax permitting heavy consonant clusters in all positions (Sigurd 1965). However, clear instantiations of these structures appear to be relatively rare in most varieties of unscripted speech. Informal listening rather suggests that the phonetics of unscripted speech can be described more aptly in terms of simpler units. These units would frequently appear to be open syllables, most commonly CVs (as suggested, for example, by the syllabic parsing made in the above spectrograms). If this could be demonstrated, it would – apart from emphasizing the striking lack of congruity between conventional phonotax and phonetic syllable structures – bring the phonetics of unscripted Swedish speech closer to universal typology.

#### References

- Engstrand, O. 1992. 'Systematicity of phonetic variation in natural discourse.' *Speech Communication* 11, 337-346.
- Engstrand, O. and D. Krull 1988. 'On the systematicity of phonetic variation in spontaneous speech.' *Phonetic Experimental Research, Institute of Linguistics, University of Stockholm (PERILUS)* 8, 34-47.
- Kohler, K. 1990. 'Segmental reduction in connected speech in German: Phonological facts and phonetic explanations.' In *Proceedings of the NATO Advanced Study Institute on Speech Production and Speech Modelling, Bonas, France, July 17-29, 1989*. Dordrecht: Kluwer Academic Publishers.
- Kohler, K. 2000. 'Investigating unscripted speech: Implications for phonetics and phonology.' In Diehl, R., Engstrand, O., Kingston, J. and Kohler, K. (editors), *Emergence and Adaptation. Studies in Speech Communication and Language Development*, Basel: Karger.
- Lenneberg, E.H. 1967. *Biological Foundations of Language*. New York: Wiley.
- Lindblom, B. 1963. 'Spectrographic study of vowel reduction.' *J. Acoust. Soc. Am.* 35, 1773-1781. Reprinted in Kent, R.D., Miller, J.L. and Atal, B.S. (editors), *Papers in Speech Communication: Speech Perception*, 517-525. New York: Acoustical Society of America.
- Lindblom, B. 1987. 'Adaptive variability and absolute constancy in speech signals: two themes in the quest for phonetic invariance.' *Proc. 11<sup>th</sup> ICPhS, Tallinn 1987*, vol. 3, 9-18.
- Lindblom, B. 1990. 'Explaining phonetic variation: a sketch of the H and H theory.' In Hardcastle, W. and Marchal, A. (editors), *Speech Production and Speech Modeling*, 403-439. Dordrecht: Kluwer Academic Publishers.
- Sigurd, B. 1965. *Phonotactic Structures in Swedish*. Lund: Uniskol.