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Syllables at multiple levels of representation in Danish

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Abstract
Arguments are presented for recognising syllables at three different levels of representation in Danish: the phonological syllable which is the domain for numerous postlexical processes, the cognitive or speaker/listener syllable as manifested in metalinguistic production tasks; and the phonetic syllable which is the domain of fundamental frequency control and durational variation in the speech output.

1. INTRODUCTION

The syllable currently inspires a lot of theoretical and empirical work, and a good deal of controversy, cf. Bannert (1998), Basbøll (1974, 1999, forthcoming), Clements (1990), Derwing (1992a), Ohala (1992), Pierrehumbert and Nair (1995), Selkirk (1984), Schiller (1997), Treiman and Danis (1988), Treiman and Kessler (1995), Treiman and Zukowski (1990). Part of the controversy about its internal structure and its boundaries may be due to (tacit) disagreement over what the representation should portray: abstract underlying forms? speakers' and listeners' intuition? acoustic phenomena? In Danish each representation yields a different segmental string, but of course they are complementary rather than mutually exclusive in the description of Danish phonetics and phonology.

2. THE PHONOLOGICAL SYLLABLE

The phonological syllable is the phonologist's construct, a convenient descriptive entity, established as a rationalization after phonetic and phonological facts. It delimits a segmental domain whose boundaries condition a number of phonological regularities in Danish:

(1) the allophonic variation of short /a/ and short /o/, i.e. /a/ is [æ ä] when neighbour to /r/ and before tautosyllabic labials and dorsals, [a] elsewhere; /o/ is [o] in open syllables and before /r/, [ɔ] elsewhere.
(2) 'consonant gradation', the principle which deprives final /p t k/ of aspiration[1] and weakens final /b d g v r/ to approximants[2] [w DÔ j/w w Q^];
(3) the elision of /g/ after homosyllabic /n/, if [ŋ] is to be analyzed as /ng/;
(4) the elision of /d/ after homosyllabic sonorant consonants.

This is Hans Basbøll's analysis, cf. Basbøll (e.g., 1974, 1999), which has come to be the generally accepted one among present-day specialists in Danish phonetics and phonology. The syllable (or its moraic substructure) is also indispensable for a succinct account of Danish stød, cf. Basbøll (1998, 1999 and forthcoming).

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1 Affrication in the case of /t/.

2 The allophony is rather more complicated, but that is immaterial for the discussion.

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2.1 Phonological syllable boundaries

Certain suffix boundaries are also syllable boundaries. Otherwise, phonological syllable boundaries can be very nearly unambiguously determined from the segmental structure of the word, according to the (Maximal) Onset Principle — adjusted so as not to create illegal clusters, i.e. clusters which are impossible in word initial or final position. However, posttonic syllables with schwa or schwa-like unstressed vowels dodge the Onset Principle according to another (ordered) set of principles: (1) The (first) postvocalic consonant closes the stressed syllable; (2) /g/ and /d/ cluster with a preceding consonant; (3) any remaining consonants are onsets in the posttonic, provided they do not form illegal clusters. See further Basbøll (1999). This yields, for instance:

/laːv•ə laːva noːtə noː•ta koːd•ə koː•da tang•ə tan•go hɛlg•ə hɛl•ga blom•strə mon•trə/

[ˈlæːwə ˈlæːva ˈnoːd̥ə ˈnoːtˢa ˈkʰoːð ə ˈkʰoːd̥a ˈtˢäŋə ˈtˢäŋg̊o ˈhɛljə ˈhɛlg̊a ˈb̥lʌmsd̥ʁə ˈmʌntˢʁ̥ə]

lave, lava; note, nota; kode, koda; tange, tango; Helge, Helga; blomstre, montre
'make, lava; note, bill; code, coda; isthmus, tango; [proper names]; flourish, showcase'.

3. COGNITIVE (SPEAKER/LISTENER) SYLLABLES

Phonological syllable boundaries are almost certainly at odds with speakers' and listeners' syllabification, perhaps most notably when a singleton precedes /ə/, as in /laːv•ə/. This may well be due to spelling influence: in word division the hyphen goes before the consonant letter, e.g. *la-ve*. But that does not make such a boundary less psychologically real. Spelling influences the phonology of literate speakers to a considerable extent, cf., e.g., Derwing (1992b) and Frost (1992).

3.1 A pilot experiment

I have run a very exploratory pilot experiment — with /ˈCV(ː)CV/ words only. The initial consonant varies randomly, the stressed vowel is /i(ː)/ or /a(ː)/, the intervocalic consonant is [d̥ ð l n s w] before /ə/, and [tˢ d̥ l n s v] before full vowels (randomly chosen between [a] and [o]). 4 stressed vowels x 6 consonants x 2 unstressed vowel types equals 48 words. By choosing an appropriate initial consonant I created a corresponding list of nonwords, which might behave differently if the spelling of words is called to mind more easily than one is devised for nonwords. 48 + 48, minus 17 structurally motivated omissions yielded 79 test items. They were randomized and divided into 4 blocks, each block used in a different task: (1) **reversal** of the syllables; (2) **reduplication** of the first or (3) the last syllable; (4) **insertion** of [d̥i]. — Ten linguistics students took turns to come forward in the classroom and respond to my oral stimuli, following a brief instruction with a couple of unambiguous examples before each test block. Each student did 5-10 stimuli. After each response I invited the auditorium to offer alternatives, so there are generally three different responses to each stimulus. Of course, with this procedure there is no way to quantify the results and determine how many speakers preferred which response. The session (lasting circa 30 minutes) was tape-recorded.

3.2 Results

Only the most pertinent trends are summarized. Nonwords and words apparently behave alike. I can detect no difference between the eight intervocalic consonants either. This, of course, may be due to the rather unsatisfactory methodology and paucity of stimulus material.

3.2.1 Syllable reversal

(1) Illegal syllables arise from all stimuli, e.g. [ˈfinə] > [ˈnəfi]; [ˈb̥iːðə] > [ˈðəb̥i]: [ə] is not normally stressed, and [ð] never occurs word initially.

(2) The singleton teamed up with the posttonic in all stimuli, cf. (1); **but** besides that, in one type, CVCə, it was also ambisyllabic, e.g. [ˈnad̥ə] > [ˈd̥ənа] **or** [d̥əˈnad̥]. I assume that the final stress is responsible: only French loans can end in a short stressed vowel in Danish.

3.2.1 First syllable reduplication

(1) The singleton dissociates from the first vowel in all (non-)words; **but** after a short vowel, whether or not the succeeding vowel is a schwa, it may also be coda and/or ambisyllabic (this indeterminacy cannot be resolved), e.g. [ˈb̥isə] > [b̥iˈb̥isə] **or** [b̥isˈb̥isə], [ˈvila] > [viˈvila] **or** [vilˈvila].

(2) Length and stress remain in place on the first syllable, cf. (1).

3.2.3 Last syllable reduplication

(1) The singleton invariably joins the unstressed vowel, e.g. [ˈg̊alə] > [ˈg̊alələ], [ˈnalo] > [ˈnalolo]. (A dissociation would have produced highly anomalous successions of vowels, e.g. *[ˈg̊aləə ˈnaloo].)

(2) Length and stress remain on the first syllable before schwa, **but** when the second vowel is a full vowel, stress and length may also be transposed to the penultimate, e.g. [ˈsg̊æːla] > [ˈsg̊æːlala] **or** [sg̊aˈlæːla] with the appropriate change in vowel quality: [a] > [æː].

3.2.4 [d̥i] insertion

(1) The singleton joins the unstressed vowel in all (non-)words; **but** after a short vowel, whether or not the succeeding vowel is a schwa, it may also be ambisyllabic, cf. [ˈlaso] > [laˈd̥iso] **or** [lasˈd̥iso].

(2) Length and stress remain on the penultimate, i.e. the inserted syllable receives stress, and length if the stimulus vowel was long, e.g. [ˈsiːlo] > [siˈd̥iːlo].

From Derwing's (1992a), Schiller's (1997), Treiman and Danis' (1988), Treiman and Zukowski's (1990) results, among others, I would have expected the students' to syllabify in a manner so as to

(a) avoid syllables which are not possible as monosyllables: NO, cf. 3.2.1(1);

(b) affiliate the singleton with a preceding short vowel more often than with a preceding long vowel: YES;

(c) render a consonant (assumed to be) spelled with two letters as ambisyllabic more often than consonants spelled with one letter: YES; but this is not a separate issue, since short vowel status generally is signalled orthographically in the number of

succeeding consonant letters;

(d) affiliate sonorants with the preceding vowel more often than obstruents: NO apparent distinction in this little trial experiment;

(e) affiliate an intervocalic consonant with preceding high vowels more often than with low vowels: NOT apparent in this limited material;

(f) demonstrate task-specific effects: YES, reversal produces more ambisyllabic consonants than the other tasks.

Briefly, then, an intervocalic consonant in disyllables with first syllable stress can always be onset to the unstressed syllable, regardless of the nature of the succeeding vowel. This is at odds with phonological syllabification. But the consonant **may** be final or ambisyllabic if the stressed vowel is short. — Stress is largely autosegmental. So is length, as in Stemberger's analysis of (1984) German and Swedish speech error data.

4. PHONETIC SYLLABLES

Syllables of a much less prototypical and canonical structure are apparent from observation of fundamental frequency (F_0) patterns and durational variation.

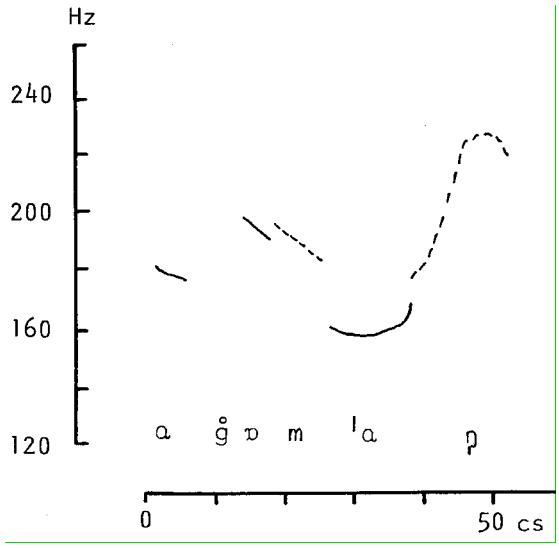

Figure 1 F_0 tracing of underlined *Der går mange busser fra Tiflis.* 'There are many buses out of Tiflis.'

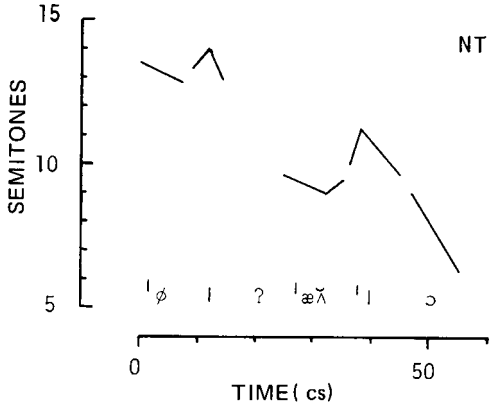

Figure 2 F_0 tracing of underlined *Den øl er lunken.* 'That beer is tepid.'

Figs. 1 and 2 depict F_0 tracings that demonstrate how consonants initial in a stressed syllable dissociate tonally from the vowel and associate with the preceding syllable. Between the [m] and the stressed vowel in *mange* a clear discontinuity is observed. And the initial [l] in *lunken*, rather than initiate the drop in F_0 between the two stressed syllables, actually performs the same slight rise-fall as the final [l] in *øl*. See further Thorsen (1984).

Numerous investigations have unanimously reported that stressed vowel onset determines the onset of the domain within which temporal compensations may take place, specifically excluding any initial consonants, thus, e.g., Fant and Kruckenberg (1989), Fischer-Jørgensen

(1982), Grønnum (1994), Huggins (1972), Strangert (1985). Apparently a restructuring of the segmental string from phonological syllables into phonetic syllables takes place just prior to the actual execution of motor programs. Thus, for example:

/jaj lar min viːn modnə langsɔmˀt/ will be produced as

[jäläminv ˈiˀnm ˈoo̯nəl ˈɑŋsʌmˀd̥]

Jeg lader min vin modne langsomt 'I let my wine mature slowly'.

F_0 does not exhibit major movements through a sequence of unstressed syllables in Danish and thus cannot be expected to reveal boundaries before unstressed vowels. But the durational data in Grønnum (1994) would generalize the structure of the phonetic syllable to at least the first posttonic. — Note that the similarity between phonetic syllables and the phonological domain which is relevant for determining syllable weight and moraic structure, the 'metric' syllable, is only partial. Syllable onset is disregarded in both cases, but the coda of metric syllables does not swallow up consonants beyond the phonological syllable boundary, whereas prosodic syllables do.

5. CONCLUSION

A full scale metalinguistic experiment needs to be undertaken, but there is no reason to doubt that the pertinent aspect of these preliminary results will be corroborated: that speakers' syllabification is different from the phonologist's and the phonetician's, and thus there are at least three different relevant levels of syllable representation in Danish phonology and phonetics.

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