

# Complementary length in Danish. Why not?

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## Abstract

This paper argues that the Danish coda consonants in *kat* and *tal* or the intervocalic obstruents in *katte* and *stokke* are, in fact, moraic. First, there is no difference in duration nor the possibility of a phonological contrast between long and short consonants, even in cases of contrast, such as in *pen*, with *stød*, versus *ven*, without. Second, if obstruents cannot be moraic, it is impossible to state important interdependencies between the length of the vowel and the size of consonant clusters in the same syllable, regardless of which major class the first consonant of the cluster belongs to. Similarly, systematic alternations between long and short vowels in pairs like *ska*[æ:]*be* – *ska*[a]*bt* are arbitrary processes, if obstruents cannot be moraic. Making syllable structure dependent on the traditional notion of ‘*stød* basis’ severs syllable structure from the rest of the phonology. A more consistent view emerges if Danish, like the rest of the Scandinavian languages, Insular and Continental, is analyzed as a strict ‘complementary length’ type, such that stressed syllables are all parsed as heavy, that is, with a strictly bimoraic syllabic nucleus.

Keywords: Danish, syllable structure, complementary length, moraic phonology, *stød*

## 1. How to parse a Danish syllable?

Anyone that needs to parse a syllable in Danish will soon realize that there are two opposing, incompatible ways to do it and that a stand must be taken to proceed. One model (Zec 1994, Morén 1999; 2005, Basbøll 2005, Iosad 2016) holds that, in contrast with the rest of Scandinavia, Danish can have light stressed syllables in words like, for instance, *kat* ‘cat’, its plural *katte* ‘cats’, as well as in sonorant-final *tal* ‘number’ or open syllable *vue* ‘view’. This would make Danish different from Swedish or Norwegian, where the equivalent words *katt*, *katter*, *tall* or *vue* are all heavy syllables with either a long vowel or a moraic coda consonant, but not both (Riad 2014 for Swedish; Kristoffersen 1991; 2000 for Norwegian). Such systems are known as *complementary length* systems (Kiparsky 1984, Itô 1986), and Danish is explicitly described as not belonging to this class (Basbøll 2005:275). It must be remembered that Faroese and Icelandic also behave as complementary length types (Árnason 2011), which emphasizes the exceptionality of the Danish syllable from a Scandinavian perspective, both Insular and Peninsular, if one insists on parsing *kat* as a light syllable after all. Nonetheless, other linguists parse the same words as heavy bimoraic syllables systematically (Riad 1992, Lorentz 1996, Kiparsky 2008, Itô and Mester 2015). In this alternative model, Danish *kat* is as heavy as Norwegian *katt*, and the coda “t” is moraic in both languages. The question is straightforward: how can we tell which model is best?

In this paper, I will side with those that parse all Danish stressed syllables as heavy, with a bimoraic nucleus, but I will not postpone the reasons behind my decision. I will refer to this hypothesis as the Heavy Syllable Model, or HS-model. So far, the contrary model, the Light Syllable Model (LS-model from now on) is the only one that has offered a comprehensive view of Danish phonology as a systematic totality and has not spared any efforts on how to connect syllable structure with the rest of the system. This fact, in my opinion, challenges those of us who nevertheless still think that Danish belongs to the complementary length prosodic type. In the following sections, I will show not only that the Danish syllable follows closely its linguistic Scandinavian relatives but also that this claim is certainly the most consistent with what is known about Danish prosody at large, as well as it is the most effective and coherent position to hold from

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a systemic point of view. Finally, I will also clarify that this claim is in all respects theoretically compatible with the most authoritative theory of *stød* to date, Basbøll's Non-*Stød* Model (2005), even though in Basbøll's model, obstruents cannot be moraic, a decision which automatically makes many stressed syllables light. In my opinion, Basbøll's theory of *stød* is ultimately compatible with the view that Danish is also a strict complementary length type (see Section 6.2) after a few adjustments. The spirit of my revision, therefore, is to seek for the integration of parts wherever they may come from, rather than a confrontation between different uncompromising totalities.

### 2. The autosegmental nature of *stød*

The confrontation of the two models of the Danish syllable is straightforward, since the two rival models share a theoretical core and use the same representational framework. The Danish phonological tradition has always analyzed Danish *stød* as a prosody, interdependent and orthogonal to length, prosodic weight, and stress (Hansen 1943, Basbøll 2005). This tradition is consistent with the autosegmental-metrical conventions of Moraic Phonology (Hayes 1989), which feeds the technical apparatus of both the LS- and the HS-model.

In Moraic Phonology, moras play a central role in defining metrical units and relevant phonotactic domains, like the nucleus of the syllable. Most interestingly, moras unify syllable weight and segmental length (Hayes 1989). By definition, a heavy syllable is bimoraic, and a light one, monomoraic. Similarly, a long vowel is a bimoraic segment and a short vowel is just one mora. Thus, a syllable with a long vowel is necessarily heavy, which is theoretically correct, and a short vowel cannot be but a light syllable by itself. This way to represent length has consequences in the computation of stress patterns and in the statement of phonotactic restrictions, making claims beyond the mere analysis of length in terms of either phonetic duration or phonological contrast, for which a segmental analysis of the feature length would suffice.

Interestingly, Moraic Phonology determines that a long vowel is always bimoraic, by definition, while a short-vowel syllable closed with a consonant may or may not be bimoraic. This is determined by setting an open language-specific parameter, *weight-by-position* (Hayes 1989). This parameter, which decides on a language-specific basis if codas are moraic or not, is different from another parameter that dictates whether a language can have closed syllables at all. If closed syllables are legitimate syllabic structures, one must still determine whether closed syllables count as light or as heavy syllables, a property which in addition makes strong predictions about how stress should be computed in that language, or whether long vowels can precede a coda consonant or a geminate, and if so, in which contexts. If closed syllables count as light syllables in the computation of stress, the most logical conclusion is that codas are not moraic in that language. If they count as heavy syllables, the most reasonable conclusion is that the coda is moraic. To the extent that there is not a metrical analysis of stress in Danish generally agreed upon, one must turn to other kind of evidence to ascertain the moraic status of coda consonants. In Danish, a potential source of evidence bearing on the *weight-by-position* parameter is *stød*, which will only appear in heavy, bimoraic syllables, with, at least, secondary stress – the so-called '*stød* basis'.

The two rival syllabic models coincide in representing Danish *stød* as the property of a second mora in heavy stressed syllables, and Moraic Phonology helps rationalize the connection between the prosodic and the segmental properties of the *stød*-basis condition. A stressed syllable must be heavy, and a heavy syllable must be bimoraic, either with a long vowel or with a moraic coda consonant. Heavy syllables attract *stød* by default, and therefore, monosyllables and oxytones with heavy bimoraic syllables are regularly words with *stød*. In other words, monosyllables and oxytones are the prototypical scenario for *stød*, in such a way that the lack of it in this type of word must be forcefully justified; see Section 6.2 below.

In Moraic Phonology *stød* can be an autosegment, a prosody which is independent from the actual segmental composition of the stressed syllable. In this light, *stød* is a constricted glottis feature assigned to the second mora of a heavy syllable by default. Its phonological behavior is also consistent with the usual behavior of floating autosegments in autosegmental theory (Goldsmith 1990), and, as such, it helps simplify the representation of phonological processes that are otherwise very hard to formulate in segmental terms.

One of those processes is the Copenhagen Rule, extremely hard to formulate in a segmental framework but quite easy to describe in the autosegmental language of linking and delinking association lines. The Copenhagen Rule resyllabifies the post-vocalic approximant after a long and stressed vowel by making it a moraic coda in the preceding stressed syllable, which results in the automatic shortening of the long vowel, since the second mora of the nucleus is now taken by the approximant. The Copenhagen Rule takes place both when the vowel has *stød*, as in *floden* ‘the river’, and when it does not, as in *gaden* ‘the street’; see (1) (cf. Basbøll 2005:293–322 for a battery of other phonological processes analyzed in moraic terms).

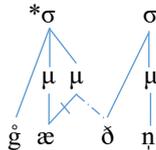
(1) *Copenhagen Rule*

- a. Vowel shortening (without *stød*): *gaden* [g̊æ:δ̃ŋ] -> [g̊æδ̃.δ̃ŋ] ‘the street’
- b. Vowel shortening (floating *stød*): *floden* [flo:ʔδ̃ŋ] -> [floδ̃ʔ.δ̃ŋ] ‘the river’

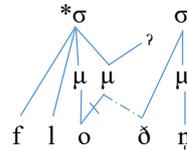
When the vowel does not have *stød*, as in *gaden*, nothing else happens, besides the fact that the vowel shortens, once the approximant is reconnected to the second mora of the stressed syllable, as we see in (2a) below. When the vowel has *stød*, as in *floden*, the approximant becomes a moraic coda of the preceding stressed syllable and it consequently receives the *stød* [floδ̃ʔ.δ̃ŋ], which was originally a phonetic property of the second phase of the long vowel in [flo:ʔδ̃ŋ]. This complex *stød*-metathesis, which is a very difficult process to describe in segmental terms, appears, in the autosegmental framework, like the most natural of outcomes, if *stød* is represented as a floating property of the second mora, indifferent to which segment ends up being linked to that mora, either the second phase of a long vowel or a coda consonant closing the syllable. All the verbosity required to express in words what goes on in the Copenhagen Rule becomes unnecessary in the autosegmental representation of *stød*, where everything goes like clockwork, with the consonant automatically occupying the moraic slot left vacant by the shortened vowel, as in (2b). In autosegmental terms, phonological processes that were very hard to express in strictly segmental formalisms boil down to the simple operations of linking, delinking, and relinking association lines between the phonological elements on different phonological tiers of multidimensional representations.

(2) *Copenhagen Rule (autosegmental version)*

- a. *gaden* [g̊æ:δ̃ŋ] -> [g̊æδ̃.δ̃ŋ]  
(*gade-n*, street-def. sg.) ‘the street’



- b. *floden* [flo:ʔδ̃ŋ] -> [floδ̃ʔ.δ̃ŋ]  
(*flod-en*, river-def. sg.) ‘the river’



3. Phonological contrasts and phonetic duration

The point I want to show in the next three sections is that it is difficult to find additional supporting evidence for the LS-model, in such a way that the close match that it draws between syllable form and *stød*-basis becomes in the end a weakness. To the extent that the alternative HS-model can predict both the distribution of *stød* and most of the phonological facts that are sensitive to syllable structure without recourse to an opaque moraic contrast, the claims of the HS-model are, in principle, more interesting from a mere epistemological point of view. It is now time to examine what else, besides epistemic design, could tip the balance in favor of the idea that syllable structure and *stød* are essentially orthogonal to each other. If they were not, as the LS-model claims, would the rest of the phonology be consistent with the syllabic demands of *stød*? Will moraic paradoxes arise in other areas?

A potential argument to bind *stød* and moraicity as close as the LS-model does would find some strength if there were eventual contrasting pairs between heavy and light stressed syllables even when *stød* is not at stake. However, this hypothetical contrast between *stød*-less heavy and light syllables does not show. Claiming that there are no long consonants in Danish becomes a conceptual problem when couched in Moraic Phonology, where the traditional notion of “long consonant” means being a “moraic coda”, either

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in a closed syllable or as part of a geminate in an intervocalic context. To the extent that Danish consonants are moraic whenever they carry *stød*, the segmental claim that there are no long consonants in Danish cannot have a straightforward interpretation. Either there are no contrasts based on the moraic status of the consonants, in the best interpretation for the LS-model, or, alternatively, all coda consonants are moraic after a stressed short vowel, given that there is no length contrast to protect and that all such consonants are moraic whenever they have *stød*. In other words, consonants never give evidence of a length contrast on its own, independent from the presence or absence of *stød*.

Another argument for the LS-model would be if the moraic “n” of *hænder* with *stød*, were systematically of longer phonetic duration than the arguably non-moraic “t” of *katte*, or longer than the hypothetically non-moraic “n” of *venner*, also without *stød*. However, no clear-cut phonetic distinction has been found in the respective duration of consonants with and without *stød*, as far as the measurements take place in identical prosodic contexts (Grønnum and Basbøll 2001). This lack of durational contrast conforms to the expectations of the rival HS-model, since in the HS-model all consonants following a short and stressed vowel are moraic, whether with *stød*, as in *pennen*, or without, as in *katte* or in *venner*. The phonetics of consonant duration are consistent with the HS claim that all consonants have the same rights and the same obligations towards the mora, regardless of *stød*. There is no phonetic duration contrast between the *stød*less “l” of *møller* ‘miller’ and the same “l” with *stød* in *Møller* ‘Miller’. Similarly, vowel length is the same in *musen* ‘the muse’, without *stød*, as in *musen* ‘the mouse’, with *stød*. *Stød* is evidence for a heavy syllable, but lack of *stød* is not a sign that the syllable is light, monomoraic.

If moras had to have a clear translation in phonetic duration, the alternative HS-model would be clearly superior to the LS-model. Notwithstanding, not to let the phonetic reality of moraic status decide the argument in favor of the HS-model at this stage, the confrontation of the two models must be carried out under the assumption that moras are abstract properties without a transparent phonetic correspondence, which is a fair theoretical possibility. As I will show in the following sections, the analysis of distributional restrictions and morphology-driven alternations will put the predictions of the two competing models of the Danish syllable in sharp contrast, but now the empirical evidence will clearly tip the balance in favor of the HS-model.

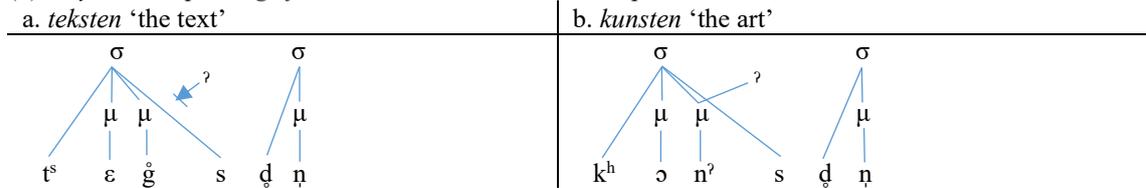
### 4. Distributional restrictions

Non-linear theories like Moraic Phonology showed that purely linear models of the syllable were not well suited to capture significant prosodic and phonotactic patterns recurrent in natural languages. In Moraic Phonology, the simple notion of the mora makes it possible to unify a set of interdependent prosodic dimensions: length, syllable weight, stress, linear restrictions, as well as tone assignment or the distribution of *stød*. In Section 2 above, the technical notion of the mora was shown to unify *stød* patterns with both metrical stress and syllabic weight, together with claims on segmental length contrasts or even with efficient ways to represent shortening and lengthening processes like the Copenhagen Rule. An important dimension to determine the internal structure of the syllable and its nucleus is the study of phonotactic restrictions. This is particularly salient in the analysis of how vowel length interacts with the size of a following consonant cluster. This point is particularly relevant for the goals of this paper, since the two models make clearly different predictions on which consonant clusters to expect after short and long vowels in Danish.

The LS-model makes the implicit claim that the number of consonants following a stressed vowel will be one consonant longer when the first member of the cluster is a sonorant, since sonorants, according to the moraic filter, are the only type that can occupy a mora, while obstruents cannot. This prediction is wrong, as the length of the cluster does not depend on whether the first consonant of the cluster is a sonorant or an obstruent. In Danish monomorphemic words, the maximum number of consonants in the cluster following a short vowel is three, if the medial consonant is “s”; after a long vowel, the maximum is two (Grønnum 2007), if the first consonant is “s”. Furthermore, not only the number, but also the nature of the consonants is the same, *mutatis mutandis*, whether the coda is a sonorant or an obstruent. When the vowel is short, the initial consonant can be either a sonorant, *kunst* ‘art’ or an obstruent, *tekst* ‘text’, and the

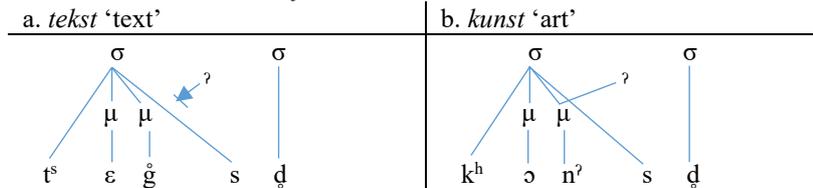
maximal size is the same in both cases. The “n” in the coda of *kunst* is clearly moraic, and therefore has *stød*. This is consistent with both the LS- and the HS- models. To maintain the parallel restrictions on cluster size, the “k” in *tekst* must also be moraic, licensed within the syllabic nucleus, connected to the second mora, as predicted by the HS-model, but clearly against the claims of the moraic filter in the LS-model. However, since the second mora is occupied by an obstruent, *tekst* will never have *stød*, and this is what requires an independent explanation in the HS model; see Section 6.2. The same structures are found in the stressed syllables of their definite forms, *teksten* and *kunsten*, see (3), such that only the latter has *stød* on the “n”.

(3) *Symmetric parsing of obstruent and sonorant-initial post-vocalic clusters*



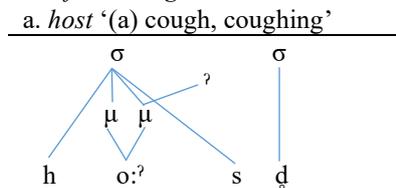
Obstruents and sonorants can be the first consonant of three-consonant clusters after a short vowel. Obstruents and sonorants, *mutatis mutandis*, behave the same in all phonotactic environments – a symmetry of behavior very much in contradiction with the asymmetric patterning that one should expect if only sonorants could be moraic.

(4) *Maximal two-consonant cluster after a moraic coda consonant*



Outside the syllabic nucleus, the only permitted sequence in monomorphemic words is “s” plus another obstruent. This pattern is independent whether the bimoraic nucleus contains a short vowel plus a moraic sonorant (4b), a short vowel plus a moraic obstruent (4a), or a long vowel (5). This proportionality follows directly from the claim that obstruents following a short vowel are also moraic. If obstruents cannot be moraic, as claimed by the LS-model, there is no way this regularity can be expressed in such concise terms as in this version of the HS-model.

(5) *Maximal two-consonant cluster after a long vowel*

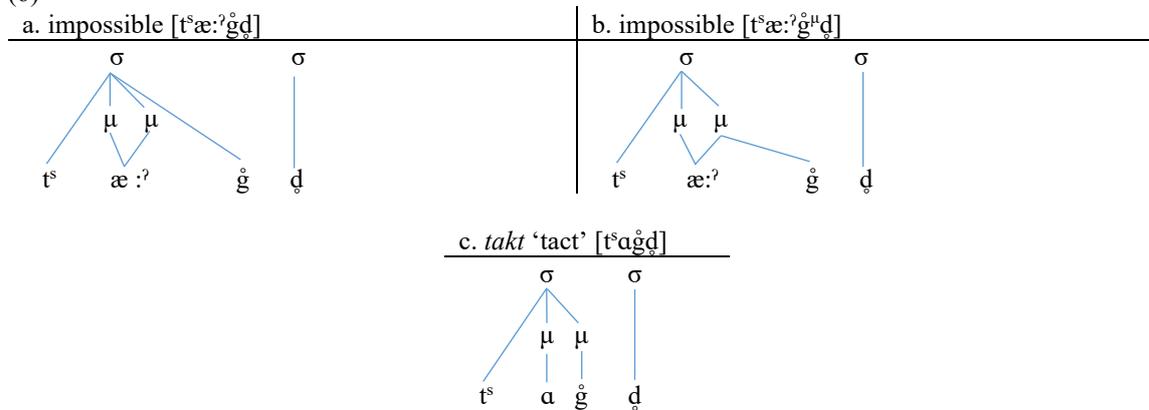


The LS-model, therefore, cannot capture the strong interdependence between the size of coda clusters and the length of the vowel. Phonotactic statements are clearly simplified if the analysis adopts the main claim of the HS-model that approximants, sonorants, and obstruents are all parsed following the same conditions. Furthermore, those conditions are fully compliant with Prokosch’s Law also in Danish (Prokosch 1939), as it is also the case in the rest of the Scandinavian languages. Coda clusters vary in quality and size with respect to whether the preceding vowel is short or long, but they do so independently of which major class the first consonant of the cluster belongs to.

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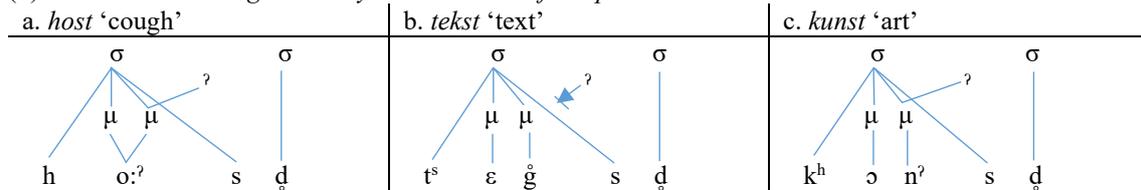
Thus, *tekst* is a well-formed word, because the voiceless velar obstruent can be parsed to the second mora of the syllable. However, neither the initial sonorant of the cluster “mt” nor the obstruent of “kt” can follow a long vowel, because the second mora is obligatorily occupied by the long vowel and only “s” can be a legal syllabic appendix outside of the nucleus; see (13) below. Without a free moraic slot for the “k”, the hypothetical *\*ma:gt*, with a long vowel, is an impossible cluster; the same reasoning applies to the hypothetical *\*la:mt*, with a sonorant-initial cluster, because there is no free mora for the “m” to connect to. The only possibility for the obstruent of a sequence “kt”, or for the one in a sequence “kst”, as in *tekst*, is to be moraic, and this can only happen if the preceding vowel is a short one, which explains that *magt* ‘power’ is a Danish word, but *\*ma:gt* is not. If anything, this turns the claims of the Light Syllable Model on its head: it is not that obstruents cannot be moraic, but, rather, being moraic is their only chance to be parsed, when they are the first consonant in a cluster; see (6c).

(6)

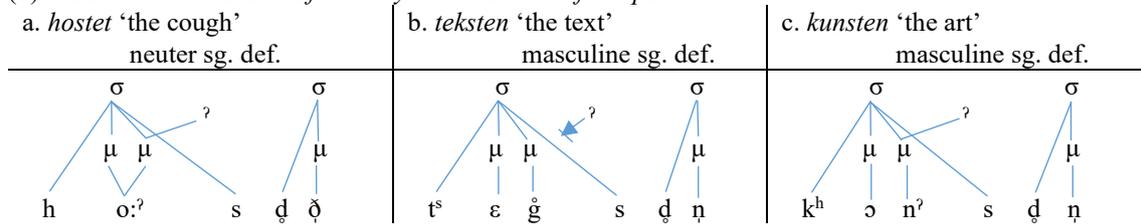


Word-final clusters are also good intervocalic clusters. They follow the same distributional restrictions as in absolute word-final position. This coincidence reinforces any analysis in which a word-final coda is parsed as the onset of a degenerate syllable, even though this is not directly relevant for the central issue of this paper.

(7) *Obstruents as degenerate syllables in word-final position*



(8) *Obstruents as onsets of weak syllables in word-final position*



In a language with complementary length, the first consonant of a cluster is always moraic if it follows a short vowel. If sonorant, it always has stød; if obstruent, it never has stød; see Section 6.2.

(9) *Same syllabic roles, different compatibility with stød*

<p>a. <i>folk</i> ‘folk’ sg. indef.</p>	<p>b. <i>boks</i> ‘box’ sg. indef.</p>
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The parallelism is preserved when the second mora is a sonorant after a short vowel and when the sonorant follows a long vowel. In (10) the contrast in length is reflected in the location of *stød*: on the sonorant, if the vowel is short, but on the vowel, if the vowel is long.

(10) *Stød always on the second mora*

<p>a. <i>lund</i> [lɔnʔ] ‘grove’</p>	<p>b. <i>lån</i> [lɔːn] ‘loan’</p>
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When the closing consonant is an obstruent, the difference is between the lack of *stød*, when the vowel is short, and *stød* on the vowel, when the vowel is long. A laryngeal filter (see Section 6.2 below) is sufficient to express the asymmetries in *stød* distribution and the symmetries in syllable structure between (10) and (11).

(11)

<p>a. <i>nat</i> [naɖ] ‘night’</p>	<p>b. <i>stat</i> [sdæːɖ] ‘state’</p>
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The main restrictions on syllable structure can now be captured with the basic ideas of the HS-model and a representation of the syllable with three potential slots for consonants:

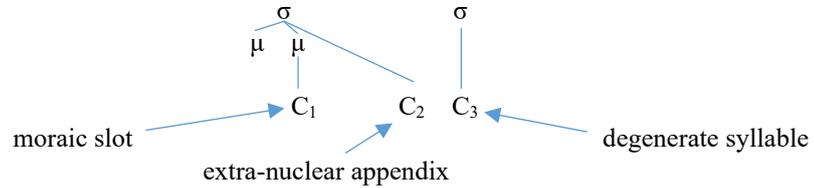
(12) *Syllabic structure of a maximal post-vocalic cluster:*

- (i) a moraic coda, after a stressed short vowel, where all consonants are licensed,
- (ii) an extra-nuclear slot reserved for “s” as its only option in a mono-morpheme,
- (iii) a one-slot degenerate syllable without a nucleus, where every consonant can be found.

Other phonotactic restrictions must refer to more local relations between the elements of the sequential chain. This would be the case when, for instance, two adjacent coronals, like \*tl or \*dl, are forbidden in an onset cluster, or when they are limited to the sequence “ld” in a coda. The violation of sonority sequence restrictions is also an important factor. Clusters that count as violations of sonority sequence relations are, for instance, an obstruent-sonorant sequence in the coda, like \*t.r, or in an onset in reverse order, say \*rt, as it is also the case for a sequence of two sonorants in an onset, say \*nl or \*ln. All those statements, taken together, will contribute to the formulation of a complete statement of the phonotactics of Danish, where the interdependence between vowel length and cluster size plays a significant role – see (13) for a graphic summary of the different licensing positions involved in a word-final monomorphemic coda cluster, or, similarly, for a word-medial intervocalic consonant sequence in a monomorphemic word.

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(13) *Representing the syllabic structure of a maximal three-consonant cluster*



### 5. Morphology-driven alternations

A goal of contemporary phonological theory is to integrate phonological patterns as components of a higher totality, where things hold together as parts of a system of mutual interdependent relations. This is now a widely accepted view in the study of phonology-driven morphological alternations. An idea gradually gaining ground – at least since Sommerstein (1977), further elaborated in Goldsmith’s (1991) *Phonology as an intelligent system*, and ultimately enshrined as a major principle in Prince and Smolensky (1993/2004) – conceives of morphological alternations not as arbitrary processes, but rather as operations taking place to satisfy phonotactic conditions on the phonological surface in the best possible way. Thus, the phonotactic conditions examined in the previous section will also make different predictions about how the Danish inflectional system works. The suffix *-t*, both in the neuter singular of adjectives and in the participle of regular verbs of the second class, provides the necessary evidence to show the superiority of the HS-model over its LS contender.

The crucial phonotactic difference between monomorphemic and inflected words is that inflected words will license more complex consonant clusters. In monomorphemic words, the maximal cluster after a bimoraic nucleus is “s” followed by an obstruent, as already seen in the analysis of *host*, *kunst*, or *tekst* in the preceding section. Inflected words relax the conditions on coda sequences and tolerate more options after a long vowel: the consonant that precedes the suffixal “t” can be not only “s”, as in *løste*, past tense of *løse* ‘to solve’, but also coronal sonorants, like “n” or “l”: *fiint*, the neuter of *fin* ‘fine’, or *helt*, neuter of *hel* ‘whole’. A long vowel followed by a “nt” cluster appears in *mente*, past tense of *mene* ‘to mean’. An approximant can also be the first member of a coda cluster in an adjective *svagt*, the neuter singular of *svag* ‘weak’.

(14) *Some adjective and verb alternations*

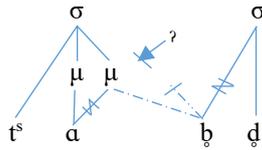
a. <i>fin</i> ‘fine’	b. <i>hel</i> ‘whole’	c. <i>mene</i> ‘to mean’	d. <i>løse</i> ‘to solve’
e. <i>fiint</i> ‘fine’ neuter	f. <i>helt</i> ‘whole’ neuter	g. <i>mente</i> ‘mean’ past	h. <i>løste</i> ‘solve’ past

However, when the “new” consonant cluster that arises after the right-adjunction of the suffix “t” has a “non-coronal” obstruent as first member, it can only be preceded by short vowels. If the vowel of the nucleus is long in the root, as in *tabe* ‘to lose’, it will inevitably shorten after adding the suffix “t” in the participle, as shown in *tabt*, because the peripheral obstruent is not licensed outside, but inside the bimoraic

nucleus. To be precise, the obstruent “b” must necessarily be parsed as a moraic coda consonant, as shown in (15). The set of phonological claims over the input /t a: b + t/ makes the shortening of the vowel a: → a, inevitable, the same way as the color of the front open long vowel [æ:] automatically turns into the back open short vowel [ɑ] in front of a tautosyllabic non-coronal consonant.

(15)

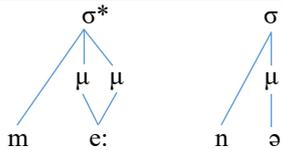
a. *tabe* [t<sup>s</sup>æ:bə] ‘to lose’ – *tabt* [t<sup>s</sup>ab̥d]



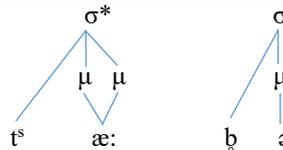
Since only coronal sonorants can be extra-nuclear in this environment, non-coronal consonants must occupy the second mora of the nucleus to escape deletion. Consequently, the long vowel of the infinitive must shorten, as it happens regularly and inevitably in all cases. The different behavior of consonant clusters in the same morphological context is fully motivated by a consistent set of structural restrictions that only make sense within the HS-model.

(16)

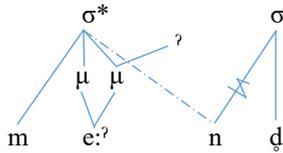
a. *mene* [me:nə] ‘to mean’ infinitive



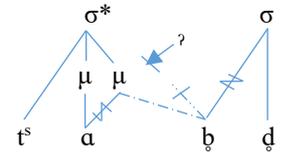
b. *tabe* [t<sup>s</sup>æ:bə] ‘to lose’ infinitive



c. *ment* [me:n̥d] ‘to mean’ past participle  
|me:n + t|



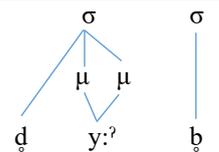
d. *tabt* [t<sup>s</sup>ab̥d] ‘to lose’ past participle  
|ta:p + t|



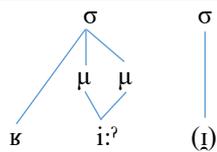
The adjective *dyb*, with a long “y” becomes *dybt*, with a short one, under the same pressure that makes the participle of the verb *tabe* become *tabt*. The reason the vowel shortens and loses its original stød, so to say, is that the labial obstruents of *dypt* and *tabt* must be moraic in both cases. This cascade of interrelated processes is inevitable in the HS-model, which is the only model where obstruents can be moraic. In the LS-model, those alternations are nothing but mysterious, if obstruents cannot be moraic. For instance, if obstruents cannot be moraic, why should the long vowel preceding “bt” or “gt” clusters shorten systematically, without exceptions?

(17)

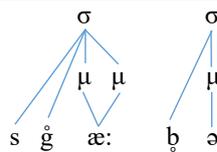
a. *dyb* ‘deep’



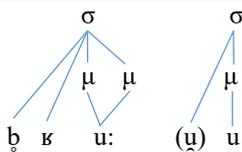
b. *rig* ‘rich’



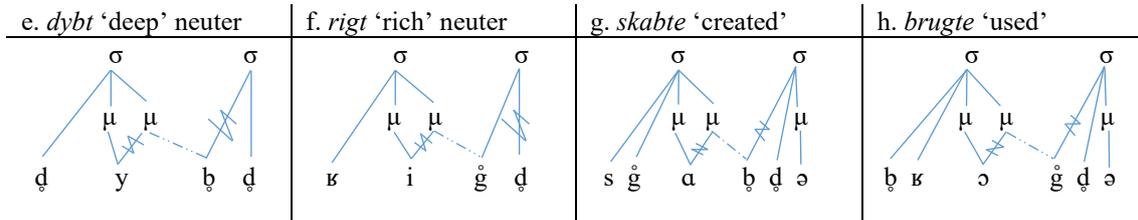
c. *skabe* ‘to create’



d. *bruge* ‘to use’



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In the HS-model, the restrictions are against licensing material in the extra-nuclear part of the coda, which is a much more restrictive position than the second mora of the nucleus, but not against licensing material in the second mora of the nucleus.

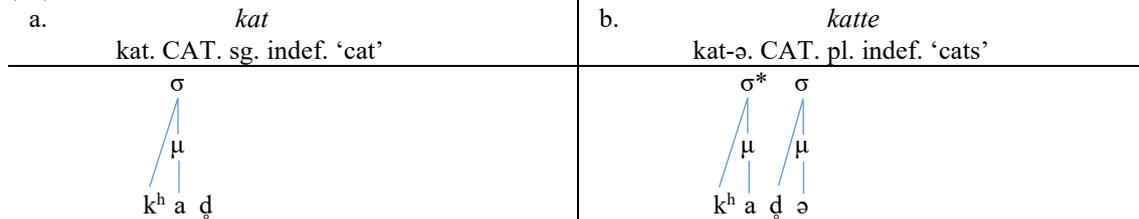
### 6. Final assessment of the two competing models of the syllable structure in Danish

Once the main syllabic facts of the Danish syllable have been presented in the preceding sections, it is now time to reassess the merits of the two competing models as the only sensible way to give an answer to the theoretical and practical questions in the opening: which is the best way to parse a Danish syllable?

#### 6.1 The Light Syllable Model (LS-model)

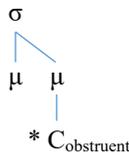
Let us start with a review of how things hold together in the mainstream Light Syllable, LS-model. The alternation between the indefinite and the definite singular of the word ‘cat’, *kat*, *katten*; [k<sup>h</sup>aḁ], [k<sup>h</sup>aḁŋ] is represented by the LS-model as follows, see (18), respecting the claim that obstruents cannot be moraic in this model.

#### (18) ‘kat’ and ‘katte’ in the LS-model



The property that obstruents are never moraic is formalized with a *moraic filter* against obstruents, consistent with a well-established thematic line on *sonority-based moraic restrictions* in general (Zec 1994, Morén 1999; 2005). The moraic filter, or any equivalent formula, has become a central claim in the LS-model, including the most authoritative and comprehensive analysis of Danish phonology (Basbøll 2005 and following work). The moraic filter is particularly cherished among phonologists because it holds the promise to make the traditional notion of *stød*-basis redundant (Martinet 1937, Hansen 1943).

#### (19) Moraic filter



Sonorants, on the other hand, can occupy moraic positions in the mainstream LS-model. However, unlike what is the undisputed case in the rest of Scandinavia, a coda sonorant that follows a short vowel in a stressed syllable can, but does not have to be, moraic in the LS-model. In the LS-model, such coda sonorants have two options. They can be either a moraic consonant that makes a syllable heavy, as in *pen* [p<sup>h</sup>ɛn<sup>?</sup>], or they can occupy an extra-prosodic slot, keeping the syllable light, i.e., monomoraic, as in *ven* [vɛn], without

stød. Parsing a coda consonant in different ways is indirectly reflected in the stød contrast between the two types of word. If the coda is moraic, it has stød: *pen* [p<sup>h</sup>ɛn<sup>?</sup>]; if non-moraic, it does not: *ven* [vɛn]. If this praxis is adopted, the stød-basis of a syllable is equivalent to be prosodically heavy, in such a way that the notion of stød basis becomes redundant as an independent condition, subsumed by the Stød Principle that assigns stød to all heavy syllables and by moraic representations like those in (20). In the LS-model, stød can be read off directly from the syllabic structure.

(20) *Lexical contrast between word-final sonorants with and without stød*

a. <i>ven</i> ‘friend’ sg. indef.	b. <i>pen</i> ‘pen’ sg. indef.

Unlike the moraic filter against obstruents, which is postulated as an absolute surface-true condition, the filter that prevents a sonorant from being moraic, active only in stødless words like *ven*, is lexically determined, limited to the absolute word-final position of a finite list of mostly patrimonial words. Thus, when the word-final sonorant is no longer word final, as in the definite singular *vennen*, it becomes moraic and therefore will have stød, if it appears in an environment which does not suppress stød. The stød contrast between *pen* [p<sup>h</sup>ɛn<sup>?</sup>] and *ven* [v<sup>h</sup>ɛn] is now lost in the definite singular, so that there is stød not only in *pennen* [p<sup>h</sup>ɛn<sup>?</sup>ŋ] ‘the pen’, but also in *vennen* [vɛn<sup>?</sup>ŋ] ‘the friend’ (Basbøll 2005:281).

(21) *Neutralization of stød contrast in word-medial sonorants*

a. <i>vennen</i> ‘friend’ sg. def.	b. <i>pennen</i> ‘pen’ sg. def.

As it has been discussed in Section 3, there is no contrast in phonetic duration between the prosodically light *ven* versus the heavy *pen* in (20), nor between the intervocalic “n” with stød in *vennen* ‘the friend’ and the stødless intervocalic “n” of *venner* ‘friends’. The only material difference is a contrast of *stød*, present only in *pen* and *vennen*, but absent in *ven* and *venner*. In terms of duration, no systematic difference can be found between the different coda and geminate “n” in their respective word-final or intervocalic contexts.

Phonologically speaking, the presence of stød imposes a set of conditions on the syllables in which it appears. A syllable can carry stød only if it is both heavy (bimoraic) and has either primary or secondary stress. Thus, in the mainstream LS-model, there is a conscious effort to read stød almost directly from syllable structure and to make the notion of stød-basis redundant, transparent on the moraic representation. Stød-basis in the LS-model is nothing but a syllable with a stressed bimoraic nucleus. Lack of stress or having just one mora in the syllabic nucleus means absence of stød. If one assumes that monosyllables have stød by default, the lack of stød in the *kat*- and *ven*-type of words is an automatic consequence of being monomoraic light syllables, albeit stressed.

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(22) *Stød-basis: stress and bimoraicity*

a. Stød-basis	b. Lack of stød-basis	
Stress and heaviness	b.1. Lack of stress	b.2. Lack of heaviness
$\sigma^{*1}$ 	$\sigma$ 	$\sigma^*$ 

Interestingly, the different motivation for the lack of stød in the two word-types represented by *kat* and *tal* ‘number’ respectively, or, similarly, by *rabat* ‘discount’ and *metal* ‘metal’, has interesting consequences for how stød behaves in their inflectional paradigms. For instance, obstruent-final *kat*, *kop* ‘cup’, *stok* ‘stick’ or *rabat* will not have stød in any of their inflected words. The filter against moraic obstruents is absolute, exceptionless. Indefinite plurals *katte* ‘cats’, *koppe* ‘cups’, *stokke* ‘sticks’ or *rabatter* ‘discounts’; definite plurals *kattene* ‘the cats’, *koppene* ‘the cups’, *stokkene* ‘the sticks’ or *rabatterne* ‘the discounts’; definite singular *katten* ‘the cat’, *koppen* ‘the cup’, *stokken* ‘the stick’ or *rabatten* ‘the discount’ will never have the chance to have a heavy stressed syllable, as a direct consequence of the LS filter against moraic obstruents.

(23) *Systematic lack of stød in the paradigm of ‘kat’*

a. <i>kat</i> ‘cat’	b. <i>katten</i> ‘the cat’	c. <i>katte</i> ‘cats’	d. <i>kattene</i> ‘the cats’
$\sigma^*$ 	$\sigma^*$ $\sigma$ 	$\sigma^*$ $\sigma$ 	$\sigma^*$ $\sigma$ $\sigma$ 

In a slightly different way, words with a word-final sonorant can have contrastive stød in their bases, say *ven* ≠ *pen*<sup>2</sup>. In this scenario, the default case is *pen*, with a moraic consonant (and stød), while *ven* is lexically marked with an extra-syllabic consonant, which cannot be parsed as a mora. Not being moraic, the root syllable of *ven* is light and necessarily lacks stød. The reason why *ven* is a light syllable is different from the reason the word-final obstruent cases of *kat* or *stok* are also light, and the predictions, accordingly, are different about what to expect concerning how stød will behave in the inflectional paradigm of the two types of word. While a sonorant following a short-stressed vowel may or may not be moraic in word-final position, the non-moraic status of the consonant cannot be maintained in word-medial positions, when followed by other segments inside a prosodic word. Thus, *ven* and *søn* ‘son’ are light and stødless, and *land* ‘land’ and *pen* are heavy and have stød, but their respective definite forms have all intervocalic moraic sonorants in word-medial position, as already mentioned, and the morphological context will determine whether they will receive stød or not (Basbøll 2005; 2014). *Pennen* ‘the pen’ and *landet* ‘the land’ have stød, but *vennen* ‘the friend’ and *sønner* ‘the son’ also have stød, even if their bases did not. The “n” that was an extra-prosodic coda in the monosyllabic and oxytonic bases is now a word- interior moraic geminate and does not have the right to be extra-prosodic. Since the preceding vowel is short, a series of related facts necessarily happen, so to say, to the word-final stødless “n” of the root: the word-interior “n” is now a moraic coda, which makes the syllable heavy and therefore capable to receive stød in the derived definite singular forms. There are no morphological reasons to prevent the presence of stød in those derived words either (Basbøll 2005; 2014).

I will illustrate the contrast between non-moraic word-final sonorants and word-medial ones with the paradigm of the word *metal*, with a stødless base but with stød in all its inflected words. The paradigm of *metal* is therefore very different from the paradigm of *kat* without stød in any of the four cells; compare (24) with (23) above.

<sup>1</sup> The asterisk represents primary or secondary stress.

(24) *Inflection of ‘metal’*

a. <i>metal</i> ‘metal’	b. <i>metallet</i> ‘the metal’	c. <i>metaller</i> ‘metals’	d. <i>metallerne</i> ‘the metals’

The distinction between *ven* and *pen* is not directly phonological. Their asymmetric syllabification relies on the lexical marking of the final consonant of *ven* as extra-prosodic. This measure has distributional consequences. While a word-final sonorant may or may not have *stød*, depending on diacritic marking, the coda sonorant in monomorphemic *hals* ‘neck’ has no choice but to be heavy and have *stød*, as two consonants cannot be extra-syllabic by lexical means, and no diacritic will produce that effect. This restriction on extra-prosodicity makes the “l” of *hals* automatically moraic, and thus automatically the target of *stød* by default. This is different from the case of words ending in obstruents, given that obstruents are all non-moraic by means of the moraic filter. Consequently, while monomorphemic *hals* must be heavy and its “l” must be moraic and have *stød*, monomorphemic *snaps* ‘shots’ or *boks* ‘box’ must always be light and *stød*-less, because the obstruents *p* and *k* are non-moraic codas in the LS-model, and therefore light and *stød*-less by logical necessity. The LS-model is, therefore, extremely successful in capturing the main facts and mapping the predictions that follow from the *stød*-basis.

(25) *Lexical contrast between word-final sonorants with and without stød*

a. <i>hals</i> ‘neck’ sg. indef.	b. <i>snaps</i> ‘(liquor) shots’ sg. indef.

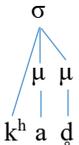
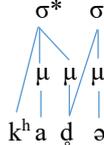
6.2 *The Heavy Syllable Model (HS-model)*

The HS-model is more concerned with syllable structure from a comparative or historical point of view and does not establish moraic distinctions among different classes of consonants, unless motivated by the conjoined examination of all the phonological dimensions where syllable structure plays a role. After considering a battery of data on phonetic interpretation, phonological contrast and lexical distinctions, distributional patterns and morphological alternations, the most reasonable conclusion is that any consonant after a stressed short vowel is systematically linked to a second mora, regardless of whether they have *stød*, as in *tallene* ‘the numbers’, or not, as in *sonnerne* ‘the sons’, regardless of whether the consonant is a word-final sonorant with *stød*, as in *pen*, or without, as in *tal*, or in any obstruent-final word, as in *kop* or *kat*. In this alternative HS-model, Danish is a pure complementary length type, like the other Scandinavian languages – not in a word-by-word comparison and not in every respect, but in the general properties of the syllable and the prosodic-morphological design of the language. Particularly, Danish syllables comply with the conditions of the Prokosch’s Law unexceptionally, making all stressed syllables heavy as a matter of principle.

As already mentioned in the preceding Section 6.1, there are two types of word that seem to challenge the view that all Danish syllables are of the Prokosch type. One of them is the group of words with a stressed short vowel followed an obstruent, either closing the syllable or in intervocalic position. This group of words never has *stød*, which could be a sign that obstruents are never moraic in Danish, thus making the stressed syllables light and unable to carry the *stød*. Compare the representation of the pair *kat* and *katte* in the HS-model below (26) and in the LS model in (18) above.

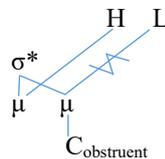
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(26) *Parsing obstruents as moraic codas and geminates*

<p>a. <i>kat</i> 'cat' sg. indef.</p> 	<p>b. <i>katte</i> 'cat' pl. indef.</p> 
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The theoretical prize to pay for making all stressed syllables heavy is that the systematic lack of *stød* in the cases examined in the previous section now must be accounted for by alternative means in any HS-model. Itô and Mester (2015) explain the lack of *stød* in coda obstruents with a segmental filter against the combination of both obstruent voicelessness and a low tone in the same coda position, as they follow Kiparsky's interpretation that Livonian *stød* is the result of a compressed high-low falling tonal contour in the short span of a single syllable.

(27) *Filter against low tone and obstruent consonant in the same moraic position*



I agree with treating the regular lack of *stød* in obstruents with a segmental rather than a moraic filter, but I maintain with Grønnum et al. (2013) that *stød* is an autonomous laryngeal prosody and not a phonological parasite of tone. With this proviso in mind, the lack of *stød* in obstruents, when these occupy a second mora in a heavy syllable, is a direct consequence of an unviolated segmental filter against the combination of not only tonal but also laryngeal prosodies with the laryngeal gestures of those obstruents sharing the same moraic position where *stød* is expected, thus subsuming cases of both *stød*- and pitch-accent restrictions as particular instantiations of an even more general laryngeal constraint. *Stød*, which behaves as a laryngeal floating autosegment, as shown in the analysis of the Copenhagen Rule in (2) above (see Goldsmith 1990, for the notion of autosegment; Clements and Keyser 1983 for the representation of *stød* as an autosegment), cannot link to a mora with an obstruent already specified with a laryngeal gesture of its own. In contrast to the moraic filter, I will refer to this general filter against the compatibility of obstruents with *stød*, but also with tone, as a *laryngeal filter*. In formal terms, there is not much of a difference whether *stød* is laryngealization or tone, but in terms of how Danish intonation works, or even in terms of the independent phonetic realization of intonation and *stød*, it does. Reformulating the tonal filter in Itô and Mester (2015) as a laryngeal filter is, therefore, unavoidable. Moreover, it is also a logical necessity to consider the laryngeal filter a matter of segmental incompatibility and not a matter of moraic impossibility, as in the case of the rival moraic filter, which is something the Heavy Syllable Model does not recognize as an absolute condition in Danish. From a logical point of view, a segmental laryngeal filter makes the HS-model of the Danish syllable compatible with the Non-*Stød* Model and its overall philosophy (Basbøll 1998; 2005; 2014).

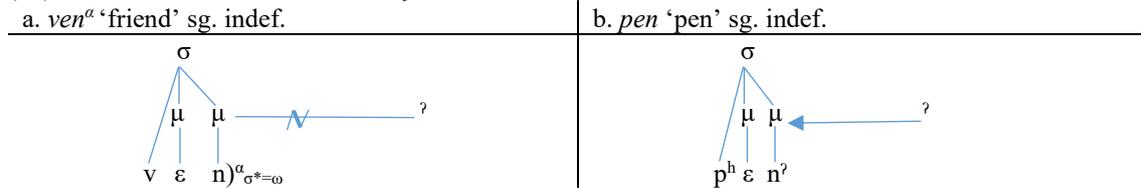
(28) *Laryngeal filters against laryngeal prosodies (tone or laryngealization) in moras with obstruents*



As far as I know, Itô and Mester (2015) provide no alternative account of the lack of *stød* in word-final sonorant words like *son*, *ven*, *tal* and many others, or whether those sonorants should be parsed with a mora

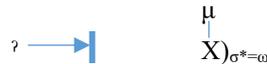
or not. However, if all Danish stressed syllables are heavy in the HS-model, there are no syllabic differences between *ven* and *pen*, and once again, the contrastive absence of *stød* in *ven* calls for an alternative explanation to the extra-prosodic account provided by Basbøll (2005). How to explain the lack of *stød* in words like *tal* is, in all fairness, still an open issue. My proposal is that the lack of *stød* in these words is the effect of a lexically composite filter in which two independent conditions have joined forces: (i) the finality condition against having the right edge of a stressed syllable coincide with the right edge of a minimal prosodic word, and (ii) the simple filter against having *stød*. In addition, this conjoint condition must be indexed, here with a superscripted alpha, to be applied to a limited set of words in the lexicon, since otherwise a word-final coda should have *stød*, as shown by *pen*, *land*, *mand*, *vand*, *sild* and many more.

(29) *Lexical contrast between word-final sonorants with and without stød*



The filter that precludes *stød* from appearing in a word-final sonorant in a lexically marked group of words has the same effect as the laryngeal filter in (28) above. They are segmental filters which do not let syllabification be altered by the particulars of the *stød* pattern.

(30) *Constraint against right-edge coincidence of stressed syllable and prosodic word plus constraint against stød*



To the extent that the finality condition is the optimality-theoretic equivalent of extra-prosodicity, there is a similar degree of stipulation in the way the two competing models handle the contrast of *stød* in sonorant-final monosyllables. To the extent that the amount of stipulation is equivalent in both models, nothing can be concluded only from the study of this restricted set of words. Relevant evidence for the HS- or the LS-model must come from other areas of the grammar of Danish, where the verdict, as shown in Sections 3-5, is favorable to the main claim of the Heavy Syllable Model. In my mind, the evidence provided in Sections 3-5 was clear enough as to be decisive, while the evidence provided by *stød* is insufficient to close the matter on its own.

**7. Conclusions**

This paper claims that the Danish syllable is shaped by the same conditions that are active in the other Scandinavian languages, both the Insular group comprising Icelandic and Faroese, and the Continental, comprising Norwegian and Swedish, the latter together with Danish. In this light, a defining prosodic feature of the Scandinavian subfamily, also known as North Germanic, is that stressed syllables behave like the strict complementary length type, fully compliant with Prokosch’s Law that all stressed syllables are heavy. In such languages, the length of vowels and consonants is interdependent, such that if the vowel is long, the consonant must be short, or non-moraic, while if the vowel is short, the consonant must be moraic. If Danish is to be included in this group, all coda consonants following a stressed short vowel must be parsed with a mora, thus making all stressed syllables necessarily heavy. Satisfaction of this condition that all stressed syllables be heavy, nevertheless, clashes with a metrical interpretation of the *stød*-basis, which requires that short vowels followed by obstruents be prosodically light and monomoraic. This conflict has forced some linguists to take the opposite view that not all stressed syllables in Danish are heavy and the more radical stand that obstruents are never moraic in the language. The situation then is whether to parse the “t” of *kat* as moraic, like in all Scandinavian languages, or non-moraic, which will make Danish the

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only Scandinavian exception to the complementary length type. My contention is that the “t” of *kat* must be parsed with a mora after all. The reasons to do so are what this paper is about.

Before comparing the two models, one must show that the alternative HS-model is also compatible with the most authoritative grammar of *stød*, used by the mainstream LS-model (Basbøll 2005; 2014). The two amendments needed are, first, to substitute the laryngeal filter (28) for the moraic filter against obstruents ever being moraic (19), and second, to prevent *stød* in words like *ven* or *tal* by means of a conjoint filter against *stød* and the coincidence of the right edges of a stressed syllable and the end of a prosodic word (30). To the extent that these two amendments do not incur any theoretical cost with respect to the mainstream *stød* grammar, the adequacy of the two competing models must be assessed in other areas of the phonological system, like phonetic interpretation, phonological contrasts, distributional restrictions, or morphological alternations, among others.

The analysis of the phonetic content of moras does not provide any support to the mainstream LS-model, since there is no systematic contrast of phonetic duration between consonants with *stød*, which must be moraic, and consonants without *stød*, which are the ones that could but need not be parsed without a mora (Grønnum and Basbøll 2001). If anything, the phonetic evidence is favorable to the HS-model, where no phonetic duration contrasts are expected between different types of consonants, which are moraic or non-moraic under the same conditions in every environment, regardless of the major class the consonant belongs to. The lack of phonological contrasts between long and short consonants in Danish also speaks for the HS-model. In any case, the arguments coming from phonetic realism and phonological contrasts are arguably weak or at least not sufficiently strong as to conclusively tip the balance to the side of the HS-model. For instance, lack of phonetic duration contrasts between moraic and moraicless can be justified if moras are understood in purely abstract terms, supported by theory internal consistency.

The stronger evidence favoring the HS-model over the LS counterpart comes from the analysis of phonotactics and morphological alternations, since in those two respects the predictions of the two models are clearly different and can easily be tested against the empirical evidence. Phonotactically speaking, the most decisive argument is that all consonants behave the same way when examining the interdependence between vowel length and size of coda cluster. The symmetry observed for all types of consonant cluster can only make sense if obstruents and sonorants are moraic in the same circumstances and under the same set of premises. In the analysis of morphological alternations, similarly, there are several regularities which are only accounted for if obstruents can be moraic. This is quite clear whenever new codas are created by the addition of the suffix “t” to adjectival and verbal bases. When “t” is added to roots with long vowels ending in a non-coronal obstruent, the length of the vowel cannot be maintained in front of the complex cluster and necessarily shortens. How can we explain this automatic process of vowel shortening if not as the effect of accommodating the non-coronal consonant, sonorant or obstruent, in the second mora?

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