Dutch Schwa in Moraic Phonology

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1. *Abstract*[1]

The dual purpose of this paper is to demonstrate that surface and initial syllabification may be rather different, and to present a strong case of a weightless vowel. More specifically, I will show that Dutch schwa, a vowel that, much as in other languages, cannot take stress, behaves as if it does not head a syllable at the early phonological level where filters on segment distribution take effect. I will show that moraic phonology, in combination with a level-ordered lexicon (Kiparsky 1982), captures this situation quite well. In moraic phonology (Hyman 1985, McCarthy and Prince 1986, Hayes 1989) unstressable vowels potentially contrast with stressable vowels in lexical representation by non-association with a mora. Since *weightless* vowels cannot head a syllable in initial syllabification, they are necessarily stressless. Here I will show the relevance of this approach for Dutch. Not only does it account for Dutch schwa being unstressable, it also straightforwardly solves the descriptive problem of schwa's co-occurrence with syllable-end in filters governing segment distribution.

2. *Dutch schwa: The descriptive problems*

2.1 *The bimoraic minimum*

Dutch vowels can be categorized in four groups:

(1) a. *Short vowels* /ɑ/, /ɛ/, /ɔ/, /oe/, /ɪ/
b. *Long vowels*[2] /a/, /e/, /o/, /ø/, /i/, /y/, /u/
c. *Diphthongs* /ɑu/, /ɛi/, /oey/
d. *Schwa* /ə/

Crucially, the distinction between (1a) and (1b,c) is one of quantity, not one of lax versus tense. This is clear from the equivalence of a long vowel to a short vowel plus a consonant: *dɑmp* 'vapor', but not **damp*, **dɑump*, or **dɑrmp* (Moulton 1962). I follow moraic theory in lexically representing vowel quantity pre-associated moras. That is, short vowels are lexically monomoraic (2a), whereas long vowels (2b) and diphthongs (2b) are bimoraic:

(2)a. μ b. μ μ c. μ μ
| \ / | |
V V V_i V_j

Now what about Dutch schwa? Clearly, (2) states that schwa is not a short vowel, but a vowel in a category on its own. The reason is that if schwa were a true short vowel, it could not occur in open syllables (Moulton 1962, Trommelen 1983, Van der Hulst 1984). I will now summarize the evidence for this below.

First, short vowels (3a) cannot occur word-finally, whereas long vowels (3b) and diphthongs (3c) can:

(3)a.	*tɑksI	b. tɑksi	'taxi'	c. bʌy	'rain shower'
	*slɛ	sle	'sledge'	χalɛi	'galley'
	*mikɑ	mika	'mica'	kenɑu	(name)

Second, the complementary observation that short vowels (4a) cannot occur in hiatus (in prevocalic position), while long vowels (4b) and diphthongs can (4c), is illustrated below:

(4)a.	*hI.at	b. hi.at	'hiatus'	c. vɛi.ɑnt	'enemy'
	*krɛ.ol	kre.ol	'Creole'		
	*mɑ.ori	ma.ori	'Maori'		

Third, single intervocalic consonants after short vowels are claimed to be *ambisyllabic* by Van der Hulst (1985); these are indicated by preceding hyphens in (5):

(5)a. mɑ-sa 'mass' b. di.lɛ-ma 'dilemma'

The generalization, then, is that short vowels *cannot occur in open syllables*. This observation has been at the root of analyses of Dutch syllable structure (Trommelen 1983, Van der Hulst 1984, 1985, Kager & Zonneveld 1986). One way of formalizing this observation is to ensure that syllables are minimally bimoraic, so that syllables minimally contain a short vowel plus consonant, a long vowel, or a diphthong. In line with this view, I will assume a filter ruling out monomoraic syllables after initial syllabification.

(6)**Bimoraic Constraint**
Syllables dominate at least two morae.

But now notice that schwa, although phonetically short, seems to escape from the effects of this filter. Minimal pairs showing this are in (7):

(7)a.	mika 'mica'	b. *mikɑ	c. mikə (name)
	hIndi 'Hindi'	*hIndI	hIndə 'hind'

Crucially, the absence of short vowels in final position cannot be explained by their obligatory reduction to schwa. This is because final syllables never reduce in Dutch, and moreover, vowel reduction to schwa is an optional process (Kager 1989). This leads to me formulate schwa's first property as (8) below:

(8) *Property 1*
Schwa can occur in open syllables, unlike short vowels.

My tentative interpretation of (8) is that schwa does not head a syllable at the level where filters on syllable structure (here, the Bimoraic Constraint) take effect. Further evidence for this view comes from the highly interesting syllabification behavior of consonants preceding schwa, to which I will now turn.

2.2 *Schwa behaves as if always preceded by a syllable break*

In this section, I will discuss the distributional evidence for a syllable boundary preceding schwa in a 'deeper' level of the phonology. The exposition will be brief since all of this, unless indicated otherwise, has been discussed earlier in Kager & Zonneveld (1986).

I stress that the distributional generalizations to be discussed are *abstract* in the sense that they are not matched by schwa's surface syllabification, which involves onset binding, much like that of ordinary vowels. How do we know it is? First, from speakers intuitions:

(9)a. va.dɔ̀r 'father' b. kwɑr.tɔ̀l 'quayle' c. rɑs.tɔ̀r 'grid'

Second, at least one rule, Final Devoicing, refers to surface syllabification:

(10) [-son] -> [-vd] / ___]σ

(11) a. /mud/-> [mut] 'courage' b. /mud+ɔχ/ -/-> *[mutɔχ] 'courageous'

Interestingly, this rule has been argued to be a word level by Booij & Rubach (1987), i.e. rule assigned to the last stratum of the lexical phonology. The relevance of this point will become clear later.

I will now turn to the evidence for schwa's 'abstract' syllabification. To start out, consonants and consonant clusters before schwa behave as if at syllable end, as opposed to consonants and consonant clusters before full vowels:

(12) *Property 2*
/h/, /ηχ/, and diphthong plus /r/ are excluded before schwa, as well as syllable-finally, whereas they may occur before full vowels (Kager & Zonneveld 1986).

This is illustrated below, where dots indicate *surface* syllable breaks (which, in the starred cases, I will assume to be analogous to surface syllable breaks in words with full vowels).

(13)a. σ[hV	b.	σ[hɔ	c. h]$_{Wd}$	d. h]σ
a.bra.hɑm 'Abraham'		*a.bra.hɔm	*a.brah	*a.brah.ma
(14)a. V_iV_j σ[r V	b.	V_iV_j σ[r ɔ	c. V_iV_j r]$_{Wd}$	d. V_iV_j r]σ
ɑu.ro.ra 'Aurora'		*ɑu.rɔ	*ɑur	*ɑur.ma
(15)a. η σ[χ V	b.	η σ[χ ɔ	c. ηχ]$_{Wd}$	d. ηχ]σ
ɑη.χo.ra 'Angora'		*ɑη.χɔl	*ɑηχ	*ɑηχ.ka

The mirror image case of Property 2 is below:

(16) *Property 3*
/η/ may occur before schwa, as well as syllable-finally, whereas it is excluded before full vowels (Kager & Zonneveld 1986).

(17)a.	b.		c.	d.	
σ[ŋV	σ[ŋə		Vŋ]Wd	Vŋ]σ	
*ɑ–ŋo.ra	ɑ–ŋəl	'sting'	wɑŋ	'cheek'	ɑŋ.χo.ra	'Angora'

Properties 2, 3 can be formulated in a maximally general way in the form of the filters (18), if the consonant clusters preceding schwa are treated as part of the preceding syllable at the level in the phonology where these filters take effect:

(18) *Distributional Filters*

a. *h / ___]σ

b. *V_iV_j r / ___]σ

c. *ŋχ / ___]σ

d. *ŋ / σ[___

Schwa patterns with syllable boundary once more in Property 4:

(19) *Property 4*
Consonant clusters before schwa cannot consist of a complex onset (obstruent plus liquid), as if they were syllable-final (Kager 1989).

(20)a.		b.	c.
ka.trɔl	'pulley'	*ka.trəl	*katr
dy.plo	'duplicate'	*dy.plə	*dypl
ze.bra	'zebra'	*ze.brə	*zebr

Observing that all of (20c) are independently excluded by the sonority law, Kager & Zonneveld (1986) make the much stronger claim that any clusters of rising sonority are excluded before schwa. However, a number of words, as well as the productive Level 1 suffix *-Ismə*, refute this. All of these contain consonant sequences of rising sonority which, however, never function as complex onsets:

(21)	draχ.mə	'drachma'	ariɑt.nə	'Ariadne'	boet.lər 'butler'
	rIt.mə	'rhythm'	dɑf.nə	'Daphne'	frɑn.jə 'fringe'
	kybIs.mə	'cubism'	pɑrt.nər	'partner'	tɑr.wə 'wheat'
	ɔrχas.mə	'orgasm'	ɔrt.nər	'file'	rapɑl.jə 'rabble'

So far I have been concerned with schwa's behavior as syllable end in segment distribution. But schwa also patterns with syllable end in a rule optionally epenthesizing a vowel of schwa-like quality, but of much shorter duration (indicated by '^' in 23):

(22) *Property 5*
Consonant clusters before schwa undergo epenthesis, as if they were syllable-final (Berendsen & Zonneveld 1984).

(23)a.		b.		c.	
hɛl^m	'helmet'	hɛl^mər	(name)	hɛl.ma	(name)
dɔl^k	'dagger'	bɔl^kə	(name)	pɔl.ka	'polka'
zɑl^f	'ointment'	ɑl^fən	(place)	ɑl.fa	'alpha'
hɑr^p	'harp'	kɑr^pər	'carp'	hɑr.pun	'harpoon'
kɛr^k	'church'	kɛr^kər	'dungeon'	kɑr.kɑs	'carcass'
wɑr^m	'warm'	mɑr^mər	'marble'	mɑr.mɔt	'marmot'

Again, a syllable break before schwa would allow formulating a generalizing rule, cf. Epenthesis (24)[3]:

(24) ***Epenthesis***

$\varnothing$ -> ^ / liquid ___ C $]_\sigma$

Where C is a nondental consonant

The final piece of evidence for an abstract syllable boundary before schwa comes from non-standard Dutch dialects discussed in Stroop (1981):

(25) *Property 6*
In some Dutch dialects, /sp/ is metathesized at syllable end and before schwa (but not before full vowels) (Stroop 1981)

a.	wɛsp	->	wɛps	'wasp'
b.	mIs.pəl	->	mIp.səl	'medlar'
c.	αs.pi.ri.nə	-/->	*αp.si.ri.nə	'Aspirin'

The conclusion from properties 2 through 6 above is that consonant clusters before schwa behave as if they were syllable-final. This conclusion fully matches my earlier speculation, that schwa is not the head of a syllable in initial syllabification. Schwa's rejection of preceding consonants (i.e. onsets) points to its defectiveness as a head of a syllable in initial syllabification. This conclusion is strengthened further by evidence from stress, to be discussed below.

2.3 *Schwa's stress properties*

Schwa's most 'prominent' property is the one below:

(26) *Property 7*
Schwa is stressless.

This property clearly supports the conclusion reached so far, that schwa is a defective syllable head. Stress being a property of syllables, it cannot be assigned to an element that does not define syllable structure. The most interesting stress property of schwa, however, is that it forces stress to the syllable immediately preceding it, under conditions to be specified below. Before doing so, I have to discuss some generalizations about stress in words without schwa.

Dutch word stress is both bounded (stress being restricted to the last three syllables of words) and quantity-sensitive (stress cannot be antepenultimate if the penult is closed) (Van der Hulst 1984, Kager 1989).

(27) *Dutch nonfinal stress*
a. If the penultimate syllable is closed, it is stressed.
b. If the penultimate syllable is open, stress is either on the penultimate or on the antepenultimate syllable.

(28)a. pi.já.ma	'pyjamas'	b. a.χén.da	'agenda'	c. ma.rɔ́-ko	'Morocco'
spi.ná.zi	'spinach'	e.lék.tron	'electron'	ma.kɑ́-sɑr	'Macassar'
a.ró.ma	'aroma'	a.ɔ́r.ta	'aorta'	spa.gé–ti	'spaghetti'
d. á.li.bi	'alibi'	e. *á.χɛn.da		f. *má.rɔ-ko	
mí.ka.do	'mikado'	*é.lɛk.tron		*má.kɑ–sɑr	
á.na.nɑs	'pineapple'	*á.ɔr.ta		*spá.gɛ–ti	

Basically, Dutch stress is bounded, left-dominant, and quantity-sensitive (to the distinction between open and closed syllables). The lexical variation between (28a) and (28d) may be analysed by lexical stress marking on the final syllable of (28d), plus 'unmarked' syllable extrametricality for the End Rule (cf. Kager 1989). As is clear from (28c,f), intervocalic consonants after short vowels close the preceding syllable for the purposes of stress, supporting the Bimoraic Minimum.

Words with final syllable schwa add an interesting further limitation on the position of stress. Stress is always prefinal if a consonant precedes schwa:

(29) *Property 8*
If the penultimate syllable preceding schwa is open, then:
a. If schwa is preceded by one or more consonants, stress is on the penultimate syllable (Kager & Zonneveld 1986).
b. If schwa is not preceded by consonants, stress is either on the penultimate or the antepenultimate syllable (Kager 1989).

(30)a. $X.C_0V:.C\partial$		b. $X.C_0VC.C\partial$		c. $X.C_0V.C\partial$	
ka.lí.bər	'calibre'	a.pós.təl	'apostle'	ko.lɔ́-nə	'column'
pa.pá.vər	'poppy'	ka.lén.dər	'calendar'	e.tɑ́–pə	'stage'
fy.ró.rə	'furore'	ro.tɔ́n.də	'roundabout'	pɑn.tɔ́-fəl	'slipper'
d. *ká.li.bər		e. *á.pɔs.təl		f. *kó.lɔ–nə	
*pá.pa.vər		*ká.lɛn.dər		*é.tɑ–pə	
*fý.ro.rə		*ró.tɔn.də		*pán.tɔ–fəl	

(31)a. a.lɛk.sɑn.drí.ə 'Alexandria' b. tɛ́–ri.ər 'terrier'
fa.ri.zé.ər 'Pharisee' bɛ́l.χi.ə 'Belgium'

More evidence for Property 8 comes from Latin and Greek loans with originally antepenultimate stress, whose final syllable's vowel is realized as schwa in Dutch. Such words tend to be realized with penultimate stress, regularizing them with respect to Property 8:

(32)	ka.ta.ló.χəs	(katáloχoes)	'catalogue'
	nɔr.ma.lí.tər	(nɔrmálitɛr)	'normally'
	no.tý.lən	(nótylən)	'minutes'

Again, the contrast between (30) and (31) shows that consonants before schwa behave as if they close the preceding syllable, supporting the hypothesis that schwa is a defective syllable head in initial syllabification.

3. *Ruling out alternative accounts*

Before I will develop my analysis, I will rule out four alternative accounts of the phenomena discussed so far. All of these accounts are, in one way or another, based on the idea that schwa is ineligible to function as a syllable head.

One analysis, one actually proposed in Kager & Zonneveld (1986), puts Dutch schwa (plus any consonants following it) in a word 'appendix' optionally added at the righthand word margin. An appendix is an instance of the more general notion of extraprosodicity (Hayes 1981): rules of stress assignment and syllabification may ignore peripheral elements (consonants, syllables, etc.).

Schwa's appendix position, outside an actual rime, leaves it incapable of binding an onset, thereby forcing any preceding consonants back to the penultimate syllable. Essentially, schwa's stresslessness follows from its extrametrical position, and all of its other properties from the leftward syllabification of consonants before it.

However, this analysis does not extend to schwa in nonfinal syllables, thereby missing the generalization that word-internal schwa, as far as is clear from the available data, shares all the properties of final syllable schwa. For example, word-internal schwa cannot be stressed; also, word-internal schwa matches properties 2-4, and 7:

(33)a. It cannot be preceded by /h/, cf. te.he.rɑn or te.jə.rɑn 'Teheran', not *te.hə.rɑn;
b. It cannot be preceded by V_iV_j r, cf. *ɑu.rə.ra;
c. It can be preceded by /ŋ/, cf. hɛ-ŋə.lo (place name), ɑ-ŋə.loes 'Angelus';
d. It cannot be preceded by /ŋχ/, cf. *hɛŋ.χə.lo, *ɑŋ.χə.loes;
e. It cannot be preceded by complex onsets, cf. *he.trə.lo;
f. It cannot be stressed, cf. *hɛ-ŋə́.lo, *ɑ-ŋə́.loes

For various reasons, it is more difficult to find positive evidence for word-internal schwa obeying properties 1, 5, 6, and 8. With respect to schwa's occurring in open syllables, it would takes hiatus to show; however, a Level 1 rule deletes schwa before vowels (/kodə+er/ => [koder] 'to encode'). Unfortunately, hardly any words occur relevant to properties 5 (epenthesis) and 6 (metathesis). Finally, it would take pre-antepenultimate stress to falsify Property 8, but stress can never be further to the left than the antepenultimate anyway, once more depriving us of relevant examples.

Clearly, an appendix analysis of schwa is based on the idea that schwa's special behavior results from its being (near) peripheral. Since nonfinal schwa displays essentially the same special behavior, this analysis is on the wrong track.

Apart from its failure to extend to word-internal schwa, Kager & Zonneveld's 'schwappendix' is not a prosodic constituent, but rather a sequence of segments (schwa plus C_O). Thus it violates the 'single-element' requirement on extraprosodicity (cf. Hayes 1981). To the extent that this analysis leaves extraprosodicity unconstrained, it undermines the explanatory force of the notion.

A *second* analysis (proposed in recent work by Van der Hulst & Van Lit) is one based on schwa epenthesis. For example, epenthesis would function to break up otherwise unsyllabifiable consonant clusters of rising sonority:

(34) /kalɛndr/ -> [kalɛndər] 'calendar'

Schwa's stresslessness would now result from its being epenthesized only after stress assignment. The main problem for this analysis is unpredictability, since schwa does not always appear in contexts that otherwise could not be syllabified. Under this analysis, clusters of falling sonority (sonorant and obstruent) must be subject to one of three lexically governed options: (i) epenthesis in the cluster (35a), (ii) no epenthesis at all (35b), or (iii) epenthesis after the cluster (35c):

(35)	a.	hɑnds	'yarn'	b.	hɑns	(name)	c. hɑnzə	'Hansa'
		ɛrds	(brand)		vɛrs	'fresh'	travɛrsə	'traverse'
		χoeldt	(name)		boelt	'hunch'	koeltə	'cult'
		ɛlds	(name)		ɛls	(name)	ɛlsə	(name)

Clearly, even if a rule of schwa epenthesis could be formulated at all, it would require full lexical marking for both applicability and insertion site. Such a 'rule' would amount to a tacit acknowledgement of schwa's underlying presence.

A *third* analysis would be one based on late ambisyllabicity (Kahn 1976): as in English, consonants before stressless syllables become ambisyllabic at a superficial level (where ambisyllabicity would condition allophonic rules such as flapping):

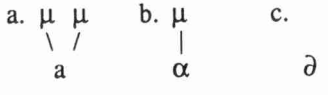
However, the problem with this analysis is circularity: I have shown that consonants preceding schwa must be part of the preceding syllable at an early level, so as to condition stress (cf. 29). Therefore stress depends on this 'backward' syllabification, so it cannot condition the required syllabification of consonants itself. Moreover, consonants and consonant clusters before stressless *full* vowels would be predicted to pattern in every aspect identically to those before schwa, which is false.

The *fourth* option, that of deriving schwa by vowel reduction, is also ruled out for Dutch, since as has been observed above, vowel reduction is optional, and restricted to nonfinal syllables (cf. Kager 1989).

This raises the question of how to represent the inherent stresslessness and mysterious syllabification behavior of Dutch schwa.

4. *Dutch schwa in moraic theory: the weightless vowel*

Moraic theory (Hyman 1985, McCarthy & Prince 1986, Hayes 1989) offers an interesting change of perspective of Dutch schwa's syllabification properties. I hypothesize that the key to schwa's mysterious behavior is its lacking a weight element - a mora - in lexical representation (37c), where long vowels have two (37a), and short vowels have one (37b):

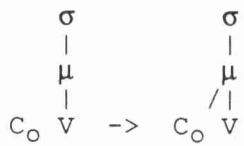


I will show that this assumption suffices to explain all of schwa's properties discussed above, given a model of the phonology in which initial syllabification

and surface syllabification may diverge. Before showing this, I will first review some theoretical assumptions.

First, syllable onsets are weightless because of their being adjoined under the first mora (Hyman 1985), not under the syllable node (Hayes 1989):

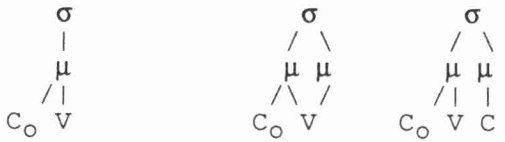
(38) ***Onset Formation***



This rules expresses that it takes weight to create an onset, something which I will show to be crucial in the case of Dutch schwa.

Second, a light syllable contains one mora, a heavy syllable two:

(39) a. *Light syllable* b. *Heavy syllables*



Third, in languages such as (39) where both long voweled syllables and closed syllables are heavy, the second mora in closed syllables is assigned by (40):

(40) ***Weight-by-position***

The only assumption I have to make in addition to schwa's weightlessness is that of a level-ordered lexicon (cf. Kiparsky 1982 for English, and Kager 1989, Trommelen & Zonneveld 1989 for Dutch) involving a differentiation of stages of syllabification across two levels: initial syllabification resides at Level 1, resyllabification at Level 2.

I assume 'stress-governing' affixation to take place at Level 1, together with initial syllabification, the distributional filters (18), the Bimoraic Constraint (6), and word-stress asignment. As word stress refers to syllable closure, initial syllabification must be as early as Level 1. It involves the following steps:

(42) ***Initial Syllabification*** (Level 1)

a. ***Nucleus Formation***
Syllabify moras, and apply Weight-by-Position (40)

b. ***Onset Formation*** (38)

c. ***Coda Formation***
Adjoin a stray consonant to the right edge of a syllable, forming σ'.

Interestingly, Weight-by-Position takes precedence over Onset Formation in Dutch, because of the Bimoraic Constraint (6). Intervocalic consonants following short vowels (5) will thus be syllabified backward, and reach their surface (ambisyllabic?) position only by Level 2 resyllabification. This makes possible an account of an otherwise mysterious property. Dutch has complex onsets consisting of a string of obstruent-liquid (Trommelen 1983). Van der Hulst (1985) observes that these strings cannot follow a *short* vowel[4]:

(44)

a.			b.		c.
zebra	'zebra'		*zɛbra		* σ σ
makro	'macro'		*mɑkro		/ \ / \
lepra	'leprosy'		*lɛpra		μ μ μ μ
kobra	'cobra'		*kɔbra		/\ \ /\ /
dyplo	'duplicate'		*doeplo		z ɛ b r a

As shown in (44c), the Bimoraic Constraint forces the first consonant in a cluster after a short vowel into the core syllable, by Weight-by-Position. The second consonant fills the onset of the following syllable. To account for this, I propose the Complex Onset Condition (45), which excludes sequences of obstruent-liquid that are outside the core syllable, i.e. do not form complex onsets.

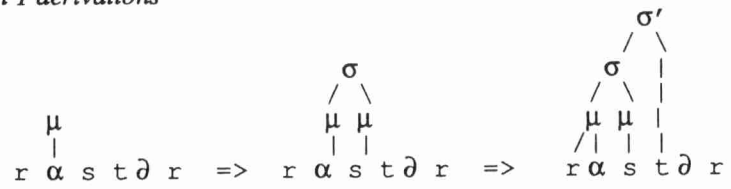
(45) **Complex Onset Condition** (Level 1)

$$\begin{matrix} *C & C \\ [-son] & \left[\begin{matrix} +son \\ +cont \end{matrix}\right] \end{matrix}$$ outside the core syllable

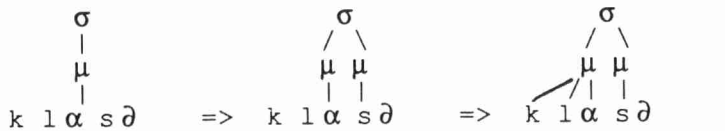
Initial syllabification proceeds in the following way:

(46) *Level 1 derivations*

a.



b.



Notice that consonants before schwa are syllabified with the preceding syllable, since the structural description of Onset Formation is not matched. Onset binding

being the prerogative of weighted vowels, weightless schwa clearly fails in this respect.

Level 2 is where 'stress-neutral' affixation and compounding take place, while its phonology includes Resyllabification (47) and Final Devoicing (10).

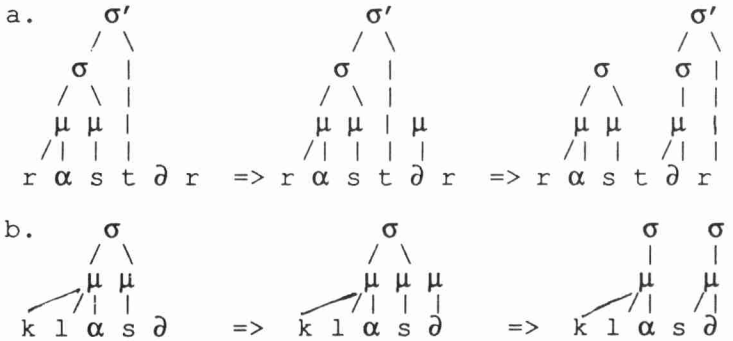
(47) *Resyllabification* (Level 2)

a. Moraify schwa

b. Reapply (42bc)

Crucially, Onset Formation reapplies at Level 2 to establish the surface onset position of pre-schwa consonants, protecting these from Final Devoicing (10), which applies as late as Level 2 (or at Word Level, in the terminology of Booij & Rubach 1987). After Onset Formation, Coda Formation adjoins any stray consonants following schwa. It proceeds as below:

(48) *Level 2 derivations*



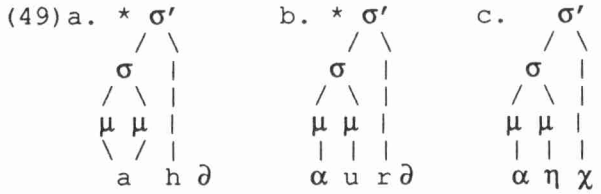
Phonological *surface* ambisyllabicity of pre-schwa consonants, much as that of intervocalic consonants after short vowels (cf. Van der Hulst 1985), is not entirely clear. Speakers, when asked to slowly syllabify such words, tend to prefer [di.lɛ.ma] and [klɑ.sə] over [di.lɛm.ma] and [klɑs.sə]. I will leave this matter open here, noting that both syllabifications could be derived by Level 2 Onset Formation. In (48), Resyllabification erases associations established at Level 1. This mode is called for if intervocalic consonants after short vowels are tautosyllabic with the following vowel at the surface. Alternatively, if the surface ambisyllabicity of such consonants could be shown, resyllabification would merely add associations to those established at level 1. Either way, this would not affect my proposal.

5. *Accounting for schwa's properties*

I will now show that schwa's moraic weightlessness correctly predicts its initial syllabification, as well as its stress behavior. Schwa is invisible to syllabification at Level 1, and is syllabified only at Level 2. It follows that schwa (i) cannot attract onset consonants, (ii) cannot receive stress, and that (iii) consonants before schwa syllabify to the preceding syllable, which becomes closed.

Property 1 (schwa can occur in open syllables) is explained by schwa being syllabified as late as Level 1, and its resulting exemption from the Bimoraic Constraint, which takes effect only at Level 1.

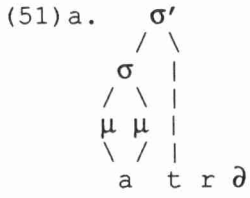
Properties 2-3 (the distributional filters) follow from the syllabification of consonants before schwa with the preceding syllable by Weight-by-Position (40) and Coda Formation (42c). As a result, these consonants are subject to filters on syllable-final material (18):



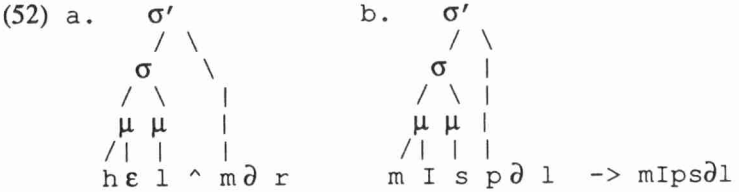
To account for the complementary distribution of /ɳ/ and /ɳχ/ (the former occurring syllable-finally and before schwa, the latter before full vowels) I assume the velar nasal /ɳ/ to derive from an underlying cluster /ɳχ/[5] by a rule deleting the velar fricative syllable-finally:

(50) χ => Ø / ɳ ___]σ

Property 4 (ban on 'complex onsets' before schwa) follows from the Complex Onset Condition (45), as schwa does not head a syllable at Level 1, which is necessary for an obstruent-liquid sequence to adjoin to:



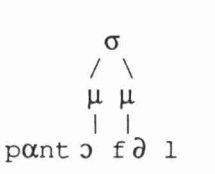
Properties 5-6 (epenthesis, metathesis) follow from similar structures:



As shown before, Property 7 (schwa is stressless) follows from schwa's weightlessness, resulting in failure to head a syllable, so that it cannot receive word stress at Level 1.

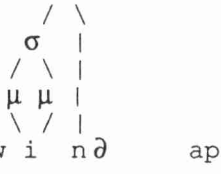
Finally, the interesting stress property 8 (stress is directly before schwa if a consonant precedes) also follows from the syllabification of consonants before schwa, closing the penult, which cannot be skipped over by the stress rule.

(53) a.



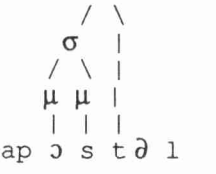
(closed)

b.



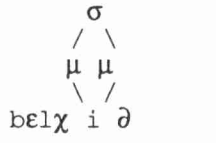
(closed)

c.



(closed)

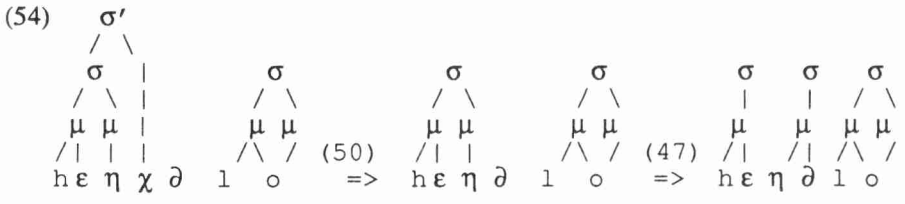
d.



(open)

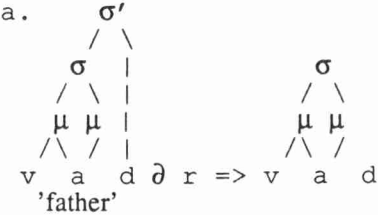
This analysis improves over Kager & Zonneveld (1986) by extending to nonfinal schwa, see (53):

(54)



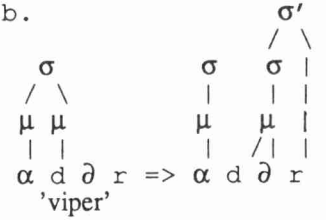
As pointed out earlier, the phonological evidence for surface onset position of consonants before schwa is in the rule of Final Devoicing (10). Level 2 Resyllabification accounts for this, bleeding Final Devoicing:

(55) a.



'father'

b.



'viper'

Notice that segments can remain unsyllabified at Level 1, to be syllabified only at Level 2. This analysis therefore deviates from proposals such as Itô (1986), where it is claimed that the output of every cycle (hence, of every lexical stratum) is exhaustively syllabified (but see Hayes 1988, Levin 1989, and Kager 1989 for arguments for non-exhaustive prosodic parsing based on footing rules).

6. *Conclusions*

Summarizing, I have accounted for a variety of distributional properties of Dutch schwa by assuming moraic weightlessness, thereby adducing evidence for moraic theory. Moraic theory provides an adequate way of representing vowels that are inherently stressless, and links this up with syllabification behavior. This analysis keeps within the general constraint that stress rules cannot have access to particular vowels (such as schwa). Finally, the analysis provides strong evidence for the potential abstractness of syllabification, distinguishing initial and surface syllabification.

Footnotes

1 I wish to thank Donca Steriade and Bruce Hayes for their valuable comments on an earlier version of this paper. Of course, all responsibility for errors is mine.
2 The distinction between 'truly long vowels' (/a/, /e/, /o/, /ø/, and 'semi-long vowels' /i/, /u/, /y/ (Moulton 1962) is irrelevant here.
3 See De Haas (1986) for an analysis of this process in the framework of Kager & Zonneveld (1986).
4 Some rare counterexamples are ɑk.ra 'Accra', bi.ɑf.ra 'Biafra'. Notice that words such as ɔs.lo 'Oslo', mɔs.lIm 'Moslem', ɑt.lɑs 'atlas' do not count as counterexamples, since no complex onsets such as /sl/, /tl/ occur in Dutch.
5 This position was taken earlier by Robinson (1972).

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