

# Feature Domains in Hellendoorn Dutch

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## 1 Introduction

Phonological features sometimes originate in a position which is less than ideal. If this happens, the misplaced features of the consonant will tend to move to a better position, or be deleted altogether.

On the other hand, allowing too many spreading and moving operations obscures the underlying structure and the morphological form of the words: if all features move to the phonologically ideal position, it would become hard to distinguish morphemes, or to find the boundaries of morphological and syntactic constituents.

The behaviour of misplaced phonological features thus represents a tension between the interaction between different factors: phonological wellformedness on the one hand, faithfulness to the input and respect for morphological and syntactic structure on the other. This is that is in the centre of interest for modern phonological theories that take into account output constraints, such as Optimality Theory.

In this article we present a case study of this phenomenon, based on the analysis of phenomena relating to nasal consonants in the Hellendoorn dialect of Dutch. We explain this way nasal consonants appear in a syllable rhyme, three things that happen to them: sometimes they disappear completely, leaving a trace of nasalization on the following vowel; sometimes they assimilate in place to an adjacent consonant; sometimes they transfer their nasality feature to an adjacent obstruent. We show that these processes can be understood in terms of phonological domains: the consonantal features of a syllable have to be in a syllable rhyme. The choice among the different options, on the other hand, is dictated by the wish to show the boundaries between morphemes and words as clearly as possible.

This article is structured in the following way:

- In section 2 we present the facts of Hellendoorn Dutch that need to be explained by a good theory of the phonology-morphology interaction.
- Section 3 gives an analysis of place assimilation of nasals.
- Section 4 formalizes this analysis in terms of Optimality Theory.
- Section 5 extends the analysis to nasalization, nasal deletion and opacity.
- Section 6 discusses what is superficially the most problematic aspect of the data at hand, viz. a case of opacity.
- The last section is devoted to a conclusion.

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<sup>1</sup> Hellendoorn Dutch is a Low Saxonian dialect of West Germanic, spoken in the Dutch province of Overijssel. Jan Nijen Twilhaar is a native speaker of this dialect.

## 2 The behaviour of nasals in Hellendoorn Dutch

In this section we discuss the forms of assimilation in Hellendoorn Dutch. We distinguish between two types of assimilation: (i), nasal consonants assimilating to preceding or following consonants in certain positions; (ii), voiced obstruents completely assimilating to a following nasal. The latter process superficially resembles the first: an obstruent almost always assimilates to a nasal which has an obstruent first. We will discuss these phenomena in turn. But before that, we discuss a phenomenon that bleeds the type of nasal assimilation we usually encounter: the preceding vowel.

### 2.1 Nasalization

In many languages, such as English (or, for that matter, Standard Dutch), nasalization occurs immediately following heterosyllabic consonants. For example, in English, the word *injection* is pronounced [ɪnˈdʒɛkʃən̩]. In Hellendoorn Dutch, however, this type of evidence for regression is lacking, because a vowel followed by a coronal nasal is always subject to nasalization, while the coronal nasal itself disappears. This is illustrated in (1):

- (1) [I]jectie                      injection  
       [ ]benul                      dimwit (on+benul, un+inkling )  
       [A]geven                     to hand an+geven, on+give )

We also find nasalization if the vowel+coronal nasal sequence is followed by another consonant:

- (2) daans: d[a ø]s                dance  
       (hee) daanst: d[a ø]st(he) dances

The environment for nasalization is the syllable (rhyme). When the nasal is in the onset of the following syllable, we do not find nasalization. Resyllabification occurs across word boundaries:

- (3) in april: [I]n apri:l            April  
       oneerlijk: [ ]neerli:k        (eerlijk = fair )  
       an alles: [A]n alles            everything

One of the pluralization suffixes of Hellendoorn Dutch is -(«)n (the other suffixes need not concern us here; cf. Nijen Twilhaar 1990). This suffix turns up when attached to a vowel-final stem, as is to be expected (4a). Interestingly, if the stem already contains a nasalised vowel, the suffix shows up as a coronal syllable. In these environments, the vowel is denasalized.

(4)	singular	plural	
a	r[Iø]	r[I ø]	deer(s)
	spr[ ø]	spr[ ø]	starling(s)
	vl[oø]	vl[oø ]	flea(s)
b	b[o ]	b[onn']	bill(s)
	m[A ]	m[ann']	man/men
	l[o ø]	l[oønn']	wage(s)

These facts seem to show that the deletion of the nasal consonant is replaced by nasalization of the vowel. There cannot be an independent rule of nasal deletion since this rule would incorrectly affect the plural of man as much as that of

## 2.2 Regressive place assimilation of nasals

Even though most potential cases of regressive assimilation are blocked by the presence of a nasal consonant in the rhyme after a vowel, there is still at least one case: the reduced form of the indefinite determiner. In Hellendoorn Dutch, we have three genders, each with its own determiner. The full forms of this article are distinguished: *n«n* (masculine), *n«* (feminine) and *«n* (neutral). Yet the reduced form, which is the same for all genders, viz. a syllabic nasal, when it meets a right environment, it is assimilated regressively to the consonant immediately preceding the nasal immediately.

### (5) Regressive nasal assimilation

[n']	doeve	a pidgeon
[M']	fietse	a bike
[ɫ']	jasse	a coat
[m']	bal	a ball

Regressive assimilation thus is not completely absent from Hellendoorn Dutch, but its effects are not as clearly visible as those of progressive assimilation to the indefinite determiner for independent reasons.

Interestingly, the reduced form of the masculine definite determiner is unaffected even though it sounds like a syllabic nasal as well. This nasal is however:

(6) Definite article den (with masculines)

[n`] man, boom, kope man, tree, head

### 2.3 Progressive place assimilation of nasals

The examples in (7) show that in each case the syllabic nasal is homorganic immediately preceding consonant. The category singular nouns contains nouns up from a root plus a class I suffix; there happen to be no underived words in Dutch which end in a syllabic nasal (cf. Nijen Twilhaar 1990: 71-72)

(7)

Verbs (infinitives, by stem + suffix -(«)n)	Derived nouns (suffix -(«)n)
loa[tn`]to let	boo[tn`]boats
roe[pm`] to call	ree[pm`] strips
w r[kN`] to work	bee[kN`] brooks
po[fm`]to roast	sto[fm`] substances
goo[jl`]to throw	buu[jl`] showers
Singular nouns	
	zei[sn`] scythe
	straam[pm`] wedge
	v r[kN`] pig

Examples such as the following seem to indicate that the domain of this assimilation is the syllable rhyme. Clusters which occur together in a syllable do not assimilate:

(8) k[n] rre old crone

Bruck[n]er

ramp[n]acht night of disaster (ramp disaster + nacht)  
 haek[n]oale crochet hook (haak crochet + noale hook)

loop [n]ie don t walk (loop walk + nie not )  
 w rk [n]ie don t work (w rk work + nie not )

There is no progressive assimilation of the syllabic nasal in the following

<sup>2</sup> Cf. Humbert (1997) for similar facts in a range of other languages.

- (9) loop [N'] keer                      walk once  
       w rk [n'] dag                      work a day  
       gooi [m'] bal                      throw a ball

The reason for this, informally speaking, is that we already have regressive nasal assimilation in a right environment is absent, which in fact implicates an incomplete determiner is not followed by a noun, nasal assimilation is progressive (10), without a right environment, in which the syllabic nasal after the same syllable as the immediately preceding consonant, with the forms in a right environment.

(10) Progressive nasal assimilation

- loo[pm']        walk a ...  
 w r [kN']      work a ...  
 goo[jɫ']        throw a ...

It is as if in these cases regressive assimilation (see above) takes precedence over progressive assimilation: we try to apply regressive assimilation first, and only subsequently apply progressive assimilation. In other words, it is as if the two processes are disjunctively ordered at the postlexical level.

In addition, progressive place assimilation seems to be subject to the following circumstances: in the examples in (11) the syllabic nasal is not homophonous with the immediately preceding consonant, in the examples in (12) it is.

- |              |          |              |        |
|--------------|----------|--------------|--------|
| (11) pa[kn'] | took     | (12) pa[kN'] | take   |
| la[xn']      | laughed  | la[xN']      | laugh  |
| sto[pn']     | stopped  | sto[pm']     | stop   |
| stra[fn']    | punished | stra[fM']    | punish |

This phenomenon is not restricted to the verbal category, or to derived forms. For instance the plurals a[kn'] certificates and li [fn'] elevators. I mention this here in order to avoid a cluster CtN of an obstruent C, a /t/ and syllabic nasal. The consonant /t/ in fact does not disappear in comparable clusters in which the following is not an obstruent. Compare for instance: poor[tn'] gates en plan[tn']

In forms such as the verbs in (11), however, the syllabic nasal is not homophonous with the immediately preceding consonant, /t/, and apparently not afterwards. The nasal is assimilated to the coronal /t/, not to the coronal stop. The nasal on the surface. We have to extrinsically order t-deletion before progressive assimilation to get the right result.

<sup>3</sup> Cf. Humbert (1997) for a similar process in Groningen Dutch.

<sup>4</sup> Some Frisian dialects distinguish between fricatives and stops (nasals tend not to do so even if they assimilate freely to the latter; cf. Visser 1997, Van Oostendorp in prep). Such a distinction in Hellendoorn.

In certain constructions we may see progressive and regressive assimilation at the same time. This results in sequences of nonhomorganic syllabic nasals, examples in (13), in which both progressive and regressive assimilation occur.

(13) de kat[n' m']bettien  
the cats a little

de kip[m' N']keer  
the chickens once

de rek[N' M'] v rfiën  
the shelves a coat

Somewhat more complex are the following examples, in which sequences of four nasals respectively.

(14) a. op de w [NN' m']bettien snee  
on the roads some snow

b. op de w [NN' n' n]acht snee  
on the roads the snow of one night

Note that in these examples the fricative /s/ of *weg* /wE~/ 'road' totally assimilates to the following syllabic nasal, a phenomenon which will be discussed now.

#### 2.4 Total assimilation of voiced obstruents and nasals

Compare the examples in (15) with those in (16).

ze[tn']	to put	(from /zE~/)	to pray	(from /bId/)
klo[pm']	to knock	(from /klo:p/)	to scrub	(from /sxrob/)
slo[fm']	to shuffle	(from /slo:f/)	to praise	(from /loøv/)
la[xN']	to laugh	(from /lax/)	to say	(from /zE~/)

(15) gives yet another set of examples of assimilation of nasal place to the following obstruent, i.e. progressive nasal assimilation. (16) in addition shows another type of assimilation, the assimilation of the obstruent to the following nasal. The phenomenon is not restricted to the onset of the obstruent. Compare the following plural nouns: *bi*[NN'] pigs, *vla*[NN'] flags, *drae*[MM'] ravens. We think that it is possible to analyse the behaviour of the obstruent in the same way. It can be seen as /dn/ underlyingly, which assimilates to the onset of the following nasal, (which means that (14b) even has five syllabic nasals).

(14) b . op de w [NN' nn' n]acht snee  
on the roads the snow of one night

One consonant somewhat mysteriously seems to duck out of the process:  
following examples:

(17) Verbs		Plural nouns	
bloa[zn']	to blow	deu[zn']	boxes
l [zn']	to read	loo[zn']	sheds

It is not clear to us why /z/ is an exception (while e.g. /d/ or /v/ are  
issues open for future research).

This processes, which we call regressive obstruent assimilation or  
a voiced obstruent and a following nasal if the nasal also assimilates  
consonant. For instance, underlying voiced obstruents do not assimilate

(18) bi[t n]og n keerpray once again  
schro[p n]og n ke~~s~~erub once again  
loo[f n]og n keepra~~s~~e once again  
ze[x n]og n keersay once again

Further, if a nasal assimilates progressively, we do not find regressive  
of the other consonant to the preceding nasal.

(19) bi[t N'] keer pray once  
schro[p N'] keer scrub once  
loo[f N'] keer praise once  
ze[x N'] keer say once

It thus looks as if application of obstruent assimilation is dependent  
nasal assimilation: regressive obstruent assimilation only applies to  
progressive nasal assimilation has applied first.

## 2.5 Rule ordering analysis of the Hellendoorn Dutch facts

In the above, along with the facts of Hellendoorn Dutch, we have provided  
of a rule-based analysis. It turns out that such a rule-based analysis  
requires quite a lot of extrinsic rule ordering:

- Nasalization has to be ordered before regressive nasal place assimila  
it;
- Regressive nasal assimilation and progressive nasal assimilation have  
disjunctively;

- T-deletion has to be extrinsically ordered after progressive nasal as opaque (counterfeeding) order;
- Regressive obstruent assimilation has to be extrinsically ordered after progressive nasal assimilation.

This dependence on rule ordering seems to constitute a serious problem for a theory such as Optimality Theory, which denies the existence of all sorts of rule ordering. In recent times, several mechanisms have been proposed which could potentially account for this instance, the opaque ordering of T-deletion and regressive voicing assimilation. One of the most popular among these undoubtedly is Sympathy Theory of McCarthy (1998), which could invoke one such theory to account for this type of effect.

Yet this does not solve all our problems. For instance, we have seen that the process of progressive nasal assimilation is restricted to a very small domain, while this is not true for regressive assimilation, which applies even to the same domain.

Furthermore, a rule based analysis has problems of its own. It can account for why regressive nasal assimilation would have a different domain than progressive nasal assimilation, or why the first rule is ordered before the second, rather than the other way around. It can formulate these things, but it does not provide us with a principled account of the nature of the interaction between various forms of assimilation.

We believe that it is possible to formulate a theory about the domain of assimilation processes which is sufficiently simple and intuitive and which can account for some of these questions. An upshot of this theory about domains is that neither rule ordering nor Sympathy Theory need to be invoked. The facts can be made to follow from a fairly classical version of Optimality Theory.

In the following two sections, we provide an analysis of the Hellendoorn Dutch facts along these lines. In section 3, we explain how the difference between progressive and regressive assimilation, and the relative ordering of the two rules, can follow from the assumption that phonological structure should mirror morphological structure as much as possible. In section 4 we then turn to the interaction of progressive nasal deletion, and the interaction of plural formation and nasal deletion and show how these facts can be made to follow from the interaction between the desire to make the phonological structure inherently well-formed, and to match it to the morphological structure in the most natural way.

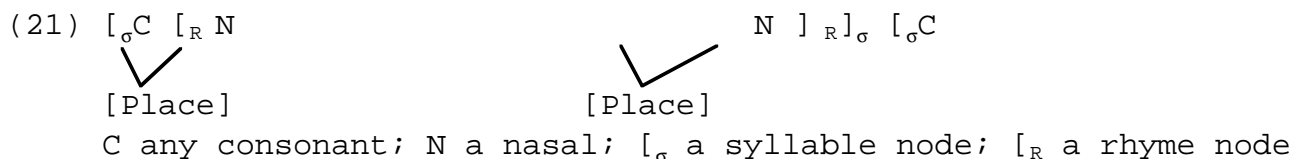
### *3. Progressive and regressive assimilation as a uniform process*

In a constraint-based analysis, it is of course no longer possible to describe both progressive and a regressive rule of assimilation, which are ordered in a way that makes them formally independent, which have a different type of domain. On the other hand, the fact that the two rules seem to conspire to achieve the following effect:

(20) ASSIMILATE: (Coronal) nasal consonants in the rhyme are assimilated to the preceding consonant.

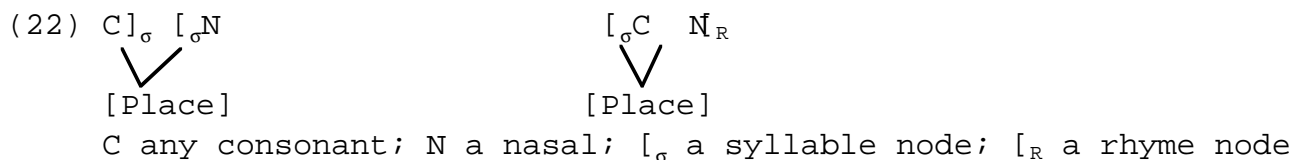


Conspiracies are the classical argument against a purely rule-based analysis (see, e.g. Hyman 1970). In this case it is a simple truth that surface forms always satisfy the WFC: a consonant in a rhyme position can only have its own, independent place of articulation, not adjacent to any other consonant. Since (coronal) nasal consonants do not occur in coda in Hellendoorn Dutch, they are always deleted in that position, leading to nasalization on the vowel. Thus, in actual practice, a restriction on the WFC in Hellendoorn Dutch. The following two possible structures are crucially in play in (20):



The lefthand structure gives us the result of progressive nasal assimilation, while the righthand structure is the result of regressive assimilation.

Acknowledging that the reason behind both progressive and regressive nasal assimilation is to achieve (20) at the surface, means that it is no longer sufficient to list the properties of these two processes. For instance, it has been claimed that progressive nasal assimilation is restricted to the domain of the syllable. This is necessary to explicitly state this fact. Progressive nasal assimilation would result in the following configuration:



The nasal would always be in an onset in cases like this. Therefore, (22) is not the driving force behind the process. And we may assume that in all configurations where regressive assimilation is not absolutely necessary, regressive assimilation is disallowed. In Hellendoorn Dutch, this is the case.

(23) WFC: Every (place) feature should be linked to exactly one segment

The structures in both (21) and (22) violate the WFC, but the structures in (21) are able to satisfy ASSIMILATE, and ranking ASSIMILATE > WFC in Optimality Theoretic terms therefore give us the required results. As for the structures in (22), they do not violate the WFC here (ASSIMILATE is not applicable), so that they are simply not the driving force behind the process.

The question arises, of course, whether the restriction to rhymal consonants makes sense. We believe that it does: it is well-known that the rhymal consonant in Hellendoorn Dutch is always a nasal.

<sup>5</sup> In other languages, (20) may be the driving force behind regressive assimilation to the extent that it is usually regressive assimilation to this position would then be due to the assimilation of an obstruent to an adjacent nasal in the rhyme is a logical impossibility. However, an intervening vowel in a wellformed syllable. It would be possible to assimilate pre-coda consonants, however (e.g. in a cluster [VCN], where C is a liquid). The issue with respect to the WFC in languages of the world is worthy to be explored.

position for consonantal material (or, in terms of moraic theory, that preferably not attached to a mora). In particular, this could be true for the syllable. ASSIMILATE could then be restated in the following way:

- (24) \*RHYME/CONSONANT: Consonantal place features should be linked to some feature outside the syllable rhyme.

The formula in (24) does not explain, why this constraint would mainly affect coronal consonants, or why it is always the place feature that originates from the syllable that survives, but answering these questions would lead us into the question as to why only underlyingly coronal nasals are affected, and not underlyingly labial ones (/bEs«mstEln`/ broom stick does not turn into /bEs«mstEln`/). We can simply assume that faithfulness to a coronal specification is weaker than faithfulness to a labial (or velar) specification, a quite natural assumption in our view.

- (25) IDENT(velar), IDENT (labial) " \*RHYME/CONSONANT " IDENT (coronal)

We are now ready to tackle another question, however, which is more central to the discussion, viz. the relative ordering of regressive versus progressive assimilation in a phonological context such as w rk [n`] dag work a day , involving a syllabic nasal. Both regressive and progressive assimilation in principle are possible, but which one actually occurs? regressive assimilation?

- (26) 
$$\begin{array}{c} [{}_{\sigma}C [{}_{R}N]_{R}]_{\sigma} [{}_{\sigma}C \\ \swarrow \searrow \\ [Place] \end{array}$$

It seems strange to say that syllabic domains are involved in this, because in such cases, the obstruent following the nasal is further away than the one preceding it. Furthermore, in many cases, Hellendoorn Dutch actually prefers progressive assimilation. These are the cases which involve a suffix -en or a stem extension.

- (27) lo[pm` k] nnen can walk (lopen walk , k nnen can )

These facts give us a clue about what may actually be going on in these cases. It is hard to think of a reason why the syllabic nasal assimilates to the coronal consonant in the same word rather than to one which is in a following syllable. We could say that the syllabic nasal assimilates to consonants which are as close to them as possible. This can be done in various ways, one of them being Alignment (cf. It and Mester 1996):

- (28) Alignment ( Crisp Edge )  
Association lines should not cross morphological (or syntactic) boundaries.

<sup>6</sup> See Humbert (1995) for some discussion.

In a regressively assimilated structure \*lo[pN` k] nnen a word boundary which would not be the case in lo[pm` k] nnen. This may be the reason structure is preferred. Presumably, also in the latter case a morphological boundary is crossed, viz. the one between the stem and the affix. Apparently, this violation is as fatal as crossing a word boundary. We thus have to respect morphological boundaries, for instance along the following lines:

(29) affix boundary < word boundary < syntactic boundary

Association lines prefer not to cross any boundaries at all; if they do, they still prefer the weaker boundaries over the stronger ones.

We can now turn to *w rk [n`] dag* 'work a day' and similar cases. It is controversial to assume that this phrase has approximately the following structure:

(30) [<sub>VP</sub> w rk [<sub>NP</sub> n` dag ]]

In other words, there is a major syntactic boundary between the verb and the noun which is absent between the determiner and the noun. Of course there is also a syntactic boundary between the latter two words in most grammatical contexts. It does not seem absurd to say that this is a weaker kind of boundary than a major syntactic boundary. We should thus refine (29) in the following way:

(31) affix boundary < word boundary within XP < XP boundary

The idea thus is that in structures such as *w rk [n`] dag* Hellendoorn there is a regressive rather than progressive assimilation, because this gives a better reflection of the morphosyntactic structure.

There are various ways of combining a constraint such as Crisp Edge with a hierarchy such as (31). One way would be to declare Crisp Edge a constraint which is stronger than a set of specific constraints Crisp(XP) " Crisp(word) " Crisp(affix) which would get this (possibly universal) ranking order. (Crisp(affix) is under consideration, in the remainder of this article, since it does not play a role in the analysis.)

As a matter of fact, syntactic XP boundaries possibly are never crossed in Hellendoorn Dutch at all. This we can conclude from facts such as the following:

(32) Hee lik [n`] aanderen man  
 He resembles a different man  
 He looks like a different man

In this example, the syllabic nasal cannot assimilate to the following vowel with a vowel. Apparently, it also does not assimilate to the preceding vowel which would have surfaced as [N`]).

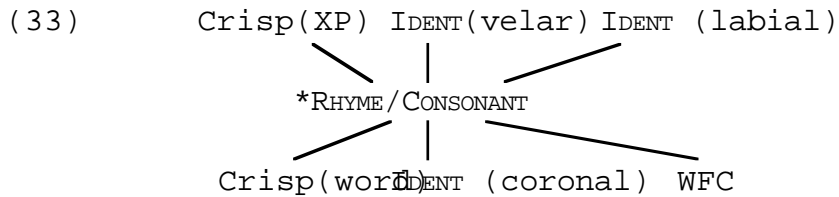
The facts with incomplete constructions (from (10)), repeated below somewhat mysterious:

- (10) Progressive nasal assimilation  
 loop m`walk a ...  
 w rk Nwork a ...  
 gooǰ ɫ`throw a ...

In these cases, the association line seems to cross the boundary between determiner indeed. We can assume that a determiner without a following project a full NP (or DP), but of course it is difficult to get any case the constructions in (10) do not count as grammatical or normal. hardly count as crucial evidence for anybody's theory.

#### 4. Progressive and regressive assimilation: OT analysis

We can now formalise the analysis in terms of constraint tableaux. We have established the following constraint ranking:



The fact that Crisp(XP) dominates \*RHYME/CONSONANT gives us that XP boundaries can be crossed; the fact that \*RHYME/CONSONANT dominates the other constraints gives us that the other boundaries can be crossed (albeit only minimal is dominated by \*RHYME/CONSONANT, finally, implies that we only find assimilation cases where this is necessary (in particular, with syllabic nasals at onset position).

We give a few selected examples below to illustrate this:

- (34) w rk nie      work not

	Crisp(XP)	*Rh/C	WFC	Crisp(word)
⇒a. w rk [n]ie				
b. w rk [N]ié*!)			*!	*!

Nasals in an onset do not assimilate, because there is no reason for as some analysts may argue that there is a major syntactic boundary between negation in this particular example; if that is true, the assimilated is an additional violation of Crisp(X), marked here in parentheses.)

(35) lo[pm<sup>ʰ</sup> k] nnen

	Crisp(XP)*RH/C	WFC	Crisp(word)
a. lo[pN <sup>ʰ</sup> k] nnen	(*!)	*	*!
b. lo[pn <sup>ʰ</sup> k] nnen	*!		
⇒c. lo[pm <sup>ʰ</sup> k] nnen		*	

In this particular instance, there are three possibilities: the nasal assimilates to the preceding obstruent (35a), to the following obstruent (35c), or not at all (35b). Assimilation is necessary (and possible), so that we can immediately discard option (35b). The boundary between (35a) and (35c), and in that case the latter form is clearly preferred because the stem-final obstruent is closer than the one in the other verb. (Again, if there is a major syntactic boundary between the two verbs in some analyses, option (35a) would get an extra<sup>7</sup> violation.)

(36) loop [N<sup>ʰ</sup>] keer

	Crisp(XP)*RH/C	WFC	Crisp(word)
⇒a. loop [N <sup>ʰ</sup> ] keer		*	*
b. loop [n <sup>ʰ</sup> ] keer	*!		
c. loop [m <sup>ʰ</sup> ] keer		*	*

In this syntactic environment we have the same three possibilities as in (35). If assimilation is possible and necessary, we can immediately discard the middle option (36b). But in this case, the closest obstruent is the one following the

(37) lik [n<sup>ʰ</sup>] aanderen man

	Crisp(XP)*RH/C	WFC	Crisp(word)
⇒a. lik [n <sup>ʰ</sup> ] aanderen	*		
b. lik [N <sup>ʰ</sup> ] aanderen		*	*

In this case, the syllabic nasal could only assimilate to the preceding obstruent, if allowed to do that, because this obstruent is too far away.

<sup>7</sup>Feature alignment in these cases arguably corresponds to syntactic structure, not to syllabification. The determiner behaves as an enclitic rather than a proclitic as far as syllabification is concerned. See W Zonneveld (p.c.) for pointing this out.

## 5. Nasalization, nasal deletion and obstruent assimilation

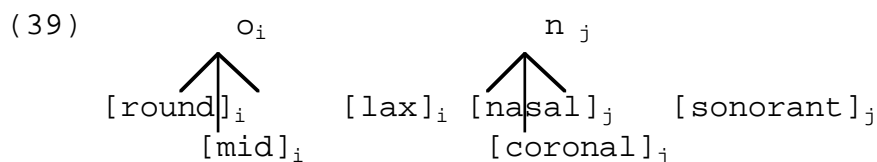
We now have a fairly straightforward analysis of nasal assimilation: syllables need to acquire a place of articulation and for this they grab the place of a consonant that is nearest. This replaces the extrinsic ordering of two assimilation rules. We are now ready to consider some of the other phonological facts we see how they fit into this general picture.

First we turn to nasalization and nasal deletion. These two processes we find nasalization of the vowel in exactly those environments in which the consonant is deleted. Furthermore, nasal deletion seems to be subject to more or less restrictions as nasal assimilation: it does not occur if the nasal appears to be a mysterious fact in a rule-based analysis.

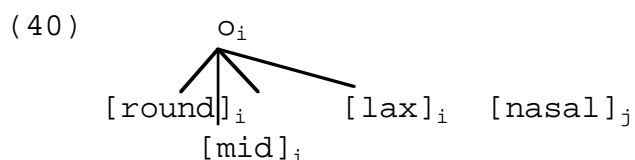
We propose that there is a causal relation between the two: the vowel is nasalized because the consonant disappears. In other words, the nasal consonant is deleted completely, but it leaves behind its feature [nasal] on the vowel. A restatement of a specific kind of faithfulness:

(38) TRACE: No segment may disappear without a trace.

TRACE can be seen as a kind of constraint on the morphology - phonology interface: a segment that is present in the underlying, morphological, representational structure must also be present in the surface phonological structure as well. As often, there are many ways to formalize this. For instance, we could invoke a kind of Correspondence. The underlying prefix /on/ is approximately the following (concentrating on the most important features and disregarding details of feature geometry):



Every segment has a unique index. TRACE says that all indexes in the input must have at least some correspondent in the output. The output [o~] satisfies this constraint because the indexes i and j are represented in the output:



Why does the consonant disappear at all? We propose that the reason for this is the constraint \*RHYME/CONSONANT. Until now we have interpreted this as strict only Place features in rhyme position, but of course we may also give it a more general interpretation and have it disallow any kind of consonantal feature in

course, the question then remains why this affects only nasals, a question here.)

The combination of TRACE and \*RHYME/CONSONANT gives us the required re

(41) [ ~]benul dimwit

	TRACE	*RH/C
⇒a. [ ~]benul		*
b. [ ]benul*!		
c. [ n]benul		**!

We have given the winning candidate one violation for \*RHYME/CONSONANT, as the feature [nasal] gives a minimal violation of this constraint. Yet this is the whole consonantal segment, as happens in (41c) (which should probably have more violations than just one).

On the other hand, in cases such as in april, the nasal gets resyllabified into the following syllable. There thus is no reason to delete the nasal consonant (and no reason to assimilate a syllabic nasal in these contexts):

(42) i [n] april

	TRACE	*RH/C
⇒a. [I.n]april		
b. [I]apri*!		
c. [I~]april		*

The question now is: why doesn't the syllabic nasal get deleted, if it violates \*RHYME/CONSONANT and if deletion is an option. Why don't we get e.g. \*[lopm] to walk? According to Nijen Twilhaar (1990), the underlying syllabic nasal in the suffix and all other instances of the syllabic nasal underlyingly actually becomes syllabic after the schwa has been deleted. But in any case it is possible to epenthesize a schwa. Why doesn't this happen?

We suspect the reason is that nasalized schwa is strongly avoided in Dutch, as it is in many other languages: schwa, being a phonologically empty vowel, is not sufficiently strong to carry nasalization (cf. Van Oostendorp's overview of the literature on the phonological properties of schwa). For that there is a specific constraint to this effect, although this might be a more general requirement that nasals should be realized with a place specified (pointed out to us by Wim Zonneveld, p.c., cf. Trigo 1988):

(43) \*NASAL/◀ : Schwa should not be nasalised.

Interaction of this constraint with the ones just established gives us

(44) loop+«n

	*NASAL/«	TRACE	*RH/C
⇒a. loop[m`]			*
b. loop[«~]*!			*
c. loop[«]		*!	

Another candidate, satisfying all of these constraints as well as (a), depends on the underlying forms we posit which constraint would be held the fact that this alternative is not selected. If the underlying form at work (dispreferring vowel epenthesis); if the underlying form is /«n be one preferring schwa to be in an open syllable rather than a closed 1995, 1998 gives ample evidence for this preference).

Finally, we want to discuss the phenomena of nasals surfacing in t not surface in the singular. The relevant facts in (4) are repeated bel

(4)

	singular	plural	
a.	r[Iø]	r[Iø ]	deer(s)
	spr[ ø]	spr[ ø]	starling(s)
	vl[oø]	vl[oø ]	flea(s)
b.	b[o ]	b[onn`]	bill(s)
	m[A ]	m[ann`]	man/men
	l[oø ]	l[oønn`]	wage(s)

In the plural forms in (4a) and the singular forms in (4b), the vowel g satisfy TRACE after the deletion of a consonant which itself is necessary \*RHYME/CONSONANT.

The crucial facts are the plurals in (4b). These show that a nasal the appropriate context. We give the relevant tableau below:

(45) bon+«n

	TRACE	*RH/C
⇒a. b[onn`]		
b. b[«~n`]		*!
c. b[lo~]*!		

The form in (45c) does not survive, because two nasals have disappeared (necessity) only one nasalization mark on the vowel. One of the two underlying forms therefore violates the constraint TRACE, while in (45a) and (45b) both s

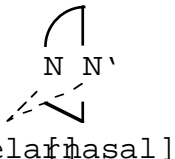
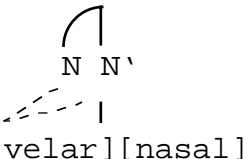


visible. However, in (45b) the rhyme has to bear a consonantal place fe it can share it with an onset in (45a). This causes<sup>8</sup> the latter candidat

Another phonological process that can now be understood in somewha obstruent assimilation: voiced obstruents in the onset of a syllabic na themselves. Some examples are given in (11) and repeated below:

- (11) bi[n̩n̩'] to pray (from /bɪd/)  
 schro[m̩m̩'] to scrub (from /sxrob/)  
 loo[m̩m̩'] to praise (from /loøv/)  
 ze [n̩n̩'] to say (from /zE~/)

What is the reason behind this assimilation process? We propose that th constraint \*RHYME/CONSONANT: no consonantal feature likes to be in the rhy the feature [nasal]. That is why (46a) is preferred over (46b):

- (46) a.  b. 

In (46a) there is literally no consonantal feature at all which is atta syllable nucleus. We thus propose that in cases like this, \*RHYME/CONSONAN cause of Place features spreading to a nasal consonant, but of the feat itself as well.

Nasal spreading seems to be much more restricted than the other ty discussed here. For instance, both the target and the source of spreadi restrictions: spreading only occurs from a syllabic nasal (and not from voiced obstruent (and not a voiceless one). The latter restriction can as a kind of faithfulness. One could say that voiced obstruents are mor their voiceless counterparts. Therefore, turning the latter into nasals faithfulness violations than doing this to the former. This still leave /bon/ does not turn into \*[mo~] (rather than [bo~]): why is this type ( to syllables with a syllabic nasal as their head. The reason for this n between a vowel and a consonant is kept to a minimum; we are not aware this type of sharing is needed in the analysis of Hellendoorn Dutch pho

Nasal spreading is restricted in other ways as well. Its scope see the syllable. The feature [nasal] spreads from a syllabic consonant lef the same syllable, not rightward to another syllable: [m' bAl] a ball mAl]. Similarly, the feature does not seem to leave the morpheme for wh is impossible in the incomplete constructions mentioned above.

<sup>8</sup> Another possible candidate is [b ~nn ], which presumably is rules out by a (fairly against unnecessary nasal vowels.

(47) [hEp m'] \*[hEm m'] have a ... (heb /hEb/, een /n'//)

This latter case however is difficult to analyse straightforwardly, since it involves a construction which can hardly be counted as grammatical, and since it deals with Final Devoicing, a general process devoicing obstruents at the end of syllables.

We thus only find hard evidence for a restriction on phonological spreading. This could be formulated in for instance the following way (other languages may have active constraints for larger domains):

(48) NASALDOMAIN: The feature [nasal] cannot be associated to segments in a syllable.

It remains to be seen whether (48) can be grounded in phonetics or in phonology, and whether some deeper phonological explanation can be given to it.

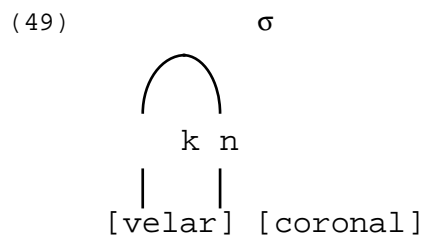
## 6. Opacity effects

Even though we believe that we have gained some insight into the nature of the phonological processes in Hellendoorn Dutch, one problem still needs to be resolved. The strange behaviour of the plural suffix, once it is attached to a stem ending in a nasal, denasalizes the vowel and surfaces itself as a syllabic nasal which is subject to final assimilation.

Opacity facts provide a strong argument in favour of rule-based approaches instead of a theory incorporating a mechanism such as Sympathy Theory. On the one hand, in particular the behaviour of the plural suffix is extremely problematic for a rule-based ordering of processes, as we will show below. We will argue here that a rule-based approach can be solved if we take the theoretical instruments which have been in use seriously.

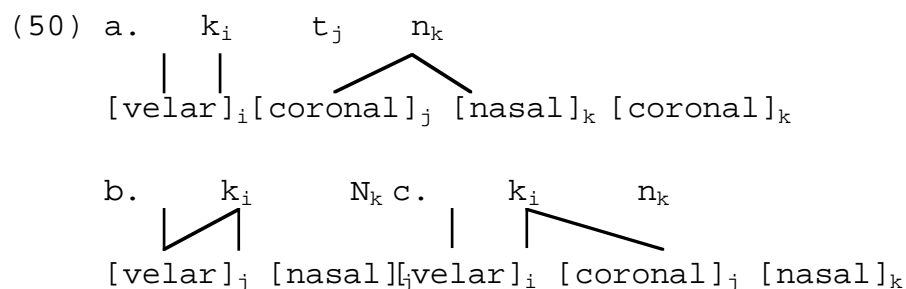
Let us therefore consider past tense cases such as [pAkn'] took, and present tense cases such as [pAkN'] take. What causes the different plural forms? Clearly the past tense morpheme should have something to do with this morpheme is a suffix -t- (after a stem ending in a voiceless obstruent in the plural cases). It thus looks as if the syllabic nasal has assimilated to the coronal consonant within a theory that bases itself on the analysis of output structures since the coronal consonant is no longer present on the surface. Furthermore, in the particular analysis presented here, another problem arises: if assimilation is desirable for consonantal features to be present in a position outside the syllable, what benefit is there in assimilating to a consonant which itself does not occupy that position at all?

We propose that in these cases there is no assimilation in the sense of the theory associated to two segments at the same time. We thus propose that the syllable of [pAkn'] is something along the following lines:



This means that in this case the nasal has an independent place feature probably originates from the past tense morpheme /t/, which has itself structure in (49) represents a very marked violation of the constraint first sight, we might think that this violation is forced by some const morpheme to be visible on the surface: if the feature [coronal] would d would spread in (49), the resulting structure would be indistinguishabl tense form. Yet this cannot be the whole story, since also the plural fo elevator ends in a heterorganic cluster [fn'] and there is no indepen the underlying /t/ is a morpheme in this case.

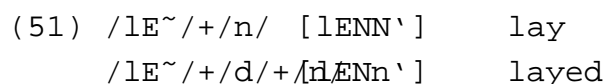
It thus looks as if we have found another effect of the constraint input in (50a) (the last three relevant segments of pak+t+n) with the and (50c):



The subscripts represent underlying segmental affiliation; a segment an are underlyingly associated to it, get the same indices.

Candidate output (50b) violates the constraint TRACE, because one u segment has disappeared without leaving a visible trace (there is no ma index j). In (50c), on the other hand, all underlying segments are pres so. Both in (50b) and in (50c), the underlying Place feature of the nas irrelevant, however, since other features of this segment (such as nasa still is material with index k on the surface.

The examples discussed so far all involve a voiceless obstruent. Be example with a voiced obstruent underlyingly:



We thus see that the nasal feature still spreads to the preceding cons preceding consonant is not the source of the place feature for the nasa notion nasal spreading is preferable over total obstruent assimilation

forms is as follows (dashed lines are used simply to facilitate the representation of the three-dimensional structure in a two-dimensional picture):

(52) 
$$\begin{array}{c} \sim_i \quad \quad \quad n_k \\ | \quad \quad \quad \{ \quad \quad \quad \backslash \\ \text{[velar]}_i \quad \text{[coronal]}_j \quad \text{[nasal]}_k \end{array}$$

The nasal feature spreads in these cases because of \*RHYME/CONSONANT. This constraint is violated by the place feature already, but this does not mean that violations of this constraint<sup>9</sup> are acceptable:

(53) /lE~/+/d+/n/

	TRACE	*RH/C
⇒a. [lE <sub>N</sub> n']		*
b. [lE <sub>F</sub> n']		**!
c. [lE <sub>N</sub> ~N']!		**
d. [lE <sub>NN</sub> ~N']!		*

The so-called opacity cases in the interaction between t-deletion (or c-deletion) and nasal assimilation thus turns out to be not opaque at all. They are the same interaction of factors which is also responsible for the fact that the deletion of a consonant is a direct consequence of nasal deletion.

## 7. Conclusion

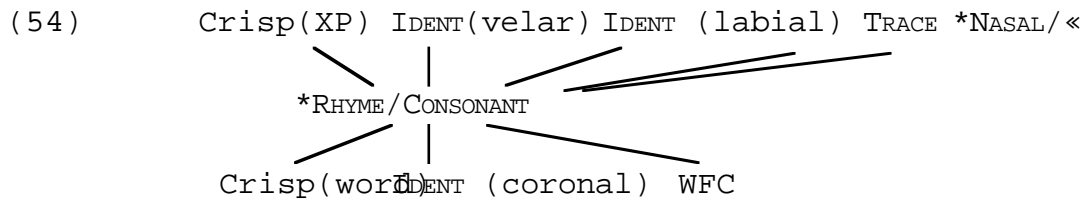
Nasals in Hellendoorn Dutch display a pattern which is quite complicated. To call upon an analysis involving extrinsically ordered rules. We have seen, however, that these facts are more profitably seen as a result of the interaction of the above factors. In the first place, the features of nasal consonants prefer no rhyme; in order to achieve this, they either get deleted, or they associate with a consonant in a nearby onset. In the second place, phonological structure should mirror morphosyntactic structure as much as possible: association lines should cross as little as possible and certain boundaries should not be crossed at all. And finally, underlying segments should not be completely deleted; preferably they should leave at least a minimal trace. The fact that this is a purely phonological type of wellformedness. The second and third findings, at the interface between morphological and syntactic structure and phonological structure, they suggest that the phonological structure should mirror the morphosyntactic structure as exactly as possible.

These assumptions obviate the need for many of the presumed orderings mentioned above:

<sup>9</sup> Of course, all of these purely phonological phenomena interact with considerations of the syntax-phonology interface in ways outlined above.

- Nasalization bleeds nasal assimilation because it better satisfies \*RHYME/CONSONANT; it is better to delete a consonant than to assimilate preceding or following consonant;
- There is no need to distinguish between regressive nasal assimilation and nasal assimilation, or to order these processes disjunctively; they are two sides of the same medal; whether a nasal consonant assimilates to the left or to the right of which consonant is nearest;
- There is similarly no need to distinguish between obstruent deletion and nasal assimilation, because again, both are instances of a general requirement of \*RHYME/CONSONANT, be it that the former is somewhat more than the latter.
- Even apparent opacity, such as the interaction between t-deletion and nasalization, can be analysed in a fairly simple constraint-based system, assuming that segments are preferably not deleted entirely; this idea has been formalized under the condition TRACE.

All in all, we have established the following constraint rankings:



We have thus set up a fairly simple grammar of Hellendoorn Dutch nasalization based on constraints we think are quite plausibly universal and which we put forward in this article: that Hellendoorn Dutch nasalization results from phonological domains in which consonantal material prefers to be in contact with a vowel and morphological and syntactic domains in which all phonemes should survive and morphological boundaries should be respected.

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