

Phonological recoverability in dialects of Dutch

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1 Introduction

One of the fundamental problems for constraint-based theories of phonology is the issue of opacity: a phonological process applies where it should not, or does not apply where it should, if we look at the phonological context on the surface. Since well-formedness constraints in a theory such as Optimality Theory typically refer to surface structure only, it is a puzzle how to deal with such phenomena within this theory. Various solutions have been proposed, all of them necessarily requiring some level of abstraction. Most of these involve some mechanism to introduce an extra representational level; an example of this is Sympathy Theory (McCarthy, 1999), in which one of the non-winning candidate representations can still influence the form of the output because it does contain the relevant phonological context, and the actual output form is bound to this candidate by faithfulness relations. This representation is abstract in the sense that it is not pronounced; but it can influence the shape of the surface form; the solution is highly reminiscent of derivational theories, in which the abstract representation is a separate step in the derivation.

Leaving aside the question whether this level of abstractness is required for other cases, I argue that one class of cases of phonological opacity can be handled without stipulating an extra level of representation, but by taking into account the morphological structure of the forms in question. In particular, deleted segments sometimes still seem to influence the surface representation of morphologically complex words, since without this influence a whole morpheme would be lost. I argue that there is a principle of the following general shape:

- (1) *Phonological recoverability*. Every morpheme in the input should be represented in the phonological output.¹

A functional explanation to (1) is possible, if needed: if a morphologically complex form needs to be parsed, it is preferable to have cues in the phonological shape for every independent morpheme, but (1) can also be seen as a purely formal requirement on linguistic structure, perhaps a consequence of some more general principle of the architecture of the language faculty. In particular, it can be seen as an instance of what Jackendoff (1993) calls ‘correspondence rules’ between components of grammar; Jackendoff makes it clear that such rules satisfy a conceptual necessity under any view of the grammar.

It can be shown how a number of apparent cases of phonological opacity can be dealt with if we use this mechanism. My examples in the following are taken from the literature on various Dutch dialects. These have been fairly well-studied in the Dutch dialectological literature, but are not well-known outside of this tradition.

I have made a further restriction to *inflectional* morphology. The reason for this is that inflection usually is rather ‘weak’ in the sense that inflectional morphemes in Germanic consist of only a few segments, and these are strongly susceptible to deletion: the vowel is usually schwa, the consonants are very often coronals, and rules deleting schwas and coronal consonants abound. If any morpheme ever is a likely candidate for violating (1), it most likely is an inflectional morpheme. Furthermore, we have a relatively clear view of the internal morphological structure of inflectional elements (which consist of purely ‘formal’ features only), whereas this is much less the case for derivational affixes, in which some amount of lexical semantics is also involved.

The structure of the argumentation will be the same in each example. An inflectional morpheme is phonologically weak in the way just outlined and therefore bound to be deleted. At the same time, if it would be present, it would either trigger or block a process of assimilation. In order to satisfy the requirement in (1) the deletion of the morpheme is not complete; the constituent of the original segment that is necessary to participate either positively or negatively in the assimilation process is left behind as a trace. For example, in Hellendoorn Dutch, an otherwise active process of progressive nasal consonant assimilation seems to be blocked in the past tense (in the cases below, the plural suffix may be assumed to be syllabic /n/; the orthographic examples represent Standard Dutch):

- (2) a. *werken* ‘(to) work’ [wɛrkɛ]
 b. *werkten* ‘(we) worked’ [wɛrkɛ]

¹Constraints which are similar to this in one way or another have been proposed among others by Samek-Lodovici (1993); Akinlabi (1996); Gnanadesikan (1997); Rose (1997); Walker (1998, 2000); Piggott (2000); cf. Kurisu (2001) for an overview.

- c. *hopen* '(to) hope' [hopm]
- d. *hoopten* '(we) hoped' [hopn]

As can be seen from the orthography, and as will become evident if we study other instances in Hellendoorn Dutch, the imperfective suffix underlyingly contains at least a coronal obstruent /t/. We can now analyze this as a case of rule opacity: first we have an assimilation rule, and afterwards a rule of t-deletion, obscuring the original environment of assimilation. This approach can also be mimicked in e.g. Sympathy Theory, invoking faithfulness to a candidate output in which the /t/ is still present, and the nasal is assimilated to that /t/. There is no clear explanation under such an approach, why the rules are ordered in this way, or why the grammar needs to be faithful to this particular candidate output.

An alternative approach is to assume that /t/ is not deleted fully, but leaves behind a trace, in the form of the feature [coronal], which is then realized on the nasal consonant. The reason for this could be a general requirement that linguistic structure should be visible and expressed, i.e. the principle in (1). The consequences of this approach are explored in this article. The discussion will be embedded within Optimality Theory, currently the most popular theory of input-output mapping; but (1) is virtually theory-independent and its effects could be couched within other frameworks as well.

2 Opacity and Optimality

First, I will briefly discuss the relevant terminology of opacity and outline the possible approaches to this within Optimality Theory. The most important work on rule opacity phenomena within generative phonology was done by Paul Kiparsky, in a number of papers that have been collected in Kiparsky (1982). In this work, Kiparsky eventually defines *opacity* in the following way:

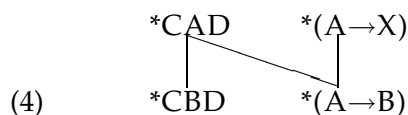
- (3) *Opacity*
 A rule $A \rightarrow B / C _ D$ is opaque to the extent that there are surface representations of the form
- (i) A in environment $C _ D$, or
 - (ii) B in environment other than $C _ D$

The converse of opacity is termed *transparency* by Kiparsky, who furthermore claims that "rules tend to be ordered so as to become maximally transparent".

Opacity is thus found in contexts such as CAD, or XBY, where $X \neq C$ or $Y \neq D$ (the most interesting cases of course are where this XBY is derived from CAD, but this formally this is not part of the requirement: all B's which are

not created by the rule are suspect). Interestingly, this formulation is stated (almost) completely in terms of the resulting surface representations. The rule ordering requirement can also be formulated in such terms: if there is a rule as in (3), languages tend to avoid CAD and XBY.

It is clarifying to ‘translate’ the problem in terms of Optimality Theory; this is an exercise which has been carried out by McCarthy (1999). Instead of the rule we need the interplay between a well-formedness constraint (*CAD) and a faithfulness constraint (*(A→B), penalizing whatever change is necessary to get from A to B). In order to make sure that A turns into B rather than something even better, we also need to establish that CAD is worse than CBD, and that a change from A to some X different from B is worse than a change to B. Kiparsky’s rule can thus be replaced by the following partial ranking of constraints.



The process described by this ranking is opaque if (i) we find CAD (for instance deriving from WAZ, where either $W \neq C$ or $Z \neq D$) on the surface, or (ii) we find XBY (and we have independent reasons to assume that B is derived from A). Both cases are difficult to model within OT, since within this framework we do not expect transparency to be *maximized*, but to be absolute. In order to model case (i) it seems that we have to make the well-formedness constraint *CAD sensitive to the distinction between underlying and surface material (cf. McCarthy, 2003a). In order to model case (ii) we need to say that there is an extra level of representation, in which C and D are still present, turning A into B (because by assumption only the well-formedness constraint *CAD has this effect). The B on the surface should be due to faithfulness to this extra level of representation, in spite of changing C or D. This extra level can also be of help in the analysis of case (i) for which we could claim that CAD is highly ranked only at this particular level, and that either C or D are not present; again, the A in the output would be the result of high-ranking faithfulness between the extra representation and the actual output. Both rule-based phonology and Sympathy Theory give us a way to describe this extra, ‘hidden’ representation.

As a matter of fact, there are various other potential ways to still attain opacity in the sense of Kiparsky’s definition. Case (i) can be obtained if (a) there is a well-formedness constraint which in some specific circumstances forces CAD into existence, outranking *CAD, or (b) there is a faithfulness constraint other than *(A→B) which in certain circumstances blocks A from turning into B. Similarly, case (ii) can be obtained, if in some circumstances A is forced into B by something other than segment C or segment D, e.g. by an independent well-formedness constraint *XAY. In other words, as soon as we look at a bigger fragment of the constraint system of a language, we

observe that the subsystem in (4) may be dominated by other constraints. We will encounter examples of both cases in the remainder of this paper.

Furthermore, Kiparsky's conception of opacity was clearly rooted in the generative framework of Chomsky & Halle (1968). The 'rule' in the definition in (3) therefore is stated in purely segmental terms: A, B, C and D are all feature bundles, that is to say, phonological segments. We could wonder whether many apparent cases of opacity do not actually disappear if we assume a somewhat more sophisticated view of phonological representations, taking into account the literature on prosodic organization, autosegmental structure and the interaction with morphological and syntactic boundaries. One representation, which is enriched by independently necessary elements, may then do the work of two poorer representations.

In Antwerp Dutch, for instance, we have a process velarising a nasal consonant in coda position. We also have a process shortening a vowel before the resulting velar nasal (Taeldeman, 1982). Both processes can be seen at work in the following examples:

- (5) a. *grune* 'green' [ɣrynə] ~ *gruun* 'green' [ɣryŋ]²
 b. *schoenen* 'shoes' [sxunə] ~ *schoen* 'shoe' [sxuŋ]

Interestingly, the velarisation process only applies to words with underlyingly long vowels, and not by words which have short vowels already underlyingly:

- (6) a. *kin* 'chin' [kin] ~ *tien* 'ten' [tiŋ]
 b. *zon* 'sun' [zɔn] ~ *zoon* 'son' [zɔn]

In order to describe this, we could write the following rules:

- (7) a. $n \rightarrow \eta / V: _ _ _$
 b. $V: \rightarrow V / _ _ _ \eta$

When applied to the different inputs in the right order, these rules will yield the correct results. While strictly speaking the rule in (7a) is opaque in the sense of Kiparsky's definition in (3),³ this is only so because it has a rather

²Apart from some cases of optional schwa deletion, the form without schwa can only be used in the singular neuter of adjectives in indefinite noun phrases. The form with schwa can be used in all other inflections (plural or non-neuter, or both).

³Rule (7a) is opaque, because we find velarised consonants which are not in the environment of a long vowel. In other words, clause (ii) is violated: we find B (=η) in a context different than C__D (where C=V: and D=∅).

Rule (7b) is strictly speaking also opaque according to clause (ii), since we find B (is a short V) in a context different from C__D, where C=∅ and D=η (for instance, we also find short vowels before a coronal). This only applies to this strict definition, it disappears if we consider that all short vowels which are *the result of shortening* (hence underlying long vowels) occur only in this particular context.

unnatural shape: it is very uncommon in languages of the world for velar nasals to only show up after long vowels. As a matter of fact, most variants of Dutch (and Germanic) allow the velar nasal to occur only after short vowels. This is even true for Antwerp Dutch, at the surface; rule (7b) is responsible for that. A much more natural rule would therefore be the one in (8):

$$(8) \quad n \rightarrow \eta / V _ _$$

Yet this process would be very opaque indeed, since we obviously find cases where underlying /n/ did not turn into a velar.⁴ We would therefore have to distinguish between underlyingly short and shortened vowels: the process seems so opaque that even an analysis based on rules (with arbitrarily many intermediate representations) cannot deal with it satisfactorily.

On closer inspection, there is evidence that the velar nasal, different from the other nasal consonants, is a moraic segment in varieties of Dutch (Trommelen, 1982; van Oostendorp, 2001; van der Torre, 2003). This could explain, for one thing, the fact that velar nasals can only occur after short vowels: we could posit a bimoraic maximum on syllables.⁵ A velar nasal after a long vowel would then be prohibited:

$$(9) \quad \begin{array}{cccc} \textit{bang} \textit{'afraid'} & \textit{ban} \textit{'ban'} & \textit{baan} \textit{'ban'} & \textit{*baang} \\ & \begin{array}{c} \mu \quad \mu \\ | \quad | \\ b \quad a \quad \eta \end{array} & \begin{array}{c} \mu \\ | \\ b \quad a \quad n \end{array} & \begin{array}{c} \mu \quad \mu \quad \mu \\ | \quad / \quad | \\ b \quad a \quad \eta \end{array} \end{array}$$

There undoubtedly are other ways to capture the same intuition: that both long vowels and velar nasals need space in the syllable and that if we would have both, this would be too much.⁶ Under the one chosen here, the opacity of the Antwerp Dutch velarisation process disappears, if we assume that there is a strong faithfulness requirement on the number of mora's in this dialect — or in rule-based terms, that we are not allowed to insert any mora's

⁴In other words, the rule in (8) is opaque under clause (i) of Kiparsky's definition: we find an A (=n) in the context C...D, where C=V (a short vowel) and D=∅.

⁵It is sometimes assumed that the reason for this restriction is that velar nasals underlyingly are /ng/ or /nŋ/, just like this is assumed for English. The Antwerp facts actually show that this analysis cannot be correct: here we find the same restriction but there is absolutely no possibility for postulating an underlying obstruent.

⁶Some approaches to Dutch syllable structure, such as Kager (1999), assume that all Dutch syllables have a bisyllabic minimum; the form *ban* would have a moraic /n/. We could then assume that the difference between the velar nasal and the other two nasals is that the former, but not the latter, has to have a mora 'of its own'. The /n/ would be able to project a mora if this is necessary, e.g. in [ban], but it would not need to do this in other cases, e.g. in [ban]. A bimoraic maximum would therefore still be responsible for the different distribution of the two segments.

Yet another possibility might be to include a constraint in our grammar which would have it that velar nasals have to occur in a nuclear position, leaving only one such position for the vowel (van der Torre, 2003).

in the underlying representation. A change from /ti:n/ — two underlying mora's attached to the vowel — to [tiŋ] (two surface mora's, one for the vowel and one for the nasal) is then allowed, but a change from /kin/ (one underlying mora attached to the vowel) to [kiŋ] (two surface mora's) is not. If we allow ourselves to introduce a few ad hoc constraints to make things work technically, an OT analysis might then run along the following lines. We need the constraints in (10), and the ranking in (11) in order to get the tableau in (12):⁷

- (10) a. FAITH(μ): Do not add or delete mora's
 b. VELAR: Nasal consonants in coda position should be η .
 c. $*\mu\mu\mu$: No trimoraic syllables

- (11) FAITH(μ) \gg VELAR

- (12) a.

☞[tiŋ]			
/ti:n/	FAITH(μ)	$*\mu\mu\mu$	VELAR
[ti:n]			*! W
[tiŋ]	*! W	*! W	
[tin]			*! W

- b.

☞[kin]			*
/kin/	FAITH(μ)	$*\mu\mu\mu$	VELAR
[ki:n]	*! W		*
[ki:ŋ]	*!* W	* W	L
[kiŋ]	*! W		L

All three constraints are known from the literature. No special mechanisms, such as rule ordering, Sympathy Theory, levels, etc., thus are necessary for Antwerp Dutch, given the appropriate assumptions on the representation of the velar nasal. This does not necessarily mean, of course, that all of the theoretical devices just mentioned are useless. There is an enormous literature on rule opacity, and many phenomena still defy explanation. Yet in the following sections, I will show that next to a more sophisticated view of phonological structure, also a more precise view of the interaction between

⁷The type of tableau used here has first been used by McCarthy (2003a), who claims that it has been developed by Vieri Samek-Lodovici and Alan Prince. Here is how McCarthy explains this format: "the winner and its violations appear above the constraints; the losing candidates are below. In addition to the losers' violations, the tableau shows each loser's relationship to the winner: does a constraint favor the winner over this loser (W), or does a constraint favor this loser over the winner (L), or does a constraint favor neither (blank). If a tableau is to yield the correct result, every loser row must contain at least one W with no L to its left. Since every loser-favoring constraint must be dominated by some winner-favoring constraint, ranking arguments involve checking that every L has a W to its left."

phonology and morphology, and in particular of the ‘visibility’ of morphology for phonology, may help to make many apparent examples of phonological opacity actually vanish. In terms of the Hasse diagram in (4), there is no constraint *CAD referring to segments C, A and D only, arranged in a one-dimensional string; what we actually have is a more fine-grained, multi-dimensional vision referring to the internal structure of these segments, and to the relations between them.

The analyses presented in this article are rooted in a tradition in which opacity is analysed as a form of recoverability: a process does or does not apply because otherwise the underlying shape of a form would be fully obscured. Representatives of this line of thinking are Kaye (1974); Gussman (1976); Kissebert (1976); Lubowicz (2002). Other than these scholars, we concentrate on a specific type of recoverability, viz. morphological recoverability: the application of phonological processes is dependent on the question whether or not all morphemes will be visibly present at the surface.

3 Nasal assimilation in Hellendoorn Dutch past tense

As outlined above, Hellendoorn Dutch — a dialect spoken in the northeastern parts of the Netherlands —, like many other languages in the world, displays a process of nasal assimilation. Interestingly, the process works from right to left as well as from left to right. The following facts are all from Nijen Twilhaar (1990), the orthography again is Standard Dutch:

(13)	orthography	underlying	surface	gloss
a.	<i>lopen</i>	lopən	lopɱ	‘to walk’
b.	<i>weten</i>	wetən	wetɱ	‘to know’
c.	<i>pakken</i>	pəkən	pəkɱ	‘to grab’
d.	<i>loop een</i>	lop ən	lopɱ	‘(I) walk a (mile)’
e.	<i>rampnacht</i>	rampnaxt	rampnaxt	‘disastrous night’
f.	<i>loop een keer</i>	lop ən ker	lopɱkɪr	‘(I) walk one time’

Nasal assimilation in Hellendoorn Dutch has some interesting properties. Examples (13a-c) show that a (syllabic) nasal assimilates to a preceding obstruent. In contradistinction to the first analysis in (2), the plural suffix is represented here as underlyingly /ən/. I will return to this assumption below. For now it suffices to see (13d) that the indefinite article, which unquestionably has a schwa underlyingly (because this schwa surfaces e.g. if an indefinite nominal phrase occurs at the beginning of a sentence), displays the same behaviour. (13e) shows that nasals in onset position are not affected by the process, and (13f) that in certain cases assimilation is *regressive*, to a following consonant.

The key facts are the ones in (14):

- (14) a. /stɔp+t+ən/ (stop+past+plural) >[stɔpŋ] ‘stopped’
 b. /zɛt+t+ən/ (put+past+plural) >[zɛtŋ] ‘put’
 c. /pɑk+t+ən/ (grab+past+plural) >[pɑkŋ] ‘grabbed’

This is a case of opacity because within a rule-based framework, we could state two rules (disregarding regressive assimilation), one of progressive nasal assimilation, and another one of /t/ deletion (the following is based on Nijen Twilhaar, 1990):

- (15) a. t deletion: $t \rightarrow \emptyset / C _ _ C$
 b. progressive assimilation (PA): [nasal]
- $\begin{array}{c} x \quad x \\ | \quad / \\ \text{nasal} \end{array}$

PA is rendered opaque by t deletion (schwa deletion is implied to be preceding the processes described here):⁸

(16)		/stɔp+t+ən/	/zɛt+t+ən/	/pɑk+t+ən/
	schwa deletion	stɔptŋ	zɛttŋ	pɑktŋ
	PA	stɔptŋ	zɛttŋ	pɑktŋ
	t deletion	stɔpŋ	zɛtŋ	pɑkŋ

It is fairly easy to set up an analysis of the non-opaque facts in (13). Again, we use a few constraints which may not be hallmarks of theoretical sophistication, but which give the required results.⁹

- (17) a. ASSIMILATE: A coda nasal and an adjacent obstruent should have the same place of articulation.
 b. *CCC: Clusters of three consonants are not allowed.
 c. FAITH(PLACE): Input place features should surface.

⁸Interestingly, this is a case of opacity either of type (i) or of type (ii) in terms of Kiparsky's definition in (3), depending on how we look at it. We have surfacing CAD in the sense that it looks as if the nasal has not been subject to assimilation even though the context is present; we have XBY in the sense that it looks as if the nasal has been subject to assimilation to a segment which is no longer there. I have chosen the second possibility here. There would be ways to test which of these two theories is correct, if we would be able to find e.g. cases where the deleted consonant is non-coronal.

⁹It would certainly be possible to give more sophisticated analyses using more elegant constraints, but these would require more different constraints, and the point would remain the same: an extra faithfulness constraint is necessary to understand the exceptional behaviour of past tense forms.

(18)

☞pakŋ			
/pak+ən/	*CCC	ASSIMILATE	FAITH(PLACE)
pakŋ		*! W	
patŋ			*! W

Hellendoorn differs from other languages displaying faithfulness of place features in that even after the consonant deletion, another obstruent stays present that could still enforce assimilation. Therefore, the opaque cases here cannot be dealt with without additional means:¹⁰

(19)

pakŋ		*!	
/pak+t+ən/	*CCC	ASSIMILATE	FAITH(PLACE)
✗pakŋ		L	
patŋ			*! W

What we need to express, here, is the idea that the nasal gets its feature from the underlying past tense suffix. One way of doing this, is by formalizing Recoverability in (1) as an OT constraint:

- (20) EXPRESS-[F]: The morphological feature F should be expressed in the phonological surface.
(Some phonological feature connected to the input expression of F should be present in the output.)

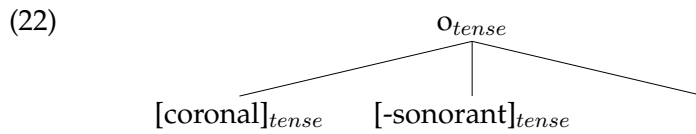
This is a special type of faithfulness constraint, basically stating that it is not allowed to delete a morpheme fully. An instance of this general constraint scheme could now be EXPRESS-TENSE: some part of the past tense suffix /-ən/ should be expressed in the output. Adding this constraint to our tableau gives us the desired result:

(21)

☞pakŋ			*	*
/pak+t+ən/	*CCC	EXPRESS-TENSE	ASSIMILATE	FAITH(PLACE)
pakŋ		* W	L	*
patŋ	* W		L	L

How exactly does EXPRESS-TENSE work? The phonological input is a /t/, i.e. a feature bundle like the following:

¹⁰It is assumed here that deletion of /k/ or /n/ is not an option for satisfying *CCC. As we will see below, /t/ is particularly prone to deletion in dialects of Dutch, but other consonants cannot be deleted. Exploring the reasons for this is beyond the scope of this article.



Every morpheme consists of a number of feature bundles, connected to a root node, and/or a timing slot. I marked this by adding a subscript to every individual element. Seen in this notation, EXPRESS-TENSE states that the output should contain at least one element which has this subscript.¹¹

Until this point, we have silently assumed that the plural suffix /ən/ has a schwa underlyingly. We can find some arguments for this in Nijen Twilhaar (1990). Most convincing perhaps is the argument that we also find monomorphemic nouns ending in a syllabic nasal, and nouns ending in /-ə/, but no nouns ending in /-ən/. This shows at least that a productive process of schwa deletion before n is going on. Furthermore, the schwa sometimes surfaces, viz. in very formal styles of speech (Nijen Twilhaar, 1990, :165); these are styles where typically the surface form is closer to the underlying representation (van Oostendorp, 1997).

There are various reasons why schwa should not surface; being phonologically and phonetically empty, it seems a less desirable nucleus, etc. There will thus be a constraint *ə or something more motivated but to the same effect (cf. van Oostendorp, 2000, for fuller detail).

We can distinguish between three groups of dialects of Dutch (van Hout & van der Velde, 2000). In some, schwa is deleted, and in others /n/ is deleted under various circumstances; in line with the previous discussion, this could be formalized as a constraint *n. The third variety (if it exists as a consistent variety at all) is one in which neither schwa nor /n/ is deleted. Crucially absent are those dialects in which *both* schwa *and* /n/ are deleted. This may be seen as an indication for the high level of activity of recoverability, formalized in this case as a constraint EXPRESS-PLURAL. This constraint would then dominate at least one of *ə and *n.

These facts are not unique for Hellendoorn Dutch; we find very similar phenomena even in typologically unrelated languages. The interaction between nasal assimilation and consonant deletion from the Ojibwa dialect of Odawa (Piggott, 1974; Kaye, 1974) show a very similar pattern:

(23)	Underlying	/takossin-k/ 'he arrives'
	Assimilation	takoffiŋk
	Deletion	takoffiŋ

¹¹Most current correspondence-based theories of faithfulness are segment-based, i.e. the faithfulness to features is mediated through the segmental node. (There are no constraints MAX(CORONAL) or DEP(CORONAL), but only IDENT(CORONAL). In order to implement the ideas presented here in such a framework, one would need a device like 'existential identity' (Struijke, 2000): "If an input segment x is [αF], then some output correspondent is also [αF]."

These facts are clearly very similar to those of Hellendoorn in the relevant respects. Viewed from a purely segmental point of view, Assimilation and Deletion are in an opaque ('counterbleeding') order. Yet if we consider the possibility that the place feature [velar] is on an independent plane, and that it can be retained even after deletion of the segment /k/, these facts follow. Also in this case, it appears that /k/ is an independent morpheme, having a conditional meaning. If we assume that this conditional morpheme has to be retained at the surface somehow, the feature [velar] would then show up on the nasal as a trace of this morpheme in order to satisfy EXPRESS-[cond]. All in all, we would get an analysis such as the following:

- (24) a. EXPRESS-[cond]: The conditional morpheme should be expressed at the surface
 b. *CC: Consonant clusters are not allowed.

The tableaux of Hellendoorn and Ojibwa thus become strikingly similar. Again, there is no need to rank most of the relevant constraints in order to get the difference between conditionalis and realis forms:

- (25)
- | | | | | |
|------------|-----|--------------|------------|--------------|
| ☞ takoffin | | | | |
| /takossin/ | *CC | EXPRESS-COND | ASSIMILATE | FAITH(PLACE) |
| takoffij | | | | *W |
- (26)
- | | | | | |
|--------------|------|--------------|------------|--------------|
| ☞ takoffij | | | | * |
| /takossin+k/ | *CC | EXPRESS-COND | ASSIMILATE | FAITH(PLACE) |
| takoffin | | *! W | | L |
| takoffink | *! W | | * W | L |
| takoffijnk | *! W | | | * |

As a matter of fact, there thus is no opacity, or any problem for surface-based phonology within Hellendoorn Dutch or Ojibwa at all, given the fairly standard assumption that place or articulation features can exist independently of their segments — an assumption that was not available in the work of Kiparsky and Kaye just referred to above. It should be noted, however, that the core of this analysis was already present in Kaye's work; the term 'recoverability' that I will use in what follows, originates in that work, although Kaye used the term in a somewhat different way.¹²

4 Voicing Assimilation in Flanders and Brabant

The next example which deserves discussion is widespread in the Dutch-speaking parts of Belgium (at least in Flanders and Brabant). In this case a process of voicing assimilation interacts with the deletion of word final /t/,

¹²In Kaye (1974), 'recoverability' is a property of phonological rules rather than of morphemes. A rule is recoverable if it would be possible to reverse-engineer it on the basis of the surface-representation.

which is the phonological shape of the third person singular verbal inflection (Taeldeman, 1982) in a way that may be considered opaque:¹³

- (27) a. [-sonorant, +continuant] → [-voice] / [-sonorant] ___
 b. $t_{3,sg} \rightarrow \emptyset / _ \# C$
- (28) *hij doe/t v/eel* 'he does a lot'
 a. *hij doe/t f/eel*
 b. *hij doe[f]eel*

(27a) is an instance of Kiparsky's case (ii): we find [-voice] in an environment where we would not expect it.

Voicing assimilation in Dutch is a well-known and widespread phenomenon (cf. Lombardi, 1999; van der Torre & van de Weijer, forthcoming, for various analyses within the OT framework). Lombardi (1999, p. 277) analyses it in terms of the following constraint:

- (29) AGREE: Obstruent clusters should agree in voicing.

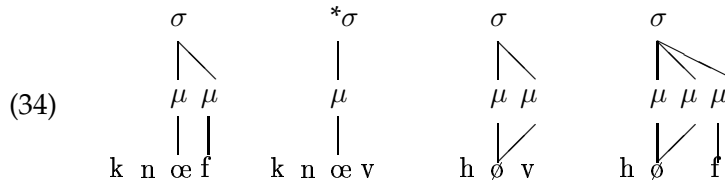
AGREE is of course very similar in form and spirit to the constraint ASSIMILATE, which we used above to describe nasal assimilation. Under this formulation, the process in question becomes unmistakably opaque, quite independent where we rank AGREE (if *CC ≫ FAITH(VOICE)):

(30)

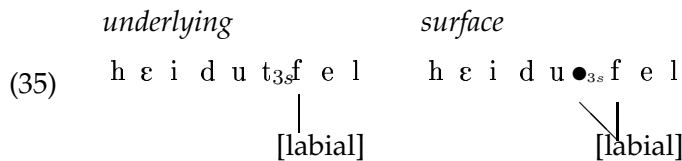
[f]			*!
<i>hij doe/t v/eel</i>	*CC	AGREE	FAITH(VOICE)
[tv]	*! W	*W	L
[tf]	*! W		*
x [v]			L

In order for a solution along the lines of EXPRESS-[F] (in this case: EXPRESS-[3PS]) to work, we need to know what exactly is the phonological element that expresses the inflectional suffix in this case. Lombardi (1999) employs a theory of laryngeal features in which [voice] is monovalent, i.e. there is no phonologically active [-voice]. This means that the underlying and surface representations are schematically as follows (representing [v] as a /f/ with attached [voice]):

¹³The rules are slightly simplified versions of the ones given in Taeldeman (1982). Taeldeman uses a definition of opacity which is somewhat different from the one employed here; under that definition, this rule ordering is actually not opaque, but the problem for Optimality Theory obviously stays the same.



If this analysis is correct, it could be the *position* of the /t/ that is retained after the disappearance of the segment:



It thus is the phonotactic position (represented here as a dot, since it does not matter whether this is a mora, a root node, or something else), that could be seen as the trace of the suffix, necessary to satisfy EXPRESS-3SG.

(36)

	[f]				*
<i>hij doe</i>	/t v/	<i>eel</i>	*CC	EXPRESS-3SG	AGREE FAITH(VOICE)
	[tf]		*! W		*
	[tv]		*! W	* W	L
	[v]			*! W	L

Notice that the tableau is very similar to the ones given for Hellendoorn and Ojibwa above: the morphological faithfulness constraint EXPRESS-3SG outranks the phonological faithfulness constraint FAITH-voice.

Taeldeman (1982) asserts that the opacity effect attested in the dialects just discussed is typical for deleted /t/ as a morpheme. Similar effects can however be found in the literature purely internal to the phonology in other dialects of Dutch. E.g. in Wilsum Dutch, the final /t/ of function words such as *net* (just), *met* (with) and *de* (that) can disappear, but still have the effect of devoicing the following /f/. We thus get examples such as the following (Spa, 2000, 46):

- (37)
- a. *ne*/t z/*o* *dudelijk* > *ne*[s]*o* *dudelijk* ‘just as clear’
 - b. *me*/t z/*ien* *ome* > *me*[s]*ien* *ome* ‘with his uncle’
 - c. *as* *ie* *de*/t v/*raogen* > *as* *ie* *de*[f]*raogen* ‘if he that asks=if he asks that’

In this case, the relevant type of faithfulness cannot be morphological, since the function words in question are expressed by an onset consonant and a vowel; EXPRESS constraints are thus satisfied in any case. It could be argued that we thus have an instance of faithfulness to the segmental position,

usually formalized as a DEP constraint (every segment in the input should have a correspondent in the output). The correspondent of *t* will be filled by material from the fricative (which means that a lower-ranking IDENTITY-constraint will be violated).

(38)

☞ [s:]				*
<i>ne/t z/o duidelijk</i>	*CC	DEP	AGREE	FAITH(VOICE)
[ts]	*! W			*
[tz]	*! W		* W	L
[z]		*! W		L

The situation is somewhat more complicated, because we need to explain why this only involves the final /t/ of function words. It has been argued that the final /t/ of words such as these is also in some abstract sense a suffix (Vanacker, 1949); the /t/ shows other types of deviant behaviour in other contexts as well. Taeldeman & Schutter (1986, 114) propose that there is a hierarchy of positions where devoicing after deleted /t/'s may occur:

- i. verbal inflection
- ii. the 'small words' *daT* 'that', *waT* 'what', *nieT* 'not' and (sometimes) *meT* 'with'
- iii. frequent adjectives of the type V:d (e.g. *goed* 'good', *kwaad* 'angry/bad', *koud* 'cold', *dood* 'dead')

This hierarchy seems to reflect the straightforwardness of the inflectional nature of the /t/ in question. The hierarchy is based on the fact that in some dialects (the ones just discussed) we only find this effect in environments (i), in other dialects (the one spoken in Bruges) we find them in (i) and (ii), and yet in others (e.g. Ghent) we find them in (i), (ii) and (iii).

		Bruges	Ghent
(39)	<i>hij doe/t v/eel</i> 'he does a lot'	[f]	[f]
	<i>da/t v/uur</i> 'that fire'	[f]	[f]
	<i>goe/d z/aad</i> 'good seeds'	[z]	[s]

The question then remains why only frequent adjectives of a specific shape participate in Ghent. The frequency effect might be attributable to the fact that there tends to be more deletion in frequent words than in less frequent words in general (Goeman, 1999). It is not exactly clear to me why there should be a preference for adjectives ending in long vowels plus /d/. Yet one aspect is of particular importance here: the fact that in this case an analysis in which an underlying feature [-voice] would be the trace of the deleted segment cannot work. This gives indirect support for the analysis presented above in which it is the position of the coronal stop that surfaces, filled with

the material of the fricative, which thereby lengthens and thus remains voiceless.

5 Remnants of the first person singular morpheme

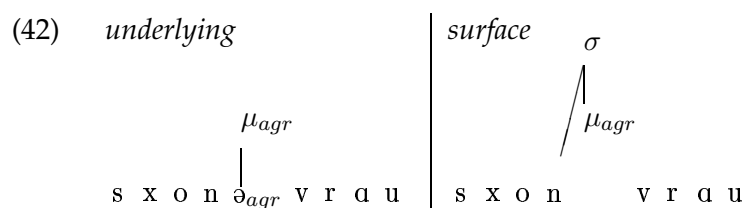
A relatively well-known case of opacity within Dutch dialectology is provided by Aalst Dutch. At least according to the very careful phonetic study of Colinet (1896), this dialect used to display an interesting opaque application of nasal assimilation: the disappearing element (an inflectional schwa) did not trigger assimilation (as was the case in the previous examples of voicing assimilation), but rather to block it (Colinet, 1896; Tældeman, 1980). (Tældeman (2002) reports that some speakers still had the phenomenon in fieldwork in the second half of the twentieth century.) If an inflectional schwa (in the case at hand a schwa which expressed adjectival agreement) disappeared before a nasal, the nasal did *not* assimilate to the consonant following it on the surface, in spite of the fact that the environment for assimilation seems to be present:

(40)	<i>schoo</i> /n/ <i>ventje</i> ‘handsome guy’	<i>schoo</i> /n/+/ə/ <i>vrouw</i> ‘beautiful woman’
	<i>schoo</i> /ŋ/ <i>ventje</i> assimilation	<i>schoo</i> /n/+/ə/ <i>vrouw</i> d.n.a.
	<i>schoo</i> /ŋ/ <i>ventje</i> d.n.a.	<i>schoo</i> /n/ <i>vrouw</i> schwa deletion

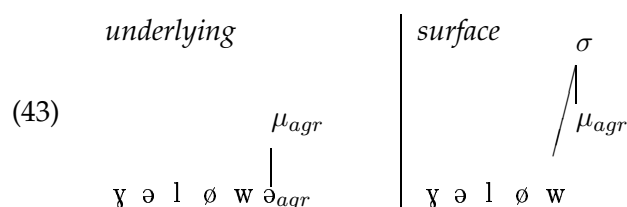
It is hard to see what the ‘trace’ of the adjectival inflection could be that would be necessary to satisfy EXPRESS-[Agr] (‘Agr’ standing for whatever the morphological features of overt adjectival inflection are). The reason for this is that the schwa seems to have gone on the surface completely, and there is nothing in e.g. the segmental make-up final [n] of *schoon* that could be seen as a trace of the existence of this segment:

(41)	<i>underlying</i>	<i>surface</i>
	s x o n ə _{Agr} v r ɑ u	s x o n v r ɑ u

How can we explain these facts? The crucial observation is that nasal consonants only assimilate in dialects of Dutch if they are *not* in syllable onset. The conclusion therefore is that the trace of the agreement morpheme that is necessary in order to derive the opacity effect, is the syllable structure. We could suppose, for instance, that the inflectional schwa has a mora underlyingly. Under this view, it is the mora then that serves as the trace of adjectival inflection. The mora then necessarily projects an (empty-headed) syllable (cf. Hammond, 1999; van Oostendorp, 2000, for a few recent applications of this concept within Optimality Theory).



A similar account may be able to explain a quite spectacular examples, cf. the lack of final devoicing in Tilligte Dutch (Goeman, 1999, p. 216). Even though this dialect displays the effects of syllable-final devoicing elsewhere pervasively, we find forms such as *ik geleuv* 'I believe' (or *ik geleuw*) in the first person singular. Importantly, Goeman (1999) notes that in neighbouring dialects we find a schwa serving as an overt first person singular suffix in the neighbouring dialects where the suffix has not yet been lost. The analysis here could be exactly the same as for Aalst Dutch:



(Goeman, 1999, 216-217) lists a large number of dialects where this phenomenon may be found; furthermore such dialects can be found in quite a large part of the Dutch language area (cf. map 1). The reason Goeman gives for this, is a historical one: the first person singular schwa has been deleted 'recently' and therefore the final devoicing has not yet taken place. We could say that this statement depends on the opacity of diachronic language change: the final devoicing process proceeds as if the historical ending were still there.¹⁶

¹⁶The data are from Goeman (1999) and the Goeman-Taeldeman-Van Reenen Database; the latter is available at <http://www.meertens.knaw.nl/>; look for 'Morfologische Atlas'/'Morphological Atlas'.



(44)

It is of interest that once again fricatives are the main focus of this exceptional behaviour, as is to be expected if we assume that fricative voicing is primarily an issue of syllable positions and those positions can be used to express morphological structure.

Other phonological processes may also be influenced by this vocalic position and the onset it licenses. In Brussels Dutch (de Vriendt & Goyvaerts, 1989) we see that various phonological processes act as if the first person singular still ends in a vowel. For instance, words in this dialect are not allowed to end in a velar nasal. Words which have such a segment underlyingly, develop a [k] at the end by some process of /k/ insertion:

- (45) 'k-insertion'
- | | |
|-------------------|--------------------|
| [puliŋk] 'eel' | [puliŋə] 'eels' |
| [ɣaŋk] 'corridor' | [ɣaŋə] 'corridors' |

We can see that the /k/ is inserted here at the end of the word since it does not occur in the plural forms, before a schwa (there is a difference here with a form such as *plank-planken* 'plank(s)' which do have an underlying /k/).¹⁷ Yet velar nasals can be found at the end of verbs in the first person singular (present):¹⁸

¹⁷Alternatively, one might argue that these words end e.g. in /ŋg/ underlyingly, which devoices at the end. In this case, we need to say that the /g/ is deleted in the first person singular, just as it is deleted before a schwa. The puzzle for the phonology-morphology interface stays the same.

¹⁸The first person singular preterite did not have a schwa ending and therefore is irrelevant from our perspective.

- (46) a. *ik hang* 'I am hanging' [ikɑŋ]
 b. *ik zing* 'I am singing' [iksɪŋ]

The behaviour of this form could be explained in various ways, depending on one's analysis of the behaviour of the velar nasal. One could state for instance, that a velar nasal is not allowed to occur as the last segment of the syllable. In the first person singular, this condition would not apply, since there is an (empty) syllable head following the velar nasal. The segment therefore would occur in the onset of such a syllable, and there would be no need to insert a /k/.

In the same dialect, we find paradigms such as the following:

- (47) a. *kleden* 'to dress' [klejə]
 b. *hij kleedt hem* 'he dresses himself' [a+klit+əm] (shortening)
 c. *ik kleed mij* 'I dress myself' [ik+klej+ma]

One way of analysing this is to assume that the verb 'to dress' has an underlying /d/, which is subject to final devoicing at the end of the word and to a process of weakening before a vowel (Zonneveld, 1978; Swets, 2004). The important point is that the first person singular patterns with the infinitive rather than with the third person singular. In other words, the first person singular behaves as if it stands in front of a vowel. Again, this is something which can be understood if we assume that

There is a well-known fact of Standard Dutch phonology that could be accounted for along similar lines. We have already cited the rule deleting /n/ after schwa, which is very productive in at least some varieties of Dutch. This rule affects (inflectional) suffixes, but also stems, such as *open* 'open' or *teken* 'sign'. However, it is a clear fact of Dutch phonology that /n/ deletion is much harder in the first person singular form of verbs (48a) than it is in other stems (cf. Zonneveld, 1982; Ernestus, 2000).¹⁹

- (48) a. *dat ik de deur open* 'that I open the door'
 b. *de deur is open* 'the door is open'

There have been several proposals in the literature that word-final consonants are onsets rather than coda's (cf. Piggott, 2002, for an overview). Most

¹⁹In standard Dutch paradigms, there is one other form which consists of a pure stem only: the second person singular in inversion (*open jij* 'open you'). I do not have any evidence whether or not /n/ deletion is blocked in this environment just as much as it is in the first person singular form. It seems to me that there is a contrast between *tekenen* (*ook*) *jullie* 'draw also you', in which the final /n/ is part of the plural inflectional ending /ən/ and in which this /n/ can be deleted quite freely, and *teken* (*ook*) *jij* 'draw also you', in which the /n/ is part of the verbal stem and resists deletion. If this intuition is shared by other speakers, the explanation may be that the second person singular in this particular context also has extra morphological structure. Otherwise, the second person would have a different structure. (The central thesis of this section does not seem to be affected either way.)

of these do not differentiate between morphological contexts: *all* words are supposed to end in a consonant. Such proposals cannot differentiate between the two instances of *open* in Standard Dutch, and the two instances of *geloof* ‘belief’ (the verbal form which ends in a voiced consonant and the nominal form which is subject to final devoicing) in Twente, or at least they have to find another way to do so.

It would be technically possible to handle these facts in Sympathy Theory as well. Let us consider the Twente case. The nominal facts (with devoicing) can be analysed straightforwardly as follows:

(49) FINDEV: Final obstruents in the syllable should not be voiced.

(50)

☞[yəlof]		*
/yəlov/	FINDEV	FAITH(VOICE)
[yəlov]	*! W	L

If we want to extend this analysis to the verbal form under Sympathy, we have to find a candidate with a voiced fricative to which the winning candidate has to be sympathetic. If Sympathy selecting constraints are faithfulness constraints, this means that this candidate has to be close to the underlying shape of the verbal form. Under the assumption that Sympathy constraints cannot see morphological information this Sympathy candidate should not be available for the noun in (50). But this implies that the noun and the verb have to have a different underlying representation, e.g., the verb ends in a schwa. The Sympathetic candidate is then selected by the constraint against schwa deletion (DEP):

(51)

☞[yəlov]			*		*
/yəlovə/	FAITH _☞ (VC)	*ə	FINDEV	FAITH(VOICE)	☞DEP
[yəlof]	*! W		L	* W	*
☞[yəlovə]		*! W	L		☞L

In other words, a Sympathy analysis of these facts seems to force us to an assumption which is quite similar to the one proposed here: viz. that there is an extra element in the underlying phonological representation of the verb. The difference is that this extra element is not related to the morphological structure of the verb (the fact that it has an extra inflection) in any obvious sense. *All* words could have this type of invisible schwa.²⁰ In this sense, a theory of phonological recoverability seems to be more restrictive.

²⁰If we try to embed this Sympathy analysis within a larger fragment of Dutch, we get the problem that there are words ending in schwa, also after voiced fricatives (*keuze* ‘choice’ [køzə]) and have to explain why these would not disappear due to a high ranking constraint *ə.

Another alternative we might want to consider, is some form of Output-Output Faithfulness. One of the more restrictive versions of this type of theory is Paradigm Uniformity (McCarthy, 2003b). The idea behind such an analysis would be that the nasal in *open* is protected from deletion by a special faithfulness relation to a form somewhere else in the paradigm, which does have an overt schwa following it (e.g. the plural form *openen*). Because schwa is not deleted in the latter form, it is also not deleted in the former.

- (52) a. OPENSCHWA: Schwa should occur in an open syllable (van Oostendorp, 2000).
 b. PARADIGM: Forms in the paradigm should be the same (in particular if some segment is deleted in one form, it should be deleted throughout the paradigm).
 c. *HIATUS: Two vowels should be separated by at least one consonant.

(53)

☞ [opən - opənə]			*
/opən - opən+ən/	PARADIGM	*HIATUS	OPENSCHWA
[opə - opənə]	*! W		L
[opə - opəə]		*! W	L

Just like Sympathy and Recoverability approaches, Paradigm Uniformity uses a separate representation where the schwa does surface. The attraction of Paradigm Uniformity is that it uses a representation which appears to be present in the grammar in any case (somewhere else in the paradigm).

However, even though Paradigm Uniformity seems successful in the case of Standard Dutch, it cannot be invoked for the analysis of e.g. the Twente facts which are very similar.²¹ In the first place, in the Twente dialects the plural ending is not a (schwa) vowel, but *-/t/*; in these cases the fricative is subject to regressive voicing assimilation and thus surfaces as [(ɣelo)f(t)]. There thus is no form in the (present tense) paradigm to which the fricative in *geloov* could be 'faithful'. The infinitive does have a schwa, but it is hard to see why this would be part of the paradigm, and if it is why the first person singular would be the only one that is systematically sensitive to its attraction; why would not e.g. the plural forms come out as either [ɣelovt] or [ɣelovd]? (If the phenomenon would occur in one dialect, this could of course still be a coincidence, but the fact of the matter is that it occurs in many dialects, as the map in (44) shows.)²²

Another argument is dialectological: *ik geloov* type dialects always occur in an area which is adjacent to an area where the first person singular suffix

²¹This point is made in more detail in van Oostendorp (forthcoming).

²²Similarly, Paradigm Uniformity also does not seem to explain why the uniformity goes in the direction of *voicing* the first person singular, rather than *unvoicing* the other forms.

is still pronounced, as is also shown in (44). This has a natural explanation in a Recoverability approach: the schwa disappears, but it can sometimes leave its position. In a Paradigm Uniformity approach no explanation for this geographic distribution is available, as far as I can see.

The attraction of Paradigm Uniformity thus is that it refers to a representation which is independently necessary. The problem is that it sometimes is demonstrably the case that the extra representational device has nothing to do with other forms in the paradigm, but only with the first person singular. Recoverability seems a parsimonious theoretical device to express exactly this.

6 Conclusion

In order to solve the problem of opacity, many Optimality Theoretic proposals have suggested to introduce extra levels of representation. In this way, the ‘rule-based’ solution to this problem (where the extra representations are seen as stages in the derivation) was essentially mimicked. In most cases, the analysts tried to relate the representation to already existing ones, such as other candidates in the tableau in the case of Sympathy. In spite of this, these approaches run against the spirit of monostratalism, in which all constraints should refer exclusively to one level of representation.

The solution of Recoverability is monostratal, in the sense that only the output of the Generator function is relevant. The cost of this is that this single output representation is in some sense ‘enriched’: it contains information as to the morphological structure of the word, in particular about which phonological segment belongs to which morpheme. There is some evidence that this information is independently necessary. Constraints such as EXPRESS-MORPHEME have been proposed in various places in the literature, notably as we have seen above (fn. 1).

Other constraints referring to the morphological affiliation of phonological material can also be found. A well-known example of this are the positional faithfulness constraints referring to stems and affixes (FAITH(AFFIX) and FAITH(STEM)). In order to be able to check whether a changed or deleted segment violates either of these constraints, we need to know whether the segment belongs to a stem or to an affix. We need something like the subscripts used here for recoverability. To give a more concrete example, Bakovic (2000) proposes the principle *Stem identity* in order to deal with

- (54) STEM IDENTITY. Given $[\text{stem}_i]$ and $[[\text{stem}_j]\text{afx}]$, where afx is a prefix or suffix and stem_i is morphologically identical to stem_j , application of a process P across the stem_j and afx boundary may not thereby render stem_i and stem_j phonologically distinct.

Bakovic (2000) uses this constraint to explain stem-controlled vowel harmony (where the harmonic features spread ‘inside out’ in morphologically complex forms), and why stems are never affected by affix vowels in such systems. Compare e.g. the following Turkish forms:²³

- (55) a. Input: *ip* ‘rope’ + *lar* ‘nominative plural’
 b. Outputs: *iplar*, *ipler*, *ıplar*

The candidate *ıplar* is disharmonic and therefore unacceptable. The candidates *ipler* and *iplar* on the other hand, are harmonic; the first one by virtue of the suffix adapting to the root, the second one by the root adapting itself to the suffix. Stem identity now chooses for the former, since this preserves the phonological structure of the stem *ip*. In order for STEM IDENTITY to work, the phonological constraints need to be able to see that the vowel /i/ belongs to the stem, whereas /e/a/ belongs to an affix. This is exactly the type of information that is needed for a constraint such as EXPRESS-MORPHEME as well.

This does not mean, of course, that we can do away with all independent representations — and thus with Sympathy Theory, Paradigm Uniformity, etc. — immediately. Many phenomena have been analysed using these devices. It is not excluded that the output representations could be enriched sufficiently so that they would be able to deal with these phenomena as well, but this remains an empirical issue in need of further exploration.

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²³In reality, it is hard to decide whether *-ler* or *-lar* is the underlying form of the suffix; but the argument does not change if we assume that it should be *ler* and consider combinations with back vowels.

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