An exception to final devoicing

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1. The issue and the data

All Dutch dialects — or, more generally, all West-Germanic dialects except English[1] — display the effects of a process called *final devoicing (FD)*, illustrated in (1) for standard Dutch: an underlyingly voiced obstruent devoices when it occurs at the end of a syllable. That the obstruent is underlyingly voiced can be seen in other morphological contexts, where it does not end the syllable. Thus in (1) there is a contrast between 'bathe', which has an underlying /t/, and 'bed' which has an underlying 'd', but the contrast only shows up when a vowel-initial plural suffix is added:

(1)	/bɛd/	[bɛt] 'bed'	/bɛd+ən/	[bɛdən] 'beds'
	bed			*bedden*
	/bɛt/	[bɛt] '(I) wet'	/bɛt+ən/	[bɛtən] '(we) wet'
	bet			*betten*

As far as is known, there are no Dutch dialects which do not have FD at all — which in itself is remarkable given the fact that there is a lot of variation on many other phonological points. On the other hand there are quite a few dialects which display exceptions to FD in certain morphological contexts (De Schutter en Taeldeman 1986, De Vriendt en Goyvaerts 1989, Goeman 1999, De Bree 2003). Of these, there are various types. A relatively widespread phenomenon, found both in eastern and in southern dialects of Dutch (including Flemish), is that the final fricative of a verbal stem (with a long vowel in the final syllable) remains voiced in the first person singular:

(2)	Tilligte	[ɪk ɣəløv]
	(Baader en Ribbert 1938, cited in Goeman 1999):	[ɪk ɣəløw]

This is the type of exceptional behaviour that will be studied in this article. At least two questions arise about this example. In the first place, why are fricatives (after long vowels) involved? In the second place, why is the first person singular involved? The first question may seem relatively 'phonological' and the second relatively 'morphological', but both issues will be discussed in this paper and it will turn out that they are strongly intertwined.
As far as my data are concerned, I will base myself on data from Dutch dialects from the so-called GTR-database (available online at http://www.meertens.knaw.nl/projecten/mand/Data.html), and the

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[1] There are a lot of differences among dialects; it is well-known for instance that so-called Standard Yiddish does not devoice consonants at the end of the word (Lombardi 1991, 1995. Wetzels and Mascaró 2001) and it is claimed for Frisian that FD did not occur until the beginning of the 20th century (Tiersma 1985). See Van Bree (2003) for an overview.

dialectological work of Van Bree (2003), Goeman (1999) and Weijnen (1991). As to the analysis, the main argument will be that a sufficiently sophisticated view of representations obviates the need for many complexities in the formulation of constraints.
I will first concentrate in sections 2 and 3 on the morphology of this type of exception and argue that an approach in terms of paradigm uniformity (devoicing would differentiate the first person singular too much from other forms) faces severe problems; it could be replaced with an approach which assumes that all underlying morphemes find expression in the output representation. In sections 4 and 5 I subsequently discuss the analysis of voicing in fricatives, and show how the phonological behaviour of these elements can be made to follow from their representation: if we assume that fricatives prefer to be [spread glottis], and if [spread glottis] segments prefer to be long (both claims have been made in the literature), the relevant facts can be made to follow. In this article, I will frame the debate in terms of Optimality Theory for the sake of concreteness, even though the issue, and most of the arguments pro and contra are really independent from this particular choice. Section 6 gives an OT formalization of these ideas. Section 7 considers how this formalisation can also account for other facts of fricative phonology, and section 8 discusses some of the typological consequences of itSection 9 is devoted to a conclusion.

2. Two approaches to the influence of morphology on phonology

Roughly two approaches to the description of the special effect of the first person singular are possible:

i. *Paradigmatic.* The first person singular should resemble 'related' forms as much as possible; application of final devoicing would increase the differences between forms in the paradigm to an unacceptable level (cf. Van Bree 2003).
ii. *Structural.* The first person singular has some property which blocks final devoicing (cf. Zonneveld 1978).

These two approaches correspond roughly to different views on morphology (e.g. Item-and-Arrangement vs. Word-and-Paradigm model; Hockett 1958, Robins 1959): the structural approach fits best with one in which it is assumed that words are structured units of morphemes, although it could be made compatible with other approaches as well. The paradigmatic approach seems to fit better into a view of morphology as a function relating words as essentially structureless units to each other, although it can probably be formulated in other theories of morphology as well.
Much modern literature within Optimality Theory seems to converge on paradigmatic approaches to facts such as the one that is currently under analysis. Examples of such approaches are Benua 1997, Burzio 1998 and McCarthy 2002b, all of them framed within correspondence theory (McCarthy and Prince 1995) in some way.
In order to make the comparison between these two approaches to phonology-

morphology interaction, we need some analytical tools to deal with final devoicing. Several of these are available in the current literature (see other articles in this volume, and also the discussion in section 5), but we will first use a relatively neutral formulation such as the following:

(3) FD (first, provisional version)
Voiced obstruents cannot occur in syllable coda.

This constraint describes the effect we need rather directly. It has to be ordered above the relevant faithfulness constraints in order to be active in the grammar:

(4) IDENT-IO(voice)
Underlying specifications for voicing should be respected.

(5) FD » IDENT-IO(Voice)

(6)

/bɛd/	FD	IDENT-IO(voice)
☞ [bɛt]		*
[bɛd]	*!	
[pɛd]	*!	
[pɛt]		**!

The phonological analysis will have to be revised quite substantially in section 4 below, but for now it will serve to compare the two approaches to phonology-morphology interface.
In the case of a paradigmatic approach, we need a special faithfulness constraint in which the output is not compared to the input, but to a different output form (most likely, another form in the paradigm). Such a constraint could take various shapes — see Benua (1997), Kager (1999), McCarthy (2002) for some proposals — but it will basically have the following shape:

(7) IDENT-OO(Voice)
The specification for [voice] of the form under evaluation should equal the specification for [voice] in some designated other form (in the paradigm).

Also for the sake of concreteness I will assume that the 'designated other form' in the case of *ik geleuv* 'I believe' is *geleuven*:

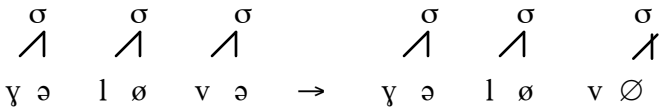
(8)

/ɣələv/ [ɣələvən]	IDENT-OO(Voice)	FD	IDENT-IO(Voice)
☞ [ɣələv]		*	
[ɣələf]	*!		*

The alternative, structural analysis would assume that, even though the vowel of the 1SG suffix has disappeared, it has not done so without leaving a trace. For instance,

there still is a phonetically empty vowel position, protecting the consonant against devoicing (because in this approach devoicing would only affect consonants in coda position). Diachronically we would then have seen the following development:

(9)



The resulting configuration would not be subject to FD, since it would not fit the description (it would not occur in syllable coda). We therefore would get the following tableau:

(10)

/ɣələv/	FD	IDENT-IO(Voice)
☞ɣələv		
ɣələf		W

This approach — of which Zonneveld 1978 counts as the Urheber in the Dutch literature; cf. also Kaye, Lowenstamm & Vergnaud 1990 and many others — requires some amount of abstractness within the phonological representation, viz. a zero morpheme in the shape of a zero vowel, but it should be noted that it does not need the notion of a paradigm which is at least as 'abstract' and on top of that hard to define.

3. Problems with the paradigmatic approach

Given the simplified exposé above, it is hard to decide between the two approaches to the phonology-morpology interface under discussion, but the paradigmatic approach to exceptions to FD seems the most promising option. Yet there are at least three problems with such an approach.

The first problem concerns the geographical positioning of the phenomenon involved. From dialectgeographic study it appears that exceptions to FD of the type discussed above, are always found in the vicinity of areas where the 1SG suffix is still overt. Tilligte, for one thing, borders on an area where people still say *ik geleuve;* the form is even reported as an indigenous variant for Tilligte itself (Goeman 1999). The same thing is true for southern dialects displaying the process, such as Ghent (cf. Goossens 1977): they are always in the vicinity of dialects in which the schwa is still pronounced, or the schwa variant can even still be found in the dialect in question. This can be clearly seen in figure 1, which displays a map of the (European) Dutch-speaking language area (The Netherlands and Flanders), where the circles denote dialects with 'exceptions' to final devoicing for any of the verbs 'to live', 'to stay' and/or 'to give' (past tense), lines indicate dialects in which the 1SG of any of these verbs ends in a schwa, and rectangles dialects in which both variants can be found:[2]

[2] Note that in the north-east, on the border of the so-called IJsselmeer *IJssel lake), we find a few circles which are not close to dialects were schwa is pronounced. It is possible that schwa

Especially the fact that the pattern is seen in two unconnected areas is very suggestive. If we assume that geography mirrors language change in this case, this is a very strange and unexpected state of affairs. We have as it were three stages of development:

1. *ik geleuve.* During this stage IDENT-OO(Voice) is not necessary because schwa protects the fricative. Since it is usually assumed that faithfulness constraints are lowly ranked by the language learner, unless there is evidence to the contrary, the constraint will have a low position in the hierarchy during this stage.
2. *ik geleuv*. In this stage, some constraint is responsible for schwa deletion (e.g. FINAL-C, McCarthy to appear, Swets to appear and references there); at exactly the same time, IDENT-OO(Voice) should become highly ranked (that is why we introduced it in the first place), even though it is not clear what the formal connection between the two

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deletion has been relatively recent in this region, which however has been recently flooded by the (neighbouring) Amsterdam dialect. The few spots indicated by circles here might be the last remnants of this.

Another possible reason is that these are so-called West-Frisian dialects, and very similar to Frisian in many ways. As has been noted in footnote 1, final devoicing did not apply to Frisian for a very long time (the province of Fryslân borders at the opposite side of the water, but data from this language have not been included in the survey on which this map was based), which explains the white spot on the province of Fryslân (the province which in the north, below the three rightmost islands). Potentially, then these dialects are indeed on the border of a linguistic area — albeit one at the opposite side of the lake.

constraint movements are.
3. *ik geleuf.* At this point, IDENT-OO(Voice) should again have become lowly ranked since it no longer effects the phonology of any segment.

The output-to-output faithfulness constraint therefore has to move up and down during language change; it is unclear what is the relation between this fact and the disappearance of schwa. In particular, we could expect IDENT-OO sometimes to go up in dialects without recent schwa apocope, so that we would find individual spots where exceptions to FD are *not* surrounded by places where there is still a schwa.
Notice that the structural approach does not suffer from this problem at all. The language change behaviour is as it were incorporated into the approach. The order of events in this case would be that the schwa would first be deleted, leaving behind its structural position. After a while also this position would be lost, and the fricative would end up in a coda. Within the structural alternative approach, there is no reason, on the other hand why a coda fricative would ever 'spontaneously' create an empty vowel behind it.
The second problem with the paradigmatic approach concerns the structure of the paradigm. In the presentation of the paradigmatic account above, we assumed that we could establish in some way that the 'designated other form in the paradigm' in the case of *ik geleuv* is *geleuven;* the latter form is the plural form of the verb (for all persons) in the Standard language. On closer scrutiny, this view is very problematic. In some of the dialects under discussion, it is not clear at all how we could get to this form. The dialects surrounding Tilligte, for instance, have a plural ending in *–t*, so that actually all other forms in the present tense are *geleuft* with a devoiced cluster.

(11)	1SG	*geleuv*	1PL	*geleuft*
	2 SG	*geleuft*	2PL	*geleuft*
	3 SG	*geleuft*	3PL	*geleuft*

The infinitive is *geleuven* in these dialects, but it is not clear why it should be the inifinitive that has this particular power. It is also not clear why the influence of this 'designated other form' restricts itself to the 1SG; the other forms in the paradigm could have become *geleu*[vd], but as far as I have been able to find out, this form is never attested. In fact, the 2SG form is *geleuf* in many dialects in so-called 'inversion context' — if it precedes the subject. Yet, as far as I have been able to find out, this is never voiced.[3] Because the notion of a paradigm does not play a role in the structural approach, this problem does not affect it. The form *geleuv* is evaluated independently of other forms in the paradigm, and it does not actually matter what the other forms in the paradigm are

[3] A complicating factor is that the subject of course is always a second person singular pronoun or clitic; in some dialects this is an (underlyingly voiced) fricative, and fricative clusters are never voiced in Dutch (cf. Zonneveld this volume). Another problematic case is where the pronoun (and especially the clitic) starts with a vowel; in that case lack of devoicing can be understood independently as resyllabification. However in many dialects the second person pronouns and clitics start with a a glide; in this case there should be no problem in voicing the fricative.

(although one could argue that in the absence of any other voiced fricative form, the language learner would no longer have a reason to posit such a form in the first place). The third problem with a paradigmatic account is that exceptions to final devoicing usually (or always) involve fricatives. Within the paradigmatic approach it is unknown why fricatives should be more sensitive to paradigmatic influence than other consonants. We could reformulate the relevant faithfulness constraint in the following way:

(12) IDENT-OO(Voice, fricatives)
The specification for [voice] **of fricatives** for the form under evaluation should equal the specification for [voice] in some designated other form in the paradigm.

An account along these lines would not count very high on the scale of explanatory adequacy. Since fricatives do not support voicing contrasts as easily as stops do, one might actually expect the opposite state of affaires. Yet, unlike in the case of the other problems, the structural approach does not immediately offer a valid alternative. There is no reason why a plosive could not occur in the onset of an otherwise empty syllable in the same way as a fricative can. This problem needs to be solved first before we can use the status of fricatives as a fatal objection to the paradigmatic approach.

4. Voicing and fricatives in Dutch

At first sight it may seem absurd that the fricatives of all segments are the possible exceptions to FD: phonetically they are *less* compatible with [voice] than plosives. It even is the case that in those cases in which exceptions to final devoicing are *not* triggered by the morphology, we seem to find the inverse pattern: fricatives devoice *before* obstruents do. In a survey of Dutch dialects, Van Bree (2003) mentions that:

> not all potential target sounds take their turn at the same time: there clearly is earlier devoicing with fricatives than with occlusives (…); this might be related to the fact that the unmarked state for fricatives is voicelessness.[4]

Incidentally, this sequencing of affairs might be reflected in Dutch spelling as well: the devoicing of fricatives is reflected in the spelling: <huis> 'house' -<huizen> 'houses', but the devoicing of stops is not: <hand> 'hand' - <handen> 'hands'. One reason for this may be that fricatives were already clearly devoiced at the time when Dutch spelling conventions were established (in the second half of the 19th century) whereas stops were not.[5]
We will have to take into account the fact that there is a difference between those cases

[4] "niet alle in aanmerking komende klanken [komen] tegelijk aan de beurt […]: bij de fricatieven vindt er duidelijk eerder verscherping plaats dan bij de occlusieven […]; dat kan er verband mee houden dat de ongemarkeerde toestand waarin een fricatief zich bevindt, die van stemloosheid is" (Van Bree 2003:7).

[5] See Wester (1987) for an alternative proposal, basically claiming that voicing is completely undistinctive for fricatives in this position and *this* is reflected in the spelling.

in which morphology is involved and those cases in which it is not. For now, let us concentrate on the former case. Interestingly, there is another well-known case where fricatives constitute exceptions to FD, viz. Turkish (Kaisse 1986, Rice 1993):[6]

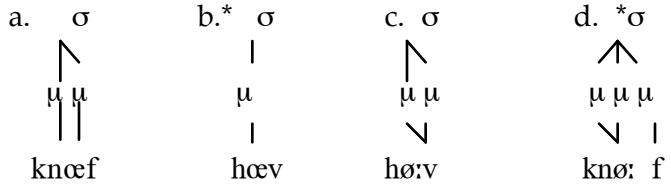
(16)	şara[p] 'wijn, NOMSG'	a[z] 'weinig'
	şara[bɪ] 'wijn, ACCSG'	e[v] 'thuis'

In general there arguably is a special relation between fricatives and voice. According to Maddieson (1984) "bilabial, dental and palatal non-sibilant fricatives are found to occur *without* a voiceless counterpart more often than with one."
Van Oostendorp (2002) argues on the basis of phonotactic distribution that in some West-Germanic dialects the opposition voiced/voiceless should be replaced for fricatives with the opposition short/long. Phonetically these oppositions are clearly correlated. This explains facts such as those above: in Turkish, fricatives would not be sensitive to FD if phonologically they do not have the feature [voice] (an idea which is clearly present also in the approach of Rice 1993 referred to above). That typologically short fricatives should occur more often than long ones is hardly surprising.
It seems problematic to replace the voicing opposition with a length opposition completely in Dutch (at least in Standard Dutch and the dialects under consideration here), but there clearly are facts that the two dimensions are correlated, e.g. the fact that short lax vowels (almost) exclusively occur before voiceless fricatives and long (tense) fricatives (almost) exclusively before voiced ones.

(17)	*knuffel*	[knœf]	'hug'	*[knø:f]
	heuvel	[hø:v]	'hill'	*[hœv]

These facts are easily explained if (stressed) syllable consist of minimally one and maximally two mora's, long vowels occupy two mora's, and short vowels only one, and if long fricatives are represented e.g. by moraic consonants:

(18)



In (18a), a short vowel is followed by a 'long' consonant, this is fine. In (18b), the short vowel is followed by one consonant; this structure is too short (contains less than one mora). In (18c), a long vowel is followed by a short consonant; this is again fine. In

[6] Rice (1993) gives these as an example of 'sonorant obstruents': the voicing of fricatives is a result of a feature (non-laryngeal) Sonorant Voice, but the stops are voiced by laryngeal [voice] and the final devoicing rule targets only the latter. This does not explain, however, why the asymmetry is exactly in this way (it seems to be similar in many of Rice' (1993) examples; to be more precise, there is no example where *stops* have Sonorant Voice, but fricatives have [voice]).

(18d), a long vowel is followed by a long consonant; this is too long (more than two moras).
There is some empirical support for this assumption in the work of Ernestus (1999:177). Based on a corpus of spontaneous (Standard Dutch) speech, Ernestus notes that

> Clusters of fricatives of the same place of articulation arise when a word-final fricative is followed by a word-initial one. These clusters are generally realized with a duration that is shorter than the duration of two segments (...). In what follows, clusters consisting of two segments with the same manner and place of articulation will be referred to as geminates.
> (...) The problem is that fricative geminates are always realized as voiceless, independently of their context, exact duration, etc.

From this we can thus at least conclude that longer fricatives are always voiceless. Similarly, the work of Slis and Van Heugten (1989) shows that the phonetic distinction between 'voiced' versus 'voiceless' fricatives is primarily cued by a difference in duration. A somewhat more complicated argument, finally comes from those (Brabantish and Flemish) dialects of Dutch (De Schutter and Taeldeman 1986) where deletion of t's in clusters cause the fricative in those clusters to devoice. So, instead of *hij doe*/t v/*eel*, people pronounce *hij doe*/f/*eel*. The same thing does not happen (or happens much less frequently) if the consonant which followed the /t/ in underlying form was a plosive. One could of course analyze this as opaque interaction between progressive assimilation (which does indeed exist in Dutch in clusters ending in fricatives) and t deletion. But under the assumption that voiced fricatives are long fricatives a different solution presents itself: deleting t would leave a position to be filled up by the fricative, which would thereby become long. Devoicing would thus be a form of compensatory lengthening.
There is cross-linguistic evidence as well. In the 'standard' 'Zingarelli' (or dictionary) variety of Italian, we find contrasts such as the following (Krämer 2003):

(19)	ca[s]a	'house'
	ca[s:]a	'box, cashier'
	ca[z]o	'incident'

In other words, we find a voicing contrast in the short sibilants, but not in the long sibilants; the latter surface as voiceless only. In other dialects of Italian this two-way contrast may be further simplified: we find only a length contrast (and no fricative voicing) in Abruzzese, and only a voicing contrast (and no fricative length) in Veneto:

(20)	*Abruzzese Italian*	*Veneto Italian*
	ca[s]a	ca[z]a
	ca[s:]a	ca[s]a
	ca[s]o	ca[z]o

Note that the fact that 'long' fricatives in one dialect can be represented as voiceless

fricatives in another lend further support to the hypothesis put forward here.
Based on these arguments, we could conclude that the following correlation exists (at least in ambisyllabic position; see Kooij, this volume, for further discussion):

(21) a. If a fricative is attached to one position, it is voiced.
b. If a fricative is voiced, it is attached to one position.

The problem is, however, that in two clear senses voicing on fricatives also behaves clearly like a feature, rather than like a voicing distinction. In the first place, in the usual case, fricatives devoice in Dutch just like stops. Devoicing is usually described as delinking of the feature [voice] or of the Laryngeal node (Lombardi 1991, 1995, 1999). If we would subscribe to a length theory of fricatives, we clearly need an alternative account. Furthermore, it is not immediately clear that the alternative account — which would need to say that somehow fricatives lengthen at the end of the syllable or at the end of the word — can give an explanation why the fricatives in first person singulars do not lengthen.
The second problem seems even more severe. One of the most well-known aspects of Dutch phonology in the international literature is that it has voicing assimilation in clusters. This assimilation (which comes in two flavours) involves stops and fricatives alike. We will return to the phenomenon in more detail below, but here one example suffices to show the problem:

(22)	a/f/+/d/oen	>	a[vd]doen	'take off'
	a/f/+/t/akelen	>	a[ft]akelen	'go to seed'

In autosegmental terms, this change can be easily described in terms of a feature [voice] spreading from the stop to the fricative. This then is clearly a contraindication to the assumption that the distinction among fricatives is primarily one of length.

5. Feature models of voicing in fricatives

Since there seem to be quite some problems with the length based account, we now turn to alternative accounts based on features. In the view of Vaux (1998), voiceless fricatives are represented as [+spread glottis] (like aspirated stops). The proposal is dubbed Vaux's Law in Avery and Idsardi (2001); we will formulate in the form of an implicational constraint:

(26) VAUX'S LAW: Fricative ⊃ [spread glottis].

Vaux (1998) presents arguments from (several dialects of) Armenian, and further from Sanskrit, Pali, the historical development of Modern Greek and from Thai for this implication. For instance, in the New Julfa dialect of Armenian, there is a future tense prefix *k-* which assimilates in its laryngeal features to the first segment of the stem: it surfaces as plain voiceless before vowels and plain voiceless stops (27a), as voiced before voiced obstruents and sonorants (27b), as voiceless aspirated before voiceless aspirated stops and voiceless fricatives (27c), and as voiced aspirated before a voiced

aspirated stop (a later rule inserts a schwa between the two consonants):

(27)		*Underlying form*	*Surface form*	*Gloss*
	a.	k-ert^{h}-a-m	kert^{h}am	I will go
		k-t-a-m	kətam	I will give
	b.	k-bzz-am	gəbəzzam	I will buzz
		k-l-a-m	gəlam	I will cry
		k-zr$-a-m	gəzər$am	I will bray
	c.	k-t^{h}o‟-n-ie-m	k^{h}ət^{h}o‟niem	I will allow
		k-savor-ie-m	k^{h}əsavoriem	I will grow accustomed to
	d.	k-b^{h}ier-ie-m	g^{h}əb^{h}ieriem	I will carry

According to Vaux (1998), this crucially shows that voiceless fricatives are like aspirated voiceless stops, not like plain voiceless stop. This is accounted for by assuming that /t^{h}/ and /s/ in (27c) both have [+spread glottis], which spreads to to the preceding /k/ (note that this does not really account for the question why sonorant consonantss pattern with the voiced obstruents and the vowels with the plain voiceless stops).

Some of the facts discussed above might be amenable to an analysis of this type. For instance the fact that fricatives seem more resistant to devoicing than stops can be understood, because voiced fricatives might be seen as actually more marked than voiceless ones, in the sense that also aspirated stops are more marked than unaspirated stops. Devoicing a fricative involves adding [+spread glottis] and this is incompatible with an analysis in which final devoicing is an instance of delinking the Laryngeal node. On the other hand, we would obviously need a new account of final devoicing, one which would regard it in some cases as a form of *final fortition*. Notice by the way that this approach seems necessary for *all* obstruents in German, if we take the suggestion seriously that this language has a distinction between aspirated and unaspirated stops seriously *and* we assume that the language has 'final devoicing' (cf. the contribution of Van der Feest et al. to this volume).

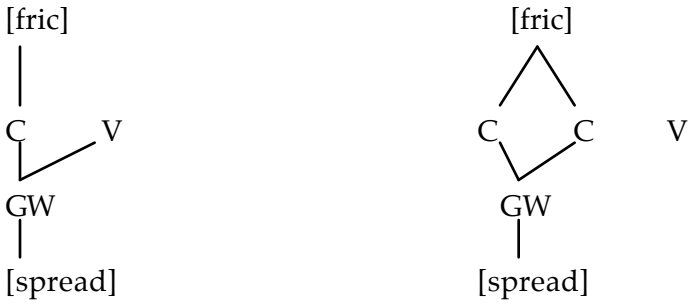
Another interesting consequence of the proposed equality between voiceless fricatives and aspirated stops, is that it is well-known that aspirated stops are also known to be substantially longer than unaspirated stops. Furthermore, it has been proposed (by Ringen 1999) in the context of aspiration that there is a constraint MULTILINK:

(28) MULTILINK
a consonant is [+spread glottis] *iff* it is long

The relation expressed by Multilink could be een as a kind of (mutual) enhancement of contrast. Ringen uses this constraint to explain why underlyingly aspirated stops in Icelandic are not allowed to surface as aspirated when they occur in a cluster (i.e. when they are followed by a sonorant). In this case, they occur as 'preaspirated' stops, sharing their [spread glottis] with an [h]. The fact that in English onset clusters, aspiration spreads from the stop to the onset ([pl8]*ead,* [tr8]*ain* etc.) could be similarly explained by this constraint.

Extending the interpretation of this constraint just a little bit, we could also use it to explain why voiceless fricatives are (preferably) long or in a cluster. It has indeed been proposed in the literature that a feature [tense] on fricatives is cued phonetically primarily by length (cf. Jessen 1998 for an overview; cf. also Van Rooy and Wissing 2001). To the extent that we can in this case see [tense] and [spread glottis] as the same formal object, MULTILINK can be seen as a formalisation of this idea. A short voiceless fricative prefers to share its [spread glottis] specification; it can do this either by being long (assuming the parts of the long fricative help each other satisfy MULTILINK), or by occuring in a voiceless cluster.
As a matter of fact, there is independent evidence in the literature for this assumption. In their discussion of laryngeal contrasts in Korean, Avery and Idsardi (2001) note that this language only has two fricatives, [s^{h}] and [s:]. Both of them are bipositional, and receive the following representations:

(29)



In this theory, GW (Glottal Width) is a class node (a 'dimension') that is 'completed' by default by the feature [spread]. Avery and Idsardi (2001:58) state that their analysis "requires only a single statement that is specific to Korean: that GW must be bipositional". Given that MULTILINK has been argued for independently from Korean, the statement may not be that language-specific after all. In order to account for the fact that Dutch does not have aspirated (i.e. [spread glottis]) stops; this constraint may however be somewhat language-specific:

(30) *SOO: Stops in onsets are never [spread glottis].

MULTILINK, together with VAUX'S LAW can help us actually formulate the behaviour of intervocalic fricatives in a much more insightful way, as will be shown now. One thing which is lost in this account, is the possible correlation with velarity. We consider this a minor loss, given the strong evidence in favour of the present proposal.[7] An interesting

[7] There actually is some marginal evidence that velar consonants also behave as 'long', at least in coda position. Phonetically, they may tend to be somewhat longer than non-velars. It is a well-known phonological fact, of course that the velar nasal behaves as a cluster of a nasal followed by a velar obstruent, for instance by occuring only after *short* vowels (just like 'geminate' voiceless fricatives). In the history of Cologne German (Scheer 1999) coronal consonants in coda turned into velars at some point, but only after long vowels, which shortened at the same time. This can be understood if the velar consonants needed to occupy an extra

aspect of our current findings is that it allows us to understand the dual behaviour of voicing in fricatives: it behaves both as a length distinction and as a feature difference, because it involves both kinds of difference.

6. OT Formalisation

In the preceding sections we have seen, first, that a structural account of the special behaviour of the first person singular seems more promising than a paradigmatic account, and, second, that a theory of voicing in fricatives which is based on length is indeed feasible. We will now try to put the pieces together to see whether we can produce a coherent analysis that can deal with all of these facts at the same time.[8] The core of the analysis are VAUX'SLAW, requiring fricatives to be [spread glottis] ('voiceless'), and MULTILINK, requiring [spread glottis] to be spread over two positions. It is first necessary to show how these two constraints can account for the behaviour of fricatives in intervocalic context, in interaction with a constraint on syllable well-formedness to the effect that long consonants are not allowed after long vowels (called *μμμ here) and assuming that faithfulness constraints are ranked conveniently (i.e. vowels are not allowed to change their length, but fricatives can change both their length and their voicing specification):[9]

(31) /a:sa:/	*μμμ	MULTILINK	VAUX'S LAW
a:za:			*
a:sa:		*!	
a:s:a:	*!		
/az:a:/ /as:a:/			
as:a:			
asa:		*!	
aza:			*!

position which it could only find in the long vowel. If this suggestion turns out to be right, we would have the following syllogism:
- velar consonants tend to be long
- long consonants tend to be voiceless
- therefore, velar consonants tend to be voiceless.

Which is exactly the conclusion we need.

[8] The account presented here is still informal to some extent. This paper has a digital appendix which contains the full formal analysis, including candidates that have been left out of consideration here because they do not contribute to the main line of argument.

[9] If we assume that neither vowels nor fricatives can change in any way, we obviously get a language in which voicing (or length) on fricatives is not dependent on syllabification; but if either voicing or length of fricatives can change, or if the vowels can change, we will get something resembling the pattern established here (albeit in some cases one where all contrasts are neutralised).

In order to describe the behaviour of fricatives at the end of the word, we need to take a closer look at the actual structure of the word in that position. Dutch words syllables usually are at most bimoraic; trimoraic syllables are only found at the end of words. As a matter of fact, the end of word is even less restrictive. Here, we even find extra (coronal) consonants. We thus have words such as *herfst* (autumn) where *herf* is a trimoraic syllable and *st* is a cluster of 'extrasyllabic' segments, which are completely outside of the realm of syllabic structure. I assume that these extra positions are also available for free for the second half of geminates:

(32) /a:s/,/a:z/	*μμμ	MULTILINK	VAUX'S LAW
a:s:			
a:s		*!	
a:z			*!
a:z:		*!	*

/as/, /az/	*μμμ	MULTILINK	VAUX'S LAW
as:			
as		*!	
az			*!
az:		*!	

On the other hand, in the exceptional cases such as *ik geleuv* in (1) can be dealt with if we assume that (a) here the fricative appears in an onset of an empty vowel (as is the point of the preceding discussion), and (b) geminates are not allowed in an onset in this position:

(33) /ɣəlø:v/	*μμμ	*GEM-ONSET	MULTILINK	VAUX'S LAW
ɣə.lø:.vV				*
ɣə.lø:f.fV	*!			
ɣə.lø:.ffV		*!		
ɣə.lø:.fV			*!	

(33) gives a comparison of [ɣəløv] with all of the conceivable possible outputs that have a voiceless consonants. The actual winner is beaten by all of these on account of VAUX'S LAW (since it does not have the feature [spread glottis]), but it beats its competitors on some higher-ranking constraint.

The difference between the dialects which do allow for this type of structure and those which do not can now be reduced to the question wether or not the dialect allows the empty V in this particular configuration. The empty V should obviously be licensed by the 1st person singular. We can assume that the constraint responsible for this is the

following (cf. Kurisu 2001 and references cited there for similar proposals):

(34) EXPRESS-MORPHEME
The presence of a morpheme (i.e. the first person singular) should somehow be expressed in the phonological surface representation.

In the dialects which allow these exceptions, EXPRESS-MORPHEME is ranked above whatever constraints we have against empty vowels (*EMPTY). For dialects which do not allow for this possibility, there are two options. The least interesting is to say that in these dialects *EMPTY » EXPRESS-MORPHEME. Somewhat more interesting would be the proposal that the ranking may not change, but the first person singular suffix may lose its status as an independent morpheme, and thus EXPRESS-MORPHEME can no longer play a role licensing the presence of the empty vowel: the vowel is no longer felt to express anything, so it will no longer be postulated in the phonology.
Notice, however, that we still do not have a formal answer to the question why stops do not display the same kind of behaviour. Assuming for a moment that FD has the straightforward formulation given above, we would indeed expect the empty vowel to show up in the first person singular also for stems ending in stops, thus saving these from devoicing:

(35) /ba:d/ 'bathe'	*μμμ	FD
ba:.dV		
ba:t	*!	

This is based, however, on the assumption that final devoicing refers strictly to obstruents at the end of syllables. A cross-linguistically more plausible analysis seems to be the one provided by Lombardi (1991; cf. also Steriade 1997 for a proposal which does not refer to syllable structure, but which would have the same effect in this case):

(36) *Final Devoicing (definitive version):*
Obstruents with [voice] should be followed by a tautosyllabic sonorant.

Yet according to this definition, [voice] also cannot appear in the onset of otherwise empty syllables, since it is not followed there by a tautosyllabic sonorant. We thus have the following tableau:[10]

[10] Alternatively, we could assume that there is a constraint on final devoicing at the word-domain next to one on the syllable domain, the effects of the former are usually obscured by the latter, except in this cases.

(37) /baːd/ 'bathe'	*μμμ	FD
baː.dV		*!
baː.tV		
baːt	*!	

A final issue we have to discuss is the difference between morphological and 'purely' phonological contexts. In the former, the fricatives are the only ones that can be exceptions to final devoicing. But we have seen that in dialects in which there are exceptions that are not morphologically motivated, these are usually stops.

7. Extensions to the phonology of fricatives

The theory presented here can hardly be taken seriously if it cannot be embedded within a larger fragment of Dutch voicing phonology. As a matter of fact, it turns out that this is indeed possible, and we do not need specific extra assumptions to be able to deal with the other phenomena. We have now dealt with intervocalic contexts and with word-final contexts, which leaves us with two types of position to consider: the word-initial position and the position in clusters. As to clusters, the following generalisation can be made:

(38) Clusters of fricatives are always voiceless.

Fricative clusters thus behave exactly as long fricatives, presumably because they can share their [spread glottis] specification, thus satisfying MULTILINK:

(39) /hœyzvœyl/	*μμμ	MULTILINK	VAUX'S LAW
hœysfœyl	*		
hœyzfœyl	*	*!	*
hœysvœyl	*	*!	*
hœyzvœyl	*		*!

In this case, we start out with two underlyingly voiced fricatives, but lengthening is not necessary for either of them to become lengthened: all that is needed is that the two share [spread glottis]:

(40) h œ y s f œ y l

[spread glottis]

How about clusters in which a stop participates? If the fricative is rightmost, we end up

with a voiceless cluster. If the fricative is leftmost, the plosive determines the voicing of the whole cluster; but if the fricative is rightmost it determines that the whole cluster becomes voiceless. In order for these facts to come out right, we need to add two constraints to our inventory. Because there is obviously assimilation of the feature [voice] when this is present on the plosive, we need a constraint such as AGREE (Bakovic 2000), and in order to prevent this constraint from ramdomly introducing new features [voice] into the representation, we need a constraint against this feature. Also the constraint against [spread glottis] (aspirated) stops (*SOO) now becomes relevant, but notice that we still do not need a faithfulness constraint for [spread glottis], mirroring the fact that the 'voicing' of fricatives is still not distinctive in this position. The curious fact that if the first obstruent of a cluster is a fricative, the direction of assimilation is 'progressive' (i.e. the whole cluster ends up as voiceless), which has been a puzzle for phonologists can now be reduced to the familiar VAUX'SLAW:

(41) AGREE: Obstruent clusters share their laryngeal nodes.
IDENT[voice]: Respect the [voice] specification of (onset) stops.[11]

(42) ɑsbɑk 'ash tray'	AGREE	IDENT[voice]	*SOO	MULTILINK	VAUX'SLAW
ɑzbɑk					*
ɑspɑk		*!			
ɑsbɑk	*!				
ɑzpɑk	*!				*

(43) ɣud zo 'good so' (=well done)	AGREE	IDENT[voice]	*SOO	MULTILINK	VAUX'SLAW
ɣut so					
ɣud zo					*!
ɣut zo	*!				*
ɣud so	*!			*	

[11] The addition 'onset' is necessary to be able to describe the cases where both obstruents in the cluster are stops.

(44) bɔspɑd 'forest path'	AGREE	IDENT[voice]	*SOO	MULTILINK	VAUX'SLAW
bɔspɑt					
bɔzbɑt		*!			
bɔzpɑt	*!		(*)		
bɔsbɑt	*!			*	

This system of constraints could presumably also take care of forms with clusters consisting of stops only. An interesting aspect of this analysis, is that Final Devoicing does not show up as an independent force in the analysis of clusters.
The last issue we have to worry about is the representation of fricatives in onset position. This is basically the only position where we have a contrast, at least in some dialects. There are also many dialects in which the contrast has disappeared altogether, even in this position, and the whole contrast has become completely allophonic; we return to them briefly below, but it should be clear that they pose less of a problem. Notice that faithfulness on fricative voicing (or length) does not play any role at all in the analysis given thus far. But in the dialects under consideration, voicing is contrastive in onsets:

(45) a. *zee* [ze] 'sea' *C* [se] '(the letter) C'
b. *vee* [ve] 'cattle' *fee* [fe] 'fairy'
c. *chloor* [xlɔːr] 'chlore' *gloor* [ɣlɔːr] 'gleam'

The example with velars in (41c) is marginal to the extent that it is very hard to find speakers who actively sustained the contrast, but this may be due to the rather marginal status of initial velar fricatives in general, as we have discussed above. For now let us concentrate on the labial case in (41b) as exemplary. We have two options: either we allow initial 'geminates' in the cases at hand, or we do not allow them. But in both cases the result is less than satisfying. If we do not allow for geminates, we get the result that all fricatives should be voiced:

(46) ve/fe	MULTILINK	VAUX'SLAW
ve		*
fe	*!	

But if we do allow for geminates, the result is that all fricatives should be voiceless:

(47) ve/fe	MULTILINK	VAUX'SLAW
f:e		
ve		*!
v:e	*!	*
fe	*!	

This result is not without interest, by the way, since there are indeed dialects of Dutch which lift the contrast in voicing also in initial position, either in the direction of only voiceless consonants ('Standard' Netherlands Dutch) or in the direction of only voiced consonants (Roermond Dutch, cf. Kats 1939, Van Oostendorp 2002). On the other hand, we do not yet have an analysis for those dialects which do allow for contrast in this position. We cannot allow a faithfulness constraint on e.g. [spread glottis] to outrank MULTILINK, since this would affect the whole of our analysis: faithfulness would also prevail in intervocalic contexts.
One possibility would be to invoke positional faithfulness (Beckman 1998, for instance of the following type:

(48) IDENTWORDINITIAL([spread glottis])
The specification for [spread glottis] in the first syllable of a word, should be faithful.

As it refers exclusively to the first syllable of the word, this constraint does not affect earlier analyses, but it can give the desired effect here:

(49) ve	IDWRDINIT	MULTILINK	VAUX'SLAW
ve			*
f:e	*!		

(50) fe	IDWRDINIT	MULTILINK	VAUX'SLAW
fe		(*)	
ve	*!	(*)	*

The winning candidate may violate MULTILINK (if we do not allow geminate consonants in initial position), but this would not really matter, given the predominance of the IDENTITY-constraint.
Another possible account for this would be to capitalize on the preservation of length contrast rather than that of the [spread glottis] contrast. Suppose word-initial geminates cannot be generally created, but they may surface if they are underlyingly present (this is called a 'grandfather effect' by McCarthy (2003). We know from the previous discussion that geminate onsets are always disallowed in Dutch, without any exception, so how could geminates be allowed to surface in the first syllable at all (except of course, without once again invoking positional faithfulness, making this approach

indistinguishable from the previous one)?
Dutch, like many other Indo-European languages, allows for an 'exceptional' s to surface at the beginning of a word, just like it allows for exceptional, extra coronals at the end of the word. Thus, while we usually have words starting with an onset of at most two segments, with a 'normal', declining, sonority slope, we also have words of the following structure:

(51) *staat* 'state', *sfeer* 'atmosphere', *schuiven* [sx-] 'shove'
straat 'street', *schrijven* [sxr-] 'write'[12], *splijten* 'split'

In all of these cases, the 'extra' consonant has three characteristics: (i) it is a fricative, (ii) it has unmarked (coronal) place, (iii) it is voiceless (Dutch does not allow a /z/ in this position). We could formulate this observation as follows:

(52) A word-initial appendix consonant has to be a voiceless fricative without independent place.

Of particular interest is the fact that the appendix consonant has to remain voiceless. This has to be secured by an independent constraint, since otherwise, we would allow clusters such as **zdraat:*[13]

(53) sdraat/zdraat	AGREE	IDENT[voice]	*SOO	MULTILINK	VAUX'SLAW
zdraat					*
sdraat	*!			*	
straat		*!	*		

We thus need a constraint outranking IDENT and *SOO, for instance one of the following shape:

(54) APP: Appendix obstruents need to be voiceless ([spread glottis]).

(55)sdraat/zdraat	AGREE	APP	IDENT-vc	*SOO	MULTILINK	VAUX'SLAW

[12] Some discussion is possible as to whether *schr* clusters are truly triconsonantal. For one thing, they do not contrast with [sr] clusters (thus, if /sxr/ is assumed to be present, /sr/ should be assumed absent, or vice versa). Second, they are the only clusters in which s is followed by another fricative, which in turn is followed by a liquid. It is not clear to me what would be the source of this phonotactic constraint, and I will not discuss it any further here.

[13] Since there are no words starting with [sʊ] in Dutch, but there are words starting with [zʊ], it has sometimes been argued (Trommelen 1983) that the latter is derived from the former by voicing assimilation. Such an analysis seems not directly compatible with the one presented here.

straat						
sdraat	*!				*	
zdraat		*!				*

Suppose that appendix obstruents can be of one of two types: either they are independent segments, displaying unmarked place, i.e. Coronal, or they share place with the following fricative, and thus are part of geminates. Word-initial voiceless fricatives would thus involve such a geminate; voiced fricatives would be single fricatives. Since this is the only position in which we find a distinction between voiced and voiceless fricatives, we still need to invoke positional faithfulness:

(56) DEP-APP/MAX-APP: Do not insert or delete segments in appendix position.

This constraint has to be ranked somewhere above VAUX'S LAW, the only constraint with which it is in crucial conflict:

(57) s:ai	APP	MULTILINK	DEP-APP MAX-APP	VAUX'SLAW
s:ai				
zai			*!	*
z:ai	*!	*		*
sai		*!	*	

(58) zai	APP	MULTILINK	DEP-INIT MAX-INIT	VAUX'SLAW
zai				*
s:ai			*!	
z:ai	*!	*	*	*
sai		*!		

Which one of the two approaches (faithfulness to [spread glottis] or faithfulness to length) is to be preferred, remains an issue of investigation. The length approach may have the slight advantage of linking the phenomena to the behaviour of sC clusters, but the link is not very strong. It has the further advantage that it does not refer to notions such as 'first syllable (or first segment) of the word', which do not have a clear theoretical status, but can refer instead to appendix positions; but again, this is not necessarily seen as a convincing argument. The issue is therefore open to more subtle investigation than can be provided here; in any case it is clear that both approaches are compatible in principle with the approach defended here.
For the sake of completion, we also need to briefly discuss two well-known problems in the phonology of Dutch voicing which may interact with the issues discussed in this article: voice assimilation in the past tense suffix, and the voicing behaviour of clitics.

The Dutch past tense suffix *-de/-te* is somewhat famous in the phonological literature for displaying assimilation 'in the wrong direction'. Whereas usually assimilation in clusters ending in an obstruent is regressive — preceding obstruents assimilate to the stop in an onset as we have seen above —, this is not the case for clusters of this type:

(59) *lee/v/+de* > *lee*[vd]*e* 'lived' *e/b/+de* > *e*[bd]*e* 'ebbed'
ma/f/+te > *ma*[ft]*e* 'slept' *sta*/p/*+te* > *sta*[pt]*e* *'stepped'*

Many different approaches have been proposed over the years to deal with this particular problem. It has been proposed that the underlying representation of the affix obstruent is underlyingly a fricative /ð/, which would explain its strange assimilation behaviour (Zonneveld 1983; the /ð/ would later be neutralized to a stop, since dental fricatives do not occur in Dutch), or that *-Te* would be crucially underspecified for binary [±voice] (Booij 1995, Ernestus 2000). Grijzenhout and Krämer (2000), working within OT, have an account which basically states that there is a difference between onset stops in the stem, which demand to be fully faithful and onset stops in the suffix which do not demand to be fully faithful. Yet another possibility is to assume that *-de/-te* are simply listed as allomorphs (in the sense of Booij 2000). In that case faithfulness does not play a role in the selection of this suffix and the shape of the preceding consonant can decide whether the agreeing cluster will be voiced or voiceless. Any of these accounts might be tested as to their compatibility with the approach presented here, but the allomorphy has the relative merit of being easy to implement. Since the past tense suffix is not the focus of the present paper, we will assume that some of these accounts can be used to supplement the current proposal.
Similarly, the behaviour of clitics does not necessarily pose a specific problem to the account presented here. The issue is here that word-final consonants devoice before vowel initial clitics, even though they are syllabified in the onset:

(60) *vind ik* /vɪnd ək/ > [vin.tək] 'find-I'

Grijzenhout and Krämer (2000) mention these facts as evidence for their claim that final devoicing does not apply to the end of the syllable in Dutch, but rather to the end of the phonological word. Resyllabification therefore would not be relevant. Such an approach is clearly compatible with the one presented here in which it is important that the word-final fricative of *geleuv* does not devoice since it is not syllable-final. There also is some evidence that an approach in terms of syllables rather than words is correct. It is not easy to find syllable-final obstruents which are not in clusters, but they certainly exist, in words such as *atlas, butler, bokma* (brand name), *a*[k]*né,* etc. In all of these cases, the obstruent in question is voiceless. Dutch is different in this respect from German, where we apparently find forms such as *A*[dl]*er* 'eagle' (the corresponding word in Dutch is *a*[dəl]*aar*).

8. Typological claims

In the previous sections we have discussed the voicing system of Dutch fricatives in

some detail. The question may arise how these facts can be related to those of other languages. Staying close to the Dutch language area, Van Oostendorp (2002) argues more generally that in many West Germanic languages (from Frisian to Swiss German) the only relevant contrast for fricatives may be one of length (cf. also Kraehenmann 2001). There are basically three groups of Germanic dialects. The first group, of which Frisian counts as an example, only allows voiceless fricatives at the beginning of the word. Compare for instance the following words with their Dutch cognates (Tiersma 1985):

(61) *sinke* [sɪŋkə] 'to sink' (Dutch: *zinken*)
seuren [sørən] 'to nag' (Dutch: *zeuren*)
fluch [flœx] 'quickly' (Dutch: *vlug*)
fioele [fijulə] 'violin' (Dutch: *viool*)

The second group, of which Roermond Dutch can be given as an example, only allows voiced fricatives in this position (Kats 1939). Speakers of German famously display a same tendency to voice fricatives also in loanwords, proncouncing [z]*ity*, etc.
None of these West-Germanic dialects are problematic for the present account: there is no stem-initial identity in these cases. Languages like Frisian allow initial geminate appendixes, and MULTILINK and VAUX'S LAW therefore always force them into existence. Languages like Roermond Dutch do not allow initial geminates, and therefore MULTILINK does not allow them to be voiceless. The difference with the dialects we have discussed thus is that positional faithfulness on the first segment or syllable is not active in these language systems. A different account for these phenomena was given in Van Oostendorp (2002), which, however, was not able to deal with Standard Dutch or with the exceptions to final devoicing (which are not noted in that article) in a satisfactory way.
But facts which look like the ones discussed here can be found in typologically unrelated languages as well. There exists a very interesting similarity between the Dutch facts discussed here and the facts of the Athapasan language Ahtna (Rice 2003). Ahtna has long vowels and short vowels. Word-finally (most Ahtna words are monosyllabic), both syllables with long vowels and with short vowels can be closed with a consonant. But these consonants behave in different ways, which are explained by Rice with the assumption that consonants after a short vowel are in a coda, but consonants after a long vowel are in the onset of an empty-headed nucleus. Interestingly, one of the arguments is voicing of fricatives. Before vowel-initial suffixes, fricatives voice after long vowels, but not after short vowels:

(62)

	CVVC	CVVC+V	
	affirmative	negative	
a.	*t'aa*[s]	*t'aa*[z]*e*	'cut several times for a period of times (durative imperfective)'
b.	*kae*[ɬ]	*kae*[l]*e*	'go by boat (imperfective progressive)
	CVC	CVC+V	
a.	*ne*[s]	*ne*[s]*e*	'be alive (customary imperfective)'

b. *ghe*[ɬ] *ghe*[ɬ]*e* 'be crazy (durative imperfective)'

Ahtna has a rule voicing fricatives in onsets, which is clearly applying in the case of long vowels, but not in the case of short vowels. Notice that the difference in behaviour only shows up in these morphologically complex environments, when the (overt) suffix vowel is attached. The assumed empty nucleus in the left-hand column in (a) apparently does not have the property of allowing the fricative in its onset to get voiced.
Interestingly, Rice also adduces arguments that there is a difference between 'morphological empty vowels' and empty vowels which are there for purely phonological reasons. In the Metasta dialect of Ahtnan, certain vowel-initial suffixes which are overt in other dialects (such as the Western dialect) no longer have a clear phonetic identity; yet they still trigger voicing of the fricative.

(63)

	Western	Mentasta	
a.	bii[ɬ]	*bii*[ɬ]	'snare for large game (non-possessed)'
b.	*-bii*[l]*e'*	*-bii*[l]'	'snare for large game (possessed)'

The parallel with the Dutch dialects is of course striking. In both cases, fricatives get exceptionally voiced at the end of a word in those cases where other dialects have a full vowel.
Another well-known case where fricative length seems to coïncide with fricative voicelessness is Italian. I will try to establish here how we can deal with the three (slightly idealized) dialects given above in the framework established here. The relevant facts are repeated in ():

(664)

Zingarelli	*Abruzzese*	*Veneto*	
ca[s]a	ca[s]a	ca[z]a	'house'
ca[sː]a	ca[sː]a	ca[s]a	'box, cashier'
ca[z]o	ca[s]o	ca[z]o	'incident'

The Abruzzese dialect does not have any voiced fricatives. In terms of the present analysis, this means that Vaux's Law is dominant in this dialect, and faithfulness decides that MULTILINK cannot play a role:

(65) MAX, DEP, VAUX'S LAW » MULTILINK, IDENT[s.g.]

(66) /asa/, /aza/	MAX DEP	VAUX'SLAW	MULTILINK	IDENT[s.g.]
asa			*	(*)
aza		*!		(*)
as:a	*!			(*)
az:a	*!		*	(*)
/az:a/,/a:sa/				
as:a				(*)
asa	*!		*	(*)
az:a		*!	*	(*)
aza	*!			(*)

For the Zingarelli dialect, we need to assume that there is faitfulness to [spread glottis] for short vowels, but

(67) DEP, IDENT[s.g.] » VAUX'SLAW, MULTILINK » MAX

(68) /asa/	DEP IDENT[S.G]	VAUX'SLAW	MULTILINK	MAX
asa			*	
~ aza	*!	*		
~ as:a	*!			
~ az:a	*!		*	
/aza/, /az:a/				
aza		*		
asa	*!			
az:a	(*!)	*	*!	(*)
as:a	*!			
/as:a/				
as:a				
asa			*!	*
az:a	*!	*	*	
aza	*!	*		*

The Veneto dialect could be derived in the following way:

(69) NOGEMINATE, IDENT[s.g.] » VAUX'SLAW, MULTILINK, MAX, DEP

(70) /asa/, /as:a/	NOGEMINATE	IDENT[s.g.]	VAUX'SLAW	MULTILINK	MAX DEP
asa				*	(*)
aza		*!	*	*	(*)
as:a	*!			*	(*)
az:a	*!	*!	*		(*)
/aza/,/az:a/					
aza			1		(1)
asa		*!	L	W	(L)
az:a	*!			W	(L)
as:a	*!	*!	L		(L)

This is obviously not a complete factorial typology of the constraints involved — the constraints given until now seem to conspire to make sure that contrasts appears preferably on short consonants before it appears on long consonants, but it is not clear why this is the case, since an 'anti-Zingarelli' ranking MAX, IDENT[s.g.] » VAUX'SLAW, MULTILINK » DEP — but at least it gives an impression of the constraint interactions involved.

9. Conclusion

In this article, I hope to have shown that the combination of a sophisticated view of representations, with a theory of constraint interaction such as OT, can provide us with insight in a phenomenon which seems simple at first sight, but quite problematic on the other hand.

The fact that exceptions to final devoicing are only found in first person singular forms of verbs ending in a (long vowel plus) fricative, at present seems to be most satisfyingly accounted for in a theory which does not rely so much on paradigm uniformity as on one which postulates a somewhat abstract morpheme for the 1SG. Notice that this analysis can also be seen as an argument in favour of (some amount of) phonological structure; it does not work without being able to refer to the syllabic position 'onset'.

Also, the reason why fricatives behave differently from stops requires explanation, and preferably one which links this particular difference between fricatives and stops to other differences, such as that in assimilation in clusters. Again, this can be attained by studying the representations we need more closely.

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