The Morphophonology of Consonant Mutations in Irish

Tom Pullman

University of Cambridge

The Morphophonology of Consonant Mutations in Irish

This thesis, which was submitted in June 2004 in partial fulfillment of the requirements for the degree of M.Phil. in Linguistics, is entirely my own work.

Chapter 1: Introduction to Irish and consonant mutations

1.0 Background and introduction

Irish is a Celtic language spoken in three main areas on the west coast of Ireland, Donegal, Connemara and the Dingle Peninsula. It belongs to the Goidelic (or Gaelic) subgroup of the Celtic languages, being closely related to Scottish Gaelic and Manx and less closely to the Brythonic Celtic languages Welsh, Cornish and Breton. Historically it was the language of the entirety of Ireland, and remained the language of the majority of the population (in the face of the increasing encroachment of English) until the nineteenth century. Today there are estimated to be 100,000 native speakers of the language, approximately 30,000 of whom use it on a daily basis. The three main areas where it is spoken correspond to three main dialect groups, which I will refer to as Donegal, Connemara and Munster. A standard reference work on phonology, morphology and syntax, encompassing dialectal variation, is Ó Siadhail (1989).

Irish possesses, as do the other Celtic languages, a system of *consonant mutations*. These consist of alterations of stem consonants, epentheses of consonants to stems, and deletions of stem consonants which occur in a wide but well-defined variety of morphological and syntactic environments. These environments include, for example, forming the plural of certain noun-classes and the past tense of verbs, marking noun-adjective agreement and the second component of compound words, and obligatory mutation after certain prepositions.

Mutations are *morphosyntactically* predictable; however, with the exception of their blocking in certain environments, their occurrence is not *phonologically* predictable – they do not always occur after vowels, for instance. Therefore, explaining their distribution is not a task for phonology. On the other hand, the behaviour of stems in a given mutation environment *is* phonologically predictable – the same thing will always happen in a given environment to any stem beginning with a /k/, for instance. It is this behaviour that this thesis attempts to analyse in terms of current phonological theory, within the framework of Optimality Theory (McCarthy & Prince 1993).

1.1 The basics of Irish consonant phonology

In this section I present the Irish consonant inventory. Fully detailed transcriptions of Irish are rather cumbersome to write and read, so I also present a simplified system of transcription of the inventory which I will use in most of the remainder of this thesis. I then discuss the details of one section of the consonant inventory, the coronal nasals and laterals. The detailed description of the consonant inventory in §1.1.1 contains quite some variation, and at the end of this section I briefly describe the parameters which affect this variation.

1.1.1 The consonant inventory in detail

The following table shows the consonant segments which are permitted in Irish. Alternatives separated by slashes are dependent either on dialect or on environment (see §1.1.4).

p^{w}	p^{j}	t̪$^{\text{ɰ}}$	t^{j}/tʃ			k$^{\text{ɰ}}$	k^{j}	
b^{w}	b^{j}	d̪$^{\text{ɰ}}$	d^{j}/dʒ			g$^{\text{ɰ}}$	g^{j}	
f^{w}	f^{j}	s$^{\text{ɰ}}$	ʃ			x$^{\text{ɰ}}$	ç	h
β^{w}/w/v^{w}	v^{j}					ɣ$^{\text{ɰ}}$	j/ʝ	
m^{w}	m^{j}	n$^{\text{ɰ}}$	n^{j}	n̪$^{\text{ɰ}}$	n̠^{j}	ŋ$^{\text{ɰ}}$	ŋ^{j}	
		l$^{\text{ɰ}}$	l^{j}	l̪$^{\text{ɰ}}$	l̠^{j}			
		ɾ$^{\text{ɰ}}$/ɹ	ɾ^{j}/ɹ̠	r$^{\text{ɰ}}$/ɹ				

Table 1.1: Permitted consonant segments in Irish, detailed transcription

The pairing up of most of these segments reflects the palatalization system in Irish, whereby each of the paired segments alternates with its partner in certain morphological paradigms. Traditionally the two series of consonants are referred to as “broad” (the first in each pair) and “slender” (the second); linguistic descriptions (in English) tend to refer to the first category as “velarized” (or “plain”) and the second as “palatalized”, despite the slight inaccuracy of these terms to some of the segments in question. It is the latter convention which I will adopt.

1.1.2 A simplified transcription of the consonants

The detailed transcription in Table 1.1 would be unwieldy if used in every example; henceforth I will omit the velarization diacritics from most examples, but they should be taken as read on non-palatalized segments (excluding [h]). I will retain the labiovelarization diacritic on labials before front vowels, purely on the grouds that it is particularly distinctive to the ear before them.

For simplicity I will also write [r] [ɾ] [ɾ^{j}] from now on rather than [r/ɹ] [ɾ/ɹ] [ɾ^{j}/ɹ̠], [w] [j] rather than [β$^{\text{ɰ}}$/w/v$^{\text{ɰ}}$] [j/ʝ], and [t^{j}] [d^{j}] rather than [t^{j}/tʃ] [d^{j}/dʒ]. Where necessary I will revert to the more precise transcription. This simplified transcription is shown in table 1.2.

p	p^{j}	t̪	t^{j}			k	k^{j}	
b	b^{j}	d̪	d^{j}			g	g^{j}	
f	f^{j}	s	ʃ			x	ç	h
w	v^{j}					ɣ	j/ʝ	
m	m^{j}	n	n^{j}	n̪	n̠^{j}	ŋ	ŋ^{j}	
		l	l^{j}	l̪	l̠^{j}			
		ɾ	ɾ^{j}	r				

Table 1.2. Permitted consonant segments in Irish, simplified transcription

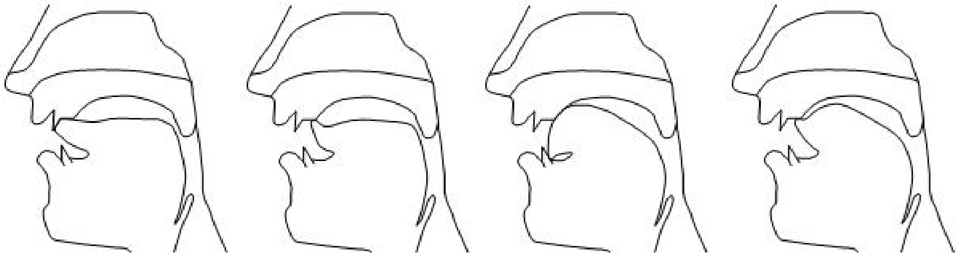
Where I wish to refer to any velarized/palatalized pair of consonants together in circumstances where their behaviour is very similar, I may omit the marks which distinguish them and simply write a single symbol; for example, I may write simply [t] instead of [t̪ tʲ] to refer to "any voiceless coronal plosive".

1.1.3 A note on coronal nasals and laterals

It is important to note that the segments [n̪ᶭ l̪ᶭ n̠ʲ l̠ʲ] are [+distributed], i.e. laminal (with an extended region of contact between the tongue and the roof of the mouth), whereas [nᶭ lᶭ nʲ lʲ] are [-distributed], i.e. apical (with a short region of contact between the tongue and the roof of the mouth). This is evidenced by the following quotation from Ó Baoill (1996:15) (by "*ll*" and "*nn*" are meant the non-alveolar segments, and by "*l*" and "*n*" the alveolar ones):

> Le *ll* agus *nn* a dhéanamh cuirtear *tosach na teanga ar fad* in éadan na bhfiacla uachtaracha nuair is consain leathana iad, agus in éadan na bhfiacla íochtaracha agus iomaire na bhfiacla nuair is consain chaola iad. Le *l* agus *n* a rá cuirtear *barr na teanga* in éadan iomaire na bhfiacla. Ar ndóigh, chomh maith le suíomh bharr nó thosach na teanga ardaítear cúl na teanga i dtreo an choguais nuair a bhíonn consain leathana á rá agus tosach na teanga i dtreo an charbaill nuair is consain chaola a bhíonn á rá.
>
> (To make *ll* and *nn*, *the whole of the front of the tongue* is placed against the upper teeth when they are broad [velarized] consonants, and against the lower teeth and the ridge of the teeth [alveolar ridge] when they are slender [palatalized] consonants. To say *l* and *n*, *the tip of the tongue* is placed against the ridge of the teeth. Of course, as well as the position of the front of the tongue, the back of the tongue is raised towards the velum when broad consonants are being spoken and the front of the tongue is raised towards the palate when slender consonants are being spoken.) *(My translation; italics original)*

My interpretation of this description is as shown in figure 1.1 (for laterals, but the mid-sagittal position of the tongue will be largely the same for nasals).



(a) (b) (c) (d)

Fig. 1.1. Mid-sagittal sections for the four lateral segments in Irish: (a) [l̻ᵚ]; (b) [lᵚ]; (c) [l̠ʲ]; (d) [lʲ].[1]

Ó Baoill's use of the phrase "the whole of the front of the tongue" is unambiguous evidence that the consonants [l̻ᵚ n̻ᵚ] are laminal, as shown in (a) in figure 1.1. For [l̠ʲ n̠ʲ], I believe that the description "the whole of the front of the tongue is placed … against the lower teeth and [the alveolar ridge]" implies the configuration shown in (c) in figure 1.1, with an extended region of contact between the tongue front and the roof of the mouth; this is also a laminal configuration.

The phrase "the tip of the tongue", which he uses in his description of [lᵚ nᵚ lʲ nʲ], unambiguously implies apical configurations for these consonants, as seen in (b) and (d) in figure 1.1.

1.1.4 Variation

The variants separated by slashes in Table 1.1 stand in the same place in the phonological system and are conditioned by dialect ([tʲ/tʃ], [dʲ/dʒ], [βᵚ/w], and the rhotics[2]) or by environment ([w/vᵚ], [j/ʝ]).

The inventory in Table 1.1 is in fact an abstraction; no dialect preserves it completely. The most important variation between dialects for present purposes concerns laterals and coronal nasals. The Connemara dialect neutralizes velarized coronal nasals and laterals to their laminal forms, i.e. [l l̻] to [l̻] and [n n̻] to [n̻] (on the surface; it still generally retains them in underlying forms). It preserves the distinction between their palatalized equivalents, though. The Munster dialect neutralizes these pairs to the apical [l n] instead, and also neutralizes their palatalized equivalents [lʲ l̠ʲ] and [nʲ n̠ʲ] to [lʲ nʲ], again while frequently preserving the distinction underlyingly.

---

[1] The base for these diagrams was taken from the University of Toronto's interactive sagittal section at http://www.chass.utoronto.ca/~danhall/phonetics/sammy.html, created by Daniel Currie Hall, and used by permission.

[2] The rhotics are also subject to variation with age, being more likely to be approximant in the production of younger speakers. Younger speakers may also produce [ɹ] in place of [ɾʲ/ɹ̝]. Both these changes are attributable to the influence of Hiberno-English, which has neither a tapped nor a palatalized rhotic.

1.2 The phenomenon of mutation

Mutations are stem-alteration phenomena, found in all the surviving Celtic languages, whereby consonants are changed, added or removed in a wide variety of morphological environments. The most typical of these changes affect the left edge of the stem, and are known as initial mutations. In the Goidelic languages, palatalization of stem-final segments also alternates in morphosyntactically predictable ways, and so can be counted as another, non-initial, mutation.

1.2.1 Initial mutations

Here are some examples of initial mutations from Irish:

(1) *dún*
[d̪uːn]
"close (imper.)"

dhún
[ɣuːn]
"closed (past tense)"

(2) *(fear) fásta*
[fʲaɾ fɑːs̪t̪ə]
"(an) adult (man)"

(bean) fhásta
[bʲan ɑːs̪t̪ə]
"(an) adult (woman)"

(3) *dúnann (tú)*
[d̪uːnən̪ t̪uː]
"(you) close"

(go) ndúnann (tú)
[gə n̪uːnən̪ t̪uː]
"(that you) close"

(4) *ólann (tú)*
[oːlən̪ t̪uː]
"(you) drink"

(go) n-ólann (tú)
[gə n̪oːlən̪ t̪uː]
"(that you) drink"

(5) *úll*
[uːl̪ˠ]
“apple”

(an) t-úll
[ən̪ˠ t̪ˠuːl̪ˠ]
“(the) apple”

(6) *úlla*
[uːl̪ˠə]
“apples”

(na) húlla
[n̪ˠə huːl̪ˠə]
“(the) apples”

Examples (1) and (2) show lenition in action, altering and deleting stem consonants. Examples (3) and (4) show eclipsis, altering a stem consonant and epenthesizing before a vowel stem. Examples (5) and (6) show t- and h-insertion before vowel stems. I will not discuss t- and h-insertion in this thesis.

1.2.2 Final palatalization alternations

Numerous morphological processes in Irish involve changing a stem-final velarized consonant into its palatalized equivalent, as in (7).

(7)	*bás*	*báis*
	[bɑːs]	[bɑːʃ]
	“death (nom.)”	“death (gen.)”
	géar	*géire*
	[gʲeːɾ]	[gʲeːɾʲɪ]
	“sharp (masc. nom. sing.)”	“sharp (fem. gen. sing.)”

Processes which change a palatalized consonant into a velarized one are much rarer, if they exist at all. This will be further discussed in chapter 5.

1.3 Conclusions

In Irish, there are morphosyntactically driven processes known as mutations which have a variety of effects on stems. These effects include segmental alteration, epenthesis, and deletion. There are several paradigms of these effects, which are made use of in different grammatical contexts. Most affect the left edge of the stem, but one, palatalization, affects the right edge.

Chapter 2: The fundamentals of an analysis

2.1 Outline

In this chapter I will describe the mechanisms that I propose give rise to mutations. I will describe the entities which lie behind them, featural morphemes, and introduce the main constraints I make use of in this analysis. I will also show how featural morphemes interact (in principle) with segmental material under various rankings of these constraints.

2.2 Featural morphemes

Featural morphemes (see e.g. Akinlabi 1997, Zoll 1997, de Lacy in prep.) are morphemes possessing features but lacking segmental nodes. Their features cannot be realized unless they become associated with segmental material in the output. Curly brackets are used to enclose the features comprising a featural morpheme.

Examples of possible featural morphemes are {+nasal} and {-voice, -son}. In combination with a stem /ta/, the first of these morphemes might produce [n̥a], [tã] or a variety of other outputs containing [+nasal], depending on the constraint ranking of the lanugage in question; it might also produce a faithful output [ta] with non-realization (or unfaithful realization) of the featural morpheme.

Featural morphemes correspond to output segments just as input segments do. ALIGN constraints are known to be important in the realization of featural morphemes in such languages as Chaha (Akinlabi 1997), DhoLuo (de Lacy in prep.) and Hessen German (ibid.). If featural morphemes are marked as prefixes or suffixes, the constraints ALIGN-L(prefix, stem) and ALIGN-R(suffix, stem) will affect which stem segments they correspond with in the output. This is illustrated in tableaux 1 and 2.

/{+nasal}$_1^{\text{PREFIX}}$ + √t$_2$a$_3$/	ALIGN-L(prefix, stem)
(a) ☞ n̥$_{1,2}$a$_3$	
(b) t$_2$ã$_{1,3}$	*!

Tableau 1

/{+nasal}$_1^{\text{SUFFIX}}$ + √t$_2$a$_3$/	ALIGN-R(suffix, stem)
(a) n̥$_{1,2}$a$_3$	*!
(b) ☞ t$_2$ã$_{1,3}$	

Tableau 2

Where such alignment constraints are dominated by constraints requiring realization of featural morphemes, the morphemes may occur at other places within the stem, as in Chaha (Akinlabi 1997). However, in Irish, mutation effects are confined to the edges of the stem; I therefore propose that ALIGN-L(prefix, stem) and ALIGN-R(suffix, stem) are undominated in Irish, at least in so far as mutation is concerned.

Any constraints dominated by alignment constraints are liable to be violated to avoid unsuitable alignments in the output. This will be discussed in more detail once the constraints to be used in this analysis have been presented.

2.3 Principal constraints used in this analysis

2.3.1 ALIGN

As mentioned above, it is crucial to this analysis that ALIGN constraints be undominated. ALIGN constraints partly govern the linear positioning of elements in the output. They are defined as in (1):

(1)	ALIGN-L/R(XCat, YCat)	"Incur a violation for every XCat in the output whose left/right edge does not correspond with the left/right edge of a YCat." (After McCarthy (2002:17))

The relevant ALIGN constraints are ALIGN-L(prefix, stem) and ALIGN-R(suffix, stem).

2.3.2 IDENT

IDENT constraints relate to segmental material, and favour outputs where segments' feature values are unchanged. They are defined as in (2):

(2)	IDENT[F]	"Incur a violation for each segment in the input which is [αF] and corresponds to a segment in the output which is [-αF]."

IDENT constraints are not violated when featural morphemes correspond to output segments with differing feature values, as featural morphemes contain no segments in the input.

2.3.3 MAX

MAX disfavours mappings where elements present in the input have been deleted. MAX constraints can refer to any type of element, from single features upwards. When no particular type of element is specified, it is assumed to refer to segments.

(3)	MAX(X)	"Incur a violation for each X in the input which has no output correspondent."

2.3.4 DEP

DEP disfavours mappings where elements are present in the output that were not present in the input. Like MAX, DEP can refer to any element, but when unspecified is assumed to refer to segments.

(4)	DEP(X)	"Incur a violation for each X in the output which has no input correspondent."

2.3.5 MORPHDISF

MORPHDISF is perhaps the most important constraint in this analysis. It is used successfully in de Lacy (in prep.) to account for stem alterations in DhoLuo. It is defined in (5).

(5) MORPHDISF "Incur a violation for each morpheme which is not realized distinctively by at least one feature."

(after McCarthy & Prince 1995:62, de Lacy in prep.)

The most important phrase in the definition of MORPHDISF is "realized distinctively". "Distinctive realization" means that (a) a feature is present in the output which belongs to the morpheme in question (realization), and (b) that feature does not belong to any other morpheme (distinctiveness).

Importantly, MORPHDISF distinguishes only between candidates with no distinctive realization of a given morpheme, and candidates with some. It cannot distinguish between candidates with distinctive realization of one feature alone from a given morpheme and those with distinctive realization of more than one. Consequently, where the featural morpheme corresponds to a pre-existing segment and alters it, there is nothing to favour a candidate with full distinctive realization of it over one with only partial such realization, and segmental faithfulness (in the form of IDENT constraints) will often limit the amount of alteration that takes place. The reasons that this should be necessary will be explained in chapter 3.

2.3.6 Other constraints

I will introduce various other constraints during the course of the analysis that are not as central as those that have been presented in this section; it is more appropriate for them to be brought in as they are needed. Several of them are new constraints I have found it necessary to create in order to find an analysis of this data. As such, they should be regarded as highly tentative hypotheses until such time as their existence may be corroborated by evidence from a variety of languages.

2.4 Interactions between featural morphemes and segmental material

In this section I will show how differing constraint rankings can produce all of the types of effects seen in Irish – segment alteration, epenthesis, deletion, and faithful realization – in order to satisfy alignment constraints.

Situations such as this one, where multiple solutions are found to a single problem, are known in the OT literature (e.g. McCarthy 2002:93-5) as *Heterogeneity of Process, Homogeneity of Target* (HoPHoT) situations.

2.4.1 Segmental alteration

To produce segment alteration, the featural morpheme must override the inherent feature value of the stem segment; the featural morpheme's feature values must be more strongly preserved than the stem segment's.

In other words, some faithfulness constraint (i.e. MORPHDISF) must demand realization of the featural morpheme's values, and must be ranked higher than whatever faithfulness constraints (i.e. IDENT(F)) demand preservation of those features in stem segments. This is shown in tableau 3. If IDENT(cont) were higher ranked than MORPHDISF, then the segmental material would be unaffected.

/{+cont} + da/		MORPHDISF	IDENT(cont)
(a)	da	*!	
(b) ☞	ða		*

Tableau 3

Segmental alteration can be blocked not only by IDENT constraints directly referring to the features in the featural morpheme, but also by IDENT constraints referring to features which must change in order to incorporate the featural morpheme's feature in the segmental material. An example is shown in tableau 4.

/{+nasal} + da/		IDENT(son)	MORPHDISF	IDENT(nasal)
(a) ☞	da		*	
(b)	na	*!		*

Tableau 4

In tableau 4, the segment /d/ cannot become nasal without also becoming sonorant, and although becoming nasal in itself would not be a problem, IDENT(son) outranks MORPHDISF and is able to force violations of it. Note that an already [+son] input such as /la/ would not be affected by this: the segmental alteration could go ahead. This is shown in tableau 5.

/{+nasal} + la/		IDENT(son)	MORPHDISF	IDENT(nasal)
(a)	la		*!	
(b) ☞	na			*

Tableau 5

Markedness constraints against possible realizations can also block segmental alteration. If *NASAL or *SONORANT were to take the place of IDENT(son) in tableau 4, the outcome would be the same.

2.4.2 Epenthesis

To produce epenthesis, MORPHDISF must dominate DEP, as shown in tableau 6. If DEP dominates MORPHDISF, epenthesis is not a possibility for distinctive realization of featural morphemes.

/{+nasal} + a/		MORPHDISF	DEP
(a)	a	*!	
(b) ☞	na		*

Tableau 6

Markedness constraints can play a part here as well. Tableau 7 shows a situation where a consonant could conceivably be epenthesized to a stem already beginning with one. It cannot in this case, however, because the markedness constraint *COMPLEX outranks MORPHDISF. (This will turn out to be true in Irish, as it happens.)

/{-cont } + ra/		*COMPLEX	MORPHDISF	DEP
(a) ☞	ra		*	
(b)	tra	*!		*

Tableau 7

Were *COMPLEX ranked below MORPHDISF, epenthesis of an extra consonant would be possible.

2.4.3 Deletion

Deletion is not mediated by MORPHDISF, as nothing is added to the stem and no segments are altered, so there is no possibility of distinctiveness. It occurs in order that the featural morpheme can map onto a segment which is not at the edge of the input form without violating ALIGN – the segment(s) intervening between the edge of the word and the desired target of mapping are deleted so that that desired target lies at the edge of the output form.

For example, imagine a language where ALIGN is undominated, and the remainder of the constraint ranking is such that it is more important to preserve the features of featural morphemes than it is to preserve those of segmental material. (See §4.2.4.3 for a discussion of this in greater depth.) An input /$\{+\text{voice}\}_1 + t_2o_3$/ might map to [$o_{1,3}$], with the initial voiceless segment deleted in order to simultaneously satisfy alignment and featural faithfulness constraints. This is illustrated in tableau 8. It is necessary for such featural faithfulness constraints (called FFC for the sake of argument here) to outrank MAX. If they do not, then candidate (a) with an invisible unfaithful mapping of the featural morpheme will win.

/{+voice}$_1$ + t$_2$o$_3$/	ALIGN	FFC	MAX
(a) t$_{1,2}$o$_3$		*!	
(b) ☞ o$_{1,3}$			*
(c) t$_2$o$_{1,3}$	*!		

Tableau 8

Markedness could block deletion in certain circumstances. In tableau 9, the markedness constraint ONSET, which demands an onset for every syllable, outranks ALIGN. Deletion of the initial /t/ is impossible under this ranking as it would leave an onsetless syllable.

/{+voice}$_1$ + t$_2$o$_3$/	ONSET	ALIGN	FFC	MAX
(a) ☞ t$_{1,2}$o$_3$			*!	
(b) o$_{1,3}$	*!			*
(c) t$_2$o$_{1,3}$		*!		

Tableau 9

A slightly different input, though, is capable of undergoing deletion under the same ranking. This is seen in tableau 10. Here the input has an initial consonant cluster, the second segment of which is [+voice]. The first segment can delete and allow the featural morpheme to align itself with the voiced consonant without leaving the syllable onsetless.

/{+voice}$_1$ + tlo/	ONSET	ALIGN	FFC	MAX
(a) t$_1$lo			*!	
(b) ☞ l$_1$o				*
(c) o$_1$	*!			**

Tableau 10

2.5 Conclusions

Featural morphemes can cause a variety of effects to happen to segmental material: alteration of existing segments, epenthesis of new segments, or deletion of segments. These effects depend on particular rankings to be possible; even where these rankings are found, they can be blocked in certain cases by both markedness and faithfulness constraints.

Chapter 3: Eclipsis

3.1 Data

The effects of eclipsis can be summarized as follows:

1) Some features are preserved:
   a) Major place of articulation is preserved.
   b) Palatalization is preserved.

2) Unvoiced consonants aside from [s] become voiced, e.g.
   a) [f̻ʲiə] “deer” ~ [ə vʲiə] “their deer”
   b) [t̪ɔxliən̪ t̪uː] “you dig” ~ [n̪ax d̪ɔxliən̪ t̪uː] “that you do not dig”
   c) [n̪ə kɑːpʲeːʃiː] “the documents” ~ [n̪ə gɑːpʲeːʃiː] “of the documents”

3) Voiced plosives become nasals, e.g.
   a) [bɑːd̪] “boat” ~ [ə mɑːd̪] “their boat”
   b) [d̪uːn̪ən̪ t̪uː] “you close” ~ [gə n̪uːn̪ən̪ t̪uː] “that you close”
   c) [gaɾiː] “garden” ~ [ɑːɾ ŋaɾiː] “our garden”

4) Nasals, laterals, [r], [s] and [h] are unaffected, e.g.
   a) [n̪ə n̪avʲdʲɪ] “the enemies” ~ [n̪ə n̪avʲdʲɪ] “of the enemies” (cf. 2(c))
   b) [l̪uəx] “value” ~ [ə l̪uəx] “their value” (cf. 2(a))
   c) [rɪn̠ʲən̪ t̪uː] “you divide” ~ [gə rɪn̠ʲən̪ t̪uː] “that you divide” (cf. 3(b))
   d) [n̪ə saidʲuːɾʲiː] “the soldiers” ~ [n̪ə saidʲuːɾʲiː] “of the soldiers” (cf. 2(c))
   e) [hal̪ə] “hall” ~ [ɑːɾ hal̪ə] “our hall” (cf. 3(c))

5) A coronal nasal (non-alveolar where permitted by the dialect in question) is prefixed to vowel-initial stems, e.g.
   a) [uːl̪ə] “apples” ~ [ə n̪uːl̪ə] “their apples”
   b) [aɾiː] “goods” ~ [ɑːɾ n̠ʲaɾiː] “our goods”

Table 1.1 summarizes the effects of eclipsis on consonants. Consonants which never begin lexical stems underlyingly (some of which may be created by eclipsis) are shown in grey; consonants which can begin lexical stems but are unaffected by eclipsis are shown in black on a grey background. The velarization diacritic is omitted for ease of reading.

p pʲ	t̪ tʲ		k c	
b bʲ	d̪ dʲ		g ɟ	
f fʲ	s ʃ		x ç	h
w vʲ			ɣ j	
m mʲ	n nʲ	n̪ n̠ʲ	ŋ ɲ	
	l lʲ	l̪ l̠ʲ		
	ɾ ɾʲ	r		

Table 1.1: Effects of eclipsis on consonant-initial stems

3.2 Analysis

3.2.1 The content of the eclipsis morpheme

Other than epenthesis, all the changes found in eclipsis involve either replacing [-nasal] with [+nasal] or replacing [-voice] with [+voice]. Therefore, the featural morpheme responsible for eclipsis has a [+nasal] and a [+voice] feature. Unsurprisingly, the segments epenthesized by eclipsis are both voiced and nasal. They are also [+dist], in those dialects containing laminal nasals, and

A morpheme {[+nasal], [+voice], [+dist]} accounts for the fact that nasals are not affected by eclipsis. As they are already [+nasal] and [+voice] (and all stem-initial nasals are [+dist] in dialects with laminal nasals), realization of such a morpheme could have no visible effect.

It also fits with the fact that eclipsis is found in locations where historically there was a preceding nasal. It is plausible to hypothesize that voicing and nasality features spread from preceding nasals onto word-initial consonants, and that the nasal's root node was then lost, leaving behind only what had spread onto other segments; where nasals preceded vowel-initial words, they would have been syllable-initial, and this may have protected them from whatever sound change resulted in their loss before consonant-initial words. The [+dist] feature most likely represents a subsequent development due to strengthening of word-initial consonants.

3.2.2 Partial realization of the morpheme

All consonants which are affected by eclipsis undergo a change in either voicing or nasality, but not both. Voiceless consonants (always non-nasal in Irish) could conceivably become voiced nasals, e.g. /t/ → /n/. That they do not is captured in the definition of MORPHDISF (see chapter 2) by the notion of "distinctive realization" – any realization is enough if it alters the existing material.

Consider the eclipsis of /t̪ahiː/ "experience". The intial [t̪] is neither [+voice] nor [+nasal]. In principle, the eclipsis morpheme {+voice, +nasal, +dist} could alter either or both of these features, producing a voiced plosive (altering only [voice]), an unvoiced nasal stop (altering only [nas]) or a voiced nasal stop (altering both). In practice, it alters only the [voice] feature. This is explained (a) by the fact that Irish has a high-ranking constraint against voiceless nasal segments, which favours [d̪] over [n̪̊], and (b) by harmonic bounding among the segmental faithfulness constraints, which favours [d] over [n̪]. This is shown in tableau 1:

/{+voice, +nasal, +dist} + t̪ahiː/	*[-voi]&[+nas]	MORPHDISF	IDENT(voice)	IDENT(nasal, sonorant)
(a) t̪ahiː		*!		
(b) ☞ d̪ahiː			*	
(c) n̪ahiː			*	*!
(d) n̪̊ahiː	*!			*

Tableau 1

Candidate (c) realizes the entirety of the featural morpheme. However, it is harmonically bounded by candidate (b), which realizes only one of the morpheme's features: IDENT(nasal) favours (b) over (c), but no constraint favours (c) over (b). Both are favoured over (a) by MORPHDISF.

The ranking of IDENT(voice), IDENT(nasal) and IDENT(sonorant) below MORPHDISF is clearly necessary on the grounds that segments are observed to change these feature values in order to realize featural morphemes.

The eclipsis of /f/ gives evidence for the ranking of a further two constraints. It is illustrated in tableau 2 with eclipsis of /fad̪/ "length".

/{+voice, +nasal, +dist} + fad̪/	MORPHDISF	IDENT(approx)	IDENT(vocoid)
(a) fad̪	*!		
(b) ☞ wad̪		*	*

Tableau 2

3.2.3 Full realization with only partial distinctiveness

Considering the eclipsis of /d̪ɑːn/ "poem", the situation shown in tableau 3 obtains.

/{+voice, +nasal, +dist} + d̪ɑːn/	MORPHDISF	IDENT(voice)	IDENT(nasal, sonorant)
(a) d̪aːn̪	*!		
(b) t̪aːn̪	*!	*	*
(c) ☞ n̪aːn̪			*

Tableau 3

Tableau 3 illustrates how MORPHDISF will not favour arbitrary changes from the input, but only those which are motivated by the content of the featural morpheme. /t/ is different from the input, so distinctiveness might be said to be satisfied, but the difference is not derived from anything in the eclipsis morpheme and thus it is not a realization of it.

3.2.4 Epenthesis before vowel stems

Before vowel stems, eclipsis is realized as an epenthesized nasal. DEP must therefore be ranked below MORPHDISF, as shown in the eclipsis of /ɑː/ "luck" in tableau 4:

/{+voice, +nasal, +dist} + ɑː/		MORPHDISF	DEP
(a)	ɑː	*!	
(b) ☞	n̪ɑː		*

Tableau 4

It is also necessary to prevent the realization of the morpheme on the initial vowel itself. Nasal vowels are permitted in Irish, so it might be expected that the morpheme could be distinctively realized by nasalization of the stem vowel. However, nasal vowels are not permitted other than preceding nasal consonants, so as long as the constraints responsible for this prohibition are ranked higher than DEP, epenthesis will be the preferred solution. This is shown in tableau 5. The constraint *INDEPENDENT NASAL VOWELS is admittedly *ad hoc*, but it is beyond the scope of this chapter to provide a detailed analysis.[1]

/{+voice, +nasal, +dist} + ɑː/		*INDEPENDENT NASAL VOWELS	MORPHDISF	DEP
(a)	ɑː		*!	
(b)	ɑ̃ː	*!		
(b) ☞	n̪ɑː			*

Tableau 5

MORPHDISF might be equally well satisfied with an epenthesized [d]; this would create a new voiced segment, and would better satisfy onset sonority constraints such as *ONS/NASAL (Prince & Smolensky 1993). MAX-F, or MAX(feature), will favour the candidate with the most features preserved from the featural morpheme. Thus it will favour nasal epenthesis over oral epenthesis, and so it must be ranked above all constraints favouring candidates with oral epenthesis. This is shown in tableau 6.

/{+voice, +nasal, +dist} + ɑː/		MORPHDISF	MAX-F	*ONS/NASAL
(a)	ɑː	*!	*	
(b)	d̪ɑː		*!	
(b) ☞	n̪ɑː			*

Tableau 6

[1] The ranking *VN » $*V^{+nas}$ » MORPHDISF » IDENT[NASAL] could accomplish this.

The laminal nasal is chosen similarly because Max-F wishes to realize all features of the morpheme. Max-F must be ranked above the markedness constraint *Laminal, which will favour less marked apical nasals. This is illustrated in tableau 7.

/{+voice, +nasal, +dist} + ɑː/		MorphDisF	Max-F	*Laminal
(a)	n̪ɑː	*!	*	*
(b)	nɑː		*!	

Tableau 7

3.2.5 Non-eclipsing consonants

3.2.5.1 Resistant consonants and Ident(+cont)

Several consonants are not affected by eclipsis (see table 1). These fall into two groups: (a) nasal stops, which already contain both feature values found in the eclipsis morpheme, and thus cannot distinctively realize it, and (b) the consonants /s ʃ, l̪ l̠ʲ, r, h/. Those in (b) are the more interesting, as there are a variety of segments to which they could conceivably be eclipsed. Nasal and oral voiced stops are the most obvious of these, and the most unmarked. However, these stops share the property that they are [-cont], while all the segments in (b) are [+cont]. Ranking Ident(+cont) above MorphDisF will prevent eclipsis of any of these segments to a nasal or oral stop, as shown in the examples in tableaux 8 and 9, with eclipsis of /sɾɑːdʲ/ “street” and /l̪uə/ “mention”.

/{+voice, +nasal, +dist} + sɾɑːdʲ/		Ident(+cont)	MorphDisF
(a) ☞	sɾɑːdʲ		*
(b)	d̪ɾɑːdʲ	*!	

Tableau 8

/{+voice, +nasal, +dist} + l̪uə/		Ident(+cont)	MorphDisF
(a) ☞	l̪uə		*
(b)	n̪uə	*!	

Tableau 9

Why Ident(+cont) and not simply Ident(cont)? The analysis of lenition will show that segments are frequently required by MorphDisF to change from [-cont] to [+cont], e.g. /k/ → /x/, so plain Ident(cont) cannot be ranked above MorphDisF. Following de Lacy (2002), I propose that there exist two Ident constraints relating to [cont], Ident(±cont) and Ident(+cont), while Ident(-cont) does not exist.

According to de Lacy (2002), the more specific Ident constraint always refers to the more marked value of the feature in question; the phenomena of Irish mutation therefore provide evidence that [+cont] is the more marked value.

3.2.5.2 Lack of epenthesis before non-eclipsing consonants

Where segment alteration is not possible because that segment is a vowel, eclipsis causes epenthesis of a nasal. Why are nasals not epenthesized before other segments which cannot be altered by eclipsis? At least some of the resulting forms would be permissible in Irish; epenthesizing a nasal before an /n/ or /r/ would give [nl] or [nr], both of which are attested in the output as eclipsed forms of /dl dr/, e.g. [ɑːr n̪ɾiːhɪ] “our wizards” (cf. [d̪ɾiːhɪ] “wizards”).

The ranking MAX » *COMPLEX » MORPHDISF » DEP accomplishes this. MAX must outrank *COMPLEX to allow underlying clusters to surface. But a consonant cannot now be epenthesized next to another one, as shown in tableaux 10, with eclipsis of /d̪ɾiː/ “wizard”, 11, with eclipsis of /reː/ “period”, and 12, with eclipsis of [ɑː] “luck”.

/{+voice, +nasal, +dist} + d̪ɾiː/	*COMPLEX	MORPHDISF	DEP
(a) d̪ɾiː	*	*!	
(b) n̪ɾiː	*		

Tableau 10

/{+voice, +nasal, +dist} + reː/	*COMPLEX	MORPHDISF	DEP
(a) reː		*	
(b) n̪reː	*!		*

Tableau 11

/{+voice, +nasal, +dist} + ɑː/	*COMPLEX	MORPHDISF	DEP
(a) ɑː		*!	
(b) n̪ɑː			*

Tableau 12

3.2.5.3 A problem: eclipsis of /s ʃ h/ to glides?

An unsolved problem is the fact that /s ʃ h/ do not become eclipsed to glides [w j] to distinctively realize [+voice]. There are several conceivable mechanisms for this blocking, but none of them is satisfactory.

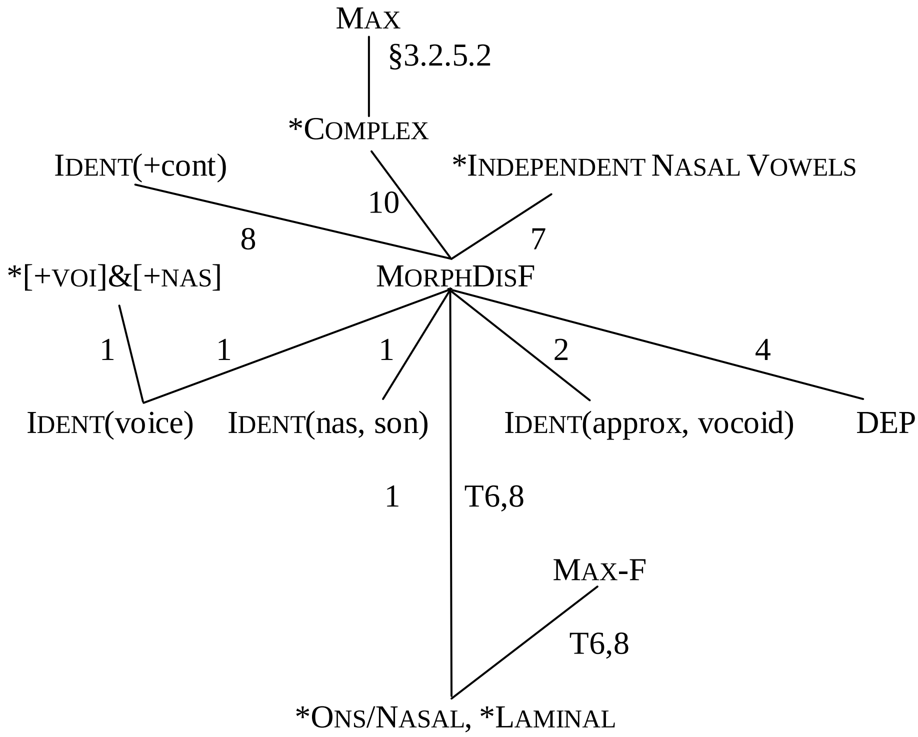
It is not possible to rule out all mutation-driven changes from non-approximant to approximant (or non-vocoid to vocoid), as both the eclipsis of /f/ (→ [w]) and the lenition of /dʲ gʲ/ (→ [j]) require this change. In other words, IDENT(approx) and IDENT(vocoid) are ranked below MORPHDISF.

Neither is it possible to rule out these changes on the basis of place of articulation change, for two reasons. Firstly, /ʃ/ need not change place if it were to become [j], so place faithfulness would have no effect. Secondly, though /s/ would have to change place of articulation to become a glide, place of articulation changes will be seen to be necessary to satisfy MORPHDISF in lenition.

/s ʃ/ are strident, and glides are not. IDENT(strident) could thus prevent their eclipsis to glides. Unfortunately, they are required to become [h] under lenition, so IDENT(strident) must be ranked below MORPHDISF. This would not protect /h/ from eclipsis, anyhow.

3.3 Conclusions

In conclusion, there exists a featural morpheme responsible for eclipsis which takes the form {+voice, +nasal, +dist}. The following constraint ranking is responsible for its effects:



(numbers refer to the first tableaux where these rankings can be found, or to sections in which they are mentioned)

Chapter 4: Lenition

4.1 Data

The effects of lenition are not as straightforward as those of eclipsis; they often involve a change in multiple feature values. The following generalizations hold concerning lenition:

1) Voicing is preserved.
2) Vowel-initial stems are not affected.
    a. [ahɪɾʲ] “father” ~ [l̠ʲasahɪɾʲ] “stepfather” (cf. 4(c))
3) Stems beginning in /r/ and /h/ are not affected.
    a. [rɔhəɾ] “bicycle” ~ [d̪ə rɔhəɾ] “your bicycle” (cf. 4(d))
    b. [hal̪ə] “hall” ~ [d̪ə hal̪ə] “your hall” (cf. 4(d))
4) Plosives and /m/ become continuants, some fricative, some approximant.
    a. [poːs] “marry” ~ [foːs] “married”
    b. [klɔx] “stone” ~ [ən xlɔx] “the stone”
    c. [mɑːhɪɾʲ] “mother” ~ [l̠ʲaswɑːhɪɾʲ] “stepmother”
    d. [guːnə] “dress” ~ [d̪ə ɣuːnə] “your dress”
    e. [dʲas] “nice” ~ [bʲan jas] “nice woman”
5) Certain consonants undergo changes of major place of articulation. These are: /t̪ tʲ s ʃ/, which become glottal; /d̪/, which becomes velar; /ɡʲ/, which becomes coronal.
    a. [d̪uːn] “close” ~ [ɣuːn] “closed”
    b. [ɡʲas] “taboo” ~ [fʷiː jas] “under a taboo” (cf. 3(e))
6) Coronal nasals and laterals change from laminal to apical. This causes a correlated change in minor place of articulation.
    a. [l̠ʲɑː] “melt” ~ [lʲɑː] “melted”
    b. [l̪iː] “lie” ~ [liː] “lay”
    c. [n̠ʲad̪] “nest” ~ [ə nʲad̪] “its nest”
    d. [n̪ask] “link” ~ [ə nask] “its link”
7) /t̪ tʲ s ʃ/ merge as [h] under lenition, losing their palatalization distinction.
    a. [sɔɾəxə] (name) ~ [hɔɾəxə] (genitive)
    b. [ʃiːnʲɪ] (name) ~ [hiːnʲɪ] (genitive)
8) /f fʲ/ are deleted under lenition.
    a. [foːd̪] “ground” ~ [fʷiː oːd̪] “underground”

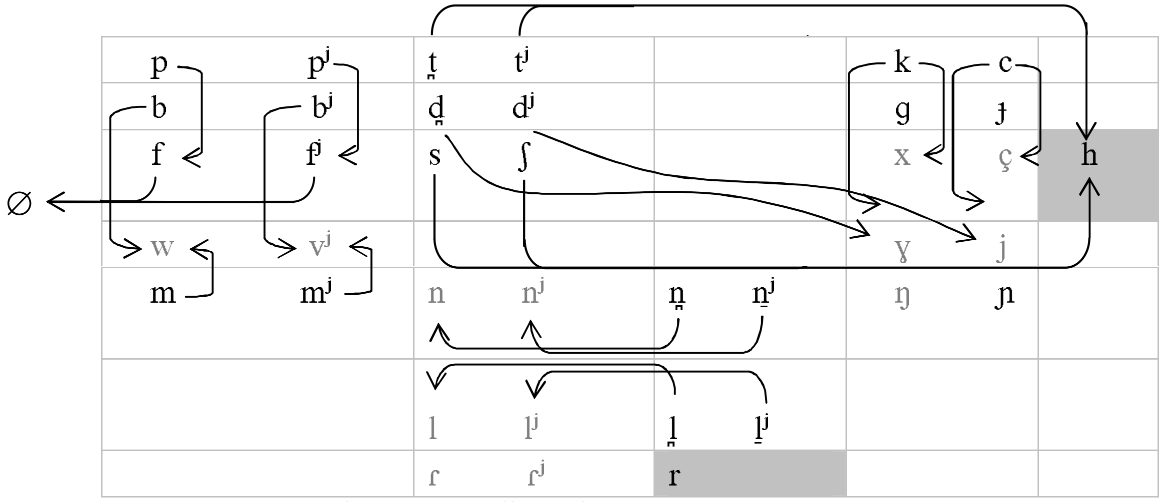


Table 2.1. Summary of commonest effects of lenition.

4.2 Analysis

The following analysis is the same in outline as the proposal for eclipsis. I will argue that lenition is a morpheme that consists of three floating features: [+cont], [-distr] and [+son]. At least one of the features must be realised distinctively. Which combination of them surfaces depends on which mapping incurs the most tolerable faithfulness violations.

For example, /p/ lenites to [f], distinctively realizing the [+continuant] feature. /p/ could have lenited to [w] as well, but doing so would have been a gratuitous violation of faithfulness – changing to [w] not only alters /p/'s [continuant] value, but also its values for [approximant] and [sonorant]. In a slightly different vein, /p/ does not lenite to [m]; doing so would distinctively realize [+sonorant], but at the cost of violating IDENT(nasal). These extra faithfulness violations mean that the realizations [w] and [m] are harmonically bound by [f].

4.2.1 The content of the lenition morpheme

I propose that the morpheme responsible for lenition consists of the features [+cont], [+son] and [-dist]. The [+cont] feature is responsible for plosives and /m/ becoming fricatives and approximants. The [+son] feature is responsible for /s/ becoming [h] and for /f/ being deleted. The [-dist] feature is responsible for laminal coronal sonorants becoming apical.

In order for these features to be successfully realized on stem segments which do not underlyingly possess them, IDENT(±cont), IDENT(son) and IDENT(dist) must be ranked below MORPHDISF. I demonstrate these and other rankings in §2.2-3.

4.2.2 Simple cases

This section demonstrates the effect of the lenition morpheme on those consonants where it causes a fairly straightforward change.

4.2.2.1 Distinctive realization with [+cont]

The lenition of /pɑː/ "pay" is shown in tableau 1.

/{+cont, +son, -dist} + pɑː/	MORPHDISF	IDENT(±cont)
(a) pɑː	*!	
(b) ☞ fɑː		*

Tableau 1

(a) does not realize any part of the lenition morpheme and thus violates MORPHDISF. (b) distinctively realizes [+cont] and thus does not violate MORPHDISF.

Why does this input not give one of the outputs /wɑː/ or /mɑː/, which would also realize the lenition morpheme distinctively? In general terms, these options are less faithful than the change to [f]. Change of /p/ to [w] also involves changes in [approximant] and [vocoid]; a change of /p/ to [m] involves a change in [nasal]. These outputs would violate IDENT(approx) and IDENT(vocoid) or IDENT(nasal) respectively. IDENT(nasal) must be ranked above IDENT(±cont), but IDENT(approx) and IDENT(vocoid) need not. This is shown in tableau 2.

/{+cont, +son, -dist} + pɑː/	IDENT(nasal)	IDENT(±cont)	IDENT(approx/vocoid)
(a) ☞ fɑː		*	
(b) wɑː		*	*!
(c) mɑː	*!		

Tableau 2

The lenition of /m/ has an additional consequence. It loses nasality under lenition, showing that IDENT(nasal) is ranked below MORPHDISF. This is shown in tableau 3.

/{+cont, +son, -dist} + mɑː/	MORPHDISF	IDENT(nasal)
(a) mɑː	*!	
(b) ☞ wɑː		*

Tableau 3

4.2.2.2 Distinctive realization with [-dist]

Considering the lenition of coronal nasals and laterals, we firstly have the situation shown in tableau 4, where the lenition of /l̪iː/ "lie" is shown.

/{+cont, +son, -dist} + l̪iː/	MORPHDISF	IDENT(dist)
(a) l̪iː	*!	
(b) ☞ liː		*

Tableau 4

Laterals are already [+cont, +son], so any alteration to satisfy MORPHDISF must come by the inclusion of [-dist].

Nasals, however, are [-cont], so MORPHDISF will also be satisfied by continuants as realizations of coronal nasals under lenition. There are no continuants in Irish that share anything with /n̪ n̠ʲ/, other than [+dist], that [n nʲ] do not also share with them. Therefore IDENT(dist) is the only constraint which will favour a continuant over an apical nasal as a realization of /n̪ n̠ʲ/ under lenition. As there are no nasal continuants in Irish, it makes sense to rank IDENT(nasal) above IDENT(dist) to ensure the correct lenition of these segments. This is illustrated in tableau 7, which shows the lenition of /n̠ʲad̪/ "nest".

/{+cont, +son, -dist} + n̠ʲad̪/	MORPHDISF	IDENT(nasal)	IDENT(dist)
(a) n̠ʲad̪	*!		
(b) jad̪		*!	
(c) ☞ nʲad̪			*

Tableau 5

4.2.3 Cases with changes of major place of articulation

4.2.3.1 Coronal to glottal: distinctive realization with [+son]

Consider the lenition of /sɑː/ "stab", shown in tableau 6.

/{+cont, +son, -dist} + sɑː/	MORPHDISF	IDENT(coronal, sonorant, vocoid, approx, strident)
(a) sɑː	*!	
(b) ☞ hɑː		*

Tableau 6

MORPHDISF must dominate IDENT constraints that would preserve any feature by which /s/ differs from [h], i.e. [coronal], [sonorant][1], [vocoid], [approximant], and [strident]. /s/ is already continuant, so any change to satisfy MORPHDISF must be to a sonorant sound. /s/ and [h] are both [-voice], so all other possible sonorants ([h] is the only voiceless sonorant in Irish) can be ruled out by DEP(+voice). The fact that [j] is coronal (Hall 1997:21-2), along with [n], means that DEP(+voice) must be ranked above IDENT(coronal), as shown in tableau 7. (The reason for using DEP instead of IDENT will become clear later.)

[1] There is disagreement as to whether [h] is a [+sonorant] sound. I take the position that it is. For discussion of this point see Churma and Shi (1995).

/{+cont, +son, -dist} + sɑː/	DEP(+voice)	IDENT(coronal)
(a) jɑː	*!	
(b) nɑː	*!	
(c) ☞ hɑː		*

Tableau 7

Exactly the same arguments apply to the lenition of /t/. However, /t/ is not [+cont], so the fact that it does not map to any continuant other than /h/ (in most environments) must be accounted for. More concretely, why does /t/ not become [s]? Such a mapping would distinctively realize [+continuant], so it would satisfy MORPHDISF.

The answer is that leniting /t/ to [h] maintains /t/'s underlying voicing and stridency. No other available segment manages to preserve both these underlying values. To be more precise, the candidates for lenition of /t/ are (a) fricatives, and (b) sonorant continuants. The voiced fricatives and all sounds in category (b) (excluding [h]) are ruled out by DEP(+voice). This leaves the set of voiceless continuants in Irish, [f fʲ s ʃ ç x h]. Ranking IDENT(strident) over IDENT(coronal) favours [h] over [s ʃ], as [t] and [h] are non-strident whereas [s ʃ] are strident. The effect of IDENT(strident) and IDENT(coronal) on /t/'s lenition is shown in tableau 8 with lenition of /tʲas/ "heat".

/{+cont, +son, -dist} + tʲas/	IDENT(strident)	IDENT(coronal)
(a) ☞ has		*
(b) ʃas	*!	

Tableau 8

The choice between [h] and the other non-strident fricatives will be made by markedness constraints on the basis of place of articulation. I assume a stringency hierarchy of PoA markedness constraints along the lines of those described in de Lacy (2004), and following the markedness scale for PoA given in de Lacy (2002:180ff):

*DORSAL
*(DORSAL, LABIAL)
*(DORSAL, LABIAL, CORONAL)
*(DORSAL, LABIAL, CORONAL, GLOTTAL)

Whatever the ranking of these four constraints, [h] will always score less violations from them than will any other voiceless fricative in Irish. No constraint (other than one to be proposed later) will favour a labial or dorsal realization of an input /t/, so [h] harmonically bounds all the other non-coronal fricatives.

The lenition of /tʲas/ “heat” is shown in tableau 9 to illustrate this.

/{+cont, +son, -dist} + tʲas/	MORPHDISF	IDENT(coronal)	*(DORSAL, LABIAL)
(a) tʲas	*!		
(b) ☞ has		*	
(c) fʲas		*	*!
(d) ças		*	*!

Tableau 9

4.2.3.2 Coronal to dorsal: distinctive realization of [+cont]

/d̪/, coupled with the lenition morpheme, has three choices (on the assumption that its palatalization may not change): to become [+cont] (i.e. to become a fricative), to become [+son] (i.e. to become a nasal or [h]) or to become both (i.e. to become an approximant). It does not become nasal for the same reason that /p/ does not (§2.2.1): IDENT(nasal) » IDENT(±cont). It does not become an approximant either, so IDENT(approx) must be similarly ranked above IDENT(±cont). This is illustrated in tableau 10, showing lenition of /d̪ɑːn/ “poem”.

/{+cont, +son, -dist} + d̪ɑːn/	MORPHDISF	IDENT(nasal)	IDENT(approx)	IDENT(±cont)
(a) d̪ɑːn	*!			
(b) ☞ ɣɑːn				*
(c) n̪ɑːn		*!		
(d) wɑːn			*!	

Tableau 10

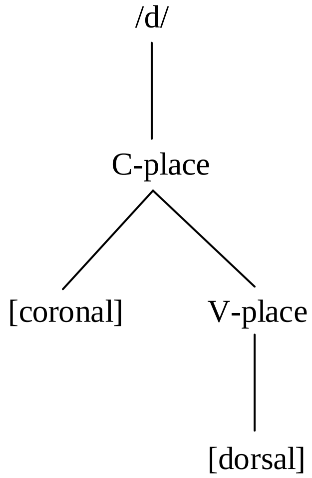
It does not become [h] because this would violate IDENT(voice), which must be ranked above *(DORSAL, LABIAL), as illustrated in tableau 11.

/{+cont, +son, -dist} + d̪ɑːn/	IDENT(voice)	*(DORSAL, LABIAL)
(a) ☞ ɣɑːn		*
(b) hɑːn	*!	

Tableau 11

It remains to account for why /d̪/ does not lenite to /β/ in those dialects which possess it, or to /v/ in other dialects in those environments where it is permitted (before laterals and rhotics). This would not violate IDENT(approx) and ought to harmonically bound /ɣ/ on the markedness scale shown in §2.3.1. It is possible that the answer to this problem lies in the velar, hence dorsal, nature of the secondary articulation of /d̪/, which can be represented as a [dorsal] feature linked under the V-place node (9).

(9)



If standard IDENT constraints are thought to refer strictly to particular locations in the feature geometry[2] then V-place and C-place cannot exert any influence on each other through them. Therefore, I propose the following constraint, to recognize the dual use of the same set of place features:

V-TO-C-IDENT(place)	"Incur a violation if an input segment with a [place] feature linked under its V-place node corresponds to an output segment without a [place] feature linked under its C-place node." (For "place" read "coronal", "dorsal", "labial" as appropriate.)

Ranked below *(DORSAL, LABIAL), this constraint will favour [ɣ] over [v β] as a realization of [d̪ˠ] (see tableau 12) but not affect the realization of /t/ as /h/ (see tableau 13, lenition of /t̪eː/ "tea").

/{+cont, +son, -dist} + d̪ɑːn/	*(DORSAL, LABIAL)	V-TO-C-IDENT(dorsal)
(a) ☞ ɣɑːn	*	
(b) βɑːn	*	*!

Tableau 12

[2] This is necessary from the point of view of lenition of /t̪/. Given that dorsal consonants are visible in Irish, IDENT(dorsal) must outrank all *PLACE constraints. If it could refer to V-place as well as C-place features in the manner of V-TO-C-IDENT(place) as proposed here, it would incorrectly choose [x] over [h] as a mapping for lenited /t̪/ (see tableau 12).

/{+cont, +son, -dist} + t̪eː/	*(DORSAL, LABIAL)	V-TO-C-IDENT(dorsal)
(a) ☞ heː		*!
(b) xeː	*	

Tableau 13

4.2.3.3 Dorsal to coronal: distinctive realization of [+cont] and [+son]

The lenition of /ɡʲ/ to [j] is the topic of this section. It is straightforward enough that [ɡʲ] is able to become an approximant: the relevant IDENT constraints are ranked below MORPHDISF (see tableau 6). This is illustrated in tableau 14, which shows lenition of /ɡʲal/ "bright".

/{+cont, +son, -dist} + ɡʲal/	MORPHDISF	IDENT(±cont, sonorant, vocoid, approx)
(a) ɡʲal	*!	
(b) ☞ jal		*

Tableau 14

According to Hall (1997:21-2), [j] is coronal. Therefore, [ɡʲ] must lose its dorsal status under lenition, and IDENT(dorsal) must be ranked below MORPHDISF. (It must also be ranked above all *(PLACE) constraints or dorsal segments will fail to appear on the surface.) These rankings are shown in tableau 15.

/{+cont, +son, -dist} + ɡʲal/	MORPHDISF	IDENT(dorsal)	*(DORSAL, LABIAL)
(a) ɡʲal	*!		
(b) ☞ jal		*	*

Tableau 15

*(DORSAL, LABIAL) must also be ranked above IDENT(sonorant), IDENT(approx) and IDENT(vocoid). This can be deduced from the fact that [ɡʲ] does not lenite to [vʲ]. Some constraint which favours [j] over [vʲ] must therefore be ranked above all those which would favour [vʲ] over [j].

[vʲ] violates IDENT(±cont) and IDENT(dorsal); however, it is identical to [ɡʲ] on all other features. [j] violates these constraints as well, so they will favour neither segment over the other. However, it also violates the constraints IDENT(sonorant), IDENT(approx) and IDENT(vocoid), which are not violated by [vʲ], and which therefore favour [vʲ]. There is only one constraint which favours [j]: that is *(DORSAL, LABIAL). It must, therefore be ranked above IDENT(sonorant), IDENT(approx) and IDENT(vocoid), as shown in tableau 16.

/{+cont, +son, +dist} + ɡʲal/	*(DORSAL, LABIAL)	IDENT(sonorant)	IDENT(approx)	IDENT(vocoid)
(a) ☞ jal		*	*	*
(b) vʲal	*!			

Tableau 16

This is possibly a slightly *ad hoc* solution. It would perhaps be preferable to recognize the greater similarity in place of articulation that exists between [j] and [ɡʲ] than does between [vʲ] and [ɡʲ] and use IDENT(place) to choose between them; however, this would require a discussion of the nature of place of articulation in the palatal region that would be beyond the scope of this thesis.

4.2.4 Deletion of /f/

In this section I discuss the ranking necessary to obtain the deletion of /f/ when it is prefixed with the lenition morpheme. Firstly I will show why /f/-initial stems do not undergo either featural alteration or epenthesis; then I will discuss the reasons that deletion is necessary.

4.2.4.1 Preventing featural alteration of /f/

With the constraint ranking developed so far, /f/ and /fʲ/ could happily realize the lenition morpheme distinctively by becoming either glides [w j] or [h]; these outputs would distinctively realize [+son]. They could also become apical nasals or laterals to realize [-dist]. However, none of these is not the attested output: as mentioned above, /f fʲ/ are deleted under lenition, e.g. /bʲan + {+cont, +son, -dist} + fɑːs̪t̪ə/ → [bʲan ɑːs̪t̪ə] “grown woman”.

[h], [j] and apical nasals and laterals are easily ruled out as options if IDENT(labial) is highly ranked. It is reasonable to treat this constraint as undominated, as no phonological process in Irish involves a labial consonant losing labiality. See the example of this in tableau 17, showing lenition of /fʲaɾ/ “man”.

/{+cont, +son, -dist} + fʲaɾ/	IDENT(labial)	MORPHDISF
(a) ☹ fʲaɾ		*
(b) haɾ	*!	

Tableau 17 (☹ indicates that [fʲar] is the most harmonic of the candidates shown, but not the actual winner)

[w] is a more serious problem, as it is a permissible satisfaction of MORPHDISF in eclipsis of /f/ (see section 3.2.2). The key lies in the fact that it differs from /f/ by being voiced. A constraint is needed which will allow /f/ to map to a voiced consonant under eclipsis, but not under lenition.

The answer is not IDENT(voice), which must be ranked below MORPHDISF (§3.3) but DEP(+voice). This is not violated by voiceless input segments mapping to voiced output segments as long as some input [+voice] feature is in correspondence with the output segment that has become voiced – in other words, as long as the [+voice] in the output has not appeared from nowhere. This is the case for eclipsis, as there is a [+voice] feature in the eclipsis morpheme. It is not the case in lenition; there the hypothetical mapping to [w] is motivated not by a [+voice] feature but by a [+son] feature, so DEP(+voice) is violated. This is seen in tableaux 18 and 19, showing lenition and eclipsis respectively of /fad̪/ "length".

/{+cont, +son, -dist} + fad̪/	DEP(+voice)	MORPHDISF
(a) ☹ fad̪		*
(b) wad̪	*!	

Tableau 18

/{+voice, +nas, +dist} + fad̪/	DEP(+voice)	MORPHDISF
(a) fad̪		*!
(b) ☞ wad̪		

Tableau 19

4.2.4.2 Prevention of epenthesis

If a segment were to be epenthesized to the left edge of an /f/-initial word, it would naturally have to be either a consonant or a vowel. Any vowel would satisfy MORPHDISF by distinctively realizing [+cont]; it would also produce a new syllable. Vowel epenthesis can therefore be prevented by ranking DEP(σ) above MORPHDISF.

Any consonant epenthesized to the left edge of the word would form a complex onset with the [f], whether or not it satisfied MORPHDISF. In Irish, [f] may never form the second element of a complex onset (except in a few loanwords). I will represent this condition as a makeshift constraint ONSETCOND (defined in (10)), which must be ranked highly if it is to constitute a general condition on syllable structure in Irish. This will prevent consonant epenthesis.

(10) ONSETCOND "Incur a violation for every [f] in an onset in the output that is not the first segment in that onset."

Taken together, these two rankings prevent epenthesis before [f]-initial words under lenition, but will not prevent epenthesis of nasals to vowel-initial stems under eclipsis. They are demonstrated in tableau 20.

/{+cont, +son, +dist} + fad̪/	ONSETCOND	DEP(σ)	MORPHDISF
(a) ☹ fad̪			*
(b) əfad̪		*!	
(c) t̪fad̪	*!		

Tableau 20

4.2.4.3 Motivation for deletion

So far in this section, I have shown that the initial /f/ in /{+cont, +son, -dist} + fad̪/ cannot be altered, and nothing can be epenthesized before it. Now I will consider the question of deletion. The field in the derivation of /{+cont, +son, -dist} + fad̪/ can be considered narrowed down to two candidates: [fad̪] and [ad̪]. Somehow the constraint ranking must choose the second of these. MORPHDISF will be satisfied by neither of them – another constraint must be responsible.

The segment immediately following an onset /f/ in Irish is always [+son] and [+cont] (in practice, a vowel, a liquid or a coronal nasal). [f] is [-son], so if the lenition morpheme can be associated with the segment following the [f], it will be able to be more faithful. Thus the [f] is deleted so that the lenition morpheme can be left-aligned with the stem (remember that ALIGN is undominated) and be more faithful than it would be were it aligned with the [f]. This mechanism for subtractive morphology is observed in DhoLuo and Hessen German as well (de Lacy in prep.).

It seems, then, that a constraint is required that favours candidates with a greater number of the featural morpheme's features realized (distinctively or not) but which does not disfavour candidates with deletion of segments, despite the loss of features that this involves. The constraint in (11), MAXFNONSEG, is designed to do that.

(11) MAXFNONSEG "Incur a violation for each feature ***not*** associated with a segmental root node in the input which does not have an output correspondent."

This is certainly *ad hoc*, but can perhaps be justified on the grounds that extrasegmental features are more marked than their segmental counterparts, and thus can be expected to have dedicated faithfulness constraints, along the lines of de Lacy (2002).

MAXFNONSEG favours maximum realization of featural morphemes' features. It therefore runs contrary to the spirit of MORPHDISF, which can be satisfied by one feature alone from a featural morpheme being realized. MORPHDISF favours neither of [fad̪] and [ad̪], so MaxFNonSeg can be successfully ranked below it. This is demonstrated in tableau 21.

/{+cont, +son, -dist}$_1$ + f$_2$a$_3$d̪/	MorphDisF	MaxFNonSeg
(a) f$_{1,2}$ad̪	*	*!
(b) ☞ a$_{1,3}$d̪	*	

Tableau 21

Because MaxFNonSeg will always favour candidates with greater numbers of extrasegmental features realized, it cannot be ranked above MorphDisF in Irish or it will destroy its effect.

Unfortunately, evidence from eclipsis shows that Max is ranked above MorphDisF (§3.3). Max will, of course, choose [fad̪] over [ad̪]. So there is apparently a ranking paradox: MaxFNonSeg must outrank Max, which outranks MorphDisF, which outranks MaxFNonSeg. One way out of this problem is to convert Max to a specific version of itself referring to all segments other than [f], Max(¬[f]). Max([f]) can then be safely ranked below MaxFNonSeg. This state of affairs is demonstrated in tableau 22.

/{+cont, +son, -dist} + fad̪/	Max(¬[f])	MorphDisF	MaxFNonSeg	Max([f])
(a) fad̪		*	**!	
(b) ☞ ad̪		*	*	*

Tableau 22

[f] lacks [+son] and [-dist] (as it is not a coronal, it possesses none of the features which depend off the coronal node) in candidate (a), so that candidate receives two violations from MaxFNonSeg. [a] in candidate (b) only lacks [-dist], so it receives only one star.

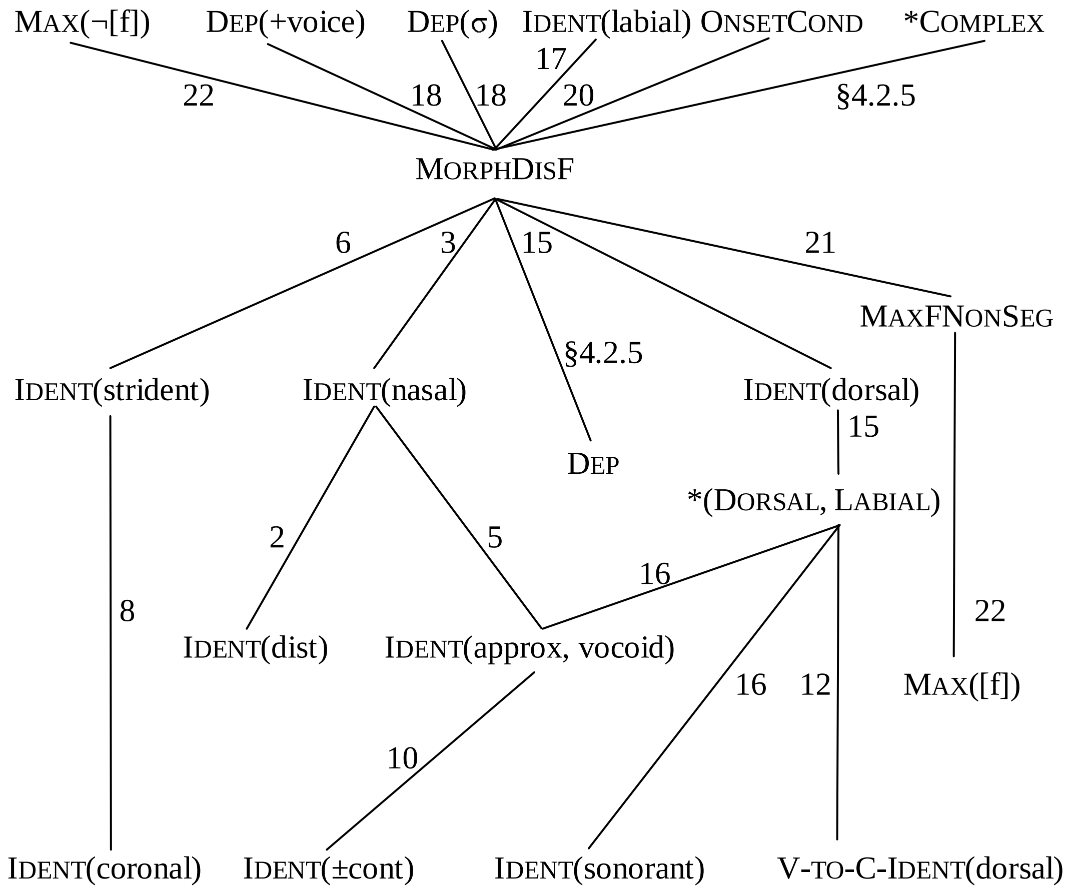
This is hardly intuitive, however, as “not [f]” is far from a natural class of speech sounds; there is no feature value unique to [f], so “not [f]” can be nothing more than an arbitrary selection of segments which happens to exclude [f]. A more explanatory treatment might take account of the perceptual factors resulting from the low acoustic energy associated with [f], connecting them with some measure of the communicatory value of retaining [f]; however, modifications to standard feature theory would likely be required, and it would be beyond the scope of this thesis to go further on this matter.

4.2.5 Unaffected consonants

The consonants that are unaffected by lenition are [h] and [r]. These consonants are already [+cont], [+son], [-dist], and so no change to them can distinctively realize MorphDisF. Segmentally altered candidates thus have no advantage over faithful ones with MorphDisF. Max (or Max(¬[f])) ranked above MorphDisF eliminates the possibility of their deletion, and epenthesis is ruled out as before (§3.2.5.2) by *COMPLEX » MORPHDISF » DEP. Therefore only totally faithful candidates remain.

4.3 Conclusions

In conclusion, the lenition morpheme has the form {[+cont], [+son], [-dist]}. The following ranking is responsible for its effects:



(numbers refer to the first tableaux where these rankings can be found)

Chapter 5: Palatalization

5.1 Data

Palatalization[1] is unlike the other mutations in Irish in that it affects the right edge of the stem, not the left. Some examples of velarized-to-palatalized alternation were given in §1.2.2; I will discuss (and discount) the possibility of palatalized-to-velarized alternation in §5.3.

The effects of palatalization can be seen in table 1.1; table 5.1 is a modified version, showing only those consonants which can appear in word-final position. The segment on the right hand side of each table cell is the palatalized counterpart of that on the left hand side.

p^{w}	p^{j}	t̪^{ɰ}	t^{j}/tʃ			k^{ɰ}	k^{j}		
b^{w}	b^{j}	d̪^{ɰ}	d^{j}/dʒ			ɡ^{ɰ}	ɡ^{j}		
f^{w}	f^{j}	s^{ɰ}	ʃ			x^{ɰ}	ç	h	
β^{w}	v^{j}								
m^{w}	m^{j}	n^{ɰ}	n^{j}	n̪^{ɰ}	n̠^{j}	ŋ^{ɰ}	ŋ^{j}		
		l^{ɰ}	l^{j}	l̪^{ɰ}	l̠^{j}				
		ɾ^{ɰ}/ɹ	ɾ^{j}/ɹ̠						

Table 5.1. Word-final palatalization.

There are two points to make about table 5.1. The first is that final [β^{w}] is only found in Munster Irish. Other dialects either delete final voiced labial continuants (Connemara), or merge them with the previous vowel (Donegal).

The second point is that [ç] is allowed on the surface only in roots. In affixes its behaviour varies widely by dialect. When in a coda, in Munster it is converted to [ɡ^{j}] (not [k^{j}]!), in Connemara it is deleted, and in Donegal it coalesces with the previous vowel (this vowel is almost always /ə/, with which it becomes [i]); in an onset, it coalesces with the surrounding vowels in all dialects. Historically, it is likely that the three dialects passed through a stage where it surfaced as its voiced equivalent [ʝ], and then diverged in their treatment of that segment. I will not attempt to analyse this diverse behaviour here.

5.2 Analysis

Given that palatalization acts on the right edge of stems only, I propose that the palatalization morpheme is marked as a suffix and acted on by ALIGN-R(suffix, stem), which can be considered as highly ranked as ALIGN-L(suffix, stem).

[1] Note that "palatalization" can refer either to the state of being one of the set of palatalized segments or to the process of changing a velarized segment into a palatalized one.

If we accept the view in Clements and Hume (1995) that secondary articulation can be represented as a place feature dependent on the segment’s VPlace node, then we can make the generalization that palatalized segments have a [coronal] VPlace feature and velarized ones have a [dorsal] VPlace feature. Clearly, then, a featural morpheme which will cause palatalization need only contain [coronal].

In order that it should attach itself to the VPlace, and not to the CPlace, node of its target consonant, it must be the case that all IDENT(CPlace) constraints are ranked higher than IDENT(VPlace dorsal), the constraint which would attempt to preserve consonants as velarized. This is illustrated in tableau 1 with palatalization of /sak/ “sack”.

/sak + {coronal}/	MORPHDISF	IDENT(CPlace dorsal)	IDENT(VPlace coronal)
(a) sak	*!		
(b) ☞ sakʲ			*
(c) sat		*!	

Tableau 1

Candidate (c) in tableau 1 has the featural morpheme’s feature attached to its CPlace node rather than its VPlace node; it fails due to the ranking of IDENT(CPlace dorsal) over IDENT(VPlace coronal). It is already known from lenition (§4.2.4.1) that IDENT(CPlace labial) is ranked above MORPHDISF, and given that IDENT(VPlace coronal) must be ranked below MORPHDISF in order for the palatalization morpheme’s feature to be realized on segmental material, the ranking IDENT(CPlace labial) » IDENT(VPlace dorsal) is inevitable.

The ranking of IDENT(CPlace coronal) is irrelevant, as attachment of the featural morpheme’s [coronal] feature to an existing [coronal] CPlace feature would not be distinctive and would not satisfy MORPHDISF.

Some coronal segments become [-anterior] when they undergo palatalization, e.g. /s/ → [ʃ], /n̪/ → [n̠ʲ]. IDENT(ant) must therefore be dominated by MORPHDISF.

5.3 Velarization?

Possibly the best candidates for this hypothetical process are the present tense forms of verbs such as *tochail* [t̪ɔxɪlʲ] “dig”, as seen in (8).

(8) *tochail*
[t̪ɔxɪlʲ]
“dig (imp.)”

tochlaíonn
[t̪ɔxl̪iːən̪]
“digs”

seachain
[ʃaxɪnʲ]
"avoid (imp.)"

seachnaíonn
[ʃaxn̪iːən̪]
"avoids"

If the imperative is taken to be the stem, then the present tense ending must cause velarization. However, Ó Siadhail (1989:172) provides an alternative analysis: the root of such verbs has a velarized final consonant (and lacks the second vowel), and the imperative undergoes palatalization (and epenthesis of a vowel if the final cluster is banned, as it is in both these cases). Thus the roots of these two verbs would be /t̪ɔxl/ and /ʃaxn/.

The palatalization seen on these imperatives is in no way required by the phonology of the language: [t̪ɔxəl] and [ʃaxən][2] would be perfectly acceptable forms. Therefore, if this account is correct, these verb roots must be undergoing some morphosyntactically determined process to form their imperative, which is a cross-linguistically uncommon, although not unknown, phenomenon. In addition, not all verbs in the language have final palatalization of their imperative stem, merely those of the so-called "second conjugation".

This account therefore requires differential treatment in the formation of the imperative between these and other verbs; but multiple morphological classes of verbs are far from a rare phenomenon. This account removes the most likely candidate for a case of depalatalization, and I will assume that it is correct and that therefore only palatalization need be accounted for.

[2] Alternation between [ɪ] and [ə] in unstressed syllables is entirely conditioned by the palatalization of the vowel's neighbouring consonants; stress is (depending on dialect) either almost universally on the initial syllable, or on a non-initial syllable if it is heavy or sonorous enough.

5.4 Conclusions

Of the two possible directions for alteration of secondary articulation in Irish, only palatalization is a true morphological operation; velarization only appears to happen because certain verbs are palatalized in the imperative.

The morpheme responsible for palatalization is {coronal} and is marked as a suffix. The following ranking is responsible for its effects.

IDENT(CPlace labial)

MORPHDISF

IDENT(CPlace dorsal) IDENT(ant)

IDENT(VPlace dorsal)

Chapter 6: Conclusions

6.1 Featural morphemes

Featural morphemes are able to account for most of the observed effects of Irish mutation, whether segmental alteration, epenthesis or deletion. The forms of these morphemes are {+voice, +nasal, +dist} for eclipsis, {+cont, +son, -dist} for lenition, and {coronal} for palatalization.

A constraint V-TO-C-IDENT(place) appears necessary to account for the facts of place of articulation change under lenition. It favours output segments whose CPlace is the same as their input's VPlace.

A constraint MAXFNONSEG appears necessary to the deletion of /f/ under lenition; it preserves features that have no root node in the input over those that do. This may be due to the more marked status of features not attached to a root node.

6.2 Constraint ranking

Figure 6.1 (on the next page) shows the constraint ranking responsible for the effects of mutation.

6.3 Remaining problems

(1) There is no solution for the problem that under this ranking, [s ʃ h] ought to become glides under eclipsis rather than being unaffected. (§3.2.5.3)

(2) MAX(¬[f]) is an extremely arbitrary constraint which gives no insight into the nature of the problem it solves, i.e. the willingness of /f/ to delete when no other segment will. This problem may well require changes to the standard feature theory to express perceptual factors before it can be solved. (§4.2.4.3)

(3) The solution for the problem of /ɡʲ/ becoming a coronal glide [j] under lenition fails to accommodate the insight that the "dorsal" /ɡʲ/ and the "coronal" [j] are very similar in place of articulation. (§4.2.3.3)

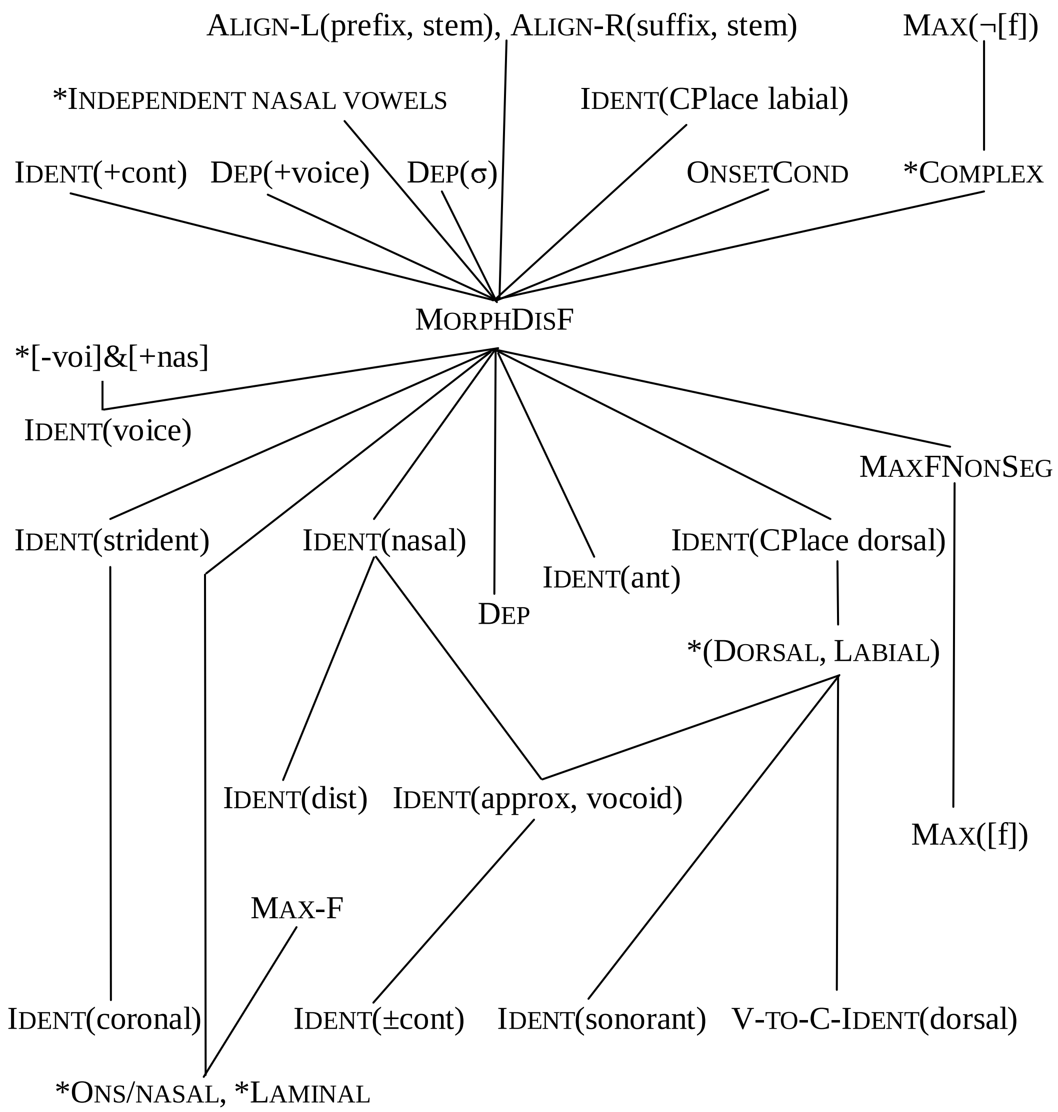


Figure 6.1. Constraint ranking responsible for mutation in Irish.

References

Where a reference is given as "ROA ###", it can be obtained via the world-wide web by visiting the Rutgers Optimality Archive at http://roa.rutgers.edu/ and entering the number "###" into the box marked "view one article by ROA number".

Akinlabi, A. 1996. "Featural affixation". ROA 185 and in *Journal of Linguistics* ***32*** pp. 239-289. Cambridge: Cambridge University Press.

Churma, Donald G. and Yili Shi. 1995. "Glottal consonants and the 'sonority' hierarchy". In Marek Przezdziecki and Lindsay Whaley (eds.), *ESCOL '95*, pp. 25-37. Cornell University.

Clements, G. N., and Elizabeth V. Hume. 1995. "The internal organization of speech sounds". In John A. Goldsmith (ed.), Handbook of Phonology, 245-306. Oxford: Blackwell.

de Lacy, P. 2002. *The formal expression of markedness.* Doctoral dissertation, University of Massuchusetts, Amherst. ROA 542.

de Lacy, P. 2004. "Conflation and hierarchies". In Marc Richards and Lluïsa Astruc (eds.), *Cambridge Occasional Papers in Linguistics* ***1,*** pp. 83-100. Cambridge: Department of Linguistics, Faculty of Modern and Medieval Languages, University of Cambridge.

de Lacy, P. (in prep.). "Variable featural morphemes".

Hall, T. A. 1997. *The phonology of coronals.* Amsterdam/Philadelphia: John Benjamins.

McCarthy, J. 2002. *A thematic guide to Optimality Theory.* Cambridge: Cambridge University Press.

McCarthy, J., and Alan Prince. 1995. "Faithfulness and reduplicative identity". ROA 60 and in Jill Beckman, Laura Walsh Dickey, and Suzanne Urbanczyk (eds.), *University of Massachusetts Occasional Papers in Linguistics* ***18***, pp. 249-384. Amherst, MA: Graduate Linguistics Student Association, University of Massachusetts, Amherst.

Ó Baoill, D. 1996. *An teanga bheo: Gaeilge Uladh.* (The living language: the Irish of Ulster.) Institiúid Teangeolaíochta Éireann, Baile Átha Cliath (The Linguistics Institute of Ireland, Dublin).

Ó Siadhail, M. 1989. *Modern Irish: grammatical structure and dialectal variation.* Cambridge: Cambridge University Press.

Prince, A., and Paul Smolensky. 1993. *Optimality theory: constraint interation in generative grammar.* ROA 537 and Report no. RuCCS-TR-2. New Brunswick, NJ: Rutgers University Center for Cognitive Science.

Zoll, C. 1997. "A unified treatment of latent segments and floating features". ROA 137.