

## 2. SHORT VOWELS: CONSONANT - VOWEL INTERACTION

### 2.1. Introduction

The aim of this chapter is to outline the interaction between the resonance elements A-I-U in the vocalic system of Munster Irish by analysing their distribution and the alternations which are traditionally referred to as consonant-vowel interaction (Sjoestedt (1931), Ní Chiosáin (1992)). First, the consonantal system of Irish will be presented and discussed with respect to quality specification, which is largely responsible for the interactions between consonants and vowels. Then we introduce the data which illustrate the vocalic alternations caused by the quality of neighbouring consonants, and present a traditional account of the Irish vocalic system. An attempt is made to define the objectives of the present enquiry, which is followed by an analysis couched in the framework of Government Phonology. Finally, recent advances in analysing vowel systems, namely, the Licensing Constraints, are introduced and applied to the Irish facts. The results of our analysis will be compared to analyses of other languages in terms of the constraints.

#### 2.1.1. The Irish consonantal system

Irish has two sets of consonants, i.e. velarised and palatalised. These values bear phonological contrasts therefore consonants must be specified for one of these values in underlying representations.<sup>1</sup> Thus we have the following two series of consonants in Irish.

(1)

velarised	p, t, k, b, d, g, f, s, χ, h, v, ʏ, m, n, ŋ, l, r
palatalised <sup>2</sup>	p', t', k', b', d', g', f', j, χ', h', v', j, m', n', ŋ', l', r'

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<sup>1</sup>An additional contrast, namely that between "tense" and "lax" sonorants (Ó Siadhail (1989:92)), will be discussed at length in 3.2.

<sup>2</sup>h' is not normally regarded as a separate phonological unit (Ó Cuív (1975:11)). It will nonetheless be used in phonetic transcription to indicate the presence of palatalisation. [ŋ'] is also found marginally, i.e. most of the time it is a result of assimilation to palatalised velar plosives. Additionally, [j] must be regarded as a palatal consonant rather than a palatalised version of [s].

Velarised consonants show heavy labialisation when they occur before front vowels. This, in certain descriptions of the language, is sometimes marked by an off-glide in the phonetic transcription e.g., [k<sup>w</sup>id'] *cuid* "part". In our analysis, the contrast between the two sets of consonants will be represented only by a diacritic in the case of palatalisation (the second consonant in [k<sup>w</sup>id'] ). Although the phonetic effect of palatalisation of consonants may not be as strong as that of velarisation (Gussmann (1985)), it seems that, in general, the phonological effects of palatalisation are more prominent.<sup>3</sup> More reasons for that choice will be given later, in any case, this particular mode of representation does not affect the analysis.

The quality specification of consonants, i.e. palatalisation or velarisation, may be present lexically or play a grammatical function. For example, the first consonant in [k'u:f] *ciumhais* "edge" is palatalised lexically and contrasts with its velarised counterpart in [ku:f] *cúis* "reason". On the other hand, the palatalisation of the last consonant in [f'ir'] *fir* has a grammatical function of denoting the genitive case of the noun [f'ar] *fear* "man". The nature of palatalisation and velarisation is considered in detail below.

### 2.1.2. **Palatalisation** (slender consonants)

It has become a common practice within Government Phonology to define palatalised consonants as containing the element 'I' (Harris (1990a:263)). We will follow this assumption here in trying to show the scope of palatalisation in Irish. One of its functions, apart from the lexical marking of consonants, is to define grammatical categories, e.g. the genitive case. Consider the data below taken from (Sjoestedt-Jonval (1938:4)).

(2)

[sop]	/	[sip']	<i>sop / soip</i>	"wisp/gs."
[olk]	/	[il'k']	<i>olc / oilc</i>	"evil/gs."

In ((2)), the palatalisation in the genitive affects the final consonant or cluster as well as the preceding vowel. However, the preceding onset in [sip'] remains intact. The same can be said about the forms in ((3)a) but not in ((3)b) below.

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<sup>3</sup>The labial off-glide will be used in the phonetic transcription only to emphasise the strong labialisation of velarised consonants.

(3)

a.	[d̪aːrəv] / [d̪aːrəvʲ]	<i>dealramh / dealraimh</i>	"resemblance/gs."
	[asəl] / [asilʲ]	<i>asal / asail</i>	"donkey/gs."
b.	[dorən] / [dirʲinʲ]	<i>dorn / doirn</i>	"fist/gs."
	[dorəs] / [dirʲiʃ]	<i>doras / dorais</i>	"door/gs."
	[soləs] / [selʲiʃ]	<i>solas / solais</i>	"light/gs."

In ((3)a), only one consonant becomes palatalised in the genitive while the data in ((3)b) exhibit what might be called a "long distance" spreading of palatalisation [dirʲiʃ]. This provokes the question of how far palatalisation (the element 'I') can spread. Notice that the first onset of the forms in ((3)b) remains unaffected as in [sipʲ]. This means that something blocks further spreading. It seems that the plural forms of the data in ((3)b) offer useful clues as to what constitutes the "buffer" preventing palatalisation from spreading further. These forms are given below.

(4)

[doːrʲə]	<i>doirse</i>	"doors"
[doːrnʲə]	<i>doirne</i>	"fists"
[siːlʲʲə]	<i>soilse</i>	"lights"

Let us disregard here the lengthening of the first vowel as well as the fact that [r] resists palatalisation.<sup>4</sup> What is important here is that the original vowel, which separated [r] from the following onset in the singular forms, has disappeared. In standard GP the existence of a vowel - zero alternation of this type suggests that an underlying empty nucleus is involved which is licensed in the plural forms by the following realised nucleus.<sup>5</sup> Having established that the second nucleus in [dirʲinʲ] is underlyingly empty and realised here due to the absence of a licenser in the following nucleus, we may assume that the "blocking" of palatalisation spreading depends on the type of nuclei. Specifically, the empty nucleus in [dirʲinʲ] allows palatalisation to affect [r], as well as the preceding vowel which now finds itself within the

<sup>4</sup>A GP analysis of this type of lengthening can be found in Cyran (1996a) while the question of [r] in homorganic contexts is discussed at length in chapter 4.

<sup>5</sup>See 1.3 for an introduction to the treatment of vowel-zero alternations as an instantiation of Proper Government in GP.

scope of application of the spreading. However, this vowel is not underlyingly empty itself and constitutes a "buffer" to further spreading. Hence, the first onset remains velarised.

We are now able to define palatalisation more precisely as a leftward spreading of the element 'I' which affects both consonants and vowels. The exact nature of this phenomenon as regards the way in which consonants and vowels are affected will be explored in the ensuing sections. Palatalisation spreading is stopped by the first vowel with underlying melody. Therefore, palatalisation cannot be viewed as merely a lexical property of consonants. Once it is present in the representation it will spread leftwards as far as it can (unbound spreading).

This definition has two important implications. First, there can be no distinction in terms of the behaviour of the element 'I' between lexical and grammatical palatalisation, i.e. the effects characteristic of the presence of the element 'I' in the representation must be identical. Secondly, the vocalic modifications which accompany palatalisation need not be viewed as instances of vowel-consonant interaction, but rather as effects of 'I' spreading within the available harmonic span.<sup>6</sup> This last point is crucial in that it precludes the possibility that a governing relation exists between a vowel and the following onset. Such a relation is not recognised in GP. On the other hand, given the fact that the same process, i.e. I-spreading, affects both vowels and consonants, the emerging picture of the phonological representation in Irish seems to be one in which consonants and vowels share certain properties, e.g. the autosegmental line on which 'I' resides.

### 2.1.3. **Velarisation** (broad consonants)

Although velarised consonants are phonetically distinct, a fact which is normally represented by a strong labial off-glide in phonetic transcriptions, they seem to play a lesser role in the grammatical and phonological systems of Irish. The question arises then whether velarised consonants should not be treated as neutral, i.e. not defined by the presence of any additional element. However, in the following sections evidence will be presented which points to the fact that the velarisation of consonants does play a substantial role in the distribution of vocalic objects and in certain phonological processes like, for instance, vowel lengthening

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<sup>6</sup>For morphological conditioning of palatalisation in Irish see e.g. Doyle (1992).

before some sonorants (section 3.2). In fact, it appears that, whatever element defines velarisation, this element spreads leftwards in the same manner in which the element 'I' does in the case of palatalisation, even if the effects of velarisation spreading seem to be less spectacular. Let us look at possible candidates for the elements which might be present in the segmental make-up of such consonants.

Harris (1990a:263) proposes that the velarity of consonants is defined by the presence of the so called "cold" vowel ( $v^0$ ). However, this element is used to define the velar place of articulation of e.g. the consonant [k], rather than the secondary quality of consonants. Historically speaking, the Old Irish consonantal system possessed three types of quality: *i*-(palatalised), *u*-(velarised), and *a*-(velarised?, neutral?) (Pokorny (1914:13), Thurneysen (1949:97)). Whether Modern Irish broad (velarised) consonants contain  $v^0$ , 'U', 'A' or nothing has to be established on the basis of their phonological behaviour. Recall, however, that velarised consonants have a strong labial off-glide which might suggest that the element 'U' is involved. Additionally, in GP the element 'U' is realised in non-nuclear position as [w], i.e. a labio-velar. If the presence of this element defines velarisation in Irish, this would explain the raising of the back of the tongue in the production of velarised consonants. Let us then tentatively assume that this is the case.<sup>7</sup>

Before we consider closely the distributional restrictions traditionally referred to as "consonant-vowel interaction", it is necessary to demonstrate that the quality specification of consonants is independent of what type of vowel follows or precedes. This is illustrated by the data in ((5)) where long vowels are involved. Irish long vowels are in general immune to any processes which are typically motivated by the flanking consonants. Hence the vocalic and consonantal contrasts in ((5)) are completely independent of each other.<sup>8</sup>

(5)

a.	[k'u:n']	<i>ciúin</i>	"calm"
	[k'i:l']	<i>cíl</i>	"raddle"
b.	[ti:]	<i>tuí</i>	"straw"
	[t'i:]	<i>tí</i>	"house-gs."
c.	[ku:f]	<i>cúis</i>	"reason"
	[k'u:f]	<i>ciumhais</i>	"edge"

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<sup>7</sup>See e.g. Smith (1988) where dependent [U] is used to define velar constriction.

d.	[kɑ:s]	<i>cás</i>	"case"
	[kɑ:f]	<i>cáis</i>	"cheese"
e.	[ge:l']	<i>Gaeil</i>	"Irishmen"
	[g'e:l']	<i>géill</i>	"surrender"
f.	[bo:]	<i>bó</i>	"cow"
	[b'o:]	<i>beo</i>	"alive"

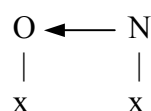
Examples ((5)b-f) show clearly that the palatalisation and velarisation of consonants are distinctive. As far as ((5)e,f) are concerned, Ó Cuív (1975:10) notices a phonetic retraction or advancement of the long mid vowels depending on whether they follow a velarised or a palatalised consonant respectively. These effects may, however, be treated as purely phonetic in nature.

In the following sections we will take a closer look at the distributional peculiarities in Irish and ask specific questions concerning the consonant-vowel "harmony" which need some clarification before we look at the vocalic transitions observed in the dialect under study.

#### 2.1.4. Consonant-vowel harmony

So far we have seen that Irish consonants exhibit a contrastive quality specification which affects the distribution of short vowels (Ward (1974)). The existence of dependencies and distributional restrictions between consonants and the following vowels is predicted in Government Phonology in that the theory recognises that onsets are in a licensing relation with their nuclei.

(6)



Thus the fact that certain combinations of segments may be illicit in a given language has its basis in the nature of a given phonological representation. As an illustration of the

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<sup>8</sup>The behaviour of long vowels and diphthongs is discussed in chapter 3.

dependency between onsets and nuclei let us look at some distributional facts concerning the high front vowels in Polish which point to the nature of such restrictions, as viewed in GP.

Polish has two high front vowels, i.e. [i] which is tense, and a lax [ɨ]. In GP the contrast between the two objects can be defined by means of headedness (Cobb (1993), Harris and Lindsey (1995)).

(7)

[i] = (I)

[ɨ] = (I.v<sup>0</sup>)

Thus [i] is headed by an active element 'I' and [ɨ] is empty-headed or non-headed.<sup>9</sup> The distribution of these vowels seems to be governed by the following conditions:<sup>10</sup>

1. *The I-headed vowel requires I as an operator in its onset.*
2. *The onset and the following nucleus cannot have the same element as the head.*

Note that both statements require that the resonance element enjoys a different status in the two consecutive positions.

The first condition ensures that the vowel [i] will always follow a palatalised consonant in Polish, i.e. a consonant will contain 'I' as an operator, e.g. [v'ɨdɔk] *widok* "view" as opposed to [vɨmɔk] *wymóg* "requirement". On the other hand, the second condition makes two predictions. First, a consonant which contains 'I' as the head e.g. [ʃ, ʒ, tʃ, dʒ] will never be followed by [i], which is also I-headed, but rather by [ɨ]. Second, [ɨ] should not follow consonants which contain v<sup>0</sup> as the head, which is the case with velar consonants. Hence, forms like \*[gɨ...] and \*[kɨ...] are illicit in Polish, but [pɨ...] and [tɨ...] are correct.<sup>11</sup> The structures below illustrate the operation of the two conditions. The heads are underlined.

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<sup>9</sup>Typically, the empty-headed vowel will be represented as (I. ). The symbol v<sup>0</sup> is used here for expository reasons and denotes the so called 'cold vowel', which additionally defines the velar place of articulation. For more discussion on v<sup>0</sup> see chapter 4.

<sup>10</sup>These conditions are merely rough approximations of what happens in Polish (see Gussmann, Kaye and Cyran (in prep.) for details) and may be derived from certain universal properties of segment distribution like the OCP.

(8)

a.	O ← N	b.	O ← N	c.	O ← N
x	x	x	x	x	x
<u>U</u>		h		<u>v</u> <sup>0</sup> --/--	<u>v</u> <sup>0</sup>
h		I --/-- I		?	I
I ----- I				h	I
[v'i...]		*[i...]		*[gɪ...]	

Having seen what factors may influence O(nset)-N(nucleus) dependencies let us turn to the Irish facts again.<sup>12</sup>

#### 2.1.5. The vowel inventory of Munster Irish

Irish has short and long vowels which exhibit the phonological contrasts outlined in ((9)) below. In addition, some long vowels can result from lengthening in certain contexts (Cyran (1992)). The discussion regarding lengthening and diphthongs will be postponed till the following chapter.

(9)

[i:n']	<i>sín</i>	"stretch"	[in']	<i>sin</i>	"that"
[gu:nə]	<i>gúna</i>	"gown"	[gunə]	<i>gunna</i>	"gun"
[t'e:p']	<i>téip</i>	"tape"	[t'ep']	<i>teip</i>	"fail"
[ko:tə]	<i>cóta</i>	"coat"	[kotə]	<i>cotadh</i>	"shyness"
[ba:s]	<i>bás</i>	"death"	[bas]	<i>bas</i>	"palm of hand"

On the basis of the above evidence it can be claimed that there are five underlying long vowels in Irish /i:,e:,ɑ:,o:,u:/. The data above suggest also that the inventory of phonologically short vowels is practically the same. This, however, cannot be confidently asserted at this stage for the following reasons. First of all, phonological contrast among

<sup>11</sup>[χi...] as in e.g. *chyba* "possibly" is exceptional and may be accounted for by assuming that the native [χ] is not v<sup>0</sup>-headed unlike the [χ] in borrowings e.g., *historia* "history". However, this problem is not directly relevant to our argument.

<sup>12</sup>The co-occurrence conditions concerning Polish high front vowels will be returned to in chapter 4 when we discuss the segmental make-up of palatalised coronals.



short vowels is rare. This is emphasised by Sjoestedt (1931:65) and Ó Siadhail (1989:36) who mention just a few contrastive pairs which are not contingent on the quality of surrounding consonants. Secondly, the phonetic shape of short vowels is to a large extent predictable from the context in which they occur. This context relates to the character of the flanking consonants. Thus, for instance, whether these consonants are palatalised or velarised will have a direct bearing on the surface realisation of the short vowel (Ward (1974), Ó Siadhail (1989), Ní Chiosáin (1991)).

Generally speaking, the dependencies between short vowels and flanking consonants can be most clearly defined by means of the following constraints which show what sequences are impossible.

(10)

*C' u C'	e.g. [m'ik'] <i>mic</i> "son-gs."	*[m'uk']
*C i C	e.g. [muk] <i>muc</i> "pig"	*[mik]

In other words, a back vowel can appear only between two velarised consonants, while a front vowel must be flanked by palatalised ones. These restrictions clearly point to the fact that both palatalised and velarised environments are phonologically active, which in turn may be taken as an argument that both types of consonants need to be specified by the presence of an active element.

If the two flanking consonants are of different value, i.e. C'-C or C-C', a certain degree of variation is allowed in the phonetic realisation of short vowels. Thus, given all possible combinations of the consonants surrounding a short vowel, i.e. C-C, C'-C, C'-C', C-C', one might expect to encounter numerous phonetic realisations of vocalic segments. This, in fact, is the case. One should add another comment here concerning the actual degree of palatalisation that certain consonants exhibit phonetically, a factor which also contributes to the ultimate phonetic shape of short vowels. This means that any analysis aiming to describe the vocalic system of Irish is not going to be an easy task.

In trying to establish the system of short vowels researchers have made contradictory claims. For instance, Sommerfelt (1927) and Sjoestedt (1931) in their phonetic descriptions of Munster Irish established a system of more than twenty vowels. Ó Cuív (1975) reduced the number to seven. The first fairly accurate presentation of the vocalic system which fully explores the dependencies between short vowels and the quality of the flanking consonants

can be found in Ward (1974). He posits four short vocalic elements /æ/, /œ/, /y/ and /ə/. These symbols stand for low, mid, high and a reduced vowel respectively, and their actual phonetic realisations are derived in the following way (Ward (1974)).

(11)

/æ/	is [a] in C'-...	e.g. [k'ark] <i>cearc</i> "hen"
	[ɑ] in C-...	e.g. [kapəl] <i>capall</i> "horse"
/œ/	is [e] in C'-C'	e.g. [g'et'] <i>geit</i> "start"
	[o] in C-C, C'-C	e.g. [gort] <i>gort</i> "corn-field"
		[d'oχ] <i>deoch</i> "drink"
/y/	is [u] in C-C, C'-C	e.g. [muk] <i>muc</i> "pig"
		[m'un] <i>mion</i> "small"
	[i] in C'-C', C-C'	e.g. [f'ir'] <i>fir</i> "man-gs."
		[kid'] <i>cuid</i> "part"

More recently, a similar system of three underlying vowels has been proposed by Ní Chiosáin (1991) for Connemara Irish. Her system differs, however, from that of Ward's in that she proposes two abstract archisegments [I] and [E] (these are simply underspecified high and mid vowels respectively, which acquire their backness specification from the environment) and a low vowel [ɑ]. The variation [a / ɑ] is treated by Ní Chiosáin as a phonetic effect (see also Ní Chiosáin and Padgett (1993)).

It must be noted at this stage that the dependencies are not limited to the Onset-Nucleus licensing domain. In fact, as the few examples in ((11)) demonstrate, the phonetic shape of Irish short vowels depends on the quality of both flanking consonants. In the following section we will take a closer look at "consonant-vowel" dependencies and try to establish a provisional inventory of short vocalic objects in Irish on the basis of the distributional facts.

### 2.1.6. The distribution

Given that the short vowels in Munster Irish are dependent on the quality of both flanking consonants, we need to determine whether the effects will be the same or different depending on the direction of influence. In other words, we need to establish the nature of the two types of interaction, namely, C-V and V-C. Let us first look at certain monosyllabic (CV) forms in Irish which exhibit very strict dependencies. Recall that this situation is predicted in GP due to the licensing relation which holds between the onset and the following nucleus.

(12)

- |    |        |              |             |
|----|--------|--------------|-------------|
| a. | [b'í]  | <i>bith</i>  | "existence" |
|    | [k'í]  | <i>cith</i>  | "shower"    |
|    | [kr'í] | <i>crith</i> | "trembling" |
|    | [rí]   | <i>rith</i>  | "running"   |

Note also: [ru] as a variant of [rí] *rith* "running".

- |    |       |              |               |
|----|-------|--------------|---------------|
| b. | [p'e] | <i>peith</i> | "dwarf elder" |
|    | [re]  | <i>reith</i> | "heat"        |
|    | [b'e] | <i>beith</i> | "birch"       |
| c. | [l'a] | <i>leath</i> | "half"        |
|    | [m'a] | <i>meath</i> | "decline"     |
|    | [ra]  | <i>reath</i> | "rutting"     |
| d. | [pu]  | <i>puth</i>  | "breeze"      |
|    | [kru] | <i>cruth</i> | "shape"       |
|    | [sru] | <i>sruth</i> | "stream"      |
| e. | [bo]  | <i>both</i>  | "hut"         |
|    | [ro]  | <i>roth</i>  | "wheel"       |
| f. | [da]  | <i>dath</i>  | "colour"      |
|    | [ka]  | <i>cath</i>  | "battle"      |
|    | [ra]  | <i>rath</i>  | "prosperity"  |

Whether these forms are indeed phonologically monosyllabic is questionable, as all of them show a latent consonant in alternations involving the addition of an inflectional vowel, e.g. the genitive singular of [bo] "hut" is [bohə].<sup>13</sup> Nevertheless, the set of data in ((12))

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<sup>13</sup> Some transcriptions e.g. Sjoestedt (1931) and Ó Cuív (1975) include the final consonant in such forms (e.g. [boh]).

represents the only situation in Irish when short stressed vowels appear to be found word-finally.

The main observation here is that the frontness or backness of vowels is contingent on the preceding onset. Thus palatalised consonants can be followed only by front (or fronted) vowels. On the other hand, velarised consonants are followed by back vowels. This restriction refers to all vowels, i.e. high, mid and low ones. It is interesting to notice the variants of the word "running", i.e. [ri] and [ru]. In Irish the word-initial [r] is phonetically never palatalised (or velarised for that matter). This presumably results in some kind of confusion as to whether the onset is palatalised or velarised phonologically, and accounts for the two forms [ri] and [ru] for "running" (see 2.3.6).

The strong dependencies observed in ((12)) exclude the possibility that all six types of short vowels are underlyingly present. However, all these reflexes should be derivable from the vocalic system that we are trying to define. Before the basic problems concerning the distribution are formulated let us see which vowels are allowed before palatalised and velarised consonants respectively, i.e. in the presence of a right hand side influence.

The VC context shows the same distributional restrictions as the CVC one, due to the fact that word-initial empty onsets in Irish seem to retain their specification as regards resonance elements defining broad and slender quality (Gussmann (1986)). This phenomenon is discussed in some detail in section 3.4.1.

(13)

- a.
- |   |    |   |       |                   |
|---|----|---|-------|-------------------|
| C | *i | C |       |                   |
| C | *e | C |       |                   |
| C | *a | C |       |                   |
| C | u  | C | [muk] | <i>muc</i> "pig"  |
| C | o  | C | [sop] | <i>sop</i> "wisp" |
| C | a  | C | [kat] | <i>cat</i> "cat"  |
- b.
- |   |    |    |         |  |
|---|----|----|---------|--|
| C | i  | C' | [kid']  | <i>cuid</i> "part"                             |
| C | *e | C' |         |  |
| C | *a | C' |         |  |
| C | *u | C' |         |  |
| C | o  | C' | [skol'] | <i>scoil</i> "school" (limited in occurrence?) |
| C | a  | C' | [kat']  | <i>cait</i> "cat-gs."                          |

- c.    C' i C    [f'is]    *fios* "knowledge" (limited in occurrence)  
       C'\*e C  
       C' a C    [l'ak]    *leac* "stone"  
       C' u C    [f'l'uχ] *fliuch* "wet"  
       C' o C    [d'oχ]    *deoch* "drink"  
       C'\*a C
- d.    C' i C'    [f'ir']    *fir* "man-gs."  
       C' e C'    [t'ep']    *teip* "fail"  
       C'\*a C'  
       C'\*u C'  
       C'\*o C'  
       C'\*a C'

We can see that certain forms show a violation of the strict agreement in backness between the nucleus and the preceding onset established in ((12)) e.g. CiC', C'uC, C'oC. Additionally, the right-hand context allows fewer vocalic contrasts in the preceding nucleus if the consonant is palatalised. One question to ask concerning the distribution presented above is whether all the violations of the CV restrictions mean that the right-hand context is responsible? This would suggest that Irish has both 'I' (palatalisation) and 'U' (velarisation) spreading. As far as the latter is concerned, the forms like [f'l'uχ] *fliuch* "wet" and [d'oχ] *deoch* "drink" clearly indicate that the right-hand context sanctions the element 'U' in the nucleus.<sup>14</sup> Recall that in ((12)) neither [u] nor [o] could follow a palatalised onset. On the other hand, the only high vowel that could follow such an onset was [i] as in [b'i] *bith* "existence", while [e] is the only licit mid vowel in this context e.g. [p'e] *peith* "dwarf elder".

Forms like C'uC and C'oC do not seem to be marginal, and the following consonant need not be [χ] as the examples above might suggest. Below we provide more data illustrating this point (Sjoestedt (1931:87), Ó Cuív (1975:22)).

(14)

[g'ulə]	<i>giolla</i>	"servant"
[spr'uk]	<i>sprioc</i>	"mark"
[ʃupə]	<i>siopa</i>	"shop"
[p'ubər]	<i>piobar</i>	"pepper"

<sup>14</sup>The representations of these nuclei are (U) and (A.U) respectively.

The occurrence of such forms is too regular to be treated as exceptional. Thus the velarised right-hand context seems to be also active. What is exceptional, on the other hand, is the existence of such forms as [f'is] *fios* "knowledge" which show no influence from the right-hand context and in which the nucleus agrees in frontness with the preceding onset. These words, however, may be explained in terms of the peculiar qualities of [s].<sup>15</sup> In a sense, forms like [f'is] could be viewed as marginal, or at least conditioned by the fact that the following consonant is "neutral" or "exceptional" with respect to palatalisation and velarisation e.g. [s] or the latent [h] ((12)). More examples are given below.<sup>16</sup>

(15)

[f'is]	<i>fios</i>	"knowledge"
[l'is]	<i>lios</i>	"garth"
[kr'is]	<i>crios</i>	"belt"

Thus, on the whole, we may conclude that the CV dependencies established in ((12)) may be "upset" by the right hand side context both when the following consonant is palatalised and when the following consonant is velarised (except ((15))).

Let us yet again emphasise some of the conditions underlying the distribution of short vowels.

[i] and [u] must have support from at least one of the flanking consonants. However the distribution of high vowels is not symmetrical in that the context C-C' precludes [u] while C'-C does not preclude [i]. The contexts C-C and C'-C' nonetheless suggest that these two vowels are in complementary distribution, and that both palatalised and velarised contexts are active.

[e] and [o] may be viewed as being in complementary distribution in Munster.<sup>17</sup> [e] must follow C' and precede C' which is practically the only natural context for this vowel to appear in. As will be seen later, certain additional conditions need to be fulfilled in this context depending on the source of [e], i.e. whether it is lexical or derived from [a] which only occurs in C'-C context.

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<sup>15</sup>More on forms like [g'ulə] and [f'is] can be found in 2.3.1 and 2.3.4.

<sup>16</sup>See the section on 'A'-harmony for more detailed discussion of the data.

<sup>17</sup>The dialects of Munster and Connemara seem to differ markedly in this respect as in the latter dialect [e] is found in the C-C' context. An important consequence of this distributional fact is that [o-e] alternations are possible, unlike in Munster (see 2.3.7).

[a] and [ɑ] seem to be in complementary distribution in that [a] must follow C' and precede C while [ɑ] must follow C and may be followed by either C or C'. It is not clear whether they should be represented in the same way since their phonological behaviour seems to be different (see below).

Let us now see how the CVC dependencies are manifested in vocalic alternations evoked by palatalisation spreading. The understanding of these mechanisms, which traditionally are referred to as consonant-vowel interaction, will be crucial in the establishment of the phonological representation of both vowels and consonants.

## 2.2. Vocalic alternations

The vocalic alternations below are traditionally referred to as the effects of consonant-vowel interaction (Sjoestedt (1931), Ní Chiosáin (1992)). In the present analysis it is assumed that the only type of vowel-consonant interaction that can take place is that between an onset and the following nucleus (see the dependencies above and 2.1.4 on Polish C-V harmony). This assumption follows from the general licensing properties whereby an onset is licensed by its nucleus. On the other hand, the effects brought about by the right hand context are not viewed here as V-C interaction but as independent 'I/U'-spreading. This distinction between the left hand side and right hand side contexts follows from the fact that no governing relation obtains between an onset and the preceding nucleus.<sup>18</sup> Consider the data below.

(16)

a.	[muk]	/	[mik']	<i>muc / muic</i>	"pig / dat."	u/i
	[pu]	/	[pih'ə]	<i>puth / puithe</i>	"breeze / gs."	u/i
	[sop]	/	[sip']	<i>sop / soip</i>	"wisp / gs."	o/i
	[knok]	/	[knik']	<i>cnoc / cnoic</i>	"hill / gs."	o/i
	[f'ar]	/	[f'ir']	<i>fear / fir</i>	"man / gs."	a/i
	[k'ark]	/	[k'ir'k'ə]	<i>cearc / circe</i>	"hen / gs."	a/i
b.	[obir']	/	[eb'ir'ə]	<i>obair / oibre</i>	"work / gs."	o/e
	[d'as]	/	[d'e]ə]	<i>deas / deise</i>	"nice / gsf."	a/e

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<sup>18</sup>Recall that palatalisation spreading has a broader application than that predicted by V-C interaction (cf. the cases of "long distance" spreading in, for example, [dorən / d̪ir'in̪] *dorn / doirn* "fist/gs.").

c.	[kos]	/	[koʃ]	<i>cos / cois</i>	"leg / dat."	o/o
	[kat]	/	[katʰ]	<i>cat / caít</i>	"cat / gs."	a/a

The alternations shown above are fully predicted by the distributional facts presented in the previous section and show three basic patterns. In the first one, vocalic expressions regularly alternate with a high front vowel ((16)a). This type of alternation seems to be predominant. In ((16)b) the target vowel is [e]. This involves the fronting of [o], a phenomenon limited in occurrence in Munster (see 2.3.7), or the raising of [a]. The latter type is additionally conditioned by the fact that the following nucleus must be phonetically realised. The last set ((16)c) shows cases in which a vocalic transition fails to occur. This phenomenon is regular in the case of back [ɑ], while [o] is typically affected and realised as [i] ((16)a). This may suggest that there are two types of [o]'s and [a]'s in Irish. Namely, some [o]'s and [a]'s alternate with [i] and others remain immune ("opaque") to I-spreading. Another type of transition, i.e. of [o] and [a] to [e] will be shown to be strictly conditioned.

### 2.2.1. A feature analysis

Ní Chiosáin (1992) represents a very recent description of vocalic alternations in Connemara Irish couched in terms of feature geometry and other devices of non-linear generative phonology. The dialects of Munster and Connemara exhibit certain phonological differences in the distribution of segments as well as in their phonological behaviour. In the discussion of Ní Chiosáin's analysis an attempt will be made to concentrate on points in which the two dialects are comparable. Additionally, the relevant differences will be pointed out. One has to admit that the theoretical frameworks employed in the present analysis and in that of Ní Chiosáin (1992) are not fully translatable, therefore the criticism will be restricted to those areas which are common to both.

In her analysis of consonant-vowel interaction in Irish, Ní Chiosáin considers only the qualitative changes of vowels involving the feature [BACK]. Her primary aim is to show the advantages of the equipollent (binary) approach to feature specification (Farkas and Beddor (1987), Steriade (1987a), Kiparsky (1991)) over the privative one (Schane (1984, 1987), Anderson and Ewen (1987), Hulst (1988, 1989), Selkirk (1991)). Her arguments are



presented within a restricted variety of the underspecification theory (Steriade (1987b), Clements (1988), Mester and Itô (1989)).

The inventory of short vowels proposed by Ní Chiosáin consists of three objects, i.e. [I], [E] and [a]. The first two are underspecified for the feature [BACK] and stand for [HIGH] and [MID] archisegments. The low vowel [a] is opaque to vowel-consonant interaction, and the fronting to [a] is viewed as phonetic in nature (see also Ní Chiosáin and Padgett (1993)).

Ní Chiosáin claims that consonants and long vowels in Irish are specified underlyingly for both values of [BACK]. Short vowels (I and E) have no [BACK] specification. This feature is provided by the ordered feature filling rules given below.

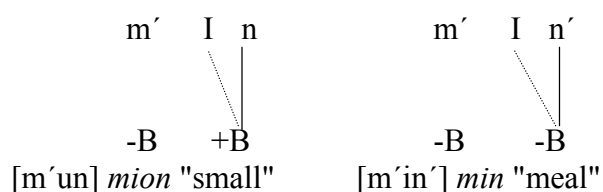
(17)

- a. spread [BACK] leftwards.
- b. spread [BACK] (default).

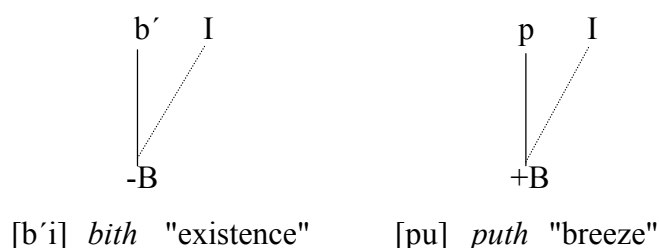
The consequence of these rules is that, if the vowel is flanked by two consonants, it receives its backness specification from the one which follows (rule ((17)a)). In cases where no consonant follows the vowel, it acquires its specification for feature [BACK] from the preceding one (rule ((17)b)). The mechanism of the application of these rules is illustrated below in ((18)) (cf. Ní Chiosáin (1991, 1992)).

(18)

- a. *spread* [BACK] *leftwards*



- b. *spread* [BACK] (*default*)



Since these are feature filling rules, this analysis predicts that long vowels will not interact with consonants as they already are specified for the feature [BACK]. Given the distributional facts presented in previous sections which to a large extent agree with the Connemara facts, it seems that the two rules proposed by Ní Chiosáin should neatly account for the vocalic alternations. However, this analysis seems to account only for a part of what happens in the vocalic system of Irish.

### 2.2.2. Problems with the feature analysis

This analysis requires that the low vowel be left aside for a variety of reasons. First, [a] does not interact with the following palatalised consonant e.g. [bʌn'ə] (Connemara [bɑ:N'ə])<sup>19</sup> *bainne* "milk", which makes it different from the mid and high archisegments E and I. Second, the fronted low vowel [a], whether we treat the fronting as phonological or phonetic in nature, violates the rule ordering proposed in ((17)), as it is the preceding consonant that affects the vowel and not the following one e.g. [l'ak] (Connemara [l'æ:k]) *leac* "stone". However the price to be paid for the exclusion of the low vowel from interaction with palatalisation is that instances of [a/i] and [a/e] alternations (Connemara [æ:/i] and [æ:/e]) as in [f'ar / f'ir'] *fear / fir* "man/gs." and [l'ak / l'ek'ə] *leac / leice*<sup>20</sup> "stone/gs.", which are numerous in both dialects, have to be disregarded.

In other words, the rules proposed in ((17)) only account for [u/i] and [o/e] transitions in Connemara. The latter does not form a productive pattern in Munster Irish where [o] either shifts to [i] e.g. [sop / sip'] *sop / soip* "wisp/gs.", or remains unaffected e.g. [kos / kof] *cos / cois* "leg/dat." Although [o] is affected in a different way in Munster than in Connemara, it is also true that in the latter dialect a distinction between alternating and non-alternating [o] also has to be made (de Bhaldraithe 1945:14), which is not predicted in Ní Chiosáin's analysis. Additionally, both in Munster and in Connemara, there are numerous lowering and raising phenomena which would require a separate set of rules to derive (Ó Siadhail (1989:38-47)), i.e. rules which manipulate the feature [HIGH] rather than [BACK]. Ideally, most of these

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<sup>19</sup>In Connemara, all stressed low vowels are lengthened (cf. de Bhaldraithe (1945:12), Ní Chiosáin and Padgett (1993)). However, the nature of that lengthening is phonetic.

<sup>20</sup>The Connemara forms are [f'æ:r / f'ir'] and [l'æ:k / l'ek'ə].

phenomena should be unified, as indeed they can be, if a different view is taken of the alternations, and especially of the phonological representation as such.

As far as the immunity of long vowels to spreading is concerned, a phenomenon for which Ní Chiosáin accounts by assuming that they are underlyingly specified for the feature  $[\pm\text{BACK}]$ , it will be shown (chapter 3) that some interaction is to be found in both Munster and Connemara. The conditions which underlie such phenomena will be demonstrated to be dependent on both the melodic content of long vowels and their formal (syllabic) structure (Cyran (1995)).

The basic question which should be asked at this stage is why Irish allows for vowel modifications and what such modifications tell us about the three-vowel system  $[I, E, a]$  posited for Irish. Even if there is a phonological distinction between low, mid, and high short vowels in Irish, as the  $[I, E, a]$  classification suggests, there are reasons to believe that this does not play an important role within the vocalic system of that language. Ó Siadhail (1989:36) notices that in Connemara Irish the short vowel system is not stable so that, phonetically speaking, the oppositions back/front and high/low are "indistinct", and minimal pairs, involving for instance the  $[u/o]$  contrast (e.g.  $[kur]$  *cur* "put, imper." vs.  $[kor]$  *cor* "move"), are extremely rare. The same can be said about Munster Irish. Sjoestedt (1931:70) points out fluctuations in the pronunciation of certain words e.g.  $[l'et'ir']$  /  $[l'it'r']$  *leitir* "letter" or  $[d'en'im']$  /  $[d'in'im']$ <sup>21</sup> *deinim* "I do". This, to a large extent, may be a matter of convention in phonetic transcription or due to misjudgements regarding the actual phonetic event (Edmund Gussmann (p.c.)). However, in one sense it also reflects the actual absence of the necessity to see or represent a distinction between  $[I]$  and  $[E]$ , which further undermines this system.

In other words, although observationally the three-vowel system  $[I, E, a]$  seems to be correct in that it captures the phonetic distinction between low, mid and high vowels, it offers little help in terms of an accurate representation and understanding of vocalic alternations of the type demonstrated in ((16)), most of which cannot result from a mere assignment of the feature  $[\pm\text{BACK}]$ .

### 2.2.3. Munster vocalic alternations: problems and objectives

The data in ((16)) may suggest that the forms in the nominative case constitute a base on which the process of palatalisation operates to form the genitive case. This would overlook the fact that in the nominative case we should expect velarisation spreading (cf. Ní Chiosáin's rule of  $[\pm\text{BACK}]$  spreading). Whether we treat the nominative forms in ((16)) as basic and the genitive as derived or the other way round, i.e. whether we want to view either 'I' or 'U' spreading as dominant, something still has to be said about the underlying forms of the nuclei which participate or do not participate in the alternations.

The aim of this section is to pinpoint the possible phonological phenomena which are caused by 'I' or 'U' spreading, and to define them in terms of element combinations. For this purpose we will assume that the vocalic modifications in ((16)) mean that one form is indeed derived from the other, i.e. in the case of  $[\text{o}/\text{i}]$  transition we assume that the underlying vowel is  $[\text{o}]$  and the alternation is caused by 'I'-spreading. Additionally, we will look at the reverse situation and assume the possibility that  $[\text{i}]$  may be the underlying vowel, and try to derive  $[\text{o}]$  by velarisation spreading. As a result of this unusual and, in fact, bogus comparison we should be able to select the possible effects of 'I' and 'U' spreading as well as discover certain facts concerning the underlying representation of Irish short vowels. (Recall that there are three basic elements defining vocalic systems which are employed here, i.e. 'I', 'U' and 'A').<sup>22</sup>

GP recognises only two types of phonological processes, namely, *composition* and *decomposition*. Therefore, the effects of 'I' and 'U' spreading, presented below in ((19)), will be limited to element addition or suppression. Additionally the phenomenon of isomeric switch in the status of elements in compounds comes into play, e.g.  $(\text{A.I}) > (\text{I.A})$ , which is widely recognised in GP and accounts for various raising and lowering effects (KLV (1985), Charette and Göksel (1994/96), Harris (1994a)). As far as element suppression is concerned, one should note the difference between 'I' and 'U' suppression on the one hand, and the suppression of the element 'A' on the other. This difference follows from two facts. First, the processes of 'I' and 'U' spreading are mutually exclusive, and secondly, these elements never combine in vocalic objects in Irish, which results in the absence of front rounded vowels

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<sup>21</sup>A similar raising phenomenon can be observed in velarised contexts in which  $[\text{o}]$  is raised to  $[\text{u}]$  e.g.  $[\text{knok}] > [\text{knuk}]$  *cnoc* "hill", or  $[\text{loxt}] > [\text{luxt}]$  *locht* "fault" (Sjoestedt 1931:67).

<sup>22</sup>The so called "cold vowel" is left aside here.

from the system. Therefore, where necessary, 'I' and 'U' suppression will be also referred to as element substitution or dislodgement. Consider the putative effects of this below.<sup>23</sup>

(19)

a. *effects of 'I'-spreading*

[muk/mik']	u/i	[U]	->	[I]	U-suppression
[sop/sip']	o/i	[A.U]	->	[I]	U- and A-suppression
[f'ar/f'ir']	a/i	[I.A]	->	[I]	A-suppression
[obir'/eb'ir'ə]	o/e	[A.U]	->	[A.I]	U-suppression
[d'as/d'eʃə]	a/e	[I.A]	->	[A.I]	switch of status to I-head
[kos/koʃ]	o/o	[A.U]	->	[A.U]	lack of interaction
[kat/kat']	ɑ/ɑ	[A]	->	[A]	lack of interaction

b. *effects of 'U'-spreading*

i/u	[I]	->	[U]	I-suppression
i/o	[I]	->	[A.U]	I-suppression and A-addition
i/a	[I]	->	[I.A]	A-addition
e/o	[A.I]	->	[A.U]	I-suppression
e/a	[A.I]	->	[I.A]	switch of status to A-head
o/o	[A.U]	->	[A.U]	lack of interaction
ɑ/ɑ	[A]	->	[A]	lack of interaction

The putative processes presented above in ((19)a,b) share certain properties, namely, both 'I' and 'U' spreading involve the suppression of other elements. A marked difference is to be observed in the fact that 'U' and 'A' may be suppressed as a result of 'I' spreading, while only 'I' disappears when 'U' spreads. It remains to be seen how such mechanical replacement of elements can be accounted for in a non-arbitrary fashion. Let us first concentrate on the interaction between the elements 'I' and 'U' which results in the suppression of one by the other.

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<sup>23</sup>In section 2.4, we consider the possibility of unifying the behaviour of 'I', 'U' and 'A' with respect to suppression by attempting to derive these effects from one property of element licensing, namely, from so called "Licensing Constraints" which define possible element combinations in a given language.

One way of viewing this phenomenon would be to assume a model of representation in which the elements 'I' and 'U' reside on the autosegmental lines BACK ('I') and ROUND ('U') which may be claimed to be parametrically fused in Irish to form one BACK / ROUND line (KLV (1985:307), Rennison (1990)). The tier fusion hypothesis ensures that when 'I' and 'U' appear on the fused line one excludes the other, and also accounts for the absence of front rounded vowels from the vocalic system of Irish.

Another way out would be to assume that, given the presence of the processes of 'I' and 'U' spreading, these elements are not present in the representation of short nuclei, in which case the problem of element substitution or dislodgement (I/U suppression) becomes irrelevant because what takes place is merely the spreading of the relevant element into the nucleus. The predictions concerning the underlying representation of Irish short nuclei which follow from this claim are considered in the following sections.

The case of A-suppression in ((19)a) e.g. [f'ar / f'ir'], has to be treated as a separate phenomenon. The reason is that 'I' and 'A' are not mutually exclusive and in an autosegmental model these two elements would reside on separate lines, which should allow them to combine. One way to naturally account for the phenomenon of A-suppression is to refer to the combinatorial possibilities that elements exhibit in a given language. For example, it may be the case that 'I' and 'A' may combine only in one way, i.e. as (A.I) and not as \*(I.A), which means that, when these elements combine, only one of them may act as the head and license the other within the nucleus.<sup>24</sup> At any rate, it seems that both cases of element suppression in ((19)a) and ((19)b) may be accepted as possible processes in a natural language.

Unfortunately, the same cannot be said about the putative process of A-addition ((19)b) which appears to be effected by the spreading of the element 'U'.<sup>25</sup> In Government Phonology, elements which take part in combinations must have a local source, therefore one must assume that 'A' is present underlyingly in the nucleus involved in [i/o] and [i/a] alternations. This claim entails the existence of A-suppression rather than A-addition as a possible phonological process accompanying 'I' and 'U' spreading ((19)a). Indeed, the process of A-delinking or A-suppression has been found in other languages and has received various

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<sup>24</sup> Note that the existence of certain conditions on element combinations must be recognised in order to account for the absence of \*(I.U), \*(U.I) and \*(I.U.\_).

treatments.<sup>26</sup> An additional argument for the existence of A-suppression in Irish seems to be provided by the raising phenomena mentioned earlier, i.e. [e/i] e.g. [d'en'im' / d'in'im'] *deinim* "I do" and [o/u] e.g. [knok / knuk] *cnoc* "hill" (Ó Siadhail (1989:36), Sjoestedt (1931:67-70)). The fact that the raising phenomena occur in both palatalised and velarised environments suggests that these contexts are equally active.

So far we have established that judging by the putative processes involved in vocalic transitions in Irish which were enumerated above in ((19)a,b) the phenomenon of 'A' addition is not likely to be due to 'I' or 'U' spreading. Additionally, a closer look will need to be taken at the phenomenon involving a switch of status in the elements of compound expressions as it could enable us to account for raising effects like [a] to [e] ([d'as / d'eʃə]) in a palatalised environment. Note that this case of raising, i.e. [a/e], differs slightly from other raising phenomena like [e/i] and [o/u] in that here no suppression of the element 'A' takes place.

However, the main focus of the ensuing analysis should be on the understanding of the complex phenomenon of the suppression of the elements 'I', 'U' and 'A', which, for expository reasons, will be divided into two parts. The first concerns the interaction between the elements 'I' and 'U', employing such terms as element substitution or element dislodgement. The phenomenon of 'A' suppression will also be investigated within the context of other processes in which this element is involved.

The second objective of this analysis will be to account for the "opaque" vowels which do not seem to be affected by 'I' or 'U' spreading. These include [ɑ] and [o], e.g. [kat/kat'] and [kos/koʃ] as opposed to [f'ar/f'ir'] and [sop/sip'] where palatalisation spreading affects the nuclei only in the last two examples, as well as [a] as in [l'ak] *leac* "stone" and [ɑ] as in [kat] *cat* "cat" which resist 'U'-spreading. Notice that parallel to [d'ox] *deoch* "drink" we should expect the element 'A' in *leac* to be affected by velarisation and yield \*[l'ok]. In other words, we need to explain the absence of the [a/o] alternation.

As far as the phonological representation of Irish short nuclei is concerned, one may at this stage make minimal assumptions which will have to be revised as more facts are taken into consideration. Namely, given the existence of the 'I' and 'U' spreading, these elements may be assumed to be absent from certain nuclei, while the fact that no 'A' addition has so far

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<sup>26</sup>Irish has a separate process of 'A' spreading, the mechanism of which differs markedly from that of 'I' and 'U' spreading (see section 2.3.4).

been attested (at least as a result of I/U spreading) means that 'A' must be present in those nuclei in which alternations or surface forms show its presence e.g. [f'ar/f'ir'] or [kos/kof].

### 2.3. A GP analysis

Following Ní Chiosáin's line of argument, one would expect that the resonance element defining velarised consonants should undergo spreading in the same fashion as the one defining palatalised consonants. This means that the rules proposed by Ní Chiosáin do not predict any asymmetry as far as the operativeness of the two types of environment is concerned. In other words, spreading of the element defining velarisation should affect short vowels in the same way as palatalisation spreading.<sup>27</sup> We agree with this to a limited extent. It seems that indeed both elements defining palatalisation (I) and velarisation (U) spread into the short nuclei; however, the nature of the spreading of the two elements will be shown to differ slightly. Generally speaking, palatalisation exhibits a stronger influence on vocalic objects than velarisation, as we saw in the previous section. This asymmetry requires a formal explanation.

Our analysis begins with the formulation of a condition on the underlying representation of Irish short nuclei. It will be proposed that the C-V dependencies which are manifested most evidently in monosyllabic forms like [pu] *pu* "breeze" and [b'i] *bith* "existence" should be formally reflected in the phonological structure and defined in terms of the sharing of the elements 'I' and 'U' between the nucleus and the preceding onset.

In this light, the vocalic alternations (or, in fact, the derivation of vocalic objects in general) will be viewed as an interaction between the left-hand context (C-V relation) and the 'I' and 'U' spreading from the right. The nature of the interaction will be first defined on the basis of the [u/i] alternation (e.g. [muk/mik'] *muc* / *muic* "pig/dat.") which constitutes the simplest situation, involving as it does only the elements 'I' and 'U'. Then, we turn to the alternations in which more complex nuclei are involved. Specifically, we will concentrate on the phonological behaviour of the element 'A' with respect to palatalisation spreading.

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<sup>26</sup>See Harris (1990b) for an account of vowel harmony in Pasiego Spanish as well as Cobb (1993) and Denwood (1993) for an analysis of A-loss in Uyghur.

<sup>27</sup>Note that there is no inherent difference between the properties [+BACK] and [-BACK] which would predict any asymmetry in the effects of spreading of these features.



Finally, the segments which exhibit immunity to element spreading will be inspected (e.g. [kat/kat'] *cat* / *cait* "cat/gs.").

### 2.3.1. The "Sharing Condition" and element spreading

Let us first recall the data which demonstrate distributional restrictions concerning short vowels in monosyllabic words.

(20)

[b'i]	<i>bith</i>	"existence"	C'i	*C'u
[p'e]	<i>peith</i>	"dwarf elder"	C'e	*C'o
[l'a]	<i>leath</i>	"half"	C'a	*C'ɑ
[pu]	<i>puth</i>	"breeze"	Cu	*Ci
[bo]	<i>both</i>	"hut"	Co	*Ce
[dɑ]	<i>dath</i>	"colour"	Cɑ	*Ca

These forms clearly show an agreement in "backness" between the vowels and the preceding onsets. Front or fronted vowels follow palatalised onsets which contain the element 'I', while back vowels follow velarised ones (with the element 'U'). In order to capture this pattern of distributional restrictions formally one can propose the following condition on the phonological structure of Irish short vowels.

#### SHARING CONDITION

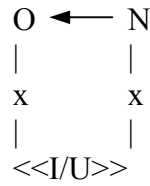
*Nuclei share the element 'I' or 'U' with their onsets.*

Structurally, the application of the *sharing condition* reflects the universal licensing relation that holds between the onset and the following nucleus (KLV (1990), Charette (1991)), and may be represented in the following way.<sup>28</sup>

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<sup>28</sup>[Cɑ] appears to be problematic in that we should expect an open [ɔ] rather than a fully low back vowel if the shared element, i.e. 'U', acts as an operator within the nucleus. One may, however, assume that the shared element is not fused with the active element in the nucleus, i.e. with the element which is underlyingly present in the nucleus, or that it is spread from the right (cf. the discussion of [ri/ru] in 2.3.6).

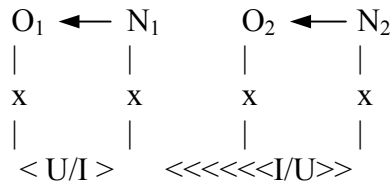
(21)



( $\langle\langle \rangle\rangle$ ) sharing

We may assume the nature of this sharing to be non-directional, i.e. both participants are equally entitled to the shared element, which means that this element is not spread from one of the participants to the other but rather reflects the governing relation holding between onsets and their nuclei.<sup>29</sup> On the other hand, we will assume that the shared element, which defines any onset-nucleus relation in a non-directional way, spreads leftwards and may affect the preceding nucleus.<sup>30</sup>

(22)



Thus the shared element I/U, which is lexically lodged in the O<sub>2</sub>-N<sub>2</sub> licensing relation, extends its own domain of application leftwards until it meets another O-N sharing domain. The latter is defined by its own element 'I' or 'U', and depending on which of the two elements is present there, we may expect different outcomes.

As hinted at before in the discussion of the distribution of short vowels, any violation of the *sharing condition* may be attributed to the influence of 'I' or 'U' spreading from the right-hand context. In other words, we may say that whatever the effect of 'I' and 'U' spreading is, the nucleus always contains the element 'U' or 'I' underlyingly as per the *sharing condition*.<sup>31</sup> It is worth noticing that the undoing of the sharing condition by 'I' and 'U' spreading from the right results in a situation similar to that encountered for long vowels in

<sup>29</sup>This structure was suggested to me by John Harris.

<sup>30</sup>This fact could be derived from the foot structure, namely, if feet are right-headed then the identification of all the positions with element shared in the right branch is obvious.

<sup>31</sup>This statement is necessarily too general as will become clear in the discussion of low vowels. It will be modified in later sections.

which this condition appears to be by and large inapplicable. Namely, the phonetic quality of the vowels does not reflect the quality of the preceding onset, e.g. [k'u:n'] *ciúin* "calm". Let us observe how the *sharing condition* interacts with element spreading in the high vowel environment, i.e. in alternations of the type [u/i].

(23)

[muk]	/	[mik']	<i>muc</i> / <i>muic</i>	"pig/dat."	u/i
[pu]	/	[pih'ə]	<i>puth</i> / <i>puithe</i>	"breeze/gs."	u/i

The vocalic alternations involving short high vowels as in e.g. [muk / mik'] *muc* / *muic* "pig/dat." may be illustrated by the following structures.

(24)

a.	O <sub>1</sub>	N <sub>1</sub>	O <sub>2</sub>	N <sub>2</sub>	b.	O <sub>1</sub>	N <sub>1</sub>	O <sub>2</sub>	N <sub>2</sub>
	x	x	x	x		x	x	x	x
	m		k			m		k'	
	< U >		<<<U>>> <sup>32</sup>			< U(  ) _		<<<<I>>>	
			[muk]					[mik'] <sup>33</sup>	

((<<>>)) - non-directional sharing of an element

(<<)) - spreading of an element

(||) - buffer

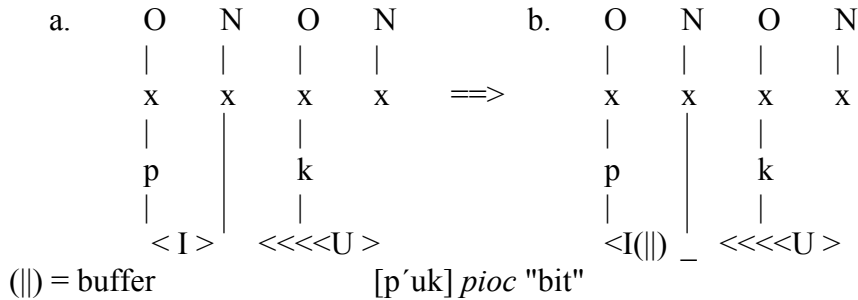
In the case of ((24)a), the effect of U-spreading is not obvious for the simple reason that the preceding onset also contains the same element, i.e. this element is shared by the nucleus and the preceding onset from the start. Since the nucleus N<sub>1</sub> shares 'U' with its onset and at the same time finds itself within the scope of application of the 'U' element lodged in the O<sub>2</sub>-N<sub>2</sub> domain, one might expect that the multiple occurrence of the element 'U' would be reduced here by the OCP.<sup>34</sup> On the other hand, in ((24)b) the element 'I', which is spread into the nucleus (is licensed in it), pushes the element 'U' out. As a result, a strong labial off-glide is

<sup>32</sup>We assume that the sharing between O<sub>2</sub> and N<sub>2</sub> is observed. However, the domain-final empty nucleus does not license any melody.

<sup>33</sup>One needs to bear in mind the fact that the undoing of the sharing condition as in *muic* is accompanied by a strong labial off-glide from the onset, which some linguists represent as [m<sup>w</sup>ik'].

formed while further spreading of the element 'I' is blocked.. This fact has its exact mirror image in the situation in which the element 'U' upsets a structure in which the element 'I' is shared. The dynamic nature of the derivation below is only assumed for expository reasons and reflects the fact that the sharing condition (structure (a)) is undone by U-spreading.

(25)



Again, in such a case one can talk about a strong palatal off-glide (cf. [p<sup>j</sup>uk] Sjoestedt (1931:87)). Notice that this analysis need not refer to the problem of mechanical element substitution but rather to the element being expelled or dislodged without being lost. It may be suggested that the element 'I' in [p<sup>j</sup>uk], or 'U' in [m<sup>w</sup>ik'] need not be banished from the representation but rather form buffers to further spreading of the "intruding" elements from the right.

This rather provisional description of the effects of 'I' and 'U' spreading will be refined later. What is interesting here is how to understand the *sharing condition* with respect to the structure of the nucleus. Does it mean that the nucleus physically contains the shared element or that it is empty? The latter possibility would upset our analysis of palatalisation spreading. Recall that empty nuclei allow palatalisation to affect the preceding onset (cf. [dorəs / dir'if / do:r[ə] *doras* / *dorais* / *doirse* "door/gs./pl." (2.1.2)), while here ([muk / mik']) further propagation of palatalisation is blocked, most probably because of the element shared by the nucleus with its onset. An additional argument against the possibility that the affected nucleus in *muic* is empty comes from the fact that empty nuclei in Irish may remain unrealised if the following nucleus has melody (cf. [dorəs - do:r[ə]]). This does not happen in the genitive of "pig", *muice*, which is [mik'ə] and never \*[mk'ə]. Nonetheless, the question of the exact structure of the nucleus will be returned to.

<sup>34</sup>Following e.g. Yoshida (1993:148), we will assume that the effects of the OCP are possible only within governing or licensing domains. This condition is fulfilled here, if we view N<sub>1</sub> as lying within the domain of application (licensing domain) of element spreading from the right.

Another intriguing issue is that concerning the actual way in which the elements 'I' and 'U' are licensed in the nuclei and in the consonants that they affect. This problem is taken up in the ensuing sections as well as in chapter 4, which is devoted to consonants.

The difference between this analysis and that of Ní Chiosáin's lies in the fact that here we are not dealing with an underspecified underlying vowel which obtains further specification by means of filling rules. Concepts like underspecification are alien to Government Phonology; therefore, in this approach we cannot postulate some underspecified segment like [+HIGH] within that nucleus. In this approach the height of the resultant vowel need not be separately specified as the element which is spread from the right is a fully specified (autonomously realisable) segment, either 'U' or 'I', and these are inherently high.

To summarise: short nuclei share the elements 'I' and 'U' with the preceding onset as per the *sharing condition* which accounts for the C-V restrictions in monosyllables (e.g. *bith*). Additionally, Irish has the process of 'I' and 'U' spreading from the right, due to which the shared element may be "dislodged" (pushed out) from the nucleus and docked on the preceding onset thus producing a labial or palatal off-glide (cf. [m<sup>w</sup>ik'] and [p<sup>j</sup>uk]). It is important to note that the shared element is not lost (deleted) but seems to act as a buffer to further spreading of elements from the right.

Below we turn to the phenomena encountered in mid and low vowels in which I-spreading causes not only dislodgement of the element 'U' shared by the nucleus with the preceding onset but also suppression of the element 'A' in the nucleus.

### 2.3.2. A-suppression

This section initiates the discussion of phenomena connected with the phonological behaviour of the element 'A' in Irish which will be shown to follow directly from the notion of phonological licensing.<sup>35</sup>

In order to be pronounced, phonological elements must be associated with skeletal position, i.e. licensed. This type of licensing (autosegmental) may be dependent on the status

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<sup>35</sup>Here, the main focus is placed on the notion of autosegmental licensing (a-licensing) which controls the attachment of melodic material to skeletal positions and is ultimately responsible for the phonetic interpretability of the melody (see introduction (1.4) for a broader discussion of licensing in phonology).

of the position within the prosodic hierarchy (Harris (1992), Harris (1994a)), which involves various levels at which smaller units are integrated into larger ones.

In what follows, we will concentrate on the lowest level of the phonological hierarchy, i.e. the autosegmental licensing (a-licensing) between skeletal positions and the melodic content. Two facets of a-licensing will be investigated with reference to the behaviour of 'A' in vocalic alternations in Irish, namely, one in which a-licensing is dependent on the higher levels of organisation (prosodic licensing), and one where melody licensing depends on the interaction between elements within a segment. In the first case, it will be shown that melodic material may be licensed within a nucleus due to a licensing relation with another nucleus. In other words, the a-licensing of melodic material is sanctioned by an external licenser (see the phenomenon of A-support in 2.3.3).

Now we turn to the other aspect of a-licensing which refers to the interaction between phonological elements within one segment. Initially, we adopt the view that an element may not be licensed within a segment (here: short nucleus) because it cannot fuse with other elements present within that segment. The aim of this analysis is to discover the conditions underlying such phenomena. Let us begin by looking at the [o/i] and [a/i] alternations in Munster Irish where palatalisation spreading causes, among other things, the suppression of 'A'. Below we reproduce the data which are of interest here.

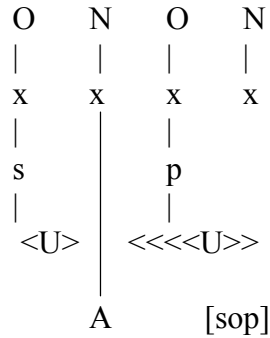
(26)

a.	[sop]	/	[sip']	<i>sop / soip</i>	"wisp/gs."	o/i
	[knok]	/	[knik']	<i>cnoc / cnoic</i>	"hill/gs."	o/i
b.	[f'ar]	/	[f'ir']	<i>fear / fír</i>	"man/gs."	a/i
	[k'ark]	/	[k'ir'k'ə]	<i>cearc / circe</i>	"hen/gs."	a/i

The alternation [o/i] involves two things, i.e. U-dislodgement, which is by now familiar, and A-suppression, and can be given the following provisional account.

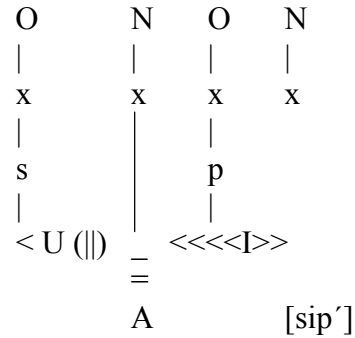
(27)

a.



(=) - element suppression

b.

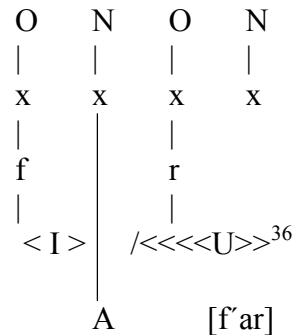


The situation in [sop] is similar to that in [muk] in that no matter what the actual result of spreading is, the nucleus contains the element 'U' which is shared with the preceding onset. Additionally, in [sop], the element 'A' is present in the nucleus. On the other hand, in [sip'], the interaction between palatalisation spreading (<<I) and the element 'U' which is shared by the nucleus and the preceding onset is the same as in [muk/mik'], except that in [sip'] the element 'A' cannot be licensed within the affected nucleus.

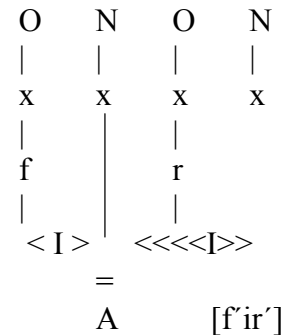
A similar kind of interaction may be assumed to obtain in the [a/i] type of alternations in which the element 'A' cannot be licensed in the nucleus if it is affected by palatalisation.

(28)

a.



b.



The facts concerning [o/i] and [a/i] transitions clearly indicate that U-spreading is not as effective as I-spreading. Notice that the structures ((27)a) and ((28)b) are parallel if not identical except that palatalisation spreading suppresses 'A', while velarisation spreading does not affect such a nucleus. This issue will be addressed later when opaque segments are

<sup>36</sup>There is no spreading of the element 'U' in the case of [a] or [ɑ], which is not dependent on the nature of the consonant (in this case [r]) but rather on the nature of the nucleus. See section 2.3.8 on "opaque" segments.

discussed. It will be shown that the status of 'A' is different in alternating mid vowels from that in low vowels.

We may conclude that I-spreading suppresses the 'A' of a preceding nucleus, or to put it differently, the element 'A' may not be licensed within a nucleus affected by palatalisation, which points to the interaction between 'I' and 'A' as the cause of the loss.

Problems with an exact account of A-suppression aside, this analysis already shows certain advantages over that proposed in Ní Chiosáin (1992). Namely, bearing in mind that there are opaque segments in which 'A' is involved,<sup>37</sup> we are now in a position to include the existing alternations in which low vowels are involved (e.g. [f'ar / f'ir']) as well as those where mid vowels are affected in the same manner (e.g. [sop / sip']) in the pool of phenomena evoked by element spreading. The single phenomenon of A-suppression explains neatly the modifications which, in traditional terms, involve not only the feature [BACK] but also [HIGH] and for that reason had to be treated as unconnected.<sup>38</sup>

Finally, let us look at some intriguing data which may reveal how the vocalic system of Irish operates. The forms presented below involve a rare case of an [a/i] type of alternation which is strictly related to a shift in stress. This type of data illustrates probably the only productive context in which the low back [a] is affected by palatalisation.

(29)

[f'i'nax / 'finig']	<i>sionnach / sionnaigh</i>	"fox/gs."
[tə'sax / 'tosig']	<i>tosach / tosaigh</i>	"beginning/gs."
[mər'kax / 'markig']	<i>marcach / marcaigh</i>	"rider/gs."
[pər'tax / 'portig']	<i>portach / portaigh</i>	"bog/gs."

It appears that under certain conditions the low back [a] also has to be included in the list of interactions between nuclear content and element spreading. What is more, the [a/i] alternation can be easily accommodated in our analysis as it involves A-suppression evoked by I-spreading once the conditions are met. Roughly speaking, the main condition for the low back vowel to be affected by palatalisation is its reduction to a schwa-like vowel (see

<sup>37</sup>It would be erroneous to assume that only low vowels are opaque to element spreading as certain [o]'s and in fact [e]'s exhibit the same property (see the discussion of "opaque" segments (2.3.8)).

<sup>38</sup>One should make it clear that this analysis accounts for the Connemara facts too, in which [sop] alternates with [sep]. In this case, all that needs to be said is that the element 'A' is not suppressed and only U-dislodgement occurs.



Gussmann (1994)), but it is unclear what is responsible for the reduction, i.e. whether it is palatalisation or stress shift that is responsible.

In 2.4, an attempt will be made to find out the exact reasons for A-suppression. However, one should bear in mind two facts concerning the interaction between 'A' and 'I'. First of all, the back [ɑ] is typically not affected by I-spreading. On the other hand, the existence of short [e] as well as long [e:], although conditioned, indicates that the two elements may combine.

Given the above analysis one may, however, think of a few reasons for A-suppression now. Firstly, the suppression might be due to the break-up of the relation between 'A' and the element shared with the onset. This means that 'A' forms a bound structure with the shared element, the break-up of which disallows a combination with the incoming element provided by I-spreading. Such an interpretation, however, would only apply to the forms like [sop/sip'] where I-spreading breaks-up the U-A combination, while the alternation [f'ar/f'ir'] would require a different explanation as the sharing is not upset here.

The line of argument adopted in the ensuing analysis is that the element which spreads into the nucleus cannot fuse with whatever is present in that nucleus because of certain properties in the spread element.<sup>39</sup> Thus, although 'I' and 'A' may combine, it may be claimed that the nature of that combination is strictly conditioned in Munster Irish.<sup>40</sup> The following section offers an analysis of a set of data in which the element 'A' is licensed in the affected nucleus from outside that nucleus, i.e. from the following nucleus, which clearly indicates that A-suppression is strictly related to element licensing.

### 2.3.3. A-support

The following series of examples illustrates two sets of facts. First, it shows that low vowels alternate in palatalised environments. Second, it supplies more evidence indicating that both the preceding and the following context can influence the intervening vowel, though not in the same fashion. The difference lies in the nature of element sharing, which is non-directional in the C-V context, as opposed to the leftward spreading of the elements 'I' and

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<sup>39</sup>This would account for both U-dislodgement and A-suppression as a unified phenomenon.

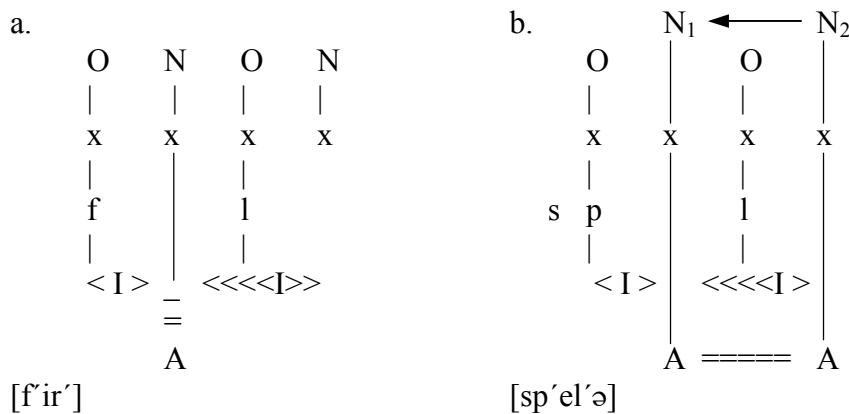
'U'. In the previous section, it was shown that front [a], which distributionally always follows a palatalised onset, alternates with [i] if the element 'I' is spread from the right. In this respect the data below may look exceptional since the I-spreading yields the mid vowel [e]. Consider the data in ((30)a) taken from Ó Siadhail (1989).<sup>41</sup> Notice that only [a] alternates with [e].

(30)

a.	[sp'al]	/	[sp'el'ə]	<i>speal / speile</i>	"scythe/gs."	[a/e]
	[d'as]	/	[d'efə]	<i>deas / deise</i>	"nice/comp."	[a/e]
	[l'ak]	/	[l'ek'ə]	<i>leac / leice</i>	"flagstone/gs."	[a/e]
	[n'ad]	/	[n'ed'ə]	<i>nead / neide</i>	"nest/gs."	[a/e]
b.	[sop]	/	[sip']	<i>sop / soip</i>	"wisp/gs."	[o/i]
	[knok]	/	[knik']	<i>cnoc / cnoic</i>	"hill/gs."	[o/i]
	[f'ar]	/	[f'ir']	<i>fear / fir</i>	"man/gs."	[a/i]
	[k'ark]	/	[k'ir'k'ə]	<i>cearc / circe</i>	"hen/gs."	[a/i]

In order to account for the data listed in ((30)a) it will be assumed that the inflectional ending of the genitive and comparative forms contains the element 'A'. It will become clear that the presence of this element in the following nucleus is necessary. Consider the phonological structures of [sp'al] and [sp'el'ə] below.

(31)



<sup>40</sup>Given the existence of [o - e] alternations in Connemara, one may assume that in this dialect the element 'A' may fuse with the incoming element 'I'. This difference between Munster and Connemara may be crucial to the understanding of the behaviour of long [e:] in the two dialects (see 3.3.6).

<sup>41</sup>[a] is a front low vowel. Although phonetically speaking it is not exactly [æ], it may still be viewed as an (I, A) compound. In Munster there is no [a/æ] contrast to speak of, and in fact, [a] is often identical to the English [æ] of *man* (Sjoestedt (1931:74), Wagner (1958:XXIII)).

( ← ) governing relation  
 ( == ) bridge  
 ( << >> ) sharing

The forms in ((31)) offer several clues as to how elements interact in Irish palatalised environments. The fact that 'A' in N<sub>1</sub> of [sp'el'ə] has to be supported by the following nucleus provides an argument in favour of our assumption that A-suppression results from a lack of licensing or fusion possibilities once the element 'I' is spread from the right (Recall the alternation [f'ar/f'ir'] in which the element 'A' is suppressed). In [sp'el'ə] this element is licensed by the following nucleus, i.e. from outside N<sub>1</sub>, in which case we may talk about a licensing or governing relation formed between the nuclei. Let us elaborate on this point in some detail.

Charette and Göksel (1994/96) refer to the phenomenon of A-bridge in Turkic languages as an instance of OCP by which two elements merge in one and become licensed within a governing expression. Their analysis will be discussed in more detail in section 2.4.2 when we turn to the question of licensing constraints in linguistic systems. In the case of Irish [sp'el'ə] ((31)b) the A-bridge reflects the relation between N<sub>1</sub> and N<sub>2</sub>, which licenses the element 'A' within the first nucleus and prevents suppression of that element like in [f'ar/f'ir'] ((31)a). Thus in fact, the element 'A' in N<sub>1</sub> is licensed by N<sub>2</sub>.

This analysis remains in agreement with the conditions on A-licensing proposed for Uyghur, a Turkic language, by Denwood (1993). Denwood discusses [a] - [i] alternations in Uyghur and determines the following conditions on A-licensing in the nucleus position.

(32)

'A' IS LICENSED:

- a. in the head of domain, i.e. in the nucleus which functions as the head of domain.
- b. in a long vowel, in which case 'A' is linked to two skeletal positions .
- c. by the following nucleus which contains 'A'.

The first condition refers to the prosodic status of the nucleus containing 'A' and will be left aside for the moment. As to the other two conditions, ((32)b) and ((32)c), they may also apply to the Irish facts. First of all, in line with ((32)b), long vowels in Irish are immune to element spreading and hence 'A' is never suppressed in such forms, while the A-support or bridge structure proposed for [sp'el'ə] in ((31)b) expresses exactly the same idea as

Denwood's last condition, namely, licensing of the element 'A' by the following nucleus.<sup>42</sup> Let us now try to look at the consequences of A-support in the Irish analysis.

At the outset of our discussion of the phenomena connected with the phonological behaviour of 'A' in Irish we made a distinction between two aspects of autosegmental licensing (licensing of melody within a position) that are crucial to this analysis. First, it was mentioned that a-licensing of an element may depend on the restrictions connected with the fusion possibilities that elements in a given language may exhibit. Examples of this type of conditioning are provided by the alternations [f'ar/f'ir'] and [sop/sip'], in which we claim that the element 'A' is not licensed (hence suppressed) due to the fact that the element 'I', which is spread into the nucleus (by I-propagation), may not combine with 'A'.

The other aspect of a-licensing is connected with the dependence of the position on the phonological hierarchy, i.e. prosodic licensing (p-licensing). In this case, the a-licensing potential depends on the interaction with p-licensing. The case of [sp'el'ə] seems to exemplify this interaction in that the element 'A' is a-licensed due to a p-licensing relation holding between the two nuclei N<sub>1</sub> and N<sub>2</sub>, and illustrates a typical instance of vowel harmony.

Thus, in the case of [sp'el'ə] one may speak of a conflict between the combinatorial restrictions which preclude a fusion of 'A' and 'I' (cf. [f'ir']) in a nucleus affected by palatalisation spreading and the phenomenon of A-bridge which, irrespective of the restrictions, supports 'A' in N<sub>1</sub>. The question is how the elements 'I' and 'A' combine to form [e] in [sp'el'ə] and what role is played by the A-bridge in supporting this combination.

In GP, the vowel [e] has normally been described in terms of an I-headed element combination in which 'A' acts as an operator, i.e. (A.I) (see KLV (1985:309)). Assuming that Irish [a] is a compound containing exactly the reverse combination, i.e. (I.A), which follows from the representation provided for [sp'al] and [f'ar], then the following hypothesis concerning A-suppression in [sip'] and [f'ir'] may be constructed. The element 'A' is suppressed if it cannot act as the head, i.e. when it is demoted to the operator position in the nucleus affected by I-spreading. This may mean two things: first, the element 'I' is spread and licensed in the affected nucleus as the head, in which case the difference in the behaviour of 'I' shared with the preceding onset and the 'I' which is spread from the right-hand context

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<sup>42</sup> Clearly the conditions (b) and (c) are similar in nature in that in both cases two skeletal positions

would follow directly from its status within the affected nucleus, i.e. whether it is an operator or the head. Second, given that elements form a head-operator relation, we may safely adopt the view that the head of such a relation licenses the operator, parallel to other instances of heads licensing their complements.<sup>43</sup>

It appears that there are two factors involved in the way elements interact within a compound which have a direct bearing on the phonetic interpretability of such segments. One of the factors involves the status that elements enjoy within a compound, i.e. whether they function as the head or as the operator. The other factor refers to the combinatorial possibilities of elements which follow from their licensing properties. For example, assuming that 'I' in Irish is unable to license other elements (operators) and is itself licensed (by I-propagation) as the head of the nucleus, then any other element which is dependent on the head will not be licensed (interpreted) in that nucleus.

On the other hand, one may equally well propose that some elements may occur only in the head position of compounds and may not be licensed as operators. This, too, might account for the behaviour of 'A' which becomes suppressed when demoted to the operator position.<sup>44</sup>

Thus, the element suppression may be due to either the absence of licensing properties in the element 'I', or to the very fact that 'A' is demoted. At any rate, the A-bridge clearly salvages the situation by supporting, or licensing the element 'A' in the affected nucleus.<sup>45</sup> The question is, what role is played by the A-bridge and what is the element 'A' supported as? Clearly, the intervention of the A-bridge could not avert the combinatorial restrictions that 'I' and 'A' exhibit because these are lexical properties which may not be altered in the course of the derivation. Therefore it is natural to hazard a guess that what is involved is the status of the supported element.

Let us consider two possibilities with respect to the status of the element 'A' in  $N_1$  when supported by the A-bridge, i.e. the operator and the head. Before that, however, we

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are involved.

<sup>43</sup>Compare this with the situation in branching onsets, branching nuclei and 'coda'-onset relations in which the head licenses its complement. All of these relations may be said to exemplify p-licensing of skeletal positions.

<sup>44</sup>The theory of licensing properties of elements will be discussed in detail in 2.4.

<sup>45</sup>The tendency for 'A' to be suppressed in languages (cf. e.g. Pasiago Spanish (Harris (1990b)) and Uyghur (Denwood (1993))), and the special requirements that need to be fulfilled for this element to be

should decide on the status of 'I' when spread from the right. It has been hinted that I-propagation licenses this element as the head of nuclei. There are arguments in support of this view. First of all, the influence of this element on the phonetic shape of vowels is stronger in the case of spreading ( $\langle\langle I \rangle\rangle$ ) than it is in the case of sharing ( $C\langle I \rangle V$ ), an asymmetry which may be accounted for by the head/operator distinction. Secondly, the very phenomenon of A-suppression suggests that 'I' is spread as the head, otherwise 'A' should combine with the incoming element 'I', just as it does with the 'I' shared with the preceding onset (e.g. in [f'ar]).<sup>46</sup> More evidence in favour of the view that 'I' spreads as the head will emerge as we go along. Henceforth, it will be assumed that this is the case. We come back now to the problem of the nature of A-support in [sp'el'ə].

The first hypothesis concerning the status of the supported element 'A' is that the A-bridge phenomenon licenses 'A' in  $N_1$  as the operator, which, given the fact that 'I' is licensed as the head (by I-propagation), has the following consequences: 'I', which is the head of the nucleus, may not license 'A' as the operator (hence [f'ir'] and [sip']), therefore, such an analysis is either impossible, or it allows the phonological derivation to override lexical (underlying) restrictions to create an illicit object  $*(A.I)$  in [sp'el'ə]. An alternative interpretation of this hypothesis might be that the supported element 'A' does not fuse with 'I', but, being licensed within the nucleus by the A-bridge, it has the phonetic effect of lowering [i] to [e].<sup>47</sup>

The other way to understand the A-bridge phenomenon would be to view it as support of 'A' in the head position of the nucleus. Recall that [a] may be viewed as an (I.A) compound in which case the A-bridge would genuinely support the underlying state of affairs in which 'A' acts as the head of the first nucleus, rather than effecting a switch in status to the operator. This interpretation, however, also has undesirable consequences. First of all, if 'A' is supported as the head, then technically speaking one has to accept the fact that no I-spreading into  $N_1$  is possible as the nucleus cannot contain two heads. In this case, the phonetic

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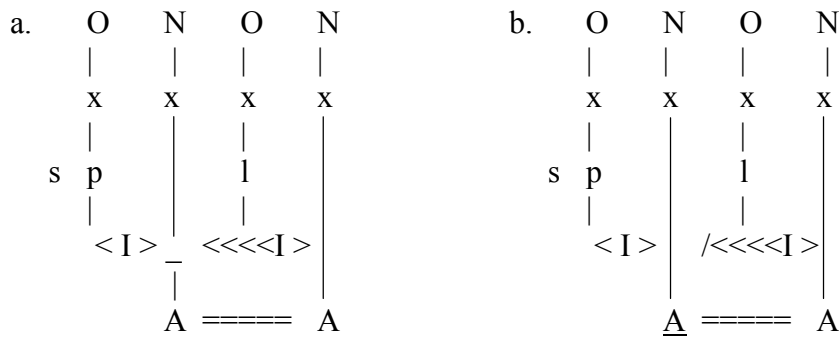
licensed, clearly set 'A' apart from other vocalic elements, and means that more needs to be understood about this element (Edmund Gussmann (p.c.)).

<sup>46</sup>This argument is plausible only if 'A' indeed fuses with the shared element 'I' in *fear*. Recall that Ní Chiosáin and Padgett (1993) view the fronting as phonetic in nature.

<sup>47</sup>No claims will be made here as to whether such a course of action is possible or not. Clearly, more needs to be understood about the way elements interact within compounds with respect to phonological licensing in general. A similar problem will be encountered in the discussion of Munster [e:] (3.3).

difference between the realisation of the same combination (I.A) as [a] in [sp'al] and [e] in [sp'el'ə] would have to be treated as a purely phonetic effect. This, in fact, does not seem to be such an outrageous idea given the fact that neither [a] nor [a] seems to be found between two palatalised consonants in Munster Irish. Additionally, the putative co-operation of two palatalised onsets to yield a phonetic [e] might explain the restricted distribution of this vowel (it must be flanked by two palatalised consonants) as well as accounting for the lack of [o] / [e] alternations in the dialect under study, which is connected with the fact that [o] follows a velarised onset while [e] is absent from the C<sup>U</sup> - C<sup>I</sup> context (see 2.3.7). The structures below illustrate the two hypotheses concerning the nature of the A-bridge in [sp'el'ə] *speile* "scythe/gs.", in which the putative heads are underlined.

(33)



(/<<) blocked spreading

(====) bridge

((33)a) illustrates A-support as an operator within the affected nucleus which is headed by the element 'l'. On the other hand, ((33)b) shows A-support as the head of the nucleus. Both interpretations have certain consequences which we have to face. Let us take a closer look at the phenomenon of A-harmony which is found in other contexts in Irish to see which of the two possibilities finds support.

To summarise the analysis so far: we have seen that short nuclei in Irish are influenced by the elements I/U in two ways. First, nuclei share one of these elements with the preceding onset in which case the status of the shared element within the nucleus seems to be that of an operator. Second, the elements I/U affect nuclei also from the right-hand context where the I/U-spreading may "upset" the sharing relation (e.g. [p'ubər] *piobar* "pepper"). The interaction between shared I/U and spread I/U is characterised by a dislodgement of the

former by the latter from the nuclear position but not from the phonological representation, hence the glide formation in [p<sup>h</sup>ubər] and [k<sup>w</sup>idʲ].

With respect to the element 'A', which is underlyingly present in some nuclei, we concentrated on the A-I interaction rather than the A-U interaction, as the latter is limited by the fact that U-spreading from the right is less spectacular in the case of mid and low vowels than it is with high ones ([p<sup>h</sup>ubər]).

As far as the A-I interaction is concerned, we established that the element 'A' in front [a] tends to be suppressed when the nucleus is affected by I-propagation ([fʰar / fʰirʰ] *fear/fir* "man/gs."). An exception to the suppression phenomenon is found in the context when the following nucleus containing 'A' supports this element in the nucleus affected by palatalisation ([spʰal / spʰelʰə] *speal / speile* "scythe/gs."). We tentatively assumed that an A-bridge tampers with the status of the supported element rather than with its licensing (combinatorial) possibilities. In the following section, we will try to establish what the actual influence of the bridge is.

#### 2.3.4. A-spreading

The phenomenon of A-support discussed above does not seem to involve the spreading of the element 'A' from one nucleus to the other, but rather, the licensing of a lexically present element by a following nucleus which contains the same element.<sup>48</sup> It seems, however, that A-spreading exists in Munster Irish and is manifested and conditioned in a similar fashion to A-support. Thus we may speak generally of one phenomenon of A-harmony which is

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<sup>48</sup>This analysis is also identical to that of height harmony in Pasiego Spanish (Harris (1990b)).



manifested in two ways: by A-support and A-spreading.<sup>49</sup> The conditions on A-harmony will be discussed in the following section. Let us now consider the data below.

(34)

- |    |                 |                    |                 |
|----|-----------------|--------------------|-----------------|
| a. | [kid' / kodə]   | <i>cuid/coda</i>   | "share/gs."     |
|    | [trid' / trodə] | <i>troid/troda</i> | "fight/gs."     |
| b. | [f'is / f'asə]  | <i>fios/feasa</i>  | "knowledge/gs." |
|    | [l'is / l'asə]  | <i>lios/leasa</i>  | "garth/gs."     |
|    | [b'i / b'ahə]   | <i>bith/beatha</i> | "existence/gs." |
|    | [k'i / k'ahə]   | <i>cith/ceatha</i> | "shower/gs."    |

In [kid'] and [trid'] the vowel is clearly derived by I-spreading. However, in the genitive the vowel is [o], which may mean two things. Either the nucleus contains [o] in the nominative too, parallel to [sop] *sop* "wisp", or it contains 'U' only and the element 'A' is spread from the following nucleus in the genitive.

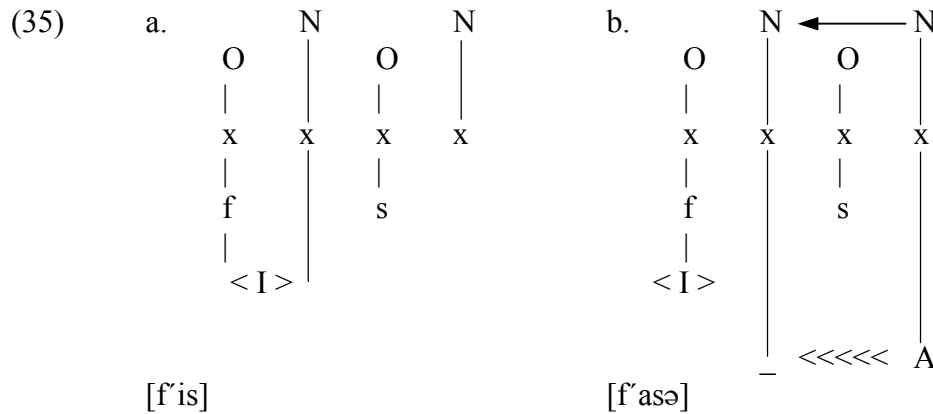
The situation in [f'is / f'asə] and [k'i / k'ahə] is more clear. The vowel [a] in the genitive form must be derived by A-spreading from the second nucleus because this element is not present in the nominative form. One reason for assuming its absence in the nominative form is that we have not discovered a possible mechanism by which this element would not be licensed in this context. If this nucleus contained the element 'A', the result would have to be \*[f'as] as it is in e.g. [d'as] *deas* "nice". It follows then that the first vowel in [f'asə] has to be viewed as a result of A-spreading from the following nucleus.

The data in ((34)b), i.e. forms like [f'is] and [k'i], are "irregular" in that the segment [s] and, in fact, the latent [h] in *cith*, being non-palatalised, should contain the element 'U' as

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<sup>49</sup>The two phenomena, although subsumed under the broader term "A-harmony", exhibit different behaviour in that A-support requires the presence of 'A' in the preceding nucleus, while A-spreading provides this nucleus with the element 'A' (see the following section).

other velarised consonants do. In this case, we should expect U-spreading and in effect \*[fʰus] parallel to [pʰuk] *pioc* "bit". However, it appears that these two segments ([h] and [s]) are neutral with respect to velarisation and palatalisation. This is manifested by the fact that [h] is neither palatalised nor velarised, while the palatalised version of [s] is in fact palatal [ʃ]. Nonetheless, this "irregularity" in the forms in ((34)b) is not directly relevant to the question of A-spreading except that it allows us to see the effects more clearly. For this reason no specification of [s] is given in the structures illustrating A-spreading below.



What is relevant in the alternation [fʰis / fʰasə] is the fact that in the genitive case ((35)b) the element 'A' spreads from the following nucleus and combines with the element 'I', which is shared by the first nucleus with the preceding onset, to yield [a] as in [spʰal] *speal* "scythe". It has been established that the shared element ('I') acts as the operator within the nucleus (see previous section), therefore we may safely adopt the view that the element 'A' which is provided by spreading from the following nucleus captures the head position. If this is the case, then the phenomenon of A-spreading argues strongly for the hypothesis that the A-bridge supports the element 'A' as the head in [spʰelʰə].<sup>50</sup>

We can now claim that in the case of A-harmony, the element 'A' in the first nucleus is licensed or spread as the head, just as 'I' and 'U' do when spread from the right. In both cases the direction of spreading is the same and agrees with the direction of internuclear government in Irish. The nature of A-harmony, it seems, is in some respects similar to that of 'I' and 'U' spreading in that only a certain type of nucleus is affected by these processes. On the other hand, there is a major difference between the two processes in terms of the scope of

<sup>50</sup>In chapter 4, it will be shown that an almost identical kind of A-bridge is found in the consonantal system of Irish.

their application. It has been shown that, for example, palatalisation affects both consonants and vowels and is only stopped by certain nuclei e.g. [ɔ].<sup>51</sup> The A-harmony, however, seems to be restricted to inter-nuclear licensing relations and is subject to similar conditions as, for instance, Proper Government.

### 2.3.5. Conditions on A-harmony

Let us now concentrate once more on the A-support supplied by the vowel in the following nucleus, and consider some evidence in favour of the assumption made earlier that the inflectional vowels in Irish contain the element 'A'.

We know that in Irish the direction of internuclear government is from right to left. So the A-support in palatalised environments can be viewed as element licensing by the following nucleus which contains a melody. It seems though that it is not enough for the following nucleus to contain an expressed segment. Consider the data below.

(36)

- |    |              |              |                       |
|----|--------------|--------------|-----------------------|
| a. | [l'ak]       | <i>leac</i>  | "stone"               |
| b. | [l'ek'ə]     | <i>leice</i> | "gs. of stone"        |
| c. | [l'i'k'i:n'] | <i>licín</i> | "diminutive of stone" |

The vowel in the first nucleus of ((36)c) cannot be viewed as a reduced vowel due to stress shift, because in Irish vowels which are followed by a long [u:] or [i:] are not reduced (Ó Cuív (1975:104)). So we should expect a form like \*[l'e'k'i:n'], which we do not find.<sup>52</sup>

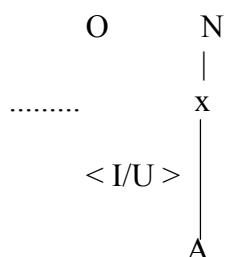
Thus one can safely assume that only a vowel which itself contains the element 'A' can support (license) this element in the preceding nucleus. Hence, A-support may indeed be viewed as a form of vowel harmony. Below, we supply what seems to be the representation of short vocalic inflectional endings in Irish.

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<sup>51</sup>One must add here that element spreading is also blocked by the "dislodged" element 'I' or 'U' (e.g. [m<sup>w</sup>ik'] and [p<sup>l</sup>uk]), but in these case the nucleus itself is affected, unlike nuclei containing [a] (e.g. [ban'ə] *bainne* "milk").

<sup>52</sup>It seems to be true that beside [l'i'k'i:n'] one may find the form [l'a'k'i:n'] parallel to [f'ar] *fear* "man" which has two diminutives: [f'i'r'i:n'] and [f'a'r'i:n']. This is, however, connected with the

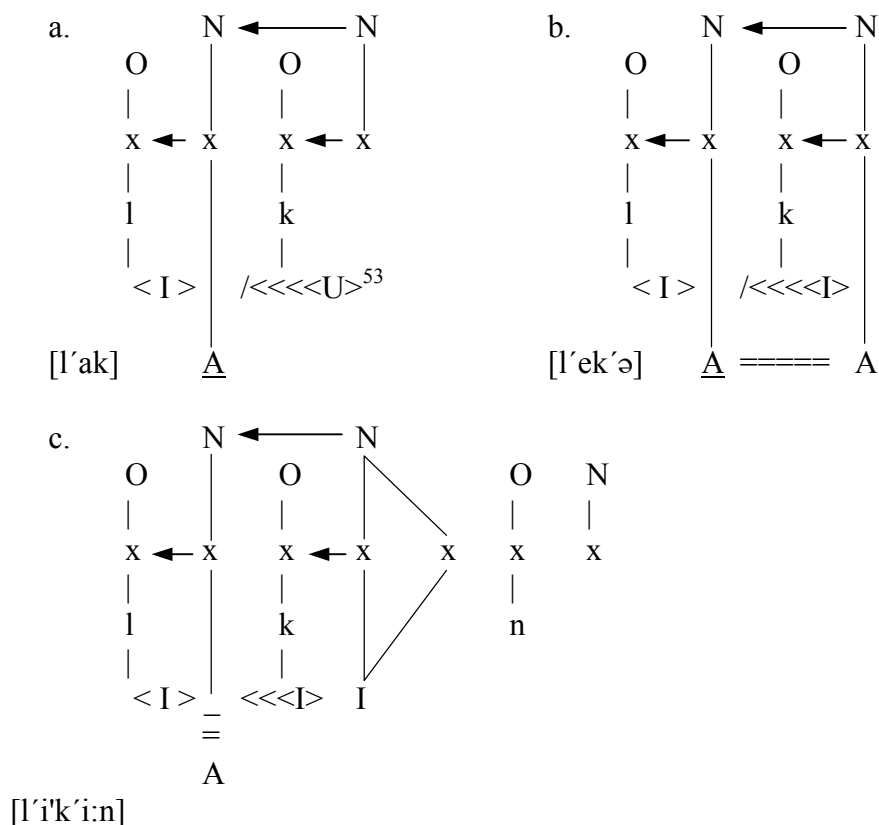
(37) structure of the vocalic inflectional ending



This structure involves a non-headed (schwa-like) vowel containing 'A'. This vowel is always reduced to a schwa although phonetically it may have a close or an open variety. This distinction depends on the quality of the preceding consonant, i.e. on the element shared between the onset and the nucleus.

Below the derivation of the data in ((36)) is illustrated structurally.

(38)



variation morphological status of the diminutive suffix *-in* (see Doyle (1992:118) where this suffix is shown to be either cyclic or non-cyclic). At any rate, we do not find \*[l'e'k'i:n'] or \*[f'e'r'i:n'].

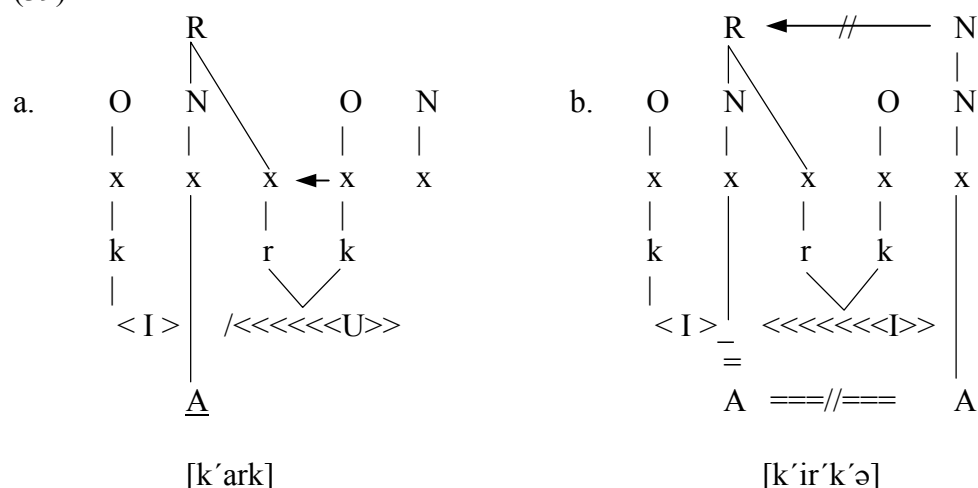
<sup>53</sup>If the assumption that the element 'A' which is headed or supported as a head by the A-bridge is not in fact phonologically affected by palatalisation (recall the discussion of [e] as a phonetic effect), then the lack of U-spreading in [l'ak] is no longer irregular, as the headed 'A' should be opaque to both 'I' and 'U' spreading.

In ((38)a) 'A' is the head and shares the element 'I' with the preceding onset (by the *Sharing Condition*), which results in a front low vowel [a]. In ((38)b) the head of the vocalic expression in the first nucleus is supported by the A-bridge, without which the element 'A' should be suppressed (cf. [f'ar / f'ir']). In ((38)c) the element 'A' cannot be supported, because the following nucleus contains only 'I', and hence 'A' is not licensed within the first nucleus.

This analysis illustrates the interaction between two processes, i.e. A-support and I-spreading. It is time to examine the basic difference in the application of the two processes. It seems that, although we can correlate A-harmony with internuclear government, we cannot do the same in the case of 'I' and 'U' propagation.

One of the conditions on internuclear government is that it cannot apply across a governing domain (Kaye, Lowenstamm and Vergnaud (1990), Charette (1991:115)). Consider the structures below in which the nuclei are separated by a 'coda'-onset governing relation [-rk-].

(39)



The difference between the two major spreading processes lies in the dependence on internuclear government which is displayed by A-harmony but not by I-propagation which still takes effect in ((39)b). The reason for that is that I-spreading is of an unbounded nature. In autosegmental terms this may be explained by the fact that the line on which the elements 'I' and 'U' reside (the BK/RD line) is shared by consonants and vowels, therefore the elements

I/U can propagate along this line and affect both vowels and consonants irrespective of the constituent structure.

Thus there can be no A-support in [k'ir'k'ə] because the final nucleus, even though it contains the element 'A', cannot govern the preceding nucleus due to the intervening governing domain. There seems to be an additional condition on A-spreading which concerns the structure of the target nucleus. Namely, the element 'A' may spread only to a nucleus which is not headed, i.e. to one in which none of the active elements plays the role of the head.

We have seen the difference between A-harmony and I/U spreading. One should also bear in mind the discrepancy between A-support and A-spreading within the major set of A-harmony processes. It seems that the difference is of the following nature. A-support refers to a bridge formed between two successive nuclei containing this element lexically, to the effect that the first nucleus is supported (licensed) as A-headed. On the other hand, A-spreading may, it seems, only occur if the first nucleus is not headed and involves physical spreading of the element 'A'. In other words A-support is impossible if 'A' is not present underlyingly in the first nucleus and A-spreading is impossible if this nucleus is headed. As will become clear, this refers to palatalised environments.

Let us look at the forms below and decide on the status of the first nucleus. It should be borne in mind that the inflectional vowel in the genitive contains the element 'A' (cf. the structure in ((37)))

(40)

- |    |                |                       |                 |
|----|----------------|-----------------------|-----------------|
| a. | [k'ɪ / k'ahə]  | <i>cith / ceatha</i>  | "shower/gs."    |
|    | [f'is / f'asə] | <i>fios / feasa</i>   | "knowledge/gs." |
| b. | [ji / jih'ə]   | <i>sith / sithe</i>   | "endurance/gs." |
|    | [pu / pih'ə]   | <i>puth / puithe</i>  | "breeze/gs."    |
| c. | [l'a / l'eh'ə] | <i>leath / leithe</i> | "half/gs."      |
|    | [d'as / d'e]ə] | <i>deas / deise</i>   | "nice/gs."      |

Let us assume that in ((40)a) the first nucleus is non-headed; therefore in the genitive the element 'A' may spread and assume the role of the head. In ((40)b), the nucleus is headless in

the nominative form but it seems that in the genitive case it is headed as 'A' cannot spread in.<sup>54</sup> Notice that initially the first nucleus did not contain the element 'A', therefore A-support is impossible. Thus 'I' assumes the role of the head in the genitive form of "endurance" and "breeze", which blocks A-spreading and disallows A-support, which in forms like [l'a / l'eh'ə] *leath* / *leithe* "part/gs." ((40)c) is clearly operative due to the fact that the first nucleus contains 'A' underlyingly.

So, on the one hand, certain nuclei require physical spreading of 'A' (e.g. [f'asə]) and on the other, only its prior presence allows for interaction with 'A' in the following nucleus. An interesting point concerning these facts is that A-spreading seems to be allowed over a velarised consonant but not if a consonant is palatalised. On the other hand, A-support occurs predominantly in the latter case. This observation might contribute to the understanding of the putative asymmetry in the behaviour of I/U spreading. Consider the facts below taken from Sjoestedt (1931:81).

(41)

[kru / krəhə]	<i>cruth</i> / <i>crutha</i>	"shape/gs."
[sru / srəhə]	<i>sruth</i> / <i>srutha</i>	"stream/gs."

The open variety of the mid back vowel in the genitive forms suggests that the compound is A-headed, i.e. (U.A). These facts might suggest that perhaps if there is U-spreading in *crutha* parallel to I-spreading in *puithe* then the difference between these two phenomena would lie in the fact that 'U' spreads as an operator and 'I' spreads as a head. Such an analysis allows us to account for the data in ((41)) above. If 'U' spreads as an operator then the first nucleus is still headless and liable to A-spreading.<sup>55</sup> Note that this distinction between 'I' and 'U' spreading may also account for the asymmetry concerning the phonological effects of spreading. For example, if 'U' spreads as an operator then it is easier for us to understand why it does not cause A-suppression.

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<sup>54</sup>In a sense, one may claim that the nominative and the genitive forms of *puith* have distinct underlying representations in that the nucleus is headless in the nominative, while in the genitive, it is defined by the I-spreading from the right which licenses 'I' as the head of that nucleus.

<sup>55</sup>[h] is neither truly palatalised nor velarised in Irish. This, however, seems to be a matter of the licensing or non-licensing of 'I' and 'U' by consonants and has no consequences as far as the presence or absence of these elements is concerned (see the discussion of [ri/ru] in 2.3.6).

To summarise: the A-harmony effects have been shown to be strictly connected with the governing (licensing) relation holding between nuclei and are subject to the same conditions as Proper Government (Kaye, Lowenstamm and Vergnaud (1990), Charette (1991)). For example, Proper Government does not apply across governing domains. Similarly, A-support is blocked in e.g. [k'ir'k'ə] due to the intervening domain ([rk-]). Another condition concerning A-harmony requires that the second nucleus (the licenser) contains 'A' (cf. [l'ek'ə] vs. [l'ik'i:n']). It is proposed that all short vocalic inflectional endings contain this element.

We distinguished two seemingly disparate processes within A-harmony, i.e. A-support (A-bridge) which supports 'A' as the head in the first nucleus, and A-spreading which supplies 'A'-head to a headless nucleus. Given that in both instances the effect is identical, i.e. as A-headed nucleus, the two processes need not be viewed as separate. One could suggest that all there is A-spreading which in the case of the A-bridge applies vacuously (Edmund Gussmann (p.c.)).

Generally speaking, 'A', 'I' and 'U' spread to headless nuclei, but only A-spreading depends on an internuclear relation (cf. [k'ir'k'ə] in which palatalisation spreading applies across the governing domain and affects the nucleus). Additionally, it appears that the asymmetry between 'I' and 'U' spreading may follow from the status of the spread element. Namely, 'I' spreads as the head, and 'U' spreads as an operator.

In the following section we take up the problem of 'I' and 'U' licensing in onsets and nuclei.

### 2.3.6. I/U licensing in onsets and nuclei

We should now take a closer look at the way palatalisation and velarisation operate. Specifically, we are interested here in the way the elements 'I' and 'U' operate and are licensed in consonants. These elements, it will be recalled, are shared with the following nucleus.

The restrictions in the C-V context suggest that the nuclei depend on the value of the preceding onset. However, the onsets themselves do not have to be "truly" palatalised or velarised. In other words, the phonological influence exerted by consonants does not always match their actual phonetic shape. This point becomes particularly pertinent in the case of



word-initial empty onsets which, although devoid of any phonetic substance, still affect the following vowels as well as preceding consonants in sandhi effects as if they contained the element 'I' or 'U'.<sup>56</sup>

In order to be able to understand the behaviour of 'I' and 'U' in consonants let us look at the way word-initial [r] affects its nucleus in monosyllabic words of the *puth* and *bith* type. This context is chosen for two reasons. First, it is the context in which the shape of the nucleus depends strictly on the value of the preceding onset. Recall that the quality of short vowels in such forms always agrees with the quality of the preceding onset as required by the *Sharing Condition*. Secondly, word-initial [r] resists both palatalisation and velarisation in Irish (Ó Cuív (1975:49), de Bhaldraithe (1945:42)). Thus if such forms still exhibit the same type of restrictions as monosyllables preceded by other consonants, then the conclusion should be that the elements 'I' and 'U' which define palatalisation and velarisation do not need be licensed in the consonants (associated with the position) in order to be active phonologically. In other words, one may postulate that these elements may be floating in some cases. Such an interpretation would allow us to accept the putative specification of the word-initial empty onsets as regular, and can be formally captured in terms of the lack of association of the elements 'I' and 'U' with the skeletal position.<sup>57</sup>

This last point is discussed at length in the ensuing sections. However, it seems appropriate to adumbrate the problem here. Essentially, word-initial empty onsets in Irish behave as if they were specified for 'I' or 'U'. On the other hand, if these elements were to be associated with the onset position then we should expect the glides [j] and [w] to appear phonetically in such forms. Below, the difference between a word-initial empty onset, a glide, and what appears to be the Irish empty onset is illustrated structurally.

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<sup>56</sup>See Gussmann (1986) as well as section 3.4.1 for a more detailed discussion of empty onsets in Irish.

(42)

a. *empty onset*<sup>58</sup>

O	N
(x)	x.....

b. *glide*

O	N
x	x.....
I/U	

c. *Irish empty onset*

O	N
x	x.....
I/U	

The behaviour of Irish word-initial onsets and a justification of the structure proposed in ((42)c) will be provided later. Now let us return to the variants of the word for "running".

The word for "running" (*rith*) can have two pronunciations viz. [ri] and [ru], which is indicative not only of the underlying specification of the word-initial [r] but also of the way the nucleus is affected by the preceding onset and the way consonants are affected by palatalisation or velarisation. The word-initial [r] cannot be palatalised or velarised phonetically, but it seems that phonologically it has to bear one of these values. The question is how to represent this form and why the two pronunciations are possible.

Let us assume that the absence of surface palatalisation or velarisation of [r] has no bearing on the phonological fact that the consonant has to be specified for one of the values, just as every filled or empty onset in Irish is. Or, to put it differently, all onsets, whether filled or empty, are phonologically specified for 'I' or 'U', but these elements need not be associated (a-licensed) to the position ((42)c). The two forms, i.e. [ri] and [ru], may then be viewed as a logical consequence of a misconstrued phonological representation, following from the absence of phonetic cues as to the specification of the onset, which must be either palatalised or velarised. The point is that whichever element is present, it will not be licensed by the word initial [r], or by any empty onset for that matter. This element will nonetheless exert an influence on the following nucleus. Below we propose a structure for both [ri] and [ru].<sup>59</sup>

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<sup>57</sup>In chapter 4. an attempt is made to explain why word-initial [r] resists palatalisation and velarisation.

<sup>58</sup>An empty onset need not have a position (see e.g. Charette (1991:92)).

(43)

$$\begin{array}{cccc}
O^1 & N^1 & O^2 & N^2 \\
| & | & | & | \\
x & x & (x) & x \\
| & | & & \\
r & & h & \\
<I> & & & \\
\end{array}
\qquad
\begin{array}{cccc}
O^1 & N^1 & O^2 & N^2 \\
| & | & | & | \\
x & x & (x) & x \\
| & | & & \\
r & & h & \\
<U> & & & \\
\end{array}$$

It is clear that the *Sharing Condition* requires a reinterpretation if it is to capture the fact that the "shared" element may not be associated with one of the partners. Notice that if this interpretation is correct then it provides another argument for having 'U' in the representation of velarised consonants.

One should, however, be aware of the possibility of an alternative interpretation of the forms in ((43)). Namely, since the [r]-onset cannot be either palatalised or velarised (similarly to empty onsets), then one may claim that the elements 'I' and 'U' are underlyingly present in the nuclei of [ri] and [ru]. This interpretation would shift the responsibility of bearing 'I' and 'U' to nuclei and ultimately would mean that the quality of consonants is dependent on the element provided by the nucleus. To illustrate this point we use similar monosyllabic forms in which the initial onset is palatalised or velarised e.g. [k'i] *cith* "shower" and [pu] *puth* "breeze" and assume that the quality of the onsets is effected by the spreading of the relevant element ('I' or 'U') from the following nucleus.

(44)

a.  $O^1$   $N^1$   $O^2$   $N^2$

$\begin{array}{c} | \\ x \\ | \\ k \\ | \\ <<<<I \end{array}$   $\begin{array}{c} | \\ x \\ | \\ | \\ <<<<I \end{array}$   $\begin{array}{c} | \\ (x) \\ | \\ h \\ | \\ <<<<I \end{array}$   $\begin{array}{c} | \\ x \\ | \\ | \\ <<<<I \end{array}$

b.  $O^1$   $N^1$   $O^2$   $N^2$

$\begin{array}{c} | \\ x \\ | \\ p \\ | \\ <<<<U \end{array}$   $\begin{array}{c} | \\ x \\ | \\ | \\ <<<<U \end{array}$   $\begin{array}{c} | \\ (x) \\ | \\ h \\ | \\ <<<<U \end{array}$   $\begin{array}{c} | \\ x \\ | \\ | \\ <<<<U \end{array}$

In fact, this analysis makes the notion of "sharing" redundant, and replaces it with mere spreading of the relevant element from the nucleus. There are, however, serious problems with this interpretation which will force us to abandon it.

<sup>59</sup>O<sup>2</sup> and N<sup>2</sup> in both forms are postulated on the basis of the alternations in the genitive in which the "monosyllabic" forms show the presence of a latent [h] e.g. [rahə] *reatha* "running-gs".

First of all, the question arises as to what is responsible for the specification of word-final onsets in terms of the elements 'I' and 'U' if these elements are to be provided by the following nucleus. Both palatalised and velarised onsets are found in this position in Irish while the following nucleus is empty and licensed by parameter. Thus, if the quality of consonants were to be dependent on the element spread from the following nucleus then we should either have no specification of word-final consonants, or no word-final empty nuclei. In neither case is this true.

Another argument against the view that nuclei define the quality of the preceding onset follows from the fact that certain vowels do not contain either 'I' or 'U', while the onset is specified for the relevant element. For example, the vowel [ɑ] in [fɑdə] *fada* "long" which is phonologically represented by the element 'A' may not velarise or palatalise the onset because there is no source for 'I' and 'U' in that nucleus, and the only quality that this nucleus is able to provide is "A-ness".<sup>60</sup> Similarly, there are vowel initial nouns which palatalise the article, e.g. [ən' oχir'] *an eochair* "the key", despite the fact that the nucleus does not seem to contain the element 'I', but rather (U.Ḃ), while nouns beginning with a high front vowel, e.g. [ən i:hə] *an oíche* "the night", fail to palatalise the article.<sup>61</sup>

Thus, we have seen that in a sharing domain ( $O^1 < I/U > N^1$ ) the elements 'I' and 'U' which define the palatalisation and velarisation of consonants need not be associated with the onset position (e.g. [ri], [ru]). At the same time the source of the elements I/U which affect the nucleus  $N^1$  in [ri/ru] as well as the preceding onset in sandhi positions, e.g. [ən' oχir'], may not be identified with the nucleus itself. This poses the question as to how the elements defining palatalisation and velarisation should be represented phonologically, and ultimately, what is sharing?

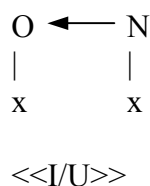
We will begin with the most abstract and highly symbolic representation in which an attempt will be made to capture both the facts concerning the nature of consonant quality specification (specification without association), and the effects of the *Sharing Condition* on the nucleus.

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<sup>60</sup>In standard GP A-ness corresponds to pharyngeality.

<sup>61</sup>One could also ask the question whether the fact that in this analysis 'I', 'U' and 'A' spread from the nucleus should not mean that the nature of the spreading should be identical, which is not the case. Recall the distinction made in 2.3.5 between I/U- spreading on the one hand and A-harmony on the other.

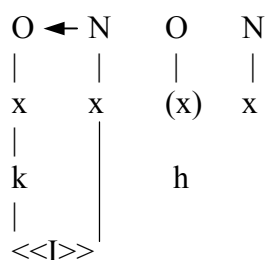
(45)



Generally, we may say that every "O←N" licensing relation constitutes a sharing domain which contains one of the elements ('I' or 'U').<sup>62</sup> The actual phonological representation of any such domain in terms of the presence or absence of association lines will depend on two major factors. One of them is the segmental make-up of the onset and the nucleus, and the other, which relates to the nucleus alone, is the presence or absence of element spreading from the right. First, let us concentrate on the way in which the shared elements I/U are licensed within the onset.

The licensing (association) of these elements in the onset seems to depend on the content of this segment. Thus, I/U are not licensed within an empty onset, hence e.g. [i:hə] *oíche* "night" (not \*[wi:hə]) and [oxir'] *eochair* "key" (not \*[joxir']),<sup>63</sup> and in the case of word-initial [r] e.g. [ri] and [ru] *rith* "running" ((43)). On the other hand, I/U would be normally licensed by any other consonantal segment and associated with the skeletal position e.g. [k'i] *cith* "shower".

(46)



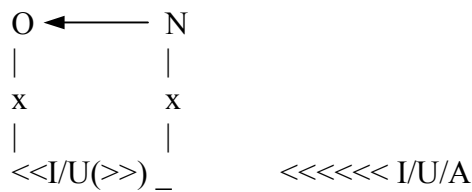
The above form additionally illustrates one of the two contexts in which the nucleus licenses (is linked to) the shared element (see also [pu] *puth* "breeze" where 'U' is shared). The other

<sup>62</sup>One should be aware of the cases in which the I/U specification is extended to two successive onsets. This happens in the case of nuclei which alternate with zero. Recall forms like [dɔrən / dɪr'in' / dɔ:rɪn'ə] *dorn / doirn / doirne* "fist/gs./pl." (2.1.2).

<sup>63</sup>Recall the sandhi effect in [ən i:hə] *an oíche* "the night" and [ən' oxir'] *an eochair* "the key" which suggest that 'U' and 'I' are present in the representation of the nouns and spread onto a preceding onset with phonetic content, either velarising or palatalising it.

instance of licensing of the shared element by the nucleus is found in forms like [f'is] *fios* "knowledge". Generally speaking, such licensing is possible only if there is no other source of resonance elements in the nucleus. We have identified two such sources of elements in short nuclei. First, they may be underlyingly present, e.g. the element 'A' as in [k'ark] *cearc* "hen" and [kat] *cat* "cat" or (U.A) and (I.A) combinations as in [kos] *cos* "leg" and [t'ep'] *teip* "fail".<sup>64</sup> Secondly, elements may be provided by the spreading of 'I', 'U' and 'A', which is illustrated below.

(47)

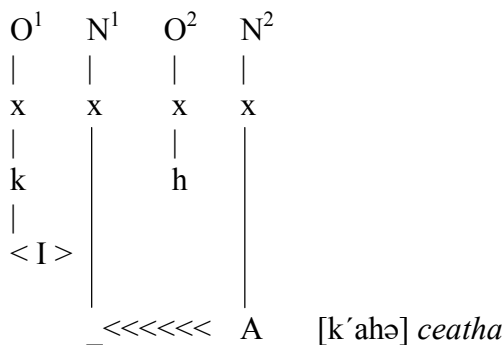


The structure above illustrates a nucleus which is available for the spreading of whatever is available or possible from the right. Ideally, one would like to claim that in the case of spreading from the right the shared element I/U is not licensed by the nucleus. This is already represented in the form above by severing the sharing symbol, and is best illustrated by such forms as [k<sup>w</sup>id'] *cuid* "part" and [g<sup>j</sup>ulə] *giolla* "servant" in which the surface shape of the vowel suggests that the nucleus contains the element provided by spreading from the right-hand context, i.e. the element defining the quality of the following consonant. Thus, the spread element does not combine with the shared one within the nucleus. On the other hand, the "dislodged" element plays an important role in blocking further spreading, hence the off-glides [w] and [j].

The forms [k<sup>w</sup>id'] and [g<sup>j</sup>ulə] clearly demonstrate that the shared element is not licensed by the nucleus if there is another source viz. spreading. Otherwise, we should expect \*[kü'd'] and \*[g'ülə] in which the combination (U.I) or (I.U) should yield a front rounded vowel. A slightly more complicated question is whether the shared element combines with the 'A' provided by spreading. Consider again the genitive form of [k'i] *cith* "shower", i.e. [k'ahə] *ceatha* with the element 'A' spread from the inflectional vowel.

<sup>64</sup>Some arguments against including 'I' and 'U' as independently present in the phonological representation of Irish short nuclei are presented in the following section.

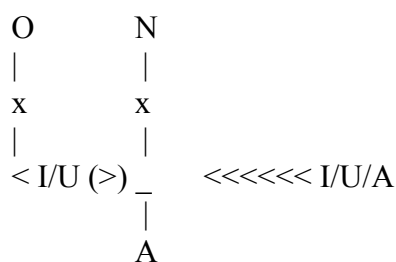
(48)



The diagram suggests that the elements 'I' and 'A' combine to form a fronted [a] which seems to upset our generalisation that the nucleus does not license the shared element if there is other source of vocalic elements in that nucleus. Recall that [e] was claimed above to be a phonetic effect when an A-head is flanked by two palatalised onsets. Given this fact, it is possible to accept the view that an A-headed nucleus yields surface fronted [a] when only one of the flanking onsets is palatalised.<sup>65</sup>

In order to round off the discussion of nuclear structure with respect to the *Sharing Condition* one has to acknowledge the fact that the symbolic structure proposed in ((47)) does not exhaust all lexical possibilities. We have found that in certain nuclei 'A' must be postulated as underlyingly present (e.g. in [sop] *sop* "wisp"). Such nuclei will differ from the ones discussed above in exactly this respect.<sup>66</sup>

(49)



The interpretation of this structure will vary depending on whether the conditions on A-licensing are fulfilled, or whether it has to be suppressed.

<sup>65</sup>It was mentioned earlier that the vowel [a] is treated as a phonetic effect in Ní Chiosáin and Padgett (1993).

<sup>66</sup>We leave the question of fusion open.

### 2.3.7. Why is there no [o/e] alternation in Munster?

The aim of this subsection is to signal and enlarge on issues concerning the absence of [o/e] alternations in Munster Irish. Recall that in Connemara Irish this type of alternation is possible e.g. [sop / sep'] *sop / soip* "wisp/gs." (de Bhaldraithe (1945), Ní Chiosáin (1992)). One possible explanation concerning the Munster dialect is provided by distribution facts which demonstrate that the mid front vowel [e] must be followed and preceded by palatalised consonants, e.g. [t'ep'] *teip* "fail" and [sp'el'ə] *speile* "scythe-gs."<sup>67</sup> On the other hand, [o] is normally found following a velarised onset. Therefore, logically, the existence of an [o/e] alternation in Munster would require that the onset preceding [o] be palatalised.

There is only one context in which palatalisation spreading may affect an onset across a nucleus. This happens if the nucleus itself is empty e.g. [uəsəl / uil'ə] *uasal / uaisle* "noble/pl.". However, the Munster [o] is unlikely to be derivable from an empty nucleus. This excludes the possibility that the onset which directly precedes [o] may be affected by palatalisation and predicts that the [o/e] alternation is banned in Munster.

Another question is why exactly Munster [e] must follow a palatalised onset. Note that both 'I' and 'A' may follow a velarised onset, e.g. in [kid'] *cuid* "part" and [kat] *cat* "cat". Why then, is the combination of the two elements restricted to nuclei which follow a palatalised onset, and why is it possible in Connemara after a velarised one? Let us recall the effects of I-spreading with respect to the element 'A' in Munster. We found that if the nucleus is A-headed, e.g. in [kat'] *cait* "cat-gs." and [ban'ə] *bainne* "milk", then palatalisation spreading is blocked and the vowel remains intact. On the other hand, there are nuclei which contain the element 'A' and are accessible to I-spreading, e.g. [a] in [f'ar] *fear* "man" and [o] in [sop] *sop* "wisp". This results in A-suppression ([f'ir'] *fir* "man-gs.", [sip'] *soip* "wisp-gs.").<sup>68</sup> Note that in both instances, i.e. in the case of blocking and suppression, the overall impression is that the two elements (I-A) find it hard to combine in Munster. Since both 'I' and 'A' may follow a velarised onset, it seems that the Munster restriction against \*Ce... may be better understood as following from the combinability of these elements in connection with distributional restrictions. For instance, we may hypothesise that the role of palatalised

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<sup>67</sup>Compare this with the nominative form of "scythe", i.e. [sp'al] *speal*, in which the vowel is followed by a velarised consonant.



onsets in the distribution of [e] in Munster is purely phonetic. In this interpretation the representation which yields a surface [e] is in fact reduced to the presence of an A-headed nucleus flanked by two palatalised consonants, i.e. C'AC'. This view finds support in the distributional facts such as the virtual absence of [ɑ] or [a] in this context.<sup>69</sup> This claim requires more refinement, as clearly the existence of an I-A combination, i.e. of a lexical [e], must be recognised if only to account for the Munster long [e:]. Thus, we may be dealing simply with a restriction on the type of I-A combination (e.g. \*(A.I)=NO, (I.A)=YES).<sup>70</sup>

In the following section (2.4), we will try to apply a recent model of parametric treatment of element combinability which has been developed in GP to find out how the Munster restriction (and indeed the whole vocalic system) can be defined in terms of licensing properties of elements. In this model the difference between Munster and Connemara Irish may be captured in terms of constraints of a parametric nature which would reflect the fact that in Connemara the elements 'I' and 'A' may combine (hence [sop / sep'] *sop / soip* "wisp/gs.").<sup>71</sup>

Let us now return to the question of the [o/e] alternation and consider an apparent example of this phenomenon in [obir' / eb'ir'ə] *obair / oibre* "work/gs.". This alternation will be viewed as exceptional for at least two reasons. First, the palatalisation of both onsets O<sup>2</sup> and O<sup>3</sup> in the genitive form (see the diagram below) suggests that the intervening vowel is derived from an underlying empty nucleus. On the other hand, the nominative form suggests that this vowel has an underlying melody which prevents the palatalisation from spreading onto the preceding onset O<sup>2</sup>. Second, our analysis predicts that when palatalisation spreads, [o] may either remain intact as in [koʃ] or alternate with [i] as in [sip']. An independent argument for this analysis comes from the fact that distributionally [e] requires a palatalised onset to precede it.

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<sup>68</sup>Recall that the element 'A' may be supported by an A-bridge in [sp'al / sp'el'ə] *speal / speile* "scythe/gs.".

<sup>69</sup>Recall that the natural contexts for these vowels are (C'aC) for [a], and (CaC) and (CaC') for [ɑ].

<sup>70</sup>In 3.3.1, we propose a mechanism of I-A decomposition ([e] to [a]) which seems to be parallel to what happens to Munster long [e:] in the context (C'-C). This might enable us to understand what happens to phonological (I.A) in this dialect.

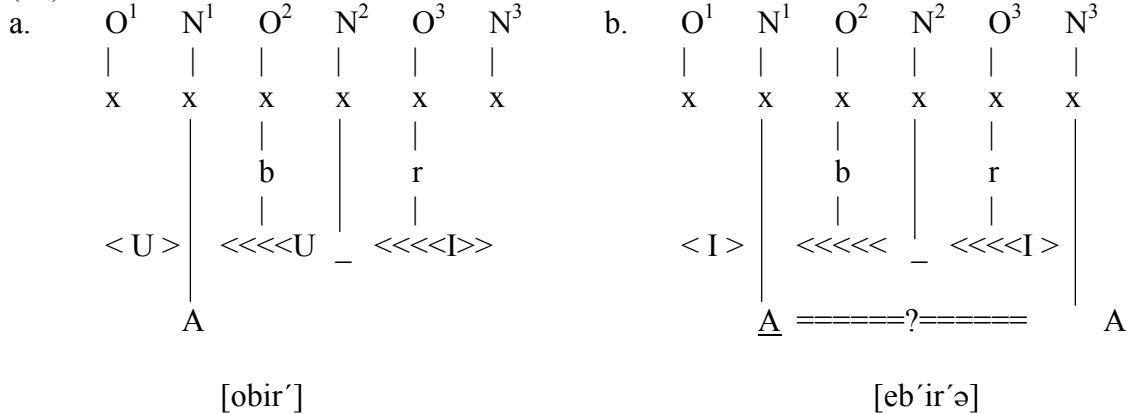
<sup>71</sup>There is more to the Connemara facts than meets the eye. While the [sop / sep'] alternation suggests that 'I' and 'A' combine freely, the front low vowel seems to follow the Munster pattern viz. [f'æ:r / f'ir']. However, the behaviour of Connemara [e:], which will be discussed in the following chapter, will show that the [sop / sep'] alternation is more representative of the element combinability settings in that dialect than [f'æ:r / f'ir'].

Thus the form [eb'ir'ə] will be predicted by this analysis only if the initial empty onset O<sup>1</sup> bears a palatal specification. Recall that word-initial empty onsets in Irish are specified for one of the qualities palatalisation or velarisation (Gussmann (1986)). This specification is responsible, for example, for the quality of the consonant in the preceding definite article *an*. Thus the absence of palatalisation in the definite article in [ən obir'] "the work" suggests that the noun begins with a velarised empty onset which does not allow a change to [e].

It seems, however, that the genitive form has a similar representation as the verb "to work" *oibrigh* ([eb'ir'ig']) which clearly shows the palatalised quality of the initial empty onset. In the past form [d'eb'i'r'i:mər] *d'oibríomar* "we worked" and in [jeb'ir'ə mə] "I worked" the marker of the past tense is affected by palatalisation (Wagner (1964:303)). Notice that the reflex of the lenited [d] in [jeb'ir'ə mə] clearly indicates that the consonant is palatalised as the lenited reflex of a velarised [d] is [ɲ]. Thus the alternation [obir' / eb'ir'ə] is not regular and this analysis clearly points to the reason for this irregularity.

The phonological representations of the two forms are given below.<sup>72</sup>

(50)



These are clearly two different phonological representations. The main difference lies in the "across-the-board" application of palatalisation which is exceptional in Irish.<sup>73</sup> The fact that the initial onset is palatalised in ((50)b) is not irrelevant in the derivation of [e]. See,

<sup>72</sup>We could claim that we are dealing with long distance A-support in [eb'ir'ə] if we were to combine our results with what we already know about the behaviour of derived [e]'s. Given the exceptionality of this form in other respects, this additional stipulation has no real consequence.

<sup>73</sup>A similar exceptional example is provided by the forms [mak / m'ik'] *mac / mic* "son/gs.". First of all, a back [ɑ] is affected by palatalisation, and secondly, the initial onset is palatalised in the genitive case. It seems prudent not to try and account for such isolated examples.

however, the structures of [ri] and [ru] above for a justification for the unassociated element being shared with a nucleus.

### 2.3.8. "Opaque" segments and I/U- spreading

By "opaque" segments we understand objects which resist influence from elements which are provided by spreading. In Munster, such objects will not license 'I', 'U' and 'A', i.e. they will not be affected by these elements. In the previous sections a few such consonantal objects were alluded to, viz. empty onsets (e.g. [obir']), [h], and the word- initial [r]. In this section we will concentrate on "opaque" vocalic objects which refuse to license 'I' and 'U'. The data below illustrate this problem.

(51)

[kat']	<i>cait</i>	"cat-gs."
[bal'ə]	<i>baile</i>	"home"
[dar']	<i>dair</i>	"oak"
[skol']	<i>scoil</i>	"school"
[kof]	<i>cois</i>	"leg-dat."
[t'ep']	<i>teip</i>	"fail"
[g'et']	<i>geit</i>	"take fright"

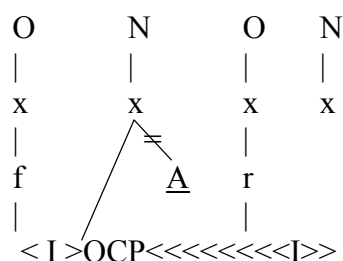
The data in ((51)) demonstrate a lack of interaction between palatalisation (I-spreading) and the nucleus containing the vowels [a], [o] and [e]. We have seen earlier that certain [o]'s are affected by this process e.g. [sop / sip'] *sop / soip* "wisp/gs.". On the other hand, [a] could be affected only if reduced to a schwa-like vowel e.g. [ʃi'naχ / 'ʃunig'] *sionnach / sionnaigh* "fox/gs."

The forms with [e] require some additional explanation. We have speculated that this vowel may be treated as a phonetic effect when an A-head is sandwiched between two palatalised consonants, in which case the elements 'I' and 'A' do not fuse. However, our analysis of such forms predicts that the element 'A' is suppressed (cf. [f'ar / f'ir']) unless it finds support in the following nucleus containing 'A' (cf. [sp'el'ə]). Despite the fact that forms like [t'ep'] and [sp'el'ə] are different in that the former does not participate in

alternations involving quality changes of the following consonant, the lack of A-suppression in [t'ep'] constitutes an apparent counterexample to this analysis.<sup>74</sup>

The situation is saved to some extent, it seems, by the existence of [e / i] fluctuations, e.g. [l'et'ir' / l'it'ir'], which indicate that such nonalternating [e]'s tend to lose the element 'A'. One way of accounting for this phenomenon might be to assume that due to the OCP the nucleus becomes I-headed.<sup>75</sup> This gives us the following possibility of deriving [f'ir'] *fir* "man-gs."

(52)



Generally, it seems, the "opaque" vowels share one property, viz. the presence of the element 'A' which forms the head within the nucleus. This statement, although it constitutes a blatant contradiction to what is illustrated above, has some justification. Thus the difference between [o] in [sop], which alternates with [i], and the [o] in [skol'], which remains intact, may be accounted for in terms of headedness. Namely, the alternating [o] is not headed, and hence liable to 'I' and 'U' spreading, while the nonalternating [o] is A-headed and immune to spreading. In fact, A-headedness itself need not be evoked here, and the notion of headedness in general may suffice to correlate the behaviour of "opaque" short vowels with long ones. Recall that long vowels are generally immune to palatalisation spreading, and at the same time they are headed.

In order to be able to include the [f'ar / f'ir'] alternation in this system it would be enough to propose that the front low vowel [a] is not headed. Then the [a/i] alternation would conform to the pattern of [sop / sip'] *sop / soip* "wisp/gs.". An additional advantage of this move is that the absence of A-suppression in forms like [t'ep'] *teip* "fail" is no longer

<sup>74</sup>Alternatively, forms like [f'ar / f'ir'] might be claimed to be exceptional. Note that the [æ:/i] alternation is also problematic in Connemara.

<sup>75</sup>Parallel to this the fluctuation [knok / knuk] might be understood as construing the nucleus as U-headed.

exceptional. Representationally, the information concerning the possibility of A-suppression in [f'ir'] will be present in the nucleus (C'AC'), i.e. in the headless nature of the expression, rather than dependent on an arbitrary application of OCP (see ((52)) above). The representation of [t'ep'] could be then characterised by the presence of a headed 'A' (C'AC'), if the view that [e] is phonetic is to be maintained, or an A-headed compound (C'I.AC').

The speculation that [a] is a headless vowel allows us to understand its behaviour with respect to palatalisation spreading, which is the major process affecting nuclei in Irish. However, this interpretation poses a few questions concerning the place of [a] in the vocalic system of Munster and its interaction with other processes such as U-spreading, which, although less spectacular and problematic, still occupies a respectable position in the system constructed here.

The first question that suggests itself concerns the headedness or headlessness of the nuclei containing the element 'A' in [a] and also in [ɑ]. Distributionally, it may seem suspicious if we say that we have A-headed nuclei when preceded by a velarised onset, e.g. [ɑ] in [mak] *mac* "son", and headless ones when the nucleus follows a palatalised onset, e.g. [f'ar]. One may ask what exactly prevents the opposite situation, i.e. (f'Ar) and (mAk)? Is the headless (A) meant to palatalise [m] in (mAk) to make sure that the distributional facts (C'A...) are correct? Or is [m] meant to make sure that 'A' becomes headed to obtain the correct form [mak] (CA...)? These somewhat naive questions have to be answered if we want to avoid making arbitrary claims about segmental distribution in Irish.

This is where our system comes into play. Note that apart from 'I' spreading we recognise the spreading of the element 'U' which also affects headless nuclei (cf. [g'ulə] *giolla* "servant"). Thus, if a headless (A) finds itself between two velarised onsets, it is liable to spreading of 'U', which yields [o], i.e. an U-A combination. This is the same [o] which participates in the [o/i] alternation e.g. [sop /sip'].<sup>76</sup> It goes without saying that the headed (A) in [mak] will not be affected by U-spreading, as headed nuclei are immune to element spreading ("opaque"). Parallel to [sop] and [g'ulə] (note that in the latter the first onset is palatalised!) we may expect that the element 'A' in the C'AC context will be susceptible to

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<sup>76</sup>More on the structure of Munster nuclei and the derivation of surface forms will be found in the following section (2.4). Note, however, the advantage of this analysis in that it treats the [o] in [sop] as derived by U-spreading. In this light the [o/i] alternation no longer looks like an arbitrary substitution of both 'U' and 'A' for 'I', but rather a case of interaction between 'I' and a headless 'A' which results in A-suppression.

similar developments, i.e. if the nucleus is A-headed, it will remain unaffected by U-spreading, while a headless (A) should yield [o]. It seems that this pattern is borne out in Munster with a vengeance, although in a slightly disturbing way, as it brings us back to square one with respect to forms like [f̃ar].

The forms in ((53)a) illustrate [a]'s which resist U-spreading parallel to [a] in e.g. [møk] and for that reason will be viewed as headed. On the other hand, the data in ((53)b) show headless [a]'s which are affected by U-spreading parallel to [sop].

(53)

a.	[f̃ar]	<i>fear</i>	"man"	*[f̃or]
	[l̃ak]	<i>leac</i>	"stone"	*[l̃ok]
	[ñad]	<i>nead</i>	"nest"	*[ñod]
b.	[b̃og]	<i>beag</i>	"small"	*[b̃ag]
	[d̃okir̃]	<i>deacair</i>	"difficult"	*[d̃akir̃]
	[d̃oχ]	<i>deoch</i>	"drink"	*[d̃aχ]

In this analysis, the difference between [f̃ar] and [b̃og] is attributed to the status of the element 'A' in the nucleus, i.e. to the fact that in [b̃og] the nucleus is headless and liable to U-spreading, while the immunity of [a] to U-spreading is put down to the headed status of the element 'A' in that nucleus. The nuclear structures of [f̃ar] "man" and [b̃og] "small" are provided below for comparison.

(54)

a.	O	N	b.	O	N
	x	x		x	x
	<<I>>	/<<U		<<I(//)	<<<U
		<u>A</u>			A
	[f̃ar]			[b̃og]	

The absence of A-suppression in [b'og] is predicted by the fact that 'U', unlike 'I', spreads as an operator. Thus, both 'A' and 'U' are licensed as operators in this nucleus and the context for suppression is not met.<sup>77</sup>

It is hoped that the above analysis clearly demonstrates that the general view that "opaque" vowels are headed may be maintained. In this respect, the alternation [f'ar / f'ir'] appears to be troublesome if not exceptional. Naturally, the claim that the nucleus in such forms is headless has more appeal with respect to palatalisation facts; however, if the spreading of 'U' is part of the system then it should not be ignored, and one must look for an explanation of [f'ar / f'ir'] elsewhere.

One promising line of investigation is the correlation of forms like [sp'al / sp'el'ə] *speal / speile* "scythe/gs." (where [sp'al] corresponds to [f'ar] and [sp'el'ə] is analogous to [t'ep']) with the composition and decomposition phenomena involving the long vowel [e:], e.g. [k'ial / k'e:l'ə] *ciall / céille* "sense/gs." (composition in C'-C') and [f'iar / f'e:r'] *féar / féir* "grass/gs." (decomposition in C'-C). This point will be taken up in chapter 3 which is devoted to long vowels.

### 2.3.9. Summary

The following picture of the Munster vocalic system emerges from our analysis so far. Concerning the phonological representation of Irish short nuclei, we have distinguished two major groups viz. *headed* and *headless*. The former are immune to element spreading from the right, while the latter readily interact with the spreading of the elements 'I', 'U' and 'A' (cf. Demirdache (1988)). Of these, 'I' and 'A' seem to become (be licensed as) the head of the target object, while 'U' becomes the operator.

I/U- spreading differs from "A-harmony" effects in general in that the latter is dependent on internuclear relations, and hence subject to the same conditions as Proper Government, which, in addition to the restriction that 'A' may physically spread only to headless nuclei, contributes to the complexity and restrictiveness of "A-harmony" in Irish. Nonetheless, as suggested in 2.3.5, the effects of "A-harmony" may be reduced to one process of A-spreading, which still differs from that of I/U-spreading.

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<sup>77</sup>This point will be clarified in the following section.

The reason for the 'I-U' asymmetry lies in the nature of the spreading, as 'I' becomes the head of the affected nucleus while 'U' seems to be spread as an operator.

Additionally, our analysis captures the relation between the I/U specification of consonants and I/U spreading on the one hand, and the stringent restrictions on the distribution of the vowels [i] and [u] ((\*C'uC'), (\*CiC)) on the other.

In the following section, a closer look will be taken at the interaction of elements in the vocalic system of Munster. We will try to define the vocalic alternations and indeed the whole vocalic system in terms of licensing properties of elements (Cobb (1993), Charette and Göksel (1994/96)).

#### 2.4. Licensing constraints in vocalic systems.<sup>78</sup>

In Government Phonology vocalic objects are viewed as realisations of the elements 'I', 'A', 'U' which, if pronounced independently, yield the simplex vowels [i], [a] and [u] respectively. The elements may combine to form compound expressions, for example, the combination (A.I) yields [e] and (I.U.A) gives [ø]. The combinations are asymmetrical in that the elements in combination find themselves in a head/operator relation. In the standard element theory (KLV (1985)), the asymmetry is illustrated by two isomeric compounds involving 'I' and 'A', of which the I-headed combination (A.I) corresponds to phonetic [e], while the A-headed compound yields [æ].<sup>79</sup> However, individual languages do not exploit all the combinatorial possibilities among elements. For instance, Polish does not seem to possess the contrast between [e] and [æ], which means that one of the combinations involving 'I' and 'A' is not present in the system. Given that the three elements 'I', 'U', 'A' may combine freely (the question of ATR contrast aside) we should expect a total of 12 underlying vocalic objects in a given system, a rather unlikely possibility.<sup>80</sup>

To avoid this undesirable outcome, languages select only some combinatorial possibilities. For example, a language which lacks front rounded vowels does not allow the elements 'I' and 'U' to combine. In autosegmental terms this is understood by viewing the I/U (or BACK and ROUND) tiers as fused (KLV (1985), Rennison (1987, 1990)). In the recent

<sup>78</sup> This section draws on Cobb (1993), Denwood (1993) and Charette and Göksel (1994/96).

<sup>79</sup> More recently Charette and Kaye (in [prep.]) suggest that [æ] is in fact a headless (A.\_).



development of the element theory (Charette and Kaye (in prep.), Cobb (1993), Charette and Göksel (1994/96)) this device is replaced by a set of stipulations of a parametrical nature which state, for example, that the elements 'I' and 'U' do not combine in a given language. Such a stipulation belongs to a set of "licensing constraints" (LC) which aim to define the combinatorial possibilities of elements and in this way restrict the number of representations. Such constraints should additionally throw light on phonological phenomena affecting vowels.

At first sight, the replacement of the notion of tier conflation with a mere set of stipulations or conditions on element combinations may seem arbitrary and of little theoretical impact. However, one possible advantage that "licensing constraints" may bring to phonological analysis is that they may unify such a notion as tier fusion with other conditions on element combinations holding in linguistic systems. In other words, apart from stating which elements cannot combine at all, licensing constraints may additionally define the conditions underlying the existing combinations.<sup>80</sup> For example, in a language in which 'I' and 'U' may combine, the combination of these elements will yield [ü] irrespective of which element acts as the head and which one is the operator (KLV (1985)). It is only through a careful analysis of the phonological behaviour of the whole vocalic system of such a language that we can decide on the correct representation of [ü]. If the system suggests that e.g. 'U' must always be a head in vocalic expressions then the vowel [ü] cannot be represented as a compound \*(U.I) in which it would be I-headed. Likewise, [o] may have the representation (A.U) rather than \*(U.A).

Ideally, if licensing constraints are to mean anything, they should fall out directly from the way the vocalic system of a particular language works. Additionally, being set as conditions on well-defined lexical representations, the constraints should not be overridden during the phonological derivation. One reason for such a restricted view is the notion of structure preservation which in GP is expressed by the Projection Principle discussed above (1.3) and repeated here for convenience.

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<sup>80</sup>The following objects are possible in such a system: (I), (U), (A), (U.I), (I.U), (A.I), (I.A), (A.U), (U.A), (U.A.I), (I.A.U), (I.U.A).

<sup>81</sup>Recently, a very interesting attempt has been made to salvage the autosegmental tiers in Government Phonology and avoid the need to refer to licensing constraints by proposing a model with tier geometry, which to some extent follows the proposals in Rennison (1987, 1990). The readers are referred to Backley (1995) and Takahashi (in prep.).

### PROJECTION PRINCIPLE

*Governing relations are defined at the level of lexical representation and remain constant throughout a phonological derivation.*

This principle ensures that phonological derivation cannot create new governing relations or alter the existing relations between two objects. Therefore if licensing constraints are to define the correct lexical representations of vocalic objects, they should remain constant throughout the phonological derivation (see however Cobb (1993)).

This declaration is particularly crucial if the notion of realisational autonomy (Harris and Lindsey (1993, 1995)) is to be maintained in GP. One of the implications of this hypothesis is that phonological representations are characterised by full interpretability at all levels of the derivation, and hence, the systematic level of phonetic representation is dispensed with. One way to understand this hypothesis is to view all derivation as taking place in the lexical representation as a result of the governing or licensing relations that are contracted there. Since phonological processes in GP take place under government or licensing which are defined at the level of lexical representation, we might ask whether there should be any difference between objects present lexically and objects derived by the phonological component.

Harris (1990b) views harmony processes in Pasiego Spanish as the result of licensing relations that obtain between vowels within harmonic spans. Thus the effects of vowel harmony are understood in this analysis to be due to the existing licensing constraints rather than a purely transformational operation of the phonological component on the lexically defined representation. Viewed in this way, vowel harmony does not derive objects in the generative sense, but rather constitutes part of their representation. In other words, the network of governing and licensing relations contributes to the lexical representation of nuclei in harmony languages.

### 2.4.1. The tense / lax distinction

One of the first steps when establishing the licensing conditions existing in a vocalic system is to find out if the objects exhibit tenseness contrasts. In the standard element theory the tenseness of vocalic expressions is expressed by the presence of the ATR element in their representation (KLV (1985)). This approach assumes that the ATR element contributes its positive charm value to the vocalic expression regardless of its status within a compound. The absence of low tense vowels is expressed in this framework by assigning a positive charm value to the element 'A' and the combination between the ATR element and 'A' is then excluded by the fact that elements of the same charm value are repelled.<sup>82</sup>

More recently charm has been abandoned and the ATR contrast between vowels has come to be expressed by the notion of the headedness and headlessness of vocalic expressions (Cobb (1993), Charette and Göksel (1994/96), Harris and Lindsey (1995)). Thus, tense vowels are now viewed as fully-headed, e.g. [i] = (I), where the active element forms the head, and lax vowels are empty-headed or headless, e.g. [ɪ] = (I\_), with the active element in the operator position. It is not clear, however, how the observation that low vowels are universally(?) non-ATR can be captured within this new approach. Logically, a headed 'A' should yield a tense vowel. This apparently never happens.<sup>83</sup>

The contrast between headed and headless vowels is typically found between long and short vowels respectively. This is the case in English where long vowels are analysed as fully-headed and short ones as empty-headed. The headedness of long vowels is assumed to be universal (Cobb (1993)). The tenseness contrasts are also found among short vowels.<sup>84</sup>

Before we try to propose the licensing constraints which define the Munster Irish vocalic system let us consider some existing analyses employing this device. Namely, we will look at the vocalic systems of a few Altaic languages such as Uyghur (Cobb (1993)), Turkish and Sakha (Charette and Göksel (1994/96)) which exhibit remarkably similar characteristics to Irish.

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<sup>82</sup>One problem with such a procedure is that a nasal low vowel should be made impossible as both 'A' and 'N' (nasality) are assumed to be positively charmed.

<sup>83</sup>KLV (1985: 314) vaguely allude to the existence of ATR [a], which, however, seems to be marked.

<sup>84</sup>See Harris and Lindsey (1995) for a reanalysis of ATR harmony (e.g. Clements (1981)) within this model).

### 2.4.2. Licensing constraints in Altaic

We saw earlier in section 2.3.3 that in Irish the element 'A' succumbs to the same licensing conditions as it does in Uyghur (Denwood (1993)). One of the conditions states that 'A' must be licensed by the following nucleus containing the same element. For this reason, given that the problem of the phonological behaviour of 'A' in Irish is crucial to the whole analysis of this language, it seems prudent to examine such systems as Uyghur in some more detail

The most prominent feature of the languages to be considered below is that they exhibit vowel harmony. Thus formally these languages seem to be quite distinct from Irish in which only traces of A-harmony are to be found (2.3.5). However, the comparisons between Irish and the Altaic languages will be made at the level at which only the element interaction will be important, while the nature of element spreading - vowel harmony or C-V interaction, rightward or leftward - remains immaterial. Thus what is crucial is how the target vowel is affected by the incoming element. We begin with a brief illustration of the way in which licensing constraints can define the vocalic system of Uyghur (Cobb (1993)).

Cobb proposes that the following three licensing constraints on element combinations hold for Uyghur.

(55)

- a.  $(\_)$  *licenses no operators*
- b. 'A' *licenses no operators*
- c. 'U' *must be head*

The first constraint expresses the idea that any element must either be headed or licensed by another "full" element. This reduces the inventory of vocalic objects in Uyghur to only headed ones plus an empty head denoting the empty nucleus. The second constraint excludes complex A-headed objects, i.e.  $*(I.\underline{A})$ ,  $*(U.\underline{A})$  and  $*(I.U.\underline{A})$ , but not  $(\underline{A})$ . And finally, the third constraint defines all combinations involving the element 'U' as U-headed.

The resulting system of Uyghur contains 8 objects listed below (Cobb (1993:59)):

(56)

- [ɨ] ( )<sup>85</sup>
- [i] (I)
- [a] (A)
- [u] (U)
- [e] (A.I)
- [o] (A.U)
- [ü] (I.U)
- [ö] (A.I.U)

To see how licensing constraints allow for explanations of the mechanisms in which vowels are involved we will consider the analyses of Turkish and Sakha, languages which are related to Uyghur (Charette and Göksel (1994/96)).<sup>86</sup> Their analysis will prove particularly useful for the understanding of the Irish facts.

Charette and Göksel propose to define the vocalic systems of Standard Turkish, and Sakha (Yakut) using very similar licensing constraints as Cobb did for Uyghur.

(57)

- | Charette and Göksel (1994/96)        | Cobb (1993)                         |
|--------------------------------------|-------------------------------------|
| a. <i>operators must be licensed</i> | a. ( ) <i>licenses no operators</i> |
| b. 'I' <i>licenses no operators</i>  | b. 'A' <i>licenses no operators</i> |
| c. 'U' <i>must be head</i>           | c. 'U' <i>must be head</i>          |

It is clear that only the constraints in ((57)b) are substantially different, which is enough for the systems to exhibit slightly different characteristics. The systems are given below:

<sup>85</sup> The empty nucleus ( ) surfaces as [ɨ] if realised phonetically.

<sup>86</sup> Cobb's analysis indeed deserves more attention as it brings up such important issues connected with the licensing constraints as the problem of Structure Preservation. Due to lack space we bypass these issues here. However, the reader is urged to consult (Cobb (1993, 1997)).

(58)

Turkish, Sakha

Uyghur

( )

( )

(I)

(I)

(A)

(A)

(U)

(U)

(I.A)!

(A.I)

(A.U)

(A.U)

(I.U)

(I.U)

(A.I.U)

(A.I.U)

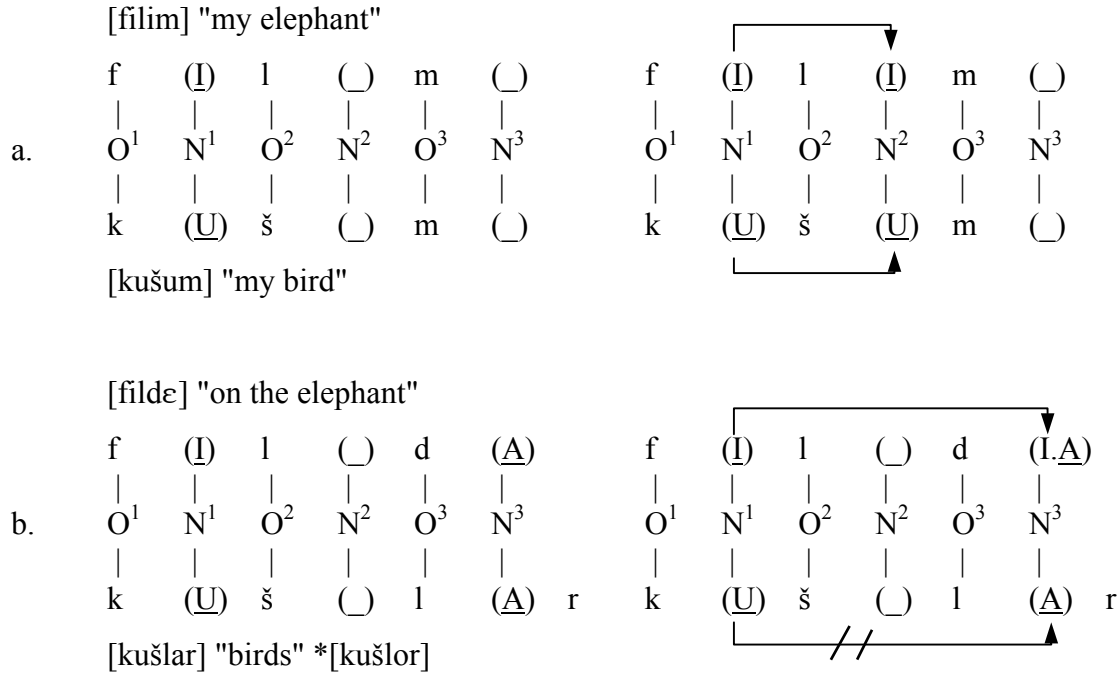
The only real difference between the two systems concerns the representation of the vowel [ε]. Let us now look at the way the constraints proposed by Charette and Göksel account for the vowel harmony phenomena.

The Altaic languages discussed in this section display vowel harmony where the elements 'I' and 'U' spread to the following nucleus. Just as in Uyghur (Cobb (1993)), Charette and Göksel found that the complex objects in recessive nuclear positions are all derived by I/U-harmony from simplex representations (A) and ( ). There are, however, certain conditions on how the elements 'I' and 'U' spread, i.e. are licensed in the recessive nuclei. Generally, both elements spread as heads to ( ). On the other hand, (A) is affected in different ways depending on the language. In Standard Turkish, (A) may only be harmonised by 'I', yet this element may not be licensed as the head of that expression but rather as the operator.<sup>87</sup> The structures in ((59)) are adapted from Charette and Göksel (1994/96) and illustrate the Standard Turkish I/U-harmony effects. The nucleus N<sup>3</sup> in ((59)a) is licensed domain finally while N<sup>2</sup> must be realised and undergoes harmony. In ((59)b) N<sup>2</sup> is licensed through Proper Government from N<sup>3</sup> and remains unrealised.

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<sup>87</sup> The two facts, namely, that both an empty-head and a headed (A) can be harmonised, as well as the nature of I-spreading once as a head and once as an operator are in sharp conflict with the conditions on harmony proposed by Demirdache (1988). Later we will see that the Irish facts are more in line with the latter work.

(59)

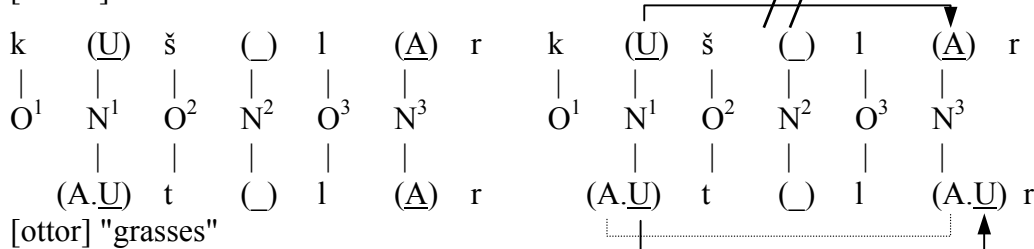


((59)a) shows that ( ) can be harmonised both by 'I' and by 'U', where the spread element assumes the head position of the affected nucleus. On the other hand, in the case of (A) in the recessive nucleus ((59)b), only 'I' can spread, however, it is licensed in N<sup>3</sup> as the operator. As to the absence of U-harmony in ((59)b), the licensing constraints proposed by Charette and Göksel seem to offer a neat explanation. Recall that one of the constraints says: *'U' must be head*. Clearly, N<sup>3</sup> in [kušlar] cannot contain two heads. But the licensing constraints proposed for Turkish offer additional predictions concerning U-harmony. Firstly, unlike 'I', 'U' cannot be licensed as the operator in N<sup>3</sup> as this would produce an unattested object \*(U.A). Secondly, one can think of another potential outcome, namely, that the status of the element 'A' in N<sup>3</sup> is switched to the operator, thus allowing for the licit object (A.U) to be constructed. Although this does not happen in Turkish, Charette and Göksel claim that it is possible in other languages. Moreover, their analysis of Sakha shows that the two languages differ precisely in terms of the presence or absence of such status switching. Let us now turn to the Sakha facts

Sakha and Turkish differ only with respect to U-harmony, in that in Sakha 'U' may spread to (A). The phenomenon, however, exhibits a rather strange conditioning. Namely, 'U' spreads to (A) from [o] and not from [u].

(60)

[kuštar] "birds"



( ——— ) - bridge

( —→ ) - spreading

Charette and Göksel claim that the presence of spreading in [otlor] is not accidental and is connected with the presence of the element 'A' in the governing nucleus. The two elements form a bridge which could be due to OCP. The elements in N¹ and N³ are aligned, i.e. the status of the element 'A' is switched to the operator status in N³.<sup>88</sup> Thus the bridge between the two nuclei facilitates U-harmony and the resulting object is licit, i.e. it observes the licensing constraints established for Sakha.

The reader will have noticed that the bridge phenomenon in Sakha resembles the A-support phenomenon in Munster Irish (2.3.3) in which the same mechanism facilitates the construction of [e] in [sp'el'ə] *speile* "scythe/gs."<sup>89</sup>

To summarise the similarities between the Altaic languages and Irish we may note the following parallelisms:

First of all, it appears that the I/U-harmony in Altaic is comparable to I/U-sharing or spreading in Irish in that in both types of systems the respective mechanisms define the representation of vowels by licensing 'I' or 'U' in the nucleus. Additionally, in both cases, we are dealing with asymmetries concerning the phonological behaviour of 'I' and 'U'. Compare, for example, the constrained operation of U-harmony in Turkish with the fact that U-spreading in Irish also seems to be less prominent.

Another major similarity is that concerning the behaviour of the element 'A' with respect to the incoming elements. We saw earlier that, like in Uyghur, certain conditions must be met for 'A' to be licensed in Irish nuclei.<sup>90</sup> Thus, the phenomenon of A-support in

<sup>88</sup> See Charette and Göksel (1994/96) and Harris and Lindsey (1995) for more details concerning head alignment and its use in analyses of ATR harmony.

<sup>89</sup> Compare also the A-licensing conditions proposed for Uyghur in Deanwood (1993).

<sup>90</sup> Hence both Uyghur and Irish exhibit [a] - [i] alternations.



Irish (2.3.3) finds a counterpart in the A-licensing conditions proposed in Denwood (1993) for Uyghur, as well as in the A-bridge mechanism in Sakha (Charette and Göksel (1994/96)). Clearly, then, A-suppression in Irish must be due to some licensing constraints with operate in this system.

Having seen how licensing constraints can define vowel systems in terms of their inventory as well as their participation in vowel harmony processes, let us now turn back to the Irish vocalic system. First, we will consider the question of the tense / lax distinction in Irish.

### 2.4.3. Irish vowels and the headed / headless distinction

The previous analysis of the Munster Irish vocalic system (2.3) points to the headless nature of most underlying short nuclei. Their headedness, however, seems to be derived by such processes as 'I' and 'A' spreading. Additionally, it appears that the only lexically headed vowels are those containing the element 'A' as the head. However, headedness does not seem to correspond phonetically to tenseness in Irish.<sup>91</sup>

Sjoestedt-Jonval (1938:68) observes that Irish long vowels are tense, while short vowels may be tense or lax depending on whether they are stressed or not and on the specification of the flanking consonants. Let us look at some cases of fluctuation in the tenseness of short stressed vowels.

(61)

	<i>tense</i>		<i>lax</i>			
i - ɪ	[il'ə]	-	[ɪl'ə]	<i>uile</i>	"every"	VC'
	[ɪjk'ə]	-	[ɪjk'ə]	<i>uisce</i>	"water"	
			[dm'ə]	<i>duine</i>	"man"	CɪC'
			[f'ɪs]	<i>fios</i>	"knowledge"	C'ɪC
	[gl'ik']			<i>glic</i>	"clever"	C'ɪC'
u - ʊ	[ən uməd]	-	[ən' ʊməd]	<i>an iomad</i>	"great number"	CuC/C'ʊC
	[unəs]	-	[ʊnəs]	<i>ionas</i>	"so that"	

<sup>91</sup>John Harris rightly pointed out to me that since ATR is no longer treated as a category, we should not expect that phonological headedness will always imply phonetic tenseness.

The tense variety of the high front vowel requires that both flanking consonants be palatalised e.g. [gl'ik']. Otherwise, especially in the VC' context, fluctuations are expected e.g. [i]k'ə / ɪ]k'ə]. The case of high back vowels seems to be parallel, i.e. [u] is perceived as tenser when flanked by two velarised onsets, and as more open and centralised when the preceding onset is palatalised (Sjoestedt (1931:87)).

The conclusion is that whatever the status of the elements involved in the segmental make-up of these vowels, ATR contrasts are irrelevant. This does not mean that the distinction headed/headless does not exist (see "opaque" segments).

It is interesting to note how the phonetic tenseness of [i] and [u] which depends on the context, i.e. C'-I-C' and C-U-C (((61)) above), could be correlated with the raising of mid to high vowels when the backness of these vowels corresponds to the quality of both flanking consonants e.g. C'-e-C' and C-o-C. In such contexts the mid vowels tend to lose the element 'A' which produces raising to [i] and [u] respectively. First, consider the data below.<sup>92</sup>

(62)

e - i	[f'ek'im'] - [f'ik'im']	<i>feicim</i>	"I see"
	[l'et'ir'] - [l'it'ir']	<i>leitir/litir</i>	"letter"
	[d'en'im'] - [d'in'im']	<i>deinim</i>	"I do"
o - ɪ	[krok'ən] - [kɾɪk'ən]	<i>croiceann</i>	"skin"
o - u	[knok] - [knuk]	<i>cnoc</i>	"hill"
	[loxɾ] - [luxɾ]	<i>locht</i>	"fault"

Schematically, the raising phenomenon may be illustrated in the following way.

(63)

$$\begin{array}{ccc} C^I - \underline{I} - C^I & & C^U - \underline{U} - C^U \\ = & & = \\ A & & A \end{array}$$

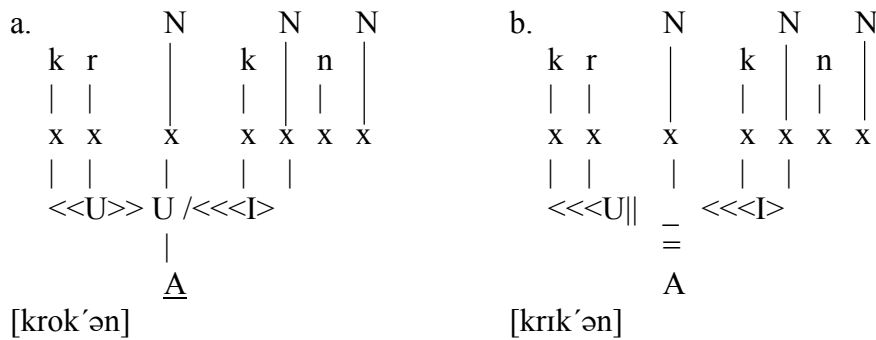
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<sup>92</sup>All these variants may be understood as stemming from fluctuations in headedness induced by the environment.

If the surface tense / lax distinction, as in [ɪl'ə / il'ə] *uile* "every" ((61)), may be connected with the phonological headed / headless distinction (contingent on the specification of the flanking consonants), then one might hazard the guess that in e.g. [f'ik'im'] and [knuk] the elements 'I' and 'U' of the nuclei are construed as the head in these forms, and that this head in some way induces A-suppression. This hypothesis would not only agree with the tenseness facts concerning high vowels ((61)), but also with what we already know about A-suppression (see [sop / sip'] and [f'ar / f'ir']). Nonetheless, in a situation when we cannot decide whether the tensing of high vowels in ((61)) reflects the status of 'I' and 'U' as heads or whether it is a mere phonetic effect, the raising phenomena cannot be viewed as obvious, although they are clearly indicative of something.<sup>93</sup>

Having found that "opaque" vowels are A-headed and only non-headed vowels can be affected by spreading, the case of [krok'ən - krɪk'ən] *croiceann* "skin" (((62)) above) is particularly instructive as it indicates that indeed a shift of headship from 'A' to 'I' or 'U' leads to suppression. The difference between the phonological representations of [krok'ən], with "opaque" [o], and [krɪk'ən] which behaves like [sip'] is illustrated below.

(64)



In [krok'ən], palatalisation spreading is blocked due to the fact that the nucleus is A-headed.<sup>94</sup> On the other hand, in [krɪk'ən] the first nucleus is construed as headless and hence

<sup>93</sup>With respect to the raising to [u] in [knuk], the interpretation involving headedness of the element 'U' in the C-U-C context provokes the question of what is responsible for the status of this element. Recall that 'U' spreads as an operator.

<sup>94</sup>In structure (a) above, we tried to reflect the fact that the nucleus has to contain 'U' which may undergo OCP with the "shared" element. The reason is, that an A-headed nucleus may not combine with anything that is not present underlyingly in that nucleus. Otherwise, there would be no contrast between the first nucleus in [krok'ən] and that in [ban'ə] *bainne* "milk" (i.e. we should expect \*[bon'ə]).

liable to interaction with I-spreading. It is then important to assume that spreading does not switch the status of the element 'A'.

Generally, we may maintain the following view of the Irish vocalic system: short vowels are either headless or headed and the distinction is revealed by the way they are affected by 'I', 'U' and 'A' spreading; only headless vowels are affected (cf. Demirdache (1988)).

One result which follows from the above analysis is that Munster Irish has a peculiar restriction concerning I/U-headed vowels, to the effect that the element 'A' may not be licensed (present) in such nuclei. Additionally, the headedness of 'I' and 'U' seems to be derived<sup>95</sup> (contingent on the environment), while headed 'A' is found in both contexts, i.e. velarised ([mak] *mac* "son") and palatalised ([t'ep'] *teip* "fail"). This dependence of 'I' and 'U' is reflected in the distribution of [i] and [u] (recall \*CiC and \*C'uC'). If 'I' and 'U' could be headed lexically, independently of the environment that is to say, then we should expect forms like \*CiC and \*C'uC' to be licit as indeed they are when the vowels are long (headed) e.g. [ki:səχ] *cuíosach* "fairly good" and [k'u:n'] *ciúin* "calm".<sup>96</sup>

We will now try to define the phenomena involved in vocalic transitions by means of parameters on element combinations along the lines proposed in Cobb (1993) and Charette and Göksel (1994/96).

#### 2.4.4. Licensing constraints and Munster alternations

In what follows we will try to demonstrate that the vocalic system of Munster Irish can be fairly accurately defined in terms of licensing constraints, i.e. conditions on element combinations. However, although the constraints to be proposed below define all the existing vocalic objects, it seems that the actual phonological inventory is even smaller.

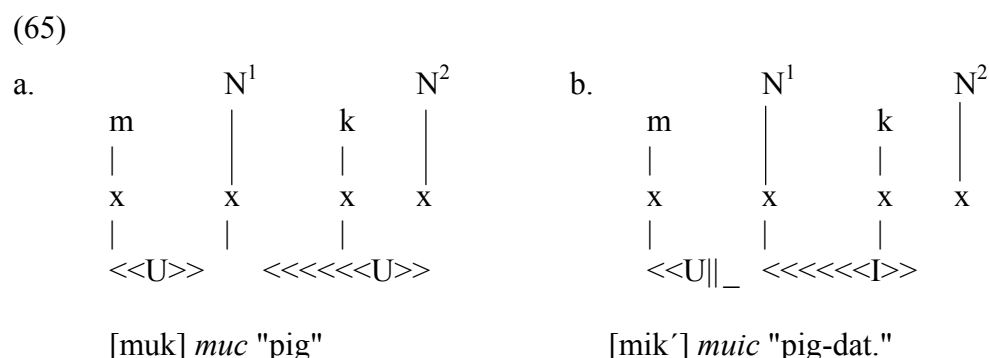
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<sup>95</sup>Later in this section we consider the question of the derivation of vocalic objects. The word "derived" is not meant to express a dynamic process here, but rather the fact that part of the specification of Irish nuclei is defined by the type of environment to which the nucleus belongs.

<sup>96</sup>This argument may not be strong enough given that long vowels have a different structure, i.e. a branching nucleus, which may be responsible for the distribution discrepancies. However, in chapter 3 it will be argued that Irish long vowels have a structure of two consecutive nuclei rather than a branching one, in which case the structural argument becomes irrelevant, being outweighed by the substantive factor (melody).

Let us begin by looking at the high vowels and the interaction between the elements 'I' and 'U'. On the basis of the distributional restrictions concerning the high vowels (\*Ci, \*C'u, \*CiC, \*C'uC'), their regular participation in vocalic alternations induced by element spreading, and the apparent irrelevance of tenseness contrasts, it will be assumed that underlyingly the high vowels are empty-headed (headless). The actual derivation of high vowels should be divided into two distinct categories. The first one involves the "restricted" nuclei in monosyllabic words ([b'i] *bith* "existence" and [pu] *puith* "breeze"), where no other source of elements is present (no I/U spreading) and the nucleus licenses the element shared with the preceding onset (due to the *Sharing Condition*).<sup>97</sup> Note that an A-headed nucleus may follow both palatalised and velarised onsets, e.g. [l'a] *leath* "part", [da] *dath* "colour".

Quite a different treatment of the shared element is found in the second category of forms in which I/U spreads from the right-hand context. This is illustrated by the alternation [muk / mik'] *muc* / *muic* "pig/dat.". (65)



(||) buffer to further spreading

We will adopt the view that in such forms it is the spread element that defines the shape of the nucleus. If the spread element happens to be identical to the shared one (e.g. [muk]), then we expect OCP to take effect. On the other hand, forms like [mik'], as well as [p'ubər] *piobar* "pepper", show that the incoming (spread) element does not fuse with the shared one, while the latter forms a buffer to further spreading.<sup>98</sup>

<sup>97</sup>Such empty-headed nuclei must not be confused with empty nuclei which have no melodic content and do not share an element with the preceding onset (cf.  $N^1$  and  $N^2$  in *muic*). This distinction explains why nuclei like  $N^1$  are not properly governed in forms like *muice* "pig-gs." and also accounts for palatalisation spreading across empty nuclei e.g. [soləs / si:l'ʃə] *solas* / *soilse* "light/pl."

<sup>98</sup>To emphasise this point we may use the palatal and labial glides in the phonetic transcription e.g. [m<sup>w</sup>ik'] and [p<sup>l</sup>ubər].

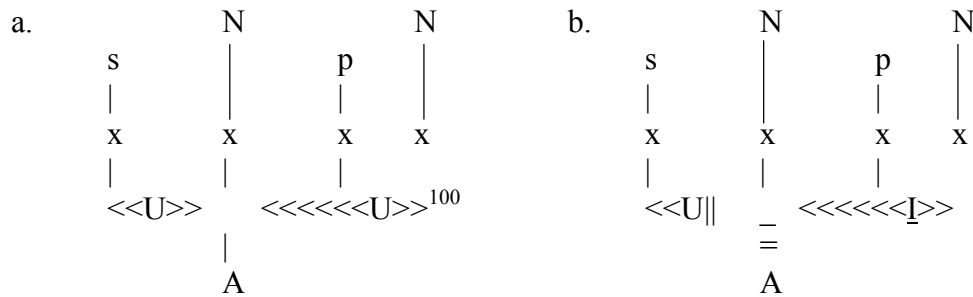
It seems to be generally true about Irish that the elements 'I' and 'U' do not combine, hence \*[mük'] and \*[p'übər] are not expected, and this follows from the structures presented above. Leaving aside the question whether this fact needs to be expressed in terms of any additional stipulation on element combinations, we will capture the lack of I-U combinations in Irish by the following licensing constraint.

LC1 - 'I' and 'U' do not combine

This constraint accounts for the interaction between 'I' and 'U' not only in the alternations involving the high vowels, but also the mid ones to which we now turn.

In accordance with our views on "opaque" vowels, those mid vowels which participate in alternations will be assumed to be headless similar to [i] and [u]. Let us consider again the alternation [sop / sip'] which at first blush looks like an arbitrary replacement of the compound (U.A.)<sup>99</sup> with the element 'I'. So far, we are in a position to understand the "replacement of 'U' (as per LC1). What remains to be defined is the nature of the A-suppression. Recall that 'I' spreads as the head into headless nuclei.

(66)



The difference between ((66)a) and ((66)b) lies in the nature of 'I' and 'U' spreading. Recall that 'U' seems to spread as an operator and 'I' as a head. The [o/i] alternation follows the pattern established for the high vowels as regards the interaction between 'I' and 'U'. In this case, however, both 'U' and 'A' may not be licensed in the nucleus to which 'I' spreads and assumes the head position.

<sup>99</sup>The compound is headless because otherwise we would not expect interaction with palatalisation spreading (cf. (U.A) in [kof] *cois* "leg/dat.")

This time we may not propose the same type of constraint as LC1, and say that 'I' and 'A' do not combine in Irish because we have found that the compound (I.A) is required in this system if only to be able to account for the presence of long [e:]. What we may say to define the A-suppression above is that 'I' does not license operators.

LC2 - *'I' does not license operators*

Notice that LC2, in a way, excludes LC1 (it makes \*(U.I) illicit) which may mean that only one of the constraints is true. However, LC2 itself does not exclude the possibility of deriving front rounded vowels completely, as (I.U) is still possible. Let us now see what types of objects are defined by the two constraints and consider the relation between the constraints and the actual phonological structure of Irish nuclei that we want to propose here.

#### 2.4.5. The structure of Irish short nuclei

The analysis presented above led to the establishment of the following two constraints.

LC1 - *'I' and 'U' do not combine*

LC2 - *'I' does not license operators*

However, to be able to account also for raising phenomena like [knok - knuk], and to exclude the (I.U) combination mentioned above, one might want to modify LC2 to include 'U':

LC1 - *'I' and 'U' do not combine*

LC2 - *'I' and 'U' do not license operators*

Let us first observe how these parameters define the vocalic system of Irish and what kind of vocalic inventory results from them:

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<sup>100</sup>Here too we assume that the spread element combines with the headless 'A'. Recall examples like [d'ox] *deoch* "drink" and [b'og] *beag* "small" which clearly show that the headless 'A' fuses with the spread element rather than with the shared one.

(67)

<i>headed</i>			<i>non-headed</i>	
a. (I)	b. *(A.I)	c. *(I.U.A)	d. (I._)	e. *(U.I._)
(U)	*(U.I)		(U._)	*(A.U.I._)
(A)	*(I.U)		(A._)	
(I.A)	*(A.U)		(A.I._)	
(U.A)	*(A.U.I)		(A.U._)	
	*(A.I.U)		( )	

The objects grouped under ((67)a) and ((67)d) are made possible by the system of constraints proposed in this analysis. Before we discuss the correspondence between the licit headed and headless objects we should first take a look at the two constraints proposed above. It was mentioned earlier that they are very similar, and even mutually exclusive to some extent. The LC2 eliminates the objects listed under ((67)b) from the vocalic inventory and ultimately accounts for the vocalic alternations in Munster Irish, while what is left for the LC1 to do is to exclude \*(U.I.A) ((67)c) as well as \*(U.I.\_) and (A.U.I.\_) ((67)e). Thus, the question is if we should retain the LC1, or could the restriction on I-U combinations follow from something else? The proposal which we will make below seems to get round that problem partially in that it accounts for the headless objects involving 'I' and 'U' without having to resort to the LC1. Let us consider first the headed and then the headless objects listed above and try to further reduce the inventory in ((67)).

One inevitable observation concerning the licit phonological objects listed in ((67)a) and ((67)d) above is that the inventory seems to be too numerous for a restricted and impoverished vocalic system like Irish. Ought we to further narrow the system by proposing additional constraints, or are some of these forms derivable from the phonological context, in which case they do not need to be postulated as part of the vocalic system, which would be independent of the environment?

The headed objects of ((67)a) seem to be justified by the fact that they neatly correspond to the long vowel series [i:, u:, a:, e:, o:]. However, in short vowels, the headed (I) is found in the contexts (C'-I-C') and (C-I-C') and is contingent on the spreading (licensing) from the right-hand context. (U), on the other hand, is only found only in the



context (C-U-C), while in (C'-U-C) it seems to be licensed as an operator (e.g. [b'og] *beag* "small" and not \*[b'ug]).<sup>101</sup> Thus both instances of headed 'I' and 'U' are clearly dependent on the environment. Additionally, if the objects (I) and (U) are viewed as derived, then the restrictions \*C'uC' and \*CiC are accounted for in a natural way. Firstly, [i] and [u] will logically not be derived in a non-licensing environment (Note that C'uC and CiC' are possible as the element spreading comes from the right). Secondly, lexically headed [i] and [u] would be expected to be immune to element spreading (parallel to long vowels, and other "opaque" short vowels) and should appear in \*C'uC' and \*CiC contexts. Thus, these restrictions need not be arbitrary, but rather follow from the phonological representation of short nuclei in that (I) and (U), being context dependent, will never appear where they cannot be derived. It should be stressed that the term "derived" is used metaphorically here. What we have is simply licensing of the elements 'I' and 'U' by the environment, which bears one or the other element. Thus the "environment", i.e. I/U spreading, may be simply understood as part of the lexical representation of phonological forms in Irish.

The remaining headed objects (A), (I.A) and (U.A) are "opaque" to element spreading as opposed to (A.\_), (I.A.\_) and (U.A.\_) which are alterable. It seems that the group of A-headed types of nuclei (the "opaque" vowels) cannot be reduced anymore so that the elements 'I' and 'U' would have to be provided by the environment to an A-headed vowel. This follows from the nature of "opaque" vowels which are immune to element spreading. Thus if we wanted to derive e.g. (I.A) from (A) by means of 'I' spreading or sharing, then the (A) may no longer be viewed as "opaque".<sup>102</sup> In fact the compounds (I.A) and (U.A) seem to be the only instances in which we need to postulate the presence of the elements 'I' and 'U' underlyingly in the nucleus. In all other cases these elements are provided by the environment, i.e. by sharing or spreading.

As for the inventory of headless objects, i.e. alterable vowels ((67)d), although they, in a sense, copy the headed series, their number seems to be too large. First of all, the object (A.\_) does not seem to correspond to any phonetic entity in Munster Irish because both back

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<sup>101</sup>We are in fact at a loss here. 'U' spreads as an operator, however, the parallel behaviour of palatalised and velarised contexts in vowel raising phenomena suggests that it acts as the head. We may postulate that the U-headed vowel may be lexical in such forms; however, the fact that this happens in the context C-U-C is disturbingly analogous to the derivation of I-head in C'-I-C'.

<sup>102</sup>One may, however, ask why such immune nuclei are still distributionally restricted, i.e. \*C'-(U.A)-C' and \*C-(I.A)-C.

[ɑ] as in [bʌn'ə] *bainne* "milk" and fronted [a] as in [l'ak] *leac* "stone" are phonologically headed (A), where the fronted or back reflex is contingent on the quality of the preceding consonant (Ní Chiosáin and Padgett (1993)).<sup>103</sup> Additionally, it is not clear what the phonetic reflex of the empty head ( ) would be.<sup>104</sup> In other words, we seem to get only the following alterable vowels:

(68)

(I. )	[b'i]	<i>bith</i>	"existence"
(U. )	[pu]	<i>puth</i>	"breeze"
(I.A. )	[p'e]	<i>peith</i>	"dwarf elder"
(U.A. )	[bo]	<i>both</i>	"hut"

It is interesting to note that all of the objects enumerated above contain the elements 'I' and 'U', and that the presence of the respective elements in their nuclei is due to the quality of the preceding onsets. Recall that nuclei share either 'I' or 'U' with their onsets. One may therefore propose that the elements 'I' and 'U' in alterable nuclei of the type given in ((68)) are "derived" by *sharing*. This proposal allows us to account for two problems. First of all, it explains the strict agreement in quality between onsets and nuclei in the monosyllabic forms ((68)), in that 'I' and 'U' will never appear where they cannot be derived, i.e. licensed by the environment (compare e.g. \*[b'u]). Second, this analysis provides an explanation for the problem of illicit I-U combinations of Munster vowels. Namely, it predicts precisely why the compounds \*(I.U. ) and \*(I.U.A. ) are impossible in Irish. The reason is that such compounds will never be licensed, as the preceding onset is either palatalised or velarised but not both at the same time. Therefore, the constraint '*I and U do not combine*' would only duplicate information inherent in the phonological structure.

This proposal reduces the inventory of headless objects in Munster dramatically and leaves us with only two objects, ( ) and (A. ), which receive further specification from the phonological environment (cf. Cobb (1993), Charette and Göksel (1994/96) discussed in

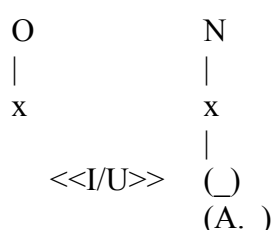
<sup>103</sup> Since the vowels in [l'a] *leath* "half" and [da] *dath* "colour" are represented as headed (A) one needs to explain the existence of [a / i] alternations (in, for example, [f'ar / f'ir]). This vowel is exceptional in that a headed vowel is affected.

<sup>104</sup> The object ( ) could be taken to represent the empty nucleus. However, the question of its phonetic shape remains pertinent in cases where empty nuclei are realised in Irish (below in this section, we provide a possible distinction that could be made between empty nuclei and empty-headed ones.).

2.4.2.<sup>105</sup> Note that these are precisely the two objects for which no phonetic reflex is found, although our system of constraints predicts that they should be present. Thus, ( ) would be the structure of the nucleus which phonetically is realised as [i] or [u] (cf. *bith* and *puth*) depending on the quality of the preceding onset. In other words, (I. ) and (U. ) could be viewed as derived by the *Sharing Condition*. On the other hand, the headless nuclei containing the element 'A' can be represented as (A. ), with the elements 'I' and 'U' provided by the same mechanism as in the case of ( ), namely, by sharing.

Structurally, the headless (alterable) short nuclei in Irish which are derived by sharing can be represented as in ((69)) below. These forms exhibit no right-hand source for the elements 'I' and 'U'. Note that almost identical representations of alterable vowels have been established for e.g. Uyghur (Cobb (1993)). The striking difference, however, lies in the fact that in Uyghur the element 'A' acts as the head.

(69)



This symbolic representation of the alterable short nuclei is able to capture fully the C-V dependencies in Irish, and account for such facts as the lack of I-U combinations, which simply follow from the phonological representation, as these elements are provided one to the exclusion of the other (consonants are either palatalised or velarised).

Technically speaking, the following objects are derived by sharing.

(70)

*by I-sharing*

( )	=>	(I. )	[k'i] <i>cith</i> "shower"
(A. )	=>	(A.I. )	[p'e] <i>peith</i> "dwarf elder"

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<sup>105</sup> One should bear in mind that apart from I/U-sharing in O-N domains Irish exhibits the process of I/U-spreading from the right-hand context in words containing more than one phonetically realised

*by U-sharing*

(  ) => (U.  )      [kru] *cruth* "shape"

(A.  ) => (A.U.  )    [bo] *both* "hut"

As for the remaining forms, i.e. [Ca] and [C'a] as in [da] *dath* "colour" and [l'a] *leath* "half", we have adopted the view that they contain a headed (A) in the nucleus which is generally unaffected (as elsewhere) by a velarised onset, and fronted (phonetically?) by a palatalised one. Note that this assumption neatly accounts for the derivation of [o] in *both*, as this is a headless nucleus containing 'A', as opposed to [ɑ] in *dath* which has to remain low. Otherwise, such forms as [da] would be impossible in the language, and similarly, there would be no way to represent the contrast between [e] and [a] as in *peith* and *leath*. In this analysis it is the status of the element 'A' that accounts for these distinctions.

Let us now consider the other type of element licensing in alterable nuclei which we referred to as I/U-spreading. In the presence of element spreading from the right-hand context, the shared element is "dislodged" from the nucleus if the spread element is different from the shared one. Recall that the dislodged element then forms a buffer to further spreading of the intruding element. This is represented below.

(71)

O	N	
x	x	
<<I/U	( <u>  </u> )	<<<<<I/U
	(A. <u>  </u> )	

Element spreading allows us to derive the following objects from the same representation of alterable short vowels:<sup>106</sup>

(72)

*by I-spreading*

(  ) => (I)      [kid'] *cuid* "part"

(A.  ) => (I)      [sip'] *soip* "wisp/gs."    (and LC2)

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O-N domain. Below, it will be shown how both phenomena, i.e. *sharing* and *spreading*, constitute the "environment" which is responsible for the derivation of vocalic objects.

<sup>106</sup> The difference between 'I' and 'U' spreading is that the former spreads as the head, and the latter as the operator. This, among other things, accounts for the different outcomes when (A.  ) is affected

by *U-spreading*

(  ) => (U.  ) [p'ubər] *piobar* "pepper"

(A.  ) => (A.U.  ) [b'og] *beog* "small"

This simple and "open" system allows for surface variation and it also accounts for the paucity of vocalic contrasts. It reflects the asymmetry between high vowels on the one hand and mid and low ones on the other. Thus, the elements 'U' and 'I' may be licensed within a nucleus only by the preceding onset (*sharing*), or by the right-hand environment (*spreading*), all of which may be understood as part of the specification of Irish short vowels. On the other hand, in the series of inalterable vowels (headed objects) the elements 'I' and 'U' are licensed by the element 'A' (for example, in (U.A) and (I.A)).

However, this system seems to pose a question as to the possibility to distinguish between empty nuclei which alternate with zero and are represented as (  ), and [i] and [u] in *bith* and *puth* which are derived here from the non-specified (  ).<sup>107</sup>

Recall that empty nuclei allow palatalisation spreading to the preceding consonant ([soləs / sel'ɪf / si:l'fə]). This does not happen in the case of our "restricted nuclei", e.g. [pu / p<sup>w</sup>ihə]. The difference might be attributed to the structure proposed below, which treats the shared elements 'I' and 'U' as part of the representation of such nuclei, as opposed to the absence of I/U sharing in the case of empty nuclei.

(73)

a. *restricted nucleus*

O	N
x	x
I/U	( <u>  </u> )

b. *empty nucleus*

O	N
x	x
	( <u>  </u> )

This interpretation accounts for the fact that the onset followed by an underlyingly empty nucleus ((73)b) receives its specification from the following onset. This takes place even if the nucleus is realised (cf. [soləs / sel'ɪf / si:l'fə] Cyran (1996a)).

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by the two elements (compare [sip'] and [b'og] below, where LC2 is responsible for the A-suppression in [sip'], while in [b'og] the derived object remains headless (A.U.  )).

#### 2.4.6. Structure vs. Condition (conclusions)

It seems that we now have two systems for Munster Irish vowels: system ((74)a), which is defined by licensing constraints and gives all the attested objects (except for ( ) and (A. )), and system ((74)b), which is what we seem to need in the underlying representation of short vowels. The question marks in ((74)a) indicate the problematic objects.

(74)

a.	<u>headed</u>	<u>headless</u>	b.	<u>headed</u>	<u>headless</u>
	(I)?	( )?		(A)	( )
	(U)?	(I. )		(I.A)	(A. )
	(A)	(U. )		(U.A)	
	(I.A)	(A. )?			
	(U.A)	(I.A. )			
		(U.A. )			

The question arises as to whether system ((74)b) should also be defined in terms of licensing constraints. This would make it very restricted, and the derivation of system ((74)a) from the underlying forms might be thwarted by the additional constraints.

System ((74)b) proposed here seems to constitute a compromise between the urge to define the whole vocalic system only in terms of stipulatory parameters on the combination of elements, and the desire to generate vocalic expressions on the basis of the information present in the underlying representation of phonological forms. The approach presented here shows that the licensing constraints must fall out of the system and that they simply reflect the mechanisms responsible for generating phonological objects (LC1), or describe (underlie) the existing processes (LC2). We have seen that the vocalic system of Munster Irish is partly defined by such constraints and partly by other mechanisms, namely, *spreading* and *sharing*.

One might ask whether we are not dealing here with a conflict between the lexical representation (defined by constraints) and the phonological component (derivation by *spreading* and *sharing*)? In the light of Harris and Lindsey (1993), who suggest that there is no phonetic level of representation, the phonological representation are characterised by full

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<sup>107</sup> On the differences between underspecification and non-specification see Harris (1994b).

interpretability at all levels of the derivation. It seems that the static status of the derivation of Irish vowels may be maintained. Recall that licensing and governing relations are contracted at the level of lexical representation (the *Projection Principle*). I/U-sharing then is an instantiation of a licensing relation holding between onsets and nuclei, therefore, the I/U specification of nuclei by sharing takes place lexically, i.e. at the time when all governing and licensing relations are contracted. As for the element spreading, we may view it in a similar way, namely, not as a dynamic process but rather as the static identification of objects with the element lodged in sharing domains. In other words, we may view spreading as licensing of a given element within a particular domain of application - in the case of spreading the domain may be identified with the foot.

Thus by assuming that sharing and spreading, as forms of element licensing, interact with licensing constraints on element combinations we avoid the question at which stage the constraints are relevant. They are relevant all the time in that they do not allow impossible combinations to arise, but they need not restrict the number of underlying segments fully, because, as we have seen in ((74)a) and ((74)b), the inventory (in the phonemic sense) may be even smaller than that defined by constraints, due to information inherent in the structure.

The analysis of the vocalic system of Munster Irish presented here is not without its problems, however, it also shows that we need to understand a lot more about the way in which resonance elements interact. To this end, more work is required in the area of comparative linguistics in order to emphasise the universal character of element interaction. Also, more theoretical work is needed concerning the nature and position of licensing constraints in phonology (see e.g. Cobb (1997)).