# The parametric occurrence of elements in phonological systems

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## Introduction

Are segmental inventories mere lists of objects, or do they exhibit some general, cross-linguistically definable properties? Do consonantal and vocalic systems generally function in any interesting way? These questions are by no means new in the history of phonology. The first of them concerns the typology of phonological systems and the descriptive problems connected with revealing the mechanisms of relating the phonological structure with certain universal properties of segments. On the other hand, the second question stresses the functional aspect of systems in allowing for and effecting particular phonological phenomena. Taken together, the typological (inventory) and the dynamic (process) aspects of phonological systems have constituted the target of phonological investigation with more emphasis being placed on one aspect or another, or with equal emphasis on both issues. This paper supports the view that it is crucial to treat both aspects as equally important. This will be done by showing that a variety of phonological systems and the types of phonological phenomena which do occur or may potentially occur in such systems can be directly accounted for by means of a few general conditions on the phonological structure of segments. On the other hand, phonological phenomena which are identical in terms of their formal definition (for instance, high tone deletion) may take quite disparate forms in different systems precisely due to the different settings of the parameters governing the segmental make-up of phonological objects in those systems.

As an illustration of the types of problems that one encounters in the analysis of segmental systems let us look briefly at some aspects of the consonantal inventories of Munster Irish and Polish and try to determine the similarities and differences between them. Both languages have two series of consonants, i.e., palatalised and non-palatalised. To be more precise, in the case of Irish one can talk of a palatalised / velarised contrast, while in Polish the distinction is one between palatalised and neutral reflexes. In the sets presented below in (1) both the palatalised series and sonorants are excluded for the purpose of clarity:[1]

[1]One exception is the inclusion of [ʃ] in the Irish set, a palatal consonant which results from the palatalisation of [s].

(1)

| | *fricatives* | | | | | *affricates* | | *plosives* | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Irish | f | s | ʃ | χ | h | -- | -- | p | t | k |
| | v[2] | | | ɣ | | -- | -- | b | d | g |
| Polish | f | s | ʃ | χ | | ts | tʃ | p | t | k |
| | v | z | ʒ | | | dz | dʒ | b | d | g |

As regards the similarities between the two systems presented in (1), it is striking that in both languages the sets of plosive consonants are identical. The voiceless series of fricatives seem to roughly correspond as well. On the other hand, Irish is characterised by the total absence of affricates from the inventory and an imperfect, if not non-existent, system of voicing contrasts among the fricatives. This last point will be expanded in the following sections in which we will try to correlate the absence of voicing contrasts among the fricatives with the absence of affricates, a task which at first blush might seem at least dubious. However, it will be demonstrated that the mechanism by means of which two seemingly disparate facts can be correlated has the additional advantage of providing a unified explanation for the different outcomes found with the same process in languages which roughly correspond to the Irish and Polish systems.

The model adopted in this paper is that of Government Phonology (Kaye, Lowenstamm, Vergnaud (KLV) (1985; 1990), Charette (1991), Harris (1990; 1994a), Harris and Lindsey (1995)). Below, we review some points concerning the theory of government in phonology with respect to the subsegmental primes.

## 1. Phonological elements in Government Phonology (GP)

The smallest units of representation to which phonology has access are called elements, which are understood as the cognitive objects of both an acoustic and articulatory nature of which segments are composed. They may be realised phonetically in isolation or form compound expressions. There

[2]Whether [v] is a contrastive unit in the consonantal system of Munster Irish is not certain (see section 3 below).

are three basic vocalic elements 'A', 'U', and 'I' which, when pronounced, correspond to the corner vowels [a], [u] and [i] respectively. These elements may combine to form complex vowels. Such combinations take the form of asymmetric relations in which one of the elements acts as the head and the other as the operator. Thus the phonetic reflex of a particular compound is dependent on the role which is assigned to the elements involved in the fusion. This can be demonstrated by comparing the two results obtained when we fuse 'A' and 'I'. When 'A' is the operator and 'I' is the head (A.I), the resultant vowel is [e]. On the other hand, when the relations are reversed (I.A), we obtain [æ] (KLV (1985)). The same applies to the combination of 'A' and 'U', where we can get an open [ɒ] (U.A) or a close [o] (A.U), depending on the combination.[3]

In addition to 'A', 'U', 'I', three other elements were initially proposed, namely, 'N' (nasality), 'H' (ATR), and v$^{o}$ (the "cold" vowel, or neutral element) (KLV (1985)). Of these three, the ATR element was abandoned as tenseness contrasts came to be expressed in terms of the headedness or headlessness of the vocalic elements 'A', 'U', 'I' (Cobb (1993), Charette (1994), Harris and Lindsey (1995)). Examples are provided below:

(2)

| *headed vowels* | | *non-headed vowels* | |
|---|---|---|---|
| (I) | = i | (I.v$^{o}$) | = ɪ |
| (U) | = u | (U.v$^{o}$) | = ʊ |
| (A.I) | = e | (A.I.v$^{o}$) | = ɛ |
| (A.U) | = o | (A.U.v$^{o}$) | = ɔ |

Thus, the tense vowels are now expressed as headed objects, while the lax vowels are not headed by an active element ('A', 'U', 'I'), i.e., they are empty-headed.[4]

The vocalic elements 'U', 'I', 'A', and v$^{o}$ are also found in the segmental representations of consonants where their role is mainly to define the primary or secondary place of articulation. Thus,

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[3]In current analyses of the English vocalic system [æ] tends to be represented as a non-headed (A._) (see Charette and Göksel (this volume)). It is assumed, however, that if in a given language both (A.I) and (I.A) are present, then the phonetic contrast between these objects would roughly correspond to that between [e] and [æ].

[4]Harris and Lindsey (1995) represent the lax series as headed by the neutral element v$^{o}$, e.g. [ɪ] = (I.v$^{o}$). On the other hand, Cobb (1993) and Charette (1994) refer to the lax objects as empty-headed, i.e., [ɪ] = (I._). Both approaches are, however, to a large extent identical.

'U' defines labiality (or a labial glide [w]), 'I' is used to mark palatality (or a palatal glide [y]), while the cold vowel ($v^{o}$) represents velarity. On the other hand, the element 'A' has traditionally been assumed to indicate pharyngeality (KLV (1985), Harris (1990)). However, it has also been proposed that this element is present in the segmental make-up of coronal consonants (Broadbent (1991), Backley (1993), Brockhaus (1994)).[5] One argument in favour of this proposal is connected with the so-called hiatus-breaking consonants in English, which can be given a straightforward account if the intrusive [r] is not treated as different from intrusive [y] or [w] glides in the data below (taken from Harris (1994b)), but rather as a realization of a third element, the presence of which is obvious:

(3)

| 'I' | 'U' | 'A' |
|---|---|---|
| see[y]ing | woo[w]ing | bar[r]ing |
| say[y]ing | go[w]ing | saw[r]ing |

We will adopt the view that the element 'A' indeed features in coronal consonants and that its phonetic realisation in a non-nuclear position corresponds to [r].

In KLV (1990) and Harris (1990) we find the following consonantal elements, which, except for 'R' (now replaced by 'A'), define the manner dimension of consonants:

(4)

R - coronal gesture (now replaced by 'A')
ʔ - occluded (constriction)
h - noise (friction)
N - nasal
H - stiff vocal cords (fully voiceless)
L - slack vocal cords (fully voiced)

Thus the vocalic (resonance) elements are assumed to mark only the place of articulation, while a separate set of elements defines the manner dimension.[6]

As in the vocalic system, these elements may combine to produce complex segments. For example, the combination (h, U) yields a labial fricative, while the compound (h, ʔ, U) defines a labial stop which may further be voiceless (H, h, ʔ, U) or voiced (L, h, ʔ, U).[7] Consider the

[5]In Cyran (1994) it is proposed that coronality is typically represented by a compound expression involving both 'A' and 'I' where the status of the respective elements in the compound corresponds to the representation of the vowel [e] in a given language.

[6]See Harris (1990; 1994a) and Harris and Lindsey (1995) for a lucid discussion and justification of the elements proposed above.

[7]Typically, the 'L' element is used to define fully voiced objects, otherwise the voiceless / voiced contrast is represented by the presence versus absence of the element 'H'.

representations of some labials below in which the tone element 'H' is ignored:

(5)

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[p]     [f]     [w]
 |       |       |
 x       x       x
 |       |       |
 U       U       U
 |       |
 h       h
 |
 ʔ
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The decreasing complexity of the segments presented above corresponds to the lenition trajectory of the opening type (see for example, Lass (1984, 178) and a discussion in Harris (1990)). An example of the lenition of [p] to [f] is found in Irish ([potə] *pota* "pot" - [sə fotə] *sa phota* "in the pot"). Additionally, the forms given above in (5) illustrate the way in which Government Phonology views phonological processing.

Unlike the rule-based approaches, GP is fundamentally a theory of representations where phonological phenomena are viewed as stemming directly from the structural and segmental conditions which are present in the phonological representation. In this model the phonological processing is viewed as either the *decomposition* or *composition* of segmental material (elements). An example of the former is given above where the lenition of [p] (h, ʔ, U) to [f] (h, U) is understood as the loss of the occlusion element (ʔ) (see Harris (1990)). Similarly, in vocalic systems, vowel raising or lowering may be viewed as the decomposition of a complex segment. For example, Irish [e] tends to be raised to [i] in palatalised environments, while [o] is raised to [u] in velarised contexts, for example, [l´et´ir´ ~ l´it´ir´] *leitir/litir* "letter", [knok ~ knuk] *cnoc* "hill". This may be uniformly represented as the loss of the element 'A':

(6)

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[e]     [i]       [o]     [u]
 I       I         U       U
 |  ==>           |  ==>
 A               A
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The other type of phonological process, i.e., *composition*, is the reverse of this, namely, elements are added to a compound by, for example, spreading. Segmental composition is additionally conditioned in that the element which is added to a segment must be locally present.

The aim of the following discussion is to demonstrate that, given the framework of Government Phonology with its model of subsegmental primes which are defined as autonomously interpretable elements, one might be able not only to account for the types of consonantal systems found across languages but also arrive at a better understanding of the correlations that exist between seemingly disjoint phenomena. More importantly, it will be suggested that the division into

vocalic (place) and consonantal (manner) elements is not entirely acurate, as some responsibility for the manner dimension may be shifted to the vocalic elements by exploring the possibility that the headedness of vocalic elements, which corresponds to the tenseness of vowels, might coincide with friction in consonants. This in turn would allow us to account for the kind of asymmetry in consonantal inventories witnessed in Irish (1) by referring to the parameterised occurrence of certain "manner" elements in linguistic systems.

Let us begin the discussion by inspecting the relation between the headedness of vocalic elements in vowels and consonants and the distribution of Munster Irish [r]-sounds. It will be shown that the interaction between Munster [r], which is represented as (A), with palatalisation (I) resembles the situation encountered in vocalic alternations caused by palatalisation - specifically, the effects produced by interaction between the vowel [ɑ] and palatalisation - and may be accounted for in a similar fashion.

**2. The theory of headedness and the Munster Irish [r]-sounds**

The distribution of [r]-sounds in Irish is puzzling. First of all, it seems that word-initially [r] may not be palatalised (Henebry (1898, 74), Sommerfelt (1927, 214), Sjoestedt (1931, 46), Ó Cuív (1975, 49)) although we find palatalised reflexes word-medially ([m´ir´ə] *mire* "speed"), and word-finally ([mi:nt´ir´] *muintir* "people"). It is also difficult to ascertain whether the word-initial [r] is in fact velarised.[8]

Let us concentrate on the question of the absence of palatalisation in initial [r]. In phonetic descriptions of Munster sub-dialects it has been noticed that the manner of articulation of [r]-sounds depends not only on their quality but also on their position within the word. The [r]-sounds are realised in two different ways, namely, as a voiced fricative or as a voiced flapped consonant. There are palatalised and velarised versions of the two realisations. However, the distribution of the two qualities does not correspond to the manner of articulation. Thus, the non-palatalised [r] is pronounced as a fricative only in absolute initial position as in [ri:] *rí* "king" or [ru:n] *rún* "secret". It is realised as a single (or double) alveolar flap in other positions, i.e., between vowels, word-finally, following consonants and preceding consonants. On the other hand, the palatalised [r´]-fricative occurs between vowels and word-finally, and the palatalised alveolar flap is found in contexts where it follows or precedes a consonant.

For the sake of argument let us concentrate on the most unambiguous situations, i.e., the

[8]de Bhaldraithe (1945, 42), in his description of the Cois Fhairrge dialect, acknowledges that word-initial [r] has the resonance of a half-open retracted ə-vowel when followed by a front vowel. Otherwise, it has a 'u-resonance', which is typical of velarised consonants. This may mean that word-initial [r] resists both palatalisation and velarisation. A similar assertion is made in the description of East Perthshire Gaelic by Ó Murchú (1989, 104).

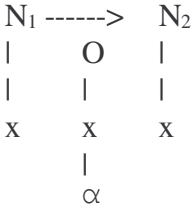
word-initial, intervocalic and word-final contexts.[9] The distribution, of [r]-sounds in these contexts seems to be complementary. This is represented in the table below (based on Ó Cuív 1975, 49):

(7)

| word-initial | intervocalic | word-final |
|---|---|---|
| r - fricative | r - flap | r - flap |
| *r´ | r´ - fricative | r´ - fricative |

As regards the velarised reflexes, one can propose the following interpretation for the facts presented in (7), namely, that the fricative / flap distinction indicates differences in strength. Thus, given the distribution of the velarised type of [r]-sounds it may be assumed that the alveolar flap is a weakened form of the word-initial fricative (trill). This claim is supported by the phonetic realisation of non-initial [r]'s, and also by the fact that the weakened member occurs in a context which has widely been recognized as a prime site for lenition or reduction (Harris and Kaye (1988), Harris (1990)), represented below:[10]

(8)




The reduction context illustrated in (8) unifies the intervocalic and word-final positions of the weakened [r]-sound as in GP word-final consonants are always syllabified in the onset position and are followed by an inaudible nucleus (Kaye (1990)). The reduction of the intervening onset may be viewed in a metaphorical way as the weakening of a possible "barrier" to the internuclear relation (Harris and Kaye (1988)), or as the result of the reduction of the segmental licensing power of $N_2$ which is itself governed (Harris (1990; 1992).

The intervocalic context seems to be indeed operative in Irish phonology as a site for lenition. One independent argument which supports this view comes from the phenomenon of nuclear fusion in verbal forms where the segment [g´] becomes delinked in intervocalic position. Compare (9a) with (9b):

[9]Phonologically, these three positions are viewed as identical in GP, i.e., in all these contexts the [r] is syllabified in the onset and is followed by a nucleus. The word-final nucleus may be phonetically empty (Kaye (1990)).

[10]The direction of Irish internuclear relations seems to be from right to left. The diagram merely demonstrates the original proposal of Harris and Kaye (1988).

(9)

I CONJUGATION

| | IMPERATIVE | | 1ST PERSON SG. ([-im´]) | | |
|---|---|---|---|---|---|
| a. | [lɑs] | *las* | [lɑsim´] | *lasaim* | "light" |
| | [kir´] | *cuir* | [kir´im´] | *cuirim* | "put" |
| b. | [n´ig´] | *nigh* | [n´i:m´] | *ním* | "wash" |
| | [sig´] | *suigh* | [si:m´] | *suím* | "sit" |

It is interesting to note that the intervocalic context effects delinking of only two types of segments, namely, [g´] and [v/v´]. The latter instance is found in some genitive forms which involve an addition of the inflectional ending /-e/:

(10)

| | | | | |
|---|---|---|---|---|
| [uv] | - | [i:] | *ubh / uibhe* | "egg/gs." |
| [n´iv´] | - | [n´i:] | *nimh / nimhe* | "poison/gs." |

Later, it will become clear why these two segments are given preference in the phenomenon of nuclear fusion. What interests us here is the fact that the intervocalic position may indeed be viewed as a weakening context in Irish, which supports our proposal that in the case of non-initial velarised [r]'s we are dealing with a weakened form (a flap).

The question is, what is involved in the weakening of the fricative [r] to a flap, and how does that relate to the distribution of the palatalised reflexes? Clearly, if its occurrence in non-initial position causes fricative [r] to be reduced to a flap, then palatalised [r´] should be realised as a flap too. This is not the case, and the palatalised reflexes are realised as fricatives. Does this mean that only velarised [r]'s can be weakened?

There are data which suggest that, to be palatalised, an [r]-sound has to find itself in a "weakening" context. This observation can in fact be read off the distribution of the palatalised [r]-sounds presented in (7) (hence no initial palatalisation), but it is additionally supported by certain sandhi effects in which word-initial [r] may be palatalised if it finds itself in an intervocalic context. For example, in [ri:] *rí* "king" the initial [r]-sound is unaffected by palatalisation. However, in the vocative form [ə r´i:] *a rí!*, when [r] finds itself sandwiched between two nuclei, the consonant is palatalised (Sjoestedt (1931, 46)) and, of course, it is a fricative. More data are given below:

(11)

| | | | | | |
|---|---|---|---|---|---|
| [ri:] | *rí* | "king" | [ə r´i:] | *a rí!* | "king/voc." |
| [ru:n] | *rún* | "secret" | [ə r´u:n] | *a rún* | "his secret" |
| [rug] | *rug* | "take/past" | [də r´ug] | *do rug* | "he took" |
| [rau] | *rogha* | "choice" | | | |
| [rud] | *rud* | "thing" | [də r´au r´ud] | *do rogha rud* | "your choice" |

The actual mechanism of the palatalisation observed in the above forms is indeed connected with

the weakening context, but it additionally depends on the representation of coronals and a particular interpretation of what palatalisation of such objects involves.[11] A discussion of these issues would go far beyond the scope of this paper, and we will only concentrate on the fact that the weakening context effects palatalisation. We will also refer only to the relevant aspects of palatalisation in Irish, that is, those which will help us understand why a weakened [r], which is a condition for the palatalisation of this object, is realised like a non-weakened [r], i.e., as a fricative.

Let us first suggest what in fact happens when the [r]-sounds are weakened. Then, by referring to the nature of velarisation and palatalisation in Irish, we will attempt to solve the problem of the manner in which the palatalised [r´]'s are realised.

We assume that the element 'A', which is present in the representation of [r], forms the head in the fricative (trilled) version. Consequently, the weakened type of [r] (the flap) contains 'A', which is not licensed as the head (A) but rather as an operator (A.$\underline{\upsilon}^{o}$).[12] The two types of segments are presented below in a simplified way:

(12) a. *trilled [r]* b. *flapped [r]*[13]


Thus the general contrast between the trilled and the flapped version may be expressed in terms of the status of the element 'A', which depends on its prosodic position. One should bear in mind that the headed/headless distinction in vocalic systems leads to tense/lax contrasts in phonetic realisation.

The next question which must be addressed is the effect of palatalisation and velarisation on the "weak" [r]-sound. Unlike the word-initial situation, in which we can assume, following the comment made by de Bhaldraithe (footnote (8)), that neither 'I' (palatalisation) nor 'U' (velarisation) may be licensed in the onset, here the two elements are present in the segmental make-up of the reduced reflexes.This is proved by the presence of the [u]- and [i]-resonance of the velarised and

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[11]In Cyran (1994) it is suggested that coronality in Irish may be defined by a compound (I.A) where even the phonetically non-palatalised coronal objects contain the element 'I'. The palatalisation of such objects involves decomposition of the compound to enable the element 'I' to act independently.

[12]This type of weakening, i.e., switch of status, is well established in GP and has been used to account for various raising and reduction phenomena that affect vowels in recessive positions (see, Harris (1994a, 112)).

[13]See Broadbent (1991), and Backley (1993) for a proposal which postulates a similar structure for English.

the palatalised types respectively. However, the effect of velarisation is different from that of palatalisation. The palatalised reflex of the reduced [r]-sound is again a fricative (trill), i.e., a strong consonant, while the velarised reflex remains a mere flap with [u]-quality.

This peculiarity can be accounted for by invoking the correspondence of this phenomenon to the nature of palatalisation and velarisation in Irish, which is characterised by an appreciable degree of asymmetry with respect to the behaviour of the elements 'I' and 'U'. The asymmetry finds its reflection in the way these elements affect nuclei in the so-called consonant-vowel interaction phenomena (Ní Chiosáin (1992), Cyran (1994)). Briefly speaking, the elements 'I' and 'U' which define the quality of the consonants in Irish may spread leftwards and affect short nuclei. However, the results of spreading differ depending on which element spreads, in that the element 'I' is licensed in the affected vocalic objects as the head, whereas 'U' becomes the operator (Cyran (1994)). If palatalisation has the same effect on coronal consonants, then we can predict that the velarised [r] will contain 'U' but the whole object will remain unheaded, i.e., weak (flap). On the other hand, we are now able to answer the question why the palatalised reflex of [r]-sounds is strong, i.e., a fricative rather than a flap. This follows from the nature of palatalisation which is defined as being headed by (I). Note that this interpretation provides a possible explanation for the condition that only a weakened [r] can be palatalised: only one of the elements can act as the head, therefore an A-headed [r] resists palatalisation word-initially.[14] The two types of [r]-sounds are given below:

(13)

a. *velarised flap*

b. *palatalised trill*[15]



The velarised weak [r]-sound does not become a headed expression because the element 'U' does not become the head of the affected expression.[16]

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[14]The interaction between the elements 'I/U' and 'A' in palatalisation and velarisation effects involving [r]-sounds faithfully follows the pattern observed in the vocalic system of Munster Irish in that A-headed nuclei resist both palatalisation and velarisation (cf. footnote (8)), while unheaded nuclei license 'I' as the head and 'U' as the operator (Cyran (1994; 1995)).

[15]One might ask why the element 'I' is allowed to be headed in the weakening context while 'A' is not. A possible answer to this problem could be that palatalisation in Irish is not restricted to one segment, but is rather the property of a domain which is characterised as I-headed.

[16]This is in keeping with what has been found about U-spreading in vocalic alternations (Cyran (1994)). See also Ó Baoill (1979) who presents a formant chart which clearly indicates that [L], [N] and [R] in East Gweedore (Donegal Irish) have the acoustic characteristics of the vowel [o:], which in our terms entails the

One conclusion which can be drawn from the above discussion is that, like the vocalic systems, the status of the vocalic elements defining non-nuclear objects may be responsible for contrasts other than the place of articulation. We claim that the headedness of the vocalic element provides the property of friction, which so far has been reserved for a separate element in Government Phonology, namely, 'h' (noise). In the following section, we investigate the Irish consonantal system further in order to find out if the observations made regarding [r]-sounds have any relevance for the whole system. We begin with an attempt to define the segmental representation of the voiceless fricative [s] which in many ways has a similar representation to [r] in various languages. First of all, they share the same place of articulation, and second, the existence of such historical processes as rhotacism ([s]->[r]) indicates that there is a close affinity between the two objects.

**3. The segmental make-up of Munster Irish fricatives**

GP tries to capture both the sets of segmental oppositions which characterise any phonological system and also the natural grouping into which sounds are organized according to their participation in phonological processes. Bearing in mind that [s] should be treated as phonologically more complex than [r], since the latter can be composed of the 'A' element alone, we have three choices for the representation of this consonant (14). The larger number of elements in [s] enables us to account for the historical process of rhotacism (for example, *honos* > Classical Latin *honor*) as decomposition or weakening of [s] so that all elements are delinked except 'A'. Thus, the presence of 'A' in [s] follows from its presence in [r]. Consider the three possibilities below:

(14)

a. [s] = (H, h, A)
b. [s] = (H, A)
c. [s] = (h, A)

(H = high tone, h = noise, A = coronality)

The representation of [s] involving the maximal choice, i.e., the three elements (H, h, A) can be described in the following way. 'H' (high tone) accounts for the voiceless nature of [s], 'h' (noise element) defines friction, and 'A' represents coronality. Below, we will consider the possibility that either 'H' or 'h' is superfluous in the representation of [s] and other Irish voiceless spirants (i.e., [f, ʃ, χ, h]). In order to see which representation of [s] is accurate we need to look at that part of the phonology of Irish where this segment reveals its contents.

One area which needs to be investigated is the system of phonological oppositions. Let us first consider briefly the phonological standing of the elements 'H' and 'h' in Irish. We begin with 'H',

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presence of the elements 'A' and 'U'.

i.e., the tone element which normally defines the voicelessness of consonants. It has a counterpart, i.e., 'L' (low tone), which is used in fully voiced consonants (Harris (1990, 264)). The voicing contrast must be specified for the group of Irish obstruents. Sjoestedt (1931, 8) provides the following contrastive pairs:

(15)

| | | | | | |
|---|---|---|---|---|---|
| [pɑkə] | *paca* | "pack" | [bɑkə] | *bacadh* | "hindrance" |
| [tɑ:] | *tá* | "is" | [dɑ:] | *dá* | "if" |
| [kɑ:] | *cá* | "where" | [gɑ:] | *gá* | "need" |

Let us assume that the contrast is represented by the presence versus absence of the element 'H', i.e., the voiceless obstruents contain 'H', while the voiced ones do not contain the laryngeal element. There are a few reasons for this interpretation. First of all, phonetically speaking, Irish voiced obstruents are fully voiced only in word-medial context, i.e., intervocalically. Otherwise, they are partially devoiced (Ó Cuív (1975, 31)). Second, the voiced obstruents come across as weaker than their voiceless congeners, which may be due to the smaller number of elements in their representation. This weaker status of voiced obstruents manifests itself in, for instance, the process of vowel lengthening due to [g] or [v] delinking mentioned in the previous section, for example, [sig´ / si:m´] *suigh / suím* "sit / I sit", where the addition of the 1st personal ending [-im] forms a weakening context (see (8)).

On the other hand, it seems that the voice contrasts among Irish fricatives are of lesser importance. In fact, one can practically assert that there is almost no contrast to speak of. For instance, [s] has no regular voiced counterpart [z]. Likewise, [ʃ/ʒ] pairs are virtually nonexistent in the system where, similarly to [s/z], only the voiceless object is present as the palatalised version of [s].

Some contrast may be perceived in the distribution of [f] and [v]. However, unlike [f], [v] does not seem to be an independent phonological unit in that word-initially only [f] appears independently, while [v] is either the result of morpho-phonological alternations like the lenition of [b] or [m], ([ən v´an] *an bhean* "woman", [ən vɑ:hir´] *an mháthair* "mother"), or the eclipsis of initial [f] ([ən vil´ tu:..] *an bhfuil tú...* "are you..."). Word-medially, [v] tends to be lost (['gr´anəvər ~ gr´a'nu:r] *greanmhar* "funny"), while word-finally [v] is found but [f] is virtually nonexistent in native words. Similar restrictions apply to [χ] and [ɣ] in that both are the result of lenition. However, [χ] has a wider distribution than [ɣ] as the latter appears only word-initially.

Thus, in the class of fricatives we may only speak of independent voiceless objects only. In this light it seems superfluous to mark them by the presence of the element 'H' as it would have no function in defining phonological contrasts. This in turn suggests that the representation of [s] is (h, A). Likewise, [f] and [χ] would be defined as (h, U) and (h, $\underline{ɤ}^{o}$) respectively. This representation assumes that, unlike in plosives, the absence of 'H' still renders the objects voiceless. A similar

assumption is made in Backley (1993) where [s] is defined as 'h' alone. One may wonder, however, if such a stipulation is not arbitrary.

Let us now consider an alternative proposal which, it seems, captures the same facts about fricatives and makes their representation uniform with that of plosives. We may propose that it is the noise component ('h') that is superfluous in the phonological representation of the Irish fricatives, and even, perhaps, in the whole consonantal system of that language. Of course, this step is possible only if we have other ways to represent friction.

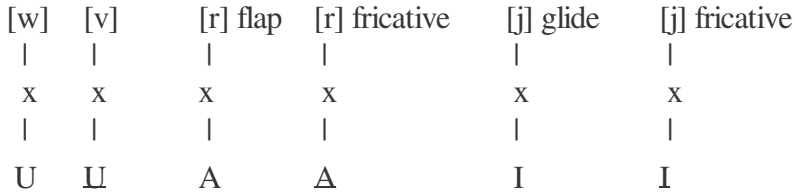
First, let us again articulate the questions which are pertinent to the issue of the Irish consonantal system (see also (1)). Namely, why should it be the case that in general the voiceless consonants have a wider distribution than the voiced ones, and why is it that a wider distributional gap concerning the voice distinction is found in the class of fricatives rather than among plosives? The last point may appear paradoxical; however, as will be shown below, the distinction plosive / fricative, if understood in terms of element complexity, may quite logically account for the distributional facts in both classes.

Now let us turn to arguments against the presence of 'h' in Irish fricatives. For this, we need to look at the relation between voiced fricatives and... glides. It appears that the fricative [v] and the glide [w] are not contrastive in Irish. For instance, the afore- mentioned example [ən vil´ tu:] *an bhuil tú...* "are you..." may have a variant pronunciation [ən wil´ tu:]. Similarly, variant forms like [uim´ / wuim´ / vuim´] *uaim* "from me" suggest that glides simply tend to be spirantised in Irish. The same applies to the glide [j] which is described by Ó Cuív (1975, 42) as a palato-velar fricative.

Our previous analysis of [r]-sounds in Munster seems to provide us with a way of accounting for the spirantisation of glides which does not refer to the element 'h'. Recall that in our analysis [r] (an A-glide!) is pronounced as a fricative when the element 'A' is headed and as a single flap if it is headless.

Given that the same distinction can be applied to the [v]/[w] variants, we may dispense with 'h' in the representation of fricatives and replace it with the notion of the headedness of vocalic elements, which in the vocalic system defines the tense/lax contrasts. Thus the distinction glide/fricative in Irish may be expressed in the following way:

(16)




Such a representation of friction reveals the logic in the distribution and phonological behaviour of Irish fricatives. For instance, the delinking of [v] in intervocalic position need no longer shock us because of the number of elements lost (for example, [uv / i:] *ubh / uibhe* "egg/gs."), because all

that is lost in the alternation [uv / i:] is the element 'U' and not (h, U). Our representation of voiced [v] seems to additionally clarify certain lenition facts in Irish. If we assume that [v] has to be represented as (h, U) rather than (U) alone, then logically, we would have to propose that Irish [m] which, when lenited, yields [v], also has to contain the noise element 'h'. Our analysis not only avoids such pitfalls, but also unifies the lenition of [m] and the sporadic weakening of [n] to [r], viewing them both as the mere delinking of 'N' (nasality) ([knuk ~ kruk] *cnoc* "hill").

Now we may propose that the voiceless spirants are represented as follows:

(17)

| [f] | [s] | [ʃ] | [χ] |
|---|---|---|---|
| \| | \| | \| | \| |
| x | x | x | x |
| \| | \| | \| | \| |
| U | A | I | v$^{o}$ |
| \| | \| | \| | \| |
| H | H | H | H |

These representations provide answers to our two questions concerning voice contrasts in the Irish consonantal system. Let us first concentrate on the question of the absence of voiced counterparts of certain fricatives, for example, [z] and [ʒ].

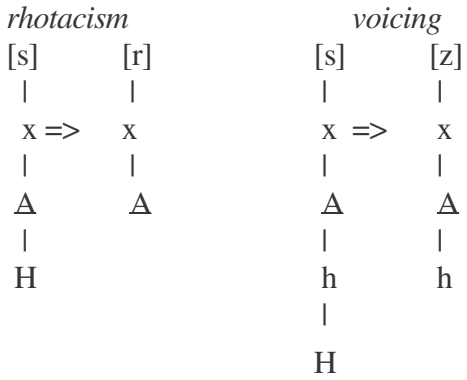
If the voice contrast is represented by the presence versus absence of the tone element 'H', then Irish [s] clearly contrasts with [r] in this respect rather than with [z], because [s] (H, A) without the tone yields (A), i.e., [r]. Note that such a representation of [s] and [r] has the potential of providing a unified account of such historical processes as rhotacism (*honos* > Classical Latin *honor*) and the voicing of [s] to [z] (Verner's law), describing them as a mere delinking of the tone element 'H'. We also predict that rhotacism will take place in a system which has no [z] (h, A),[17] or, to be more specific, in a system in which [s] is represented as (H, A) and not as (H, h, A). This is illustrated below:[18]

[17]Unless we are dealing with a process which delinks 'h' (noise) and not 'H' (tone), or unless we provide a different representation for [z], i.e., [L, A] or [L, h, A].

[18]One has to bear in mind that the Munster Irish consonantal system is only a potential member of the group of languages in which rhotacism is a possibility. The indispensable condition for such languages is the process of high tone deletion.

(18)

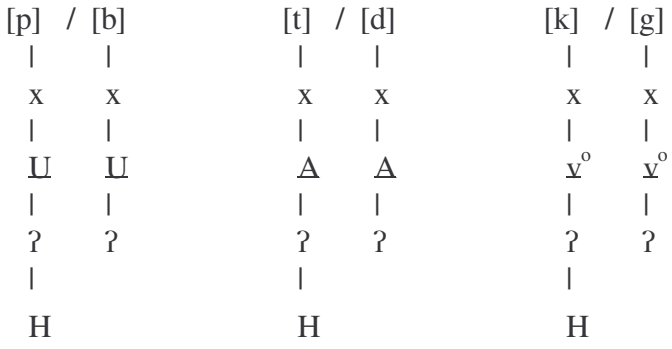
loss of 'H' (high tone):




We may account for the absence of [ʒ] from the Munster system in the same fashion. Its voiceless counterpart [ʃ] will yield [j] rather than [ʒ] when the tone element is removed precisely for the same reasons: for [ʒ] to appear in the system the element 'h' must be present in consonants. Note that this analysis has also something to say about the occurrence of [v] and [ɣ] in Irish, even though they can hardly be said to contrast with [f] and [χ] respectively, given their distribution. In these cases, simply, the absence of 'H' does not produce such dramatic contrasts as in the case of [s] and [ʃ], and the result is merely the labial or velar voiced fricatives [v] and [ɣ] or vocalisation.

Now let us turn to the second part of our initial question, namely, why the distributional gap concerning the voice distinction is found among fricatives rather than among plosives. Let us look at the representations of Irish plosives below in which we assume that 'h' is also absent from these objects. Note that the absence of 'H' in voiced plosives does not cause them to lose their plosive character, though they are inherently weaker than their voiceless counterparts:

(19)




First of all, the voiced plosives in all the series are weaker than the voiceless ones. Second, velar plosives are inherently weaker than the other series and the voiced velar plosive appears to be the weakest of all. Recall the instances of vowel lengthening due to [g] or [v] delinking in, for example, [sig´/si:m´] *suigh / suím* "I sit", [uv / i:] *ubh / uibhe* "egg/gs.", and note that one of the reasons for the propensity of the two objects to be vocalised may be the fact that each of them contains only

one active element. Finally, we are in a position to define precisely what is targeted in the lenition of such objects, namely, the occlusion element (ʔ).

Thus, it appears that the proposal that the element 'h' is absent from the phonological system of Irish provides ways of understanding the phonological behaviour of segments, together with their inventory and distribution phenomena, which otherwise would have to be ascribed to factors of an arbitrary nature. Note that in the system proposed above the asymmetry between fricatives and plosives follows directly from the uniform (symmetrical) representation of voicelessness by the presence of the element 'H', and the uniform (symmetrical) absence of the noise element 'h' in both classes. Recall that the alternative view involved the arbitrary labeling of fricatives as "marked" by depriving this class of the tone element 'H' and assuming that toneless fricatives are realized as voiceless, unlike the toneless plosives. Needless to say, the account which derives the inventory asymmetries in a uniform fashion will be given preference here.

The fact that 'h' is not available in Irish phonology does not mean, however, that its theoretical standing in general is in danger. Quite conversely, given that its occurrence in languages is governed by a parameter, it provides useful tools for understanding phonological processes and segmental distribution, the two main areas of investigation in phonology. As regards processes, the parameterised occurrence of 'h' explains why the deletion of the high tone (H) in [s] yields [r] in some languages and [z] in others. Also, given the representation of Irish obstruents above, it becomes clear why the lenition process, which clearly targets the element 'ʔ', yields fricatives if the obstruent is voiceless ([p] => [f]), and why voiced obstruents tend to produce glides ([gˀ] => [j]), thus skipping one stage on the lenition scale.[19] Let us then propose the following parameter:

(20)

**'h-parameter'**

*The occurrence of 'h' in languages is parameterised* (ON/OFF)

Thus, Irish is a language which has this parameter set in OFF, i.e., it is a 'h-less' language, while 'h-ful' languages have the parameter set in ON.

When we look at distribution, we see that the absence versus presence of 'h' in the system accounts for the two-way ([s] -> [r]) versus three-way ([s] -> [z] -> [r]) contrasts in a straightforward manner. In the following section we examine some further advantages and predictions that follow from the parameterised occurrence of the element 'h' in languages.

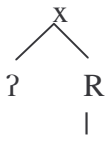
[19]More needs to be said about element structure in consonantal objects as, for instance, both lenited [d] and [g] yield [ɣ] (or [j] if they are palatalised), which points to certain similarities in the representation of coronals and velars in Irish.

**4. Parametric 'h' and affricates in linguistic systems**

It appears that the parameter proposed in the previous section may allow for a better understanding and a more adequate definition of linguistic systems. The single parameter on the occurrence of the element 'h' provides the means of relating the absence of voiceless fricatives to the non-occurrence of affricates in such systems in a straightforward fashion. Thus, it seems that the single setting of the 'h-parameter' may account directly for the situation encountered in (Munster) Irish as well as for the discrepancies between this system and that of Polish (cf. (1)). Let us, however, first look at the formal structure of affricates as understood in Government Phonology.

Harris (1990, 270) provides the following phonological representation of the affricate [ts]:

(21)




(R = coronality, ʔ = occluded, h = noise)

This is a contour segment in which the plosive element 'ʔ' does not combine with the noise element 'h'. Thus, one may propose that, essentially, affrication consists in breaking up the "h-ʔ" relation. Given the above structure and interpretation, it becomes immediately obvious that in Irish the possibility for affricates to occur is thwarted by the lack of the noise element. Hence the differences between Irish and Polish, which we illustrate again for convenience:

(22)

a. IRISH

| *fricatives* | | *affricates* | |
|---|---|---|---|
| [s] | [ʃ] | --- | --- |
| [r] | [r´] | | |

b. POLISH[20]

| | | | | | |
|---|---|---|---|---|---|
| [s] | [ɕ] | [ʃ] | [ts] | [tɕ] | [tʃ] |
| [z] | [ʑ] | [ʒ] | [dz] | [dʑ] | [dʒ] |
| [r] | | | | | |

The impoverished Irish system is to a large extent due to a single parameter which defines Irish as a 'h-less' language. On the other hand, in languages which make use of 'h', such as Polish, for example, we expect both three-way ([s] - [z] - [r]) contrasts and affricates. This, in fact, is the case

[20]Polish exhibits a three-way contrast on the plane of palatalisation as opposed to the two-way contrast in Irish. However, this aspect of the Polish consonantal system is not directly related to the question of the element 'h'.

in Polish. Recall that the three-way contrast ([s] - [z] - [r]) is defined as (H, h, A) - (h, A) - (A).

Thus, what we observe in Polish is a whole array of fricatives and affricates, both voiced and voiceless, which additionally exhibit a three-way contrast on the plane of palatalisation. We have voice contrasts ([s/z], [ɕ/ʑ], [ʃ/ʒ]) and ([ts/dz], [tɕ/dʑ], [tʃ/dʒ]), which are due to two factors: a) the presence of 'h' in the system, and b) the absence of 'H' in the voiced series. The contrasts connected with the degree of palatalisation, for example, ([s] - [ɕ] - [ʃ]) and ([ts] - [tɕ] - [tʃ]), seem to be dependent on something else, i.e., an additional parameter.

**Conclusion**

The aim of this paper was to demonstrate how the theory of elements in Government Phonology is capable of integrating the two major aspects of any phonological system, namely, the inventory of segments and the processes that affect them. We hope to have demonstrated that certain asymmetries concerning segmental inventories are spurious and follow from quite symmetrical factors like parametric occurrence of some phonological elements across linguistic systems. This proposal involves the assumption that a certain amount of responsibility for defining consonantal contrasts in the manner dimension be shifted to the vocalic (resonance) elements which, traditionally, have been assumed to define place only. Specifically, we claim that headed vocalic elements may be responsible for friction in consonants. This step seems to be justified for two reasons. First of all, this proposal constitutes a mere extension of the headedness theory proposed for vocalic systems, where the headed / headless distinction corresponds to the tense / lax contrasts (see, for example, Cobb (1993), Charette and Göksel (this volume)). And second, the analysis of the Irish [r]-sounds seems to provide evidence that the correlation of headedness with friction is well motivated.

The proposal that the element 'h' may not be present in some linguistic systems allows us to account for a number of phenomena. As regards phonological processes, it provides a way of unifying certain disparate data which essentially result from the same type of process. For example, the hight tone (H) deletion may result in rhotacism in 'h-less' languages ([s]>[r]), and in voicing in 'h-ful' ones ([s]>[z]). Additionally, if Irish [v] can be defined without making reference to the element 'h', then the lenition of [m] to [v] no longer requires the arbitrary addition of that element as a result of lenition ([m] does not contain 'h'). As far as the segmental inventory is concerned, the 'h-parameter' accounts for apparent asymmetries between certain natural classes, for example, between fricatives and plosives in Irish, in that voicing contrasts are not present in the former class. Additionally, the absence of 'h' in Irish phonology entails the absence of affricates. However, this analysis does not offer an explanation as to what causes affrication in 'h-ful' systems, and it is possible to assume that the presence of 'h' is only one of the factors which condition this phenomenon.

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