Tonal Alignment in Irish Dialects

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Abstract

A comparison of the contour alignment of nuclear and initial prenuclear accents was carried out for the Irish dialects of Gaoth Dobhair in Ulster (GD-U) and Cois Fharraige in Connaught (CF-C). This was done across conditions where the number of unstressed syllables following the nuclear and preceding the initial prenuclear accents was varied from 2-0. This tests a *variable peak hypothesis* prompted by findings for other languages, that peak timing drifts as a function of the number of syllables preceding (the prenuclear) and following (the nuclear) accent. These data also test a second hypothesis that the L*+H dominant accent of GD-U might be viewed as being underlyingly the same as the dominant H* or H*+L accent of the CF-C dialect. According to this *realignment hypothesis,* the difference between these Ulster and Connaught dialects lies in the way that the melodic tier is aligned to the segmental tier: GD-U would be viewed as having a delayed realisation of the peak relative to the Connaught dialect. Results do not support the variable peak hypothesis for Irish, as in either dialect, the peak appeared to be rather fixed across the three conditions examined (though not necessarily identical for prenuclear and nuclear positions). The results also militate against the realignment hypothesis, which rather than providing a more simple unifying account, would greatly complicate it. One reason is that there is a peak timing difference between the nuclear and prenuclear accents of CF-C, not mirrored in GD-U. Furthermore, even if one were to limit consideration to a single (e.g., prenuclear) context, a simple realignment of the accents in one dialect does not generate the appropriate contour in the other.

Key Words: Irish, Intonation, Cross-dialect, Peak Alignment, Prosody

Introduction

This paper is concerned with cross-dialect differences in Irish intonation and looks both at the gross differences/similarities in tonal inventories of a number of these dialects, as well as the finer alignment of the tonal targets in two dialects. These two dialects were chosen to represent the large divide between Ulster and Connaught dialects, where tonal configurations are, on the face of it, diametrically different.

This work forms part of, and represents an initial report on a wider Irish Prosody project (Ní Chasaide, 2003-2006), which is aimed at providing a broad account of the prosodic system of the main dialects. The project targets a major deficit in our knowledge of the linguistic structure of Irish. Despite a long tradition of research on the phonetics of Irish dialects, it has been virtually all directed at the segmental level, with almost no coverage of Irish suprasegmentals. Given that the project aims to encompass the main dialects (see Figure 1), there is a particular interest in dialect differentiation – and in the phonetic/phonological dimensions that serve this differentiation.

Our research on Irish dialects is also timely in that it taps into part of a wider enterprise of research on dialect intonation in various languages such as Grabe for English (2004), van Leyden for Orkney and Shetland Island dialects (2004), Peters for varieties of German (2004) and Gussenhoven for Dutch dialects (2003-2006)). It thus contributes to the growing pool of knowledge on prosodic typology, across and within languages. Having comparative data for Irish is particularly interesting when it comes to considering the possible influences that Irish may have had on dialects of English. The question of whether the occurrence of rising nuclei in the declaratives of a number of English dialects is likely to reflect the influence of Irish, is one which has been raised over the years (see Knowles, 1975; Cruttenden, 1997). The discussion however, has been carried out in the absence of actual descriptions of Irish intonation. As will be clear below, the patterns of the Gaoth Dobhair dialect of Donegal in Ulster are highly relevant to this discussion.

The question of tonal alignment is of particular interest for a variety of reasons. Firstly, as will be clear from the broad outline presented below of some of the main dialects, a major difference emerges with regard to the tonal inventories. One of the dialects exhibits low rising tones where others have high (and high falling) tones. In this context, one needs to consider whether the differences are truly phonological, categorical differences, as the different tonal inventories would imply, or whether they might alternatively be appropriately viewed as different surface phonetic realisations of the same underlying tonal primitives, differing rather in terms of the alignment of the tonal targets to the segmental string. Such an analysis has provided an insightful account of cross-dialect differences in Swedish (Bruce and Gårding, 1978; Bruce and Thelander, 2001; Bruce, 1987). In the case of Swedish, lexical contrasts occur on the basis of differing intonation contours, i.e. the meaning of certain segmentally identical disyllabic words may differ on the basis of having different tonal accents. Furthermore, there are striking cross-dialect differences in the precise intonational contours that effect these lexical contrasts. It has been convincingly argued that a unifying account of the dialects can be presented if one posits an underlying simple tonal contrast, with cross-dialect differentiation resulting from differences in the alignment of the melodic material relative to the segmental string. In the case of Irish the issue is somewhat simpler, and we are not dealing with lexical contrasts involving different tonal contours. Rather we are simply borrowing the concept that the apparently very different tones which occur for grammatically identical sentence types might be interpreted, not as a categorical difference in terms of the phonological inventories, but rather as a surface level realignment of the tonal peaks with the segmental material. This we term the *realignment hypothesis* and we elaborate on it further below.

Secondly, quite separately from the possibility of providing a unifying account of apparently different prosodic systems, the fine detail of tonal alignment is highly relevant to a fundamental goal - that of understanding and being able to capture in our descriptions, the prosodic differences between dialects. While listeners are sensitive to prosodic differences among dialects, the typical linguistic descriptions rarely adequately capture these differences. This is of course not surprising: the linguistic descriptions are particularly geared to the gross structural dimension, and to arrive at this one necessarily needs to abstract away the finer phonetic detail. There is now a growing body of research that demonstrates that the time-alignment of otherwise similar "tunes" relative to the segmental string is an important dimension of cross-dialect and cross-language differentiation. This research gives impetus to our attempts: not only is time alignment data likely to enable finer comparisons among the Irish dialects, but it also provides interesting points of comparison with the emerging typological body of evidence from other languages, permitting us to get a sense of how the "tunes" of Irish differ from similar tunes in other languages.

The timing of the melody to the segmental string has been shown in other languages to vary as a function of many different factors (House and Wichmann, 1996; Ladd et al., 1999; 2000). One frequent finding is that the timing of intonational peaks tends to "drift" when the number of syllables preceding the initial prenuclear accent varies: similar drift is observed when the number of syllables following the nuclear accent varies. In the present study, the alignment of nuclear and initial prenuclear accents is examined in GD-U and CF-C across conditions where the number of unstressed syllables following the nuclear and preceding the initial prenuclear accents is varied from 2-0. Given the tendencies reported for other languages such as English (Silverman and Pierrehumbert, 1990; Farrar and Nolan, 1999) our default expectation, which we will term the *variable peak hypothesis* is that increasing the number of syllables following the nuclear accent will yield a *rightwards* drift in the peak timing, while increasing the size of the anacrusis will yield a *leftwards* peak shift.

We do not intend to imply that the fine alignment of the melodic tier is the only dimension that is relevant to the prosodic differentiation of languages or dialects. Clearly other aspects of the melody are likely to be important, such as the dynamic range and the relative scaling of peaks etc. We are particularly interested also in the rhythmic dimension as well as the hitherto largely neglected dimension of voice quality, and we would argue that these need to be incorporated into the description, if we are to provide a more holistic view of how prosody "works". This is certainly our longer-term aspiration (see Ní Chasaide and Gobl, 2004a; 2004b), but as they are not at issue in this paper they will not be discussed further here. Note that the materials analysed in the present paper are rhythmically similar, and so dialect differences in rhythm would not be an influence on the findings presented here regarding peak alignment.

In focussing on the finer detail of the timing of the melodic tier, one further motivation is to provide detailed data to inform a model of Irish intonation that can be implemented in synthesis. In a parallel activity we are hoping to develop a text-to-speech system for Irish, and we are thus particularly interested in providing an account that will enable such an application of results (see Ní Chasaide et al., 2004; Prys et al., 2004).

In the first section of this paper, we provide a broad sketch of some dialects, based on our analyses to date. These analyses have been carried out within the framework of autosegmental-metrical phonology, using IViE, a variant of the ToBI transcription system. IViE was proposed by Grabe et al. (1998; 2001) in their account of dialects of English, mostly British, but including some Hiberno-English dialects. IViE assumes a left-headed accent inventory: the relevant section of the F0 contour is always taken to begin on the accented syllable (the starred tone) and the trailing tone continues up to the next accented syllable. This is relatively simpler than ToBI, which allows for left-headed and right-headed accents. Another difference in the two systems is that IViE uses boundary tones but no phrase accents. Furthermore, unlike ToBI which has two boundary tones (L% and H%) IViE permits three, to include a 0% . This additional boundary tone was prompted by the range of possibilities at the phrase boundary for Belfast English (see Fletcher et al, 2005), and this feature turns out to be necessary to account for the possible boundary conditions in Gaoth Dobhair Irish, GD-U. While we remain open to the possibility that the IViE system may need to be adapted to provide for the features that may emerge as we progress with our analyses of Irish dialects, it has to date proven to be well-suited to the materials analysed. The fact that it was developed to cater specifically for cross-dialect description means that it has many attractions for the present enterprise, e.g. it has a rich inventory of labelling possibilities, allowing the different dialects to be characterised by different subsets of labels, and equivalent intonation patterns in different dialects cannot be given different transcriptions. For transcription and annotation we have been employing the PRAAT shareware (Boersma and Weenik, 2005).

The second section of this paper deals specifically with the alignment of initial prenuclear and nuclear tonal accents in two of these dialects, chosen because they represent the major Ulster/Connaught divide that has emerged in our analyses. The interest is not only in how the very different tonal targets align to the accented syllables, testing the *variable peak hypothesis*, but also in the question of whether the accent differences might be treatable in terms of a possible realignment of the melodic and segmental tiers - the *realignment hypothesis*.

A Broad Sketch of Three Dialects

The Irish Prosody project (Ní Chasaide, 2003-2006) aims to provide descriptions of the dialects indicated in Figure 1 below. We have carried out some, though not equally detailed, analyses on all those shown by filled squares in Figure 1. The Kerry dialect (empty square) has not yet been analysed. Before proceeding to a consideration of peak alignment, we present here a short sketch of those dialects analysed to date. The corpora looked at include read passages and individual sentences illustrating different grammatical types. The main difference among the dialects will be illustrated here in terms of the contours found for declaratives and two kinds of interrogatives.

Two broad dialect groupings emerge, with very large differences between the northern (Ulster) dialect of Gaoth Dobhair (GD-U) located in Donegal on the one hand, and the Connaught dialects of Mayo, (M-C), Cois Fharraige (CF-C) and Inis Oirr, (IO-C) on the other. This grouping came as something of a surprise. The Mayo dialect, although geographically situated in the Connaught province, is generally regarded as being more closely related to the Donegal than to the other Connaught dialects. This is partly because of the provenance of the people, who are thought to have migrated from Donegal in Cromwellian times, the sustained contact that remained between the two regions as fishing communities, and partly because of similarities in the segmental and other aspects of the structure of Mayo Irish (see discussion in Ó Dochartaigh, 1978).

INSERT FIGURE 1. APPROXIMATELY HERE

Declaratives

The dialects of CF-C, M-C and IO-C, clearly belong to a single broad grouping of Connaught dialects. Declarative sentences in these dialects are characterised by predominantly H*+L nuclear pitch accents and the dominant boundary tone is 0%. There are some instances where the nuclear accent could suggest an analysis of H* with a following L%. However, when there is enough post-nuclear material to see how the L is timed relative to the H*, the clear trend in our materials is for the fall to be realised relatively quickly, with a subsequent flattening out of the contour.

Prenuclear accents are typically sequences of H* or H*+L with downstep commonly found between successive tones. The final nuclear accent differs from the preceding ones in that downstep is an option which is not always realised. Thus a typical IP would be notated as follows:

H*   !H*   H*+L 0%.

An example with no nuclear downstep is illustrated in Figure 2.

INSERT FIGURE 2 APPROXIMATELY HERE

GD-U presents a different picture. For declaratives, the dominant accent in nuclear position is a low rise L*+H. The most frequent following boundary tone is 0%, so that the most typical overall final contour is a low on the accented syllable followed by a rise in the following unstressed syllables. The rise plateaus when followed by more than one unstressed syllable. This we symbolise as L*+H 0%. There is also the possibility of a final low boundary L%. This latter pattern would yield an overall low-rise plateau with fall. Prenuclear pitch accents are virtually always similar to the nuclear, i.e. low rising tones: L*+H. A typical example of a GD-U intonational phrase with three accented syllables is shown in Figure 3, and is notated as follows:

L*+H L*+H L*+H 0%

INSERT FIGURE 3 APROXIMATELY HERE

Interrogatives

In Connaught Irish, the basic tonal pattern for wh-questions appears to be generally similar to the declarative one. Yes/no-questions are not generally differentiated in terms of the nuclear contour or the final boundary tone (which have typically a H*+L accent followed by 0%), but rather by a frequent occurrence of a low rise on the initial accented syllable in the IP. Thus the most typically observed pattern was

L*+H H*+L 0%.

Although it was not a dominant trend in our data so far, some occurrences of a final high boundary tone H% have been observed.

In GD-U the most striking feature is the overall similarity of interrogative and declarative contours. The basic tonal pattern for both categories of questions still involves sequences of L*+H tones. Wh-questions however differ from the yes/no questions. Wh-questions virtually always exhibit a 0% boundary tone, and in most cases present identical tonal patterns to the declaratives: a rise plateau nuclear contour. One difference that is occasionally observed with wh-questions, and which differentiates them from declaratives, is a high H* tone on the initial prenuclear accent of the IP. The yes/no questions can yield a final high boundary tone H%, and in this respect appear to be different from the declaratives and the Wh-questions.

Peak Alignment

The issue was raised earlier as to whether the L*+H of Gaoth Dobhair and the H* (or H*+L) of Cois Fharraige could simply be regarded as different surface realisations of the same underlying pitch accent type (H* or H*+L) but with different timing alignment of the tonal and segmental content. As illustrated schematically in Figure 4 the L*+H of GD-U could conceivably be viewed as a relatively later phasing of the tonal material, so that the H peak is delayed relative to the accented syllable, with the consequence that the rising pitch towards the H peak gains prominence and becomes L*, while the H becomes a trailing tone.

INSERT FIGURE 4 APPROXIMATELY HERE

This would provide a unifying account of the cross-dialect differences, along similar lines as was proposed by Bruce and Thelander (2001) to account for the different realisations of the word Accent I and II across the four main Swedish dialects that maintain an Accent I vs. Accent II distinction.

The attraction of this kind of approach is that within it lie the seeds of an explanation and of a historical derivation for such large divergences in intonation. If one assumes that the tonal contours in these dialects have evolved from a common origin, one is confronted with the task of explaining the divergence of the current forms. The phonological interpretation - that the difference involves a phase shift between the segmental and melodic strands - can also serve as a hypothesis that this is what has happened historically. Thus for example, as is illustrated by the lighter dotted lines in Figure 5 (which is an elaboration of Figure 4) it could be argued that the GD-U pattern arose out of a gradual rightwards shift over time in the realisation of the peak. This type of explanation has been explored by Engstrand & Nyström (2002) in relation to the differences referred to above among the Swedish dialects.

INSERT FIGURE 5 APPROXIMATELY HERE

In its simplest form this hypothesis predicts that introducing an appropriate "delay" to the tonal contour of CF-C should yield that of GD-U, allowing for the fact that parts of the contour could be hidden if it falls on say, a voiceless consonant.

Peak Timing in Gaoth Dobhair and Cois Fharraige Irish

This section presents data on the alignment of the peaks and troughs associated with the nuclear and with the initial prenuclear accented syllables in declarative utterances for the two dialects, GD-U and CF-C, chosen to represent the Ulster/Connaught divide.

Materials and Measurements

The data in this study were for 2 speakers of each dialect. The speakers were all female, aged 40-55, and all were working in Dublin in professional capacities. None of the informants were professional speakers (actors, radio announcers etc.). Subjects were not given any instructions as to how they should read the sentences, and were simply informed that we were working on a cross-dialect study. The specific test sentences for this analysis were interspersed with a larger set of sentences all of which were designed to elicit nuclear and initial prenuclear accented syllables in a variety of conditioning environments where the peak location might be expected to vary. All sentences were randomised. The specific subset used here is shown in Table 1: in all of these sentences the accented syllable /gˠɤbˠ/ was elicited so that the number of unstressed syllables - preceding it, when in initial prenuclear position, and following it when in nuclear position -- was systematically varied from 0 to 2. The abbreviations PN and N are used from here on to refer to the prenuclear and nuclear accented syllables respectively: the numbers following are used to indicate the number of adjacent unstressed syllables (so, for example, PN2 = prenuclear accented syllable, with two preceding unstressed syllables).

The recording included 8 randomised repetitions of each sentence. 5 representative utterances were chosen from the 8, which allowed for occasional errors, hesitations etc. Thus the results presented are based on a total 60 utterances per dialect.

INSERT TABLE 1 APPROXIMATELY HERE

To begin with the data was examined by both authors, and analysis strategies adopted concerning labelling points etc. The measurements were carried out by the first author. As a starting point for the analysis, the accented nuclear syllable and the following two unstressed syllables in each utterance were segmented. The duration of each segment was measured and averaged. This appeared warranted as there was not a great deal of cross-speaker variation within either dialect. In the sentences where we examined the initial prenuclear accent, the segments of this syllable and of all unstressed syllables preceding the accent were similarly measured and averaged.

A number of points in the contour were then labelled, and their time location measured relative to the nearest segmental boundary. Values were again averaged within each dialect, as there was very little variation between the two speakers. Considerable variability has been found in English and Catalan prenuclear accents (Esther Grabe, personal communication), but this was not the case for the present data. The labels used for the time points and which are illustrated in Figures 8-11 are glossed below and a schematic representation of the measured timepoints is given in Figures 6 and 7. The first set of labels, H, H*, L and L*, represent the f0 minima and maxima associated with the H and L targets of our prior intonational analysis. In order to capture other potentially important aspects of the tonal contour a number of further points were also identified. For these, lower case letters were used, along with an indication of their relationship to the main tonal landmarks (by showing the landmark in brackets, before or after as appropriate). Where a peak or valley was realised as a plateau, the label *p* was used, preceded or followed in brackets by the tonal target symbol, e.g. *(H*)p* indicates the end of the high plateau following the H in CF-C. In the case of CF-C, the lowest pitch preceding the H* accent was also measured and labelled as *l(H*).* The complete label set was as follows:

L* the trough corresponding to the dip in the L*+H accents of Gaoth Dobhair - but see also discussion below of point ***p(L*).***

H the beginning of the high plateau which corresponds to the trailing tone in the L*+H accent of Gaoth Dobhair.

H* the peak in the Cois Fharraige H* prenuclear and nuclear accents. In the prenuclear condition, this accent was realised as a plateau, with a clear elbow or turning point. For these prenuclear cases, the H* label refers to this point at the beginning of the plateau.

L the f0 minimum corresponding to the trailing L tone in the Cois Fharraige H*+L nuclear accent.

(H*)p denotes end of the high plateau in the Cois Fharraige prenuclear accent.

(H)p notes the end of the high plateau in the Gaoth Dobhair L*+H.

p(L*) this label requires an explanation. Initially we considered whether the L* of the L*+H accent in GD-U should be treated as a plateau or as a trough. Although there was typically an identifiable minimum at the end of the accented vowel, the extent of the drop during the vowel of the accented syllable was not extensive and for one speaker there were some instances where the L* appeared to be plateau-like. Overall however, a plateau analysis did not seem the most appropriate because a) f0 dropped over the duration of the vowel in the majority of cases, and a plateau analysis would lose this generalisation, and b) informal listening tests suggested that it was the final part of the vowel that corresponded to our perception of the f0 minimum. Thus our analysis treats the f0 minimum as the timepoint corresponding to L*. However the f0 value in the early part of the vowel was also labelled *p(L*)* and measured.

l(H*) the f0 minimum which precedes the H* in CF-C. For the nuclear condition, this is the minimum between the nuclear H*+L and the preceding H* accent. In the case of the prenuclear accent, this minimum always occurred at the beginning of the phrase.

h(L*) the f0 at the start of the utterance preceding the prenuclear L*+H accent of GD-U.

INSERT FIGIRE 6 AND 7 APPROXIMATELY HERE

The timing of these labelled points was measured, relative to the nearest segment boundary. In the majority of cases, these points occurred very close to segment boundaries. Values were averaged across both speakers of each dialect. The f0 values at all timepoints were also measured and averaged. In Figures 8 to 11 the f0 values for these timepoints are shown in semitones, and located relative to the segmental string.

Results: prenuclear accents

Results for the prenuclear accents of CF-C and GD-U are shown in Figures 8 and 9 respectively. Note that in each prenuclear (PN) condition, the number indicates the size of the anacrusis: so, in PN2 there are two preceding unstressed syllables, while in PN0 there are none. In both of these dialects it transpired that the phonologically "voiced" stops were produced with extensive devoicing, so that they were effectively phonetically voiceless. This complicates the picture somewhat, particularly as many of the high and low turning points appear to be located at the vowel/consonant boundaries. The results are therefore insufficient to elucidate in more detail whether the true turning points might be located within the consonants themselves: clearly further refinement will ultimately be required here, with further data that includes fully voiced consonants.

Although Figures 8 and 9 show very different looking contours for the two dialects, it is rather striking how little variation there is in tonal alignments across the three prenuclear conditions for either dialect. Insofar as we can ascertain, the size of the anacrusis appears to have little or no effect. In CF-C, the peak is realised as a plateau, whose onset, point H* (see segmentation details above) is consistently located at the boundary between the accented and the following unaccented syllables. Thus the plateau is realised on the post accented syllable and may continue beyond that. This was consistent across both speakers. The lack of apparent shifts in the peak timing is quite striking, in comparison to results for peaks in other languages, where the number of preceding unstressed syllables does seem to have an effect (for data on English, see Farrar and Nolan, 1999; for Greek, see Arvaniti and Ladd, 1995). The caveat just mentioned must be remembered however: given the voicelessness of the /b^{γ}/, one cannot rule out the possibility of H* occurring earlier (during the consonant), and potential shifts in alignment due to the size of the anacrusis being masked. Nonetheless, it seems safe to conclude from these data that the peak in CF-C is anchored to the right edge of the accented syllable. Note that in their descriptions of Irish dialects several authors such as De Bhaldraithe (1945), de Búrca (1958), Mhac an Fhailigh (1968) mention that following short vowels (as in the present data), the syllable boundary is after the intervocalic consonant.

INSERT FIGURES 8 AND 9 APPROXMINATELY HERE

In GD-U, both tones of the L*+H sequence appear to be rather stable in terms of their location across the different anacrusis conditions. L* is always realised towards the end of the accented vowel or at the boundary of the accented vowel and the following consonant. As for CF-C, because of the devoicing of the final consonant in /gˠɤbˠ/, we cannot exclude the possibility that the minimum might occur somewhat later, during the consonant. If this were the case, slight shifts in alignment occurring with changes to the size of the anacrusis could be hidden. A further point has already been mentioned: the slope of the f0 drop on the accented vowel is quite shallow, and indeed, some clear instances of an L plateau were produced by one of the speakers. However, given the fact that in these utterances the f0 minimum was most frequently located towards the end of the accented vowel, and given our informal auditory impressions, we decided that the most satisfactory interpretation for the present is that L* is anchored to the right edge of the accented vowel (or syllable). It is also worth noting that L* is essentially the endpoint of a fall that begins at the onset of the phrase, which increases in scale as the size of the anacrusis increases.

Although locating L* towards the end of the accented vowel does appear to be the most appropriate interpretation of the present data, the possibility that it should be treated as a plateau must be borne in mind. Obviously segmentation decisions of this kind have implications for our alignment results. This is something we will need to investigate more fully with more varied materials that contain, for example, long vowels and sonorants in the onset and coda.

The H target of the trailing tone of the L*+H prenuclear GD-U accent is always located on the vowel of the second unstressed syllable following the accented syllable. The peak tends to be realised as a plateau, and its onset is labelled H in Figure 9. There is some slight variation in the timing of H across the three prenuclear conditions. However, the size of the anacrusis is unlikely to be the cause of this variability, as it does not shift in a systematic way with an increase in the size of the anacrusis. Note that H is earlier in PN2 than PN1, but later in PN1 than in PN0. As it is also the case that the onset of a plateau is a relatively more difficult timepoint to locate consistently than an f0 maximum associated with a sharp peak, we would not wish to make specific claims about these rather small differences. It is however striking that the distance from the L* to the H is consistently a gap of two syllables (i.e. the H is always two syllables later than L*). It is worth noting also that there is no consistency in terms of absolute time (the interval between L* and H is approximately 130 ms in PN0 and 250 ms in PN1). This is in keeping with our basic intuitions that the important points in the melodic tier are aligned with the syllables (or voiced portions thereof) rather than with the segmental string as such.

In this (prenuclear) environment, the H* of CF-C and the L* of GD-U have in common that they appear to be aligned towards the right edge of the accented syllable, with the H* alignment being slightly later than the L*.

The starred tone in either dialect furthermore appears to remain invariant across differences in anacrusis size. CF-C and GD-U differ in that the anacrusis is produced with a rising intonation in CF-C, and a falling intonation in GD-U. The range of the pitch drop to the L* in GD-U increases with the size of the anacrusis, something that does not hold for the rise in CF-C. There is a very large rise in the anacrusis for PN1 of CF-C, but there is no obvious explanation for it and it clearly cannot be attributed in a simple way to the duration of the anacrusis, as a comparison of the three prenuclear conditions show.

Results: nuclear accents

Figures 10 and 11 illustrate the alignment and pitch measurements for the nuclear accents of CF-C and GD-U respectively. In CF-C, the final, nuclear accent tends to be realised as a bi-tonal H*+L sequence. Unlike the prenuclear case, the H* element is not realised as a plateau. The H* is consistently aligned with the beginning of the accented vowel in the syllable /gˠɤbˠ/. As the initial /gˠ/ is devoiced, this is effectively the onset of voicing in the syllable carrying the nuclear accent. The alignment of H* does not appear to be affected by the number of unstressed syllables following the accented one. We note again however that, given the voiceless nature of the onset consonant, one cannot fully rule out the possibility that the H* target might be located within the consonant, or if so, that there could be slight shifts occasioned by the number of following syllables. We reiterate that further materials with voiced sonorants will be required to elaborate more precisely whether H* can occur during the initial consonant. We would at this point simply conclude that the peak is anchored towards the left-edge of the accented syllable, and that its timing does not appear to be affected by the number of following unstressed syllables. This differs from the situation reported for English (Steele, 1986; Silverman and Pierrehumbert, 1990) where a rightward drift of the peak timing was found with an increase in the number of following syllables. The CF-C data is rather more similar to data reported for Northern Standard German (Grabe, 1998) where the number of following unstressed syllables does not affect the peak location. However, unlike the left-aligned CF-C peak, the H* in the German data was invariably aligned with the right-edge of the accented syllable.

The H alignment in the nuclear accent is earlier than in the prenuclear. The difference appears to be a matter of a right-edge vs. a left-edge alignment to the accented syllable. A difference in peak phasing between nuclear and prenuclear accents has been reported in other languages e.g. Silverman and Pierrehumbert (1990) found that the peak tends to be earlier for the nuclear than prenuclear case in American English.

We would argue that the GD-U realisation of the nuclear L*+H accent, though superficially different to the prenuclear, is in fact essentially similar. The location of the H element does vary, but this variation would be an expected surface realisational difference if we are correct in assuming that the underlying anchoring of H is to the second unstressed vowel following the accented syllable (as can be seen in the prenuclear data and in N3). Our interpretation of the GD-U data is that the L*+H tone has an intrinsic time requirement for its realisation, and that this requirement is most likely to be violated in certain nuclear conditions, e.g. when the accented vowel is short and there are not enough post-accented syllables. These conditions arise in N0 and to a lesser extent in N1. The fact that H occurs earlier going from N2 to N0 can be taken to simply reflect the successive decrease in the number of unstressed syllables available for its full realisation. In other words, these look like instances of truncation rather than a planned realignment of the peak timing. Truncation is also suggested by the reduced height of H, going from N2 → N1 → N0, where the scale of the rise for H reduces from approximately 5.5 semitones in N2, to 3.75 in N1 and 2.5 in N0. This truncation is most likely to have its roots in production constraints on the rate of pitch variation in neutral speech, and the reduced time available for the realisation of the contour. A final pointer to truncation in the GD-U data is the lack of a high plateau following the rise in N0.

The small variations in the timing of the L* would seem to beg a similar explanation. In N2 and N1, L* appears to be anchored to the same point as in the prenuclear cases, i.e., to the right edge of the accented vowel (or syllable). The relatively early timing of L* in N0 suggests that that we are dealing with compression of the contour, where the L* has shifted to an earlier point in the accented vowel, presumably under the "pressure" of the fact that there is only a single syllable available for realisation of the L*+H.

In view of this interpretation of the nuclear accent it is worth noting that also in the prenuclear data there may also be some evidence of a tendency to truncation. Note in Figure 9 that the fall to the L* (in GD-U prenuclear items) is greater as the size of the anacrusis increases. In other words, the slope of the fall to the L* remains the same, but the L* target is lower with more prenuclear syllables. This could be taken to indicate a general tendency to truncation to GD-U.

INSERT FIGURES 10 AND 11 APPROXIMATELY HERE

Discussion

This rather detailed look at tonal target alignment in the two dialects shows up not only the striking differences between them, but also points to some common features, particularly in the prenuclear accent. The starred tone in each dialect appears to be aligned towards the right edge of the accented syllable, occurring somewhat later in CF-C than in GD-U. They also have in common that the size of the anacrusis, which often affects target alignment in other languages, does not appear to affect alignment in Irish.

The alignment differences between the dialects are greater in the nuclear position. While the accent of GD-U retains in nuclear position (where possible) the essential characteristics of the prenuclear accent, in CF-C, there is a shift in alignment of the peak from the right-edge of the accented syllable (prenuclear) to a left-edge alignment (nuclear).

It is striking that there is no support for the *variable peak* hypothesis. Although the two dialects differ enormously, they have in common that the peak does *not* drift, either in prenuclear environments, when the size of the anacrusis varies, or in the nuclear environment, with varying numbers of unstressed syllables following the accented syllable. Thus, the patterns of peak drift for these conditions, commonly reported in other languages do not appear to hold for Irish, or at least, not for these dialects.

The question was raised earlier in relation to the Ulster vs. Connaught dialects, as to whether the differences in the tonal sequences might be regarded as a realignment of the (same) tonal targets relative to the segmental string. Could the L*+H of Gaoth Dobhair (GD-U) be just a later realisation of an underlying H, with the L simply a manifestation of the trough between successive H accents, a product of declination, which in the case of GD-U becomes associated with the stressed syllable in the foot? Some of the findings for the prenuclear accent could be seen as possible support for such a realignment hypothesis; the fact that H in both CF-C and GD-U is realised as a plateau; the fact that the H in CF-C is in any case realised rather late relative to the stressed vowel could be taken to indicate a general tendency to peak delay in Irish.

However, a careful comparison of the alignment results leads us to conclude for a variety of reasons that the data do not in fact support the realignment hypothesis. First of all, considering only the relative timing of the peaks in nuclear and prenuclear positions, it is clear that a single realignment factor will not work for both environments. In the prenuclear cases, shifting the GD-U peak leftwards by one syllable could be argued to generate an approximate match to the CF-C data. However, in the nuclear condition the distance between the peaks is two syllables. Thus the realignment argument would have to be rather complex to allow for the considerable variability in these timing differences. Further possible objections to the realignment hypothesis can be illustrated in terms of Figures 12 and 13, where the pitch contours for CF-C and GD-U are superimposed for the nuclear and the prenuclear data respectively, but realigned so that the H timepoints coincide.

INSERT FIGURE 12 AND 13 APPROXIMATELY HERE

Looking first at the nuclear accents in Figure 12, we find that even when the CF-C accent is shifted to coincide with the H of GD-U, it simply does not generate the appropriate GD-U contour. The sharp peak in CF-C does not match the plateau in GD-U. Perhaps more problematic is the mismatch in the f0 minimum preceding the peak. While in GD-U the trough associated with the L* is substantial, in CF-C the trough is shallow, when indeed it is present. Consequently, the scaling of the peak relative to the preceding f0 minimum emerges as being quite different for the two dialects, as is illustrated in Table 2 for the nuclear accents. As mentioned earlier, the speakers for both dialects were from comparable social classes and professions, it is unlikely that these large differences in peak scaling could be an artefact in these data.

INSERT TABLE 2 APPROXIMATELY HERE

In the prenuclear case (Figure 13) the realignment "works" better. The H peak is here a plateau in both dialects. The scaling of the peak relative to the preceding minimum is still a problem in the case of PN2, where there is a long anacrusis. The falling vs. rising anacrusis of the GD-U vs CF-C contour does not fall into place if we simply realign the peaks. This highlights the fact that the L* of GD-U is not simply the onset of a rise, but a turning point in the contour.

There are other reasons why the realignment hypothesis is counterintuitive for GD-U. The fact that L* is always within the accented vowel militates for it being regarded as the primary tonal target of this dialect, more of a mirror image of the H* in CF-C than a fallout of H realignment. Furthermore, the time-locking (in terms of syllables) of the L* and H in GD-U is also striking, and suggests that we are dealing with a bi-tonal target where *both* targets have crucial alignment properties, are closely linked to the syllabic tier and define the dominant "tune" of this dialect.

The rising L* + H tone of GD-U can be compared to similar rising tones in other languages for which alignment data is available. In Figure 14 a schematic representation of the prenuclear GD-U rising tone is superimposed on illustrations presented for comparable data of English, as well as of Northern and Southern German in Atterer and Ladd (2004).

INSERT FIGURE 14 APPROXIMATELY HERE

Whereas the data in these other languages look like the same accent with very fine time shifts differentiating among languages/dialects, the GD-U rise differs from say, the L*+H of the German dialects in having a longer trough-to-peak interval as well as a later anchoring of the L* in the accented syllable.

Conclusions

The alignment data presented here militate against the realignment hypothesis, and suggest that it would be impossible to derive the GD-U accents by simple time-shifting of an underlying peak. Any attempt to relate the different contours to a single underlying contour would have to invoke very complex phonetic realisation rules, and this removes the potential attraction of the hypothesis in any case. We therefore conclude that the best treatment of the Ulster vs. Connaught dialect differences is in terms of different underlying categories.

This conclusion and the data presented raise numerous new questions. One is prompted to speculate on the origins of the differences. The fact that the synchronic account cannot be simply framed in a unifying framework does not of course mean that a diachronic derivation of the differences could not invoke realignment as the major triggering of dialect differentiation. As these data show however, the diachronic realignment account will need to be very complex to account for the kinds of differences that are illustrated here.

These data also raise questions concerning intonational variation in different accents of English. In particular there are striking similarities between our GD-U patterns and the pitch contours described by Grabe and Post (2002) for Belfast English for both declaratives and interrogatives. Note that the pitch contours for Belfast English differed dramatically from those of the other English dialects reported in the IViE project. A rising nucleus in declaratives has also been described by Knowles (1975) for Liverpool English and features also in Glaswegian, Birmingham and Newcastle (but see Grabe and Post, 2002 on the latter). As mentioned earlier the question of these rising nuclei reflecting an influence of Irish has been discussed by Cruttenden (1997) and by Knowles (1975).

Our opinion at this juncture is that the similarities in tonal patterns of Gaoth Dobhair (Ulster Irish) and Belfast (Ulster English) are very pervasive and hardly a coincidence. And although there are similarities between Belfast English and the British varieties mentioned above, these are more distant and less pervasive (affecting declaratives in particular). Therefore, whatever one might argue about the latter British dialects, it seems reasonable to hypothesise that the rise-plateau nuclear contour of Ulster English could be a direct influence from Ulster Irish. If so, this could be seen as supporting a view within historical linguistics that in such language contact situations, the syntax comes from the conqueror and the phonology from the conquered.

It is interesting to note here how very different the Southern Connaught Irish dialects are to the Ulster dialects, and how superficially similar the declarative patterns are to those of the mainstream British accents. Yet they differ from the latter in not having rising nuclei in yes/no questions, and interestingly, this is a feature Grabe and Post (2002) mention for Dublin English.

Past speculations concerning Irish influences on English intonation in British dialects have not hitherto been based on any knowledge of Irish intonation, but rather on certain similarities to Belfast English, and on the fact that the accents in question were towns in which Irish immigrants settled. Given how very different the northern GD-U and the southern CF-C patterns are, it is obvious that we will only really come to grips with this question when we (a) have a fuller understanding of the intonation contours of the main Irish dialects and (b) we tie this in with information about the known settlement patterns of immigrants and migrants from these areas.

This study sets the agenda for some of our future directions. Firstly we will need to refine and extend the alignment study on GD-U and CF-C analysing more informants and using more complex materials to overcome the limitations imposed by the devoicing of stops in the present study. Secondly we plan to look more closely at the time alignment details among the dialects of Connaught. A preliminary look suggests that there may be rather fine differences among these rather similar dialects. Furthermore, in future work we would hope to include some coverage of matched dialects of Hiberno-English, as these may also be important to understanding the operation of possible cross-language influences.

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Prenuclear position

PN0

Gobann	an	**sceach**	a**mach**	thar	an	**mball**a
Sticks	*the*	*bush*	*out*	*over*	*the*	*wall*
The bush	is	sticking	out	over	the	wall

PN1

Tá	**gob**án	ag	**teacht**	a**mach**	thar	an	**mball**a
Is	*tradesman*	*the*	*bush*	*out*	*over*	*the*	*wall*
A	tradesman	is	coming	out	over	the	wall

PN2

B'ag	a'	**ngob**án	a	bhí	an	**teach**	a	**b'fhearr**
At	*the*	*tradesman*	*that*	*was*	*the*	*house*	*the*	*best*
The	tradesman	had the	best	house				

Nuclear position

N0

Ní	**maith**	le	**Daidí**	an	**gob**
Not	*Good*	*with*	*Daddy*	*the*	*beak*
Daddy	doesn't	like	the	beak	

N1

Ní	**maith**	le	**Daidí**	an	**gob**án
Not	*good*	*with*	*Daddy*	*the*	*tradesman*
Daddy	doesn't	like	the	tradesman	

N2

Ní	**maith**	le	**Daidí**	an	**gob**adán
Not	*good*	*with*	*Daddy*	*the*	*sandpiper*
Daddy	doesn't	like	the	sandpiper	

Table 1.

Trough to peak distance in semitones		
	Gaoth Dobhair	**Cois Fharraige**
N0	2.5	0.25
N1	4.5	1.0
N2	6.25	1.25

Table 2.

Table 1. Test sentences elicited for both dialects. PN = prenuclear; N = nuclear. Numbers 0, 1, 2 indicate the number of unstressed syllables preceding the prenuclear and following the nuclear accent.

Table 2. Scale of peaks, relative to preceding f0 minima for nuclear accents in GD-U and CF-C. Values in semitones.

Figure 1. Map of Ireland illustrating the location of the dialects.

Figure 2. F0 trace of the utterance “Ní **maith** le **Daid**í an **gob**adán”, a typical example of a Connaught Irish intonational phrase. < > indicates the rhythmically strong syllables.

Figure 3. F0 trace of the utterance “Ní **maith** le **Daid**í an **gob**adán”, a typical example of a GD-U intonational phrase. < > indicates the rhythmically strong syllables.

Figure 4. Schematised representation of how the rising accent of GD-U (heavy dashed-line) might be derived as a later phasing of an underlying peak, essentially similar to that of CF-C (heavy solid-line). Note that the schematised time grid is in syllables, with the accented syllable shown in black.

Figure 5. Schematised representation of how the rising accent of GD-U (heavy dashed-line) might be historically derived as a successively later phasing (lighter dotted lines) of the melodic contour, which is essentially similar to that of CF-C (heavy solid-line).

Figure 6. Schematic figure illustrating the labels associated with the timepoints measured in prenuclear accents for CF-C and GD-U.

Figure 7. Schematic figure illustrating the labels associated with the timepoints measured in nuclear accents for CF-C and GD-U

Figure 8. Tonal contours for prenuclear accents in CF-C, with semitones on y-axis and x-axis in ms. PN0= no anacrusis, PN1= anacrusis of one, PN2= anacrusis of two.

Figure 9. Tonal contours for prenuclear accents in GD-U, with semitones on y-axis and x-axis in ms. PN0= no anacrusis, PN1= anacrusis of one, PN2= anacrusis of two.

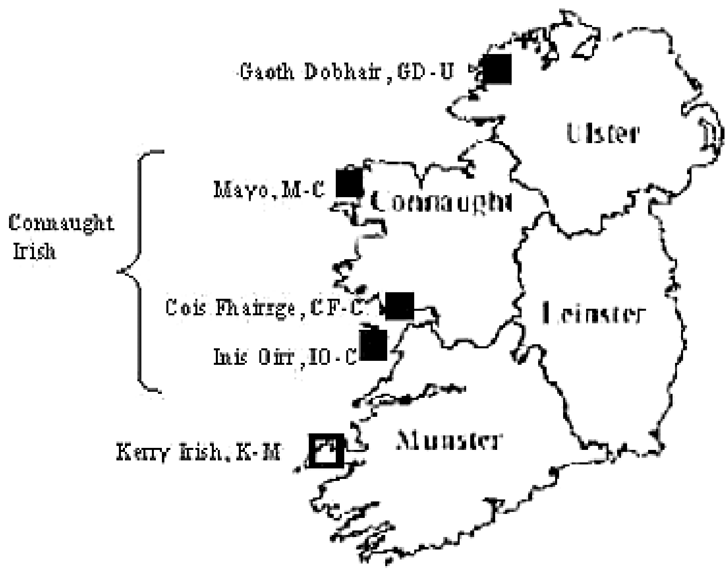
Figure 10. Tonal contours of nuclear accents in CF-C. y-axis=semitones; x-axis=ms. N0, N1 and N2 = no, one and two following unstressed syllables respectively.

Figure 11. Tonal contours of nuclear accents in GD-U. y-axis=semitones; x-axis=ms. N0, N1 and N2 = no, one and two following unstressed syllables respectively.

Figure 12. Nuclear tonal contour of GD-U (solid-line) superimposed on that of CF-C (dashed-line), aligned to the H peaks (encircled) of either dialect.

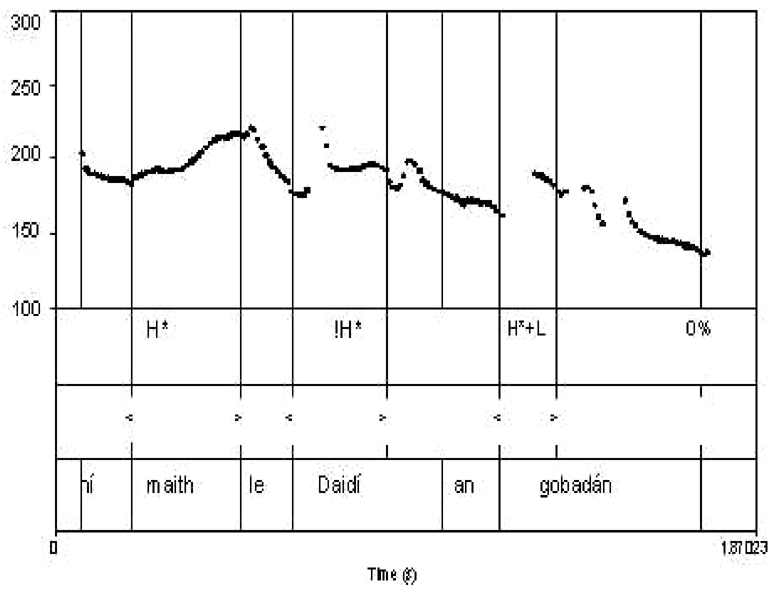
Figure 13. Prenuclear tonal contour of GD-U(solid-line) superimposed on CF-C (dashed-line) aligned to the H peaks (encircled) of either dialect.

Figure 14. Schematic illustration of the L*+H of GD-U illustrated in comparison to rising tones in other languages as presented in Atterer and Ladd (2004).



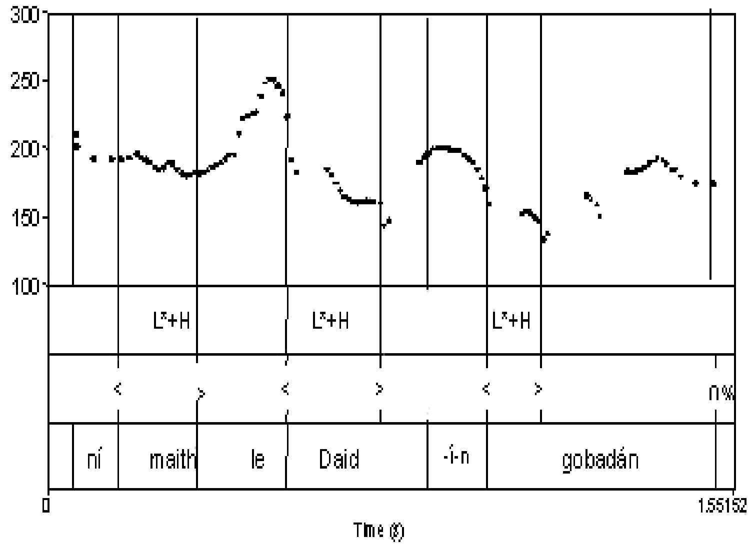
Gaoth Dobhair, GD-U
Ulster
Mayo, M-C
Connaught
Connaught
Irish
Cois Fhairrge, CF-C
Leinster
Inis Oírr, IO-C
Kerry Irish, K-M
Munster

Figure 1



300
250
200
150
100
H*
!H*
H*+L
0%
ní
maith
le
Daidí
an
gobadán
0
1.87023

Figure 2.



300
250
200
150
100
L*+H
L*+H
L*+H
<
>
<
>
<
>
n%
ní
maith
le
Daid
-í-n
gobadán
0
1.55152
Time (s)

Figure 3.

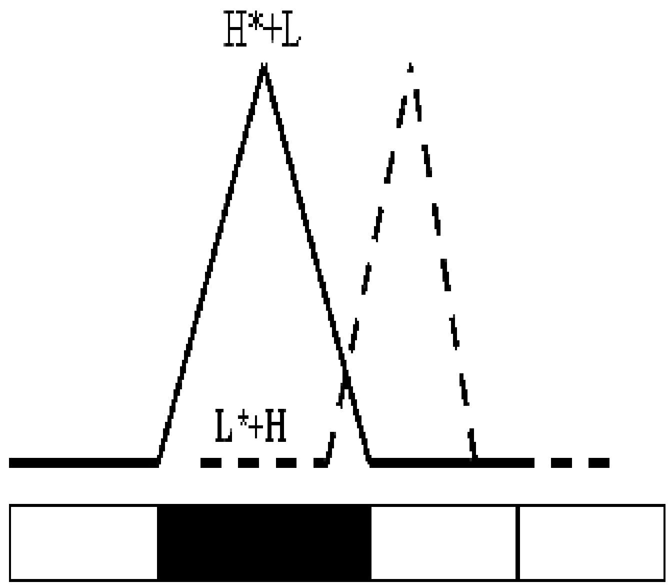


Figure 4.

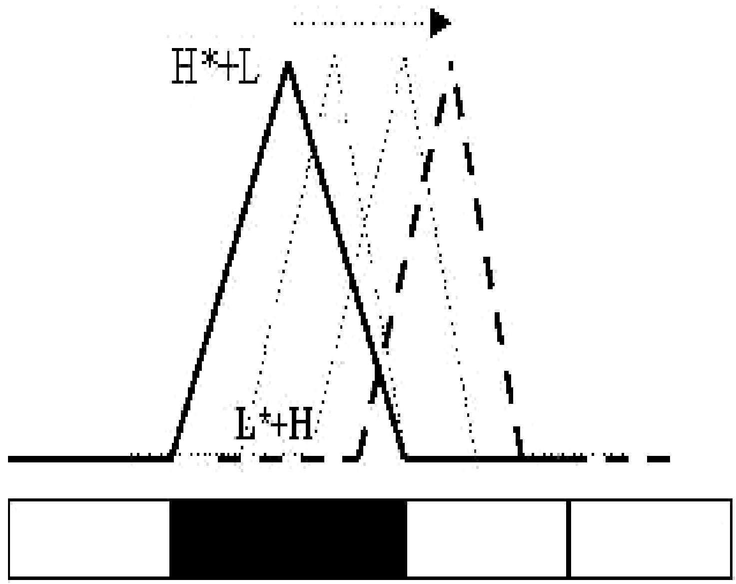


Figure 5.

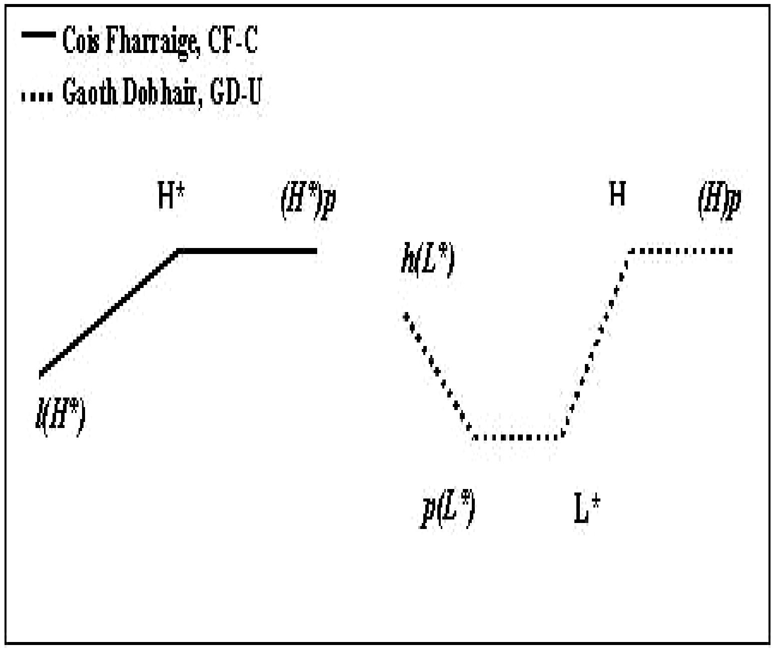


Figure 6.

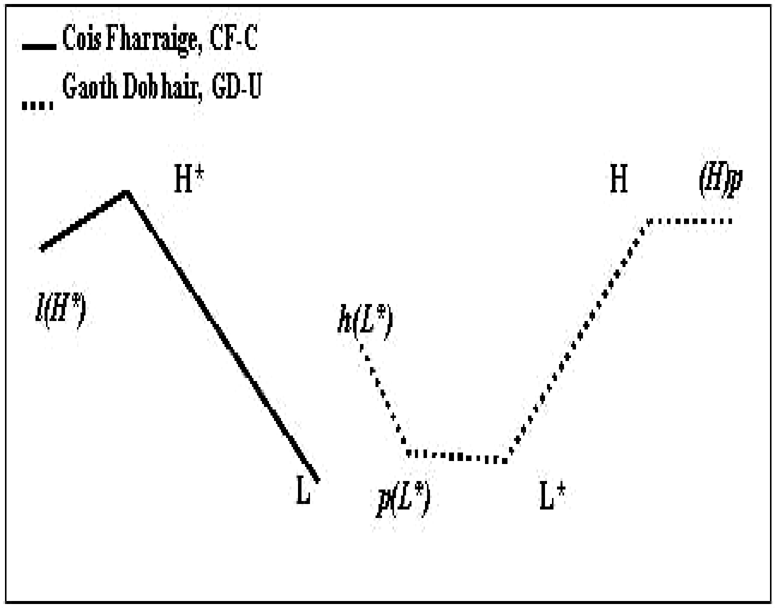


Figure 7.

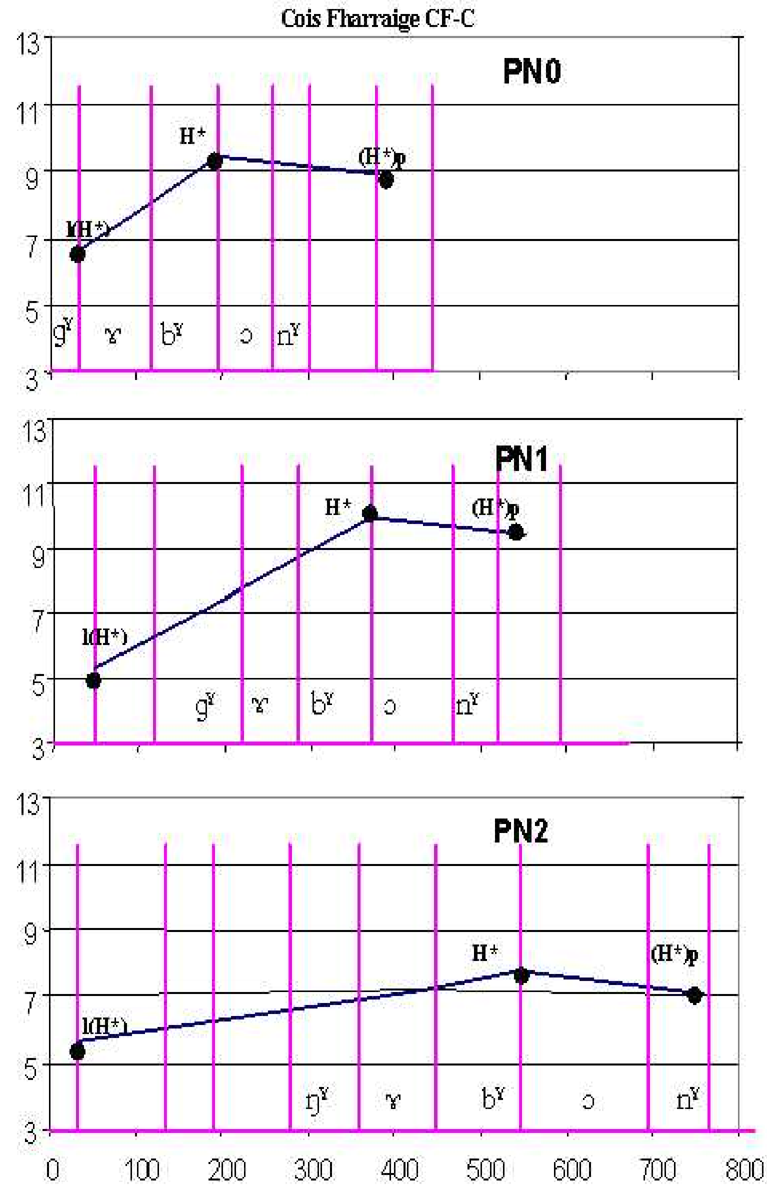

Cois Fharraige CF-C
PN0
PN1
PN2
H*
(H*)p
l(H*)
13
11
9
7
5
3
0
100
200
300
400
500
600
700
800

Figure 8.

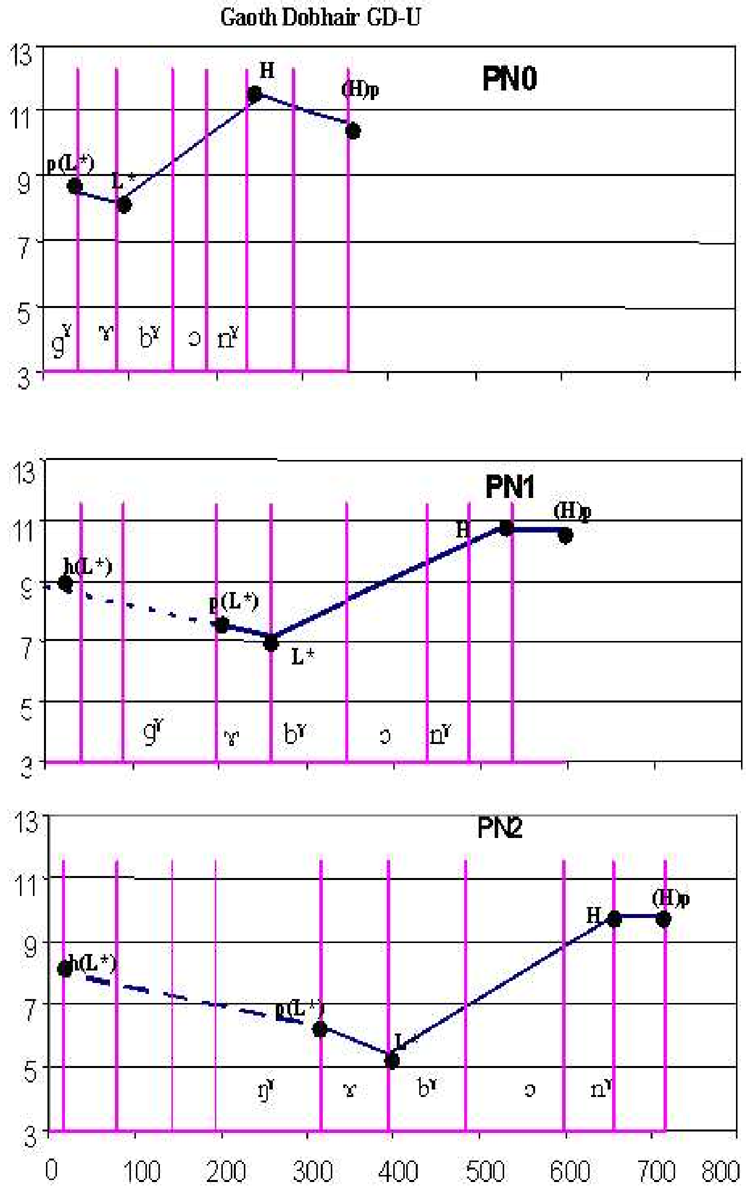

Gaoth Dobhair GD-U
PN0
PN1
PN2
p(L*)
L*
H
(H)p
h(L*)
L
13
11
9
7
5
3
0
100
200
300
400
500
600
700
800

Figure 9.

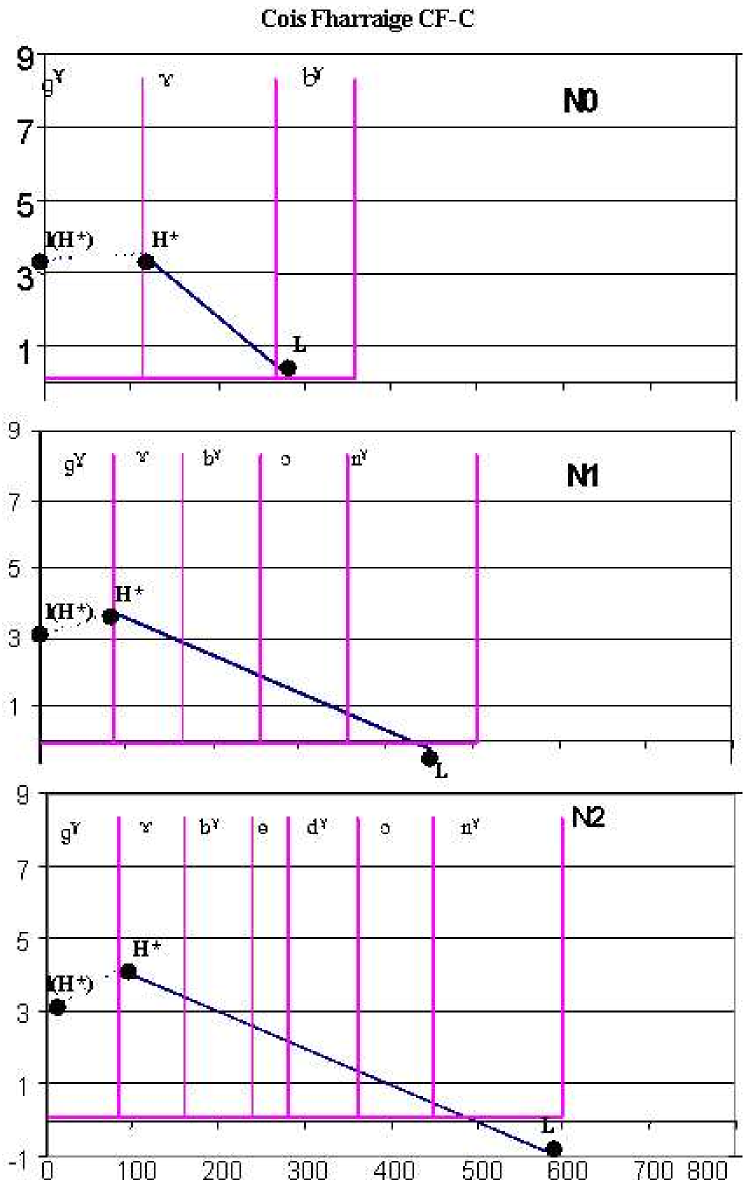

Cois Fharraige CF-C
N0
N1
N2
H*
L
9
7
5
3
1
-1
0
100
200
300
400
500
600
700
800

Figure 10.

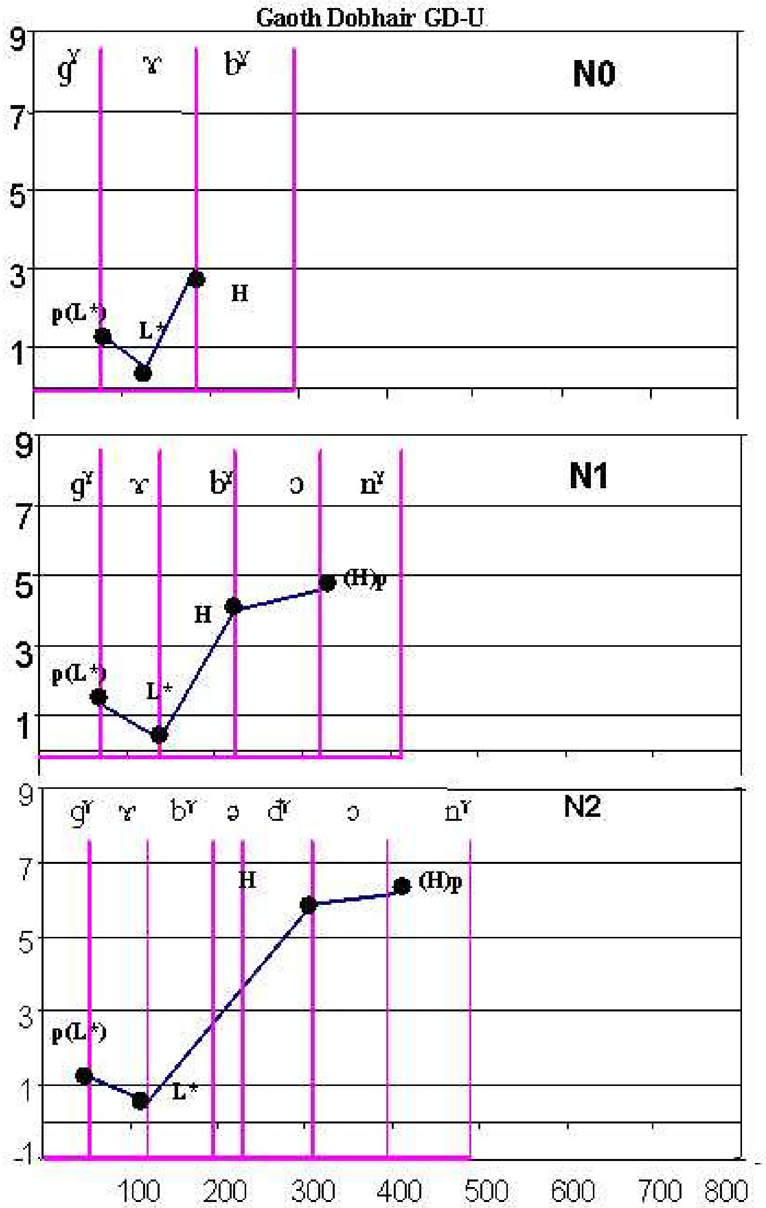

Gaoth Dobhair GD-U
N0
N1
N2
p(L*)
L*
H
(H)p
100 200 300 400 500 600 700 800

Figure 11.

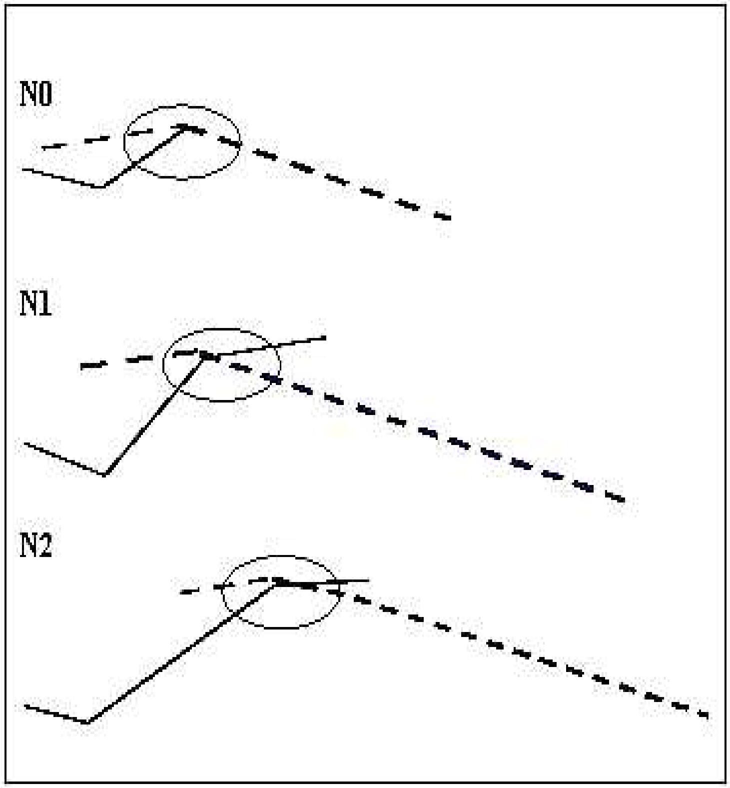


Figure 12.

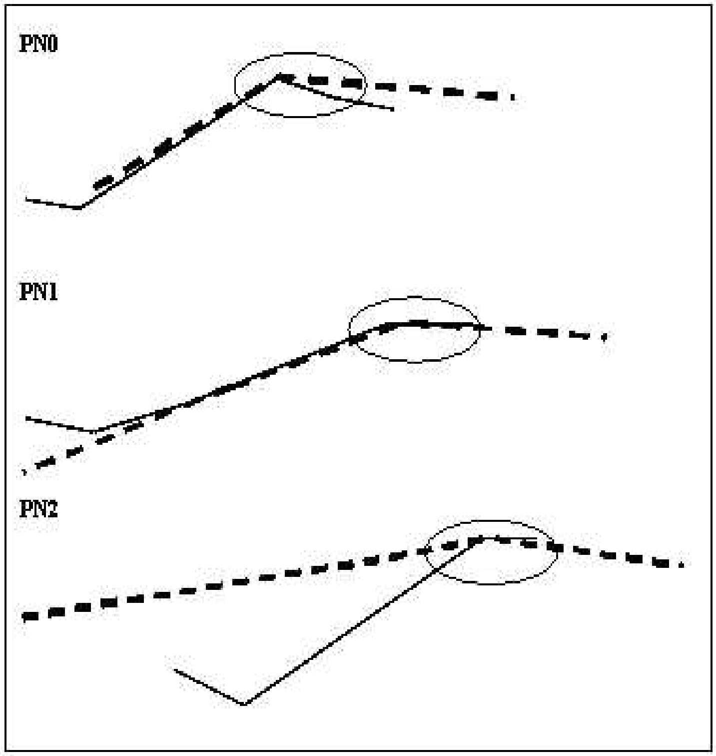


Figure 13.

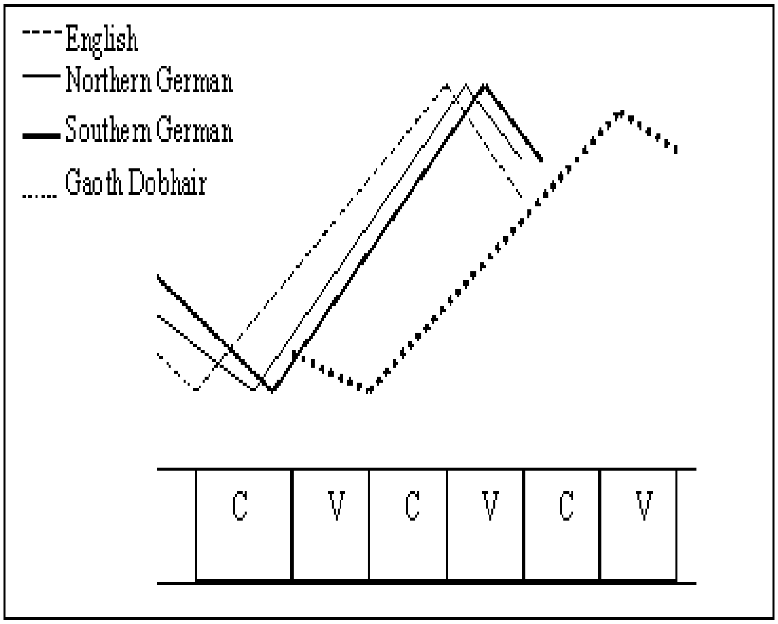

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Figure 14.