Vocalisations: Evidence from Germanic

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A thesis submitted for the degree of doctor of philosophy

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October 2016

Abstract

A vocalisation may be described as a historical linguistic change where a sound which is formerly consonantal within a language becomes pronounced as a vowel. Although vocalisations have occurred sporadically in many languages they are particularly prevalent in the history of Germanic languages and have affected sounds from all places of articulation. This study will address two main questions. The first is why vocalisations happen so regularly in Germanic languages in comparison with other language families. The second is what exactly happens in the vocalisation process.

For the first question there will be a discussion of the concept of ‘drift’ where related languages undergo similar changes independently and this will therefore describe the features of the earliest Germanic languages which have been the basis for later changes.

The second question will include a comprehensive presentation of vocalisations which have occurred in Germanic languages with a description of underlying features in each of the sounds which have vocalised.

When considering phonological changes a degree of phonetic information must necessarily be included which may be irrelevant synchronically, but forms the basis of the change diachronically. A phonological representation of vocalisations must therefore address how best to display the phonological information whilst allowing for the inclusion of relevant diachronic phonetic information. Vocalisations involve a small articulatory change, but using a model which describes vowels and consonants with separate terminology would conceal the subtleness of change in a vocalisation. The model presented here has therefore been designed to unite the descriptions of consonants and vowels to better demonstrate this change whilst allowing for relevant phonetic information to be included.

Acknowledgements

For any study spanning four years there will obviously be a number of people who have contributed in one way or another to its progress. I would especially like to thank my supervisor, Wyn Johnson, for the support she has given me throughout. On many an occasion I have explained a particular linguistic problem I have been facing and she has always known exactly which papers I should read to help me and so I thank her for her vast knowledge of the field and I feel honoured that I can now class her as a friend.

I extend a thank-you to the linguistics faculty at the University of Essex who have been very encouraging throughout the process and conversations about linguistics with them have been very helpful to better my knowledge. From the faculty I would like to mention and thank Rebecca Clift and Vineeta Chand from my advisory board and Nancy Kula for random conference conversations on phonology. I would also like to thank my research group who have allowed me to test some of my crazier theories on them and given me invaluable feedback, and from this group I would especially like to mention Jenny, Sara, Sami and Nutcha who have been there from the start.

Finally I would like to thank my husband, Michael Raebel, who has allowed me to follow my dream knowing full well that we would only be able to afford camping holidays over this period. He has been by my side throughout and given me the emotional support I have needed and I could not have embarked on this project without him.

Contents

1 Introduction

A vocalisation is a linguistic process whereby a former consonant in a language's history starts to be produced as a vowel and more specifically it refers to the precise period in the language's history that such a change occurs.

Within my own variety of English, for example, I have a process known as l-vocalisation, such that my phonemic /l/ is produced as a vowel [ɤ ~ o] in a non-prevocalic position. In prevocalic position I produce the sound as [l], such that 'lull', which is phonemically /lɐl/ is more likely to be produced as [lɐɤ] by me. I, and others who l-vocalise or are familiar with the process, perceive both the initial and final sounds as /l/ but the initial allophone will be produced consonantally, whereas the final /l/ is produced vocalically. We can therefore say that my dialect, and many other English varieties, is undergoing a process of vocalisation.

Vocalisations are part of a larger process called lenition. Lenitions are described by Kirchner (2001:3) as referring to "synchronic alternations, as well as diachronic sound changes, whereby a sound becomes "weaker", or where a "weaker" sound bears an allophonic relation to a "stronger" sound." A number of people have produced 'paths of lenition' to show the usual direction a sound takes within a lenition process.

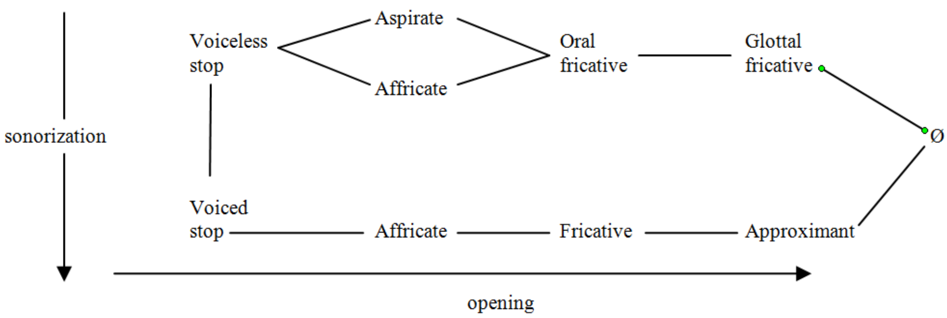


Figure 1

We have for example a general model by Lass (1984:178) as shown in Figure 1, one by Hock (1991:83) specifically for coronals as shown in Figure 2 and one showing how rhotics change, though not specifically showing lenitions, by Sebregts (2014:281) in Figure 3.

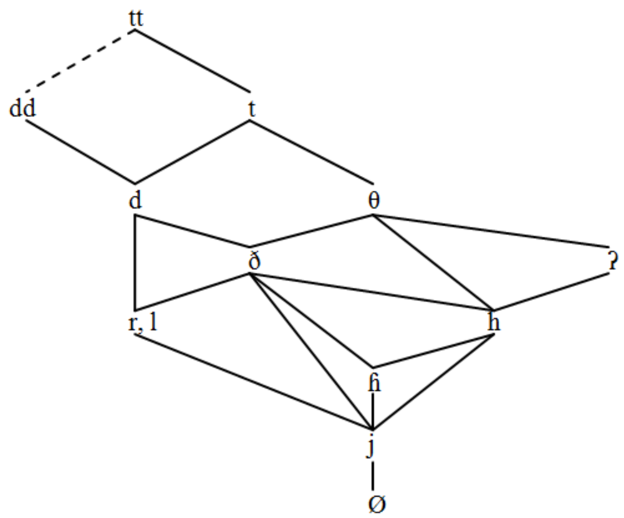


Figure 2

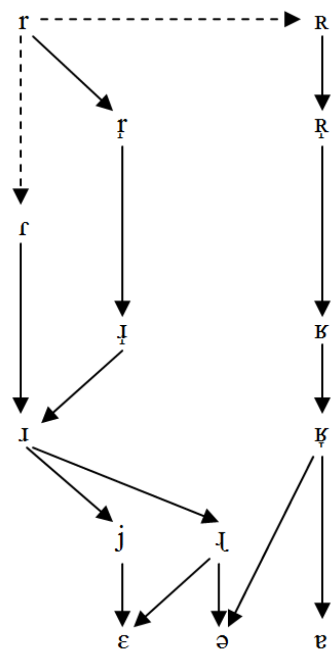


Figure 3

Of the three, Sebregts is the only representation to indicate the possibility of a vocalisation with both Lass and Hock bypassing this step, although, for coronals we shall see that this is indeed mainly accurate. Also by looking at the models of lenition as shown above it can be seen that there are a number of different processes which may be classed as lenitions. We find sonorisation, where voiceless sounds become voiced, degemination, where long or double consonants become short or single consonants and debuccalisation, where a sound loses its place of articulation and becomes glottal.

An alternate approach to lenition is that found in Government Phonology. Harris (1990:265) suggests the following definition:

> "...under an element-based analysis, lenition is defined quite simply as any process which involves a reduction in the complexity of a segment. Complexity is directly calculable in terms of the number of elements of which a segment is composed."

Here segments are described in terms of privative 'elements', such that given the element (h) representing 'noise', (?) representing occlusion and (R) representing coronality, a combination of all three elements would produce the sound [t]. A lenition would therefore eliminate one of the elements, such that loss of occlusion, (?), from the sound would produce [s], followed by loss of coronality, (R), producing [h] and then finally loss of noise, (h), would result in elision (cf. Harris 1990:269).

As an overall series of synchronic snapshots, such an approach is attractive, however it does not allow for representation of underlying phonetic information which, although irrelevant synchronically may be diachronically relevant. We shall see in this study that it is often this synchonically irrelevant underlying phonetic information which surfaces in the process of lenitions.

The form of lenition mentioned above which is most relevant to the vocalisation process is lenition of stricture where the stricture at a sound's place of articulation decreases. This process is included above where stops become affricates, then fricatives and then approximants as in Lass's model, where [d] becomes [ð] which in turn becomes [j] in Hock's model or where [ɾ] becomes [ɹ] which becomes [j] and eventually vocalises in Sebregts's model. In a discussion of vocalisations, lenition of stricture will necessarily be the main focus, though degemination will be discussed in relation to syllable structure.

Before presenting the data in this thesis two questions need to be addressed. The first is why a study of vocalisations might be considered of interest at all and the second is why this study is limiting the data to Germanic languages.

1.1 Why vocalisations?

Throughout the 19th Century the main focus of linguistic research was to see how different languages were related by tracing them back to common ancestors. Saussure (1916) rightly saw such grammatical descriptions including historical data as cumbersome and proposed a split between diachronic and synchronic descriptions. He understood diachronic rules as being of a phonetic nature, whereas synchronic rules were understood as phonological, though he used different terminology to describe this. His proposal to split the two disciplines subsequently led to a split between phonetics and phonology.

The focus therefore shifted to a search for a definition of phonology separate from one of phonetics, which led for the need to define the phoneme (cf. for example Twaddell 1935) and ultimately to the search for defining features of phonemes (cf. Trubetzkoy 1939) which were further refined, amongst others, by Jakobson, Fant and Halle (1952) and Chomsky and Halle (1968).

The reduction of phonemic segments into relevant features has deepened the rift between synchronic and diachronic study. As we shall see in this study that it is often precisely the information deemed synchronically irrelevant which is necessarily important when discussing language change.

The study of language change has also been allowed to develop separately. There has been a concentration on the driving forces behind change which have also led to splits. Mowray and Pagliuca (1995), for example, wished to reduce all change to processes of articulatory ease, whereas Steriade's works (cf. Steriade 2001) have attributed language change to a drive for perceptual saliency. The ideas, as mentioned in Blevins 2004:14, to whether change is "goal-directed and teleological, directly invoking notions of articulatory ease...or other "optimal" sound patterns" (cf. Prince and Smolensky 1993) or whether chance is a bigger factor (cf. Blevins 2004) have also led to divisions.

If an attempt is to be made to try to reconcile these different viewpoints research into phenomena such as vocalisations which involve synchronic variation as part of a larger ongoing historical process is important as a bridge between many of these divisions. A difficulty that needs to be overcome will be to find a model to represent sounds using synchronically relevant data with a minimalistic approach, but at the same time to allow for more diachronically relevant data to be expressed within the same model. Models currently available have largely approached problems from either a phonological or a phonetic standpoint and so phoneticians struggle to include data they want to include in a phonological model, whilst phonologists find phonetic models unwieldy or irrelevant. One of the aims of this thesis is to attempt to introduce a model which is versatile enough to appease both sides.

Another bridge to be overcome by looking at vocalisations will be how to express consonants and vowels. Because of their positioning within syllables and the way they behave they are often considered separately and have differing models for both. Other lenition processes which consider how a consonant lenites to become another consonant may of course use these same established models and a consideration of how to link consonants and vowels in this way is unnecessary. In a vocalisation, however, we find a consonant becoming a vowel. For an l-vocalisation, for example, we usually change from a velarised alveolar lateral approximant [ɫ] to a high back vowel, with or without rounding [ɤ ~ ɯ ~ o ~ u]. The way the consonant has just been described here is completely separate from the method used for describing the vowel so such a change described in these terms may indicate a major difference between the two sounds which is not the case. Our model must therefore be able to describe consonants and vowels together such that the small change involved in a vocalisation can indeed be shown as a subtle change in the representation.

By looking at vocalisations therefore, we are forced to find a way to bring together phonetics and phonology, diachrony and synchrony and to describe consonants and vowels using just one representation.

1.2 Why Germanic?

The second question which needs to be answered is why just Germanic languages are being considered.

Vocalisations occur sporadically in many different languages. Probably one of the most common types of vocalisation is l-vocalisation which has briefly been mentioned above. We find l-vocalisations to have occurred in many Romance and Slavic languages, for example, there are r-vocalisations in Czech dialects, velar consonants have become vowels in the history of Portuguese and labials have lenited to vowels in some Slavic languages and Hausa, for example (cf. Haas 1983:1112, Rehder 1998, Vennemann 1988:26, Williams 1962:85).

Indo-European languages are spoken throughout Europe and range in an almost continuous line to the Indian subcontinent. Proto-Indo-European (hereinafter PIE) is the hypothetical language from which all later Indo-European languages stem. Proto-Germanic (PG) is just one group of dialects which were spoken in Northern Europe and split from the other Indo-European languages, such as Romance, Celtic, Slavic and Baltic, to form its own subgroup.

Proto-Germanic in turn split into East Germanic (represented by Gothic, with Crimean Gothic dying out in the 18th century), North Germanic (represented by the Scandinavian languages, excluding Finnish and Saami, but including Icelandic and Faroese) and the West Germanic languages (although it is unsure if these ever formed a coherent group and are represented by English, Frisian, Dutch, German and Yiddish).

Portuguese may well have been an interesting language to study when looking at vocalisations as many of the vocalisations which are described below have also occurred in Portuguese. One major reason for studying just the Germanic languages is that whereas vocalisations do occur elsewhere, the Germanic languages have all undergone many vocalisation processes and vocalisations have occurred in all places of articulation. It is clear that something in the development from Proto-Indo-European to the dialects which became Proto-Germanic has made vocalisations such an important factor when describing their history which did not occur in the other Indo-European families. By looking at a language family as opposed to just a single language we have a wider basis to gain insights into why such a change may have occurred.

We could have a discussion of vocalisations as a purely descriptive study showing what happens in the vocalisation process, but without also discussing why these vocalisations occur we would miss an important aspect in understanding the process of a vocalisation. Obviously by including just the Germanic languages this will only definitely show us why the Germanic languages have vocalised, but it may also give clues about similar processes involving other language families, more so than if just a single language had been presented.

1.3 Outline for the thesis

The thesis has been divided into two parts.

In the first part the phonetic data will be presented. Chapter 2 will present details from previous studies showing the complex nature of sounds and how this is relevant to the Germanic languages. Chapters 3 through to 8 will then present a comprehensive list of vocalisations as they have occurred in Germanic languages, discussing the result of a vocalisation for each type of sound and making conclusions about the underlying articulatory nature of the sounds. A summary of each of the places of articulation and types of sound will be given in chapter 9.

The second part will then present the phonological analysis. Chapter 10 will analyse how and why the stress shifted to the initial syllable in the development from Proto-Indo-European to Proto-Germanic and Chapter 11 will then show how the shift affected syllable structure and what this in turn means for the status of coda consonants within the Germanic languages.

Chapter 12 will show how the early historical changes in Proto-Germanic can be used to explain underlying features of the later Germanic languages and will also present a model for the representation of sounds based on conclusions from the phonetic data. Finally, Chapter 13 will show how the representation of the sounds as described in the previous chapter can be used to show the result of each vocalisation.

There will be concluding remarks in chapter 14.

Part 1

Data and Phonetic Analysis

2 Complexity of sounds

Vocalisations are the result of a lenition of stricture of the primary articulator in the production of consonants. All sounds could be described as complex meaning they involve more than one articulator. In order to produce a voiced sound, for example, we need a restriction within the oral cavity combined with a loose narrowing of the vocal folds so that they vibrate. If we consider the state of the vocal tract whilst not speaking, the velum will be lowered to allow breathing through the nasal cavity, non-nasal sounds will thus also involve a raising of the velum so that the air will flow through the oral cavity.

Vowels, for example, may be produced with an advanced tongue root or without as well as a narrowing between the tongue and the palate in combination with the voicing as described above (if the vowel is voiced as in most languages) and the amount of lip rounding in the production of each vowel will also affect its quality.

When describing consonants it should be noted that for any articulation the tongue is necessarily present below the palate, the area needed to produce vowels. When producing a ‘non-complex’ bilabial sound, for example, the raising of the lips means the jaw is also raised. By raising the jaw we get a narrowing of the stricture between the tongue and the palate, similar to that which is produced with high vowels. Even within the production of [h] or [ʔ] the tongue is still present below the palate, meaning that there is an underlying, albeit voiceless, vocalic element, which is sometimes shown in the representation of [h] as a voiceless vowel, [ə̥] for example, depending on the surrounding sounds and ‘neutral’ position of the individual language.

This underlying position of the tongue in relation to the palate in the production of the speech sounds is important to our understanding of vocalisations. If a vocalisation is described as a lenition of the stricture at the primary place of articulation, then the resulting remnant of the sound will be the other sounds which have contributed to its make-up. These in turn will come to be perceived as the sound and the vocalisation process will thus be complete.

The concept that each consonant has an inherent underlying vocalic element has been explored before and will be discussed in the following section.

The idea that all sounds are complex, not just those which are traditionally described as complex, is an important concept within theories of lenition and thus within a theory such as Optimality Theory which is based on the principle that sound change produces a more optimal, or simpler, result, whether simpler perceptually or simpler articulatorily (which it should be noted may counter each other). If all sounds are complex, involving more than one articulator, then they can always be simplified, but by simplifying a sound, the tongue or some other articulator will necessarily still be present and thus another complex sound will still necessarily be underlying, unless the sound is elided completely, which is the ultimate goal of lenition processes as was demonstrated in the models of lenition given in Chapter 1. These ideas will be discussed at greater length in the following sections.

In analysing the process of vocalisations an important question that needs to be asked is what the result of a vocalisation will be. Vowels are produced by positioning the tongue at a set height below the palate, with the highest point of the tongue ranging between palatal front vowels and velar back vowels. These are combined with lip positioning for rounded and unrounded vowels. In languages most vowels are voiced (cf. Maddieson 1984:132 where only two languages from his database of 317 languages have contrastive voiceless vowels) which involves simultaneous vibration of the vocal folds. In the production of the consonants, however, an active articulator will approach a static articulator and the stricture produced will restrict the airflow.

An important point to notice though is that even in the production of consonants the tongue will still be in a position below the palate and the lips will still form a shape, thus fulfilling the requirements for a vowel apart from having a restricted airflow. So the question arises whether in the formation of each consonant we can speak of an inherent underlying vowel quality.

This question has been asked in a number of studies, three of which will be discussed below.

2.1 Consonant prevocalisation

One study which addressed this question and is related to the question of vocalisation was that conducted by Operstein (2010) on consonant prevocalisation. She defines it thus: "Consonant prevocalisation [...] refers to phonological processes which have in common the development of a vocalic prearticulation by consonants" (p3). Her study focuses on a stage before complete vocalisation takes place, namely where epenthetic vowels may appear prior to the production of consonants. This epenthetic vowel is interpreted as an anticipatory surfacing of the consonant's underlying vocalic gestures. The study concentrates on this phenomenon as a spontaneous synchronic process.

She notes (p11) that the production of consonant prevocalisation is sensitive to a whole range of conditioning factors, covering syllable position, stress, morphological conditioning and sociolinguistic factors. Weak consonants are more likely to be targeted in this process and she notes that particularly sonorants and fricatives display epenthesis, and especially those in final or pre-consonantal position, and as part of the lenition process this ultimately leads to weakening of the consonant or its deletion (p21).

She notes that a preceding vowel has relatively little influence on the epenthetic vowel produced (p23), however, a secondary articulation will override the underlying vocalic element of the consonant. She gives the example in the development of Old French from Latin:

nuce > Old French *noiz* ‘nut’ ([k] > *[k^j] > [jz])

palatiu > Old French *palais* ‘palace’ ([tj] > *[t^j] > [js])

where the resultant [j] derives from the secondary articulation and not from the consonant and it ultimately becomes diphthongal with the preceding vowel. Another example of the influence of secondary articulation as being the main provider of the epenthesised vowel is that given on page 48 where [p^j] would be expected to result in [wp^j] if the primary articulation were the main provider, but this is never the case and instead [jp^j] is the surface production. This is also confirmed in Walsh Dickey (1997:66) for other procedures where examples are given such that the secondary place node is promoted when the primary place is lost. For example, in the change from PIE [k^w] > Greek [p] the primary dorsal node is lost and the secondary labial node is promoted.

An example Operstein gives (p27-29) supporting her hypothesis of the relative independence of the prevocalised element from a preceding vowel is from Maxakalí (a language spoken in Minas Gerais, Brazil). The data are given in Table 1 in full:

		Prevocalised Allophones	Vocalic Allophones	
	Basic realisations	Before a nonhomorganic consonant or utterance-finally	After a transition glide	Before a homorganic consonant
/p/	[p]	[ɣ̯p]	-	[i̯]
/m/	[m]	[ɣ̯̃m]	-	[ɣ̃]
/t/	[t]	[ə̯t]	[ə]	[ə]
/n/	[n]	[ə̯̃n]	[ə̃]	[ə̃]
/c/	[ʧ ~ ʃ]	[jʃ ~ jç ~ jt^j]	[i]	[i]
/ɲ/	[ɲ ~ j̃]	[j̃]	[ĩ]	[ĩ]
/k/	[k]	[ɯ̯k]	-	[ɯ]
/ŋ	[(ŋ)g]	[ɯ̯̃ŋk]	-	[ɯ̃]

Table 1

An analysis of the schwa resulting from the alveolar consonants is claimed by Clements (1991:117) as being a default vowel, unspecified for place of articulation, and thus carrying no information from the alveolar, which Operstein refutes. She uses evidence such as that given to show underlying vocalic information resulting inherently from the consonant. Her conclusions as to the type of vowel inherent to each consonant are as follows (taken from p69):

Type of consonant	**Expected prevowel quality**
palatal / palatalised	[i ~ e]
alveolar	[i ~ ə]
dental / labial	[ə ~ ɯ]
velar / velarised	[ɯ ~ ə]
labialised	[u ~ o]
pharyngeal / pharyngealised / uvular	[ɑ ~ ə]

2.2 Loci

The idea that sounds have underlying vocalic gestures is not a modern one. In Green's study of 1959 he took up the idea of consonantal loci being "the theoretical point on the frequency scale at which all the vowel transitions associated with a given consonant seem to have their origin" (p7) and the interaction between consonants and adjoining vocalic segments. He stated that experiments had revealed that for at least synthetic speech, "vowel formant inflections are important, and sometimes sufficient, cues for the perception of certain consonants" (p5); note the cautious 'certain'. His research looked at English CV, VCV and VC combinations and noted the change in second formant transitions for frontness/backness noting that the first formant had little or nothing to do with the place of production of the contiguous consonant (p6). The formant diagrams were then mapped against each other to see if there was any convergence onto a single value. A sample diagram produced is as follows, this one showing /d/ in coda position following the six vowels /i:/, /æ/, /ɜ:/, /ɑ:/, /u:/, /ɔ:/ (Figure 4 taken from Green 1959:42):

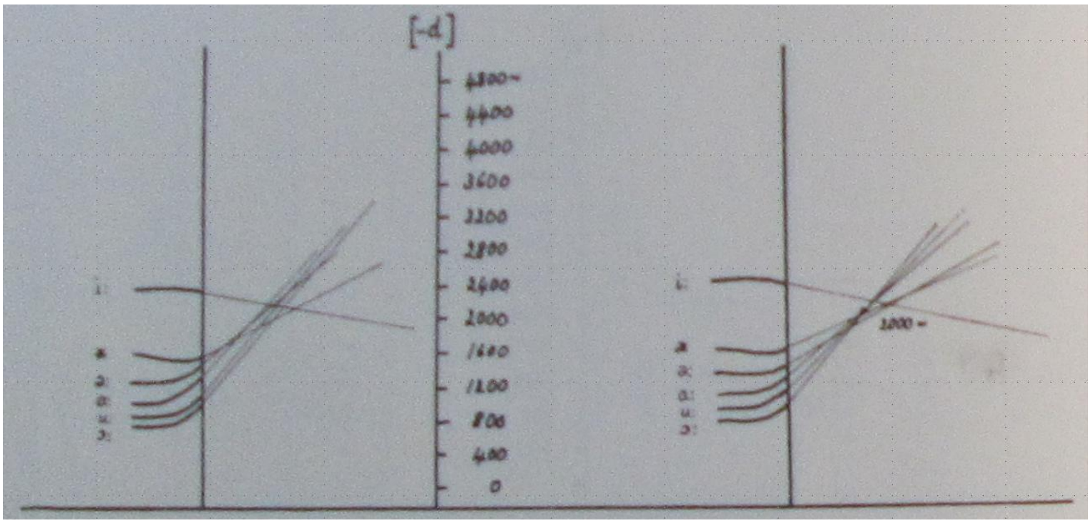


Figure 4

From this diagram it can be seen that for an English final postvocalic /d/ the second formants do seem to converge on a point around 2200Hz. Implying for this speaker that underlyingly /d/ has a vocalic gesture with a level of frontness lying between /i/ and /æ/, which does indeed correspond with Operstein's prediction of alveolars having an underlying [i ~ ə]. If similar results can be achieved for each of the consonants in all positions, then Operstein's arguments for steady underlying vocalic gestures for each sound could be accepted. However, analysing the data we see that /d/ in this position was one of the 'better-behaved' sounds. The following diagram for coda /n/ will show that this was not always the case (taken from Green 1959:43):

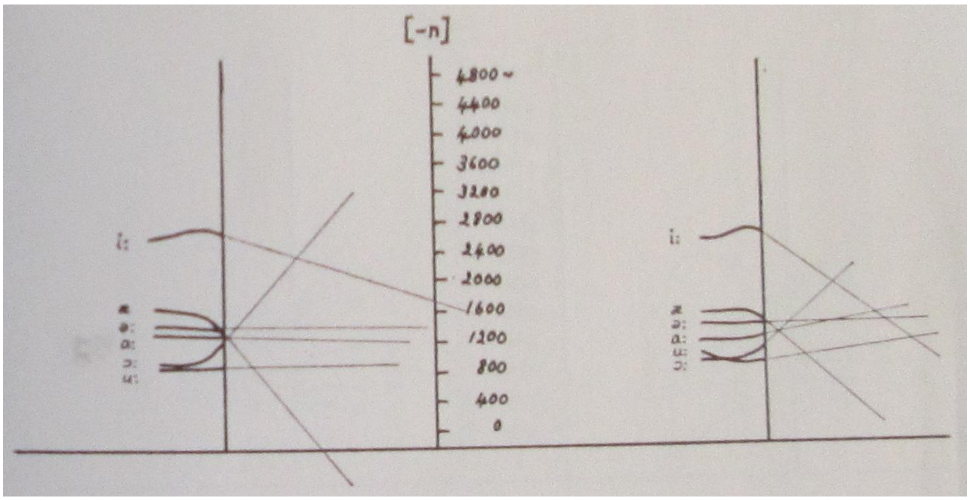


Figure 5

From Figure 5, we can see that there is a tendency towards the centre of the front/back spectrum, but there is no clear intersection of the formant values, and so a conclusion of a clear underlying vocalic gesture for English /n/ cannot be drawn, which makes it difficult to conjecture an underlying vowel for coronals generally.

We should also point out that the values given are for English sounds. If for example a similar test was done with Russian with its contrast between [d̪] and [dʲ] we should expect different values for each with the [d̪] being more backed, producing a greater contrast to the palatalised version.

2.3 Child language acquisition

A third area of interest when considering underlying vocalic elements in the production of consonants is child language acquisition. In acquiring language children do not completely master the fine motor skills required for adult production of sounds and as such early disorders can offer insights into the sounds being produced.

Bates, Watson and Scobbie (2002), in investigating phonological disorders in child language development, pointed to a number of studies which also point to the notion of an underlying vocalic element directly linked to a consonant. One of their comparisons was a study by Davis and MacNeilage (1990) which showed that in children's early attempts at consonant-vowel combinations, for a single case study, high front vowels occurred in the vicinity of alveolars, with high back vowels occurring with velars and mid-central and low-central vowels tending to co-occur with labials. Figure 6 would give the following basic pattern in this one case:

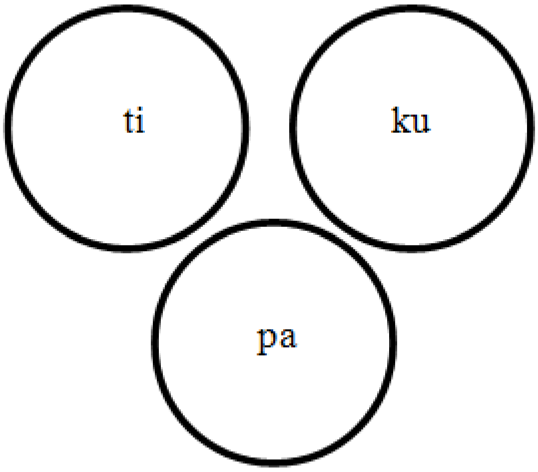


Figure 6

However they also pointed to a single case study by Fudge (1969) where the subject's target labials and velars were produced as alveolars preceding front vowels, as in the previous study mentioned, but target alveolars were produced as labials before back rounded vowels and velars before back unrounded vowels. This seems to give the alternative image as follows:

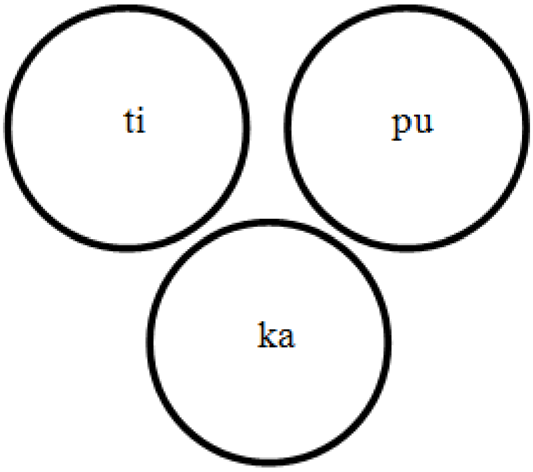


Figure 7

The difference between the two studies is that the first one represents the vowels which were produced given the target consonants, whereas the second study represents the consonants produced given the target vowels indicating that the child learners had different learning strategies. But these studies also highlight that different parameters play differing roles in determining an underlying vocalic element, especially where non-alveolar consonants are involved.

In the first study the height and backness of the consonantal velar produced a high back vowel whereas the ‘neutrality’ of tongue height combined with a lowered jaw required to produce a labial produced a lowered vowel.

In the second study the roundness of the high vowel produced the labial whereas the backness with lack of rounding produced a velar.

It should be noted though that both studies found that the alveolars are linked to the high front vowels, but the seeming disparity between the two results demonstrates that although all articulators are present in the formation of the consonants besides just the active ones involved in the production of the sound, the exact position of these articulators, the tongue, lips, velum etc., may vary. Also separate aspects of these articulators may play different roles, such as whether the lips or the tongue height are more active or important in high back vowels to determine which vowel exactly is underlying.

Yet another study they mention by Camerata and Gandour (1984) showed a complementary distribution between alveolars and velars which is conditioned by vowel height. In their data, high vowels condition alveolars whereas low vowels condition velars, and labials stand unrestricted. Although this may seem like a dissimilatory process, they argue instead that this relies on an acoustic feature [+diffuse] (from Jakobson and Halle 1971) which groups alveolars, labials and high vowels together and is characterised by a higher concentration of energy in the noncentral region of the spectrum, whereas nondiffused sounds, where the higher energy bands occur in the mid range of the spectrum, would be the palatals, velars and non-high vowels.

If this is indeed the case and children pair some sounds based on perceptual effects, then these must also be considered, such that we cannot rely solely on the articulatory categorisations to discover the underlying vocalic element of consonants, as was done in the studies by Operstein and Green mentioned above in 2.1 and 2.2 respectively.

2.4 Umlaut

A further criticism of consonants having an inherent underlying vowel would be a case like umlaut, which is especially pertinent given that this study focuses mainly on the Germanic languages. In the process of umlaut vowels had allophonic variants depending on the vowel which occurred in the following syllables.

The basic vowel system of PG was (cf. Voyles 1992:86-87):

ī̆		ū̆
ē̆		ō̆
(ɛ̄)		(ɔ̄)
	a	

Figure 8

Common Germanic underwent a number of umlaut features in its development from PIE as follows (data taken from Wright 1910:23-24):

Common Germanic /e/ > /i/ and /eu/ > /iu/ when /i(:)/ or /j/ occurred in the following syllable, such that PG **esti* ‘is’ > Gothic *ist*.

Common Germanic /i/ > /e/ and /u/ > /o/ when /a(:)/, /o(:)/ and /e:/ occurred in the following syllable (although not when there was an intervening nasal and homorganic stop).

In later dialects umlaut continued to play a role to varying degrees such that in Proto-Scandinavian (which had the most changes based on umlaut from all the Germanic dialects), for example, we had the vowels as follows (taken from Haugen 1976:152):

i		u	i:		u:			iu	
e		o	e:		o:				
	a			a:		ai			au

Figure 9

These underwent a number of umlaut processes as follows (where a downwards arrow indicates a-umlaut, left-pointing arrows indicate i-umlaut and right-pointing arrows indicate u-umlaut):

i	→	y	←	u
↓				↓
e	→	ø	←	o
ɛ	→	œ	←	ɔ
	↖		↗	
		a		

i:	→	y:	←	u:
e:	→	ø:	←	o:
ɛ:	→	œ:	←	ɔ:
	↖		↗	
		a:		

		iu		
ia				iɔ
ɛi	→	ɛy	←	ɔu

Figure 10

If we are to assume that consonants have an invariable underlying vocalic element then umlaut would have to bypass this element. The frontness and height of [i] is anticipated in the previous vowel. If there is an intervening [p], for example, which would have an expected prevowel quality of [ə ~ ɯ] according to Operstein (2010:69) then the frontness of [i] would have to bypass the backness of [p]. The only exception, following Operstein's argument, would be if this [p] was palatalised because of the following [i] and the secondary articulation of [p^j] would thus allow for the fronting of the preceding vowel.

An alternative argument would be that there is no underlying vocalic element and that vowels are on a separate tier to consonants (cf. Clements and Hume 1995:296-297). Such an argument would allow for a featural explanation of i-umlaut across an intervening [p] thus:

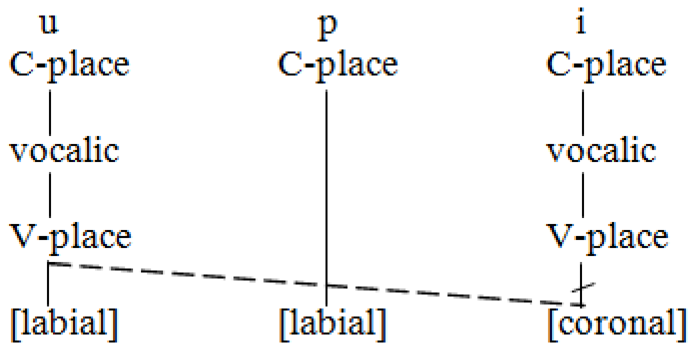


Figure 11

A separation of consonants and vowels into tiers however ignores evidence such as that given in Operstein and Green as well as evidence from child language acquisition.

2.5 Summary

These studies have shown that in order to understand exactly what happens during vocalisation processes, examples need to be examined on a case by case study. The data given certainly suggest that a consonant has underlying vocalic properties but it would be an oversimplification to say that a vocalised alveolar, for example, will produce a high front vowel. Operstein's evidence based on articulatory evidence and Green's data based on acoustic evidence suggest that this is the case, but it has been shown that the situation is more complex than this. The evidence from child language disorders gives more evidence of the complexities involved in production of these sounds which introduces a perceptual element into production, allowing for more variation than the previous two studies mentioned. A separation of consonantal and vocalic tiers as suggested by Clements and Hume where 'vocalic' appears as a subtier of C-place in the explanation of umlaut phenomena would not account for features such as consonant prevocalisation as provided by Operstein or vocalisations as will be described here.

This study is limited in that obviously not all vocalisation processes that have occurred throughout history can be discussed. The concentration will therefore be on Germanic languages for reasons which have been discussed in the introduction. The following is a discussion of historical vocalisation processes which have occurred since PG times. There will inevitably be some omissions, but as the vocalisation process as a whole for the Germanic languages has never been discussed the data presented will be as extensive as possible.

The data will be arranged by consonant type prior to the vocalisation occurring and for some of the consonants, especially the rhotics, this will provide evidence for their production within PG.

3 Rhotics

A brief look ahead at Figure 16 on page 40 will show the variation within the modern European Germanic languages. These reflexes of earlier common rhotics include [r, ɹ, ʀ, ʁ, ɻ, ɹ̝, ʐ, ʋ, χ], not including rhotic vocalised elements. With such variation we need first to establish what features, if any, rhotics have in common which link them together into one group.

Rhotics are characterised by spectrally lowered F3 and F4, which may be produced articulatorily by a constriction of the pharynx just above the epiglottis which appears in r-coloured consonants, retroflexes and r-sounds (from Disner 1978:4, Ladefoged and Maddieson 1996:234). Alwan, Narayanan and Haker (1996b:1085) attribute F3 to the cavity formed between the tongue and the incisors. We will see that both the narrowing of the pharyngeal constriction and the greater prelateral cavity are anatomically linked. If we take pharyngealisation as the characteristic which binds these sounds together, Ladefoged and Maddieson (1996:307-8) note for pharyngealised sounds in Tsakhur and Udi, two Caucasian languages, that the front of the tongue is bunched which leaves a hollow cavity below the uvula. They mention that pharyngealisation is also coupled with a slight raising of the first formant.

Comparing formants with vocalic equivalents, a raised F1 is indicative of a lowered vowel, which, although not the main factor, may also be accompanied with a lowered value for F3. All this would point to the result of a rhotic vocalisation being a non-high vowel. In the vocalising German area around Berlin with the underlying pre-vocalised rhotic being [ʀ ~ ʁ] the resulting vocalisation is non-high [ɑ ~ ɒ]; in British English r-vocalising areas where the underlying form is alveolar [ɹ ~ ɻ] a central non-high schwa is the result (both examples are taken from personal experience). An initial study of these formants alone, though, cannot explain apparent anomalies such as the vocalising Dutch speaking area south of Amsterdam and around Brussels where we find [i̯] as the result of a vocalisation (compare Sijs 2011:158).

A closer inspection of individual pronunciations is necessary and in the case of already vocalising areas we will need to study their neighbouring non-vocalising areas, their pronunciation of /r/ in non-prevocalic position and historical effects on preceding vowels to determine the exact mechanisms involved in the vocalisation process. The following subsections will look at the nature of PG rhotics and the rhotics of the older Germanic languages with historical effects of rhotics on neighbouring vowels, before looking at modern vocalisations and how they have arisen.

3.1 The PG rhotic

One of the earliest indicators of the quality of the rhotic in PG appears to be the development of the PIE syllabic /r̥/ which became /ur/ in PG (cf. Ringe 2006:81). At first sight this might indicate a back value for /r/ which produced the back epenthetic vowel /u/. However, it should also be noted that all the PIE syllabic sonorants inserted /u/. This may seem consistent with an underlying backness for /l/ and underlying lip-rounding for /m/, but it is more difficult to justify this influence based on syllabic /n̥/ which lacks either backness or rounding. It may be more indicative of an underlying neutral vocalic position for the Germanic languages than of any quality of the sonorants themselves, so we cannot use this is an indicator for the quality of rhotics here. We need therefore to look elsewhere for an indication of how early rhotics were pronounced in PG.

Let us turn our attention then to the articulation of /r/ in the earliest Germanic dialects. With the exception of Gothic the other Germanic languages obtained their /r/ from two separate sounds of PG, /r/ and /z/. /r/ was inherited from PIE, whilst /z/ arose from Verner’s Law being applied to the PIE inherited /s/ which voiced fricatives when non-initial and preceded by unstressed vowels. Voyles (1992:126) gives the following explanation of the features of this latter sound and the [r] which arose in the daughter languages (except for Gothic where it either remained /z/ in voiced environments or devoiced to /s/):

/z/ [+obst; -son; +strid]

/r/ [-obst; +son; -strid]

He concluded that the transitional sound must have been either [+obst; -son; -strid] or [-obst; +son; +strid]. The earliest writings of Old Norse consistently indicated a difference between the inherited /r/ (*r* which will be represented here as /r^1/) and the rhotic formed from /z/ (confusingly written *ʀ* in the literature but hereinafter shown as /r^2/) so there must initially have been a difference in the pronunciations before they started to merge. He points out that in the development of Old Icelandic [+obst] segments underwent final devoicing, but as /r^2/ did not undergo devoicing it could not have been an obstruent and thus concludes that this intermediate sound must have been [+son; +strid] which could have a modern example in Czech *ř* [r̝] or [ɹ̝] as appears as an option in northern Norway. His argument is therefore for the two rhotics to have been [r] for /r^1/ and [r̝] for /r^2/.

Runge (1974) argues for the newer /r^2/ to be [r], which seems uncontroversial, as this is indeed the apparent development of this sound into the later Germanic dialects, but he argues for an alternate [ʀ] as the development from Germanic /r^1/. He hypothesises (p70) that if PG had /r^1/=[ʀ] then the rhotacisation process which occurred in the other Germanic languages could have bypassed Gothic. He argues (pp90-91) that the difference between the two sounds could later have merged into an allophonic variation. Lambdin (2006:xii) tentatively also adds that Gothic script borrowed heavily from Greek, but the symbol for /r^1/, written ʀ, more closely resembles Runic *r* than Greek [r] written as *P*, which may be an indication of a very different pronunciation and suggests that this may have been what he describes as 'guttural'.

Runge's argument, however, has a number of flaws. Gothic /r/ assimilated to a following /z/ when they occur tautosyllabically, which more likely indicates the alveolar nature of both of these sounds (cf. Krahe 1948:58). A more compelling argument against Runge, though, is that positionally /r¹/ (his [ʀ]) more often occurred prevocalically whereas /r²/ (his [r]) more often occurs postvocalically. With the reduction of final unstressed syllables in the daughter languages this would have meant /r²/ mainly occurred in coda position, whereas /r¹/ could have occurred either in the onset or the coda. Later pre-rhotic vowel changes in some of the daughter languages are similar to u-umlaut effects, where front and low vowels were rounded if the following syllable contained /u/ or if they were followed by /r²/ (cf. Haugen 1976:153). He claims this would be produced by a back quality of [ʀ], but positionally these would have been caused by this 'front' [r] and not the 'back' [ʀ], which does not seem likely. The situation where there is an allophonic difference between Runge's hypothesised prevocalic [ʀ] and non-prevocalic [r] does actually occur in transitional areas of South Sweden between the [ʀ ~ ʁ] producing South and the [r] producing Centre (Braunmüller 1999:40), however the effects on the preceding vowel do not mirror effects such as u-umlaut.

If we assume that both /r¹/ and /r²/ were produced with the tongue tip this still leaves the question as to where the effects such as u-umlaut could have come from.

The changes from PIE to later Germanic realisations can better be demonstrated in the diagram below:

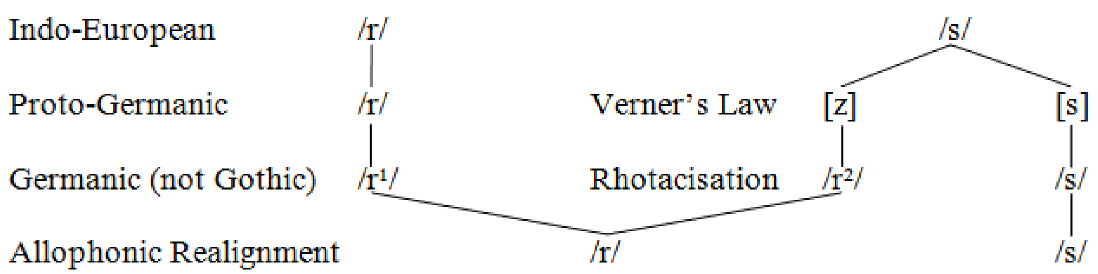


Figure 12

We can get a closer view of the nature of this inherited /r^1/ by seeing the effects it had on preceding vowels in the two daughter languages where it did not initially merge with /r^2/; Gothic and Old Norse.

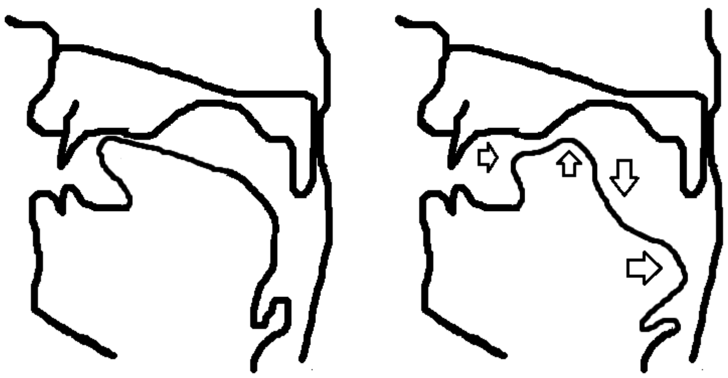
As mentioned above, PG /z/ remained a fricative in Gothic. As /r/ and this /z/ were therefore not in complementary distribution there would have been no great pressure to alter the pronunciation of /r^1/ in order to keep it distinct from /z/ in Gothic from its inherited PG [r].

In Gothic, Germanic /e/ and /o/ merged with /i/ and /u/ to become [i] and [u] respectively, except before /r/, /h/ and /h^w/ where they both merged to [ɛ] and [ɔ] (cf. Braune and Ebbinghaus 1981:28, 32; Hirt 1931:39; König and Auwera 2002:21; Krahe 1948:32; Krahe and Meid 1969:58; Prokosch 2009:101, 114; Robinson 1992:58; Wright 1910:27-29). Voyles (1992:48-50) sees this as occurring in two stages, the first affecting the unstressed vowels and the second affecting all vowels equally. Hirt (1931:44) suggests that the merger would have occurred first followed by the lowering before the consonant, but this seems unlikely as it would have meant that /e/ was first raised to /i/ and was then subsequently lowered, which would suggest a changing quality of the consonants involved.

In Old Norse we have the advantage that the two sounds are separate, though both rhotic, so we can compare the differences between the two. The main difference is that /r^2/ has a similar effect to i-mutation, such that Gmc [a, uː, aː, au] → [e, yː, æː, ey]. /r^1/ does not produce this effect (cf. Gordon and Taylor 1956:272; Hutterer 2002:151; Noreen 1970:66-67; Prokosch 2009:84). A further change is that /r^2/ also causes lowering of [i, iː, u] → [e, eː, o], whereas /r^1/ does not (Prokosch 2009:115). Prokosch mentions that in the rhotacisation there would have been a raising and retraction of the tongue tip behind the alveolar.

We need to ask the question here as to why the tongue retracted. Sproat and Fujimura (1993) show that for laterals there are two gestures, a coronal and a dorsal. In onset position the coronal ‘consonantal’ gesture precedes the dorsal gesture, whereas in a non-prevocalic position the dorsal gestures are produced before the coronal ones. Consonantal gestures are stronger in onset position and weaker in codas whereas this is reversed for vocalic gestures. We have seen above in Chapter 2 that all consonantal sounds necessarily have a vocalic (dorsal) gesture so this argument could be extended to non-lateral consonants. It should be remembered that this /z/ would have always been post-vocalic, as Verner’s Law, which was necessary to produce it, could only apply to post-vocalic fricatives. Gothic had an early split geographically from the other Germanic languages and underwent final devoicing so this /z/ in final position once again became /s/, effectively blocking a rhotacisation process. With the shift of stress to the initial syllable in PG and the gradual loss of final unstressed syllables /z/ would have become mainly a coda consonant. A retracted tongue position leads to a stronger underlying dorsal gesture, which would explain why during the rhotacisation process we find retraction of this consonant.

The following Figure 13 shows hypothetical tongue positions for /r¹/ and /r²/:



/r¹/ /r²/

Figure 13

Here the retraction and bunching of the tongue tip causes displacement of the tongue in additional areas. Initial stridency as noted by Voyles above would probably indicate that in the early stages of the rhotacisation process it would have been closer to a fricative than a trill.

Alwan, Narayanan and Haker (1996b), in their study of American English rhotics, noted that both a bunched /r/ and a tongue-tip /r/ produce similar shapes. By retracting the tongue tip this causes a bunching of the anterior of the tongue. A consequence of this bunching was a greater cavity posterior to the tongue tip constriction, due to the pulling up of the lateral margins of the posterior of the tongue by the styloglossus and palatoglossus muscles. It is suggested that there is an interplay between the "extent of the contraction of longitudinal muscle fibres and the geniglossus, and the effectiveness of the styloglossus and the palatoglossus in pulling up the lateral margins of the posterior tongue body...Retraction of the posterior tongue body, which results in the secondary pharyngeal constriction, may be due to the hyoglossus pulling the tongue back and down." (p1085) They note that the concavity is not as great when the tongue is more anterior and as a result the midpharyngeal constriction is also not as great. They suggest that for pure retroflexes the concavity and pharyngeal constriction will also not be as prominent.

This would suggest that by keeping the tongue tip to the anterior of the alveolar position, as suggested here for /r^1/, the front of the tongue is only slightly raised to a mid position. With bunching, as suggested for /r^2/, we can see how a preceding vowel could undergo fronting (due to the high front nature of this tongue position), lowering (due to the lowered position of the tongue body caused by the greater cavity posterior to the tongue tip constriction) or even backing (owing to the increased pharyngeal constriction). So Prokosch (2009:115) does indeed seem to be correct.

Why then does /r^1/ not produce these effects? It should be noted again that /r^1/ and /r^2/ were separate phonemes of Old Norse. If we assume /r^1/ to be [ʀ], as Runge (1974) suggests, then this would indeed prevent fronting, but would also encourage lowering. The following diagram shows the tongue position for the uvular [ʀ] of modern German (based on Ladefoged and Maddieson 1996:229):

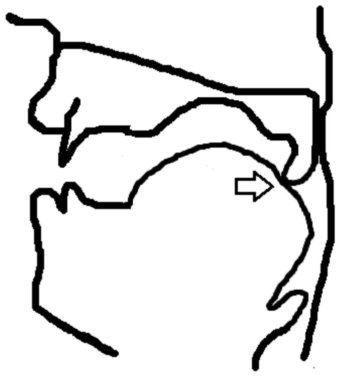


Figure 14

In this production the back of the tongue is raised towards the uvular. This would indeed prevent back vowels undergoing processes similar to i-mutation which was described, however there is here nothing to prevent lowering of high vowels. The nature of the tongue being in contact with the uvular forces the tongue below the velum to be in the mid position. An anterior tongue position, which is forced to remain anterior to avoid a merger with the retracted /r²/, would require a more rigid tongue position. Raising of the tongue in the palatal region, which would facilitate i-umlaut, would result in a tongue shape more closely resembling /r²/ which was necessarily avoided. By keeping the tongue anterior the tongue body must remain flat, so there would also be no raising of the preceding vowel.

Also as noted by Alwan, Narayanan and Haker above a more anterior tongue tip will not produce as great a concavity pit behind the oral constriction implying that lack of tongue retraction could produce this effect without the need to postulate a completely back [ʀ] pronunciation for /r¹/.

Another feature which differentiated /r^1/ from /r^2/ in Old Norse was the alternate development of Germanic /ai/ before each sound. The standard development of /ai/ in Old Norse was /ai/ → [ai] → [ei], though before /r/, /h/ and heterosyllabic /w/ we get the development /ai/ → [ɑː] (Hirt 1931:39; Noreen 1970:50; Runge 1974:70; Speyer 2007:45). Speyer notes that this occurred before the rhotacisation process, but is unique to Old Norse, which would indicate that rhotacisation occurred as a separate development in both North and West Germanic daughter languages; though Prokosch (2009:116) puts the monophthongisation of /ai/ → [ɑː] and /au/ → [ɒː] occurring later during the 7^{th} century.

We can hypothesise that this could be explained by early /r^1/ being a rhotic trill produced with some bunching. The bunching would reduce the amount of raising of the second element of a diphthong. As the rhotacisation of /r^2/ started, the retraction produced bunching of the front of the tongue, which would have pushed the production of /r^1/ to a more anterior tongue position. Both rhotics would still prevent too much raising of vowels, however the bunching in /r^2/ would have been greater than that in /r^1/ so the front of the tongue would have also been lower for /r^1/. As the two sounds started to merge the allophonic difference between the previous vowel qualities would have become significant.

It should be noted that a rhotacisation process also occurred in the West Germanic daughter languages. /r^1/ and /r^2/ had merged in each of these languages before written records began but there are many processes in these early languages where /r/ sits together with /h/ and /w/. The most noticeable processes are breaking and monophthongisation which will be examined in the following sections.

3.2 Rhotic effects on vowels

Old English dialects underwent a process whereby vowels were ‘broken’, or diphthongised before /r/, /l/ and /h/. This is widely reported in descriptive literature, (compare any of

Barðdal et al 1997:33; Barrack 1975:51-54; Coetsem and Kufner 1972:120; Fichte and Kemmler 1994:18; Hirt 1931:49; Hutterer 2002:209; Lass and Anderson 1975:60; Operstein 2010:35, 37; Prokosch 2009:115; Robinson 1992:158; Runge 1974:57; Voyles 1992:147; Wardale 1947:37). Speyer (2007:55) gives the following Table 2 for the positions in which vowels were broken:

	West Saxon	Kentish	Mercian	Northumbrian
a → *ea*	___rC, lC, h	___rC, lC, h	___rC	(___rC)
e → *eo*	___rC, (lh), h	___rC, (lh, lf), h	___rC, (lf)	___rC, (lf)
i → *io*	___rC, (lh), h	___rC, h	___rC	___rC

Table 2

It can be seen from this table that breaking occurred most readily in West Saxon and Kentish. We shall return to features of /l/ in the chapter on laterals, but one condition that should be noted is that breaking only occurred before rhotics when /r/ was tautosyllabic, being forced into a preceding syllable by a following consonant which would either be of equal or lesser sonority. The exact nature of the digraphs *ea*, *eo* and *io* is much discussed in the literature. Most traditional and modern studies describe them as diphthongs (cf. Dresher 1985; Fichte and Kemmler 1994:5-7; Freeborn 1998:27-29; Voyles 1992:161), though there is the possibility that they represent monophthongs, the suggestion being that they are back or centralised unrounded vowels (compare for example Mossé 1945).

Lass and Anderson (1975:83-90) consider the nature of the three conditioning consonants. They see breaking as epenthesis of a 'protective' back vowel which is inserted before the conditioning consonant. They first describe the features of the three sounds as given in Table 3.

	/r/	/l/	/x/
obstruent	-	-	+
consonantal	+	+	+
anterior	+	+	-
coronal	+	+	-
high	-	-	+
low	-	-	-
back	-	-	+
lateral	-	+	-
continuant	+	+	+
voice	+	+	-

Table 3

Here the only features shared by all three are [+cons], [+cont] and [-low] but as these are shared by other sounds which do not trigger breaking they are redundant. They conclude that there are three possible processes involved:

a) we are dealing with an unnatural process,

b) there were actually two processes,

c) there was a natural assimilatory process.

In their argumentation they tend towards the third option which would imply that /r/ and /l/ were [+back] in this position, so [rˠ] and [lˠ = ɫ]. They argue that a velarised [ɫ] non-prevocalically is very common in English and elsewhere and they suggest that /r/ may have been [ʀ ~ ʁ] in this position.

They do however give the example for two separate processes by pointing out that New York English adds an epenthetic [ɨ] between V[+front] and /r/ (with [ə] added before back vowels), attributing this latter change to an assimilation of sonority "with some feature of the liquid being copied out or segmentalized as a vowel...not necessarily back". This latter observation is more in line with the idea that consonants have an underlying vocalic element.

It should also be noted through their personal correspondence with Fred Householder that epenthetic V also occurred in Latin and Greek where /r/ is unambiguously [r]. He notes that retracted /r/ and dark /l/ have similar articulatory shapes and similar acoustic properties and this could be the factor behind a ‘back’ offglide of the front vowels preceding the rhotic.

Gick and Wilson (2001) examine American English and observe a situation very similar to breaking before liquids by studying what they term excrescent schwa. For the high vowels followed by a liquid in American English (and it should be pointed out also in other forms of English) it has long been noted that a schwa is perceived which has generally been attributed to epenthesis, as suggested also for Old English as in the description above by Lass and Anderson.

They note however that if this was indeed epenthesis then we should expect to see an increase in duration for this combination when compared to a vowel plus a non-liquid consonant, something which their findings do not suggest. They conclude that this schwa should not be treated as epenthetic, but rather as transitional (p273).

We can also see that for breaking explained above we have a remarkably similar situation. The only diphthongs (if they were indeed diphthongs) in Old English were those formed by breaking and these can be seen to be either long or short diphthongs, with the short diphthongs behaving like short vowels and long diphthongs like the long vowels when we consider rhymes (for a discussion of this and whether these digraphs do actually represent diphthongs compare Lass and Anderson 1975:75-83). This would indicate that instead of an epenthetic schwa, or back vowel being formed we simply have a case of transitional tongue movements being perceived as schwa as with the modern English dialects which have this phenomenon.

This leads us to ask the question what the form of the /r/ was which initiated breaking. Once again, Runge (1974:57-58) concludes that we must be dealing with a 'back' /r/ of the form [ʀ]. However, turning to our description of bunched and tongue-tip /r/, as given by Alwan, Narayanan and Haker above, it was noted that in the production of bunched /r/ a low posterior tongue position and secondary constriction in the mid-pharyngeal region will automatically be produced. The transition of the tongue from a front vowel to such a rhotic will produce the breaking effect mentioned. We do not need to include the possibility of [ʀ] having been produced in this position. Operstein (2010:36) concludes that it was this pharyngeal element of tongue-tip /r/ which produced this breaking, though, as has been shown, the low mid-tongue concavity may well also have produced this.

A further effect on vowels within the earlier Germanic languages that should be mentioned here is monophthongisation. PG originally had three diphthongs, /iu/, /ai/ and /au/. The two rising diphthongs /ai/ and /au/ were monophthongised to /e:/ and /o:/ in Old High German when preceding /r/, /w/ and /h/ otherwise they became the diphthongs /ei/ and /ou/ respectively (cf. Coetsem and Kufner 1972:126; Frey 1994:46-47; Hirt 1931:39-40; Prokosch 2009:116-117; Robinson 1992:235; Runge 1974:50-52; Speyer 2007:56; Voyles 1992:81, 205). Runge (1974:52) claims that this would have involved a lowering and backing of the second element of the diphthong, again giving a pronunciation of [ʀ] as the cause. However, once again looking at our diagram in Figure 13 we can see that the lowering could have been caused by the posterior tongue concavity in much the same way as the mid vowels were prevented from raising in Gothic.

Prokosch (2009:117) notes that i-umlaut was blocked in Old High German if there was an intervening consonant cluster of the form /hs/, /ht/, /Cw/. This block was extended in Upper German dialects if an intervening cluster /lC/ or /rC/ were present. This would put the liquid in coda position and would suggest that the frontness of the /i/ could not carry across the coda rhotic onto the preceding vowel. Comparing the liquids to the other consonants we again find a link between them and /h/ and /w/. Although a bunched /r^2/ has a raising of the front of the tongue in its production which may allow for i-umlaut to occur, the retraction in the pharyngeal region and the lowering of the tongue in the central region seems to have been the reason this phenomenon was blocked in this position. It should also be noted that many Upper German dialects later produced /r/ as a uvular rhotic, so the underlying back elements in the production of the original rhotic may have already been perceptually dominant.

3.3 Summary of the PG /r/

From the above data we can conclude that the PG /r^1/ adopted from PIE would originally have been a trilled alveolar [r], which may have had some bunching to account for early Common Germanic processes. As PG /z/ started to retract and bunch to form /r^2/ this would have led to a push chain where /r^1/ became more anterior [r̪]. The bunching of the anterior tongue body and the concavity of the posterior tongue body would have become the features of this spirant /r^2/ with the tongue tip of /r^1/ initially being pushed forward towards the incisors. As it is an unusual position to have two rhotics in such near proximity they eventually merged into one (possibly trilled) /r/ sound in the daughter languages with a bunched allophone in coda position and an anterior sound in all other positions.

Maddieson (1984:73-89) showed that whilst 76% of languages in his database have a rhotic, only 19% of these have more than one rhotic. The most common places of articulation for rhotics were alveolar (44.6%) and dental (38%) with uvular articulation only occurring in 0.9% of the languages which were restricted mainly to European prestige dialects. Of those languages where there were two or more rhotics the most common combinations appear to be a difference in manner of articulation (about 42%, the most likely combination being a trill [r] and a tap/flap [ɾ]), differences in plain rhotics versus those with a secondary articulation account for about 33% of cases (the commonest combination being between [r] and [r^j], with differences in place of articulation accounting for just 24% of cases with the commonest being between alveolar and retroflex. The case where [r] and [ʀ] occur in a phoneme inventory as separate segments, though not impossible, would be extremely rare and does not occur in Maddieson's data. Ladefoged and Maddieson (1996:227) give Occitan as an example of contrasting [r] and [ʀ] and I am aware that many Portuguese dialects also display phonemic differences between [r] and [ʀ], these appear however to be very isolated cases.

I would suggest therefore that there is no need to speculate that this /r¹/ had become the rare uvular where it had been uncontroversially [r] in PIE. The arrival of the pronunciation [ʀ], though apparently appearing early in German, appears to have been an affectation or speech 'defect' which gained currency in the courts of France and gradually spread through the cities of Western Continental Europe. Yiddish /r/ is uvular and there is evidence that this split from German in the 13th century, though a uvular [ʀ] may have been a later development in both languages which were spoken in neighbouring communities (cf. Jacobs 2005:9-15, 109). It would have been a sound which could be easily adopted in languages which had a bunched /r/ as this articulation has a back element in its contraction in the pharynx. If this is perceptually a strong indicator of this sound then adoption of a uvular trill is obviously not too great a change.

3.4 Rhotic vocalisations

The map at Figure 15 shows areas where vocalisations occur. The boundary of the Germanic speaking area is shown in this map to indicate that r-vocalisation, at least within the area shown is restricted to Germanic speakers. Vocalisations outside the Germanic speaking area are usually considered individualisms, as in Czech (cf. Żygis 2004:8) or French (personal communication with Wyn Johnson).

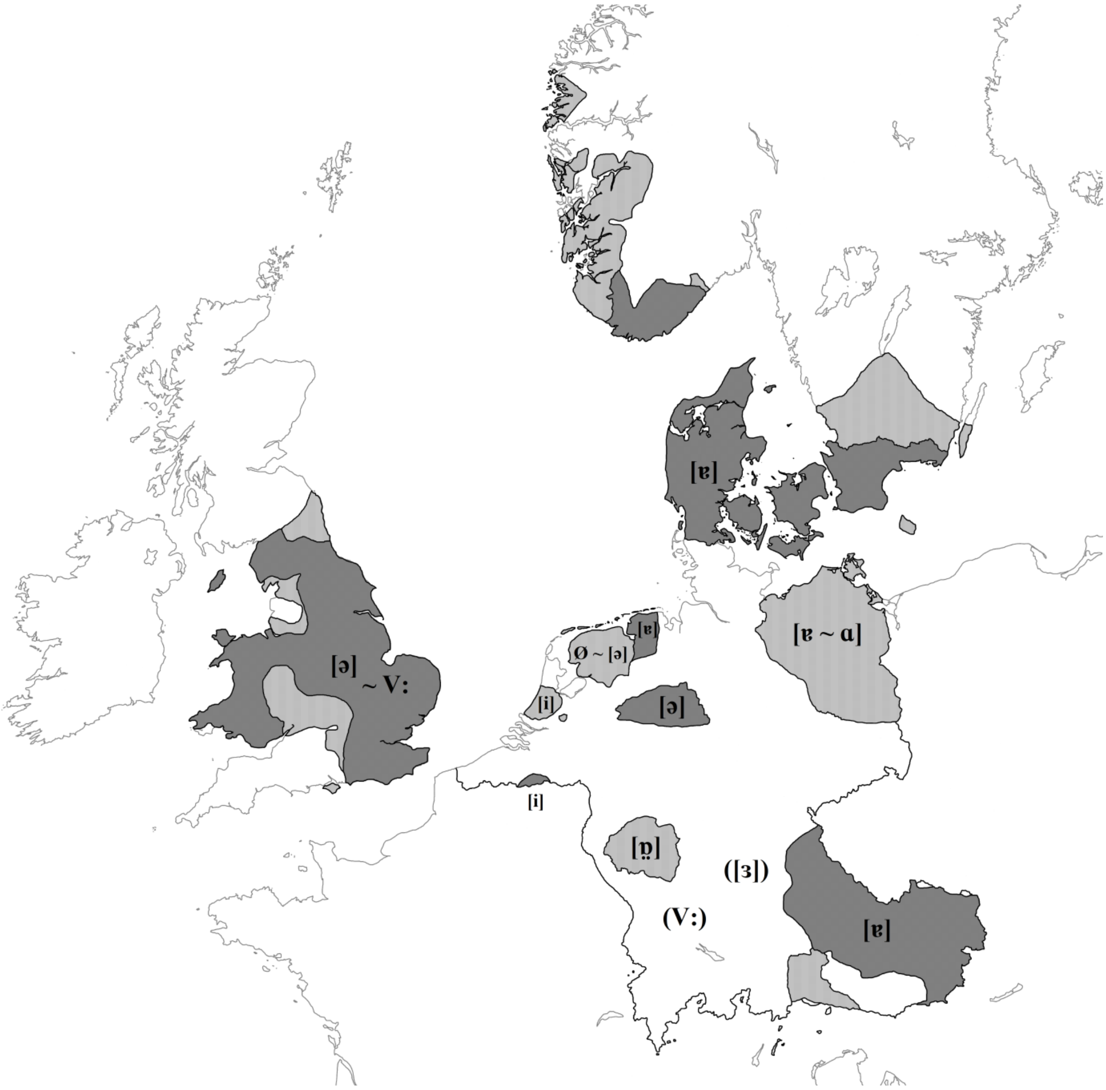


Figure 15

The map[1] at Figure 16 shows realisations of /r/ throughout the European Germanic speaking area, including neighbouring countries. It can be seen from this map that there are two main

[1] The sources for the rhotic maps are: Ausems 1953:61, 63; Bakkes 2002:31; Barðdal et al 1997:248; Barry 1981:48; Bergmann 1990:295, 297; Berns 2002:38; Bloemhoff 2002:30; Boekenoogen 1897:XXXVII; Britain 2002:52-54; Brøndem-Nielsen 1951:114, 119, 124; Chapman 1962:63; Daan 1990:285, 287; De Vin 1953:2, 17; Durrell & Davies 1990:75, 229; Garlén 1988:86, 101; Graddol et al 1996:264-265; Green 1990:250; Hakkarainen 1995:90-91; Haugen 1976:73, 277; Heestermans & Stroop 2002:40-41; Heger 1975:137, 142-145; Hutterer 2002:153, 155, 382; Jacobsen & Matras 1961:XXVI, XXXI-XXXII; Johansson 1980; Klausmann et al 1994:134-135; Knop 1954:75, 117-118; König & Auwera 2002:511; Kristoffersen 2000:24, 36; Ladefoged & Maddieson 1996:170-171; Milroy 1981:66; Newton 1990:168; Niebaum & Macha 1999:73; Pettersson 1996:191, 193-195, 200; Popkema 2006:63-64; Remmers 1997:103; Rollinson 1997:xix; Rowley 1990a:400; Rowley 1990b:423; Runge 1974:36-40, 93, 95, 100; Russ 1990b:348; Russ 1990c:371; Schlobinski 1996:5; Schönfeld 1990:97-98; Siebenhaar 2002:§ 3; Sijs 2011:158, 166, 178; Sipma 1913:5, 14, 32; Spangenberg 1990:277; Speyer 2007:25; Swanenberg & Swanenberg 2002:21, 30; Thráinsson et al 2012:45, 54; Trudgill 1990:25-28, 39-40, 53-56; Upton & Widdowson 1996:30-31; Viereck et al 2002:12-13, 120; Vigeland 1995:40, 45, 86, 139; Warrack 2000:9; Weel 1904:10, 39; Wells 1982:12, 303, 342-343, 367-370, 372, 374, 378-380, 390, 410-411, 431-432, 446; Wiesinger 1990:453, 470, 475-476, 478; Wiik 2002:72, 256; Zehetner 1985:55-56, 60, 62, 64-65; Żygis 2004:8

pronunciations outside of the Germanic speaking area [r] to the east, north and south and [ʀ ~ ʁ] to the west (in France).

Figure 16

In Figure 15 darker shading indicates areas where vocalisation is the norm, whereas lighter shading indicates either that it is optional, though common, or it occurs regularly positionally dependant on other factors. The two other areas in Southern Germany in parentheses show areas where vocalisation is less common, but does occur. It should be added to the map above that throughout the remaining Germanic uvular-r producing area, vocalisations are very common and usually result in a mid/low central [ə ~ ɐ] or low back [ɑ] vowel. Also the situation in Britain shown is rather conservative and now even areas of the South West and Scotland demonstrate varying degrees of non-rhoticity.

All of the results of the vocalisations can be explained by the position of the tongue during articulation of the rhotic. The most common result of a vocalisation is a mid to low central vowel. The lower the vowel the greater the concavity of the vocalised rhotic, which would indicate a more retracted tongue position. This occurs in areas which originally had [ɹ] (English areas), [r] (Frisian, Low German and Bavarian) and [ʀ ~ ʁ] (Southern Scandinavia and North-eastern Germany). The reason for the concavity with alveolar rhotics has been explained above. In the production of a uvular [ʀ ~ ʁ] the highest part of the tongue will be the root, which is drawn downwards and backwards. The central part of the tongue will therefore be lower accounting for the lower [ɐ] pronunciations which we encounter in these areas. For the [ɒ̤] producing Franconian dialects we see that the underlying rhotic straddles an alveolar [r] and a uvular [ʀ ~ ʁ] producing areas. This may be an indication that formerly there was just one quality for the coda /r/ where this has been vocalised showing possible allophony between the two positions. A back quality would be present in the tongue position for both bunched alveolar-r and uvular-r so this needs no further explanation.

A further possible result of vocalisations can be found in the Dutch speaking area where we find [i ~ j] as the result in both the area south of Amsterdam and the area around Brussels. These are not as easy to explain as the underlying rhotic in the Amsterdam area is [r ~ ʀ ~ ʁ] whereas that found in Brussels is uvular. We have seen that bunching in coda [r] will result in a high front area which would explain a possible vocalisation as a high front vowel, however uvular-r would not have this underlying bunching. If however we assume that the uvular pronunciation is modern, which it certainly is in the area south of Amsterdam then we can attribute the vocalisation to stem from [r] and not [ʀ]. It should be noted that throughout the Flemish speaking area the more common rhotic is alveolar (cf. Sebregts 2014:40). The majority language in the Brussels area is French with uvular-r, so here we can hypothesise that the vocalisation came from Flemish [r] with [ʀ ~ ʁ] being a later loan from French for prevocalic /r/.

A final result of the vocalisation process which we have not yet discussed is in areas where the vocalisation results in lengthening of the previous vowel and the rhotic is completely suppressed. This occurs in English examples following low vowels and in Swabian vocalisations following all vowels when followed by a coronal consonant. Although they are different processes the important underlying feature here is the moraicity of the former rhotic.

In the development of English vocalisations the concavity of the mid section of the tongue meant that high vowels necessarily lowered in the transition to the following rhotic. This [ɹ], being sonorous would have been moraic. This transitional lowering came to signal the presence of the following rhotic and eventually completely dominated the moraic timing slot allocated to it when the coronal consonantal feature was lost. If the rhotic had a preceding low vowel, the vowel would not have needed to lower in order to transition to the following rhotic. The underlying tongue position of sounds, it was noted above in Figure 13, are purely by-products in the articulation of the primary constriction. A rhotic's moraicity could therefore be all that is needed to indicate its presence which would result in a longer preceding vowel, so we are dealing with a case of phonological compensatory lengthening here. It will also be shown in Chapter 8 that coronals generally just contribute a mora in the vocalisation process. If the retraction of the tongue is not as great then this sound will not produce bunching and thus will behave more similarly to the other coronals.

For the Swabian example we have an underlying uvular pronunciation. If this is followed by a non-coronal sound then the formation of a uvular-r involves a single movement of the tongue. In the transitions from a vowel to a uvular-r to a coronal, however, it is necessary for the tongue to move from the vowel to the uvular then anteriorly from this low back position, thus increasing the effort involved. In order to reduce this effort the underlying moraicity of the rhotic is taken as the trigger for its presence and the consonantal gesture may be dropped, resulting in a lengthened vowel.

Some discussion needs to be made as to why some languages choose high front, some mid central and some low back vowels as the underlying feature in vocalisation processes. This can be explained as a ranking of the features of this sound.

If we consider a bunched /r/ as postulated here for PG to be of the form given in Figure 17 (we shall return to consideration of this feature diagram in section 12.3 below):

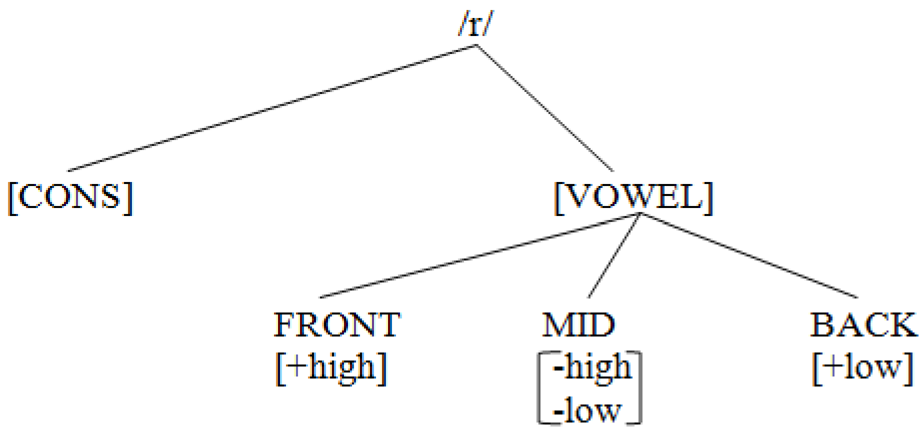


Figure 17

then for a correct production of this sound we have the following faithfulness constraints:

GEST(/r/-CONS)

/r/ has a consonantal gesture

GEST(/r/-[i])

/r/ has an underlyingly [+high, -back] gesture

GEST(/r/-[ə])

/r/ has an underlyingly [-high, -low] gesture

and

GEST(/r/-[ɑ])

/r/ has an underlyingly [-low, +back] gesture

then without ranking of these features we get the PG situation in Table 4:

Input: /r/	GEST(/r/-CONS)	GEST(/r/-[i])	GEST(/r/-[ə])	GEST(/r/-[ɑ])
(non-bunched) [r]		*!		*
[i]	*!		*	*
[ə]	*!	*		*
[ɑ]	*!	*	*	
☞ bunched [r]				

Table 4

If for individual dialects they are perceptually ranked separately, then a ranking for /r/ as present in the regions of the Netherlands prior to it being vocalised to [i] could look like Table 5:

Input: /r/	GEST(/r/-CONS)	GEST(/r/-[i])	GEST(/r/-[ə])	GEST(/r/-[ɑ])
(non-bunched) [r]		*!		*
[i]	*!		*	*
[ə]	*!	*		*
[ɑ]	*!	*		
☞ bunched [r]				
[rʲ]			*!	*

Table 5

We get the same optimal result of a bunched [r] but there is a different priority about which features of the /r/ are of higher importance. It has been shown here that a palatalised [rʲ] would break lower order feature constraints so would be less optimal than a bunched [r]. This would become more significant once a vocalisation has occurred.

If we consider the case for those dialects of German, Dutch or Danish, prior to their adoption of uvular [ʀ ~ ʁ] we may have had a ranking as follows where /r/-[i] seems to have been so lowly ranked that the uvular could be easily adopted, but as can be seen in Table 6 a bunched [r] still wins initially:

Input: /r/	GEST(/r/-CONS)	GEST(/r/-[ɑ])	GEST(/r/-[ə])	GEST(/r/-[i])
(non-bunched) [r]		*!		*
[i]	*!	*	*	
[ə]	*!	*		*
[ɑ]	*!		*	*
☞ bunched [r]				

Table 6

There are a number of areas where rhotics in coda clusters necessarily undergo changes to prevent them from vocalising. A rhotic consonant in a coda cluster is especially prone to vocalisation, especially if such a cluster results in a trimoraic syllable. A sonorous consonant in a coda cluster will usually be in coda position even when the cluster is followed by a vowel, where the second element of the cluster may form the onset of this following syllable, unless the cluster is composed of two sonorants where the second sonorous consonant is more sonorous than the first. Coda consonants are especially prone to lenite (see discussion in Chapter 2) so a rhotic in this position will either vocalise or need to have a mechanism to save it from being vocalised. The map shown in Figure 18 demonstrates some of the mechanisms Germanic languages have utilised to avoid coda vocalisations.

Figure 18

I shall only give a brief explanation of each of the processes as they prevent the process being discussed here and so are only marginally relevant.

Epenthesis is very common in Dutch, German and Scots dialects. This results in a schwa being inserted between the rhotic and the following consonant. By insertion of schwa it places the rhotic in a prevocalic, thus stronger onset, position and will not undergo lenition processes.

In Iceland and Norway we find strengthening of the rhotic to [d] in clusters involving a following sonorant. This [d], being less sonorous than the following sound, will then force the second element of the cluster to be syllabic, or to be part of the onset of a following syllable if the cluster is followed by a vowel, and once again the [d] will form an onset of this syllable or onset cluster and avoid lenition.

In non-southern Scandinavian dialects and in isolated northern British dialects we find a lenition process whereby the rhotic merges with the following consonant and not with a preceding vowel as is the case with vocalisations. The resulting retroflexes indicate the presence of an underlying rhotic.

Cases of complete elision occur in southern Norwegian, Frisian, Flemish and Swabian. A complete elision may of course also be seen as a lenition, though loss will not result in vocalisations so does not need to be considered here. Complete elision occurs primarily in coda clusters which would allow the second element of the cluster to be moraic, thus avoiding trimoraic syllables.

4 Laterals

Laterals, in contrast to rhotics, are more cohesive and thus simpler to define, though traditional definitions of laterals have been pulled into question. The Oxford Concise Dictionary of Linguistics defines them as “articulated in such a way that air flows past one or both sides of the tongue” (Matthews 1997:200). The very word ‘lateral’ comes from the Latin *lateralis* which means ‘belonging to the side’.

Phonetic research by Ladefoged and Maddieson (1996:182) however has found that there is not always complete closure along the midline of the mouth and this can vary greatly between languages and speakers. They found that the only defining feature of laterals was a narrowing of the tongue’s profile affecting both the tongue body and blade.

We see a parallel between laterals and retracted rhotics in that they are defined more by a manipulation of the tongue shape than in the actual position of the tongue. Retracted rhotics as seen above in Chapter 5 necessarily involve bunching, concavity and pharyngeal retraction, whereas the laterals involve a narrowing of the tongue, and we will see that anatomically this in turn necessitates a displacement of the tongue.

The types of phonological lateral recorded from UPSID data are [l̪, l, l̠, ɭ, ʎ, ʟ] and they can be palatalised, velarised or pharyngealised. The comparative frequencies within the database are as follows in Table 7 (taken from the summary in Walsh Dickey 1997:12):

	Dental	Dental/Alveolar	Alveolar	Palato-Alveolar	Retroflex	Palatal	Velar
No secondary articulation	40	222	257	13	38	28	5
Palatalised	5	7	8	0	0	0	0
Velarised	3	5	4	0	0	4	0
Pharyngealised	0	1	1	0	0	0	0
Total	48	235	270	13	38	32	5
Percentage of Laterals	7.5%	36.7%	42.1%	2.0%	5.9%	5.0%	0.8%

Table 7

Within the Germanic speaking area we only find coronal laterals and it seems unlikely that there were any non-coronal laterals in PIE so there is no need to hypothesise a phonological non-coronal lateral as being present in PG. Only the coronal laterals will therefore be considered here.

When measuring the acoustics of American English, Olive, Greenwood and Coleman (1993, cited in Walsh Dickey 1997:50-51) noted that coronals generally have a low F1 locus and a modest raising of F2, however with coronal laterals both F1 and F2 are considerably lower and these formants resemble more closely those found for [w]. The main difference between [w] and the coronal laterals is that F3 is lower for [w] than for the laterals. It should be noted that the formants resemble [w] for both ‘clear’ /l/ (one without secondary velar articulation) and ‘dark’ /l/ (with secondary velar articulation), though the second formant is lower for dark /l/ than for clear /l/. Another difference between spectrographic representations of the two sounds is that the formant structure is steadier for laterals than for [w] and this is also seen in the discontinuity from a vowel to a following lateral as opposed to that between a vowel and a following [w]. This discontinuity does not occur in the transition from vowels to other coronals and it indicates an abrupt change in the size of the resonating chambers when air is allowed to pass by the sides of the tongue in the formation of a lateral. A low value for F2 is indicative of a dorsal tongue gesture, [ɫ] having a lower F2 than [l] but both having lower F2 values than the other coronals.

This dorsal gesture is in line with the explanation given by Ladefoged and Maddieson above in that the narrowing of the tongue’s profile will necessarily mean that the mass of the tongue will be displaced, and is thus phonetically determined. The exact positioning of the displacement seems however to be language specific and therefore of a phonological nature. Recasens (1996:63) notes that within Romance languages although [ɫ] always involves a retraction of the tongue dorsum the retraction is not consistently towards the velum and may be more towards the upper pharynx. It should also be noted for Bavarian, where it is argued that a clear [l] appears in both onset and coda positions for those speakers that do not vocalise that the displacement of the tongue occurs in the palatal region (this will be noted below in 4.5 when we encounter vocalisations of the type *Salz* [sɔits], cf. for example Niebaum and Macha 1999:73-74).

4.1 Early Germanic laterals

Let us turn to the nature of the PG /l/. This lateral was an inherited sound from PIE /l/. It should be noted that PIE syllabic /l/, as with the other syllabic consonants, became PG /ul/, i.e. with a pre-epenthesised /u/, which may indicate an underlying velar pronunciation, at least for syllabic /l/, at this early stage with a tendency to make the nucleus of these syllables more sonorous, though as noted in section 3.1 that /u/ was epenthesised before all syllabic consonants including /n̥/. If this is an indication of the dorsal element of the syllabic /l/ then this may also indicate a dorsal element with the syllabic rhotic and nasals. The various daughter languages dealt with these syllabic consonants in different ways with Armenian, for example, changing /l̥/ into /al/ and Celtic changing /l̥/ into /li/, neither of which would cause us to speculate any inherent velarity in the sound, though Latin changed /l̥/ and /r̥/ into /ol/ and /or/, whilst /m̥/ and /n̥/ were changed into /em/ and /en/ respectively which may indicate a stronger velar element in the liquids than the nasals. Unusually, /l̥/ and /r̥/ followed by one of the laryngeals in PIE (/l̥h_1/, /l̥h_2/, /l̥h_3/) became /la/ in Latin and in Albanian, where, in the latter, /l̥/ had a possible reflex of /ul/ (as well as /il/, /li/ and /lu/), these syllabic laterals became /al/ which again would not indicate any velarisation or indeed laryngealisation of the lateral (cf. for example Mallory and Adams 2006:464 for a complete list of PIE correspondences). Germanic syllabic consonants followed by the laryngeals behaved like those without laryngeals and uniformly epenthesised /u/ as mentioned. That they do not behave differently in Germanic probably indicates that the laryngeals were lost early on in the development of Germanic. The fact that /u/ was epenthesised before all the syllabic sonorants, including /n/, which does not have a ‘back’ element, would indicate that the epenthesised vowel was more likely to be a neutral vowel than one shaped by the following consonant, and we should be wary of making conclusions from its choice.

There is some evidence from the early Germanic dialects that coda-l had a velar element. This can be seen in breaking of vowels before /l/ in Old Norse and Old English and the blocking of i-umlaut in various Upper German dialects with an intervening coda liquid as well as environmentally sensitive vocalisations of coda /l/ following back vowels in Middle Dutch, all of which will be discussed below.

The process of velarising coda-l, and often vocalising it, seems however to be a natural process (as will be shown later in 4.3) and so could have developed independently in the various daughter languages. Evidence for a later process may be seen from a comparison with Gothic liquids. Whereas Gothic /r/ may allow us to speculate a low element in its production due to its lowering influence on preceding vowels, Gothic /l/ produced no such influences with even the limited word list available for Crimean Gothic displaying no evidence of velarisation, cf. Crimean Gothic words such as *goltz* from PG *gulþ-* compared with *kommen* from *kuman-*, or *alt* from *ald-* with *ano* from *hanjō* where vowels before the coda-l behave no differently to those before other consonants (compare wordlists as supplied in Grønvik 1983:116). Based on the Gothic evidence and that of Middle Dutch it would seem an unnatural progression if PG had an allophonic [ɫ] in coda position which was lost in Gothic, so it seems to indicate that PG did not have a separate coda allophone, but rather a positional one based on neighbouring sounds, which would not necessarily be represented in written texts. The naturalness of the l-vocalisation process needs to be discussed but it is important first to understand the complex nature of the sound.

4.2 The complex nature of laterals

Giles and Moll (1975) studied the American English production of /l/ in both post- and pre-vocalic positions. They noted that /l/ had no inherent lip rounding, but took on that of neighbouring vowels (pp215-223). In some coda clusters they noted that apex (coronal) contact may not occur depending on the nature of the cluster, with homorganic clusters being most likely to have apex contact whereas non-homorganic clusters displayed variable results. They also noted that there was less movement of the tongue post-vocalically than there was pre-vocalically. They separate /l/ allophones into two groups, with post-vocalic /l/ exhibiting more posterior positions than pre-vocalic /l/. Their description of clear /l/ is such that it is articulated with a "lowering and flattening of the tongue, with the dorsum position fronted and somewhat raised", whereas their dark /l/ is described as "having the dorsum shifted toward the velum and palate with lingual contact made either on the teeth or alveolar ridge" (p222). They noted that the two allophones should not be considered the same physiologically.

Sproat and Fujimura (1993:291) considered laterals, whether clear or dark, to have both coronal and dorsal elements and to thus be complex segments. For darker varieties of /l/, at least within English varieties, there is a greater retraction and lowering of the tongue, also maximal retraction and lowering occur earlier for darker varieties than for clearer varieties. They state that vocalic gestures have a strong affinity with syllable nuclei whereas consonantal ones have an affinity with the margins, therefore in coda position the vocalic dorsal gesture will occur closer to the nucleus than the consonantal coronal gesture. This ties in with the part of Vennemann's Coda Law (Vennemann 1988:21) which states that "A syllable coda is the more preferred ... the less the Consonantal Strength of its offset". From this, if we consider laterals to be complex sounds with both (consonantal) coronal and (vocalic) dorsal elements, then of the two the dorsal elements, i.e. those with weaker consonantal strength, would be preferred in coda position.

They showed the amount of ‘darkness’ of the /l/ correlates with the duration of the rhyme. Their conclusion for the two allophones was (Sproat and Fujimura 1993:302):

> “a. Dark /l/s have a greater retraction and lowering of the tongue body than light /l/s.
>
> b. In light /l/s [Tip Extremum] precedes [Mid Lowering Extremum], in dark /l/s [Mid Lowering Extremum] precedes [Tip Extremum].
>
> c. For pre-boundary /l/s, the duration of the pre-boundary rime is a good predictor of the quality of /l/ as measured by various articulatory (and acoustic) factors: /l/s in shorter rimes are lighter than /l/s in longer rimes.”

Alwan, Narayanan and Haker (1996a) again studied the allophonic variation in (American) English. They noted great variability between subjects’ production of laterals with clear and dark/vocalised varieties being either apical or laminal. Two representations of their MRI scans are demonstrated below in Table 8 showing examples of the varieties encountered (p1067):

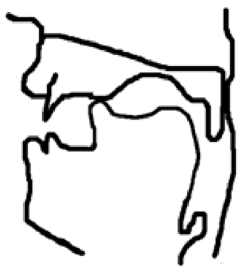
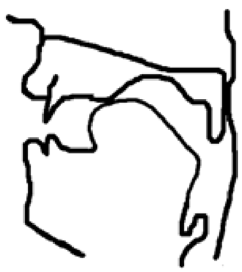
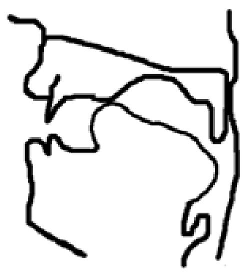
	Clear	Dark
Apical		
Laminal		

Table 8

For both apical and laminal dark /l/ there is retraction of the tongue, being more velar in nature for apical productions and more pharyngeal for laminal productions. The amount of laminality as opposed to apicality produced by the individual seems to be down to speaker preference and does not have a marked acoustic effect. They noted that though the tongue body shape for clear and dark varieties was similar for individual speakers, the positioning of the tongue in the velar or pharyngeal area varied. The main difference they found between clear and dark /l/ was that there is a somewhat greater area in the palatal region immediately behind the alveolar contact for dark /l/ than for the clear variety, and the second biggest difference was a decrease in area at the uvular/upper-pharyngeal and/or the lower-pharyngeal for dark varieties when compared with clearer /l/ (p1072).

Walsh Dickey (1997:40) indicates that sounds allowed in coda position are usually more restricted than those which appear in onset position. We find a parallel with this in languages where coda-l simplifies, as when this sound is vocalised.

4.3 Lateral vocalisation as a natural process

In a study by Johnson and Britain (2002) they noted the naturalness of having a dark /l/ in coda position and the ultimate vocalisation of this sound. Basing their evidence on the studies by Sproat and Fujimura they note again (p14) that the vocalic gesture of laterals appears closer to the nucleus than the consonantal gestures. An onset /l/ will thus have its consonantal element appear before the vocalic one, whereas this will be reversed for coda /l/. As has been noted in Chapter 3 that coda position is a somewhat weak position for consonants so the consonantal coronal gesture of this /l/ will also be weak, or weakened.

They show (p15) that in child language acquisition (based on a study by Smith 1973), dark /l/ tends to be replaced with [w] or [u] even when there is no vocalisation in the adult dialect being acquired. Using the constraint:

CAE

Conserve articulatory effort

(from Gess 2001 based on Jun 1995:225) they give (p18) an example, reproduced in Table 9, from child language acquisition for early production of ‘table’:

Input: /tebl/	CAE	FAITH$_{[COR]}$
tebl	*!	
☞ bebu		*

Table 9

We shall return to this constraint later in our analysis of vocalisations in Chapter 13.

They note that at stage 9 (2 years 189-196 days) there is a mixture of vocalised and coronal contact, so no strict ranking between the two constraints but FAITH$_{[COR]}$ finally wins if the child does indeed successfully produce coronal contact in its production of coda /l/. For historical vocalisation processes this procedure would be reversed with CAE finally emerging as successful.

Although their data indicate the naturalness of the vocalisation process, their finding that the result of a vocalisation being somewhere in the region of [u] is based largely on English data and we shall see below that this is not always the case, but is language specific depending on the exact nature of the tongue position. As such, a constraint ranking as given above would need to contain further information about the shape of the tongue.

4.4 Lateral effects on vowels

If we bear these natural trends in mind, we can now return to early Germanic processes involving laterals with a better understanding of why such processes took place. The first such process we shall consider here is ‘breaking’. We already saw for rhotics above in Table 2 on page 33 (repeated here for ease of reference) that pre-liquid vowels in Old Norse and Old English often underwent breaking, i.e. diphthongisation (or arguably backing).

	West Saxon	Kentish	Mercian	Northumbrian
a → ea	___rC, lC, h	___rC, lC, h	___rC	(___rC)
e → eo	___rC, (lh), h	___rC, (lh, lf), h	___rC, (lf)	___rC, (lf)
i → io	___rC, (lh), h	___rC, h	___rC	___rC

Table 10

A similar process of breaking occurred in the Middle English period before coda /l/ such that /a ~ aː/ and /o ~ oː/ → /au/ and /ou/ when followed by a coda /l/ (cf. Fichte 1994:30). We have the example for the word ‘old’ where Old English saw breaking of *ald* to *eald* with [æə]. This breaking was lost in the later Old English period and we had *āld* with lengthening to [aː]. This was raised in the Middle English period to *old* [ɔːld] and during the late Middle English period became diphthongised to [ɔuld] before becoming modern English [əʊld].

It has been noted that in Modern English dialects there is a similar process of diphthongisation before coda /l/ such that *hill* /hɪl/ may be pronounced [hɪəɫ] and *well* /wɛl/ is [wɛəɫ] (cf. Wells 1982:121). Similar phenomena have been noted for Urban Scottish English (Wells 1982:412), Devon English (where the transitional vowel is rounded) (Marten 1974:10), Newfoundland and Labrador English (where the mainly monophthongal GOAT vowel [ɔ ~ o] is diphthongal [ɐʊ ~ ʌʊ] before coda-/l/) (Clarke 2010:34), Southern American English (where a possible pronunciation of *feel* is [fiəl ~ fijəl] and *rule* is [ruəl ~ ruwəl]) (Wells 1982:487).

Gick and Wilson (2001:273) cite a previous study by McCarthy (1991) where he suggests that this is a result of a sonority clash such that a glide and liquid are too close on the sonority scale so that the liquid cannot be syllabified with the previous diphthong resulting in the epenthesised schwa.

They also point to a study by Lavoie and Cohn (1999) in which they argue that the duration of syllables with an excrescent schwa resembles that of syllables with a similar moraic structure which do not have excrescent schwa.

They argue however that the case for a trimoraic syllable rhyme would indicate greater length, and their own measurements have indicated that this is not the case. Rhymes of the form /-ald/, /-ajd/ and /-ajl/ in American English each have similar durations, even though the form /-ajl/ has a perceived epenthetic schwa. They argue instead that this excrescent schwa is purely an incidental acoustic result caused by a transition from the vowel to the consonant which arises from the tongue moving through what they term as ‘schwa-space’.

This latter description appears to be a powerful argument for the previous cases of breaking in Old and Middle English. The only diphthongs present in Old English were those which were the result of breaking and we find both short and long diphthongs with indications that the short diphthongs were no longer than the short vowels. It appears that at the early scribal stage of Old English they perceived this excrescent schwa which appeared before the various ‘back’ consonants as having a separate quality to the pure vowels. Later, moving onto the Middle English period, this vowel plus excrescent schwa was no longer perceived as having a separate quality to the pure vowels and it was no longer indicated in writing. It does not necessarily mean that the process disappeared.

It should be noted that within the various dialects of Old English we find the greatest degree of breaking before coda-/l/ to have occurred in the South (West Saxon and Kentish) with a lesser degree in Mercian and Northumbrian. This would indicate, as indeed is also the case today, that there was a back /l/, so a velarised [ɫ], present in coda position in the South of England, whereas this was not present, or at least only marginally so, in the North.

A similar diphthongal pronunciation of vowels before coda-/l/ can be found in the Zaansch dialect of Dutch around the town of Zaandorpen giving *skò*$_{w\text{ə}}$*l* ‘school’ and *ve*$_{\text{ə}}$*l* ‘skin’ (Boekenoogen 1897:XL). Also in the mixed dialect of Stellingwerfs we find a diphthongal quality of /oː/ before coda-/l/ when followed by a coronal, giving [oːə̆] though this may be vocalised in the far west to [ou] as in standard Dutch (Bloemhoff 2002:34).

In the Mercian dialect of Old English we find that whereas in other Old English dialects there was a retraction of *æ* in open syllables (cf. Dresher 1985:62-63 where /l/ is counted as a back consonant), we find in the Vespasian Psalter that there is fronting of this vowel and it appears as *e* and *æ* (for the equivalent values *æ* and *a* respectively elsewhere). The one exception to this fronting was in the position before a lateral where we find *a* (Campbell 1959:63). It is uncertain whether the fronting occurred before the backing and then the back quality of the /l/ affected the preceding vowel or vice-versa, but it indicates the ‘backness’ of the /l/ in this position.

This situation also occurred in Old Frisian. We find that *a* usually became *e* but remained *a* in the position before ___hC; ___lC and partly ___rC. Note in these situations the /h/, /l/, and /r/ would necessarily be in coda position (Cummins 1881:13, Prokosch 2009:116, Robinson 1992:191).

In Old Saxon i-umlaut would normally influence earlier /a/ to become [ɛ]. This change, however, did not take place in the position ___hC (where C is a coronal) and also sporadically not in the position ___rC, ___lC, i.e. when a liquid is in coda position. A blocking of i-umlaut in these positions also occurred in Upper German dialects such that we get a contrast between Franconian *heltit* 'holds', where umlaut did occur, but Upper German *haltit* without umlaut (Prokosch 2009:117). This situation may also indicate a back articulation for the Old Saxon /l/.

There are a number of other processes involving the interaction between vowels and laterals in the history of the Germanic languages which deserve a mention and are listed below. A change to a pre-consonantal vowel is often the cue to the perception that the following consonant is present, so for completeness all such changes will be presented.

In the change from Old Norse to modern Icelandic and early modern Faroese, vowels were lengthened in the position ___lC where C was labial or back, and sporadically also before /ls/ (Chapman 1962:74, 119, Gordon and Taylor 1956:276, 319, Thráinsson et al 2012:396). Note that in these cases /l/ is necessarily in coda position, being of higher sonority than all other consonants apart from /j/ and /w/, but /j/ would not trigger any changes and Germanic /w/ had changed to /v/ with lower sonority in Old Norse. We thus have Icelandic examples such as *halfr → hálfur* 'half'; *halmr → hálmur* '(drinking) straw'; *folk → fólk* 'people'. Faroese still represents these vowels with an acute accent, to indicate that they were formerly long, but has since shortened vowels in this position, though they retain the quality of the longer vowel. Some orthographic examples from Faroese include *ulfr → úlvur* 'wolf'; *folk → fólk* 'people'; *sjalfr → sjálvur* 'self'.

In regions of Norway in Setesdal and Inner Telemark we find similar lengthening with an extension to vowels in the position ___ld as well as those mentioned above. Some examples include *sjalfr* →/sjåv/ and *folk* → /fowk ~ foːk/. Note in these examples that the /l/ has been elided. The diphthongal quality of /fowk/ is due to changes in the quality of the long vowels in general and not because of the elided /l/ (Chapman 1962:74).

There was lengthening of vowels in the position before sonorants followed by a homorganic consonant in the development of both Danish (before 1300) and Swedish (before 1350). Again, the sonorant would, in this position, have formed a coda of the same syllable as the lengthened vowel (Gordon and Taylor 1956:322-323). In these cases the reflex of older /a/ became modern [ɒ ~ ɔ ~ o] (written *å*) (Pettersen 1996:131). This is also the case in Skåne Swedish where it is extended to other homogeneous clusters (Brøndum-Nielsen 1932:12).

We find *e* undergoing one of two processes in Old West Frisian in the position ___lC where C was {d, k, n, r}. It could either raise (giving *hild* from earlier *held* 'favour') or could be lengthened to *ē*. This lengthened vowel was subsequently diphthongised giving *feld* → *fēld* → *fiēld* [fɪeːld] 'field', and *eldera* → *ēldera* → *ieldera* 'elder, parent' (Bremmer 2009:115). Further to this we also find *a* lengthened to *â* in the position ___ld (Knop 1954:3).

In the Frisian dialect of West Terschelling we find sporadic lengthening in the position ___l such that /ɔ/ becomes [ɔː], *hol* [hɔːl] 'head'. This lengthening is otherwise limited to vowels in open syllable position (Knop 1954:29-30).

The Dutch dialect of Schouwen-Duiveland often underwent lengthening of West Germanic /e/ → [æː] and especially in the environment of a following liquid giving, for example, *wääle* for the cognate 'well' (De Vin 1953:6).

Lengthening of vowels before /l/ when followed by a coronal is also evident in Ripuarian dialects of German, although the loss of the coronal in this environment hides the process to some extent, so we get *alte* → **ahlte* → *ahle* 'old' (Newton 1990:156). Vowels have also undergone lengthening before liquids and nasals in Franconian dialects and have subsequently participated in later tonal changes of long vowels (Newton 1990:153).

A possible explanation for lengthening of vowels before sonorants follows from a reanalysis of the timing of the sonorants, where the vocalic element precedes the consonantal element (cf. Sproat and Fujimura 1993). Although Gick and Wilson (2001:273) argue with pre-liquid excrescent schwa that they do not contribute to syllable length, they are nevertheless perceived as being present. If a new generation of speakers perceive the transition between a vowel and a following sonorant, or the dorsal element preceding the consonantal one (for /l/ in this case), as being present and not just as a result of excrescence it could then be reanalysed as moraic and contribute to lengthening of the preceding vowel.

Contrary to tendencies mentioned thus far involving lengthenings we also find the opposite tendency in many modern English dialects where long vowels are shortened before coda-/l/ with resulting neutralisations. We thus find neutralisations of /iː - ɪə - ɪ/ to /ɪ(ː)ə/, /æ - eɪ - aʊ/ to /æ/ and /ɔː - ʊ - uː/ to /o(ː)/ before coda /l/ in London English, for example (Wells 1982:298, 312-317). It should be pointed out that this kind of shortening occurs primarily in dialects where [ɫ] is often vocalised. A reason for this shortening would seem therefore to be avoidance of superheavy syllables. When /l/ has been completely vocalised its timing slot will thus be filled by a vowel and so the sound will necessarily be moraic, whereas it may be classed as less moraic or non-moraic whilst it is still consonantal.

As has been suggested, there is a back element of coda /l/ in many Germanic dialects. A number of examples of changes in vowels in the position before a following /l/ which would indicate the back nature of this sound are discussed below.

Backing of vowels is common in many modern English dialects before a coda /l/. In East Anglia we find /ɛ/ → [ɜ ~ ʌ] in this position (Wells 1982:340). Wells notes that this is more common amongst younger speakers, which is logical as East Anglia is traditionally an area with no difference between clear and dark /l/, the difference being mainly made by younger speakers.

There is a split of the vowel /uː/ in London English, which is becoming fronted to [ʉ: ~ y:], with the possibility of reduction of rounding, however this is not the case before coda-/l/ where the vowel remains [uː] or has merged with /ɔː/ giving [oː] (from observation of my own variety of English, personal correspondence with Wyn Johnson and Wells 1982:312-317). This split of /uː/ is also present in New Zealand English where *tomb* is [tʉːm] whereas *tool* is [tuːɫ ~ tuː], with the possibility of vocalisation in both New Zealand and London (Wells 1982:609-610). In both dialects we find widespread neutralisations of vowels in this positions, though differing from one another (compare Gordon et al 2004:33, giving New Zealand mergers of the vowels in DRESS-TRAP; LOT-GOAL-STRUT; KIT-FOOT-THOUGHT-GOOSE, with the mergers as given above for London English). Newfoundland and Labrador English also share this split where /uː/ is generally centralised apart from before coda-/l/ (Clarke 2010:35). Also note that in Southern State American English there is the possibility of a merger of /ɪ/ and /i/ before a coda /l/ so that words such as *pill* may be identical with *peel* which is comparable with mergers in Northern and South-western states where /u/ and /ʊ/ merge in this position making *full* and *fool* homophonous (Wolfram and Schilling-Estes 1998:71).

Belfast English often produces /ɪ/ as [ʊ] before coda-/l/(Milroy 1981:69). It should be noted that this is the only area of Irish English where /l/ has generally a darker quality.

We find backing in the South African dialect of Natal where /e/ → [æ̈] (in words such as *bell* and *belt*), /ə/ → [ɤ̆] (in *milk* and *still*), /ɒ/ → [ɒ̹] (in *cold* and *roll*) (Wells 1982:617).

Australian English also exhibits retraction of vowels and diphthongs before coda-/l/ especially with the diphthong /ʌʊ/ which is produced as [ɔʊ] in this position (*coal* [kɔʊl]) (Wells 1982:598).

Southern State American English is noted for having backer qualities for the vowels in *doll*, *gull* and *tool* than in words which do not end in coda-/l/ such as *dot, gut* and *toot* (Wells 1982:550).

Backing of vowels before coda /l/ is not limited to English varieties. We find that Dutch /aː/ has the allophone [ɑː] before coda-/l/ in the Zaansch dialect of Dutch (Boekenoogen 1897:XII). This becomes [ɔː] in the dialect of Schouwen-Duiveland giving examples of *ôl* 'all', *ôlef* 'half', *ôles* 'neck' (compare German *Hals*), *vôle* 'to fall' and *kôlef* 'calf' (De Vin 1953:5). The epenthetic *e* in these cases is a later development and the example for 'to fall' would have originally had a geminate /l/, meaning that for all of these cases the change occurred with /l/ in coda position. In the Dutch of Bruges and Ghent we find /e/ becomes [ɑ ~ ɒ] and /a/ becomes [ɔ] in the environment ___l, the latter indicating not only backing but also rounding (Caljon 2000:8-9).

In Eastern Afrikaans we find a lowering of /ɛ/ to [æ] which seems to be progressing towards [a] in the environment before [k, x, r, l] in words such as *nek* 'neck', *weg* 'gone', *werk* 'work' and *vel* 'skin' (Ponelis 1993:67). Although this would appear to be a lowering of the vowel, I would suggest the overriding tendency is one of backing, which would make sense given the back nature of [k] and [x] and the liquids as has been discussed previously.

We find a similar process in Old Saxon where *ar, al* can be found sporadically for *er, el* (Prokosch 2009:117). We also find PG /a/ changed sporadically to /ɔ/ in Old Saxon in the environment ___ld (Holthausen 1900:28).

For each of these cases we can hypothesise that the /l/ has a back, so velarised or pharyngealised, quality in coda position, [ɫ]. This is certainly the case for the English varieties where we encounter backing, Afrikaans English (cf. Wells 1982:609) and Dutch (cf. Collins and Mees 2003:197). Although modern Low German dialects have a clear /l/ in this position, this may be under influence from High German dialects, so the case of Old Saxon could also be explained by hypothesising a dark coda /l/.

An apparently opposite trend is where raising of a vowel occurs.

An original *e* was raised to *i* in Old West Frisian in the position ___rC and ___lC (so before coda liquids when followed by a consonant) giving *wertha* → *wirda* 'to become', *held* → *hild* 'favour', *skeld* → *skild* 'shield' and *weld* → *wild* 'power' (Bremmer 2009:115).

Zürich German formerly raised /o/ to /u/ and /ø/ to /ʏ/ in the position before nasals and liquids, although this is dying out due to pressure from standard varieties (Weber 1948:66-67). /o/ is also raised to [u] before /l/ in the Austrian dialect of Styria (Wiesinger 1990:471).

This opposing trend would indicate a high front value, so a clear /l/. This is certainly the case in Austria and although the /l/ is now relatively dark in quality in West Frisian, it may have been clearer previously and have undergone the natural darkening of /l/ in coda position at a later stage.

We find rounding (and backing) in the West Terschelling dialect of Frisian in the position ___l(l) such that /e/ becomes [o̜], though this feature is not present in East Terschelling (Knop 1954:15).

In the Middle Dutch period we also find sporadic rounding of earlier /ɛː/ to /œː/ in the vicinity of labials and liquids giving *ruese* and modern Dutch *reus* 'giant' and *luenen* with modern Dutch *leunen* 'lean' (compare German *Riese* and *lehnen* with unrounded vowels) (Goossens 1974:51). This process has continued sporadically into the modern period especially in the environment C_1___l(C)$ where C_1 is labial, giving *spul* ~ *spel* 'game', *wulp* ~ *welp* 'whelp' etc. (Meer 1927:48). We find a similar sporadic rounding of /e/ to /ø/ in early modern High

German in the environment before /l/, /ʃ/ and labials, such that earlier *helle*, for example, becomes *Hölle* ‘hell’ (Frey 1994:89). This process can also be found in North Bavarian dialects where /i, e, ɛ/ are produced as [ʏ, ø, œ] respectively in the position before /l/ (Rowley 1990b:422). This rounding is also underlyingly evident in the /l/-vocalising parts of East Bavarian where a word such as *wild* ‘wild’ is produced as [wyːd] and *stehlen* ‘to steal’ is produced as [ʒdœːn] with rounding and subsequent vocalisation (Wiesinger 1990:463). There is a transitional zone between Swabian and Bavarian dialects where the diminutive suffix *-el* is produced as [œl] around Augsburg whilst further to the south around Reutte in Austria we find [ɛl] (Wiesinger 1990:484).

Rounding is a little difficult to explain as it does not appear to be underlyingly present in other Germanic articulations of coda /l/ or indeed a necessary consequence of the articulation so appears to be language specific. It should be noted however that whereas alveolar /s/ in German is produced without lip rounding, postalveolar /ʃ/ does have accompanying rounding (cf. Hakkarainen 1995:79). Niebaum and Macha (1999:72) describe coda /l/ in Bavarian as [ʎ] but indicate that it may also be accompanied with lip rounding in some dialects. This may indicate a similar development to [ʃ] where the retraction of the tongue from an alveolar [l] is reinforced with rounding.

Although there are a number of different changes that vowels can undergo before coda-/l/, we can see that most share common features. In the cases of breaking mentioned, we find the vowel is diphthongised during the transitional period from the vowel to the following /l/. We may say that the influence of the /l/ only partly affects the previous vowel. This transitional vowel is often perceived as a central vowel when the vowel in question is a front vowel, but may appear as a raised offglide for back vowels.

Where we get backing or raising of vowels before coda-/l/ we can say that the influence of the /l/ fully affects the previous vowel. The 'transitional period' is no longer transitional but rather complete. This is demonstrated in Figure 19 below.

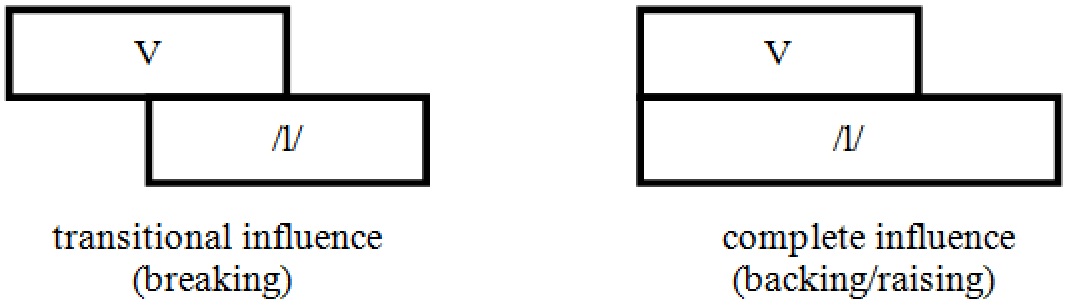


Figure 19

Due to the complex nature of laterals, having both coronal and dorsal gestures, when the dorsal gesture precedes the coronal one, as has been shown to be the case for coda laterals there is necessarily a 'clash' between the dorsal gesture of the vowel and that of the lateral. The period of transitionality between the vowel and the /l/ will differ depending on the dialect as can be seen in the examples given above.

4.5 Lateral vocalisations

Let us turn now to the situation to be found in the modern Germanic dialects. Figure 20 shows the pronunciation of /l/ in the various areas. Alternative pronunciations are shown with a tilde whereas onset-coda allophones are shown with a forward slash[2].

[2] Sources for Figure 20 are Barnes 1998:20, Bloemhoff 2002:30, Booij 1995:8, Brøndum-Nielsen 1951:118, 124, De Vin 1953:16, Eijkman 1955:97, Graddol et al 1996:264-266, Gussenhoven & Jacobs 1998:55, 165, Harbert 2007:56, Knop 1954:77, König and Auwera 2002:535, Kristoffersen 2000:25, Orton et al 1978, Pettersson 1996:199, Popkema 2006:63, Rowley 1990b:423, Russ 1990b:348, 1990c:370-371, Sipma 1913:15, Viereck et al 2002:16, 141, Vigeland 1995:39, 121-123, 141, Warrack 2000:9, Wells 1982:43, 80, 341, 370-371, 374, 390, 411-412, 431, 446, Wiesinger 1990:467, Wiik 2002:72

Figure 20

Figure 21

The previous Figure 21 shows where vocalisations have occurred, either historically or currently, in the Germanic speaking area and neighbouring countries[3].

[3] Sources for Figure 21 are Ausems 1953:45, Bakkes 2002:69, 87, Barnes 1998:15, Berns 2002:17-18, 24, Bloemhoff 2002:34, Bossard 1962:15, 23, Britain 2002:58-59, De Vin 1953:5, 7, Dictionary of the Scots Language, Freeborn 1998:371-372, Garlén 1988:80, Grant in Warrack 2000:9-10, Haas 1983:1111-1113, Johnson

It should be noted from this map that the result of vocalisations in Bavarian and some other parts of Germany is a high front vowel, with or without some rounding. From an articulatory perspective this can be explained by the narrowing of the tongue necessitating a displacement of the tongue body. This displacement usually occurs in the velar or pharyngeal area for English, as demonstrated by Alwan, Narayanan and Haker (1996a) and shown in Table 8 in section 4.2 above and the various studies demonstrated in Johnson and Britain (2002). These studies have however concentrated on English and French examples. Similar back vocalisations can be found in Portuguese (Williams 1962:30, 39, 68-69, 89-90), Gascon (Coffman 2013:11), and the Slavic languages Baltic Slavish, Sorbian, Kashubian, Polish, Slovene, Croatian and Serbian (Rehder 1998).

Displacement of the tongue towards the velum seems to be an unmarked default, as it occurs in far more languages. Most German dialects, though, have a clear /l/ in all positions. An underlying vocalic element of a clear /l/ is a high front vowel. This can be seen from child language acquisition, where gliding of liquids results in onset /l/, so clear /l/, becoming [j] (Johnson and Britain 2002:15). We also find this in the development of Latin consonant clusters with /l/ into Italian, such that:

Latin	>	Italian
oc(u)lus 'eye'	>	*occhio*
fib(u)la 'buckle'	>	*fibbia*
**duplus* 'double'	>	*doppio*
teg(u)la 'baking pan'	>	*tegghia*

(from Vennemann 1988:46).

and Britain 2002:13-17, Knop 1954:3, König and Auwera 2002:73, Niebaum and Macha 1999:73-74, Reenen and Jongkind 2000:189-192, 194, Rollinson 1997:xix, Schönfeld 1990:108-109, Siebenhaar 2002:§3, Sijs 2011:142, Sipma 1913:5, 23, Trudgill 1990:45-46, 63-66, Viereck et al 2002:100-101, Weel 1904:13, 25, Wiesinger 1990:473-474, Zehetner 1985:55-56, 60, 62, 64-65

We can conclude from this that the displacement of the tongue is a necessary phonetic condition of the production of laterals, but where exactly the displacement occurs is language specific and thus phonologically determined.

A number of studies have looked at where /l/ vocalisations most frequently occur. For vocalisation of syllabic /l/ in English Johnson and Britain (2002:25) based their ranking on works by Côté (2000), Anttila (1997) and Nagy and Reynolds (1997) and had a hierarchy of:

*GLOTTAL-l, *LABIAL-l >> *DORSAL-l >> *CORONAL-l

i.e. syllabic /l/ is more likely to vocalise after a glottal or labial than after a dorsal and it is more likely to vocalise after a dorsal than after a coronal.

They added the constraint $\text{FAITH}_{[\text{COR}]}$ proposing the variable ranking as:

$\text{FAITH}_{[\text{COR}]}$(*GLOTTAL-l, *LABIAL-l >> *DORSAL-l >> *CORONAL-l)

such that if vocalisation occurs after coronals then it will also occur after dorsals, labials and glottals, whereas a vocalisation of a dorsal will not guarantee a vocalisation after a coronal, but /l/ would also vocalise after labials and glottals.

They found that pre-vocalic /l/ is likely to be treated as an onset, even across word boundaries, although there is the possibility of vocalising coda /l/ even if a vowel follows.

A study by Hardcastle and Barry (1989) of Southern British English found the following percentages of vocalisation of coda /l/ clusters (p14):

(a)	/l/ before	vocalised	not vocalised
	velar	67%	33%
	palato-alveolar	41%	59%
	alveolar	16%	84%

(b)	/l/ after	vocalised	not vocalised
	front V	38%	62%
	back V	28%	52%

They also found that /l/ usually had only partial closure before sibilants which they attributed to anticipation of the following grooved tongue configuration (p15). That /l/ vocalised more readily before velars, they attributed to co-articulatory effects (p16). Dark /l/ in this position involves both a tongue tip gesture and a tongue body gesture, the tongue body is also used in the production of velars. They explained the greater frequency of vocalisation after front vowels as resulting from perceptual factors, with the velar component of [ɫ] contrasting more clearly with front vowels than with back ones and thus the alveolar contact is less important as a perceptual cue to the presence of /l/.

Haas (1983:1112-1113) provides two hierarchies for /l/ vocalisation in German, the first for Swiss German style vocalisations to [u̯] and the second for Bavarian style vocalisations to [i̯] as shown below:

Hierarchical /l/ vocalisations based in German dialects of /l/-[u] form.

a) /l/ → [u̯] / V___C (Swiss, Lausitz) (where this often also depends on the quality of the previous V or the value of the following C, with a preceding back V being a favoured position for vocalisations especially following an [o]. Vocalisations especially occur preceding coronals and of these especially before [d] and [t]. Note that this contradicts the findings for English mentioned above by Hardcastle and Barry.)

b) /l/ → [u̯] / V___## (Swiss, Thüringian)

c) /l̩/ → [u̯] (Swiss, Lausitz)

d) /ll/ → [u̯u̯] / V___V (Swiss)

e) /l/ → [u̯] / V___V (Swiss, Transylvanian)

f) /l/ → [u̯] / ##(C)___V (Zips - but they note that here there are Slavic influences).

Hierarchical /l/ vocalisations for German /l/ → [i̯] type vocalisations:

a) /l/ → [i̯] / V___{$C_{[VELAR]}$; ##}

b) /l/ → [i̯] / a___## (where this occurs especially after labials and OHG h/hh, less often after [kx] and least often after [g ~ gg])

c) /l/ → [i̯] / V___V (which is very limited and does not have a very wide regional spread. Note that there are no geminate /ll/ in Bavarian as there are in Swiss German.)

Finally, Figure 22 taken from Niebaum and Macha (1999:73-74) more clearly shows the variety of vocalisations as they occur in Bavarian:

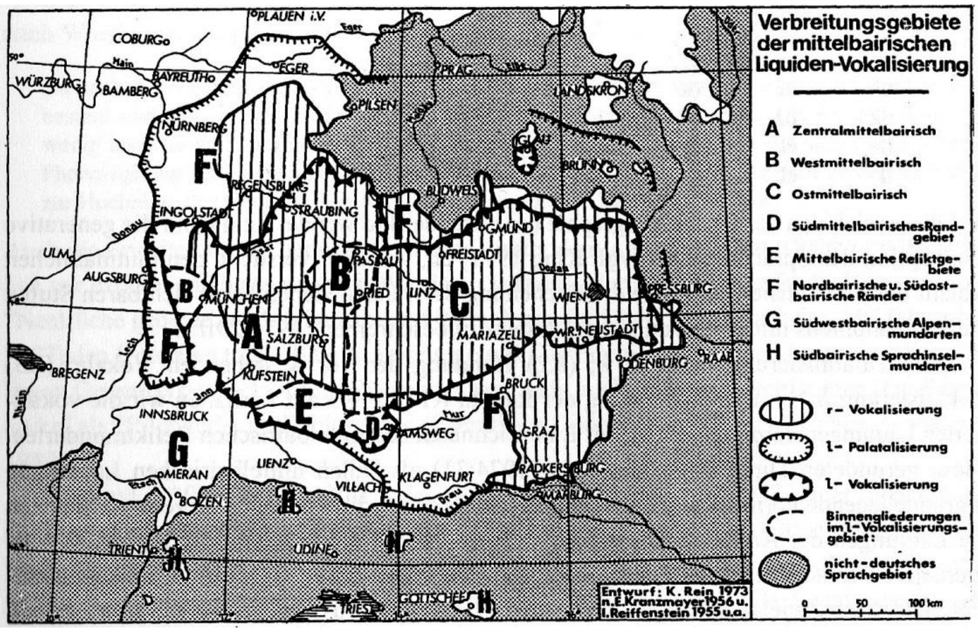


Figure 22

where:

	wild 'wild'	stellt 'puts'	Feld 'field'	alt 'old'	Holz 'wood'	Schuld 'guilt'
A	iː/ei	ei	ɛi	ɔi	oi	ui
B	ui	oi	ɔi	ɔi	oi	ui
C	yː	øː	œː	ɔi	oi	ui
D	iː	eː	ɛː	ɔi	oi	ui
E	yi	øi	œə	ɔi	oi	ui
F	yʎ	øʎ	œʎ	oʎ	uʎ/oʎ	uʎ
G	il	el	ɛl	ol	øl	yl
H	iɫ	eɫ	aɫ	aɫ/au	uɫ	ɔɫ

5 Nasals

Whereas oral consonants are produced by air escaping through the mouth, in the production of nasals the velum is lowered such that air may flow through the nasal cavity. The degree of lowering is non-contrastive, so there is no language which has fricative nasals (although it should be noted that some languages have nasalised fricatives, though here the fricative refers to the stricture in the mouth and not of the velum lowering) (cf. Ladefoged and Maddieson 1996:103). A few Austronesian and Indonesian languages have been analysed with degrees of nasality based on whether a nasal will trigger nasalisation of a following vowel. In the Indonesian examples this is a result of a former nasal + stop element having historically lost the stop, but retained the non-nasality of the following vowel. Catford (1977:139-140) interprets the situation for Acehnese (a Malayo-Polynesian language spoken in Sumatra) as having 'lightly' and 'heavily' nasal consonants. It seems also here though that the nasality is due to the control of when the velum is lowered as opposed to the amount of lowering involved.

Whereas with oral consonants air flows through the mouth and resonances from the oral cavities both anterior and posterior of the closure will form their formants, as the air flows through the nose with nasals the oral cavity forms a side chamber. A more forward closure in the mouth and a lower tongue position will produce a greater cavity. This side chamber produces a spectral zero with greater cavity areas producing lower zeros than smaller cavities (Ladefoged and Maddieson 1996:116). Spectrograms of nasals therefore characteristically have a very low first formant centred at about 250Hz and they generally also have a large region of no energy before the second formant ranging between 1500Hz for [m] and 3700Hz for [ŋ] (Ladefoged 1993:201). They are perhaps better recognised from their interaction with a preceding vowel.

The following Figure 23 (taken from Ladefoged 1993:201) shows spectrograms for three types of nasals as produced with a British accent. The words produced were ‘pin’, ‘Tim’ and ‘king’ respectively.

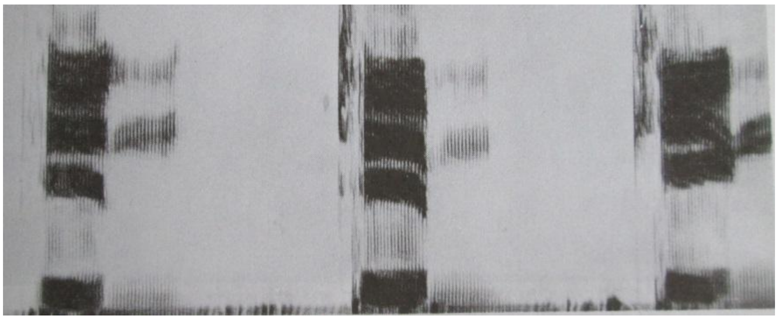


Figure 23

It can be seen there is a slight rise in the value of F1 for both coda /n/ and /ŋ/ and lesser so for /m/, whereas the F2 value is noticeably lowered for /m/, less so for /n/ and raised for /ŋ/. It will be seen from the following chapters on labials, dorsals and coronals that F2 mirrors the results for oral stops so shows more the positional effect on the vowel, however F1 seems to show more effect of the nasality (to a lower vowel in this case).

If we look at the frequency of nasals in world languages we get the following results from the UPSID database (Maddieson 1984:60):

	Simple Plain Voiced Nasal	Other Nasals	Total	Percent
Dental/Alveolar	316	40	356	96.8%
Bilabial	299	47	346	94.3%
Velar	167	23	190	52.7%
Palatal	107	11	108	33.8%
Retroflex	20	1	21	0.06%
Palato-alveolar	17	0	17	0.05%
Labial-velar	6	1	7	0.02%
Labio-dental	1	0	1	0.003%
Dental-palatal	1	0	1	0.003%

Table 11

Only 3.2% of the languages in the database have no nasal and a further 2.2% have only one nasal, with a significant majority having at least two nasals. The column in Table 11 labelled ‘other nasals’ includes voiceless nasals and those with a secondary place of articulation.

Vowels can also be categorised with nasality. In a very few languages the amount of nasality on a vowel may differ. French, for example, displays a difference in nasality between such words as *bonnet* ‘cap’ where the vowel is classed as oral and velum lowering occurs only towards the end of the vowel, *nonnette* ‘young nun’ where although we have an oral vowel there is slightly more nasality as it is influenced by both a preceding and following nasal and *non-être* ‘non-entity’ which is a fully nasalised vowel (cf. Ladefoged and Maddieson 1996:298).

Articulatorily Hajek (1997:125-127), citing Hombert (1987:274), explains that the lower the vowel being produced the greater the amount of velum lowering. We thus get more nasal ‘seepage’ for lower vowels regardless of whether there is a following nasal or not. The following Figure 24 shows the production of the three vowels /i/, /u/ and /a/ and, whereas it can be seen that there is complete velar closure for the two high vowels, the velum is slightly opened for the low /a/.

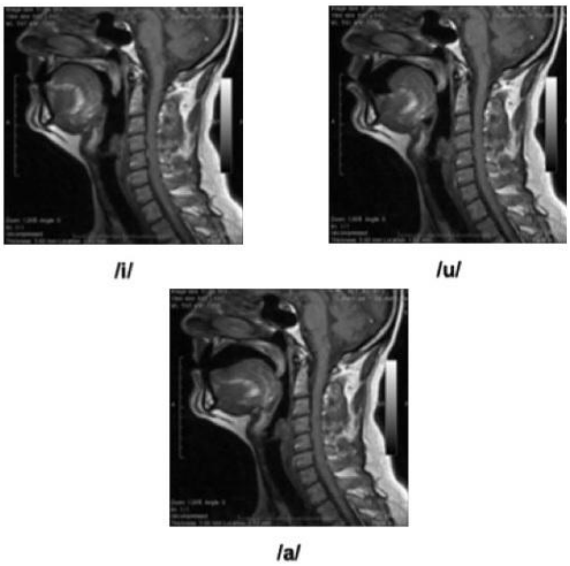


Figure 24

This is however not a reliable cue for the perception of nasalisation where higher vowels may sound nasal with less velum lowering than for perceptually oral low vowels.

A trace of the tongue positions for the three vowels shown above with a raised velum are given below in Figure 25 on the left. The right-hand diagram shows the effect velum lowering would have on the vowel space if only the velum were lowered and the tongue shape for the vowel were kept in an identical position as with the oral vowels.

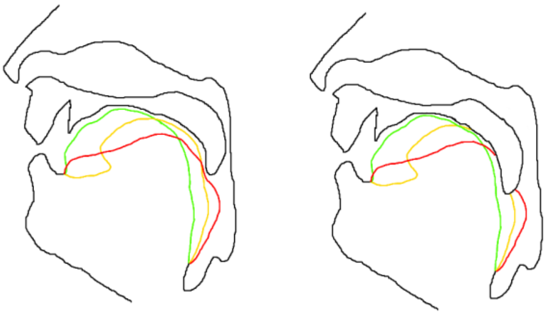


Figure 25

Hypothetically there would be a reduction of the vowel space with the spatial reduction being more so for back vowels than front vowels. From this we would expect articulatorily the tongue's distance from the roof of the mouth and back of the vowel space to reduce resulting in a rise in height of the vowel being produced. We will however see that this is not necessarily the case, and so along with the velum lowering there will also be an adjustment of the tongue position.

Figure 26

22.4% of languages from the UPSID database have a contrast between oral and nasalised vowels. Nasalised vowels also occur in European languages as the map in Figure 26 demonstrates[4], where shaded areas represent dialects with nasalised vowels. Most noticeably from this map are Irish, French and Polish which are immediate neighbours of the Germanic speaking area, but with the exception of Elfdalian in Sweden and Frisian, no standard Germanic language has contrastive nasalisation, although it can be seen that many dialects have some form of nasalised vowels.

[4] Sources for the Figure 26 are: Brøndum-Nielsen 1951:114-115, 118, Cohen et al 1972:117-118, Gussenhoven 1998:73, 126, Haas 1983:1114, Hajek 1997:152, Klausmann et al 1994:42-43, 124-125, 152-153, Niebaum and Macha 1999:45, Popkema 2006:72-73, Rehder 1998:148, Sijs 2011:164, Sipma 1913:5, 28, Spangenberg 1990:277, Steensland 2010:13, Wiesinger 1990:459, 469, 472

5.1 Early Germanic nasals

The PG nasals were direct descendants of the PIE nasals, of which there were just two which contrasted, /n/ and /m/. Alveolar consonants are often considered to have the unmarked place of articulation and as such are particularly prone to assimilate. Of the alveolar consonants /n/ has the added feature that its nasality is a mark of its presence. If the oral stops assimilate for place then they will merge with stops in other positions, if however the nasal alveolar /n/ assimilates for place, when there are fewer contrastive nasals in a language then we are less likely to see neutralisations. It is therefore particularly common for the alveolar nasal to have positional allophones depending on the following sound. We can therefore assume that the PIE /n/ had at least as many allophones as there were places of articulation in its inventory, which would mean it had at least the allophones [ɲ] and [ŋ]. The sonorants of PIE could form a syllable nucleus. Syllabic /n/ and /m/ developed into /un/ and /um/ respectively in PG, thus losing this function. The palatal series of consonants from PIE merged with the velar series in PG although /j/ remained, so there would still have been the possibility that /n/ had the positional allophones [ɲ] and [ŋ], although /n/ would have been less likely to assimilate before an approximant than before a stop, so [ɲ] would have been rarer, if it did indeed occur. [ŋ] became phonemic in most of the daughter languages with the loss of following homorganic stops.

5.2 The complex nature of nasals

We noted for laterals above in 4.2 that they are a combination of a consonantal alveolar gesture and a vocalic dorsal gesture. Sproat and Fujimura (1993:305-306) point to the complexity of nasals in much the same way as this occurs with laterals. We thus get a consonantal obstruction along the mid-sagittal plane and a vocalic lowering of the velum. As with laterals the gestures behave according to syllable sonority laws with the consonantal gestures being pushed to the syllable boundaries whereas the vocalic gestures get drawn towards the nucleus. In onset position the velum lowering is thus less than in syllable final position whereas the consonantal gesture has a significantly greater displacement in onsets than in codas. They note that in onset position the velum lowering and consonantal gesture coincide, whereas the velum lowering extends earlier into the previous segment, resulting in partially or fully nasalised vowels.

Nasality in vowels must be treated as a secondary feature. All languages which have nasal vowels also have oral ones although these are not necessarily identical in quality (cf. Maddieson 1984:130-132). In the same way, all languages which have nasal stops also have oral stops. In the UPSID data (p65) the set of places of articulation of the plain voiced nasals usually forms a subset of the places of articulation of the series of stops. There are only 6 languages which do not have this pattern, where they have a palatal /ɲ/ but no oral palatal stop.

We can therefore consider nasals to have an additional level of complexity than the oral consonants. They not only have oral stricture and with it tongue position, as occurs with oral sounds but additionally there is velum lowering which can also occur simultaneously with vowels. Prominence of any of these features could be considered a cue to a nasal’s presence and any could affect the resultant vowel in a vocalisation process.

5.3 Nasal effects on vowels

Nasal effects on preceding vowels seem to be quite complex and the various descriptions result in contradictory conclusions.

Previous studies (as listed in Beddor 1983) have shown that phonetically nasalised vowels, i.e. those which are nasalised due to the coarticulatory effects of a following (or more rarely preceding) nasal, are shown to raise vowels. This can be explained by a diagram such as that shown in Figure 25 above. A lowering of the velum reduces the cavity space between the roof of the mouth and the tongue. This has the effect of raising the vowel.

The previous studies have also found that phonemically distinct nasal vowels tend to lower. This could be as a result of a need for a perceptual distinction and overcompensation of the tongue height when the velum is lowered.

Beddor however found that the situation was more complex than this, with high and mid front vowels tending to lower but low and mid back vowels tending to raise. Velum lowering is more likely to affect back vowels than front ones as due to the physiology of the jaw there is less possible downward movement towards the posterior positions than there is anteriorly. The velum's posterior position will mean that when it is lowered the area beneath the velum for the back vowels will be affected more so than that for the front vowels. High back vowels can be adjusted to keep the nasalised vowel perceptually equivalent to the corresponding oral vowel, whereas there is less movement for the non high vowels and the narrowing of the stricture at the velum will consequently cause these vowels to be raised acoustically.

The perceptual reasons for lowering front vowels as suggested for previous studies holds for the non-low front vowels, whereas again there is not so much movement for the lower front vowels due to physiological factors stopping the speaker from lowering the jaw too much.

Beddor's findings therefore suggest that lowering of non-high front vowels is perceptually motivated, whilst raising of back vowels has an articulatory motivation. These findings best serve as an indication of likely events and not as a rigid rule for all changes involving nasals as will be seen from the following data.

During the course of the Germanic languages' histories there have been a number of effects on pre-nasal vowels which will be discussed. None of these effects are unique to Germanic languages but to complete the overview of Germanic languages have been included here.

At a relatively late stage of Northern and Western Germanic there was a merger of /e/ → /i/ however this merger did not occur if /a/ was present in the following syllable (cf. Barðdal et al 1997:31, Cercignani 1980:126, Frey 1994:48, Hirt 1931:48, Krahe 1948:31, Krahe and Meid 1969:58, Prokosch 2009:100, 112-113, Voyles 1992:49, Wardale 1947:17, Wright 1910:22, Załuska-Strömberg 1982:40). There was however one additional caveat to this exception in that /e/ did indeed still raise to /i/ with an /a/ in the following syllable if there was an intervening nasal + consonant.

In a similar way /u/ was lowered to /o/ before /a/ in the following syllable, however if there was an intervening nasal + consonant cluster this remained as /u/ (Hirt 1931:43, Krahe and Meid 1969:58).

We thus get:

PIE	PG	PG
**pelu* 'much'	**felu*	*filu* (Old High German)
**kelono-* 'conceal'	**xelanan*	**helanq*
**wentos* 'wind'	**wenðaz*	**winðaz*
**jugom* 'yoke'	**jukan*	**jokq*
**k̂mtom* 'hundred'	**xundan*	**hundq*

Table 12

It is unclear whether these changes were prompted by the nasal or whether the nasal acted as a block to the process.

There was an additional change in North and West Germanic of unstressed final syllables consisting of **amz* as occurred in a-stem dative plural nouns (developed from PIE *-*ómis* where the /m/ would have been retained). This **a* became **u* (compare PIE $*d^{h}og^{hw}\acute{o}mis$ ‘day dat.pl’ → Pre-Germanic **daɣamiz* → PG **daɣamz* → Old Icelandic *dǫgum*, Old High German *tagum* but Gothic *dagam* (Voyles 1992:75, Załuska-Strömberg 1982:40)).

In Old Norse and Old High German we find /o:/ being raised to /u:/ (and subsequently shortened and with loss of nasal in Old Norse) in unstressed syllables such that PG **tungōn* ‘tongue’ became Old Norse *tungu* and Old High German *tungūn* (Hirt 1931:43).

A preceding /n/ also sporadically raised /a:/ to /o:/ in Old Norse such that **nahtu* ‘night’ became *nótt* ~ *nátt* (Gordon 1956:273). /a:/ was often raised to /o:/ in Old High German and this was especially frequent in the position before a nasal (Frey 1994:89).

In Skåne Swedish we find short /a/ > [ɑ ~ ɔ̝ ~ ɔ̞] in a position before /nd/ and partly also before /mp/, /nt/, /ŋk/, /mb/ and /ŋg/ (Brøndum-Nielsen 1932:12).

In Anglo-Frisian /a:/ was raised to /o:/ in a position before nasals such that **māna* ‘moon’ became *mōna* in both (Campbell 1959:50, Fichte 1994:9-10, Hutterer 2002:195, Prokosch 2009:113, Voyles 1992:140). We also find raising of /e/ to /i/ and /o/ to /u/ in a position before /m/ here such that Old High German *nëman* ‘to take’ and *quomen* ‘to come’ correspond to Old English *niman* and *cuman* and Old Frisian *nima* and *kuma* (or *koma*) respectively. This change also happened to a lesser extent in Old Saxon and Langobardic (Coetsem and Kufner 1972:89, Holthausen 1900:30, Hutterer 2002:199, Lass and Anderson 1975:70, Wardale 1947:6, 21). In addition /e/ was also raised to /i/ before a cluster where the first sound was a non-anterior nasal, such that Old Norse *flengja* ‘to fling’ and *vǣngr* ‘wing’ were Old English *flingen* and *wing* respectively (Wright and Wright 1928:67). We find also that in neighbouring dialects, such as the Dutch dialect of Urk we also have raising of /o/ to [u] before clusters with /n/ and a following coronal consonant so that Dutch *bont* ‘colourful’ is Urk *bunt* (Daan 1990:282).

West Germanic /a/ regularly became /æ/ in Anglo-Frisian dialects apart from when followed by a nasal (Barrack 1975:46, Coetsem and Kufner 1972:89, Hutterer 2002:209, Lass and Anderson 1975:60, Robinson 1992:157, Voyles 1992:146). We also have a modern parallel of this in Scots dialects such that TRAP and PALM vowels rarely contrast there, however they are more likely to when followed by a nasal, such that, for example, 'Sam' is [sam], whereas 'psalm' is [sɑm] (Wells 1982:403). Although this is an apparent backing of this sound, it is likely to be the first stage of a general raising of back vowels in this position. We can see from Old English dialects that this /a/ did indeed continue on a path to /o/ sporadically in words such as *hwanon* ~ *hwonon* 'whence', *þanc* ~ *þonc* 'thought', *land* ~ *lond* 'land' and *mann* ~ *monn* 'man' though was generally lost away from West Midland dialects, though words such as 'long' come from earlier *lang* (Anderson and Williams 1935:14, Brook 1963:68-69, Campbell 1959:14, Freeborn 1998:114-115, Hutterer 2002:209, Moessner and Schaefer 1987:159, Sims-Kimbrey 1995:1, Upton and Widdowson 1996:18-19, Viereck 2002:82-83, Wright and Wright 1928:19, 67 and compare for example the map at Orton et al 1978:Ph5 for recent reflexes of 'man'). Also in Old Frisian we find this /a/ raising to /o/ sporadically, where 'man' becomes *mon* or *man* (Coetsem and Kufner 1972:89, Voyles 1992:177). The raised version is more likely to occur in Old East Frisian than in Old West Frisian (Bremmer 2009:16, 114).

A similar situation is underway in Pennsylvanian German such that /a/ may be backed and rounded to [ɒ] in the position before nasals, velars and /l/, such that we get [ʃaŋg ~ ʃɒŋg] 'closet' and [man ~ mɒn] 'man' (König and Auwera 2002:423). If this had just happened before the velar nasal then it could have been described as a result of the nasals place of articulation, but it also happens before /n/ so it must be a nasal phenomenon and as seen above for English and Frisian varieties seems correct to include it as part of a general raising phenomenon.

It should be noted that raising of the low unrounded back vowels /a(:)/ to a rounded /ɔ(:)/ or higher vowel is linked to a raising effect of nasals on preceding vowels and not a rounding effect. The rounding comes naturally from back vowels being unmarked as round and would be marked if they were unround.

In Scots dialects Old English /u/ is generally lowered to /ʌ/ but it often becomes /ɪ/ in a position before nasals (Warrack 2000:9). It is unclear here if the /u/ became /ɪ/ directly, which would imply fronting of this vowel or if the /ʌ/ has been raised.

In Newfoundland and Labrador English dialects /æ/ is fronted and raised in all environments, but this is especially so in the environment before nasals (Clarke 2010:30).

/ɛ/ is raised, and subsequently merged with /ɪ/ in Southern American English and also Black English, such that *pen* = *pin* = [pʰɪn] (Wells 1982:540-541, Wolfram and Schilling-Estes 1998:70-71).

Dutch /ɔ/ is realised as [+high], so [o] when is appears before nasals (Booij 1995:17).

In Zaansch Dutch /e/ is raised to [ɪ] before /n/, although it sometimes diphthongises to /eɪ/ when the /n/ is the first segment of a consonant cluster, such that Dutch *venster* ‘window’ becomes Zaansch *veinster* (Boekenoogen 1897:XII, XXII).

Raising and tensing of /e/ and /ɪ/ to [i] before the velar nasal /ŋ/ also occurs in the dialect of Schouwen-Duiveland such that Dutch *denken* ‘to think’ becomes *dieŋke* [diŋkə], and *drinken* ‘to drink’ becomes *drieŋke* [driŋkə] (De Vin 1953:6-7). Tensing of /ɪ/ to [i] also occurs in West Brabants, but this time before /n/ plus a following homorganic consonant, such that Dutch *wind* ‘wind’ is produced as *wiend* (Heestermans and Stroop 2002:36).

In the Low German dialect of Brandenburg /a/ is often raised to [æ ~ e] when followed by /nd/ such that *anderen* ‘others’ becomes [ænɐn] (Schönfeld 1990:100).

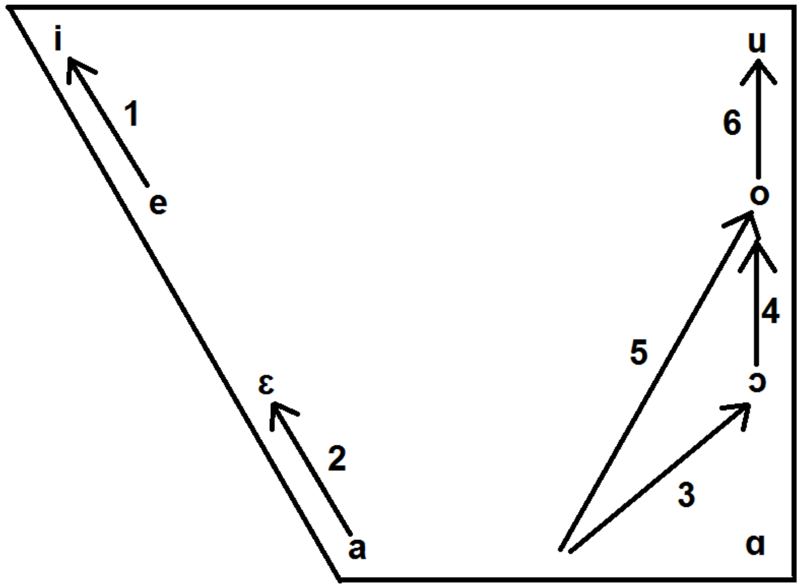
In Luxembourgish we have raising of short /a/ to [ʊ] before /n/, such that German *Bahn* ‘railway’ which earlier underwent shortening here to **Bann* has become *Bunn* (Newton 1990:156).

We find raising and also monophthongisation of the vowels /ɛ, ɛ:, ɒ:, ɛɪ, ɔʊ/ to [e, e:] and [o:] and also /o/ becomes [u] in the position before nasals in South Hessian dialects such that Standard German *Lämmchen* ‘little lamb’, *nämlich* ‘namely’, and *Name* ‘name’ become *Lemmsche, neemlisch* and *Noome* respectively (Durrell and Davies 1990:227).

A former feature of Zürich German was to raise /ø/ to [ʏ] and /o/ to [ʊ] before nasals. This was described as a dying feature in 1948 in favour of the standard, so it is doubtful whether it still exists (Weber 1948:66-67).

In the Tyrol we find raising of Middle High German /e:/ and /o:/ before nasals such that *gehen* ‘to go’ has become [giən] and *Lohn* ‘wage’ is [luən]. Also raising of /a:/ > [o:] > [u:] has occurred in the East such that *getan* ‘done’ is [gətu:n], *Fahne* ‘flag’ is [fu:n(ə)], *Mann* ‘man’ is [mu:n] (this latter example also showing lengthening of the /a/) (Wiesinger 1990:479).

These raisings have been summarised in Figure 27.



1 Old English, Old Frisian, Old Saxon, Langobardic, Dutch dialects, Austrian dialects; 2 Newfoundland, Brandenburg; 3 Pennsylvania German, Skåne; 4 Dutch; 5 Old Norse, Old English, Old Frisian, Luxembourgish; 6 Old Norse, Old English, Old Frisian, Old Saxon, Old High German, Langobardic, Austrian dialects

Figure 27

It can be seen from the examples given above that raising does often occur in pre-nasal back vowels. This would seem to correspond with Beddor's findings. There are however a number of cases where front vowels also raise, which contradict her findings, but may instead verify earlier studies which showed phonetic raising of vowels in this position.

Prokosch (2009:113) points out the Germanic trend of raising of the mid vowels /e/ and /o/ to /i/ and /u/ respectively which did not occur where /a/ was present in the second syllable unless there was an intervening N(C). He notes for Old Norse though that for nasals before certain consonants (not mentioned but limited to voiceless stops by others (cf. Gordon 1956:275)) the preceding V had a lowering of its acoustic effect which caused the actual articulation to be lowered before the nasality of the vowel, and the following nasal disappeared leaving a geminate voiceless stop. We thus get the examples of Old English *rinc* but Old Norse *rekkr* 'man', Old English *drincan* but Old Norse *drekka* 'to drink', Gothic *sugquans* but Old Norse *sokkenn*.

Voyles (1992:109) shows this as :

Ṽ[+high, α-round] → Ṽ[α-round, -high] / ___[+stress]C{V[-high], V[+high, -α-round]}

He demonstrates this with the following examples:

Proto-Norse	Old Icelandic	
θĩ̄hlu	*þél*	/θẽːl/
sprintan	*spretta*	/sprẽtta/
krumpenaz	*kroppenn*	/krõppenn/
fĩ̄fila	*fífl*	/fĩ̄vl/ (this latter example with no lowering)

It should however be noted that in unstressed position before /m/, /o/ became /u/ (Noreen 1970:119, Załuska-Strömberg 1982:40).

Final unstressed /-in/ from Old Norse became variably [e, ɛ, æ, ɑ] in modern Norwegian dialects. This indicates that they probably went through a stage of being nasalised which lowered the sound (Kristoffersen 2000:4).

In Skåne Swedish we find lowering of former long /uː/ to [o̜] in a position before /m/ (Brøndum-Nielsen 1932:13).

Although we find raising of /o/ to /u/ in the position before /m/ in Old Frisian we find the opposite effect in the position before /n/ for some West Frisian dialects, usually where this is followed by another consonant, such that ‘sound’ is *sond*, ‘time’ is *stond* etc. (Bremmer 2009:115, Sipma 1913:38).

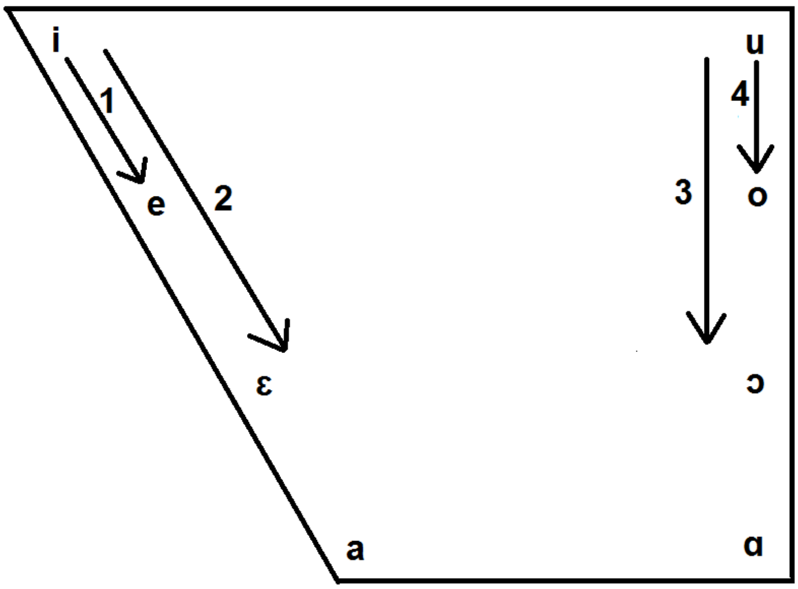
Dutch /u/ is lowered to [ɔ] in the Midsland Dialect when it appears with a tautosyllabic nasal, such that *hunderd* ‘hundred’ becomes [hɔndərt] (Knop 1954:111).

In the Urk dialect of Dutch we find /i/ lowered and slightly lengthened to [eˑ] when followed by /n/ and a homorganic consonant cluster (Daan 1990:278).

Mid-German dialects saw /u/ lowered to /ɔ/ in the environment preceding a nasal, and this was occasionally also the case for High German dialects such that *sumer* ‘summer’ became *Sommer* and *sunne* ‘sun’ became *Sonne* (Frey 1994:90).

Rhine Franconian dialects have lowered /ɪ/ before nasals to [e] (Klausmann et al 1994:54). This has been lowered further to [ɛ] as well as /ʊ/ being lowering to [ɔ] in the Thüringian German spoken in Ilm, such that *Kind* ‘child’ becomes [kɛnt] and *Pfund* is [fɔnt] (Spangenberg 1990:274). This is also a reported feature for Swabian dialects of German (Klausmann et al 1994:54, 106-107, 152-153).

These lowerings are summarised in Figure 28.



1 Old Norse, Dutch dialects, Frankonian; 2 Norwegian dialects; 3 Skåne, Dutch dialects, Mid German dialects; 4 West Frisian

Figure 28

It can be seen from these examples that there are fewer lowerings of vowels before nasals and these are spread between front and back vowels. The Rhine Franconian and Swabian examples formerly had nasalised vowels and the nasalisation has since been lost. This would imply that the nasal vowels were phonemic at some stage. This seems to correspond with earlier reports of phonemic vowels lowering.

In standard Icelandic vowels have lengthened before velar nasals and subsequently diphthongised (see the following section). There is a region in the northwest of the country on the Westfjords Peninsula and just south of the Snæffellsnes Peninsula where diphthongisation has been blocked. (Hutterer 2002:155). Although there are only slight differences between the various accents of Icelandic, whether diphthongisation occurs before velar nasals or not is one determining factor. The following Figure 29 (taken from Chapman 1962) shows the region where diphthongisation does not occur with the area marked as (1).

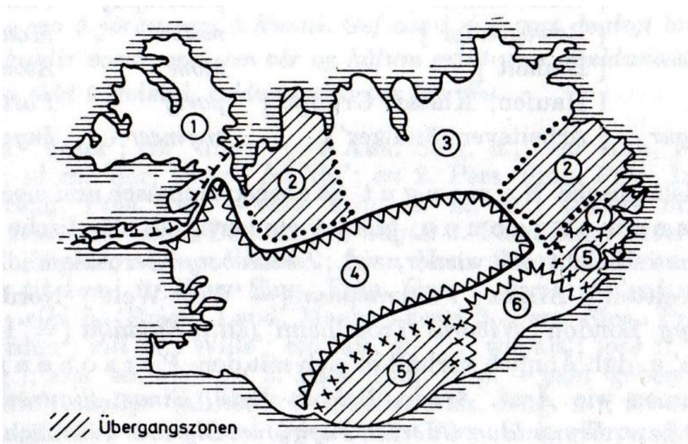


Figure 29

Whereas most East Scandinavian dialects changed all diphthongs into monophthongs, though new diphthongs have arisen there since, West Scandinavian dialects retained diphthongs. There is however a region of East Norwegian where diphthongs have been monophthongised (and sometimes shortened) before sonorants and coda consonant clusters (Hutterer 2002:164). Vowels could be long or short in Old Norse with diphthongs counting as long.

Changes occurred in all Scandinavian dialects such that long vowels were shortened in closed syllables and short vowels were lengthened, exactly how this was done differed between the dialects. A diphthong before a consonant cluster would be classed as being in a closed syllable and would thus need to shorten. Icelandic and Faroese have long and short diphthongs as a result, but East Norwegian as explained has shortened the diphthongs to monophthongs. For a diphthong followed by a sonorant we may have a case of avoidance of superheavy syllables, so those with three moras, which causes the diphthong to monophthongise and shorten.

We find many Middle English dialects where older /-eŋ-/ followed by a suffixed /d/ or /θ/ developed into /-ein-/ in the Middle English period, such that *lengþu* 'length' became *leinþe* (Wright and Wright 1928:127). Here the nasal has assimilated to the following sound and the epenthetic /i/, they claim, denotes the palatal nature of the nasal.

Wells (1982:306-307) indicates that in London English the pronunciation of /u:/ is [ʉ: ~ əü] with the monophthongal pronunciation realised before nasals and the diphthongal one elsewhere. As a London English speaker, though, this is not a feature of my own pronunciation.

West Germanic /iŋ/ became Old Frisian /juŋ/ such that we find Old English *singan* 'to sing' is *sjunga* in Old Frisian (Hutterer 2001:236). The route of this change was probably /ɪŋ/ > [ɪu̯ŋ] > /ɪuŋ/ > /juŋ/, so an epenthetic back vowel occurred before the velar nasal which was phonologised and then the diphthong went from a falling one to a rising one. This epenthesis of [u̯] would be a result of the place of articulation of the following nasal and is mirrored in processes involving back sounds such as breaking.

There is a tendency for /e/ to be diphthongised to /ei/ when followed by the cluster /nd/ in Old Frisian giving *einda* 'to end', *seinda* 'to send' etc. although this was not a strong rule

(Bremmer 2009:115). This also often occurs sporadically in Dutch which also has *eind* 'end' in this position (Meer 1927:57).

Short vowels are lengthened (and lengthened vowels are subsequently unconditionally diphthongised) in Icelandic and Norwegian north of Bergen before the velar nasal /ŋ/ (Chapman 1962:56, 75, Noreen 1970:110). This gives the Old Icelandic examples of *langt, löng, þing, kongr, ung, yngri* with their modern Icelandic pronunciations /lawŋg, lejŋgi, þijŋg, kowŋgʏr, uwŋg, ijŋgri/ respectively. If however the nasal and following velar belonged in Old Icelandic to separate syllables then this change did not occur, giving, for example, *vangá* 'inadvertence' (from *van-gá)* as [vaŋ.gawː] and not *[vawŋ.gawː] (Einarsson 1945:9).

A similar change occurred in Faroese where /a/ and /e/ were lengthened before /ŋ/ and /ɲ/. Whilst lengthened it was raised in Northern Faroese then subsequently shortened everywhere and is now pronounced [ɛ] in this position in the north but [a] in the south (Chapman 1962:119, Jacobsen and Matras 1961:XXIV-XXV, Thráinsson et al 2012:344, 396). We thus have the words *mangur* 'many' being [maŋg̊ʊɹ] in the south and [mɛŋg̊ʊɹ] in the north and *blankur* 'bright, shining' is [b̥laŋ̊kʊɹ] and [b̥lɛŋ̊kʊɹ] respectively.

Also in Faroese, as in Icelandic, /e/ similarly has become /ei/ before /ngi, nki/ giving Old Norse *drengir* 'boys', Faroese *dreingir* [d̥rɔiɲd̥ʒɪɹ] (Thráinsson et al 2012:396).

It can also be found in Norn and appears today in some modern Orkney dialects where we find, for example, the vowel of 'wrong' as [ɒˑ] whereas 'rot' has [ɒ] in South Ronaldsay and Stronsay (Chapman 1962:119, Mather and Speitel 1986:18, 26).

This feature also occurred in Western Norwegian dialects where we find Old Norse *lang* 'long' > /lɒŋ ~ laoŋ/ (the diphthongisation being a result of general changes to the long vowel and not because of the following nasal) (Chapman 1962:75).

We also find lengthening and subsequent diphthongisation of /e/ > /ei/ around Sunmøre in Norway when this occurs before consonant clusters containing /n/ (Chapman 1962:75).

Vowels were generally lengthened before *-ng* [ŋg] and *-rth* [rθ] in Danish before 1300 and in Swedish before 1350. This is also often the case before *-ld* [ld], *-mb* [mb], *-nd* [nd] (regularly so in Old Danish, cf. Jacobsen 1984:20) and *-rt* [rt] (Gordon 1956:322-323). We find some pronunciations of former /and/ as [ɔ̰̃:j] on Fynsk, [ɔ̰:ŋ] in Jutland and [ɑ:n] on Bornholm (Brøndum-Nielsen 1951:111).

Lengthening of vowels occurred often in the later Old English period when they were before consonant clusters where the first sound of the cluster was a sonorant, though in some positions they were later shortened again (Fichte 1994:18, Hajek 1997:155, Moessner and Schaefer 1987:65, Upton and Widdowson 1996:18-19, Wardale 1947:29).

The PG combination /and/ has undergone both lengthening and raising in the Terschelling dialect of West Frisian to become [ɔ:n], also with loss of the former final /d/ such that Old Frisian *lant* ‘land’ is produced [lɔ:n] in the dialect (Knop 1954:4-5).

Also in Culemborgs /i/ and /a/ have been lengthened (and /i/ has undergone subsequent diphthongisation) before a cluster of /n/ and /t/ or /d/ such that Dutch *binden* ‘to bind’ is produced *bàinde*, *winter* ‘winter’ becomes *wàinter*, *land* ‘land’ becomes *laand* (Ausems 1953:41-44).

Non-high vowels are generally lengthened in West Brabants dialect before clusters with nasals such that Standard Dutch *dansen* ‘to dance’, *lamp* ‘lamp’ and *lomp* ‘rude’ become *daansen*, *laamp* and *loomp* respectively (Heestermans and Stroop 2002:26, 36).

We find too that short vowels are lengthened before liquids and nasals in Franconian dialects, a feature which must have occurred early as they have subsequently taken part in long vowel tonal developments (Newton 1990:153).

Lengthening occurs very often before sonorant clusters (cf. also Hock 1991:139). If we consider vowels before voiced sounds in English they are longer than their equivalents before voiceless sounds. The cessation of vocal fold vibration in the production of coda voiceless sounds stops the vowel from being voiced and thus shortens the vowel. In order to produce stops or fricatives there is an additional stricture in the mouth. The more vowel-like the following consonant the less obstruction there is to the airflow which allows vowels to continue for longer before nasals and liquids than before stops and fricatives. This allophonic lengthening may be interpreted as relevant in the production and so it is very common to get lengthening of vowels before sonorants.

PIE **ā* and **ō* merged to become PG **ō*. If, however this was in a final position before a nasal this vowel was shortened to **a* (Hirt 1931:135-136, Prokosch 2009:139). Speyer (2007:40) points to evidence from Runic inscriptions that this vowel would have probably been nasalised and the nasal subsequently dropped giving:

PIE **wl̥kʷom* 'wolf' → **wl̥pom* → **wulpan* → **wulfã* (Runic *wulafa*)

Terschelling Frisian has some shortening of vowels before the alveolar consonants /l/, /n/, /t/ and /s/ such that Old Frisian /u:/ which is fronted to /y:/ in the dialect surfaces as [y] in this position (Knop 1954:47).

In the Westvoorne dialect of Dutch we find some shortening of long vowels before /m/ such that standard Dutch /blu:m/ is pronounced /blom/ (Weel 1904:26-27). Also in the Schouwen-Duiveland dialect we find it too shortening to /ɔ/ as above. This is a development of West

Germanic /o:/ which raised in the standard variety of Dutch but shortened in these dialects and then did not undergo raising of the long vowel (De Vin 1953:11).

We also find long vowels generally being shortened before /m/ in West Brabants dialects of Dutch (Heestermans and Stroop 2002:48).

Shortening of the vowel in non-stressed position can be explained as a tendency towards a mono-moraic syllable. The shortenings that we find before coda /m/ in stressed syllables indicates the moraic nature of the nasal. A combination with a preceding long vowel would produce a superheavy syllable which is avoided.

A map of where nasalised vowels occur within the Germanic area was given in Figure 26 above. All the nasal vowels encountered in Germanic dialects are a result of mistimed velum lowering from a former (or current) nasal extending into the vowel.

We find some nasalisation of vowels preceding nasals in Danish dialects on the islands and to the north of Jutland. In some of these areas it is also possible to find a former geminate /n:/ and /nd/ to have vocalised to /j/. We also find on Fynsk that the combination /aŋ/ has developed into [ãj ~ ã: ~ ɑ̃w]. These will be discussed below further in 5.5 (Brøndum-Nielsen 1951).

Nasalisation of vowels with loss of nasals occurs quite commonly in Canadian and American English varieties. In Newfoundland English the word *Newfoundland* would be pronounced [ˈnufɛ̃læn]. This only happens in unstressed syllables (Wells 1982:501). Nasalisation with nasal loss also commonly happens in American English in words such as *dent* where a voiceless stop follows. The following is taken from Gussenhoven (1998:130) where the higher the line the more nasal the sound.

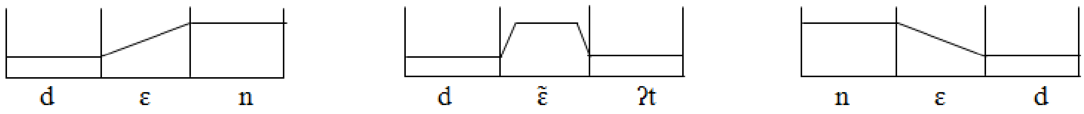


Figure 30

This nasalisation is particularly strong in Boston English (Hutterer 2002:395) and Southern American English (Wells 1982:541).

West Frisian vowel plus nasal combinations followed by a continuant consonant are undergoing a process similar to that which affected Old English, Old Frisian, Scandinavian and Alemmanic dialects (which will be discussed in the next section), in that the vowel is nasalised and the consonant lost, however there does not appear to be any compensatory lengthening in this change. We get, for example *ynfalle* /ĩfɑlə/ 'to fall in', but if a non-continuant follows then there is no nasalisation and the nasal remains, so *yngean* /ɪŋgɪən/ 'to go in' (Gussenhoven 1998:73). We would also get this in a word such as *wenje* 'loves' where the following /j/ is continuant, however this /j/ subsequently coalesces with the previous /n/ giving us [ʋɛ̃ɲə] (Cohen et al 1972:117-118). This same phenomenon of vowel nasalisation and loss of nasal where a continuant follows also occurs in Yiddish, again without lengthening, such that we get *dinstik* 'Tuesday' becoming [dĩstik] and *kamf* 'battle' is [kãf]. The phenomenon may be blocked with oral stop epenthesis such that *menč* 'person' may be [mẽʃ], so nasalised before a fricative, or [menʧ] with no nasalisation as it is followed by the stop closure of the affricate (Jacobs 2005:97-99).

Daan (1990:306) claims for the Urk dialect of Dutch that the last quarter to a half of a vowel is nasalised before a following /n/ and the /n/ itself may be elided. He gives examples of the combination *ans* which becomes [ã·s] whereas *uns* becomes [u̯ũ̯ns] (so with partial nasalisation). For the combination *in* the claim is that the /i/ is not nasalised, but the duration of the /n/ is longer.

In Rhine Franconian dialects and also in the Banat we find nasalisation of long vowels often with the nasal being subsequently lost, however this does not occur on short vowels. So we have Middle High German *bîn* 'bee' becoming Banat [pɔ̃ø̃] where the diphthong is not because of the nasal, but Middle High German *bin* 'am' becomes [pin] (Hajek 1997:87).

We find a similar situation in Palatinate dialects, though nasalisation may also occur on short vowels, but as mentioned the nasal will not then be elided, although it will after long vowels (Green 1990:245). This also occurs in South Hessian where words with long vowels such as *klein* 'small', pronounced [g̊lãː], and *Bahn* 'railway', pronounced [b̥ɔ̃õ], are nasalised and lose their final nasal consonant, whereas *lang* 'long', produced with a short vowel [lɑ̃ŋ], is nasalised but retains the final consonant (Durrell and Davies 1990:227).

The Thüringian German spoken around West Henneberg formerly had a feature of nasalisation due to final /-n/ loss, such that *Wein* 'wine' became [wĩː]. It is currently undergoing a process of denasalisation (Spangenberg 1990:277). The exact conditions under which this nasalisation took place in the first place are unfortunately not given in the literature.

Nasalisation followed by nasal consonant loss occurs after long vowels in the Swabian dialect of German, and the long vowel has often also been denasalised in western varieties. It does not however occur after short vowels as examples are given where no nasalisation or nasal loss has occurred. Vowel nasalisation is explained as a phonetic realisation in these dialects, although it has been phonologised in some dialects bordering Bavarian (Klausmann et al 1994:152-153, Russ 1990b:347).

Nasalisation has also occurred in Lower Austrian, although the conditions where it occurred are not described here. The nasalised vowels are however becoming denasalised (Wiesinger 1990:466-467). An unusual result of a nasalisation in Styrian German is for the vowel to be fully nasalised and what apparently seems to be the final nasal being realised as [ɐ̃] such that *gehen* ‘to go’ is [gĩɐ̃], *schön* ‘beautiful’ is [ʒĩɐ̃] and *Lohn* ‘wage’ is [lũɐ̃] (Wiesinger 1990:472). There are no examples given in the literature of these vowels without a final nasal, so it is unclear whether this [ɐ̃] is a result of the /n/ vocalisation or of later independent diphthongisations of the vowel.

For the German examples this difference seems to be caused by a reduction of superheavy syllables. Reducing these to heavy syllables means a need for the loss of the final nasal, but it leaves a trace on the preceding vowel. However there is no need to reduce the heavy syllable further so the final nasal here does not need to be elided and its nasality is therefore not spread as an indication of its presence.

Rounding does not happen often before nasals. Situations where a vowel has been rounded preceding a nasal usually result from a former low back unrounded vowel raising, and consequently becoming rounded as an unmarked default. There is however a situation in the Terschelling dialect of West Frisian where former /e/ has been rounded and backed to /ɔ/ in a position before formerly geminate /m:/, /n:/ and /ŋk/, so Old Frisian *nima* ‘to take’ becomes [nɔmə]. The gemination is no longer present but it would have been in the position where the vowel and nasal were tautosyllabic (Knop 1954:16). It is difficult to explain what is happening here. Old Frisian *nima* had come from earlier **neman*. There may have been a period where this became **nama(n)* in the local dialect and then underwent raising. A rounded production could be explained with the bilabiality of /m/, but this also happened before non-labials such that Old Frisian *rinna* ‘to run’ from earlier **rennan* also became [rɔnə], so it is more likely to be a case of raising of a low vowel than rounding.

5.4 Explanation for the effects

The picture for the effect nasals have on vowels is complex due to the complex nature of nasals. In addition to oral consonantal constrictions, which it has been shown may be considered articulatorily complex, there is the added level of velum lowering. Within a process where the nasal affects the preceding vowel and the trace left is an indication of its previous presence, this trace may manifest itself either by tongue position, as with oral stops, or by nasality, or even a combination of both. A brief explanation for some of the effects on vowels will be given here as this is the first stage towards nasal loss.

Beddor's tentative conclusion of non-low front vowels lowering and non-high back vowels raising in nasalisation processes does carry some weight when looking at the data, though we have seen that there are some counter examples which may be explained by the earlier studies cited by Beddor where coarticulatory nasalisations cause vowels to raise whereas phonological nasalisations cause vowels to lower.

She notes (Beddor 1983) that perception becomes more important with phonemic contrasts than allophonic ones, explaining that there is a perceptual centralisation of vowel height such that low vowels are perceived as higher and high vowels are perceived as lower. A shift in vowel height is therefore not just due to articulatory factors, but also a perceptual understanding of nasal vowels. If a hearer attributes perceptual height effects of nasalisation to tongue height rather than nasalisation this could reinforce articulatory differences.

From this we should conclude that we cannot ignore articulatory factors as the articulation produces the acoustic signals which are triggers for the changes caused by perceptual factors. On an allophonic basis, in order to produce complex segments such as nasals, a number of articulations need to occur simultaneously. 'Leakage' of articulations from one segment into another causes allophonic variation. If this variation is then perceived as being the trigger for a segment, this is when a sound may be phonologised.

We can sum this up, at least for nasals, although it seems true for all vocalisation processes, that articulation causes allophony, but perception of allophony causes phonologisation.

Alternately, it was shown above in the introduction to Chapter 5 how lowering of the velum causes a narrowing of the vocal tract so that the space available for the production of vowels is reduced.

We have discussed the complex nature of nasals in 5.2 that they have not only oral stricture involving both consonantal and vocalic gestures as with the oral sounds, but they have the added feature of nasality. A nasal sound can be described thus:

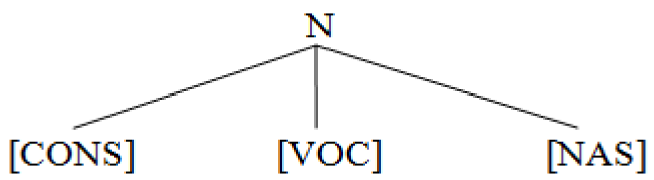


Figure 31

Any ranking of the gestures involved in the formation of a nasal consonant must therefore have these three gestures. We can therefore posit the following faithfulness constraints which ensure the production of the nasal consonant:

GEST(N-[CONS])

Nasal consonants must have a consonantal gesture.

(Note this can be refined depending on the place of articulation of the nasal).

GEST(N-[VOC])

Nasal consonants must have a vocalic gesture.

(This will also be defined depending on the place of articulation)

GEST(N-[NAS])

Nasal consonants must have velum lowering.

A process of nasalisation with loss of the consonantal gesture will involve a lower ranking of GEST(N-[CONS]) and production of either or both of the other two gestures will then be optimal.

For most of the situations mentioned above where this manifests itself as nasalisation and a change in the quality of the previous vowel but the vocalic gesture of the former consonant is lost then GEST(N-[NAS]) must be ranked higher than GEST(N-[VOC]). Where we get a diphthongal character coupled with nasalisation then these two constraints will be ranked equally or at least closely together.

The underlying vocalic gestures present will depend on the place of articulation of the oral stricture. As nasal stops are featurally the same as oral stops with the added feature of velum lowering we would expect a process involving the vocalisation of a nasal to mirror the development of the corresponding oral sound.

From this we would expect a vocalised /n/ to have a similar effect to vocalised alveolars, whereas vocalised /m/ would be similar to vocalised bilabials etc. but each with the added feature of nasalisation and an allophonic raising of vowels caused by the lowered velum or a perceptually driven lowering of the vowels. In Danish dialects, for example, which have vocalised former geminate /n:/ and /nd/ the resultant vowel is [i̠] so a high front vowel (cf. Brøndum-Nielsen 1951:Kort 15). Also in East Fynsk /aŋ/ has developed into [ãj], in South Fynsk we find [ɑ̃w] and in West Fynsk we find [ã:] (Brøndum-Nielsen 1951:119). The situation in the East and South mirrors a velar vocalisation (see below in Chapter 9) where the resultant vocalisation depends more heavily on the vowel which precedes, whereas the West Fynsk example shows more the effect of just the nasality having a role with the position of the consonant not leaving a trace.

This can only be shown to be a direct result of the place of articulation of the stop if the effects are different depending on the oral stricture involved. A possible case of this happening is in the example mentioned in 5.3 above for Old Frisian where /o/ was raised to /u/ before /m/, but later West Frisian dialects have /u/ lowering to /o/ before /n/ (Bremmer 2009:115, Sipma 1913:38), although this is not a direct contrast, so it may be incorrect to compare the two in this way.

For the majority of the cases of nasalisation as mentioned above, though, it seems that nasality is the more salient feature of nasal sounds and therefore a constraint where a nasal sound must have nasality ranks higher than any consideration of the underlying vocalic tongue position. As mentioned in 2.1, Operstein (2010:23) found that a secondary feature in a consonant will override the primary feature in cases of consonant prevocalisation, such that /p/ may prevocalise to [ʊ̯p], whereas /p^j/ will surface as [i̯p^j] and not *[ʊ̯p^j]. As nasality may be considered a secondary feature in nasal stops it is this that surfaces and not any underlying vocalic elements present.

5.5 Nasal vocalisations

There is possibly some controversy in the classification of a nasalisation as a type of vocalisation. In vocalisation processes we find underlying non-consonantal gestures within a consonantal segment surfacing as the perceived indicator that the segment is present and thus enabling the consonantal features to be reduced and finally elided. These non-consonantal gestures may surface purely on the timing slot allocated to the former consonant resulting in a diphthong, or they may extend into the previous vowel, affecting it partially or completely, again resulting in diphthongs or lengthened monophthongs.

With nasalisation processes we have exactly the same situation in that the non-consonantal gestures of the nasal consonant (nasality and tongue position) become perceived as the cue that the consonant is present which allows the oral closure of the nasal stop to reduce and finally to elide. The most salient underlying gestures with nasal stops is their nasality and so it is usually this feature which is allowed to surface as the cue to its existence, however the position of the tongue in the production of the oral stricture may also affect the resultant vocalisation.

In the same way as we see the non-consonantal gestures of a dark /l/, for example, being attracted to the nucleus and pushing the consonantal gestures to the margins, we see too with nasalisations that the non-consonantal nasality is attracted to the nucleus and the consonantal gestures are pushed to the margin.

We can see this process better with the following diagram for coda consonants where C indicates consonantal gestures and NC are underlying non-consonantal gestures:

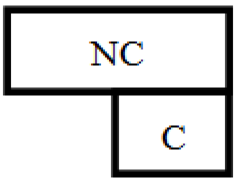


Figure 32

such that the non-consonantal gestures will spread into the preceding vowel segment.

The obvious difference between the two processes is the different nature of the non-consonantal gestures present. Whereas tongue position is the primary feature of vowels such that a vocalisation of an oral consonant directly affects the quality of the vowel, nasality is only a secondary feature and a nasalisation will add this secondary feature to a vowel and not affect the quality of the vowel itself, although as has been shown the place of the former consonant means that some nasalisation processes involve both vocalisations and nasalisations in their narrower sense, but the reasons for the spread and the description thereof are the same in both cases, so they may be considered together.

Hajek (1997:209) proposed the following hierarchy for the positional likelihood of vocalisations based mainly on data from Romance languages:

V:N#	VNF	VNStop [-voice]	VNStop [+voice]	V:NV	VN#	VNN(V)

$$\longrightarrow$$

Figure 33

where the further left along the scale you go the less likely a nasalisation process is to occur.

The most likely position for nasalisations to occur then is in the position where a coda nasal follows a long vowel. An explanation for lengthening of vowels before nasals was offered in 5.3. The result of a lengthened vowel before a nasal is a syllable with 3 moras. Superheavy syllables are avoided which would mean a ranking of a constraint such as (cf. Hall 2001):

***3μ**

No trimoraic syllables

higher than corresponding faithfulness constraints ensuring the consonants presence. Note though that a constraint ensuring bimoraicity as suggested later in 12.2.1 will also restrict superheavy syllables. A way to avoid this situation would be for the second timing slot to share features of both the vowel and the nasal and the following moraic consonant can be removed.

This is a different situation to where we find compensatory lengthening so a constraint where moras are preserved such as:

> **IDENT-IO(μ)**
>
> Correspondent segments in input and output have identical moraic structure

so the historical interaction between these two constraints would necessitate *3μ outranking IDENT-IO(μ). We find this situation occurring in many German dialects where we find nasalisation and nasal loss where a long vowel is present, whereas this does not occur where we have a short vowel (cf. 5.3 above).

Lengthenings, such as those described in 5.3, before a nasal may be a step along the nasalisation process, moving these syllables along the scale to allow for their eventual nasalisation.

VNF is shown as being the next most common position for nasalisations to occur. Ohala and Busà (1995:125-144) point out that nasal loss before a following voiceless fricative can be explained on a perceptual level. They show that vowels followed by voiceless fricatives have an acoustic effect which is similar to that of nasalisation. As such nasals in this position may be interpreted as this "spurious nasal element" which one can expect in this environment, which may lead to nasal loss. Based on an older work by Ohala and Ohala (1991) they show that segments involving high airflow necessitate a greater opening of the glottis. This greater opening may spread to the margins of neighbouring vowels. The acoustic effects of a coupling of oral and subglottal cavities produces lowered amplitude and increased bandwidth of the first formant which is also encountered in a coupling of oral and nasal cavities.

Another way to look at this kind of sound change is by dividing the sounds into smaller segments and showing how changes in articulatory movements may also produce loss of nasals in the position before a following voiceless fricative.

Stage 1

No loss.

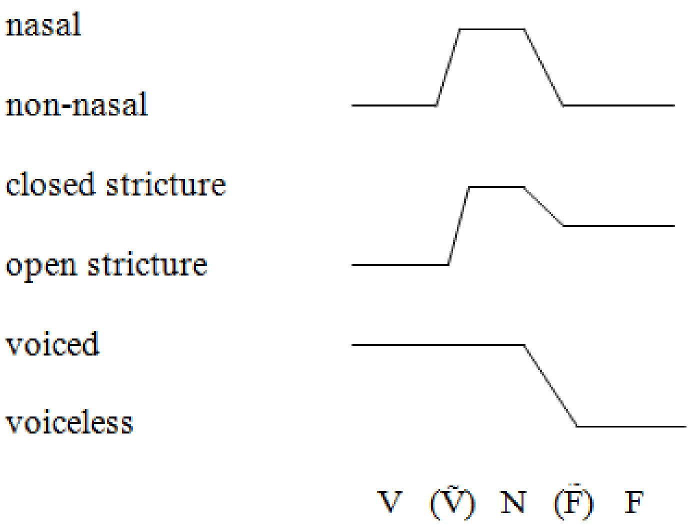


Figure 34

Stage 2

Gradual nasalisation of vowel and lessening of oral closure.

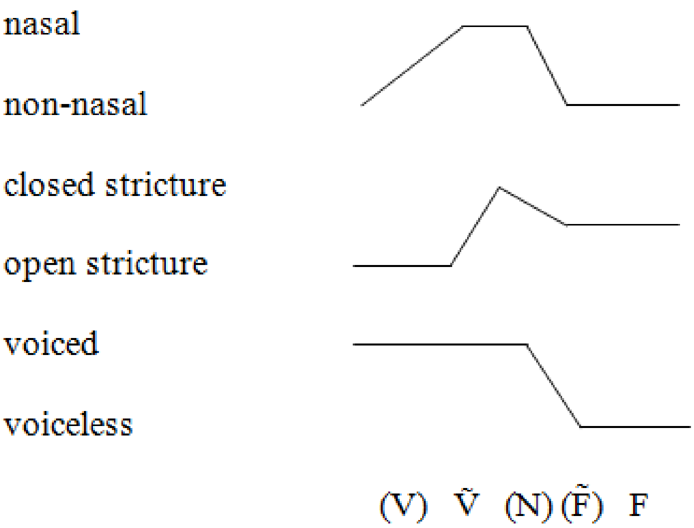


Figure 35

Stage 3

Full nasalisation of vowel with ‘compensatory lengthening’ (note that from an articulatory perspective compensatory lengthening is a misnomer, as what actually happens is purely preservation of timing slots) through loss of the nasal. Note also that there may be a slight raising of the tongue towards a nasal stop, though full closure is not achieved.

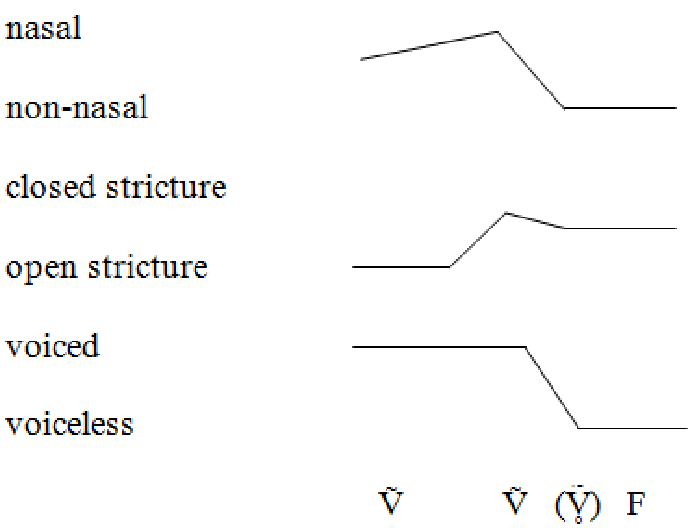


Figure 36

An interpretation of stage 3 would completely eliminate the oral gesture for the former nasal stop leaving a long nasalised vowel followed by the voiceless fricative.

Hajek (1997:212) showed this same process as VNF → ṼF̃F → ṼG̃F → Ṽ:F → V:F also showing one further stage where the nasalisation is subsequently lost.

The following Figure 37 shows Germanic speaking areas where a VNF combination has resulted in Ṽ:F (and subsequently V:F)[5]. It should be noted that this has occurred more completely in English and Frisian than in Dutch and Scandinavian. It can be seen that this has

[5] Sources for Figure 37 are Barrack 1975:44, Bremmer 2009:25-27, Campbell 1959:47, Coetsem and Kufner 1972:89, Cummins 1881:19, Einarsson 1945:19, Gussenhoven and Jacobs 1998:158-159, Haas 1983:1114, Hajek 1997:95, 138, 152, Haugen 1976:155, Heyne 1873:24, Holthausen 1900:68, Hutterer 2002:195, 199, 233, 246, Jacobsen 1984:18; Niebaum and Macha 1999:45, Nielsen 1989:99, Robinson 1992:88, 122, 159, 192, Viereck et al 2002:51, Voyles 1992:105, 140, 166, 188-189, Wardale 1947:21, 29, 53

affected areas north of the line going through continental Europe and in a region in South West Germany, extending into Switzerland. The nasal has been reintroduced into many modern Low German dialects under the influence of prestige Franconian dialects (cf. Haas 1983:1114).

Figure 37

The next ranked position on Hajek's scale is for nasalisations to occur in the position $VNStop_{[-voice]}$. It was shown in 5.3 above that this occurs in American and Canadian varieties of English. The voicelessness of a following consonant can spread onto a previous nasal. Because of coda rules nasal-stop combinations in codas are highly likely to be homorganic. The features to indicate the presence of a nasal stop are voice, place and nasality. The voice matches the previous vowel and the place matches the following stop. The nasality however would necessarily need to spread and this then occurs on the previous voiced vowel and not the subsequent voiceless consonant. The voicelessness of the nasal will mean that it lacks a mora and so no mora needs to be preserved in this position, so it may occur without compensatory lengthening, although as seen lengthening before nasals may always be possible.

Nasalisations at positions lower on Hajek's scale do not occur in Germanic so do not need to be discussed here.

A further observation of Hajek's (1997:167) concerns which place of articulation of the nasal is most likely to nasalise. He shows the following scale for Northern Italian data, which has been enhanced with data from Tuttle (1991:59-62) here as cited by Hajek:

ŋ n m ɲ N: →

Figure 38

where the most likely nasal to trigger the nasalisation process is /ŋ/ and geminate nasals are least likely. I unfortunately do not have similar details for Germanic languages but it would be interesting to see in another study if this scale holds also for vocalisations with velars being more likely to undergo the process than labials, say.

The following sections will give more information on vocalisations of sounds occurring at other places of articulation which will in turn provide more information about vocal gestures present in the formation of nasal stops.

6 Labials

Bilabial stops are the only stops which involve movement of both the lower and upper articulators, as both lips are active. Ladefoged and Maddieson (1996:16-17) note that as both articulators are active the release phase is typically shorter than with other stops. They also note that as both articulators involve soft tissue the closure of the sounds is less likely to be complete, giving the example of Japanese where /p/ alternates with [ɸ ~ h] word initially, whereas stops at the other places of articulation do not exhibit this alternation.

Labiodental sounds are even less likely to be produced as stops, which they indirectly note (p17) is owing to complete closure being difficult or impossible if a speaker has gaps between their teeth, for example.

Owing to the nature of the labials which are produced with the lips, the tongue, as needed for the production of the vowels, plays little role in their formation. Operstein (2010:57-58) notes that the default tongue setting for labials is central, but that its capacity for coarticulation with neighbouring vowels is especially pronounced.

It should be noted that the lips are utilised in vowel rounding, so this is a feature that may play a role when considering vocalisations, although even here spread lips and rounded lips can coarticulate with bilabial stops as the following Figure 39 shows in my own production of the /b/ in the words ‘bee’ and ‘boo’ where rounding can clearly be seen. So although ‘labiality’ is a feature for both rounded vowels and the labials it does not directly follow that rounding must result in the vicinity of labial consonants, although we shall see that this is indeed often the case.

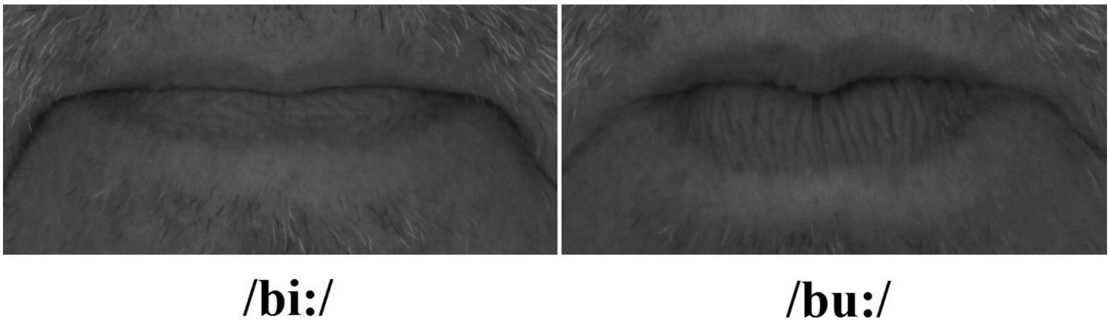


Figure 39

The labials are characterised spectrographically by having a rapid increase in the first three formants going from an onset labial to a vowel and a corresponding decrease in the transition from a vowel to a coda labial (Figure 40 taken from Ladefoged 1993:200)

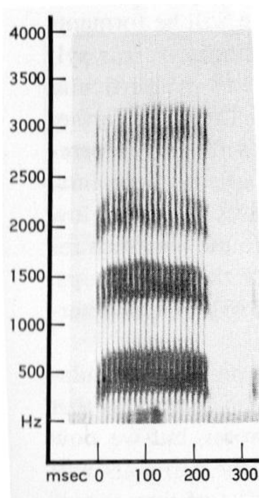


Figure 40

Although the labial articulation of these consonants does not immediately affect the positioning of the tongue it should be noted that the bilabial glide [w] is the consonantal (margin) version of the high back vowel [u].

Recasens (1996:70) notes that syllable final /w/ displays slower formant transitions and higher F1 and F2 frequencies than syllable initial /w/, with F1 being around 350Hz and F2 being around 650Hz for syllable initial /w/ and around 545Hz and 850Hz respectively for syllable final /w/. He attributes the increase in F1 and F2 to a decrease in lip rounding and to tongue undershoot. He cites a study by Wood (1982) where the dorso-pharyngo-velar area was manipulated which indeed substantiates these results.

In languages generally it should be noted that in the voiceless set of stops /p/ is more likely to be missing than either /t/ or /k/ (from UPSID data (Maddieson 1984:35) where 18 languages have /b/ but no /p/ and 24 languages have /k/ but no /p/, whereas only four languages have /p/ but no /k/). Ladefoged (1993:200-201) notes that /p/ has a lower frequency and intensity than either /t/ or /k/ which would imply that it is perceptually harder to distinguish and this is probably the reason for its heightened degree of absence from world languages. Maddieson (p36) also notes that in languages where devoicing occurs the bilabials are more likely to resist the process than the other stops. Because of the distance between the glottis and the lips being greater than with the other sounds air can continue to flow into the oral cavity for a longer period of time allowing the vocal folds to also continue vibrating for longer. Also with the reduced closure period of the active articulators as mentioned above this would reduce the likelihood of devoicing.

If we consider the fricatives frequencies given in UPSID (Maddieson 1984:47ff) we note that although labiodental /f/ occurs in 135 of the languages surveyed and /v/ in 67 the bilabial equivalents /ɸ/ and /β/ occur in only 21 and 32 of the languages respectively. Maddieson (p50) shows that [f] has more intensity than [ɸ] in the voiceless series of fricatives (even though [f] is still low on the intensity scale), with [ɸ] having the least intensity of all. Perceptually then [f] will be more salient than [ɸ]. He does not provide such a scale for the voiced fricatives, though it is likely that the results would be replicated.

The two sounds [f] and [ɸ] also do not commonly contrast with each other in languages. From the 21 languages in UPSID which have [ɸ] as a separate phoneme only four of these also have [f] and in one of these cases, Kanuri, [ɸ] only occurs very rarely and another, Tarascan, it occurs only in loan words, leaving just two Ewe and Iai where it contrasts fully. In order to create fricatives there needs to be a narrowing of the articulators in order to create a turbulent airflow and this involves a higher degree of articulatory precision than is required with stops. To create this level of precision between two moveable soft articulators is far harder than if one of the articulators is non-fleshy and static such as the teeth. Owing to the positional and acoustic similarity between the two sounds in historical processes which change bilabial stops into fricatives the likelihood is for a labiodental to be produced eventually instead of a bilabial fricative, showing the precarious nature of the bilabial fricatives.

6.1 Early Germanic labials

It has been postulated that in PIE the /b/ was absent, or at least only present in onomatopoeic words (cf. Schmitt-Brandt 1998:77). This developed into /p/ in the Germanic languages and the vast majority of words with /p/ in Germanic are either later loans or of unknown origin possibly indicating that they are loans from a pre-PIE substrate language. A gap in the series of voiced stops at /b/ is unusual (UPSID indicates that although 21 languages have /b/ but no /g/ only three have /g/ but no /b/). If the initial position of PIE is however the Glottalic Theory position then a gap of /p'/ in the ejectives would be the reason for the absence which is much more likely (there are 33 languages with /p'/ in UPSID, whereas there are 49 with /t̪' ~ t'/ and 49 with /k'/), this is however not the place for a discussion on the merits of Glottalic Theory, however appealing it is.

If we consider traditional interpretations of PIE, there were three series of stops; an aspirated voiced series, a plain voiced series and a plain voiceless series. These became respectively in

PG a voiced fricative series (with positional voiced stops), a voiceless series and a voiceless fricative series. This meant that PIE /bʰ/, /b/ and /p/ became PG /β/~[b], /p/ and /f/ respectively (this /f/ was probably originally [ɸ] but later became [f] in most places with possibly some traces of its bilabiality in Old Norse) (see the introduction to this chapter for an explanation of why such a change might occur).

Using this interpretation of the sounds of PG, as the phoneme /β/ had the positional allophone [b] we shall look briefly at the oldest Germanic dialects to compare their pronunciations of this sound.

In Gothic, /β/ was pronounced medially when geminated and finally following another consonant as [b], elsewhere it was a fricative, so intervocalically it was [β] and it was devoiced finally to [ɸ] (Wright 1910:9, 58-59). This is summed up in Rauch (2011:43) as:

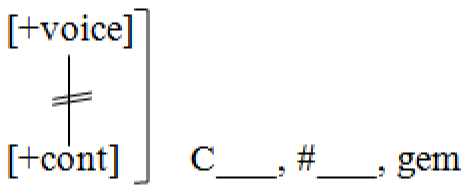


Figure 41

Ringe (2006:94) points to the bilabial nature of these early fricatives.

The distribution between the labial stops and fricatives in Old Norse was similar to that mentioned for Gothic. There was however no final devoicing and the fricatives seem to have become labiodental (Haugen 1976:199, Noreen 1970:42). Ringe (2006:94) points out that orthographic convention used *p* for the voiceless fricative when this occurred before /t/ and concludes that this would therefore probably have had a different pronunciation from [f] which used the grapheme *f*. He suggests that this was a fossilised [ɸ] in this position.

The approximant /w/ which was also inherited from PIE eventually often became spirantised in the history of all the Northwest Germanic languages with the exception of English and its development is shown in Robinson (1992:84) as being from [w] > [β] > [v]. It had already changed to [v] in the earliest scripts of Old Norse.

An additional change at this early stage was that both original /β/ and /w/ were lost intervocalically when followed by /u/, giving, for example, **seβun* 'seven' > **sequβun* > **sequn* > **sjqu* > *sjau* (Voyles 1992:122).

In both Old English and Old Frisian, /β/ again retains the above distribution with the intervocalic and word final /β/ remaining fricative, although they had become labiodental as a natural process. Also fricatives were only fully voiced intervocalically and in the vicinity of other voiced sounds, so word finally they were devoiced. This gives Old English and Old Frisian *wīf* 'woman' but Old High German *wīp* (with final devoicing of the stop) (Hutterer 2002:200).

A /w/ which had developed from the series of labialised velars was lost, such that **singwan* 'to sing' > *singan* in Old English and *siunga* in Old Frisian, and it was also deleted following other consonants if /u/ followed in Old English or if any back round vowel followed in Old Frisian, **beadwu* 'battle' > *bædu* in Old English and **swō* 'so' > *sō* in Old Frisian (though this was *swa* in Old English) (Voyles 1992:152, 177).

Details about Old Low Franconian are not as well documented but it seems that it underwent the same changes as Old Frisian. We see 'to sing' surface as *singon* and 'so' becomes Middle Dutch *so*. It was retained before *r* where it was lost in Old High German (from dictionary searches cf. for example Pijnenburg and Schoonheim (1997)).

Old Saxon orthography has the symbol *ƀ* for a voiced labial fricative which alternated allophonically with both /β/ in the positions mentioned above and as the voiced equivalent of /f/ which probably indicates that it at some stage had become labiodental [v] (cf. Voyles 1992:200-210). Heyne (1873:25) mentions that /β/ was only pronounced as [b] in combinations *mb, bb, bd* though as the symbol *ƀ* did not occur initially it seems likely that it was pronounced [b] initially too.

The approximant /w/ was at this stage still pronounced [w] (Heyne 1873:26, Holthausen 1900:58), though it has become [v] or [ʋ] in modern dialects. This /w/ also underwent the deletion mentioned above for Old English (Voyles 1992:197).

The development of Old High German was dissimilar to the other Germanic dialects in that it underwent a second sound shift which affricated the voiceless stop series and devoiced many of the voiced stops. A by-product of this second sound shift is that the /β/ phoneme became a stop, [b] (or devoiced [p]), in all positions. Also with the second sound shift there was much dialectal variation in that the affrications were more fully carried out in the South. The amount of occlusion varied dialectally with the South being the most advanced and Mid-German dialects more conservative (Voyles 1992:215).

As with the Anglo-Frisian and Old Saxon dialects there was /w/ deletion following the original labialised velar series and intervocalically when followed by a round vowel. /w/ was also dropped word-initially when followed by a liquid. We thus have **sehwan* 'to see' > *sehan*, **swōʒʒi* 'sweet' > *suozi* (note here that *uo* is a reflex of pre-Old High German **ō* and not as a result of the **wō* combination), **wrexxan* 'persecute' > *rechan* (Voyles 1992:218).

The following is a table showing the details above of the development of the voiced labial fricative in tabular form. Beyond the PG column, only those values which differ from this original pattern will be shown. The values for /w/ inherited from PIE have also been included. Data not included above have been obtained mainly from Voyles (1992) and Goossens (1974:69) for Old Low Franconian.

	PG	Gothic	Old Norse	Old English	Old Frisian	Old Low Franconian	Old Saxon	Old High German
N___	b							
geminate	b							
#___	b							
C___	β	b	v	v	v	v	v	b
___Obs	β	b	v	v	v	v	v	b
V___V	β		v (~ Ø)	v	v	v	v	b
___#	β	ɸ	v	f	f	f	f	p
w	w		v (~ Ø)	w (~ Ø)	w (~ Ø) (later v ~ w)	w (~ Ø) (later v)	w (~ Ø) (later v)	w (~ Ø) (later v)

Table 13

For the situation to be as shown above this would imply that we have situations where a fricative [β] becomes a plosive [b], most notably in intervocalic position in Old High German. Vennemann (1984) indicates the unnaturalness of such a change. Whereas in lenition processes a plosive will often be spirantised to become a fricative he shows that apart from this situation proposed for Germanic and a very few cases of individual fricative phonemes becoming plosives or changes due to assimilatory processes there are no other examples where a whole series of fricatives undergo occlusivation (p8). He therefore suggests that a better starting point for the series of obstruents given as /β/, /ð/ and /ɣ/ in traditional analyses would be for there to have been the series /b̥/, /d̥/ and /g̊/ which would then have positionally undergone lenitions in the daughter languages.

6.2 Modern Germanic labials

The various dialects have largely retained the pronunciations as described above, although there have been a number of changes. Mergers of the former /w/ and /v/ have often occurred, also vocalisations of these sounds have occurred. Figure 42 shows reflexes of the inherited intervocalic /b/ and /w/ from PG in the modern Germanic area[6]. The shaded areas show the region where the two sounds have not merged, whereas the unshaded region shows where the two sounds have merged.

It can be seen that over much of the area the /w/ has been at least partially spirantised, or has changed from being bilabial to being labiodental. The two former phonemes /β/ and /w/ seem to have been very similar. We have also noted above that [β] is an unstable sound as the motor control in its production is difficult to maintain. We therefore expect it to move and it usually has been strengthened in ‘strong’ syllabic positions, such as word initially, whereas it has become a fricative in weaker positions and it is here that it has often merged with reflexes of /w/.

It should also be noted that in Dutch, Faroese, Norwegian and Swedish, pronunciations of the type [ʋ] are common (cf. Boekenoogen 1897:XXXIX, Eijkman 1955:80, Gussenhoven and Jacobs 1998:165 for Dutch, Thráinsson et al 2012:46 for Faroese, Kristoffersen 2000:25 for Norwegian and Garlén 1988:73 for Swedish). Kristoffersen (2000:25) notes that for the Norwegian [ʋ] it is usually without aperiodic noise and its formant structure is very close to both [ʉ] and [w]. He also notes that it may be used as an alternative to the glide in [æw], though it does behave like an obstruent.

The Old Saxon intervocalic /ƀ/ has become [v] throughout North Germany and in the standard High German as spoken in North Germany the older /w/ also has the labiodental pronunciation [v], though [ʋ ~ w] is an option in initial clusters.

[6] Sources for Figure 42 are Keller 1961:49, 51, 95, 134, 176, 216-217, 266, 313, 354, Klausmann et al 1994:24, 60, 124, Klausmann 2012:32, König & Renn 2007:89, Krug 1969:38, 42-43, Möhn 1962:154, Renn & König 2006:68, Sijs 2011:160, Spangenberg 1998:132

Figure 42

Prokosch (2009:76) notes that medial /b/ has been pronounced as [β] in Bavarian and Alsatian since the middle ages and that this pronunciation stretches into substantial regions of Middle German especially in the West. /b/ seems also to have been pronounced [β] in initial position in Middle Bavarian giving spellings such as *wischof* ‘bishop’ for standard *Bischof*. When pronounced in this way it seems to have merged with the former /w/. Green (1990:249) gives the example of *Nebel* ‘fog’ being [neβl] in the Palatine region and for Bavarian we have *lieber* 'dear masc.' given as [liɐwɑ] in Wiesinger (1990:453), which based on other references is probably more accurately transcribed as [liɐβɑ]. Philipp and Botherel-Witz (1990:318) also state that /b/ is often pronounced as [v] in Low Alemannic, though they do not give an exact quality of this sound. Based on other literature though it does indeed appear to be [v] here and not [β] as it is further to the west or east.

This lenition of PG intervocalic /β/ to [v] is also present in Yiddish (Jacobs 2005:93-94) and it has become [w] in Pennsylvania German (König and Auwera 2002:424).

6.3 Labial effects on vowels

Although we have seen from modern reflexes of non-initial PG /β/ and /w/ that they very often behave in similar ways, there are still large areas, as can be seen in Figure 42 above where we get a labial consonant without indication of the amount of rounding involved in its production and thus no real indication as to the type of vowel which is underlying the consonant and which will surface as the result of a vocalisation. The only clear indication of rounding is where we have [w] as the reflex of one of these former sounds, as is the case in English and Elfdalian in Sweden.

We will therefore turn now to historical changes in vowels preceding labials to see if this gives a clearer picture.

As with the liquids vowels were often diphthongised before a following /w/. We find the situation in Old (Eastern) Norse that /y/ was broken to [iu] when followed by a labialised velar nasal (Hutterer 2002:146). We have noted above in 5.2 that this process is most likely a result of a 'back' quality of the consonant which followed having an effect, so for this process to occur in this situation it may be the backness of the velar playing a role. However, a velar nasal alone did not produce breaking, so this change must be at least partly due to the /w/.

Earlier /e/ and /i/ were diphthongised (or backed, depending on one's interpretation) to *eo* and *io* when followed by an intervocalic /w/ in Old English. We find, for example, spellings such as *cneowes* 'knee gen.' from earlier *cnewes* (Wardale 1947:28). It is interesting here to note that the vowels were not however diphthongised when a /j/ followed the /w/ (Fichte and Kemmler 1994:11). This may indicate that without a following /j/ this sound was fully rounded and back, whereas the /j/ may have reduced the amount of rounding of a preceding /w/ and it certainly reduced its degree of backness.

A modern example of breaking before labials exists in Southern US English where we find the lax /ɪ, ɛ, æ/ receive a schwa offglide in stressed syllables, which happens more commonly before labials than any other sounds. We thus get *lip* pronounced as [lɪəp] here (Wells 1982:535).

Monophthongisation of former /ai/ occurred in Old Norse when this was followed by /h/, /r/ or /w/ (Runge 1974:70). This indicates the backness of the consonants preventing a raising of the second element of the diphthongs.

The dialect of Dutch spoken in Schouwen-Duiveland has a normal progression of the West Germanic *au* as [ɔə]. This diphthong has however been monophthongised to [ɔː] before a following labial or velar (De Vin 1953:13).

Monophthongisation has also occurred in Old High German as well as Old Low Franconian, such that PG /ai/ and /au/ became [eː] and [oː] here when followed by /h/, /r/ or /w/. We have discussed the 'backness' of /r/ above and /h/ is also a back sound so it would indicate the back nature of /w/ too (Frey 1994:46-47, Hirt 1931:39, Prokosch 2009:116-117, Robinson

1992:235, Runge 1974:50-52, Speyer 2007:56, Voyles 1992:205 for Old High German and Robinson 1992:212-213 for Old Low Franconian). If backness is triggered by roundness, as seems to be the case, then this would mean that this sound was probably still round at this stage and had not yet become [β ~ v] which it later did. The monophthongisation occurred early in the 7th century.

We find rounding and raising of former /æ/ in the vicinity of /v/ to [œ̞] in the Skåne dialect of southern Sweden (Brøndum-Nielsen 1932:15).

Faroese has undergone a similar process whereby former /e/ has been rounded if it is preceded by /v/, such that Old Norse *dvergr* 'dwarf' is Faroese *dvørgur* (*dvergur* in Icelandic) and *sverð* has become *svørð* in Faroese, whilst remaining *sverð* in Icelandic (Thráinsson et al 2012:396). It should be noted here that all the examples given in this source have the /v/ as part of an initial cluster. It was noted above in 6.2 that German often has [ʋ ~ w] in similar clusters, so this may be an older shared feature from PG whereby /w/ was not fricativised in this position.

This rounding also occurs in Western varieties of Danish where standard *leva* 'to live' becomes [løw] and *kniv* 'knife' is pronounced [knyw], both also with vocalisation of the former coda /v/ (Barðdal et al 1997:260).

In the Northumbrian dialect of Old English we find rounding of /e/ when this followed /w/, such that other varieties of Old English have *we* 'we' whereas we find *wœ* or *wo* in Northumbrian (Wardale 1947:40). We find this feature in other dialects as well, such that *wiota* 'wise man' was sometimes written *wuta* but it was more sporadic elsewhere (Anderson and Williams 1935:22).

There is sporadic rounding of vowels in the vicinity of labials and liquids in Middle Dutch, such that older *minte* becomes *munte* for example (Goossens 1974:51). There is no obvious connection between these sets of sounds, but it may be more indicative of rounding being present in the production of the liquids than adding much to the discussion on labials. It does however indicate the link between rounding and labiality.

In the Westvoorne dialect of Dutch there is rounding of PG long /iː/ if this occurs between two labial sounds, such that Dutch *blijven* 'to remain' (where there is diphthongisation of this sound) becomes Westvoorne [blyːvə] and *twijfelen* 'to doubt' is pronounced [tvyːfələ] (Weel 1904:21).

Rounding of vowels in the vicinity of labials seems to occur sporadically in many of the Dutch dialects. We find examples of this in Culemborg (Ausems 1953:48) and Schouwen-Duiveland (De Vin 1953:7, 10).

West Germanic /a/ was sometimes raised and rounded to [o] in Old Saxon following /w/ (Holthausen 1900:41).

During the Middle High German period there was extensive rounding of /e/ to [ø] when this was followed by /l/, /ʃ/, labials and affricates (Frey 1994:89). From personal experience I know that /ʃ/ is accompanied by rounding in German, so it appears this would also link the labials with rounding.

We find /a/, which is normally phonetically [a] in Danish, is retracted to [a̠] in the position before [+LAB] and [+VEL] consonants (Braunmüller 1999:99-103). This would indicate a back nature of the labial, positioning it with the velars. They both share the feature [+grave], as do back vowels, which may be the reason these behave similarly and affect the vowel the way they do (cf. Jakobson, Fant and Halle 1952:30).

In Scots we find that the normal progression for former /aː/ and /oː/ was to [e] and [ø] respectively, these however became [ɑː ~ o̦ː] and [ʌu] respectively when followed immediately by /w/, so the fronting process was blocked. It should also be noted though that /o/ became [a] when followed by a labial, which appears to be a dissimilation (Dictionary of the Scots Language §34, 35.5, 54).

In Belfast English we find /ɪ/ backed to [ʌ] when following /w/ such that *winter* is pronounced with [ʌ] (Milroy 1981:69).

In Old Frisian the West Germanic /ai/ was monophthongised to [ɛː]. This usually became [eː], but was lowered and backed to [aː] in the position before /x/ and labials (Voyles 1992:170). Again this link with the back /x/ would indicate a back quality for the labials which would probably mean a level of rounding for these sounds.

In the Westvoorne dialect of Dutch we find backing of /i/ to written /u/ in the vicinity of labials, such that standard *timmeren* 'to carpenter' is pronounced here as [tumərə] and *wervel* 'vertebra' becomes [wurəvəl] (Weel 1904:21).

There is fronting of the long /u:/ to [y:] when this is followed by /v/ or /b/ in the Skåne dialect of Sweden (Brøndum-Nielsen 1932:13). This is the only example I have found of fronting before a labial in the Germanic speaking area. The roundness of the former vowel is retained which more naturally should keep the sound as a back vowel. There is possibly some dissimilation happening here to make it fronted although dissimilations are usually sporadic, but I can find no other reason why this may be the case.

In Anglo-Frisian there was raising of /e/ and /o/ to [i] and [u] respectively in the position before a following /m/. It has been noted though that raising of vowels before a following nasal does occur elsewhere, so this is probably more a result of the nasality of the /m/ than of the labiality (Hutterer 2002:199).

Gent Dutch has raising of West Germanic /ɔː/ to [oŭ] when followed by labials and velars (Caljon 2000:8). Linking these two together indicates the feature [+grave].

There was raising of the first element of the diphthong of West Germanic /eo/ to [io] (which was occasionally left as [eo]), though we find raising of the second element when a /w/ followed, giving [eu] (Holthausen 1900:37-39). This second development of West Germanic /eo/ was also shared with Old High German, though the environment was before all velar and labial consonants (Robinson 1992:245).

In Old English we find that /u/ usually became [o] when the following syllable contained either /a/ or /oː/. This was however blocked when the /u/ was in the vicinity of a labial consonant, either preceding or following the vowel. We thus have PG **fullaz* 'full' becoming Old English *full* (cf. Old High German *fol* which also underwent this change without the labial restriction). Other examples are **fuglaz* 'bird' > *fugol* (cf. Old High German *fogal*), **wulfaz* 'wolf' > *wulf*, and **wullō* 'wool' > *wulle* (cf. German *Wolf* and *Wolle* respectively, Wardale 1947:28). If this indicates a fundamental difference between the two dialects then it may be that there was more rounding in the English varieties in the production of the labials. This might also explain why /w/ was retained as [w] in later varieties of English, whereas it became [β] or [v] in German.

Another Old English development was the general fronting of former /a/ to [æ]. This was however blocked when it occurred before /w/ or if there was a back vowel in the following syllable (Lass and Anderson 1975:60, Robinson 1992:157). It was also blocked if it was followed by a nasal but this has been discussed in Chapter 5.

I-umlaut in Old High German affected all vowels apart from /aː/ when /i/ or /j/ occurred in the following syllable, such that the vowels were fronted. This process was however blocked if there was an intervening /h/ or a /w/ in the first element of a cluster, thus making the /h/ or /w/ tautosyllabic with the unaffected vowel (Speyer 2007:50).

West Germanic /au/ usually became [oː] in Old Saxon but remained the original diphthong when followed by /w/ (Holthausen 1900:37-39).

Apart from the case of fronting in Skåne, which I have hypothesised as being dissimilatory in nature, it can be seen that the tendency in vowels before a labial is for them to raise, round or back which would imply an assimilatory movement towards a high back vowel. We shall also see in the following section that a high back vowel is the usually result of a vocalisation of labials.

6.4 Labial vocalisations

The labials have vocalised or been dropped a number of times throughout the history of the Germanic languages, most noticeably in Danish, but also elsewhere. The following Figure 43 shows areas where vocalisations of the former bilabial stop have occurred. The darker shaded areas show areas where coda vocalisations have occurred unconditionally, whereas the lighter shaded areas show regions where these have only occurred positionally or have resulted in elision without vocalisation. An explanation follows[7].

[7] Sources for Figure 43 are Barðdal et al 1997:160, 228, Braunmüller 1999:101-103, 283, De Vin 1953:20, Dictionary of the Scots Language §70.1, Einarsson 1945:22, Hutterer 2002:160, 178, Jacobsen 1984:19, Jacobsen and Matras 1961:XXXII-XXXIII, Johansson 1980:12, Knop 1954:81, König and Auwera 2002:191, 194, 320, Schönfeld 1990:102-103, Sijs 2011:146, Stellmacher 2000:239, Thráinsson et al 2012:36, Weel 1904:43

Old Norse underwent an early elision of /β/ in intervocalic position when followed by /u/. We thus have PG **seβun* 'seven' > **séaβun* > **séǫβun* > **séǫun* > **sjǿu* > *sjau* (Voyles 1992:122).

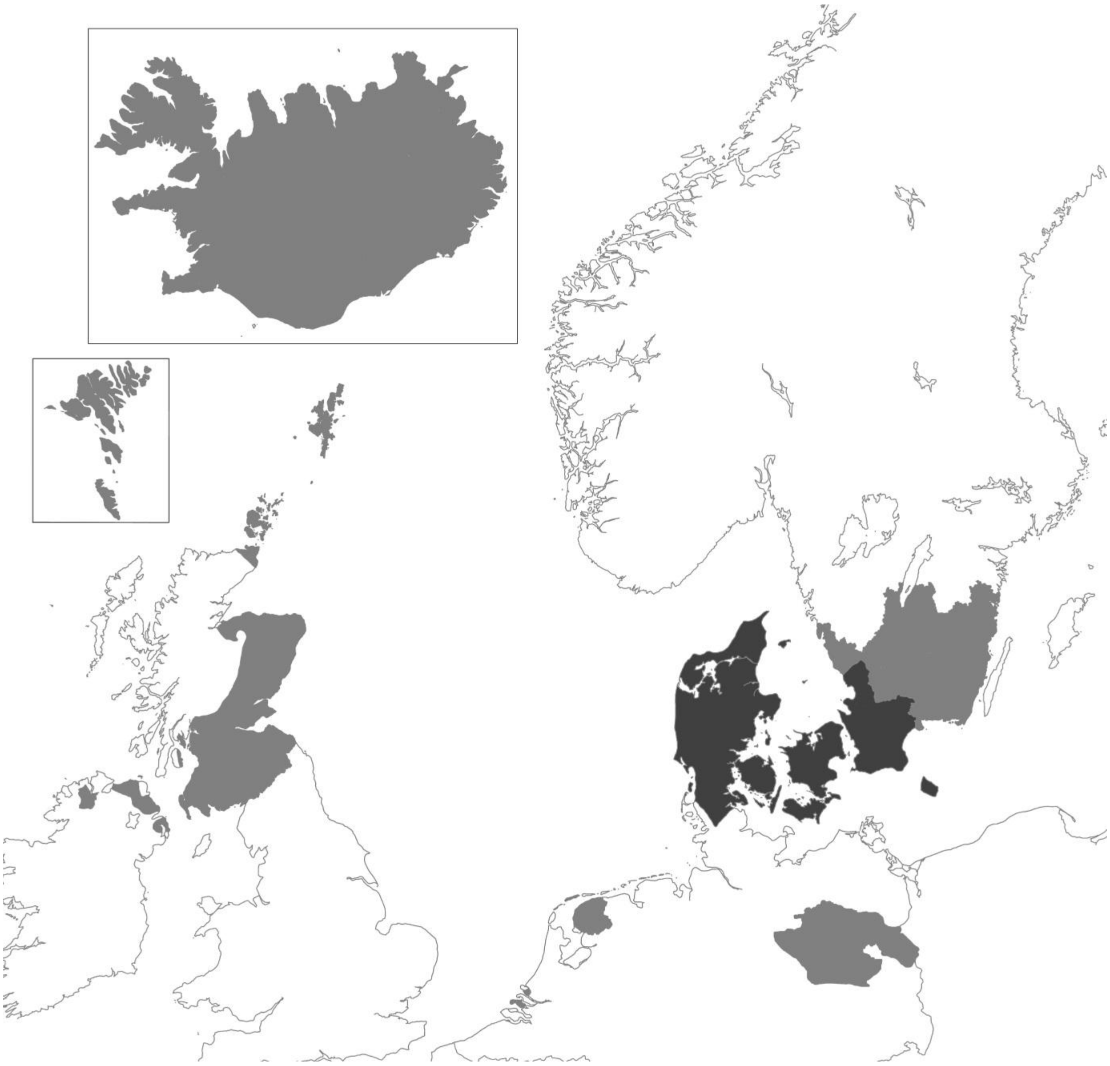


Figure 43

In Icelandic /v/ is absorbed into a previous diphthong if this diphthong ends in a high back vowel. This gives *sjávar* 'of the sea' as [sjau:ar] and *sljóvan* 'dull acc.' as [sljou:an] (Einarsson 1945:22). (It should be noted for these two examples that the diphthongal character of the vowels is the standard pronunciation for orthographic *á* and *ó* and not because of the vocalised /v/. Also the length is because they stand in open syllables and not because they have been complementarily lengthened.

In Faroese a cluster of /vn/ results either in [m̥] when followed by another consonant, where there is a fusion of the labiality of /v/ and the nasality of /n/, (this gives *javnt* ‘even’ as [jam̥t]), or the /v/ is vocalised to [u] such that *havn* ‘harbour’ is pronounced [haun] (Braunmüller 1999:283, Hutterer 2002:160, Jacobsen and Matras 1961:XXXII-XXXIII, König and Auwera 2002:191, Thráinsson et al 2012:36). Jacobsen and Matras note here that in the cluster /mn/ the /m/ is also vocalised to [u], such that *gamni* ‘fun, joke dat.’ is pronounced [ˈgaunɪ].

Intervocalically in Faroese the /v/ is pronounced as [w] when it appears after a diphthong ending on a high back vowel (König and Auwera 2002:194), though this could equally be a case of elision followed by glide insertion to avoid hiatus.

Garlén (1988:80) notes that /v/ is sporadically dropped when followed by an obstruent. This is more common in the dialect of Småland where we find, for example, *au’bröt’na* for standard Swedish *avbrutan (blomma)* ‘a broken off (flower)’ (Johansson 1980:12).

In the Middle Danish period intervocalic /v/ (which had developed from earlier /b/) was elided following a high back vowel and became [w] following all other vowels, such that Swedish *duva* ‘dove, pigeon’ is cognate with Danish *due*, whereas *havn* ‘harbour’ is pronounced [haun] (Jacobsen 1984:19). Vocalisation of the labials and velars in Danish has led to an extensive set of diphthongs which can be found in Braunmüller 1999:101-103, Hutterer 2002:178 and König and Auwera 2002:320.

The Old Norse postvocalic /p/ has undergone voicing in Modern Danish and this has subsequently also undergone a diphthongisation process in the dialects of the islands as can be seen in Figure 44[8].

In the history of English a consonantal /w/ became fully vocalised towards the end of the Old English period. The orthography does not show this change so Old English *blāwan* ‘to blow’ [blaːwan] became Middle English *blawen* ~ *blowen* [blɔːwən] and later [blɔuən ~ blauən] (cf. Campbell 1959:113-115, Fichte 1994:15, 21, 28-29, 41-42, König and Auwera 2002:117, Moessner and Schaefer 1987:72, 155, Mossé 1952:29, 41, Wardale 1947:59, Wright and Wright 1924:59, Wright and Wright 1928:53, 57-62, 110-111).

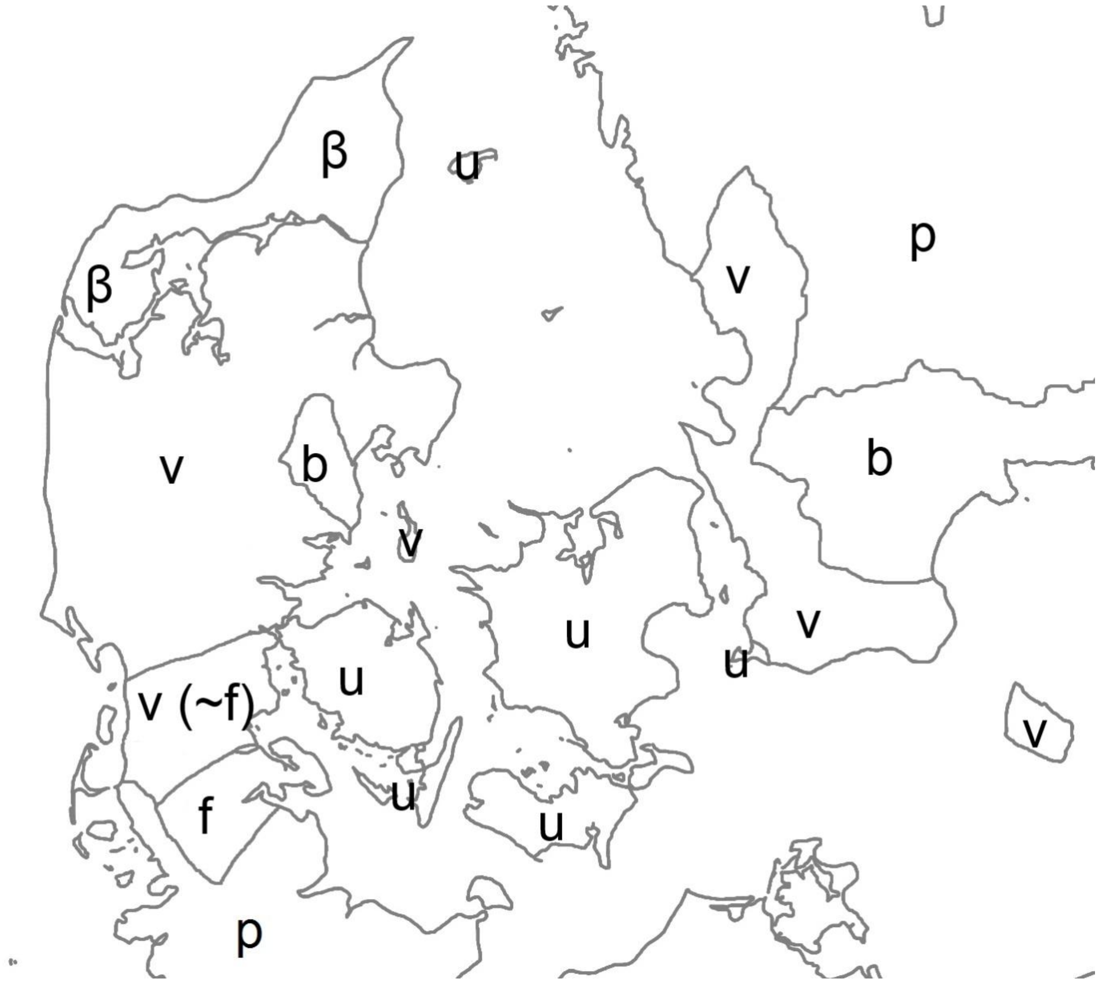


Figure 44

[8] Figure 44 is based on maps in Brøndum-Nielsen 1932:Kort 1 and Brøndum-Nielsen 1951:Kort 10.

We also find the combination /af/ becoming [au] with vocalisation of the /f/. Wright and Wright (1928:57) give the example of Old English *hafoc* 'hawk' becoming Middle English *hawek* ~ *hauk*.

In Scots we find elision of /v/ in postvocalic position, such that English *have, dove, devil* and *even* have the Scots equivalents *hae, doo, deil* and *een* (Dictionary of the Scots Language §70.1). In intervocalic position the /v/ was also often lost in early modern English, giving spellings such as *ne'er* and *o'er* though these are now restricted to poetic usage and in some dialect writing (Wright 1924:110).

In Old Frisian we find intervocalic /v/ becomes /w/ which has subsequently been fully vocalised in the modern dialects, such that Old Frisian *bilîva* 'to stay' > *blîva* > *bliuwa* > *bli̯uwə* > *bli̯uə* > *bluə* in the West Terschelling dialect (Bremmer 2009:114, Knop 1954:81).

During the Middle Dutch period the combinations /aw/, /uw/ and /iuw/ where the /w/ can be considered consonantal were fully vocalised and merged to /ou/ (Goossens 1974:45). In modern dialects we find sporadic elision of postvocalic /b/, /f/ and /v/ in the Zeeuws dialect such that *hōəd* 'head' corresponds to standard *hoofd* and *hee* 'to give' is equivalent to standard *geven* (where the /g/ is pronounced [h] and the final orthographic *n* is not pronounced even in the standard variety).

Afrikaans often elides intervocalic /v/ such that Afrikaans *oor* 'over' corresponds to Dutch *over* and *naeltjie* 'navel' is Dutch *naveltje* (König and Auwera 2002:484, Meer 1927:XXXIV).

A similar elision process to that given for Afrikaans occurs in the Brandenburg dialect of Low German such that High German *Abend* corresponds to Brandenburg [aːnt ~ ɔːnt] (other

Low German dialects have an intervocalic /v/ here and not /b/, so *Avend*) (Schönfeld 1990:102-103).

Beyond the Germanic speaking area we find vocalisations of /p/ and /b/ in Romance, cf. Spanish *cautivo* from Latin *captivu*, Latin *bibere* 'to drink' > *bebre* > *beu̯re* > *bere* in Italian (Vennemann 1988:25) and Latin *adoptāre* is *adoutar* in Portuguese (Williams 1962:85).

/v/-vocalisations have also occurred in Slavic languages where Slovene *živ* 'living' and *právda* 'law' are pronounced [ʒiu̯] and [prau̯da] respectively, Ukrainian and Belorussian /v/ (orthographically *в*) is non-prevocalically [u̯] such that Ukrainian *вовк* 'wolf' is pronounced [vou̯k] and *лев* 'lion' becomes [leu̯] and Slovak /v/ has also undergone this change such that *pravda* 'truth' and *krv* 'blood' have become [prau̯da] and [kru̯] respectively (Rehder 1998:95, 114, 215, 233).

Vennemann (1988:26) gives examples from Hausa where coda labials and velars vocalise to, what he gives as, /w/ such that input **ma.kaf.ni.ya* 'a blind one fem.' surfaces as *makawniya*.

Although it was shown from Figure 39 above that the labials can be produced with both spread or rounded lips there is a definite tendency from the data presented here to equate labiality with rounding. The result of a vocalisation of a labial is usually a high back rounded vowel. Also the effect the labials have on neighbouring vowels very often results in rounding of these vowels.

From the data presented there appears also to be a link between rounding and backness. In Maddieson's (1984:124) UPSID database 94% of front vowels are unrounded and 93.5% of back vowels are rounded. The difference between front and back vowels acoustically is that front vowels have higher F2 values. Flemming (2004:234 citing Liljencrants and Lindblom 1972, Stevens, Keyser and Kawasaki 1986) offers a perceptual explanation whereby lip-rounding lowers the F2 value so is preferred in maximising vowel space. This perceptual explanation means that front vowels tend to be unrounded, whereas the back vowels will tend to be rounded where distinctiveness is the overriding factor. This trend would presumably also go in the other direction where roundness is associated with backness. A sound with labiality and, if it is the case as it seems to be in the Germanic languages, therefore also rounding will have a connection to backness.

As the link between rounding and backness is suggested as being an acoustic-perceptual one there is no problem in drawing on Jakobson, Fant and Halle's (1952:29-30) feature 'Grave'. In order to determine if a consonant is grave (or its opposite 'acute') this can be done by looking at the second formant in the spectrum of the transition from a consonant to a vowel. We can see from Figure 40 on page 111 above that the second formant appears lower for the consonant than the vowel so the labial /b/ as presented here is described as grave. In sonorants if the second formant is closer to the first formant then it is described as grave, but when it is closer to the third formant it is described as acute. For vowels, then, this means that front vowels are the most acute and back vowels are the most grave, which is demonstrated in Figure 45 (taken from Ladefoged 1993:194). Here each vowel was said in a framework of [h-d]. It is clear that for the front vowels the second and third formants are closer, whereas for the back vowels the first and second formants are closer.

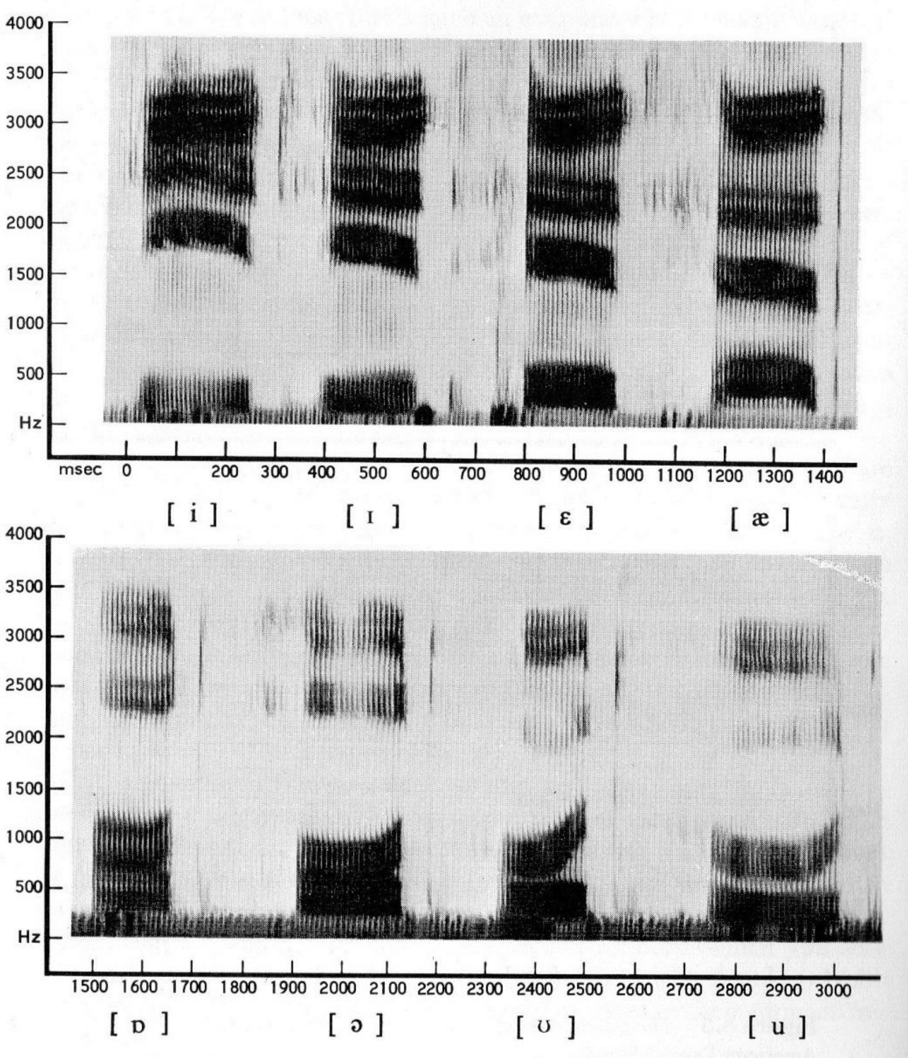


Figure 45

Jakobson et al mention that in the production of grave sounds there is a “larger and less comparted mouth cavity” (p30). This means that in the production of the labials the tongue is not used primarily and so does not divide the oral cavity into sections. Also for the velars and back vowels the highest point of the tongue is far back in the mouth allowing for a larger cavity pre-lingually. These sounds contrast with coronals, palatals and front vowels where the tongue height in the centre of the oral cavity produces smaller cavities pre- and post-lingually. They also note that there is a narrowing of the pharynx in the production of grave sounds as opposed to acute ones.

With this in mind the effect the labials have on preceding vowels can easily be explained with the feature [+grave]. This explains the breaking of front vowels before labial sounds, as the transition from the front vowel to the backness of the labial will cause a diphthong (or a backing of the vowel if this interpretation is believed). At the same time it explains the backing of vowels where not only the transition from the vowel to the following labial is affected, but rather the whole vowel has been backed. Rounding of vowels can be explained with the labiality, although without backing we cannot ascribe this to the presence or spreading of the feature [+grave].

The monophthongisation processes described affected the two diphthongs /ai/ and /au/. It should be noted for the first diphthong the /i/ is the most acute vowel possible. A glide to an acute sound and then back to a grave one would therefore expend more energy than if the sound were constant, so /eː/, as a compromise between the two sounds without the /i/ offglide would be preferable before another grave sound. It is a little harder to see why /au/ monophthongised to /oː/ in this position as the /u/ (or any) offglide would be optimal anyway and would not need to change. Its development to /oː/ occurred later than the front monophthongisation (Hirt 1931:39) so we may have a case here of a vowel change to retain symmetry. We can also note that the monophthongisation of this back diphthong was a general feature in Old Saxon, but this was blocked and kept as a diphthong before /w/, which would indicate that there is nothing inherent in the sound which would produce a back monophthong over a diphthong, strengthening the case for a consideration of symmetry.

The situations where labials apparently ‘blocked’ vowel changes are also simple to explain with the grave feature. Most of the processes blocked were ones which involved vowel fronting. Here a grave vowel would be better than the tendency to an acute one, so the fronting did not occur.

Prevention of lowering of a vowel, coupled with raising vowels before labials may be because the lips are close together for the labials and in order to produce them the bottom jaw will also be raised. In the production of the other non-labial sounds the tongue is involved but not directly the jaw. Raising the jaw will also raise the tongue therefore the blocking of a change in vowel height can be explained this way.

The only process which is difficult to explain is the fronting of /uː/ to /yː/ in Skåne when this is followed by /b/ or /v/ (Brøndum-Nielsen 1932:13). We may have a dissimilation here. The /b/ and /v/ in the Danish (and south Swedish) speaking areas are prone to vocalise to [u]. In order to produce the sound as separate from the neighbouring vowel this vowel may be fronted to avoid the consonant being subsumed.

In all areas where we get vocalisations this surfaces as a high back vowel. The most vowel-like labial is [w] which is a consonantal version of [u]. If this surfaces from a vocalisation it is then no surprise.

7 Dorsals

In this section, both palatal sounds and velars will be discussed. Palatal consonants were not present in PG as the palatal series of consonants in PIE had merged with the velar series and only arose later in some of the Germanic dialects through fronting of the former velars. It is therefore necessary to discuss these palatals and velars together.

A characteristic spectrographic analysis of velars is the narrowing of the second and third formants. The spectrographic image in Figure 46 for the word *gag* demonstrates this well (taken from Ladefoged 1993:200).

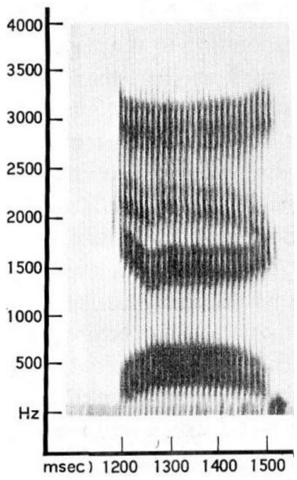


Figure 46

7.1 Early Germanic dorsals

PG velars developed from earlier PIE velars. In PIE there were three series of velar consonants; a plain series consisting of /g^h/, /g/ and /k/, a palato-velar series which is often shown as /$\hat{g}^h$/, /ĝ/ and /k̂/ and a labialised one consisting of /g^{wh}/, /g^w/ and /k^w/ (cf. Kausen 2010:63). The distinction between the plain and palato-velar series was lost whereas the labiality of the labialised series was phonologised giving the Germanic velars /g/, /k/, /x/ (and /gw/, /kw/, /xw/) (Kausen 2010:113).

Because of the loss of distinction between the plain and palato-velar series we can hypothesise that the exact position of the tongue in the production of the velars was more flexible than in the older PIE and the exact degree of frontness in the later languages was heavily dependant on the surrounding vowels, as we shall see below.

In addition to the velar series of consonants in PIE there was also a series of what have been termed laryngeals, commonly referred to as /h_1/, /h_2/ and /h_3/ which have been much debated as to their exact nature (cf. for example Lindemann 1997). These mainly had an effect on vowels in the daughter languages and can be largely reconstructed from features such as ablaut. As they had completely disappeared before PG developed they will not be considered here further.

The PG /g/ phoneme seems to have had the allophones [ɣ] which occurred post-vocalically and [g] which occurred elsewhere (so initially, following consonants and in geminates). There are slight variations of this situation in the individual languages which will be discussed in the following section (Voyles 1992:97).

According to Wright (1910:10), Gothic followed the PG pattern above with the additional feature that there was word final and positional devoicing which gave us [x] word finally and before /s/. Rauch (2011:43), on the other hand, limits the pronunciation of [g] to the position after a nasal.

Robinson (1992:83) gives the Old Norse distribution of /g/ as the same as that given for PG above, but the fricative allophone was devoiced before voiceless stops and we also have palatalisation to [gʲ] before a front vowel or /j/. Post-vocalically and before a front vowel or the glide /j/ he gives the pronunciation as [j˔]. Here there is obvious influence from the following vowel on the consonant but it is unclear how much a preceding vowel could affect the underlying vocalic element of the consonant.

As with Old Norse, a following vowel in Old English also affected the value of the velar. We have the situation for the voiceless velar such that /k/ → [k^j] (→ [c]) → [ʧ] when followed by a high front vowel. The voiced velar, though, underwent the changes /g/ → [ʝ] → [j] in this position (compare Anderson and Williams 1935:12, Fichte and Kemmler 1994:20-21, Freeborn 1998:29, Hutterer 2002:208, Lass and Anderson 1975:114, Robinson 1992:155). From this we can deduce that the input value of the voiceless /k/ was a stop [k], whereas the input value for /g/ would have been the fricative [ɣ]. Lass and Anderson (1975:134) also come to this conclusion, though they point out that initial /g/ does appear to have become a stop [g] later during the Old English period.

Additionally, a previous vowel also affected the pronunciation of the velars. Wardale (1947:56) mentions that a /g/ following one of the vowels ǣ̆, ē̆, ī̆ would have had what he called a y-like quality, though he mentions that it would have been more fricative, so we can give it the value [ʝ], though this did indeed later become [j].

It is also pointed out by Campbell (1959:64-65) that the fronted versions of velars only occurred before originally fronted vowels and not before those fronted through umlaut, so the velar fronting must have occurred at an earlier stage than umlaut and after the fronted consonant had become phonologised.

Although fricatives generally underwent devoicing in word-final position, this does not seem to be the case here for [ɣ]. This may indicate that at this stage it was less fricative than some of the other fricatives of Old English which would make it more of an approximant (at least in this position) such that devoicing did not occur.

Bremmer (2009:48) gives the Old Frisian /ɡ/ as being the stop [ɡ] in initial position before back vowels (and later umlauted vowels), the voiceless fricative [x] in word final position (and presumably before voiceless consonants) and the voiced fricative [ɣ] elsewhere. Voyles (1992:172) states that the /ɡ/ would have become [j] before front vowels, though not before the umlauted [a(:)].

For Old Low Franconian, both Robinson (1992:210-211) and Goossens (1974:67) give the value of /ɡ/ as [ɡ] after nasals and when geminated, finally there was devoicing which produced [x] (which would presumably also have been the case before voiceless consonants) and elsewhere it would have been [ɣ].

As with the other North Sea varieties, Old Saxon would have had a fronted version [j˔] in the position before the front vowels [i, e]. Old Saxon also underwent final devoicing, which presumably would have extended to a position before a voiceless consonant (compare, for example, Heyne 1873:21).

Old High German underwent a second sound shift where /ɡ/ → /k/ and /k/ → /x/. This however depended on the dialect spoken with more southern dialects showing the greatest degree of shift. For those dialects where /ɡ/ remained voiced this would have undergone devoicing word finally. It should also be noted that the fricative version [ɣ] became a stop, probably as part of the second sound shift (compare, for example Ellis 1953:22-23).

A brief explanation will be given here about a process which occurred in Gothic and Old Norse and variously in later dialects which will give us some further insights into the nature of the velars.

Within Gothic and Old Norse the PG combinations of /jj/ and /ww/ underwent a process named variously 'sharpening', 'Verschärfung' or Holzmann's Law in the literature (cf. Braune and Ebbinghaus 1981:57, Coetsem and Kufner 1972:85, Hirt 1931:113, Krahe 1948:17, Rauch 2011:26, Voyles 1992:94-95).

The change is such that /-jj-/ became [-ddj-] in Gothic and [-ggj-] in Old Norse, whereas /-ww-/ became [-ggw-] in both Gothic and Old Norse. Vennemann (1988:16) explains the change as a case of head strengthening. As a geminate the /j/ and /w/ would be ambisyllabic, belonging to both the coda of the first syllable and the onset of the following one. A head favouring a strong consonant could turn this /j/ into [g] (or [d]) and the gemination would then pull this consonant into the coda of the preceding syllable. It allows for a strong onset, whilst retaining the former approximant.

The relevance to us here is not so much in the process but more in which consonants actually resulted from the process. We thus have for both languages mentioned a [g] surfacing from a former /w/. This implies a link between the backness of both [w] and [g]. The two languages, however, differed in their development of /-jj-/ in that although Gothic became [-ddj-], Old Norse became [-ggj-]. We have seen that Old Norse /ɣ/ was palatalised in pre-vocalic position when this vowel was [-back], however this was not the case in Gothic. We may, however hypothesise that underlyingly for both we had here a palatal sound, although the orthography differed. Whereas the palatal could be associated with the palatal allophone of /ɣ/ in Old Norse, and so was also written *g*, this was not the case with Gothic so *d* was chosen here to represent the sound. Subsequent loss of the palatal /j/ in later Gothic dialects resulted in an alveolar and not a palatal sound (cf. Crimean Gothic *ada* 'egg' from unattested earlier Gothic **addja* from PG **ajja-* (Stearns 1978:127).

Table 14 summarises the situation described in the previous sections showing the positions in the individual daughter languages which differ from the original PG model.

	PG	Gothic	Old Norse	Old English	Old Frisian	Old Low Franconian	Old Saxon	Old High German
#___V[-back]	[g]		[gʲ]	[j]	[j]	[ɣ]	[j˔]	([~k])
#___V[+back]	[g]			[ɣ ~ g]		[ɣ]		([~k])
V___V[-back]	[g]		[j˔]	[j]	[j]	[ɣ]	[j˔]	
N___	[g]							
g___	[g]							([~ kk])
C___	[g]			[ɣ ~ g]		[ɣ]		
V[-back]___	[ɣ]			[j]			[j˔]	[g]
V[+back]___	[ɣ]							[g]
___C[-voice]	[ɣ]	[x]	[x]		[x]	[x]	[x]	[k]
___#	[ɣ]	[x]		([ɣ˕])	[x]	[x]	[x]	[k]

Table 14

As was noted in 6.1 taking the analysis as shown above we therefore have the very marked situation that a phoneme /ɣ/ occasionally occlusivised. Vennemann (1984) therefore suggested that the original sound would have been /g̊/ which positionally voiced and spirantised; both of which are common in lenition processes.

7.2 The complex nature of dorsals

We mentioned earlier in section 2.3 that when children are first acquiring language they have motor skills which greatly limit the movement of their mouths. Two studies mentioned in the aforementioned section showed acquisition of a CV structure where either the consonant was produced correctly or the vowel was accurately given. The studies showed that if the velar consonant was produced correctly the following vowel produced would be a high rounded back vowel, whereas correct production of a vowel produced a /k/ if the vowel was a low vowel. If the following vowel was a high front vowel a /t/ would be produced and if the vowel was a rounded back vowel then a /p/ would be produced.

Considering the implications of this for a moment regarding the anticipatory nature of language, if a speaker anticipates a high front vowel then we would expect a tendency towards /t/. If the actual consonant is /k/ then we would expect this to be fronted. If on the other hand a high back vowel is anticipated then we should expect a tendency towards /p/. If the actual consonant produced is /k/ then we should expect a certain amount of lip rounding to occur, but otherwise the consonant will stay where it is. If, however, the anticipated vowel is low then we should not expect much movement. In none of the sources above does it mention the degree of lip rounding involved in a /kV/ environment but it would be highly unusual if there were no variation in lip-rounding depending on the following vowel.

The fact that for most of the dialects we find some fronting occurring before a high front vowel is therefore not surprising.

Proceeding from the study involving accuracy in the consonant, this will affect the anticipatory nature of the vowel more noticeably. In the following sections we will see the effect the velar element has on a preceding vowel.

We have previously explained that all consonants necessarily involve the tongue and the lips. In the production of velars the lips can be rounded or unrounded. In modern Germanic dialects this is not phonemically relevant, but as we have seen in 7.1, there was a series of labialised velars in PIE. As the labialisation had been phonemicised to a velar + /w/ combination the velars in PG would have behaved like modern dialects and the amount of lip rounding would be irrelevant at a phonological level.

The dorsum however plays a crucial role in the production of both velars and vowels and due to lenition processes targeting articulators, a reduction of the movement between the velars and vowels is therefore likely to be of greater importance than it would be for consonants where the dorsum is not primarily utilised in their production.

7.3 Dorsal effects on vowels

In this section the historical effects the velars and adjacent vowels have had on each other in the Germanic dialects will be shown.

Old East Norse underwent a process of diphthongisation or breaking before a following labialised velar consonant such that we get comparisons of the form in Old Icelandic *syngva* 'to sing' being *siunga* in Old Swedish and *siunge* in Old Danish (Hutterer 2002:146).

Danish /a/, which is normally [a], has the allophone [a̠] before [+LAB] and [+VEL] consonants (Braunmüller 1999:99-103). This would mean it becomes [+grave] before [+grave] consonants pointing to a back quality of the Danish /g/ in this position. In the Fynsk dialect of Danish the long version of this vowel is coupled with vocalisation of the velar to [w] and the vowel becomes [ɔ̹ː] in East and Southern varieties on the island and [œ:] in the West (Brøndum-Nielsen 1951:119). The variety with [œ:] seems unusual in that there is fronting combined with rounding and I am uncertain how to explain this here. It possibly represents different periods of the dialect's development, with former fronting when the velar was given a front quality, but maybe the vocalisation to [w] of the former velar may have been a spread feature from neighbouring dialects and this subsequent [w] rounded the [ɛː].

Pittsburgh English laterals form a natural class with voiced velars such that a following [l] or [g] causes non-low vowels to lax (Walsh Dickey 1997:31)

teal [tɪl]	*fatigue* [fətɪg]
meal [mɪl]	*league* [lɪg]
ale [ɛl]	*Hague* [hɛg]
pale [pʰɛl]	*Sega* [sɛgʌ]
pool [pʰʊl]	*frugal* [fɹʊgəl]

tool [tʰʊl] *loogie* [lʊgij]

toll [tʰʊl] *rogue* [ɹʊg]

The dark /l/ in Pittsburgh may undergo vocalisation, appearing as a high back vowel, which would indicate the underlying height and backness of the velar.

For this latter case it was noted that there is greater difficulty in maintaining voicing with dorsals than with coronals or labials (Westbury 1983). One way to overcome this is to widen the pharyngeal cavity which is done with advanced tongue root. This is not extended to the voiceless [k], but it behaves in a similar way to laterals which may also exhibit a much wider pharynx when compared with the alveolar stops (Ladefoged and Maddieson 1996:183). The claim here is for German /l/, but also Russian [l̺] (p187). They do however give other languages where there is a narrowing of the pharynx in combination with laterals, Albanian [l̪] (p186), Russian [l̪] (p188). I have no evidence of the exact articulatory shape of Pittsburgh English /l/ to make a better judgment as to which of these laterals it most resembles.

In Southern US English we find /ɑ/ has the allophones [ɑ] before velars and dark-/l/ and following /w/, elsewhere it is pronounced [ɑ̟] (Wells 1982:535). Note though that in these same dialects we find palatal offglides following front vowels when followed by velars, though not when followed by dark-/l/ or when following /w/ (see below).

In Old Frisian we find that *a* and *e* were often written interchangeably, however before geminates and especially before *l* and *x* ([ks]) we only find *a* (Cummins 1881:13). This would indicate a back quality for the [k] in this position, though when velars were followed by front vowels they were palatalised (Bremmer 2009:30-31, Cummins 1881:23).

In the Westvoorne dialect of Dutch we find the usual progression of former short /o/ is claimed to be [ɔə], however the diphthongal offglide is absent in those syllables ending in a velar consonant, such that *bòk* 'buck' is [bɔk] and *rògge* 'rye' is [rɔgə] whereas *pòt* 'pot' is [pɔət] and *gebòd* 'command' is [ɣəbɔəd] (Weel 1904:24). He unfortunately does not give any examples of this vowel with a following labial so it is unclear whether the velar prevents the diphthongisation or whether it is triggered by a following coronal.

Afrikaans has a lowering of [ɛ] to [æ] before velars and liquids which appears to be progressing towards [a] (Ponelis 1993:67). Although this looks like a lowering, it is part of a greater backing process as described in 4.4.

There is vowel breaking in Yiddish whereby a schwa is epenthesised when followed by a velar fricative giving /biːx/ 'book' as [biːəx] and /hojx/ 'high' as [hojəx]. This only happens when the velar is tautosyllabic, being lost when such words add a vocalic suffix in the plural for example (König and Auwera 2002:392). This phenomenon is especially noticeable in Sosnovce and Retín where the epenthesised vowel can be [ɔ ~ ɒ] (Jacobs 2005:104-105).

Contrary to the velar nature of this sound as just described, it could also behave like a palatal sound. A weak middle syllable /a/ became /i/ in Old Norse if an /i/ was present in the following syllable, but this also occurred if it followed either /ɣ/ or /k/ (Noreen 1970:118).

A vowel followed by a palatalised /g/ or /k/ was umlauted in Old Norse in the same way as i-umlaut (Gordon 1956:322, Voyles 1992:115). [ɡʲ] and [kʲ] occurred as allophones of /g/ and /k/ before all front vowels (cf. Robinson 1992:83), so this extension of i-umlaut must have been triggered by the consonant and not the following vowel, where non-high front vowels would not have triggered the rule.

The Icelandic combination /gi/ is pronounced [ji] which has led to diphthongal lengthening of a previous vowel such that it has a high front off-glide with rounding dependant on the previous vowel, giving the combinations *agi* [aiːjɪ], *egi* [ei:jɪ], *ogi* [ɔiː], *ugi* [(ʏ)y:jɪ] and *ögi* [œy:jɪ], although this is not present in the Southeast of the island (Barðdal et al 1997:265, Einarsson 1945:9).

In Faroese, for diphthongs ending in [ɪ̯], the front offglide is subsumed into a following long /ɟː/ or /cː/, which are palatalised versions of former */ɡʲː/ and /*/kʲː/, which is still evident from the orthography. So *doyggja* ‘to die’, where the diphthong is elsewhere pronounced [ɔɪ̯] becomes [d̥ɔɟːa] (Jacobsen and Matras 1961:XXIV, Thráinsson et al 2012:42).

In Old English, the PG velars had been palatalised before front vowels. This palatalisation was a direct result of the frontness of the vowel. A later change in West Saxon was that these palatalised sounds in turn had an effect on the following vowels in that they were regularly diphthongised (Campbell 1959:69). We thus get the situation that PG combinations such as */ɡe/ became Pre-Old English */ʝe/ and subsequently West Saxon /ʝie/.

The usual development of Old English *ō* in Scots was to the fronted [ø], however this acquires an additional high front offglide when followed by a velar, giving, for example, *bōc* ‘book’ → *beuk* [bøɪk] (Warrack 2000:9).

In Belfast English the usual pronunciation of the TRAP vowel is [a] however this is raised to [æ ~ ɛ̹] in a position before velars. Most noticeably is that this vowel may lengthen and subsequently diphthongise before [ɡ] and [ŋ] giving *bag* as [bɛˑɪɡ]. Even where there is correction away from this pronunciation the offglide will remain giving [baˑɪɡ] (Milroy 1981:75). This also has parallels in Southern American dialects where /ɛ/ and /æ/ can become [ɛɪ] and [æɪ] respectively in the position before velars. The following velar may also palatalise and with it the offglide will be lost in this position giving *egg* [ɛɪɡ ~ ɛɟ] and *back* [bæɪk ~ bæc] (Wells 1982:486).

In Old Yiddish we find fronting of /u/ to [y] and rounding and diphthongisation of i to [yə ~ iə] in the environment before the velar fricative [x] (Hutterer 2002:351), which seems rather oddly to indicate a front quality, even though Modern Yiddish only has [x] without an allophonic front [ç] unlike German (cf. Jacobs 2005:110).

In North East Yiddish we find a high front diphthongal offglide of /e/ and /ɑː/ in the position before the velar nasal [ŋ] giving /breŋgst/ 'you bring' as [bʁejŋgst] (Jacobs 2005:125). Here though it is unclear if this is a result of the following velar or the result of the following nasal quality of the consonant.

Perhaps unusually, unrounding occurs in Faroese, such that the combination *úgv* is pronounced [ɪgˑv] and *ógv* becomes [ɛgˑv]. The usual pronunciation for *ú* and *ó* are [ʏ] and [œ] respectively (Jacobsen and Matras 1961:XXIV). If this is an effect of the following velar and not one of hypercorrection then it would indicate a spread gesture from the [g] as the following [v] would tend towards rounding.

Wardale (1947:40) points to a monophthongisation of diphthongs before a back segment in the Anglian dialect of Old English, such that ea → e, io → i, ēa → ǣ → ē and īo → ī. He claims it as a monophthongisation but it is probably best to say that it was lack of diphthongisation in this position. This was generally also the case in Northumbrian and Mercian (cf. Dresher 1985:33).

We also get raising of /æ/ to [e] before a following back segment in the Mercian dialect (Dresher 1985:32).

In the Middle English period we find widespread diphthongisation of mid and low vowels before a following velar fricative which have subsequently monophthongised but remained in the orthography (cf. Brook 1963:64). Words such as *eight* and *ought* come from Old English earlier *ehte* and *ahte* and through 13th century *eyghte* and *oughte* (Barnhart 2004:318, 740). This is interesting in that the influence the velar fricative has on the previous vowel is its height. The velar fricative /x/ probably had the allophones [ç] and [x] following front and back vowels respectively. These never fully merged with other diphthongs in some Northern English varieties, such that a word like *weight* may be pronounced [wɛɪt], whereas *wait* has the monophthong [weːt] (Wells 1982:194) and Orton's maps (Orton et al 1978) show *snow* as being usually monophthongal [ɔː] (Ph190b) whereas *daughter* has a diphthong [ɔu ~ ɑu ~ au] (Ph194).

In modern West Frisian dialects we find standard [u] being pronounced as [o] before nasals and velars (Sipma 1913:38), which may indicate lowering of this vowel in this position and as such could be a dissimilation, however the example given is *jûk* 'yoke', where standard Frisian has [juk] but dialectally we find [jok], and we also find this 'lowering' in many other earlier dialects including Old English, Old Norse, Middle Dutch and Old High German, so it is unclear what exactly is happening here (cf. dictionary items for each of the languages).

Long vowels were shortened in Middle Dutch in the position before -*cht* [xt ~ çt] (Goossens 1974:51). Whether this was because of the quality of the following consonants or due to moraic considerations with vowel shortening in closed syllables is unclear, though we also find this change occurring in those words where the ending -*cht* had become -*ft*, so it is more likely to be a result of syllable shortening and not the consonant.

In the Schouwen-Duiveland dialect of Dutch, West Germanic *ô* usually becomes [u], however it remains low [ɔ] in the position before a following /m/ or /xt/ (De Vin 1953:11).

By analysing the data presented, it becomes clear that the most common processes involving a vowel plus velar combination are ones where there is some form of epenthetic glide insertion. The form of this glide often seems to depend upon the nature of the previous vowel rather than the velar. There seems to be a symbiosis between a vowel and a following velar in that the vowel will affect the level of frontness of the following consonant, whereas the consonant will then reaffirm this level of frontness and add height to the previous vowel.

This situation is to be expected. The velars (and the palatals as included here) and vowels share a common space in the mouth. Unlike the anterior consonants where the primary articulators are not in the same space as the vowels and so the effects between the two are less clear we find the exact production of the velar being more directly affected by a neighbouring vowel. As such the exact value of a resultant vocalisation is also strongly influenced as will be seen in section 9.4.

The situations where we get lowering of the vowel are a little more difficult to explain. It should be remembered from 4.3 and 9.2 above that in child language errors, correct pronunciation of a low vowel seemed to trigger a prevocalic /k/, whereas correct pronunciation of the /k/ triggered a following high vowel. We do not have the corresponding equivalents for when the vowel precedes the consonant, as this is usually considered to be a more marked situation and one where child language is less likely to produce a relevant result, so such data would be difficult to elicit. This may be playing a role in these cases though, but it is unusual that correct pronunciation of a low vowel produces /k/ in children's errors, whereas it is precisely the vowel which changes under pressure from the following consonant, so it seems unlikely that we can include this as the explanation here.

Where front vowels lower, as in the Afrikaans case, this seems to be as part of a general backing process in progress. Whereas the Dutch development of West-Germanic /ɡ/ is pronounced [ɣ], it remains [ɡ] in Afrikaans (cf. Ponelis 1993:140). Because stops involve full contact of the active articulator against the passive one, more precise positioning is involved than with fricatives where the active articulator approaches the passive one. We can compare this with Modern German data where the stops /ɡ/ and /k/ are slightly fronted to [ɡ̟] and [k̟] respectively in the vicinity of front vowels, whereas the fricative /x/ has the fully fronted allophone [ç] in the vicinity of front vowels (personal knowledge). A following velar stop, then may be more accurately velar in Afrikaans than it would be if it were a fricative, and this in turn would force preceding front vowels to become more back.

7.4 Dorsal vocalisations

The following Figure 47 shows regions within the Germanic speaking area where PG /g/ has developed into a vowel, either historically or as ongoing processes[9].

A brief glance will reveal that there are two possible outcomes of a vocalisation of the former velars in the Germanic language area which are dependent on the adjacent vowels and not on any inherent character of the consonant itself.

If we consider the positioning of the vocalising sound within the syllable it should be noted that it is in the weak coda position. In a syllable with CVC structure the strong vowel segment will have more prominence than the coda consonant (this will be discussed more fully in following sections). It was noted for child language in 2.3 that if a high back vowel was produced correctly then the onset will likely be /p/ and only if a low vowel was produced correctly did we get a /k/. However, adult speakers are indeed in a position to deal with coda consonants. Correct pronunciation of /k/ produced a following high back vowel. If in the course of the language the velar consonants have developed an allophonic distribution of palatalised consonants following front vowels and fully velar consonants only following back vowels as the Germanic languages have indeed done, then it is no surprise that the resultant vocalisations are as explained.

[9] The information for Figure 47 is drawn from Anderson and Williams 1935:22, 25, 32, Barðdal et al 1997:228, Cummins 1881:20, 22; Einarsson 1945:15, Fichte and Kemmler 1994:15, 27-28, Freeborn 1998:111-112, 208, Gordon and Taylor 1956:325, Green 1990:247, Hutterer 2002:175, 178, 208, 218, 233, Jacobsen 1984:19, Klausmann et al 1994:162-167, König and Auwera 2002:195, 320, 117-118, Meer 1927:56, Mossé 1952:27-29; Newton 1990:155, Schönfeld 1990:102-103, Thráinsson et al 2012:401, Wardale 1947: 29, 57, Wright and Wright 1928:52-60, 64, 110

We shall turn to the individual developments of the velars as an explanation of the map.

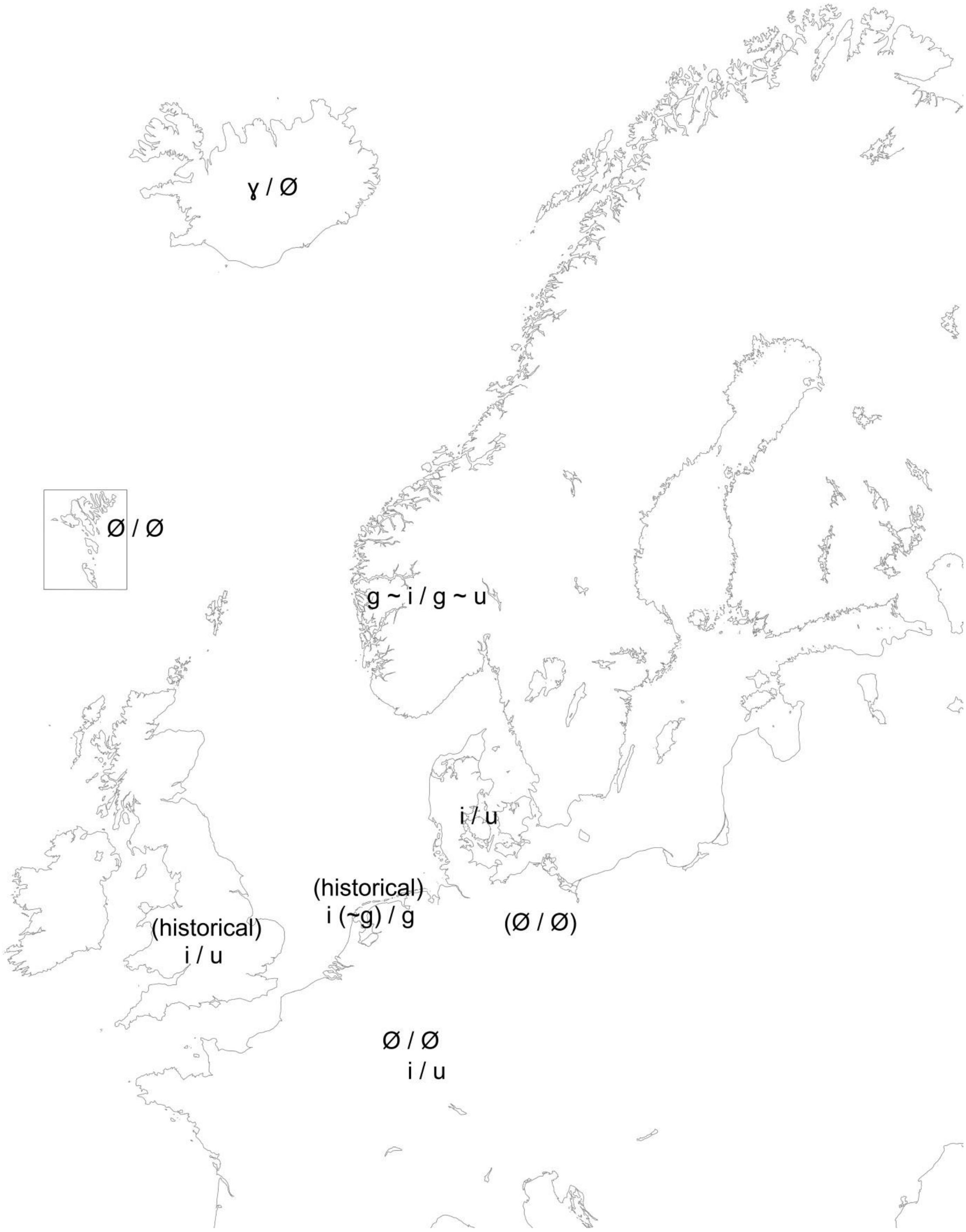


Figure 47

We shall turn to the individual developments of the velars as an explanation of the map.

By Front-Back vocalisations I shall refer to vocalisations whereby combinations of a front vowel followed by a velar results in a high front vowel and a back vowel followed by a velar results in a back vowel.

One of the earliest distinctive processes in the PG language group was the treatment of the labialised series of velars. The usual progression of the PIE series /g^{hw}/, /g^{w}/, /k^{w}/ into PG was to /ɣ^{w}/, /k^{w}/, and /x^{w}/ respectively. An example of an early vocalisation is in the derived form for the word meaning ‘island’. PIE **ák^{w}eh^{2}* ‘running water’ became PG **ax^{w}ō*. The derived term for ‘island’ from pre-PG **ax^{w}jā* underwent Verner’s law to **aɣ^{w}jā* before becoming common PG **aujō* (cf. Old Norse *ey*, Old High German *ouwa*) with a vocalised velar /ɣ/ (Hirt 1931:13, 127, Ringe 2006:109, Wright 1910:64). Here the previous vowel plays less of a role and it is the labiality of the /ɣ^{w}/ which determines its vocalised outcome.

The North West Germanic dialects underwent a further change with /ɣ/ becoming /u/ in the position between a back vowel and /m/. Here /a/ is included, so we can conclude that it probably had a back quality at least at this stage, which is also reinforced by its alternation with the long /ɔː/. We get examples of PG **baɣmaz* ‘tree’ (cf. Gothic *bagms*, which did not undergo the change) became Old High German *baum*; **flauɣmaz* ‘swarm’ became Old Norse *flaumr* (which is related to *fluga* ‘to fly’ where the /ɣ/ was not vocalised) (Nielsen 1989:96, Voyles 1992:75).

In the Østland and Bergen regions of Norway we get vocalisations of the type *skog* ‘forest’ [sceu], *stiga* ‘to increase’ [steia] (Barðdal et al 1997:228). The source does not mention the development of the diphthong of *skog* with the front first element [e] which seems unusual here, but it is probably the development of [ou], based on the orthography, and so would be correct to include this in this section. There were also widescale vocalisations of this type in the dialect of Gotland during the 17th Century, such that former *fluga* ‘to fly’ and *segla* ‘to sail’ became *flye* and *seila* respectively (Barðdal et al 1997:64).

This is also a change which occurred in Old Danish, such that [ɣ] became [u] following back vowels (including) /a/ and became [i] following front vowels, giving for example *sauthe* ‘said’ when compared with Old Norse *sagði* and *mawe* ‘stomach’ compared with German *Magen* (Gordon and Taylor 1956:325, Hutterer 2002:175). This process remained active into the Middle Danish period with later example such as *feg* > *fej* ‘coward’ and *gagn* > *gavn* (where the orthographic *v* represents [u]) ‘use’ (Jacobsen 1984:19).

These changes have resulted in the extensive modern series of diphthongs in Danish where formally there were only monophthongs, lists of which can be found in Hutterer 2002:178, König and Auwera 2002:320 and do not need to be repeated here. The situation in Denmark is made more complex in that there have been two waves of vocalisation. The first just affected the originally voiced sounds and can be seen throughout all Danish dialects. The voiceless obstruents were subsequently voiced and they too were vocalised. The following Figure 48 shows the situation of the consonant in Danish dialects of a vowel plus a former voiceless velar. In Figure 48 FV represents front vowels, BV are back vowels. (The map is based on Kort 12 in Brøndum-Nielsen 1951, cf. also Barðdal et al 1997:228).

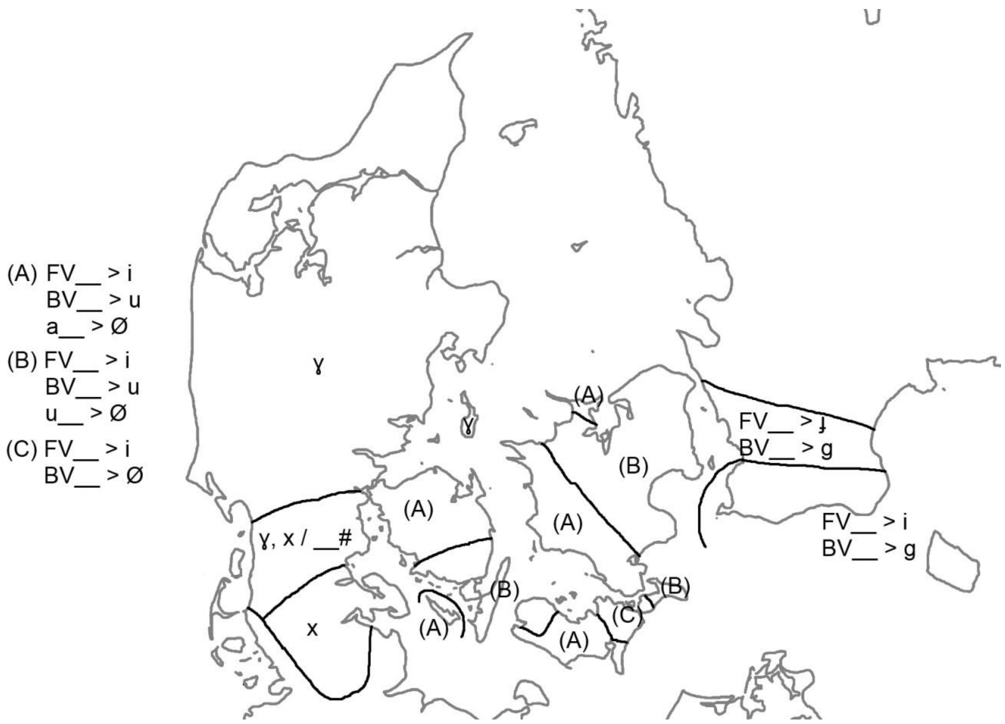


Figure 48

In Old English /g/ was pronounced [j] in coda position following a high front vowel and [ɣ] elsewhere. The exact value of [j] may have been slightly fricated, so similar to [ʝ], and it was only in the transition from Old English to the Middle English period that we can speak of its vocalisation, although it did undergo elision with compensatory lengthening before /d/, /ð/ and /n/. We get Old English *dæg* 'day' [dæʝ] becomes Middle English *dai* [dai], *segl* 'sail' [sejl] becomes *seil* [seil] and with elision early *sæɣde* 'said' [sæʝde] becomes *sǣde* [sæːdə] (Anderson and Williams 1935:22, Fichte 1994:15, Hutterer 2002:208, König and Auwera 2002:117-118, Wardale 1947:29, 57).

In addition to this the coda [ɣ] which remained after the back vowels also vocalised in the transition to Middle English leaving [u], usually written as *w*. This gives Old English *fugol* 'bird' [fuɣol] becoming Middle English *fuwel* ~ *fowel* [fouəl] and *āgen* 'own' became later *ōwen* (Anderson and Williams 1935:32, Freeborn 1998:111-112, 208, Hutterer 2002:218, Wright and Wright 1928:52-55). More extensive lists of these new diphthongs with early dialectal differences can be found elsewhere (cf. for example Fichte 1994:27-28, Mossé 1952:27-29 Wright and Wright 1928:54-60).

As in Old English, Old Frisian underwent similar changes, such that coda /g/ after front vowels was vocalised, giving PG **dag-* 'day' becoming Old Frisian *dei*, PG **hagl-* 'hale' became *heil* and **weg* became *wei* (Cummins 1881:20, 22, Hutterer 2002:233).

This kind of vocalisation also occurred in the history of Dutch, though it was restricted in its distribution. The /ɣ/ only vocalised in coda position when followed by /n/, such that we get Middle Dutch *bregen* 'brain' becoming modern *brein*. Also intervocalically in the earlier West Germanic combination -*egi*- this became [ɛij] in many dialects giving, for example *peijl* 'water mark' from earlier **pegil* (cf. German *Pegel* with the same meaning) (cf. Ausems 1953:46, 65, De Vin 1953:6, Meer 1927:56, Weel 1904:15).

The northern Alsatian dialects exhibit an intervocalic distribution of [j] occurring after front vowels and [w] after back vowels, lending a diphthongal character to these combinations here (cf. the maps in Klausmann et al 1994:162-167).

Although elisions are not cases of vocalisations, they have been included here as they have been in discussions of vocalisations for the other places of articulation. They are also especially common with velars and a possible reason for this will be given in the summary of this section.

In Old Norse we often see elision of final voiced velars when following a vowel, such that we have oppositions between *liúga* 'to lie' and *ló* 'lied' (cf. this with Gothic *liugan* and *laug*) (Krahe and Meid 1969:101).

In Icelandic /g/ disappears in final position when following *á, ó, ú* which are [au], [ou] and [u] respectively, so after a high back vowel. It is also elided between these vowels and *a, u* giving *lág* 'hollow' [lauː], *dróg* 'bad horse' [drou:], *súg* 'draft acc.sg.' [su:], *drógar* 'hacks' [drou:aɽ̥], *drógu* 'they drew' [drou:ʏ] (Einarsson 1945:15). Note here that the vowel lengthening indicates that these vowels are considered as being in open syllables and not as a result of compensatory lengthening.

In Faroese both [ð] and [ɣ] in non-initial position have been elided though they are still shown in the orthography, giving, for example, *eg* 'I' [eː] and *dagur* 'day' [dɛavur] (here the [v] is the result of intervocalic glide insertion to avoid hiatus and not the progression of underlying [ɣ]) (cf. Jacobsen and Matras 1961:XXI, König and Auwera 2002:195, Thráinsson et al 2012:401).

In Afrikaans we get elision of intervocalic voiced velars following long vowels or diphthongs, such that earlier, and Dutch, *spiegel* 'mirror' is Afrikaans *spieël*. and *ploegen* 'plough' has become Afrikaans *ploeë* (cf. Hutterer 2002:285, König and Auwera 2002:484, Meer 1927:XXXIV). In addition we find compensatory lengthening when the /ɡ/ is elided intervocalically after a short vowel, giving Dutch *legger* 'file' becoming Afrikaans *lêer* [lɛːər] and *troggen* 'trough' in Afrikaans is *trôe* [trɔːə] (König and Auwera 2002:481).

Old Saxon usually retained a consonantal /ɡ/, it was however lost intervocalically before a following [i]. Elsewhere this /ɡ/ would have been pronounced [j ~ ʝ] before front vowels (Holthausen 1900:81). In modern eastern Low German varieties we, however, find that intervocalic -g- has been elided completely giving for example High German *fliegen* 'to fly' produced as [fle:n] and *Tage* 'days' produced as [dɔːə] (Schönfeld 1990:102-103). This feature can also be found further south in some Saxon dialects (so Eastern Middle German) where High German *sagen* 'to say' can be pronounced [sɔen] and *Wagen* becomes [vɔen], though this elision only occurs after [a] and not the other vowels (Bergmann 1990:296), as well as Western Middle German dialects, such as those spoken in Luxembourg where exactly the same phenomenon occurs (Newton 1990:155). The Pfalz region also has the pattern as exhibited in Brandenburg, described above in Schönfeld (cf. Green 1990:247).

It should be noted that vocalisations occur outside the Germanic speaking area, in that, for Spanish, the development of Latin *pectu* 'breast' > **pei̯to* > *pecho* and for Italian, Latin *integru* 'entire' > **intei̯ro* > *intero*. The distribution in these Latin languages is much more restricted and not as widespread as it occurs in Germanic languages (Vennemann 1988:25). A closer pattern occurs in Portuguese where /k/ was vocalised to a high front vowel giving Latin *sĕx* 'six' > Portuguese *seis*, and *ŏcto* 'eight' became *oito*. We also find the front back distribution in words such as *actum* 'legal papers' > *auto* and *doctum* 'scholarly' > *douto*, although the distribution tends to be dialectal with some areas having more *ai/ei/oi* reflexes with others having more *au/ou* reflexes (Williams 1962:85).

It has already been mentioned that the velars and vowels are intimately linked as they share the same articulatory space, much more so than the other consonants. As such the progression from a vowel to a following velar will necessarily change the outcome of the vowel and the velar. It is possible to prepare the front of the tongue for a following alveolar stop, for example whilst keeping the back of the tongue involved in the production of a preceding vowel fairly constant (although, as has been shown this is not necessarily what actually happens). The transition between a vowel and a velar (or palatalised velar) will necessarily involve a raising of the tongue to produce a consonant and the frontness or backness of the tongue for the vowel production will also influence the position of the following consonant. The cases, mentioned above, where elision occurs, usually intervocalically, eliminates this movement to aid fluency, whereas a vocalisation of a former velar consonant will inevitably just retain the upward movement of the back of the tongue as a trace of the former consonant without the amount of backness playing a very significant role.

Within this current description the coronal sounds may be considered the most consonantal, or at least most non-vocalic, of all the sounds. Whereas the labials result in rounding, and with this backing, and the velars share directly the same space in the oral cavity as the vowels, the coronals use of the tongue tip and blade does not impact adjacent vowels where the back of the tongue and lip position are more important.

Maddieson's (1984) UPSID data separate the coronal sounds into dental, alveolar and "dental/alveolar" where the available literature does not make this clear. If we sum all the coronal sounds together and compare them with the labial and velar then for stops we have the following table for the frequency of plain stops by place (based on the table on p35):

	Labial	Coronal	Velar
Plain voiceless	263	290	283
Plain voiced	199	195	175

Table 15

He notes that of the 290 languages that have a plain voiceless coronal, 19 of these have both a dental and an alveolar. He notes though that all languages in the database, with the exception of Hawai'ian have a plain voiceless coronal amongst their inventory.

If we consider secondary articulations produced, then labialisation occurs more readily with the velars and uvulars than with the other sounds, with only 8 languages having labialisation of non-velars out of a total of 94 languages with labialisation (Maddieson 1984:38). We have already discussed the link between backing and lip rounding in 6.4 above. It is no surprise then that the back velars may share lip rounding. Also because the lips are active articulators in the production of labial sounds it is less likely that these will also be labialised by adding lip rounding. In languages which have palatalisation this is fairly evenly spread across all places of articulation with 17 languages palatalising labials, 19 having palatalised coronals and 14 with palatalised velars. He notes, as is also noted here in 7.4 that velars are more likely to change their exact position of articulation because of the shared space with adjacent vowels which accounts for the lower figure for the velars.

The following Figure 49 shows a spectral image of the word *dad* (taken from Ladefoged 1993:200).

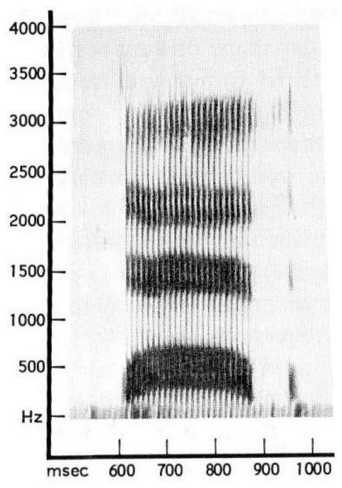


Figure 49

It should be noted that although there is a definite raise in the first formant for the transition from the /d/ to the vowel and a drop from the vowel to the following /d/, as there was in Figure 40 and Figure 46 the effect the consonant has on the second formant is not as pronounced as it was for either *bab* or *gag*. As a low first formant in vowels indicates a high vowel and all stops involve closure somewhere in the mouth, so will also involve the mouth being relatively closed, this is therefore unsurprising. The second formant however is more indicative of the effects the interaction between the vowels and consonants will have on each other at each place of articulation. That there is little movement in the second formant in the transition between consonants and vowels for this sound will be indicative of some of the features we find in the Germanic languages described below.

8.1 Early Germanic coronals

As with the other stop series, following traditional analyses, the coronal stops arose from PIE /dʰ/, /d/ and /t/ to become in PG /ð/, /t/ and /θ/ respectively. /ð/ had allophonic varieties, mirroring those described above for labials, whereby it became [d] word initially, when following a nasal and when geminated (Voyles 1992:46).

A brief description will be given of their realisations in the older Germanic dialects.

For Gothic, /ð/ also became a stop [d] when it followed another consonant and when it was followed by an obstruent, such that it only remained a fricative intervocalically or word finally following a vowel (Rauch 2011:43, Voyles 1992:97, Wright 1910:9). It should also be noted that there was word final devoicing so /ð/ became [θ] in this position. It is also possible, as I have argued in 7.1 above that through the process known as 'sharpening' Gothic may have had a palatalised or palatal sound [dʲ ~ ɟ] which arose from changes to the geminate /-jj-/ into (orthographic) *-ddj-*, although other literature just gives this as the combination [-ddj-]. However it is interpreted, the link between /j/ and /d/, so the link between high front vowels and [d] as pronounced in Gothic, should not be overlooked and may be indicative of the link in PG.

Old Norse followed the PG pattern, although it had [d] in a position following /l/ (Voyles 1992:46). One further change that occurred in Old Norse was that intervocalic /ð/ became [ɡ] when preceded by a round vowel and followed by /u/ (the /u/ often being subsequently dropped). We therefore have PG **iuðura* 'udder' becoming Old Norse *júgr* (Voyles 1992:127). This may be an indication that the coronal sound is not compatible with back vowels.

Old English and Old Frisian underwent a common West Germanic change whereby /ð/ became [d] intervocalically such that PG **faðer* ‘father’ became Old English *fæder* (Voyles 1992:139). This appears to be an unusual change as intervocalic position is one which very often promotes ‘lenitions’ and [ð] is more vocalic than [d].

If we look at the frequencies of fricatives from Maddieson’s UPSID data (1984:45) we find generally that voiceless fricatives are more common than voiced ones (there are 766 voiceless fricatives as opposed to 346 voiced fricatives, although this does not account for allophones, where voiceless fricatives are often voiced in the vicinity of other voiced sounds). Of the 346 voiced fricatives recorded, the most common one is /z/ (be it alveolar or dental), which occurs 96 times, followed by /v/ occurring 67 times. The following Table 16 shows the amount of times each voiced fricative is present in the database (based on the table given from the above reference):

Sound	/z/	/v/	/ʒ/	/ɣ/	/β/	/ð/	/ʁ/	/ʕ/	/ʝ/	/ɮ/	/ʐ/
Frequency	96	67	51	40	32	21	13	9	7	7	3

Table 16

As can be seen /ð/ is rarer than the other fricatives recorded resulting from lenitions of labial or velar consonants [β ~ v] and [ɣ] respectively. This may be an indication of its instability. Maddieson (p50) gives an intensity ranking for the voiceless fricatives and [θ] is ranked very lowly on this scale, only being more intense than [ɸ]. He does not give an equivalent scale for the voiced sounds but we can assume a similar ranking. The relative instability of the labial [β] has already been discussed in Chapter 8.

Given the relative scarcity of /ð/ in sound inventories and its lack of intensity in comparison to other fricatives, in an intervocalic position, as we have here, these other instabilities seem to have overruled the tendency to lenite in this position.

To further complicate matters for the development of English in the development to Middle English this intervocalic /d/ then was once again lenited to [ð], which also occurred post-vocalically before a liquid.

There is a lack of literature about this sound in Old Low Franconian, but it should probably be expected to have followed the same patterns as the parent language, though final devoicing, as is still present in Dutch would have meant that final /d/ became /t/.

Old Saxon underwent the common West Germanic change of intervocalic /-ð-/ to [d] (Voyles 1992:188). It also underwent a change which it shared with Old Norse and Old High German whereby /ð/ became [d] when following /l/ (p195).

Because of the second German sound shift, the series of alveolar sounds shifted such that the PG /θ/, /ð/, /t/ became /d/, /t/, /tȥ ~ ȥȥ/ respectively in Old High German where the symbol /ȥ/ represents a disputed sound which Voyles (1992:212) describes as being a [-strident] equivalent of [s] and it only later became the [+strident] [s]. By undergoing this second sound shift Old High German retained the three-way distinction between the coronal sounds which many of the other Germanic dialects lost through shifts from fricative allophones of /ð/ and /θ/ to stop sounds.

The following table summarises the data as presented above:

	PG	Gothic	Old Norse	Old English	Old Frisian	Old Low Franconian	Old Saxon	Old High German
#___	[d]							[t]
N___	[d]							[d ~ t]
geminate	[d]							[t]
C___	[ð]	[d]						[t]
___Obst	[ð]	[d]						[t]*
___#	[ð]	[θ]		[θ]	[θ]	[t]		[t]
l___	[ð]		[d]				[d]	[t]
V___V	[ð]			[d] (>[ð])	[d]		[d]	[t]

*Note the sequence /tr/ was unaffected by the second sound shift in Old High German and thus merged with older /dr/

Table 17

Following Vennemann's analysis (1984) as given in 6.1 above for labials, he suggests that this sound would have originally been /d̥/ and not /ð/ as given in traditional analyses for PG. This would mean that /d̥/ positionally lenited to [ð] in the various daughter languages, a situation which is commonly attested in lenition processes in other languages, whereas that shown here following the traditional analysis would imply a positional occlusivation, which would be very marked. This would be a particularly marked situation in intervocalic position.

Further to the results presented thus far there were additional changes to the fricatives /ð/ and /θ/ in the history of the languages. It has been noted above that the fricatives [ð] and [θ] are not very common in world languages and that they are perceptually weak. In order to emphasise the presence of these sounds they are likely to shift to more common positions or to sounds which are more audible. These have therefore undergone head-strengthening and shifted to stops in many of the modern languages.

8.2 Modern Germanic coronals

Figure 50 gives the modern equivalents of the four-way split between PG [d ~ ð], /t/ and /θ/ from PIE /dʰ/, /d/ and /t/ respectively[10]. The diagram is obviously a simplification of the actual pronunciations as the coronals may vary between dental and alveolar and the amount of voicing involved may also vary. Exact tongue position in the production of these sounds may be especially indicative of the result of a potential vocalisation.

[10] Sources for Figure 50 are Barbour and Stevenson 1990:94-95, Barry 1981:88, Eijkman 1955:83, Einarsson 1945:13, 15, 22-23, König 1998:149, Kristoffersen 2000:22, Ladefoged and Maddieson 1996:96, 144, Schrijver 2013:122, Sijs 2011:57, Thráinsson et al 2012:42-49

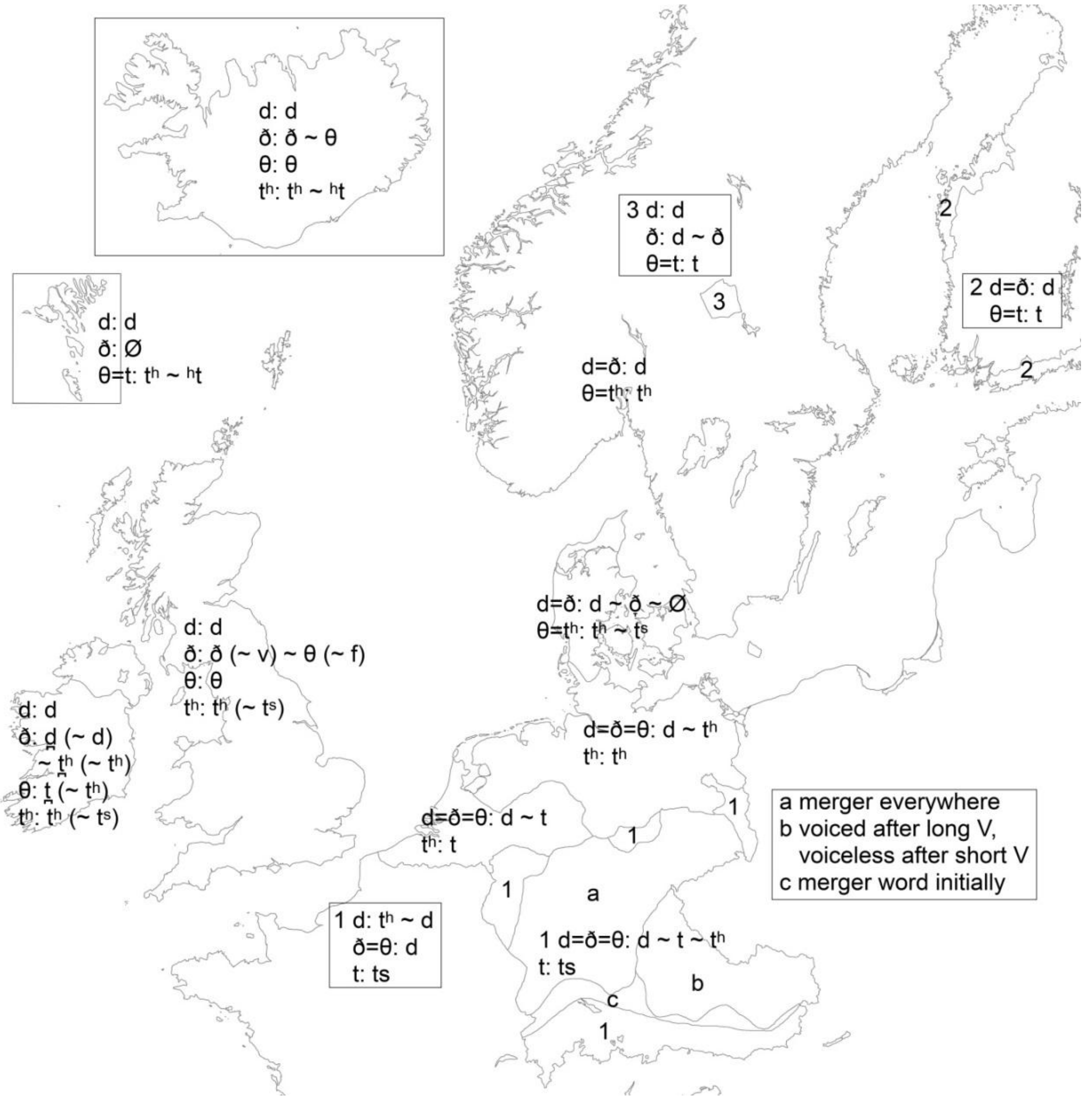


Figure 50

Ladefoged and Maddieson (1996:24) state that if a language has both dental and alveolar consonants, then the dental stop will generally be laminal, whereas the alveolar will be apical. Figure 51 below, taken from the same page, shows the production of a coronal apical sound (/n/ in this case) as opposed to the laminal nasal /n̪/. These were sounds as produced in Bulgarian, but may equally be useful in an analysis of Germanic sounds. It should be noted that for the apical sound the body of the tongue is slightly lower than in the production of the laminal sounds.

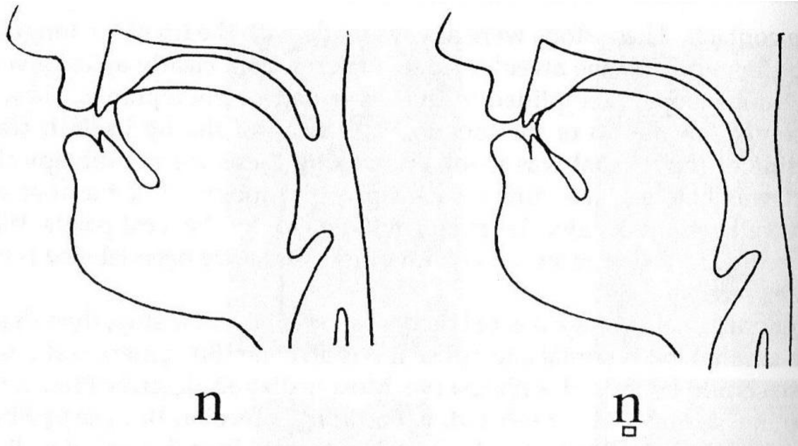


Figure 51

They also show the spectrogram for a laminal dental sound versus an apical alveolar sound (as produced in Isoko p23-24, see Figure 52). They note that the second formant has a lower locus for the laminal dental stop than it does for the apical coronal. A lower second formant when compared with vowels is indicative of a backed position.

A further general tendency which they note (also p23) is that laminal consonants are more likely to affricate than apical ones. This can also be seen from the spectrogram in Figure 52 where the dental has more fricative noise following the release of the stop than the corresponding apical sound.

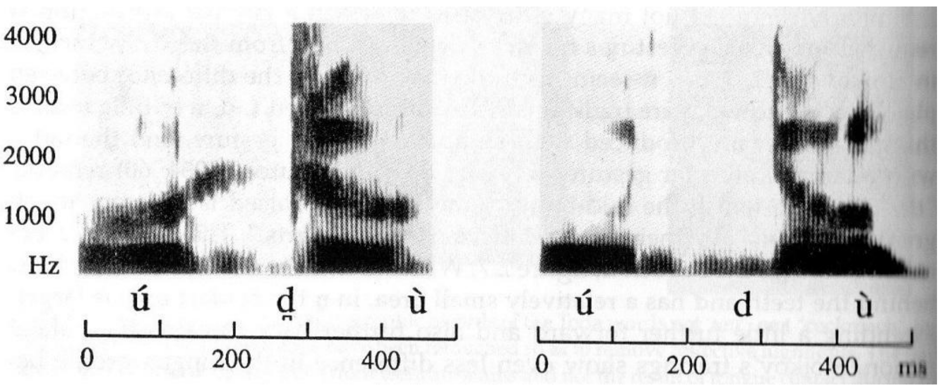


Figure 52

Returning to the Germanic languages it can be seen that affrication of the voiceless stop has occurred a number of times; as part of the second sound shift in High German, then also as part of a modern feature in some Southern English dialects (my own feeling is that it occurs variably south of a line from London to Liverpool, although I do not know of a study which has actually plotted this). I certainly affricate my /t/ slightly and it is more laminal than my apical /d/. It further occurs in some Irish English and also in Danish dialects. If affrication is associated more with laminality, then at least for these regions the /t/ may indicate a laminal production. It does not happen so readily with the voiced stops though, so we may consider this to be more apical in the areas which do display affrication.

Laminality was shown from the Bulgarian nasal above to have an underlyingly lower tongue position than apicality, so if we have a more laminal voiceless sound and a more apical voiced sound, which seems to partially be a trend for the Germanic languages given this evidence, then we would expect the result of a vocalisation of a voiced sound to be a higher vowel than the result of voiceless vocalisation. It should also be noted though that the front of the tongue is not especially high for either and there is also no apparent backing of the tongue so we may expect a vocalisation of a laminal voiced coronal to be a mid to high central vowel.

Some of the literature does give further details about the exact positioning of the tongue in the various languages and a survey of this will follow for the modern languages.

Ladefoged and Maddieson (1996:144) note that the /θ/ and /ð/ in Icelandic are retracted to [θ̠] and [ð̠] making them alveolar non-sibilant fricatives.

Norwegian stops are noted as being laminal (denti-)alveolars with the tip of the tongue resting against the lower teeth and the blade raised to the (dental-)alveolar region

(Kristoffersen 2000:22). These contrast with the retroflexes (which have arisen from earlier /r/+coronal consonant clusters) which are apical.

Ladefoged and Maddieson (1996:96) cite a study by Engstrand (1989) which showed that the contact area of /t/ in a dynamic palatographic study was more extended than for /d/ in Swedish, indicating more laminality for the voiceless sound than the voiced one, as the conclusions above in 8.1 also show.

The Swedish dialects as spoken in Finland do not have aspirated stops as is general elsewhere in the North Germanic dialects (Schrijver 2013:122). Schrijver attributes this to influence from Finnish where there is also no aspiration on the voiceless stops.

As with the other stops, Danish has undergone a series of lenitions, such that former /d/ has been lenited to an approximant [ð̞] or elided. The elision process will be discussed more fully in the section on vocalisations below in 8.4. Post-vocalic Old Danish /t/ has then also been voiced and this too has undergone the same lenition process. The following Figure 53 shows the dialectal result of this second lenition process[11].

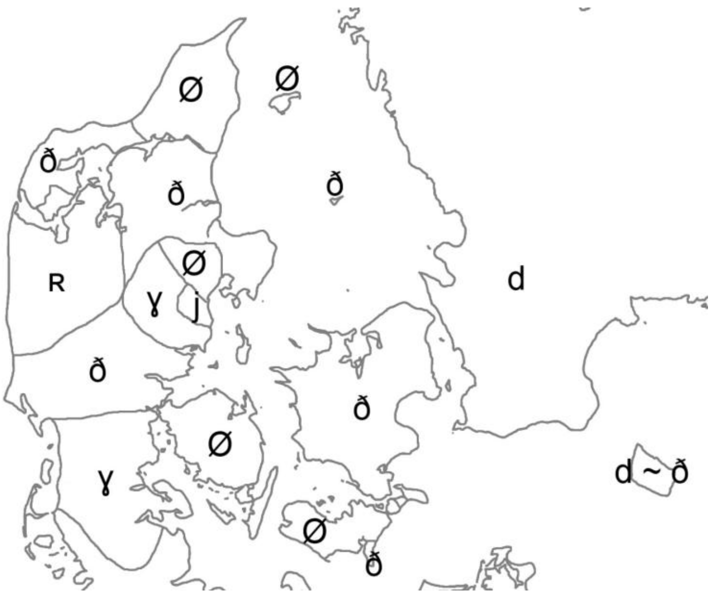


Figure 53

[11] Figure 53 based on the map in Brøndum-Nielsen 1951:Kort 11

The sound represented in Figure 53 as /ð/ was described by Jespersen in 1897-9 (cited in Ladefoged and Maddieson 1996:144) as being a laminal alveolar fricative made with the tip of the tongue behind the lower teeth, so presumably very close to the stop described above for Norwegian. They claim though that now the friction is all but lost and it is best described as an approximant, so [ð̞]. Brøndum-Nielsen (1951:108-109) describes the sound as produced on Bornholm island (on the far right of this map) as being either [d] or a linguo-labial fricative, so [ð̼], though Ladefoged and Maddiesson only claim this kind of sound for languages of Vanuatu, so the description as given in Brøndum-Nielsen may have either died out, or been an attempt to describe the [ð̞] which can be found in other modern Danish dialects.

Within the West Germanic dialects, the dental fricatives /ð/ and /θ/ have undergone occlusion and become [d̪] and [t̪] in large parts of the south of Ireland, although they have remained fricatives in the north (Barry 1981:72-73). Barry also recorded compromise realisations of [t̪θ ~ t̪$^{\theta}$ ~ ^{t}θ] for the voiceless sound and [d̪ð] for the voiced sound in the region between the fricative producing north and the stop producing south. He also notes that the pronunciation of /t/ as [t^{s}] is frequent in the south, though mainly in word final position. It is difficult to be sure if this implies that there is a laminal articulation for both of these sounds in the south, where a laminal dental seems likely given generalisations from other languages, but also a laminal alveolar is present to allow for affrication, at least word finally.

Slight affrication of /t/ also occurs in some Southern British varieties as described previously. For those of us who affricate, it is my impression that the tip of my tongue is further forward in the mouth for this sound than it is for the corresponding /d/ and thus slightly more laminal, although through correspondence with speakers from Essex and Lincolnshire their /t/ and /d/ only differ in aspiration and not in position.

Ladefoged and Maddieson (1996:143) note for the production of the dental fricatives that the tip of the tongue is positioned behind the upper front teeth, whereas in American English the same sound is more likely to be made with the tip of the tongue protruding so the friction was made between the blade of the tongue and the upper incisors. Thomas (1947:59) describes the sound as being either dental, like the British sound just described or interdental, so it seems to be a gradual trend towards a more interdental pronunciation in American English.

Again from my own English, as just one more example, and not necessarily typical of English varieties in general, my word initial /ð/ has very little friction and is probably best described as an approximant. Again I would use the transcription [ð̞] for this as with the Danish example above, although the Danish sound is a laminal approximation towards the upper teeth, whereas my own is an apical approximation. Intervocalically, though my /ð/ is a fricative.

Eijkman (1955:83) describes the Dutch coronals as having a 'flat' tongue with a 'flattened tip' either against the border between the teeth and the alveolar ridge (so slightly dental) or just behind this (so alveolar). I am unsure if he is indicating a laminal or apical production here, though presumably a laminal production would be described with a bulge in the tongue shape. Also affrication of this sound does not seem common in Dutch. This is however, partly due to the voiceless sounds not being aspirated. Schrijver (2013:122) attributes the lack of aspiration in Dutch (and he also includes Limburgs and Westphalian dialects of Low German as examples of having non-aspirated voiceless sounds) as being from Romance influences. Although Romance languages may have played a role, I think it is doubtful that such a change could have spread throughout the language, and it is more likely to have been the result of a language internal feature. In Stellingwerfs, which is a Dutch dialect with a Frisian substratum we find flapping of /d/ intervocalically, which would indicate that at least for /d/ here it is probably apical, so this may be the case elsewhere in the Dutch speaking area (Goossens 1974:97).

In the Low German speaking area of Groningen in the north of the Netherlands /t/ may be affricated to [tˢ] which would indicate that here at least there is the possibility of a laminal production for this sound (Cohen et al 1972:3). Flapping of /d/ intervocalically is also recorded in North Central Westphalian, though we also find elision of the sound intervocalically (Durrell and Davies 1990:73).

In the Palatine dialects of High German, Green (1990:249) describes intervocalic /d/ as [r], such that *baden* 'to bathe' is pronounced [baːrə], though this may be an inaccurate description of flapping. Maddieson and Ladefoged (1996:231) in their description of flaps do not say whether it is possible to have a laminal as opposed to an apical flap, but as they only involve a short period of contact this is better produced with a smaller surface of the tongue so would imply that they are produced apically.

8.3 Coronal effects on vowels

It was noted above at the start of the chapter that from spectrographic evidence and articulatory considerations the coronals affect neighbouring vowels less than both labials and velars. The main effect spectrographically was that there is a rise in the first formant in the transition from a coronal to a following vowel and a corresponding drop in this formant from a vowel to a consonant, which would imply an underlying higher vowel. Looking at the positioning of the tongue from Figure 51 above for Bulgarian sounds we also saw that the tongue body was higher for laminal sounds than it was for apical, but for both the tongue appeared to be in a mid vowel position, neither being high nor low. Bearing this in mind we shall now turn to the effect coronals have had on neighbouring vowels.

For effects involving raising, Wells (1982:305) notes that there is a palatal offglide in Cockney English of front vowels when followed by a voiced consonant which is particularly noticeable when the consonant is /d/. He gives the examples of *bed* as [beᶦd] and *bad* as [bɛːᶦd].

The former /eː/ sound of West Germanic has remained a monophthong generally in Emslander Frisian, we find though that it gains a palatal offglide in the position before dental voiced sounds, it should be noted that in the literature here they are described as dental and not alveolar (Bremmer 2009:113).

Lowering occurs in Old Norse where inherited /iu/ became [io] before the coronal sounds. The path it took was **iu* > **eu* > **éo* > *jo* (Gordon and Taylor 1956:275). There was also sporadic lowering of /eː/ to [æː] in the position before a geminate /t/.

In the Sjællandsk dialect of Danish there is fronting such that former *utt* has become [yt ~ yd̥]. The sound's usual progression is to [u] (Brøndum-Nielsen 1951:115).

In New Zealand English the vowel /əʊ/ is usually realised as [ö̞] giving *whole* as [hö̞l] and *most* as [mö̞st]. If this is followed by an alveolar stop (/t/, /d/ or /n/) then there is a centring offglide such that *coat* is [kö̞ət], *road* [rö̞əd] and *stone* [stöən] (Wells 1982:525). We also find here that /e/ is often diphthongal, especially before /d/ such that *shed* ~ *shared* becomes [ʃɪəd] (p608).

A similar situation occurs in Midsland Dutch dialects where West Germanic /ai/ and /au/ normally become [oː] and [oˑ] respectively but gain a centring offglide and raising before a following coronal to [o̝ːə] and [o̝ˑə] respectively (Knop 1954:116). (He describes the sounds as being dental in the literature).

In the Zuidhoek dialect of West Frisian we note that West Germanic /u/ becomes [y] in a position before d, t, l, s and z, elsewhere remaining a back [u] (Popkema 2006:24).

Rounding occurs in some Lincolnshire dialects of English, where the sound /ɜː/ has become [ɔ] when followed by /d/. We get orthographic examples such as *bodd* ‘bird’ and *wodd* ‘word’ (Sims-Kimbrey 1995:209). This could however be partly under the influence of a former /r/ being present. It is also the case for some other words, such as *wokk* ‘work’, but the environment before a following /d/ seems to more readily change this vowel.

In West Frisian the usual development of West Germanic /a/ is to [ɑ], however this is rounded to [ɒ] in the position before /n/, /t/, /s/ and /l/ (Sipma 1913:6).

In the Terschelling dialect of West Frisian we find vowel fronting and shortening of [uː] to [yː] and then [y] in the environment before a palatal /l/ and /n/, /t/, /s/ and /st/ (Knop 1954:47). Here there are probably two processes at work, one before the palatal sound and one before the voiceless sounds. The voicelessness of the coda consonants may precede the movement of the tongue for the consonant producing shortened vowels. It should also be noted that elsewhere (p7) he notes that a short /a/ is lengthened before a voiced sound to become [ɛː].

In comparison to the other sounds mentioned in the previous sections it is probably worth pointing out that there are far fewer effects of the coronal consonants on the previous vowels. It has already been shown that whereas vowels have labial and dorsal gestures, so labial and dorsal consonants share space with, and are thus more likely to influence, previous vowels, vowels do not have coronal gestures. As such, a coronal gesture will have less effect on a neighbouring vowel and will not necessarily affect its pronunciation.

Where we have raising it would imply a high tongue position. If we consider that the tongue has a set position in the production of a vowel and then this tongue shape is retained when the tip is raised to a coronal position then the tongue may also be raised. The two cases of raising mentioned both involve front vowels and the anterior of the tongue is used in the production of the coronals so these cases are likely to indicate general movement of this region of the tongue overlapping the production of the vowel. This use of the anterior of the tongue for the coronal sounds will also account for cases where fronting of vowels occurs.

The case of lowering in Old Norse is a little more difficult to understand. It may be linked to the cases of diphthongisation involving a centring offglide that we find for example in New Zealand English and Midsland Dutch. The flat position of the tongue may be the target for the production of coronals in this position.

Rounding in Lincolnshire dialects is also unusual, but we find that it often occurs after a labial sound, so this may be the trigger for rounding of the vowel and not the following coronal. This however cannot be the explanation for the rounding as seen in West Frisian. I am struggling to understand why there should be rounding of a vowel before a coronal and unfortunately I must leave the explanation open apart from to say that it may be dissimilatory in nature.

8.4 Coronal vocalisations

Actual vocalisations involving coronals are rare in Germanic dialects and those few that could arguably be classed as vocalisations could be explained by later changes in vowel quality or epenthesis to avoid hiatus. Elisions, however are very common so their presence and the reason for this will be discussed, even though they are not vocalisations.

In PG all final PIE coronal stops were lost in polysyllabic words such that, for example, PIE **nepōt* > Germanic **nefōd* (Old English *nefa*, Old Frisian *neva*, Old Saxon *nevo* etc.). /z/ too was elided in this position in West Germanic (Hutterer 2002:53, Krahe and Meid 1969:126, Meillet 2005:44).

In Mid Norwegian dialects there is loss of postvocalic /t/ and /n/ to varying degrees which leads to one of the best markers for dialect recognition (Fossum and Ugland 1995:51).

A /d/ will often be elided intervocalically such as in Faroese (cf. Barðdal et al 1997:266, König and Auwera 2002:195, Thráinsson et al 2012:401) and a glide may surface to avoid hiatus, however the glide is more an indication of the vowels it is connecting than an indication of the former coronal consonant. This is a similar situation in Middle Danish such that /ð/ in Swedish *sked* 'spoon' is Danish *ske*, whereas Swedish *möde* 'chore' is Danish *møje* 'effort' with epenthesis based on the front vowels to avoid hiatus (Jacobsen 1984:19).

Old West Frisian /d/ tended to be elided in intervocalic position with lengthening such that *snede* 'to cut' became *snē ~ snei* and *broder* 'brother' became modern *broer* (Bremmer 2009:115). The lengthening however is probably a reflex of two syllables coming together in hiatus rather than the /d/ itself adding to the length. In the modern West Frisian dialects we often also find elision of /d/ in other positions such that *ridlik* 'honest' may be pronounced [rɪlək], *nidle* 'needle' is [nølə] (Sipma 1913:24). It may also be dropped word finally after diphthongs ending in [ə] such that *ried* 'counsel' is [ri·ə(d)] and *goed* 'good' is [gu·ə(d)] (p32). This /d/ may then reappear in plurals such that *trie* 'wire' has the plural *triedden* (König and Auwera 2002:511).

It is a regular feature of Terschelling Frisian that former intervocalic /d/ has been lost. Again here the resultant length is not because of the loss of /d/, but rather a retention of the length of the two syllables. So we have the examples 'bladder' (with a /d/ intervocalically in English) is [bli:r] and 'floor' is [bo:m] (cf. Dutch *bodem*) (Knop 1954:83).

We find /d/ 'vocalising' in the combination *âd, oed, ôd* from Middle Dutch to become modern *aai, oei* and *ooi* such that *baaien* 'to bathe', with a long vowel, contrasts with *bad* ‘bath’ with a short vowel and no vocalisation (Meer 1927:69). This is particularly common in informal usage where we also find /d/ becoming [w] intervocalically when it follows /ɔŭ/ and the case mentioned above by Meer is described by /d/ becoming [j] intervocalically after tense vowels giving *oude* ‘old’ > *ouwe, rijden* ‘to ride’ > *rijen*. Elsewhere intervocalic /d/ may be elided and the vowel lengthened to show the length of the former two syllables such that *veder* ‘feather’ becomes *veer* and *nader* ‘near’ becomes *naar* (König and Auwera 2002:448-449). Cases of this kind are mentioned for West Brabants (Heestermans and Stroop 2002:19), Zaansch (Boekenoogen 1897:LII), Urk (Daan 1990:289), Westvoorne (Weel 1904:46, 49-50), Culemborg (Ausems 1953:70) and Schouwen-Duiveland (De Vin 1953:10, 22). Culemborg Dutch has a situation where an intervocalic *-nd-* is represented by a glide (shown as *kàjjer* ‘children’ instead of standard Dutch *kinder*) (Ausems 1953:64). As /n/ tends to nasalise a previous vowel and not leave a trace of its place of articulation in processes of this kind it may be that there was tensing of the vowel followed by a nasal and subsequent intervocalic gliding to avoid hiatus.

The dialectal pronunciation with intervocalic loss has been carried over to Afrikaans where it is considered standard (König and Auwera 2002:484, Ponelis 1993:156-159).

Intervocalic /d/ loss also occurred in the Low German dialects of Low Franconian, Westfälisch, Ostfälisch, western parts of Niedersachsen and Western Mecklenburgisch such that *beden* ‘to pray’ is Westfälisch [beːən] (Schönfeld 1990:98, Simmler 1983:1123). This occurs sporadically too in other Low German dialects, such as Altmark-Brandenburgisch where intervocalic /d/ can become [d ~ ɾ ~ l ~ j ~ Ø] (Schönfeld 1990:104). This is also the case for the bordering Ripuarian dialects where Aachen produces *braten* ‘to roast’ as *broene* (presumably [bʁɔənə]) (Newton 1990:155-156).

The elision has also often led to compensatory lengthening as in the following cases.

Old Norse /ð/ was elided with compensatory lengthening in a position before /n/ and /r/ around 1100AD (Voyles 1992:128). Danish /d/ has also often elided such that *moder* 'mother' has become *mor* [moːɐ̯] and *mord* 'murder' is [moˀˑɐ̯] (König and Auwera 2002).

West Germanic [eː] (as opposed to [ɛː ~ æː] which was inherited directly from PG) arose from loss of a following /z/ with compensatory lengthening such that Old High German *miata* 'wages' (where [ia] is a later diphthongisation of [eː] unrelated to the loss of /z/) has a cognate in Gothic *mizdo* from PIE **mizdhōn* (Hirt 1931:33, Krahe and Meid 1969:94, Prokosch 2009:105). There were other sporadic losses with compensatory lengthening of /z/ (which underwent rhotacism to become /r/ in the West Germanic dialects) such as Old High German *lirnēn* 'learn', Old English *leornjan* which had the Old Saxon cognate *līnōn*, Old High German *zwirn* 'twine' was Old English *twīn* (Hirt 1931:128).

Lenitions involving coronals have been shown to behave differently from the other places of articulation which have been discussed. When labials and dorsals vocalise we find not only a trace of their moraic structure remaining, but also an indication that the former sound was either labial or dorsal. We do encounter cases of compensatory lengthening accompanying the lenition processes of coronals but an underlying vocalic element does not seem to be present or is completely subsumed into neighbouring vowels. I suggest that a reason for this is that the coronal place node is not present in the production of the vowels and so will not leave a trace of their existence in a resultant vocalisation, unless, as discussed in Operstein (2010:23), there is a secondary articulation to the coronal consonant which does share place nodes with vowels. We shall analyse this further below in 9.1.

9 Summary of Germanic sounds

This current Part 1 has brought together the sounds as they occur in the Germanic languages and explained the types of vocalisations likely to occur dependant on the place of articulation of the consonant vocalising. An analysis of the processes involved and how to represent these complex articulations will be given in Part 2, but a few comments will be made here comparing the results from Germanic with that found in previous studies.

In 2.1 above Operstein's study on consonant prevocalisation was discussed (Operstein 2010). From her data she showed the expected value of vocalic epenthesis as given in Table 18 (repeated from section 2.1 above):

Type of consonant	**Expected prevowel quality**
palatal / palatalised	[i ~ e]
alveolar	[i ~ ə]
dental / labial	[ə ~ ɯ]
velar / velarised	[ɯ ~ ə]
labialised	[u ~ o]
pharyngeal / pharyngealised / uvular	[ɑ ~ ə]

Table 18

As has been explained the type of vocalisation involved in each case can be explained by the articulatory gestures underlying the production of the consonant and do largely coincide with Operstein's findings. The data presented in this chapter have, however, been presented slightly differently to that given in Table 18 and so will be summarised here.

In some of the following sections I shall also consider acoustic evidence by comparing my own production of various relevant approximants and comparing spectrographic formant values against my cardinal vowels and [ə]. To give some background to my own production, at the time of writing I am a 45 year old male and have spent most of my life living in Northeast London but also spent eight years in Germany and I now speak some German on a daily basis, though my German /r/ is a uvular fricative [ʁ]. The values for my cardinal vowels are summarised as follows in Table 19.

Vowel	[i]	[e]	[ɛ]	[a]	[ɑ]	[ɔ]	[o]	[u]	[ə]
F1	313	428	596	890	533	450	334	250	543
F2	2300	2179	2137	1760	805	816	648	630	1372

Table 19

9.1 Coronals

In some analyses coronal sounds and specifically alveolars may be considered the most neutral of the places of articulation. They frequently undergo assimilation processes which indicates that in being undefined for place of articulation, as suggested for coda alveolar consonants in underspecification theory (cf. Archangeli 1988), they will then take the place of articulation of a following consonant and only when they are in a neutral position without a following consonant will they surface as alveolar. By extension this can also explain why a coda /t/ in English often becomes [ʔ] where it has lost its oral stricture completely by being unspecified for place. If this is the case then the results which we find can easily be explained (although an alternate analysis of underspecification for coronals will be given in 13.1 below).

We find in lenition processes involving coda coronal consonants in Germanic languages that the coronal itself does not contribute to the quality of the resultant vocalisation although it may contribute moraically so that we find compensatory lengthening coupled with its lenition. This may seem to contrast with Operstein's findings where she suggests a consonantal prevocalisation of [i ~ ə] for alveolars, however if we consider [ə] to be the neutral vowel, also underspecified for place, then this would be expected to take place features from neighbouring segments and surface as a long vowel in vocalisations. We find traces of the high front element [i] in the effect the coronals have on preceding vowels where we do find some diphthongisation ending in high front vowels and also some raising or fronting of sounds in this environment, but again these are rare in comparison to the effects on vowels involving other places of articulation. The height and frontness of this sound is a result of the raising of the front of the tongue in its approach towards the alveolar ridge. As such we can assume they are articulatorily driven allophones and have not been phonologised, so perceptually they do not play a role.

With this in mind I would suggest that the coronal place of articulation does not play a role in determining vowels, which will be determined by dorsality and labiality alone. This will be further explored in 13.1 below, although a link between coronals and high front elements would be advantageous for descriptions of other processes.

9.2 Dorsals

Operstein divided dorsals into palatals and velars. Since palatals in PG arose from fronting of velars in the vicinity of neighbouring front vowels or the only original palatal /j/ they have been considered together with the velars as dorsal segments. It has been shown that the result of a dorsal vocalisation depends heavily on its neighbouring vowels. The interaction between the vowel and the consonant in this position means that the frontness of a vowel will produce a front pronunciation of the consonant, whereas back vowels correspond to back consonants. In vocalisation processes the resultant vowel is determined by the previous vowel as this will have already affected the former consonant. The height of the consonant’s former tongue position is therefore the indicator that it was formerly present.

Operstein's conclusion that palatals have [i ~ ə] and velars have [ɯ ~ ə] underlyingly in the production of consonant prevocalisation is therefore true, however it is determined much more by the preceding vowel than the consonant itself and instead I will suggest that dorsals contribute [+high] but the degree of fronting and lip rounding is taken from a preceding vowel.

9.3 Labials

Whereas in consonants labiality may be the primary place of articulation, it is only a secondary feature when applied to vowels. The link between labiality and backness was described in 6.4 above and we do indeed find that there is a tendency to back or round vowels preceding labials and the result of a vocalisation will also be a rounded vowel which, because of this link will also be back.

Labiality then means articulatory rounding which in turn means perceptual backing. Operstein suggested that labials have an underlying [ə ~ ɯ] in their production. I would suggest that backing is a perceptual by-product of labial consonants rather than an inherent feature of them. This would suggest a Jakobsobian feature such as [grave] needs to be considered for labials. That vocalisations result in high vowels would therefore be best explained by the height of the jaw in their production.

Acoustically my production of an approximant labial shows formant values which are just outside the vocalic space, but are placed beyond the top right of my vowel chart. The closest value would be [u] which is in keeping with height and backness as mentioned here. Interestingly the labiodental approximant, which I use for my own production of the English rhotic has an F1 value of 531Hz and an F2 of 1384Hz which are very close to my production of [ə]. This probably demonstrates more the position of my tongue when it is at rest rather than an underlying feature of the sound, though. It also has a lowered F3 at 1963Hz, which also falls in the vowel area, so a mapping of F1 against both F2 and F3 is possible as is shown with two values for [ʋ] as shown in the following diagram:

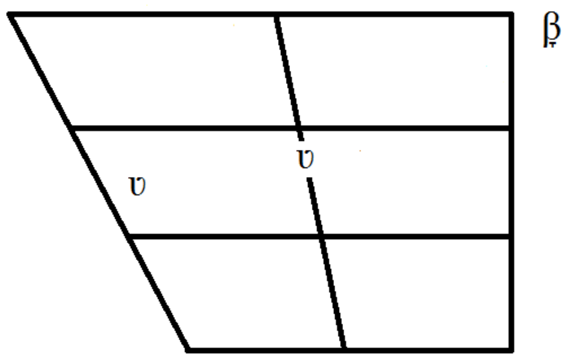


Figure 54

The only situation we find where a front value such as appears here for [ʋ] could be where Danish /æ/ is raised and rounded to [œ̝] in Skåne (Brøndum-Nielsen 1932:15), which could suggest that the change here was acoustically driven. All other cases seem to have the high back element so I would suggest that vocalisation of labials stay labial and do not become labial dental, at least not in Germanic dialects.

9.4 Nasals

The complex nature of nasals was discussed in 5.2. Nasal stops are articulated as oral stops with velum lowering such that air flows through the nasal passage. A vocalisation involving a nasal might be expected to contribute both a trace of its place of articulation as well as nasality in a resultant vocalisation. What we find however is that the place of articulation contributes little, if anything, to the vocalisation process such that we more often just get a lengthened vowel with nasality, which is why it has usually been considered as a separate process.

Operstein showed that secondary articulations were major contributors in consonant prevocalisation processes, so the secondary feature of nasality seems also to be a major contributor. We have also seen that in Germanic vocalisation processes involving oral sounds, coronals contribute very little to the quality of a vocalised sound beyond its moraic length and dorsals too will contribute height, but owing to the symbiosis encountered between coda dorsals and preceding vowels neither will they contribute to the place of articulation. This only leaves the labial nasal /m/. We may expect to find that this behaves slightly differently in that it might add rounding with accompanying backing to a vocalised sound. It was noted that rounding on a vowel is also a secondary feature and is usually just created by a perceptual correlate to back vowels. As such a labial nasal may contribute both the secondary vowel features of nasality and labiality, but even here it seems that nasality is ranked more highly than labiality such that there is no discernible backing or rounding of the vowel when /m/ vocalises.

We find an early change involving labial nasals which might offer a clue as to why a labial nasal sound does not contribute labiality to a vocalisation. When a former PIE labial nasal occurred word finally in unstressed position it became [n] in PG (cf. Voyles 1992:58). We must regard this as a weakening of the sound and we see that the labiality was lost before the nasality, which would indeed point to perceptions of nasality being ranked higher than perceptions of labiality for this sound.

9.5 Liquids

Liquid vocalisation needs to be considered in a different way in that the production of the liquids involve a change in tongue shape and not in their place of articulation. Recognition that a liquid is present necessarily involves recognition of the underlying tongue position.

We have seen that describing the bunched coronal rhotic of PG is more complex than to talk about simply its coronality. The consonantal coronality has even been replaced with consonantal low backness in becoming a uvular consonant in German, Dutch and Danish amongst other dialects.

In order to demonstrate the acoustics of rhotics I have here produced three consonantal sounds, an alveolar trill with little retraction (shown as [r]) a trill with retraction (shown as [r̠]) and an approximant bunched-r (shown as [ɹ]). During the production of rhotics it was noted that F3 is lowered such that it too falls into the vowel space spectrum and so for each sound there will be more than one value where F1 will be compared against both F2 and F3. The formant values I recorded for the three rhotics are as follows:

Rhotic	[r]	[r̠]	[ɹ]
F1	433	520	378
F2	1034	990	1198
F3	1766	1646	1537

Table 20

Comparing these with my cardinal vowels we get the following diagram:

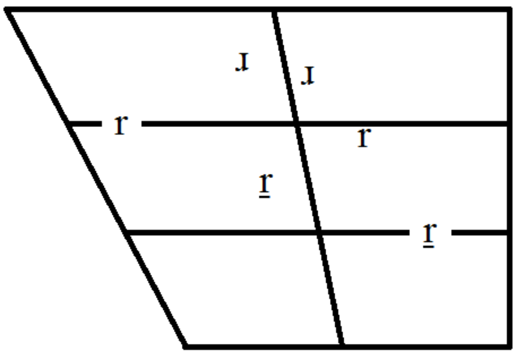


Figure 55

It can be seen that by very slight alterations of the rhotics we get a band of underlying resonances ranging from high front through mid central to low back values which does indeed coincide with conclusions about underlying gestural features in the production of a rhotic. Further slight changes would no doubt produce more variety.

In the same way the narrowing of the tongue in the production of laterals results in a secondary articulation. Previous studies have concentrated on English or French where the displacement has been in the velar-pharyngeal area. Within the Germanic speaking region, though, a large l-vocalising area occurs in Germany where the displacement of the tongue is in the palatal region. Operstein showed that secondary articulations are more important than primary ones when consonant prevocalisations emerge. The secondary velarisation or palatalisation then is the feature which contributes to the vocalised sound and not the primary coronal feature.

Measuring my formants for the production of [l] and [ɫ], as with the rhotics, I have a lowered third formant value although this is not as strong as that for the rhotic. My values are as shown below:

Lateral	[l]	[ɫ]
F1	296	291
F2	575	619
F3	1745	1537

Table 21

giving the following diagram where F1 is compared against both F2 and F3 and these are compared with my cardinal vowels:

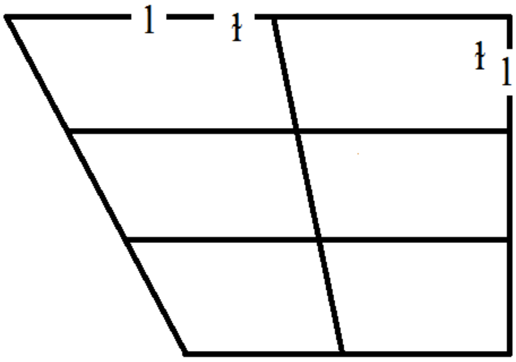


Figure 56

As can be seen for both laterals we have high front and high back resonances so it does seem to be a question of timing for both types of lateral and rankings of these gestures will provide the resultant vowel in a vocalisation process.

9.6 Summary

We can summarise the Germanic vocalisations with the following table:

Consonantal sound	Its contribution to the vocalisation		
Coronal	μ		
Labial	μ, [+high], [+round] (→ [+back])		
Dorsal	μ, [+high]		
Nasals	μ, [+nasal]		
Velarised Laterals	μ, [+high], [+back]		
Palatalised Laterals	μ, [+high], [-back]		
	front	mid	back
Bunched-r	[+high]	[-high], [-low]	[+low]
	μ		

Table 22

How we present this data will be discussed in Part 2.

Part 2

Phonological Analysis

10 The Proto-Germanic accent shift

‘*The momentum of the more fundamental, the pre-dialectic, drift is often such that languages long disconnected will pass through the same or strikingly similar phases. In many such cases it is perfectly clear that there could have been no dialectal interinfluencing.’*

Sapir 1921:184

The main reason given for the gradual weakening and loss of unstressed syllables in Germanic whose effects are still being felt in the modern dialects is often simply stated as a result of the shift in accent from a pitch accent to a stress accent and its shift in position to the first syllable (of the root in verbs) in the development of Proto-Germanic from Proto-Indo-European (cf. Hirt 1931). With the quote by Sapir in mind, it is therefore extremely important to understand the actual mechanisms of this shift in accent to fully comprehend much later linguistic processes such as vocalisations, which still seem to be the result of this shift and still link the Germanic languages together.

We thus need to gain an understanding of what exactly is meant by accent. In the following sections we will look at which features are involved in order to produce a stressed accent as opposed to a pitch accent, whether tone, muscular energy or length of the affected syllable are the deciding factors in defining a syllable as stressed.

Although it may be impossible to fully understand why the second change in PG took place with accent shifting to the root syllable, we can look at internal factors as well as similar examples of accent patterns in other languages in order to discover possible motivations for this process.

10.1 The nature of accent

In much literature on changes which took place to form PG we find such terms as a change from 'musical' accent (one related to pitch) in PIE to an 'expiratory' or 'dynamic' accent (one related to strength) in PG (e.g. Hirt 1931:16, Hutterer 2002:63, Wright 1910:15). While their terminology may differ, they are clearly talking about a pitch accent versus a stress accent. Hirt (1931:27) explains that within an accent there are three different features with varying prominence:

Quantity – whether a syllable is short, long or overlong,
Musical accent (pitch) – each syllable has a different tone height,
Expiratory (intensity) – each syllable being produced with more or less pressure.

For the purposes of this explanation I shall reserve the terms 'quantity', 'pitch' and 'intensity' for these features, the term 'accent' for individual manifestations of stress, and the term 'stress' for the combination of quantity, pitch and intensity accents. The terms 'pitch accent' and 'stress accent' will be reserved for accents traditionally perceived as having stressed syllables characterised by a change in pitch or greater intensity and quantity respectively.

Hirt explains that within any system of stress there is a combination of all three, but one of the three may be more prominent giving us the so-called pitch accent or stress accent. He claims PG has a strong stress accent, though quantity and pitch are also lesser features. He notes conversely that where languages have a strong pitch accent we may not notice the strength of the syllable. Krahe and Meid (1969:46-47) and Prokosch (2009:118-120) also note this combination between intensity and pitch, but do not mention quantity. They say that by speaking of a stress accent or a pitch accent a predominantly stress accent or predominantly pitch accent is implied and that one cannot exist without the other.

Lehiste (1970:106) gives a more detailed description of stress. She again describes the difference in stress through traditional terms splitting it into three qualities as described above, quantity, tonal features (pitch), and stress (intensity). Her findings are that, whilst quantity and pitch are measurable, intensity is somewhat elusive in being readily defined.

Pitch can be defined as a change in fundamental frequency caused by vibration of the vocal folds, which in turn is caused by greater or lesser airflow. Quantity is also a measureable feature, though this is not as intricately linked to air pressure as pitch is. Ohala (1977:147), moreover, showed that emphatic intensity, though not un-emphatic intensity, is linked to duration.

Stress seems to have different definitions depending on the speaker, the listener and also varies depending on the language being spoken, meaning that there is unfortunately not a single definition for stress. This is a situation also found in studies on stress where the concentration is either on its phonetics or its phonological function (cf. Hyman 1977:38) without necessarily linking the two. Obviously perceptual constraints are as important as constraints involved in production, as for a feature to be distinctive it needs to be perceived (Lehiste 1970:5). Intensity seems to have an ambiguous role in the production of stress and seems to have a weak role in the perception of stress (Lehiste 1970:125).

By the nature of the vocal tract we find that individual vowels take greater or lesser intensity to produce to be perceived with the same loudness. By using the same amount of intensity in airflow, high vowels will have lower amplitudes than low vowels. In a study mentioned in Lehiste (1970:117-118) by Lehiste and Peterson (1959), high and low vowels were produced with equal intensity of airflow. Listeners perceived these as having the same loudness although the high vowels actually had lower amplitude. Production of the vowels was manipulated so that all would be produced with equal amplitude regardless of whether they were high or low. This took greater effort by the speaker when producing the high vowels.

The resulting vowels were then played to listeners who perceived the high vowels as being louder than the low vowels, although the amplitude was the same. This simple test implies that when dealing with perceived loudness and measured amplitude we clearly are dealing with two separate features.

In studying lung volume whilst producing stressed syllables, Ohala (1977:157) noted that for non-emphatic stressed syllables the lung capacity decreased at the same rate as it did for non-stressed syllables, noting that the involvement of the respiratory system was only apparent in the production of emphatically stressed syllables. Ladefoged (1968) showed that there was, however, an increase in the activity of the expiratory muscles in the immediate vicinity of the stressed syllable, either coinciding directly with this syllable or just prior to its production.

Intensity is also intimately linked with fundamental frequency (Lehiste 1970:82, 125). Higher intensity in the sub-glottal region will make the vocal folds vibrate more quickly producing a higher fundamental frequency. In order not to increase fundamental frequency with higher intensity other factors will necessarily come into play such as extra tension in the vocal folds. There have been many studies which show that higher fundamental frequency is in fact a main cue in the perception of stress (cf. Morton and Jassem 1965 for English examples and Westin, Buddenhagen and Obrecht 1966 for Swedish etc.) It seems from the studies mentioned in Lehiste (1970:131) that higher fundamental frequency is in fact nearly always the main indicator of stress, more so than quantity which itself is a greater cue than intensity, but she does point out that in some languages quantity seems to be the most important cue, as in English (1970:138). She mentions a study by Parmenter and Treviño (1935) where Western American stressed syllables were found to be approximately 50% longer than their unstressed counterparts.

Another study she mentions by Cooper, Liberman and Borst (1951) showed that with words like *object*, where the noun has main stress on the first syllable, whereas the verb's stress is on the second syllable, if there are both longer duration and higher intensity on the stressed syllable there is no difficulty in perceiving the correct word. When intensity was removed and there was just longer duration on the stressed syllable perception of the correct word remained high at 70%, whereas when there was only higher intensity without lengthening of the stressed syllable, comprehension went down to 29%.

In Czech, however, duration does not play a major role in perception of stress placement. In this language there are both long and short vowels and these may be in stressed or unstressed position. In a study by Straka (1959) it was shown that the duration of vowels, whether long or short, in stressed syllables did not differ significantly from those in unstressed position. Note that in a pitch language, such as Norwegian, manipulations of quantity have no effect on comprehension, whereas those of tone do (Efremova, Fintoft and Ormestad 1965).

In the same way increasing the speed of speech in some languages will shorten the duration of all syllables equally, whereas there will be greater shortening in unstressed syllables than in stressed syllables in other languages, such as English (cf. Lehiste 1970:38-39).

Clearly, although higher fundamental frequency is always considered a cue for stress, the role which duration plays is language specific.

To use earlier definitions of stress as either dynamic or musical is therefore an oversimplification of the situation in languages and from a phonetic perspective is not measurable. The dynamic aspect of a stress accent is perceptually less important than pitch and, depending on the language, may be less important than duration.

Jones (1960:246) defines stress as an articulatory gesture, but introduces the term prominence as a perceptual quantity which is language specific and will depend on such things as length, stress, pitch and timbre. Although phonetically, stress is abstract, phonologically we may define the language specific stress accent based on these features.

Hyman (1977:40) sums up stress as being characterised by a pitch change, by greater duration and by greater intensity, in that order, a summary echoed by Ohala (1977:146). Laver (1994:450) adds to this by including “greater articulatory excursion from the neutral disposition of the vocal tract” as another feature of primary stress. He notes that this correlation of stress with a more peripheral location in the vocoid space as the weakest cue to recognition of stress though (Laver 1994:513).

Hirt’s 1931 explanation of the three features of quantity, pitch and intensity interacting to produce stress is consequently quite accurate, but the role each of these plays in the production or perception of accent differ from each other and are much more subtle. Oppositions in quantity or tone are shown to be conditioned by stress, though conversely the presence of stress is inferred from the occurrence of these oppositions (Lehiste 1970:139).

In order to speak of strong stress in PG we need to establish exactly what this means with regards to the three features of quantity, pitch and intensity.

10.2 PIE accent

With this in mind we can now draw our attention to changes which occurred in the formation of PG from PIE. We need to start by examining what kind of accent was present in PIE.

For PIE, Hutterer (2002:31) implies that sentence accent was pitch based whereas individual words had a mixture of pitch and stress accent, which gradually became either mainly pitch accent or mainly stress accent in the individual dialects.

Hirt (1931:51) explains this in more detail by giving a four stage change in PIE accent patterns which go part way to explaining ablaut in the individual dialects. In the first two stages of PIE accent change we see a reduction of unstressed vowels both before and after the main stress followed by their deletion leading to the 0-stage in Ablaut. This, he says, would indicate that a stress accent, so presumably one where duration had an important role, was present. In the following stage we have qualitative gradation whereby *e > *o. He equates a change of this type with pitch accent. And there was finally a breakdown into individual dialects; in the case of PG this would mean a change back to stress-accent (cf. also Krahe and Meid 1969:48, Prokosch 2009:118-120).

If as stated above higher fundamental frequency is a major feature of stress accents, then we need to understand how this situation differs from the so called pitch accent.

Pitch accent is defined as "an accent which is primarily realized by differences of pitch between accented and unaccented syllables" (Matthews 1997:282). Languages which have pitch accent will have accent assigned to syllables in a word. This is the basic definition of an accented language as opposed to a tone language in that there is only one primary stress per word (Hyman 1977:38). There is indeed some indication that in PIE there was only one accented syllable within a word, even if underlyingly there were more accented syllables across morpheme boundaries, making PIE an accented language and not a tonal one.

Basing their analysis on Sanskrit, Lithuanian and Russian, the position of accent in PIE was conjectured by Kiparsky and Halle (1977:209-210) to be as follows.

That every word only has one primary accent in PIE, although they may underlyingly have more than one accent across morphemes, can be given as the Primary Accent Rule (PA). The placement of accent follows the Basic Accentuation Principle (BAP) whereby the leftmost accented syllable takes the primary accent in the word. If the morphemes do not carry accent then the accent will fall on the first syllable. We have then the situation shown in Figure 57.

$$\begin{array}{cccccccccccccc}
 & & & & & H & & & & & & & & \\
H & H & & & \text{(BAP)} & H & H & & & \text{(PA)} & H & & & \\
\sigma & \sigma & \# & \sigma & > & \sigma & \sigma & \# & \sigma & > & \sigma & \sigma & \# & \sigma
\end{array}$$

or

$$\begin{array}{cccccccccccccc}
 & & & & & H & & & & & & & & \\
H & & & H & \text{(BAP)} & H & & & H & \text{(PA)} & H & & & \\
\sigma & \sigma & \# & \sigma & > & \sigma & \sigma & \# & \sigma & > & \sigma & \sigma & \# & \sigma
\end{array}$$

or

$$\begin{array}{ccccccccc}
 & & & & \text{(BAP)} & H & & & \\
\sigma & \sigma & \# & \sigma & > & \sigma & \sigma & \# & \sigma
\end{array}$$

Figure 57

Stem morphemes may be accented with either a fixed accent on one of their syllables, or unaccented, with no inherent accent; this would become fixed once rules have applied. Morphemes which form suffixes fall into three categories. Weak endings are stressed so these take the accent if the stem is unaccented, but lose their accent if the stem has fixed accent. Strong endings trigger *metatony*, such that they give accent to the preceding syllable, again only affecting unaccented stems.

Metatony : $V > [+\text{stress}] : \_\_\_\_ \; C_0 \# C_0V$

And finally there were de-accenting endings, which de-accent the whole stem forcing the first syllable to be accented under BAP.

The stress placement in the later stages of PIE just before it became PG, taking into consideration the placement of weak, strong and de-accenting endings, was the following rather complex system as given in Voyles (1992:19-20):

For masculine and neuter nouns + adjectives with -a-, -wa-, -ja-, -az/-iz endings the stress was on the stem in the nominative, accusative and vocative, elsewhere there was end stress.

For other nouns and adjectives there was stem stress in the singular for all cases and also the plural of the nominative and accusative, but end stress in genitive plural and dative plural.

Adverbs had end stress.

Strong verbs had stem stress in the first two principal parts and end stress in the second two.

1 sg. pres.	*déukō*	1 pl. past	*dukmé*
1 sg. past	*dóuka*	past part.	*dukónos*

Weak verbs always had end stress.

Bisyllabic conjunctions, prepositions, and others had final stress.

If we now draw our attention to how this accent was manifested then let us first consider accent in Lithuanian which has pitch accent as is implied for PIE. Krahe and Meid (1969:49) claim a similar two way accent for PIE as described below for the long vowels.

In Lithuanian there are three main types of accent (cf. Matasović 2008:136). Short syllables are indicated by higher fundamental frequency. Long vowels and diphthongs (which end in a sonorant) have one of two accents. The first is the so called *acute* accent, characterised by a slight rise in frequency then a sharp falling throughout the vowel. The second is a *circumflex* accent, one where the frequency starts relatively high, though not as high as in acute accent

(Kiparsky and Halle 1977:214). This accent then rises gradually throughout the V before falling at the end. These accents are indicated in Figure 58:

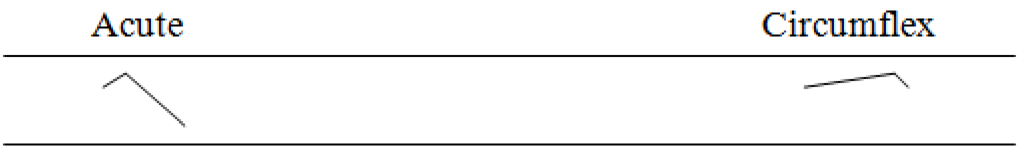


Figure 58

We can indicate this as short stressed syllables having H, long acute syllables having HL and circumflex accents having LH. At first sight this might indicate that PIE also may have had a complex variety of pitch accented syllables, but we can demonstrate that early Lithuanian had just one underlying pitch pattern, LH.

If Lithuanian went through a rule (1) where tone became intricately linked to moras, and a single mora (limited to sonorants) could either have high or low tone but not both then we get the following situation. By default unaccented syllables have L tone (2).

Short accented vowels would have been of the form:

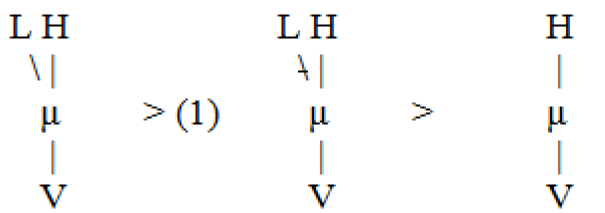


Figure 59

Acute accent falls on long vowels in the following positions:

i) Those which underwent compensatory lengthening before laryngeals with subsequent loss of the laryngeal (3) (where C in the following diagram indicates a laryngeal):

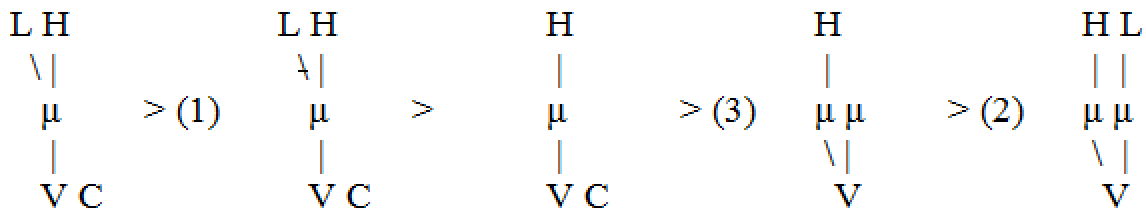


Figure 60

ii) Those which underwent lengthening before voiced stops (4) (where C in the following diagram indicates a voiced stop). This step includes other lengthening processes which occurred in Lithuanian:

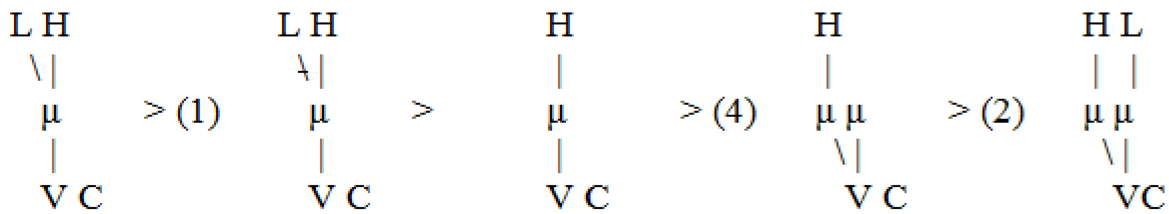


Figure 61

Circumflex accent occurred on all other long V and diphthongs (i.e. those VS combinations where S is a sonorant) as follows:

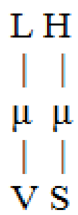


Figure 62

Similar processes can be shown for the different pitch accents which developed in Ancient Greek. From this demonstration we can show that there was probably just one inherited type of accent from our PIE model above. This gives us the situation that PIE accent was present on just one syllable in the word and there was just one type of pitch involved to indicate the accented syllable. We shall return to this situation below.

10.3 Accent changes from PIE to PG

Hirt and others state clearly that the change to a stress accent occurred before the shift in accent to the first syllable of the stem (cf. Hirt 1931:16). This seems to imply a major change from a pitch accent to a stress accent. In Viereck (2002:49) we have an approximate dating for the two shifts in accent with the change to a stress accent occurring somewhere in the period from 1500BCE to 500BCE, and the change of accent to the first root syllable as occurring in the period 500BCE-0.

If we consider the resulting pitch accent which was present in PIE before it split into separate dialects it has been shown above that the accent was characterised by a single accent on each word with a single pitch pattern. We cannot say with accuracy how this pitch was manifested, but unaccented vowels would have lacked pitch differences in their production, whereas accented vowels would have been marked by a difference in the underlying pitch between the accented syllables and their unaccented counterparts.

In determining stressed syllables in pitch accent languages, primary stress always falls on either a high tone, or a contour tone containing a high tone (Gordon 2006:20). During the pre-PG stage before any changes in accent had occurred, the tone would have contained a high element, either as a pure high H pitch, a rising LH or a falling HL pitch, then the change from a pitch accent to a stress accent would therefore not have been as major a change as claimed.

As shown previously pitch and intensity are intimately linked. We have already noted that one method of producing higher fundamental frequency is to increase the air pressure in the sub-glottal region, i.e. to increase intensity. We have also seen above that the main cue in perceiving accent cross-linguistically is a rise in fundamental frequency, more so than other features such as intensity and quantity, although quantity too is a very important feature in such languages as English. If all that was involved in the PG case was slight lengthening of accented syllables then analysing this pre-PG phase as having either pitch accent or stress accent seems irrelevant as we have an accent which could be described as either.

The change in position onto the first syllable of the stem in PG must necessarily have happened after Verner's Law took place, where voiceless fricatives occurring after an unstressed syllable were produced lenis, which initially caused voiced allophones of the previously voiceless fricatives to appear and finally, after the shift, to become phonemicised (cf. Speyer 2007:39, Krahe and Meid 1969:48-49).

The exact timing is explained in Bennett (1972:1101-102) where he postulates that Verner's Law did not reach completion until after the shift in position of the accent. He claims that a lenited voiceless fricative allophone could still remain voiceless, but produced with less energy than a fortis voiceless fricative. After the change of position of the main accent in a word these allophones would have remained until they finally merged with the voiced fricatives.

During the initial stages in the formation of PG we find an early indication of accent shift which would have occurred before Verner's Law took place. Note that Verner's law which affected fricatives immediately following unstressed syllables took place within the early stages of PG and was one of the main processes shaping PG. Ringe (2006:104) shows the loss of final non-high short vowels, whereby if this final vowel was initially accent-carrying then the accent was shifted to the previous syllable. He gives the example:

PIE **n̥smé* 'us' > **n̥swé* > **unswé* > **úns* > PG **uns*

Obviously stress would have necessarily been present throughout the process, so it indicates that in the process from **unswé* > **úns* there would probably have been some form of vowel reduction which may have necessitated the accent to regressively shift before the vowel was lost altogether giving us the possible situation:

**unswé* > **unswə́* > **únswə* > **úns*.

If this was indeed the case then in this situation it would have been the reduction of this vowel which initiated the accent shift.

The other possible situation would have been a shift away from the final syllable before any reduction took place as in:

**unswé* > **únswe* > **únswə* > **úns.*

This situation may indicate a change in accent perception. We shall return to possible reasons for this shift in 10.4.

If we follow the situation given in d'Alquen and Brown (1992:67) we have an alternation caused by Verner's Law between **wérþanan* 'to become' and **wurðúm* 'we became'. If this voicing of a fricative occurred due to the lack of stress accent in the previous syllable giving that previous syllable less energy and carrying over onto the following fricative causing this too to be lenis, then this does not take into account syllable boundaries or situations where say *city* [ˈsɪti] may become [ˈsɪɾi] or [ˈsɪʔi] where the following consonant is lenited. If stress accent is however not present and the accented syllable is pitch accented with rising tone, then the **-þ-* would occur with high pitch coming at the end of an accented syllable and **-ð-* would occur with low pitch coming at the start of an accented syllable. If there is any alternation at all then high pitch is associated with voiceless consonants and low pitch with voiced (cf. Henderson 1982).

Ramers (1994), however, postulates a high tone for PIE, which might seem to speak against this argument, but if the target for the high tone is on the vowel, then a preceding consonant, i.e. one which is not preceded by high tone, may still have had the low pitch and voicedness associated with it.

Iverson and Salmons (2003) see the voicing of consonants following unstressed vowels as a case of passive voicing and consonants which do not undergo the change as being more marked. This voicedness as shown seems more to be associated with pitch than any other feature of stress which points at pitch accent being present whilst Verner's Law was active.

If we are to accept a pitch accent and also to accept Hirt's hypotheses then we unfortunately have a clash at this stage. Hirt attributes a whole range of changes in the forming of PG to its supposed strong stress accent. One of the main features of Germanic is of course Grimm's Law or the first Germanic Sound Shift. He claims (Hirt 1931:104), that a stress accent could have produced the PIE **p, *t, *k* with strong aspiration giving **p*^{h}*, *t*^{h}*, *k*^{h} in turn leading to affricates **pf, *tþ, *kx* and finally just fricatives **f, *þ, *x*. One point to note against Hirt's argumentation here though is of course that the sound shift occurred in all positions, not just in those which were stressed. If the intensity of stress had caused the shift, then this would have only occurred in stressed positions (cf. also Goblirsch 2005:72-74).

Verner's Law is traditionally seen as coming after the first Germanic sound shift, but we have already seen that for Verner's Law to take place this would less likely have been triggered by stress accent alone and a possible explanation is that pitch accent was still in place. This would then imply that Verner's Law must have taken place before the first Germanic sound shift. The problem with this is that we would then encounter /p, t, k/ becoming /b^h, d^h, g^h/ respectively in the position after an unstressed syllable, which is obviously a very strange situation. The following (somewhat simplified) Table 23 will indicate the two situations thus far explained:

(A) PIE	Sound Shift	Verner's Law
p	ϕ	ϕ ~ β
bʰ	β	β
b	p	p
t	θ	θ ~ ð
dʰ	ð	ð
d	t	t
k	x	x ~ γ
gʰ	γ	γ
g	k	k

(B) PIE	Verner's Law	Sound Shift
p	p ~ bʰ	ϕ ~ β
bʰ	bʰ	β
b	b	p
t	t ~ dʰ	θ ~ ð
dʰ	dʰ	ð
d	d	t
k	k ~ gʰ	x ~ γ
gʰ	gʰ	γ
g	g	k

Table 23

Scenario (B) obviously seems a very unnatural one with alternating voiceless stops and aspirated voiced stops. If however we consider different values of PIE consonants based on Glottalic Theory as postulated by Hopper (1973) and Gamkrelidze and Ivanov (1972) then we would have the following two situations:

(C) PIE	Sound Shift	Verner's Law
p ~ pʰ	ϕ	ϕ ~ β
b ~ bʰ	β	β
p'	p	p
t ~ tʰ	θ	θ ~ ð
d ~ dʰ	ð	ð
t'	t	t
k ~ kʰ	x	x ~ γ
g ~ gʰ	γ	γ
k'	k	k

(D) PIE	Verner's Law	Sound Shift
p ~ pʰ	p ~ pʰ ~ b ~ bʰ	ϕ ~ β
b ~ bʰ	b ~ bʰ	β
p'	p'	p
t ~ tʰ	t ~ tʰ ~ d ~ dʰ	θ ~ ð
d ~ dʰ	d ~ dʰ	ð
t'	t'	t
k ~ kʰ	k ~ kʰ ~ g ~ gʰ	x ~ γ
g ~ gʰ	g ~ gʰ	γ
k'	k'	k

Table 24

If this is the case then either scenario (C) or (D) would be a possible scenario, and if anything (D) where Verner's Law precedes the sound shift looks neater as the law would affect all voiceless obstruents (note voiceless ejectives are by their nature impossible to pronounce voiced) and not just the voiceless fricatives. Allowing for scenario (D) would allow us to postulate Verner's Law coming before the sound shift, which in turn allows us to postulate a pitch accent still being present when Verner's Law was active and would allow for the sound shift to have occurred after the accent had changed to a stress accent, fitting in with Hirt's assumptions. This also corresponds with Vennemann's findings (1984:22) where he also postulates Germanic sound shifts to have occurred after Verner's Law. In his theory the sound shifts more closely follow from a Glottalic Theory consonantal series for PIE.

Of course this is not the place to discuss the merit of Glottalic Theory but this will demonstrate that it would fit comfortably into our time scale above.

Turning to the shift in the place of accent and taking into consideration the effects of Verner's Law, Voyles (1992:41-44) gives an alternate view claiming a difference in timing between East Germanic and the rest of the Germanic area. He gives the following stages:

Stage 1 (East Germanic)

> V > [+stress] : [##; +]C_0_ in all strong verbs and many weak, (where + refers to a boundary between a verb stem and it prefix).

Stage 2 (Also only East Germanic)

> V > [+stress] : ##C_0_ (in all adjectives, nouns and pronouns in singular)

Stage 3 (1 and 2 spread through all Germania and additionally):

> V > [+stress] : ##C_0_ (in all words excluding some prefixes)

So

PIE **déukonom, *dóuka, *dukmé, *dukónos*

Gmc **déuxonom, *dóuxa, *duxmé, *duxónos* (1st sound shift, stages 1 and 2)

EGmc **déuxonom, *dóuxa, *dúxme, *dúxonos*

NWG **déuxonom, *dóuxa, *duxmé, *duxónos* (Word stress Stage 1)

EGmc **déuxonom, *dóuxa, *dúxme, *dúxonoz*

NWG **déuxonom, *dóuxa, *dugmé, *dugónoz* (Verner's Law)

EGmc **téuxonom, *tóuxa, *túxme, *túxonoz*

NWG **téuxonom, *tóuxa, *tugmé, *tugónoz* (2nd sound shift, stage 3)

EGmc (Got) *tiuhan, tauh, tauhun, tauhans* (Word stress Stage 2 and 3)

NWGmc (OS) *tiohan, tōh, tugun, gitogan*

It should be noted that he also splits the first Germanic sound shift into three stages. Stage 1 aspirates voiceless stops, stage 2 turns aspirated stops into fricatives, and stage 3 devoices voiced stops.

Whether this is the case is uncertain and in fact Goblirsch (2005:71) mentions that the more common view is to see Verner's law as taking place before the sound shifts took place, although as mentioned this would have led to strange alternations between voiceless stops and aspirated voiced stops which do not form a natural link. For this to take place then either Glottalic Theory for PIE must be correct, or we have an intermingling of sound shifts and Verner's Law as suggested by Voyles.

Again if we go from d'Alquen and Brown (1992:67) where they claim a pitch accent to be present for Verner's Law to have happened the way it did then stages 1 and 2 of the sound shift as given by Voyles would not have been triggered by stress accent as claimed by Hirt. Goblirsch (2005:33) explains the sound changes of /p, t, k/ > /ɸ, θ, x/ in a similar way to Hirt with aspiration being the trigger, but instead of this being caused by intensity of airflow, which would be a strengthening process, he sees the aspiration as a weakening of muscle intensity. Turning aspirated stops into fricatives is a continuation of this weakening process. He postulates that the aspirated voiced stops were already fricatives in the pre-Germanic stage. The second process turning voiced stops into voiceless stops was caused by weakening of the vocal folds. The reduction of the vibrations of the vocal folds would have led to voiced stops becoming voiceless (taken from Boer 1924:136-137).

Although other literature claims a shift in manner of accent before the shift in place of accent, by looking at the information above we may conjecture that the changes happened the other way round giving us first a change in place before a change of manner, or at least a considerable overlap between the two.

10.4 The reasons for the accent shift

If we follow on from this theory then an explanation needs to be provided as to why the accent shifted position. We have already noted that the timings between change in place of accent and change in manner of accent seem to coincide, though they are not necessarily related. Hirt (1931:143-145), who attributes the majority of changes in PG to the strong dynamic accent, claims, because similar changes occurred in Romance and Celtic dialects, that this was due to the influence of a substrate language of the original inhabitants of Europe becoming Indo-Europeanised. We have however seen that the shift in manner of accent probably occurred after Verner's Law which itself occurred after Germanic had split from the other languages. If the indigenous peoples of Europe had mastered a pitch accent by the time Verner's Law took place then we have to look for some other reason for these changes to have occurred.

In a study by Hayes (1985) he noted that languages where there is quantity sensitive stress, i.e. stress only falling on long syllables, with short syllables being unstressed then the rhythm of the language will be iambic, meaning that the feet will be LH, with greater final stress in the feet. If however stress is quantity insensitive, so that stress can fall on both long and short syllables, as was the case in PIE then the rhythm of the stress system is trochaic, meaning that the feet will be HL, with greater initial stress in the feet.

It was also noted above that if there were two morphemes in a word both having accent then primary accent would fall on the leftmost accented syllable. This means that before the languages split from PIE, there was already an inherited trend towards the initial syllable of feet being stressed and towards the first syllables in a word more likely to be accent-carrying than final ones.

In PG it was noted above that we had already had an early shift in position away from final position when the originally accented final syllable was a short open vowel. This change may first have occurred when the open syllable was phrase final. Hyman (1977:45) notes that final position is phonologically weak. He also notes (1977:42-43) that languages tend to assign accent to those syllables where a pitch change is most perceptible. If the pitch accent produced on the accented syllable involved a change in tone then because the vowel was short the tone may not have been able to change as much as for a vowel in a closed position or a long vowel. Without the full change in tone it may not have been felt to be accented in the same way as other accented syllables. We introduced earlier the concept of metatony where so called strong endings forced accent onto the penultimate syllable when the stem was accentless. This lack of indication that the final vowel was accented may have made these final weak ending syllables behave like strong endings.

Passy (1890:118-119) indicates that analogy plays an important role in language change and is one of the main motivations for accent displacement. If these phrase final short vowels were treated as accentless, then it is a short step to extend these to being accentless in all positions and not just when they are phrase final.

Now let us consider the other case endings. For PIE we have, as said, weak endings which take the primary accent in words which are unaccented, strong endings which trigger metatony again in words which are unaccented and finally de-accenting endings which force the accent onto the initial syllable in both accented and unaccented words.

It should be noted that for Proto-Balto-Slavic metatony ceased to play a role before case endings (Kiparsky and Halle 1977:213). This meant that if the stem was unaccented then the primary accent would be placed on the initial syllable. It should also be noted that Celtic and Italic languages also had a shift in accent onto the initial syllable as in PG (Prokosch 2009:118-120, Hirt 1931:51). This first loss of metatony as described for Proto-Balto-Slavic may not have been restricted to this dialect group but could have been a general trend in the PIE dialects of Europe. Metatony seems to have been a weak rule in these dialects which was readily dropped in all of them.

Note above that Voyles claims a shift first in East Germanic before the other dialects. The process would probably have happened at different stages throughout the Germanic dialects. Taking into consideration the changes that also occurred in non-Germanic languages it seems that we may have a case of drift as described by Sapir.

A shift in some weak endings to strong endings followed by loss of metatony in PG would go part way to simplifying the complex system of stress placement in early PG and would make more words accented on the initial syllable. For unaccented stem words, this would leave us with accent either falling on the first syllable or on the ending.

As noted by Voyles in nominal declensions, end stress only occurred in the genitive and dative, and for the majority of nouns only then in the plural. The vast majority of nouns then would have had stem stress.

Many of these stressed stem words had initial stress, so it seems likely again that the only words with stress on a syllable other than the initial syllable or ending were those with original fixed stress. These would have been in the minority, and in some situations, as when followed by de-accenting endings, they too would have shifted their accent to the first syllable. Hyman (1977:46) states that stressed syllables are best perceived when they are flanked by unstressed syllables. Words in PG with final stress would have been next to words with initial stress. These would then have been in weak positions to be perceived as having stress, which would be another possible motivation to move the stress away from this position.

Passy (1890:118-119) also notes that rhythm may play a role in shifts in accent position. If now we have the situation that words are stressed mainly on the initial syllable but occasionally on the ending then we may see rhythm playing a role here too. A word with stress on the first syllable of a non-monosyllabic ending may start to develop secondary stress on a syllable non-adjacent to it in the stem, the most likely position being the initial syllable. This is indeed the case in samples of world languages (Hyman 1977:46). Those with stress on the first syllable usually have a secondary stress on the penultimate syllable, whereas those with penultimate primary stress have secondary stress on the initial syllable. If the primary accent diminishes and the secondary accent increases then this secondary accent could eventually become primary. Motivated also by other words having primary stress on the initial syllable analogy would play a role at this stage.

It seems likely that stress for PG speakers would have started to take on a demarcative role, as opposed to its former morphological role in PIE (cf. Hyman 1977:39-41). With demarcative stress the closer this falls to the morpheme boundary obviously the better. In Hyman's database of languages this most often fell on the first syllable. The increase in words displaying initial stress in PG would in itself have been a trigger to perceptions of the role of stress as demarcative. Hyman (1977:44) notes that demarcative stress is an aid to comprehension, which seems a likely explanation for further changes in the position of accent.

Now if accent has shifted to the first syllable in a word, then as the accent is pitch determined and this pitch is high, this first syllable, and with it the indication that there is a new word, will be indicated by being high and subsequent syllables will then have lower fundamental frequencies and consequently be produced with less intensity. Bennett (1972:111-112) states that the resultant stress pattern in PG was fixed on word initial syllables. Secondary stress would occur on second elements of compounds, or quasi-compounds. Unstressed syllables therefore occurred medially or finally between stressed syllables. As mentioned, rhythm played a role so every other 'odd' syllable would have had more intensity i.e. higher frequency than the medial 'even' syllables.

Because the accented syllable has become demarcative, for the speaker this first syllable has also become the important syllable in the word. The speaker will then give this syllable more intensity and the listener who knows the language will also perceive the raised pitch and importance of this first syllable as being due to intensity. For the speaker and the listener then, although change in pitch is still present it now plays a secondary role in their understanding of stress. As far as the users of PG are concerned they are now speaking a stress accented language.

The question remains as to why this has led to the gradual erosion of final syllables and consonants in coda position in the Germanic (and Celtic) languages whereas languages such as Czech and Finnish, also with accent falling on the initial syllable have not gone through this process. We noted above that for speakers of Czech, duration does not play a significant role in perception. This may be a clue as to the underlying differences between the languages. We shall return to the Czech and Finnish situations again in section 12.2.2. The next stage is therefore to explain the reasons these accent shifts trigger Germanic weakening processes.

11 Syllable structure

Having understood the reasons for the shift in stress in the Germanic languages we can now turn to the relevance this had in relation to Germanic syllable structure. The syllabic structure within Germanic languages will shed light on which of the features of stress is more prevalent in the early dialects and has subsequently had an influence on all future Germanic dialects.

11.1 The heavy root syllable

It should be noted from Chapter 10 above that the shift in accent meant that the root syllable coincided with the stressed syllable. Also as the stressed syllable placed importance on pitch, and subsequently intensity and weight, this implies that the root (provided this was only one syllable long, as is the case for most Germanic roots) also shared this prominence, which in turn affected the syllabic composition of the stem syllable. As this initial stressed syllable was identical to the stem in words with mono-syllabic stems it also gave the stem a prominent role semantically. We shall see in 12.2.2 the effect this had on later features of the Germanic languages such as umlaut which is one factor differentiating them from other language families.

11.2 Morphological considerations

There are a number of clues from the early languages which enable us to see what effect this prominence had on the syllable structure. An initial clue can be seen from how the early dialects coped with words where the coda consisted of two consonants with the second being more sonorous than the first. This most commonly occurred when a semantic morpheme was added, such as the causative where -j- was inserted between the verb root and the verbal inflection (with or without a vowel change), though there are also non-causative verbs with a similar structure. An example of this is the weak verb of PG **satjaną* meaning ‘to set’. The relevant question here is how this is syllabified. There are two possibilities; we either have [ˈsat.ja-] or we have [ˈsa.tja-], both of which are problematic. [ˈsat.ja-] is problematic if we consider Vennemann’s Contact Law which states (1988:40):

> “Contact Law
>
> A syllable contact $A^{\$}B$ is more preferred, the less the Consonantal Strength of the offset A the greater the Consonantal Strength of the onset B; more precisely - the greater the characteristic difference CS(B)-CS(A) between the Consonantal Strength of B and that of A.”

The contact in the syllables given in this example is between coda [t], arguably the strongest of the consonants, and onset [j], among the weakest of the consonants.

The second possibility, [ˈsa.tja-], is problematic if we consider Vennemann’s Weight Law (1988:30), which is also known as Prokosch’s Law (Prokosch 2009:140), which looked specifically at the situation in Germanic languages and so is extremely pertinent in this present discussion.

> “Weight Law
>
> In stress accent languages an accented syllable is the more preferred, the closer its syllable weight is to two moras, and an unaccented syllable is the more preferred the closer its weight is to one mora. (The optimal stressed syllable is bimoraic; the optimal unstressed syllable is unimoraic).”

For [ˈsa.tja-] we have a unimoraic stressed syllable.

We can see that neither of these situations was ideal and the Germanic languages dealt with the situation in different manners. If we consider the West Germanic languages we find Old English had *settan*, Old Frisian had *setta*, Old Saxon had *settian* and Old High German had *sezzen*. So in all of these languages we find a geminate which is equal to the coda [t] (apart from Old High German which underwent additional consonantal changes in addition to gemination). In all of these dialects apart from Old Saxon the [j] has also disappeared. Note that the vowel [a] of the root has undergone i-umlaut, i.e. has become [ɛ ~ e] in these languages and the change in vowel indicates the former presence of [i ~ j]. We see from Old Saxon, though, that the [j] (or at least [i]) has remained. Geminates are such that across syllable boundaries each element of the geminate will fall into separate syllables, so by making the coda geminate it allows for the initial syllable to be bimoraic, but also gives the second syllable a better onset.

Old Norse still had *setja* where i-umlaut had occurred but it had retained the awkward original form across the syllable boundary. We find though that Swedish, Norwegian and Danish followed a later similar path to West Germanic with the forms *sätta* in Swedish, *sette* in Bokmål, *setta* in Nynorsk (in all of which the [t] is a geminate) and Danish has *sætte* where subsequent degemination has occurred. Contrastingly we find Faroese *seta* which is pronounced [ˈseː.ta] where the [j] has been dropped and the [t] becomes an onset, but in order to preserve the bimoraic stressed syllable the [e] is lengthened. Icelandic is the only modern dialect to preserve the form *setja* but here the [e] is also lengthened and the word is syllabified as [ˈsɛː.tja].

In PG we commonly find sonorous sounds in the second syllable onset position which were all liable to similar types of changes as that mentioned, where two features were necessarily preserved in order to form more optimal syllables, namely bimoraicity and greater abidance to the Contact Law.

11.3 Degemination

The rules are preserved if the languages retain their geminates as in the non-Danish Scandinavian dialects. However the situation is complicated in cases where we find degemination. Kirchner (2001:3) lists processes which may uncontroversially be classed as lenitions which he classes as a reduction in either constriction degree or duration. The change from a geminate such as [t:] to a simple consonant [t] would thus be classed as a lenition and therefore a not unexpected outcome in the history of languages. This is a process which has occurred in many of the Germanic dialects which originally allowed geminates. This process however causes difficulties when considering syllabic structure. A word such as *happy* in English formerly had a geminate [p:] where this [p:] could be split across syllables to give [ˈhæp.pɪ]. This has since degeminated and causes problems for English speakers as to which syllable the [p] belongs to. Another example from English is the treatment of /t/ in a word like *better*. There are many varieties of English where a word such as *bet* may be pronounced [bɛʔ]. The sound [ʔ] as an allophone of /t/ is often restricted to coda position in English. There are dialects with a coda glottal where in a word like *better* the /t/ would be pronounced as [t], which would indicate that the /t/ is not in coda position, however there are other dialects where the /t/ will be pronounced [ʔ], limiting its distribution to coda position. In the word *better* then it is once again difficult to decide if the intervocalic sound is a coda, onset or something else.

One way to remedy its ambiguous nature is to treat it as an ambisyllabic consonant, so belonging to both syllables. The following section will discuss this idea of ambisyllabicity in various Germanic dialects.

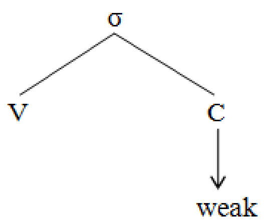
11.4 Ambisyllabicity

Ambisyllabicity is claimed as a feature of German by Vennemann (1982:280-281). His arguments include that short vowels necessarily only occur in closed syllables so in a word such as /ʁɔbə/ *Robbe* ‘hedge’ the syllable containing /ɔ/ necessarily requires a coda as it is a short syllable. However an analysis of /ʁɔb.ə/ would also be wrong. German has a rule of coda devoicing. If the /b/ is in the coda then it must appear as /p/ which is not the case. He concludes that the /b/ must be, what he calls, a link between the two syllables i.e. ambisyllabic.

Borowsky, Ito and Mester (1983) argue similarly for ambisyllabicity in Danish. They consider three features of Danish which indicate that certain consonants behave both as the onset of a syllable and the coda of the preceding syllable.

They first discuss consonant gradation (CG) which they define as:

a)



b)

Underlying		Surface
voiceless	→	voiced
voiced	→	spirant

Figure 63

That is, underlying voiceless obstruents /p/, /t/, /k/ become voiced and underlying voiced obstruents /d/ and /g/ (but not /b/) become the fricatives /ð/ and /ɣ/ respectively when these consonants appear in coda position.

The second feature is grave assimilation (GA) affecting the vowels [a] and [ɑ], which they define as:

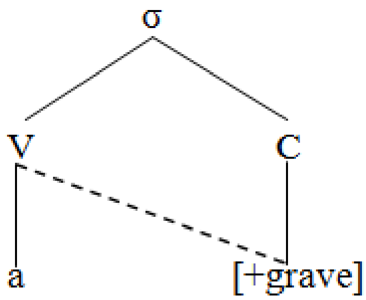


Figure 64

That is that the vowel /a/ becomes [ɑ] when the syllable is closed by a grave consonant. (Following the definition from Jakobson, Fant and Halle 1952:29 this links coronals and front vowels as acute and back vowels and non-coronals as grave.)

The final feature they consider is Stød Association (SA) which they define for stressed syllables as:

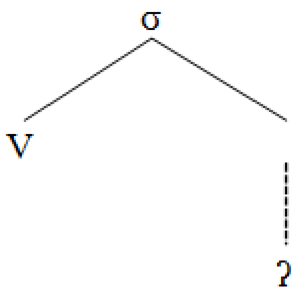


Figure 65

That is, if a vowel is long it will bear the stød [ʔ], however if the vowel is short the stød falls on the sonorant consonant and if there is no sonorant consonant then the stød will not appear. In the following examples stød will be shown with an apostrophe following the vowel or the consonant to indicate that the previous sound bears the stød.

They give various examples where the rules apply, such as [ˈlɑbə] from underlying /lapə/ *to patch*, [ˈhun’ən] from /hunən/ *the dog*, and [ˈbæɣə] from /bægə/ *to bake*. The first of these examples shows both CG and GA, the second SA and the third CG. They give a second set, however, with the examples of [ˈkɑpə] from /kapə/ *kappa* which shows GA but no CG, compared with the similar example [ˈkan’ada] from /kanada/ *Canada* where the stød is placed on the consonant indicating that a consonant in this position is indeed part of the coda.

The difference between the two sets of words is that the first set are morphologically complex, whereas the second set are monomorphemic and they conclude that there is a cyclical interpretation with a word such as [[lap]ə] having CG occur on an earlier cycle, whereas this does not occur in a monomorphemic word such as [kapə]. They then introduce a gemination rule, which is defined as:

$$\text{Gemination:}\qquad \begin{array}{ccc} X & & X \\ X & \rightarrow & X\;X \\ \sigma & & \sigma \end{array}$$

Figure 66

which would add a second grid position to vowels under stress. This would link the syllables as follows:

$$\begin{array}{ccccccccccccc}
\text{a)} & X & & \text{b)} & X & & \text{c)} & X & & & & X & \\
 & X & X & & X & X & & X & X & \rightarrow & & X & X \\
 & \vert & \vert & & \vert & \vert & & \vert & & & & \vert & \vert \\
C & V & C & C & V & C & C & V & & & C & V & C
\end{array}$$

Figure 67

On a second cycle the CG rule needs to apply again. They give the example of an enclitic article /əd/ being added postlexically which does undergo CG, becoming [əð] on a later cycle to show that CG does still apply. This would give the derivations for the two words /lapə/ and /kapə/ as:

	ka.pa	lap
CG	-	lab
affix	-	lab+ə
Gemin.	C C	C C
	kapa	labə
GA	C C	C C
	kɑpa	lɑbə
SA	-	-
CG	-	-

Figure 68

In order to account for this second gemination not occurring they give a further rule applying to geminates stating: “No rule can apply to the melody element of a geminate structure unless both skeleton positions fulfil the structural description of the rule”, so a coda geminate cannot undergo weakening as the geminate onset would not undergo this same weakening. They conclude then that if the /p/ of /kapə/ were a coda then it should undergo weakening to /b/ which is not the case. Their interpretation then is that a short stressed vowel in Danish will be followed by a phonological geminate, even if this is not phonetically differentiated from a simplex consonant.

Hulst (1985) uses this interpretation from Borowsky et al to account for the distribution of short vowels in Dutch. Dutch short vowels cannot occur word finally, whereas long vowels, diphthongs and schwa may occur in this position. He analyses schwa as being a special case of a syllable which allows a short vowel to occur with no coda, because they have a distribution which behaves similarly to the long vowels. They will not be considered further here, but Hulst’s work considers them in more depth. He claims that syllables are necessarily of the form:

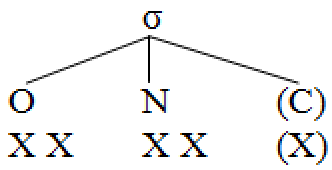


Figure 69

Key in this interpretation is that the nucleus contains two slots, but a short vowel is only able to fill one of those positions. A consonant must therefore be linked to this second empty nucleus position in order to ‘check’ the short vowel. If we consider strings of the type CVCVC where the first V is short to be syllabified as CV.CVC, so assigning the second C to the onset of the second syllable, then we would expect to see also structures of the type CV.VC with the first vowel being short. This, however, does not occur. In words such as *hiaat* ‘hiatus’ the first vowel /i/ is long /hi.at/ and a short */hɪ.at/ would not be possible. A further argument against this is with stress assignment rules in Dutch where a word such as *confetti* behaves the same as a word such as *agenda* so determines the penultimate syllable to be closed and thus heavy allowing it to take the stress.

If, on the other hand, this string is analysed as CVC.VC it would violate the Maximal Onset Principle and also, as with German, would require the coda C to be devoiced.

He therefore concludes that an intervocalic consonant following a short vowel must be both a coda and an onset.

For Germanic dialects which allow gemination they have bisyllabic trochees of the form ($\acute{\sigma}_{\mu\mu}$ σ_{μ}) where the stressed syllable is necessarily bimoraic and thus attracts a coda consonant. Where there are geminates this does not cause a problem as the first element of the geminate will therefore attach to the first syllable and the second element will form the onset of the second syllable.

Haugen (1982:24ff) explains the process (the Great Quantity Shift) as follows where overlong syllables were the first ones eliminated, such that *nátt* → *natt*, which occurred in Common Scandinavian. The short syllables were eliminated later by either lengthening the stressed vowel or geminating the following consonant depending on the dialect. This situation can be summarised below.

ˈcvvc.cv	→	ˈcvc.cv		
ˈcv.cv	→	ˈcvv.cv		
		ˈcvc.cv	Minimal	σ́ bimoraic (V or C lengthens)
(ˈcvv.cv	→	ˈcvv.cv)		
(ˈcvc.cv	→	ˈcvc.cv)		

11.5 Summary

One feature that we find throughout this section has been the pervasiveness of bimoraicity in Germanic dialects as a result of the stress shift as described in Chapter 10 and evidenced by syllabic considerations at the start of this chapter. Coupled with the idea of bimoraicity is the gravitation of consonants towards coda position in stressed syllables. We can show the problem better with Figure 70 where σ indicates the syllable, O the Onset, R the Rhyme and N the nucleus.

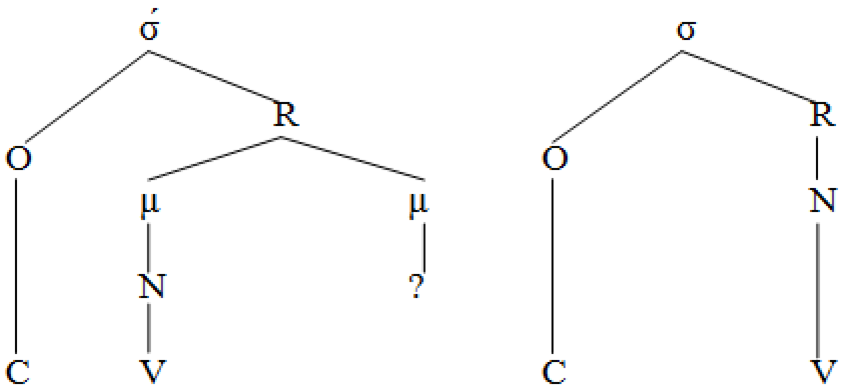


Figure 70

The question is what the additional mora in the rhyme of the stressed syllable should attach to. Although we do encounter cases where this attaches to the vowel to produce a long vowel (as in Icelandic and Faroese), we have more often encountered gemination where the following onset consonant becomes a coda. As geminates existed anyway in PG (compare **xattuz* 'hat') this was an allowable solution to the problem, albeit one that violates restrictions of changes to the original form. We therefore have the situation solved with the following diagram for early Germanic dialects where Cd represents the coda:

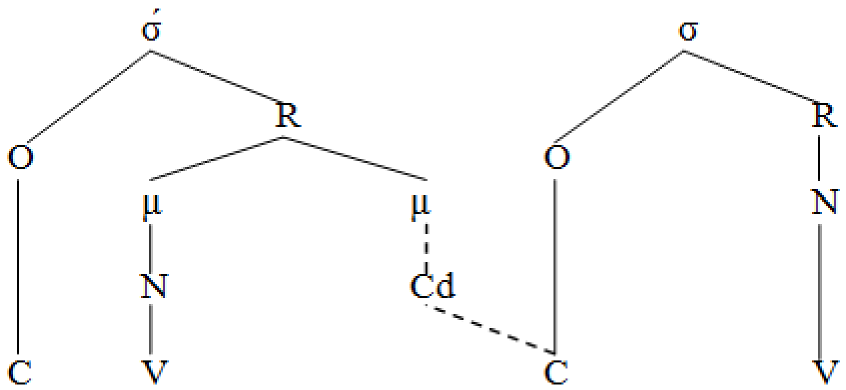


Figure 71

When later changes eliminated unstressed vowels the position of the onset consonant was easily solved as it already filled the coda slot in the initial syllable. If the link between the second mora and the following consonant had not been established then we would have a floating consonant which could variably be considered the onset of a syllable with an empty nucleus slot, we could attach it directly to the stressed syllable, by-passing the rhyme, thus not being moraic, or we could attach it in the same way as the most frequent Germanic situation to the rhyme so that it fills the coda position and makes it moraic. As this is the main path open to Germanic languages it means the link between a coda consonant and moraicity in Germanic is defined from an early stage which in turn explains why in Germanic lenition processes a coda consonant will more often retain its moraic status and instead of disappearing will instead become vocalic. This is not to say that this path is not one taken by other language families but it does explain the preponderance of vocalisations found within the Germanic language family.

12 Why do giraffes have such long necks?

Why have giraffes evolved to have such a long neck? There are two main theories about why a giraffe's neck has evolved to be so long. The first is that it enables them to reach higher in branches of trees and the second is that a longer neck is considered more attractive in the giraffe world.

One thing to note though is that with each new generation, they didn't decide to have a longer neck, but for whichever reason, a longer neck was seen as an advantage and the neck continued to grow so that several million years later giraffes now have impressive necks.

Seeing as this is a thesis about linguistics and not about giraffes, this is of course an analogy. No generation of speakers of a language decides how its language will change, and we cannot speak about an ultimate goal of a change, but rather a single change in the language may be considered advantageous in some way and so is adopted by future generations. However, as with giraffes, where those animals with stronger longer necks are considered more advantageous, we see tendencies in related languages which do not appear to be random in nature. Each new generation of giraffes did not see reaching the top leaves of trees as the ultimate goal, but rather they found a longer neck was more advantageous, thus neck length followed what appeared to be a trajectory of change, albeit a non-predefined one, which was made possible by anatomical factors of giraffes.

In order to understand what is happening with giraffe neck length we need to understand that it stemmed from an initial mutation which produced a longer neck in some animals and then we need to consider the factors which have kept it on its trajectorial path; the juicy leaves and the sex appeal. As these motivating factors have remained relevant throughout the evolution of giraffes, neck length has continued to increase.

If we consider diachronic change to be evolutionary in nature then similar changes that take place in related languages which apparently occur after contact is broken may be considered trajectorial. Sapir (1921:157-182) was the first to formulate such an idea in his description of 'drift'. Once dialects of a language no longer have contact with each other they drift from the mother language and consequently diversify (p162). He speaks of language change as being "constituted by the unconscious selection on the part of its speakers of those individual variations that are cumulative in some special direction". He continues to talk about the trajectorial nature of change, as discussed above by saying "This direction may be inferred, in the main from the past history of the language" (pp165-166). Instead of trajectories he speaks of the 'slope' of a language and that tendencies in the current language can become the norm later, which presumably in turn will push these tendencies further.

To say, though, that all change is trajectorial would obviously be an oversimplification, and it would be foolish to claim such a thing. There will always be other factors which could influence change, so that there will always be other changes within related languages which evolve in completely different directions. If we consider another analogy of throwing two balls in an open field with roughly the same strength and an equal trajectory, then they will probably land in more or less the same position. But if we change the starting point and instead throw the two balls from the top of a windy mountain then we should expect the balls to bounce off rocks and trees and be blown around such that they will probably come to rest in very different positions. In order then to understand language change that appears to be more random in nature, we would need to find what the rocks and trees are and in which direction the wind has blown.

Before I turn to how this can be relevant to an analysis of Germanic vocalisations, I shall demonstrate a few cases which appear to be trajectorial in nature.

In Sapir's initial commentary on drift he points out the demise of 'whom' in favour of 'who' in American English (pp166-176). He suggests some factors behind this change by looking at the history of English. He draws attention to the loss of the accusative/dative distinction mainly due to sound changes which simplified the language giving greater importance to word order. The personal pronouns show a distinction between subject and object, but the interrogative pronouns who/whom stand isolated from these other pronouns and thus have the potential to change in a separate way.

It is interesting to note that in describing this change he is just referring to American English in his description, but an identical analysis could also apply to other Englishes. The motivation for the change and factors facilitating it are identical in each variety.

If we accept this idea of trajectorial change then it is clear that to fully understand the nature of the specific change we will have to discover the initial mutation and the motivation to keep the change on its trajectory.

Trudgill et al (2000) examined changes in New Zealand English which, although mirroring changes happening in other Englishes, appeared to occur independently of these other Englishes. They divided Sapir's definition of drift into two subtypes. Type 1 were those where a change is underway when dialects are split which continue to drift along the same path, and Type 2 covered those where an identical or similar change occurs independently in both languages after they have split, saying that both languages "inherit shared *tendencies* or *propensities*" (p112). They emphasise that the two types do lie on a continuum and should not be treated as radically different from each other, an assessment which will be returned to later in 12.1.

Their research looked at various New Zealand phenomena which they divided into the two types. They gave diphthong shifts as a continuation of the Great Vowel Shift, the fronting and lowering of the *STRUT* vowel, and loss of rhoticity as being examples of changes which were also underway at the time of the first settlers and continued along a similar path to changes throughout the Southern Hemisphere and also to some dialects of Britain. Examples of type 2 innovations which also occurred elsewhere but seemed to arise independently were *HAPPY*-tensing (so the change from /ɪ/ to /i/ in the second syllable of a word like *happy*), glide weakening (which seems to coincide with general diphthong shifts mentioned for type 1), and the fronting, raising and rounding of the *NURSE* vowel which mirrors other Southern Hemisphere Englishes, but is less common in, although not absent from, British English varieties.

They had the benefit of early New Zealand recordings so were able to show if the changes were ongoing or innovative by recordings from some of the earlier settlers compared with those of later second or third generation New Zealanders to show that these changes were indeed as they claimed.

Britain and Sudbury (2002) also looked at Southern Hemisphere Englishes and compared the shift of the grammatical feature of ‘there are’ followed by plural nouns becoming ‘there’s’ which is apparent in both New Zealand and Falkland Islands English. They claim it as another example of a type 1 change as given by Trudgill et al above, so already present in British English varieties before the two separate areas were settled.

The question arises as to whether type 1 changes which are already present in a language before the dialects split are fundamentally different from type 2 changes which occur seemingly independently in the two varieties after they have split. I would argue that type 1 changes are just further along a general trajectory of change and a type 1 change which is occurring in both the varieties may form the basis for a later type 2 change.

12.1 Type 1 and Type 2 changes

We have seen the two types of drift, one an inherited ongoing change, where both split dialects continue along a trajectory, and one where a propensity for change is inherited, which later appears as an innovation in both dialects. I would suggest they are both part of the same process and the innovation is purely the end point of whatever change is underlying. It certainly depends on the languages involved so will be language specific, but it still involves universal tendencies such as weakenings occurring, determined by ranked underlying constraints which are shared and dominate when other constraints are demoted. So constraints which do not play a main role in synchronic rankings become more significant when these more highly ranked (synchronically significant) constraints have been demoted.

Note though that each new generation will relearn and reassign their constraint ranking so perception of a constraint can fundamentally change if it is understood differently by the next generation. For any individual they might have gradual reranking during their lifetime, but across generations with a different perspective of how the language works there can be quite dramatic rethinks about constraints. An example of this will be given in 12.2.

If we have independent changes occurring in separated dialects, i.e. cases of drift, then a feature must exist which both varieties share which will initiate the change. In type 1 changes this will be obvious, as the drift can be seen already in its infancy in common earlier varieties. Type 2 changes, though, do not show this commonality in earlier varieties and therefore a shared feature which triggers the later change needs to be found, but it is not always immediately evident what this shared feature is.

In the case of vocalisations in Germanic languages, we have a type 2 drift scenario, where the dialects, long after splitting, have displayed many vocalisations. The following sections will show what these underlying features are.

12.2 OT and language change

I am choosing to use Optimality Theory here to show what occurred in Germanic fully aware of its limitations. OT is a wonderful model when describing synchronic usage of an individual, but given its strict rankings it can struggle when dealing with variation and change. One modification to OT which aims at dealing with variation is Stochastic OT. This allows for a less rigid ranking such that two constraints may be alternately ranked.

Such a model will, however, still have limitations. The alternate rankings will still be based within a rigid framework of other constraints so can explain why individuals have alternate forms or can change slightly throughout their lifespans, but the said individuals will still be limited within the general ranking of constraints which they have internalised and we would not expect to see radical changes in these rankings for any individual[12].

Language change however often involves cases of reanalysis such that features of a language which are important to one individual may be perceived differently by another individual and other generations such that rankings of some constraints may dramatically differ even though the surface optimal form is very similar.

A hypothetical example of this could be the change in perception of vowel length into one of vowel quality. One generation has vowel length as an integral feature of their phonology. Long vowels have more time to form than short vowels such that a side-effect of long versus short vowels is that long vowels tend to be more peripheral than their short counterparts. So although this hypothetical first generation perceives vowels as being long and short they may also produce them with slightly different qualities with the shorter vowel being slightly

[12] A radical reranking may be the case if an individual suffers from a stroke, for example, but I don't know of any studies which have researched this, but it would be an interesting point of further research if such a study has not been undertaken.

centralised. So for this generation a perceptual constraint governing vowel length will be ranked highly whereas one involving vowel quality between pairs will not be relevant so will be lowly ranked and lurking in the realms of those constraints which never play a role at surface level.

A second generation though may perceive that although there is a vowel length difference the vowels consequently also differ in quality. For these individuals both features of the vowels may be potentially used to differentiate sounds. A constraint governing vowel quality for the pairs involved can thus be perceived as being similarly ranked to one limiting a perceptual cue to vowel length.

A further generation may then again reanalyse the vowels such that they perceive vowel differences based on the quality of the vowel and not on the vowel length. A side-effect of producing tense vowels is that they take more effort than lax vowels and therefore tend to be slightly longer than their lax partners. However vowel length for these individuals is no longer used as a perceptual cue and this means that a constraint for perception of vowels based on their quality will be highly ranked, whereas one based on vowel length may have been banished to obscurity.

The following Table 25 shows this scenario based on the original vowels /iː/ and /i/:

Generation	Perceptual Cue	Phonology	Realisation
1	Quantity	/iː/, /i/	[iː], [ï]
2	Quantity and Quality	/iː/, /ɪ/	[iː], [ɪ]
3	Quality	/i/, /ɪ/	[iˑ], [ɪ]

Table 25

It can be seen that the realisation of the vowels between the first and third generations changes very little but the ranking of the two perceptual constraints between these generations may be radically different. Much of the difference between individuals can therefore be explained by their different analyses of features even though different rankings can produce very similar results.

Reanalysis of constraints must therefore always be considered when describing differences between individuals and inevitably when describing diachronic change, although a reanalysis may well be the result of a secondary phonetic consequence of the primary phonological features. It will be shown that reanalysis is an important factor in describing the Germanic situation and that the change from the phonological stress pattern of PIE to the demarcative stress as found in PG (and outlined above in chapter 2) is the key to understanding why the coda lenition process in Germanic languages so often results in vocalisations and not elisions. The results of the vocalisations will be analysed in Chapter 13 below.

12.2.1 The stress changes in Germanic

PIE stress placement was described above as phonological. Both a stem and an ending could have stress where the leftmost stress became the primary stress. If the stem did not have stress and neither did the ending then the stress would fall on the leftmost syllable.

In Kiparsky and Halle’s analysis of PIE stress (1977:209-210) they analysed this with two rules which acted as constraints. The Primary Accent Rule (PA) determined that each word had only one primary accent and the Basic Accentuation Principle (BAP) determined that the leftmost accented syllable should take the primary accent and if no phonological accent is present then this should fall on the first syllable.

Within an OT framework for PIE stress placement we shall therefore consider the following constraints:

PRIMARY ACCENT RULE (PA)

There is one and only one primary accent per word.

The BAP contains two constraints; first that if more than one stress is present in a word (so one on the stem and one on the ending) then the leftmost stress will be primary. Secondly that if no stress is present then the leftmost syllable will take the stress. As stress is phonologically determined we therefore need a correspondence constraint to ensure that a phonological stress surfaces:

IDENT-IO(stress)

Correspondent segments in input and output have identical values for [stress].

and then we need to ensure that the leftmost stress surfaces as dominant if there is more than one phonological stress across the word, giving:

LEFTMOST

Align (Hd-Ft, Left, PrWd, Left)

The head foot is leftmost in PrWd.

PA must outrank IDENT-IO(stress), to limit the situation where stress appears on both a stem and an ending, which in turn must outrank LEFTMOST, although this must be ranked to ensure that if no stress is phonologically determined on either the stem or the ending then this stress will fall on the initial syllable. The following examples are for the PIE words **d^h^og^hw^éso* 'day-GEN.SG' (where the stem **d^h^og^hw^*- does not have phonemic stress) and **H₁éḱ^w^eso* 'horse-GEN.SG' (where the stem **H₁eḱ^w^*- does have phonemic stress). The genitive singular ending -*eso* has underlying ending stress on the first syllable.

*d^{h}og^{hw}- + *-éso	PA	IDENT-IO(stress)	LEFTMOST
*d^{h}óg^{hw}éso	*!	*	
*d^{h}óg^{hw}eso		*!*	
☞ *d^{h}og^{hw}éso			*

Table 26

*H$_1$ék^w- + *-éso	PA	IDENT-IO(stress)	LEFTMOST
*H$_1$ék^{w}éso	*!		
☞ *H$_1$ék^{w}eso		*	
*H$_1$ek^{w}éso		*	*!

Table 27

The first change we encounter to the stress system of PIE on its path to PG was that ending stress became metatonic (for a description of this see 10.2 above) if the ending stress fell on a short vowel. This implies that stress required at least bimoraicity to be allocated, remembering that metatonic stress places stress on the final syllable of the stem.

PIE stress is described in the literature as having a pitch accent. The link between pitch, length and intensity was described in 10.3 above. This introduction of a length rule into the placement of stress implies that the perceptual cue for stress was no longer just a recognition of pitch, but also one of length.

We have the following situation for PIE prior to the rule (for the strong verb past tense stem **b^{h}ēr-* ‘carried’ with the 1st person indicative past plural ending **-é*):

*b^{h}ēr- + *-é	PA	IDENT-IO(stress)	LEFTMOST
*b^{h}ḗré	*!	*	
*b^{h}ḗre		*!*	
☞ *b^{h}ēré			*

Table 28

With the introduction of the length constraint:

FT-BIN(μ)

Feet are binary under moraic or syllabic analysis

We get the following ranking (assuming that sound changes had taken place prior to changes in stress as Verner's Law implies):

*bēr- + *-e(with ending stress)	PA	FT-BIN(μ)	IDENT-IO(stress)	LEFTMOST
*bḗré	*!	*	*	
☞ *bḗre			*	
*bēré		*!		*

Table 29

Notice that here FT-BIN(μ) outranks IDENT-IO(stress) as a higher ranking of the latter would place the stress on the final mono-moraic syllable.

The next change was the loss of metatony. This was only ever a weak rule in PIE and only survived in Sanskrit. As this loss only occurred at a phonemic level it did not affect the ranking as described above.

The next change to have occurred in Germanic languages was the rise of secondary stress. Proto-Germanic by this stage had many words with initial stress and a few with penultimate stress and on single syllable stems with mono-moraic endings these would have been identical anyway.

It was described in 10.4 above that in the majority of languages with primary penultimate stress there is a secondary stress on the initial syllable. If this were the case in Germanic with those words which had penultimate stress a consequence would be to put secondary stress on the initial syllable of the stem of the word. This has the consequence that the primary stress will shift from the penultimate syllable to the initial syllable.

This change can be explained with a simple reranking from

IDENT-IO(stress) >> LEFTMOST

to

LEFTMOST >> IDENT-IO(stress).

We now have the situation that non-initial stress occurs very infrequently and mainly on stems with no endings. The final change is the analogical shift in stress in these words to the stem initial syllable. A child learning the language at this stage will therefore perceive stress as demarcative and not phonological. The constraints which deal with phonological stress are therefore no longer relevant and will be lowly ranked, so PA which ensures that there is only one stress in a word and IDENT-IO(stress) which preserves a phonological stress may all be demoted which leaves us with the situation where we just have the highly ranked constraints FT-BIN(μ) and LEFTMOST, the ranking of which is unimportant.

Following from reduction of unstressed syllables, we often, in the modern dialects, find single syllable words. Also with the introduction of foreign loan words into Germanic languages which do not follow this stress pattern a constraint such as LEFTMOST is losing its relevance and being ranked more lowly.

This in turn has left us with the constraint FT-BIN(μ) which, when applied to a single syllable word, will require a bimoraic structure of this syllable. We consequently have a move away from feet being necessarily bimoraic to a stressed syllable being bimoraic. The bimoraicity is then reanalysed as stressed syllables needing two moras which can be shown with a high ranking of the constraint:

STRESS-TO-WEIGHT (S-W)

If a syllable is stressed, then it will be heavy.

12.2.2 Syllabic considerations in Germanic

We shall now consider the syllable structure in Proto-Germanic. We have again seen from Chapter 11 that the bimoraicity of stressed syllables is very important. Because of a need to have a bimoraic syllable we have seen that we have the following situation where the stressed vowel necessarily either lengthens the vowel or attaches to a following consonant:

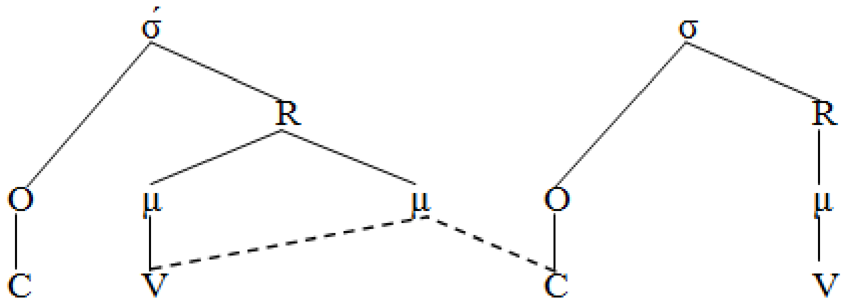


Figure 72

In the majority of cases we saw that the option of applying this moraic element to the consonant was preferred. This was the case in West Germanic and Eastern Continental Scandinavian, whereas vowel lengthening was preferred in Western Scandinavian. Later degemination in Western Germanic and Southern Scandinavian has resulted in ambisyllabicity as outlined in 11.4.

Reductions of unstressed syllables have added to the moraic structure and therefore positioning of coda consonants within the stressed syllable. As yet the reasons behind these unstressed vowels leniting has not been addressed, but it is important it shows why languages like those of the Germanic family behave this way, but languages such as Czech and Finnish, which share initial stress, do not.

There is some debate as to the exact vowel inventory of Proto-Germanic which partly depends on which stage in the development of the language the inventory is taken from, but there is consensus that the inventory was small. Campbell (1959:38) gives it as that shown in Figure 73 (not including diphthongs):

Short			Long	
i		u	ī	ū
e			ē	ō
	a		ǣ	

Figure 73

Comparing this to a language such as modern Danish (again not including diphthongs), for example which is given in Figure 74 (Braunmüller 1999:99-103):

Short				Long			
i	y		u	iː	yː		uː
e	ø		o	eː	øː		oː
		ə					
ɛ	œ		ɔ	ɛː	œː		ɔː
a	a̠	ɐ	ɑ	æː		aː	ɒː

Figure 74

shows that the inventory size has greatly increased. Danish is an extreme example, but all the Germanic languages have larger than average vowel inventories; Maddieson's (1984:126) UPSID database has a modal number of vowels as five.

One factor which has contributed to this increase in size is umlaut which is a form of vowel harmony where unstressed vowels may anticipatorily change the quality of the vowel in preceding syllables. So i-umlaut, for example, is such that if [i] or [j] occurs in an unstressed syllable, a preceding stressed vowel may adopt some qualities of this vowel in anticipation, making back vowels front and raising low vowels. By undergoing umlaut the grammatical information provided by the unstressed syllable is incorporated into the stressed syllable. As the grammatical unstressed syllable now provides no additional information it may lenite and eventually disappear.

Another factor is that discussed above. Where vowels are in open syllables in Germanic languages they have developed different allophones from those in closed syllables. If grammatical information is given by a root being followed by an unstressed syllable as opposed to a root with no subsequent syllables then this information will again be obvious from the change in vowel quality of the root.

This situation differs from Czech in that there is little to no difference in the vowel of a stressed first syllable depending on the subsequent unstressed syllable. The grammatical information contained in the subsequent unstressed syllables prevents these from leniting.

Finnish does have vowel harmony, but it acts in the opposite direction to early Germanic languages in that the stressed root vowel will affect subsequent affixes. The affixes can therefore not be reduced as these are the only indicator that the grammatical information is present which prevents lenition.

When the vowels in unstressed syllables lenite and disappear in Germanic we are left with the following situation:

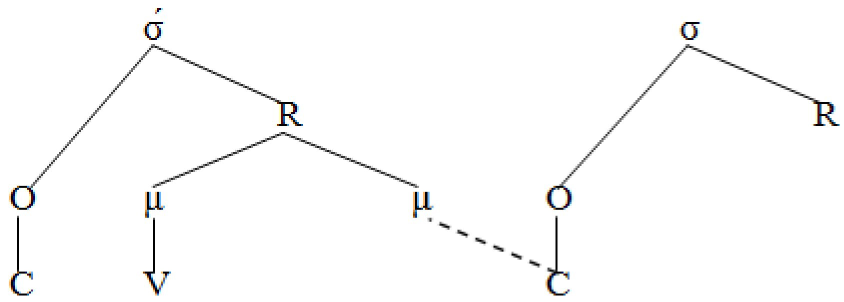


Figure 75

i.e. a rhyme-less unstressed syllable. This onset consonant already has a place automatically available in the initial syllable, provided the initial syllable contains a monomoraic vowel. So we have the situation:

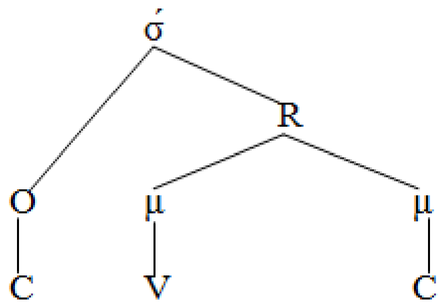


Figure 76

where the 'empty' syllable may be dropped.

For other languages which do not have such a high ranking of FT-BIN(μ) or indeed of LEFTMOST, although connecting this former onset onto the previous rhyme is an option, it is one of a number of options. It may, for example, remain in an empty syllable slot and behave like a separate syllable, it may attach to the previous syllable's rhyme and gain a mora, as with Germanic languages, or it may attach to the previous syllable but be extra-syllabic and non-moraic. This may also depend on the nature of the consonant in question. More sonorous consonants are more likely to attach and become moraic, whereas less sonorous consonants are less likely to do so. We find for example in French that historically /l/-vocalisation has occurred which would indicate that it was moraic in coda position, however /r/-vocalisation does not occur, instead we find elision which would indicate the non-moraic nature of coda-/r/ in the language.

We are also left with this choice in Germanic languages if the stressed syllable contains a long vowel such that prior to the unstressed vowel eliding we have:

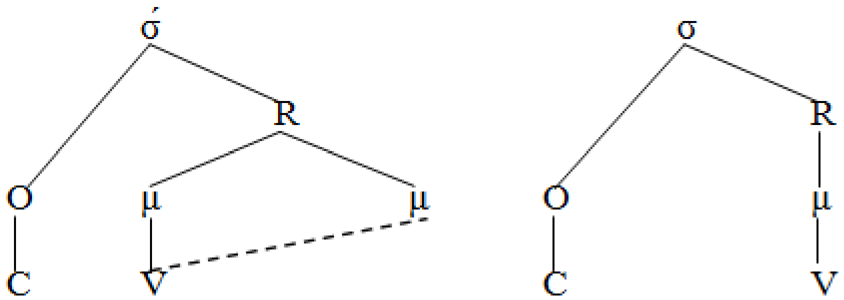


Figure 77

And elision of this unstressed vowel produces the situation:

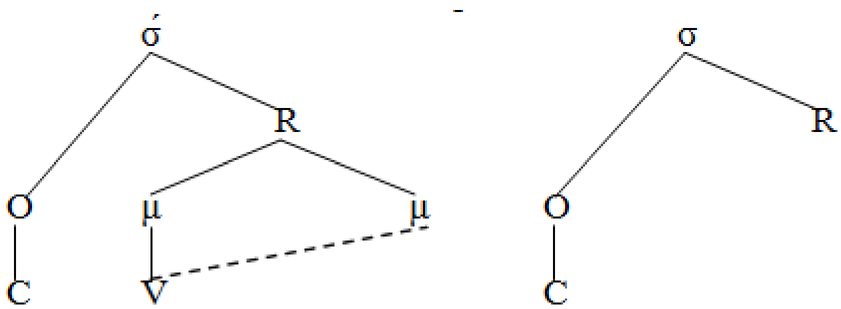


Figure 78

As the option of joining a consonant onto a rhyme and making it moraic is open to and indeed necessary for stressed syllables with a short vowel this is one option open to this onset consonant.

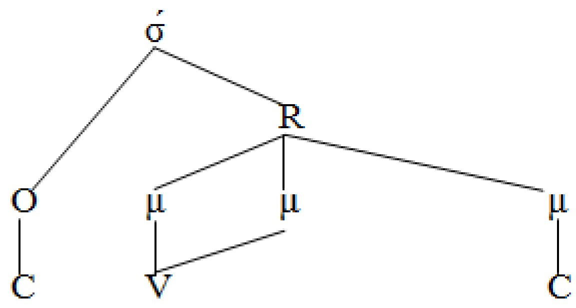


Figure 79

However this would lead to a trimoraic rhyme which would be marked and so should be avoided. If this situation does arise then it may actually speed up a lenition process of this final consonant. If a constraint IDENT-IO(μ) is ranked higher than FT-BIN(μ) then this situation would be allowed but because FT-BIN(μ) is so highly ranked it would remain a marked situation which would necessitate a lenition to remedy the situation.

Another option would be to join this to the previous rhyme and shorten the vowel, but this solution does not appear to be one adopted by modern Germanic languages. We can of course leave this consonant in an empty syllable or make it an extrasyllabic consonant attached to the previous syllable in which case it may be non-moraic and may subsequently elide without leaving a trace.

One final option would be to attach the vocalic elements of this consonant to the previous rhyme where the moraic length of the vowel is preserved as well as the vocalic nature of the consonant. This option is difficult to represent if we consider consonants and vowels as separate segments. The representation of sounds will be discussed in 12.3, but an initial portrayal of this may be given using the syllable trees as shown above:

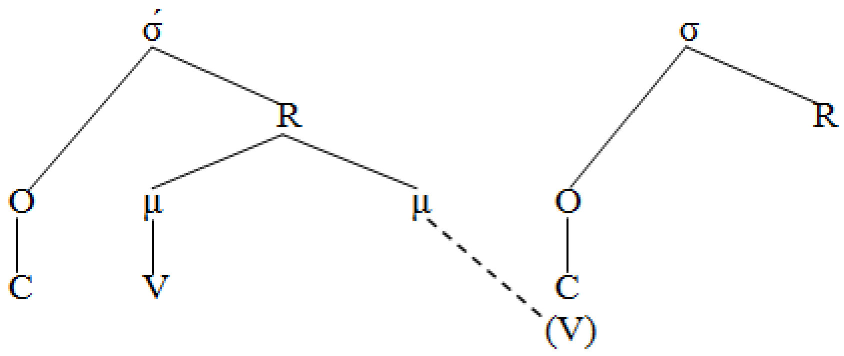


Figure 80

Once this situation has occurred then the vocalic trace in the previous syllable is indication enough of the sounds presence such that the consonant may be lenited.

Vocalisations have therefore occurred in Germanic languages because of the bimoraicity of the leftmost syllable and are triggered by lenition processes to obey syllable laws requiring consonantally weak codas.

In the following section we shall turn to how to represent the underlying vocalic elements of consonants.

12.3 Representation of sounds

To represent the vocalisation process we shall see in Chapter 13 that it can be simply shown as a lenition of stricture and for this process an OT approach will be used. As the result of a vocalisation differs depending on the sound being vocalised, its underlying vocalic element must be determined in the description of the sound being input into the process. What follows is a discussion of a feature geometric approach which will be used to describe the sounds.

It should be clear from the data in Part 1 above that the result of a vocalisation is more complex to predict than by relying solely on a generic locus for each sound. In order to produce fluid speech the mouth will be prepared for the sound that will follow, although it also forms the features considered necessary of the target sound in the production of a segment, and so it is important to determine and represent these required features.

With each consonant the tongue and lip positioning will also obviously be present and therefore will have an underlying vocalic element. In the historic representation of vocalisation processes, any model used must be able to show the vocalic elements of the sounds involved. The articulator directly relevant to the production of a vowel is the tongue body, and articulations which complement the tongue to produce secondary features are the lips and velar lowering in nasalisation. These articulators are also used in the production of the consonants; the tongue body being used in the production of the velar and palatal consonants, the lips for labial consonants and velar lowering for the nasals.

We have seen in Table 22 on page 185 that for non-liquid vocalisations the articulators used for each sound determine the resultant vocalisation, but the articulations also depend on the vowel which precedes the segment being vocalised.

A vocalised labial will therefore add an element of rounding which is perceptually close to back vowels. The height of the jaw in the production of the labial consonants is also higher than it would be for vowels and we consequently find that labial vocalisations result in diphthongs with high back rounded elements.

A vocalised dorsal consonant depends much more on the vowel segment which precedes the vocalised segment. In Germanic languages we have a symbiosis between the amount of backing involved in production of a vowel and a neighbouring dorsal consonant. Front vowels will attract front (palatal) consonants whereas back vowels will attract back (velar) consonants. The space shared between vowel production and the dorsal consonants is primarily the same and we consequently find a vocalised dorsal consonant resulting in a rising diphthong with the same place of articulation as the previous vowel.

Coronal vocalisations behave in a different manner. In the production of coronals we use the anterior of the tongue. This is not an active articulator in the production of the vowels and we consequently see far less trace of a coronal's presence in lenition processes than we do for either labials or dorsals. In vocalisations of coronals in the Germanic languages the only evidence remaining that a sound was formerly present is that a mora may remain and the vowel will be lengthened. In Operstein's data (2010) she found that the vowel quality present in a prevocalised coronal consonant was [i ~ ə]. There is some evidence of a high front vowel element underlying coronals in that whilst the segment is still consonantal a preceding vowel may raise and front before this sound (cf. section 8.3), however the more lenited this segment becomes the less of an influence it appears to have. Such a link between coronality and high frontness of vowels does however need to be shown in a representation of the segment in order to capture this link. As with labials I shall treat this here as a secondary feature of vowels.

Clements and Hume (1995) treat palatals and consequently front vowels as if they are coronal. In Germanic languages however this seems counterintuitive. The dorsal segments for most of the Germanic languages have front and back allophones, such that a word in English like 'keep' would be [k̟iːp], whereas 'caught' is [k̠ɔːt]. The fronting of velars is such that it becomes palatal (or palatalised) in some of the other languages (cf. for example German /x/ with [ç ~ x] allophones depending on neighbouring vowels). To say that the allophone is sometimes dorsal and sometimes coronal complicates the link between the two sounds. This is especially so when considering the vocalisation process, as we have seen the preceding vowel determines which high vowel follows. There is some argument however for treatment of palatals as coronal for phonological rather than allophonic palatals which is a reason that there is necessarily a link between the front vowels and the coronals. This will be returned to below in 13.1.

I shall show here in Figure 81 the model given by Clements and Hume and discuss some places where I feel it needs to be altered to account for historical changes leading to vocalisations.

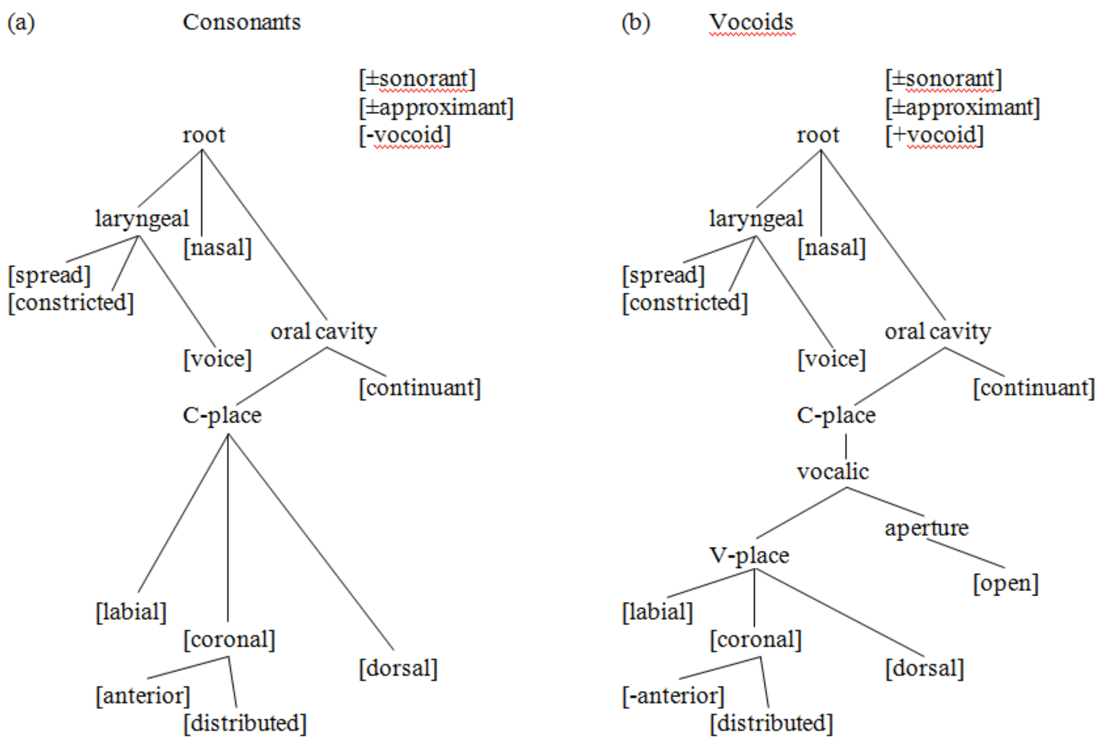


Figure 81

Clements and Hume (1995:274) decided to leave placement of 'guttural' sounds out of their feature model as conclusions as to their position in relation with the other sounds was unclear. If we consider vocalisations of uvular rhotics we end with a low back vowel, so a pharyngeal node as it relates to vocoids should be linked to the vowel space here.

We could leave this as a two-tier system where each consonant is linked to both a vocalic tier and a consonantal tier, whereas the vowels are just linked to the vocalic tier as there is no articulatory contact. The process of vocalising could therefore be described as a severing of the ties to the consonantal tier which would just leave the vocalic tier present.

If the sound in question is however voiceless then although the tongue and lips are in place for an underlying vowel, the link to this tier is dependent on voicing being present (the vocalisation could of course result in a voiceless vowel, but these are rare). If there is a vocalisation of a voiceless sound then this will be the result of the mistiming of the preceding vowel carrying part-way into the following consonant allowing the vocalic elements of the consonant to surface.

Also we have noted above that in order to produce fluid speech the mouth is prepared for the sound that will follow. If this is the transition between a consonant and a following vowel then the tongue and lip positioning of the following vowel will partly overlap with that of the preceding consonant where this is allowed. If a consonant follows a vowel then in order to transition to the consonant there is likewise some overlap but the consonant will only be truly consonantal when the aperture between the primary articulators is close enough for it to be considered consonantal. The underlying vocalic elements may however be formed transitionally and it is these that may be reanalysed as a diphthongal nature of a preceding vowel.

A different approach, and the one adopted here, is to consider both consonants and vowels as being on a continuum and forming a single tier. The link therefore between a consonant prior to its vocalisation and the resultant vowel following the process will not involve severing a link between tiers but will rather be simply a change of stricture along a continuum within the feature geometry. If we consider traditional descriptions of vowels in terms of high, low, front and back this imposes a false construct which forces vowels into binary positions. Vowels are however more subtle than this. Looking at the actual highest positions of the tongue for each of the cardinal vowels we get an image more similar to the following:

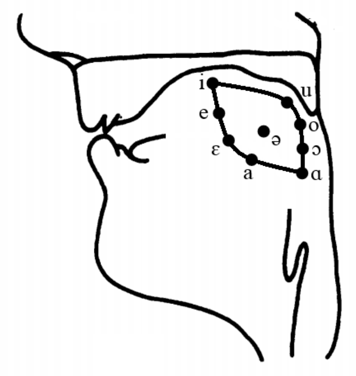


Figure 82

We can see from this that [i] corresponds to a position close to palatal consonants, [u] is close to a position associated with velar consonants and the other back vowels range between uvular and pharyngeal consonants. Much of this corresponds to our findings in the previous chapter and this is also partly addressed by Clements and Hume in their model in Figure 81.

To describe a velar consonant as velar but a back vowel as back loses this union which exists between the two sounds. Also a vowel such as [ɑ] to be described as [+back, +low] gives the impression that it is far from the passive articulators when it is in fact close to the pharyngeal wall, but again there is no link between [+back, +low] and pharyngeal in traditional feature geometric descriptions.

In a lenition process such as a vocalisation where the difference of a unit being described as an approximant consonant or a vowel is often purely one of stricture where a slight reduction will result in a vocalic element as opposed to a consonantal one.

By classing the least amount of stricture, being when the tongue is in rest position, so somewhere around [ə] in most languages, though this could be language specific depending on the language's rest position of the tongue, as 0 on a scale and the most amount of stricture as occurs with stops as 2 then all other manners of articulation may be placed on the scale. We set the cut off point between consonants and vowels as 1 such that any value just above 1 would be an approximant and with any value just below 1 being a high or back vowel. Figure 83 better exemplifies this situation.

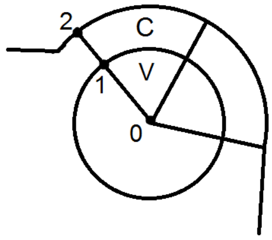


Figure 83

We can now speak of high front vowels as being palatal, high back vowels as being velar and low back vowels as being pharyngeal all with a stricture value <1. The low front vowels are as yet not covered, and are not relevant to vocalisations but could be considered to be 'mandibular' in nature and again with a stricture value <1 where the closer to 1 one gets the greater the displacement from schwa. A further solution to these vowels could be with negative movements away from the three 'top' articulators, such that [a] could be described as velar but with a negative value. If a model such as the one being discussed here is adopted where front low vowels need better analysis then how to resolve descriptions of the low front vowels would need to be further investigated. This model also leaves aside how a sound such as a trill could be best described as the stricture varies in the production of this sound. Again it should be further investigated, if such a model is found to be useful for other descriptions, but is not relevant to the discussion here as vocalisations only occur in the historical transition of a sound from an approximant to a vowel.

As vowels are underlyingly present in the production of consonants, we can assume their constant existence and vowels have purely consonantal place with less stricture, so fundamentally no difference between the two. By combining the consonantal and vocalic geometries of Clements and Hume as shown in Figure 81 above and including stricture values as discussed for the places of articulation, some other features become unnecessary, such as [continuant], [sonorant], [approximant] and [vocoid]. This is a move away from binary descriptions which may understandably be controversial from a phonological perspective, but if we include phonetic evidence, as is necessary for descriptions of historical change then this is a necessary sacrifice and one which more accurately allows for inclusion of phonetic data.

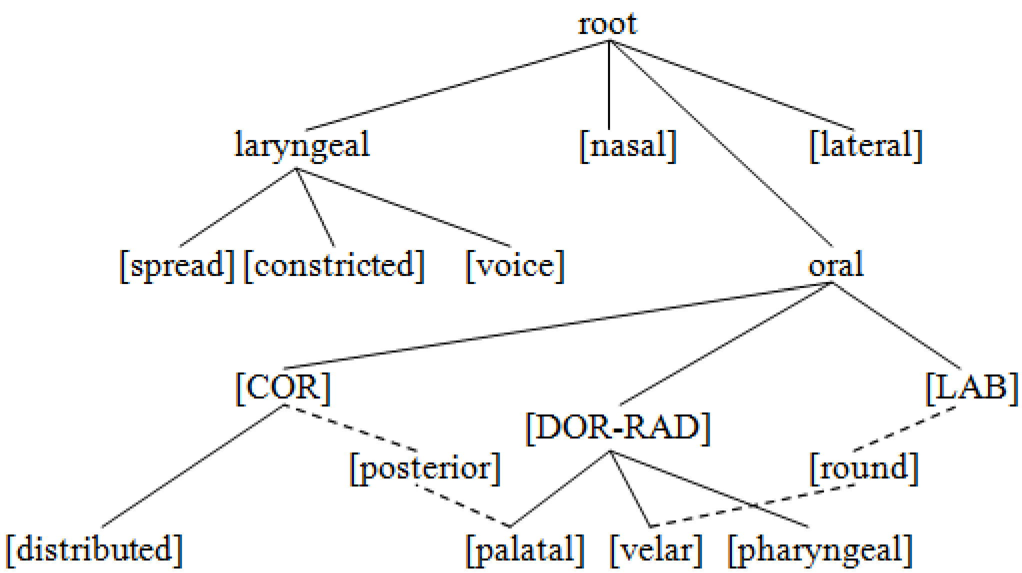


Figure 84

This preliminary diagram needs a little further explanation. Clements and Hume discussed (p293) the uncertainty of placement of the [lateral] feature as to whether it should be connected below the [COR] node or to the root. There are a few problems with discussing lateral consonants when applying this kind of model to a process such as vocalisation. Although a lateral approximant is exactly that, an approximant so ideally it should be granted a stricture of 1, a vocalisation of a lateral involves a reduction of the tongue along the midsagittal plane. With this in mind the feature [lateral] has been placed on the root node whilst the stricture of the tongue placed under the [COR] node will refer to the stricture along the midsagittal plane, so for [l] this will be 2. Also, placing the feature lateral under the coronal node would mean that it also needs to be placed under other nodes to explain sounds such as [ʎ] and [ʟ] for languages which have them. Although I have not included it here, as it is irrelevant for Germanic vocalisations, the question of lateral stricture would need to be included for languages which have lateral fricatives. Again for these sounds the mid-sagittal stricture is 2, but the degree of stricture in the lateral plane would be closer to 2 for the fricative but closer to 1 for the approximant.

The Dorsal node from Clements and Hume also includes Radical sounds which were omitted from their description. By including them together in a Dorso-Radical node this better shows the relationship between palatal and velar sounds, velar and uvular sounds and uvular and pharyngeal sounds. Although it coincides with the vocalic space, I have avoided calling it vocalic in the geometry as this would again confuse the line between vowels and consonants.

A further feature in the diagram is the inclusion of a feature [posterior] (as opposed to [anterior]) and a dotted line between this feature and the coronal stricture and palatal sounds. Depending on which description is read, a palatal sound may be described as coronal (cf. Clements and Hume 1995:294) or dorsal. The arguments for describing them as dorsal, as will be done here, are that they are produced with the body of the tongue, as opposed to the front of the tongue as we find with the other coronals. This will be further discussed in 13.5 below. There are arguments for both descriptions. By maintaining a link between them reduces this problem. We shall see for the analysis of rhotics in 13.3 that there may be grounds for measuring stricture levels at a [posterior] position as opposed to [anterior] one. This will be discussed in greater detail there and will explain the link between the features.

A second dotted line links rounded sounds with velar ones. This maintains the link between roundness and backness as described in 6.4. It should also be noted that there is a dotted line between roundness and labial stricture. This will be discussed in more depth in 13.2 but it indicates an inversely proportional link between degree of labial stricture and roundness but still allows for roundness to be either absent or present in the production of labial stops.

In traditional descriptions secondary articulation is treated separately from articulatory features which are purely present as a result of a primary articulation and are not usually relevant to synchronic descriptions. Underlying tongue position is however crucial to the resultant sound when considering cases of vocalisation. These therefore need to be represented on such a feature tree for our purposes here. As these by-products of articulation are not primary features they may be treated separately, and could be shown, for example, in grey type if necessary to indicate the non-primary nature of these articulations. However secondary articulations are not usually treated in such a way and so I will not adopt such a feature here.

By using such a model a sound such as [ɫ] can therefore be described as [COR(2), +voice, +lateral, velar(0.8)]. Here the stricture in the mid-sagittal plane is complete at the coronal node, thus giving it a value of 2. This has been represented with [COR(2)]. Voicing and degree of laterality are given as binary features, although, as discussed above, stricture values may be used for this feature. Finally velar has been given an arbitrary value of 0.8 to show the velarised vocalic element underlying the sound. The fact that the value is <1 indicates that it is vocalic and not consonantal, but the actual value given is not based on accurate measurements but is rather a theoretical high back vowel. Depending on the degree of detail one wishes to show for this sound the other nodes may also be employed such as lip rounding, the distance of the tongue from the palate and the pharynx etc. Our minimalist approach therefore indicates a more phonological analysis, whereas inclusion of all nodes would be a much more phonetic approach, but the model allows for both to be considered. Underspecification of nodes is therefore an important feature of this model. Whereas the Clements and Hume type model as given in Figure 81 would, for example, allow for a labial consonant to be described and the coronal and dorsal nodes would then be irrelevant, the model used here would require other nodes to also be present in the description, though they may be underspecified.

For the sound [ŋ], this would be described minimally as [velar(2), nasal], thus indicating complete closure between the tongue and the velum and nasality. Again nasality, like laterality has been described in binary terms, but degrees of nasality could be introduced, although their level of usefulness would probably be limited. Degrees of nasality have been argued for some Austronesian languages (cf. Ladefoged and Maddieson 1996:103), though whether this is a phonological consideration or relates to actual velum lowering is uncertain. They mention a study by Durie (1985) which argues for nasal airflow differences in Acehnese, which would indicate stricture differences. If stricture is to be considered here then 2 would indicate closure so non-nasals anything less than 2 would indicate a nasal sound. For the purposes of this present study, [nasal] will indicate that nasality is present, whereas an underspecified default will indicate non-nasality.

Also within this framework it allows for variability in production based on the degree of stricture. A sound such as [j] may be more consonantal with a value of [palatal(1.2)] or more vocalic with a value of [palatal(0.8)], say. Either of these sounds may be perceived as [j], so to allow for this variability we could describe the sound as [palatal(1±0.2)]. It is this variability which is important in language change and therefore important in the description of vocalisations. Such variability will need to be incorporated into a descriptive model.

The process of vocalisation involves a conservation of effort in the production of the degree of stricture for a sound. In lenition processes discussed in the introduction it was shown that one path of lenition was to increase the opening at a place of articulation. The constraint Conserve Articulatory Effort (CAE) was described in Gess (2001) based on Jun (1995:225) as the weakening constraint. As it is a sensible constraint to use in a theory such as this it deserves a more thorough description within the framework described.

If a sound such as [j] is analysed with a target stricture of 1 but an allowable articulatory-perceptual variance of 0.2 this gives us the description [palatal(1±0.2)]. Any sound which is articulated within this range will therefore be perceived as [j]. The CAE constraint is a 'laziness' constraint (the constraint LAZY was described in more detail in Kirchner (2001), but I shall use CAE here as an alternate description). The basic premise behind CAE is that the minimum amount of effort is expended in order to produce a sound, so in the case of degree of stricture, the closer one comes to a stricture value of 0 (the rest position) the more optimal the sound as this will involve the least amount of movement of the tongue from this rest position. We know from coda laws, as described above in 6.2, that the coda is likely to weaken more so than other positions in the syllable so CAE will be restricted in the ranking given below to the coda position CAE(Coda). Nucleus weakening may also occur in historical processes, but as this is less likely than lenitions in coda position it will be ranked lower and does not directly affect the vocalisation process, as such it will not be further mentioned. So a value of [palatal(0.8)] will be more optimal than a value of [palatal(1)] which in turn is more optimal than [palatal(1.2)]. However this constraint needs to be checked as a value of [palatal(0)] (which is a schwa) would be the most optimal, but this would no longer be perceived as [j]. In order to avoid too much lenition this constraint would need to be dominated by a constraint such as IDENT-IO(stricture). Because the description of the input sound allows for variance, in this case [palatal(1±0.2)] we have the following situation:

[j]=[palatal(1±0.2)]	IDENT-IO(stricture)	CAE
[palatal(2)]	-1	-2
[palatal(1.2)]		-1.2
[palatal(1)]		-1
☞ [palatal(0.8)]		-0.8
[palatal(0.6)]	-1	-0.6

Table 30

I shall describe this initial tableau in more depth as this approach will also be used in the following tableaux.

This tableau has utilised an approach similar to that used in Harmonic Grammar (cf. for example Pater 2016) where violations are given in a negative numerical format as opposed to showing violations with asterisks. The reason for this is because of the scalar nature of the representation of the input sounds.

Table 30 tells us that for a value of [j] being represented by the scalar value [palatal(1±0.2)], i.e. any palatal sound with a stricture range between a high vowel (0.8) and a slightly fricated approximant (1.2) would be recognised and interpreted as [j]. If a sound is produced with a greater or lesser amount of stricture than this allowable range it would no longer be recognised as [j] and so would incur a violation value of -1 for IDENT-IO(stricture).

All values apart from [ə], with a stricture value of 0, will violate CAE given our definition as described above, however the greater the stricture value the greater the violation. Therefore [j] produced as a slightly fricated approximant with a stricture value of (1.2) will violate this constraint more than [j] produced as a high vowel with a stricture value of (0.8). This degree of violation is shown in the constraint values of -1.2 and -0.8 respectively for the two values shown, i.e. in a historical lenition process production of [j] as a high vowel would be the expected outcome, whereas production as a slightly fricated approximant would be a marked situation, even though both would be possible at a synchronic level.

The level of variance in the stricture described will be speaker specific, but because of CAE there is a trend for this to head towards 0 as we do indeed find in lenition processes. McCarthy (2003) proposes a ban on scalar constraints such as CAE as they have no limit and this would indeed be the case here were it not for the higher ranking IDENT-IO(stricture) where stricture values falling outside the range given in the representation will fail.

This could give us the situation where Speaker 1's value of [j] is [palatal(1±0.2)]. A next generation Speaker 2 may have a value of [palatal(0.9±0.1)] such that all Speaker 2's values fall within the range of Speaker 1's sounds, but the target has shifted slightly to be more vocalic and not to allow the consonantal realisations that Speaker 1 produced. A following generation speaker who is more likely to hear speakers from Speaker 2's generation may then allow for more variance with a value of [palatal(0.9±0.2)] and the process may continue until one generation produces this vocalically and it will be reanalysed in the nucleus and will therefore no longer participate in the coda lenition process.

Fitting this into a structure where weight of the stressed syllable must be considered would give us the basic ranking model of S-W, IDENT-IO(stricture) >> CAE(Coda). Combining this structure with an accurate description of the consonant being considered will therefore show the vocalisation process and the resultant product of this vocalisation. CAE has been ranked lower than the other constraints as this is a constraint which is a universal diachronic tendency and at a synchronic level is only secondary. As an OT framework is well suited for synchronic description, but is lacking diachronically it is difficult to understand where such a feature should fit. In this situation and most of those described below it could be equally ranked with the other constraints, but any value in the above example from [palatal(0.8)] to [palatal(1.2)] would be perceived as [j] so are more optimal than a value which falls outside this range, but if CAE was equally ranked then they would all break this rule at an early stage. It has therefore been decided to rank this constraint lower than the others, though I realise this could be debated.

The following sections will show how this works in practise for the vocalisations we have seen in the Germanic languages.

13.1 Coronals

It was noted in 9.6 that when coronal codas vocalise they leave a mora as a trace of their previous existence. We saw in 8.4 for example that Dutch *bad* 'bath' with a short vowel is related with *baaien* 'to bathe' with a long vowel and an epenthetic [j] to avoid hiatus. Preservation of the mora has therefore occurred here in the verb where a lenition has taken place. A voiced coda coronal therefore has the target of [COR(1-2), +voice] but may be left underspecified for [DOR-RAD]. This gives us the following diagram for the situation prior to a vocalisation:

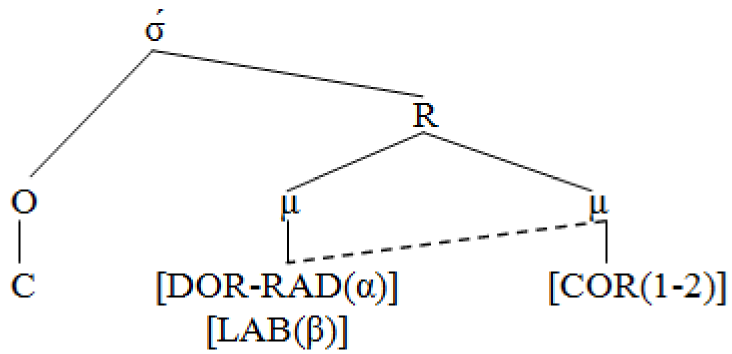


Figure 85

A vocalisation process caused by the gradual reduction of the stricture will give a coronal value <1. For a value less than one at the [DOR-RAD] node, this would indicate a vowel as there is a stricture between the passive articulators and the dorsum of the tongue.

Remembering that for each sound there will necessarily be a stricture at the other points in the mouth, by underspecifying the coronal node, i.e. not giving it a specified [DOR-RAD] or [LAB] stricture value, these values will still be present even if they are not specified. With underspecification we therefore have the situation that the [DOR-RAD] and [LAB] values must be filled from somewhere else and in the case that we have a coda coronal we take these values from an adjoining (previous) vowel.

We would therefore underspecify [eð], for example, as [palatal(0.5), μ][COR(1.5±0.2), distributed, μ], but the [DOR-RAD] value of the consonant would necessarily be taken from the previous vowel, i.e. be [palatal(0.5)]. The [LAB] node in this case may still be left underspecified as rounding is not present. This is important in descriptions of vocalisations as this is the only sound remaining which can be heard once the coronal stricture is less than 1.

Within the coronal range the stricture is measured between the front of the tongue and the coronal region and does not contribute significantly to the vowel sound being produced, although there may still be a residual tongue tip gesture. The sound perceived would be provided by the dotted line in the diagram above thus producing a long vowel.

The following is an example given in 10.4 for the rhyme of Middle Danish *sked* [sgeð̞] to modern Danish *ske* [sge:]:

[eð̞] [palatal(0.5), μ] [COR(1±0.2), distributed, μ]	S-W	IDENT-IO(stricture)	CAE(Coda)
[eð] [palatal(0.5), μ] [COR(1.5), distributed, μ]		-1	-1.5
[eð̞] [palatal(0.5), μ] [COR(1), distributed, μ]			-1
[e] [palatal(0.5), μ] [COR(0.8), distributed]	-1		-0.8
☞ [e:] [palatal(0.5), μ] [COR(0.8), distributed, μ]			-0.8

Table 31

Note here that the optimal outcome [e:] may still have a coronal gesture by those who initiate the vocalisation, but this will not be perceived and so may be reanalysed as not-present by future generations. The value of [e] (to produce a long vowel) remains and not some other vowel because of the underspecification at the [DOR-RAD] node which is necessarily taken from the previous vowel. Also the mora as shown in the syllable diagram above attaches to the previous vowel. It should also be noted here that the vowel does not change significantly, so the target range for this vowel has also not shifted, which is why there is no variance shown. Again the value of [palatal(0.5)] for the value [e] is arbitrary at a phonological level, but could be accurately measured if required. Our tree from Figure 84 will be repeated here as Figure 86 for ease of reference:

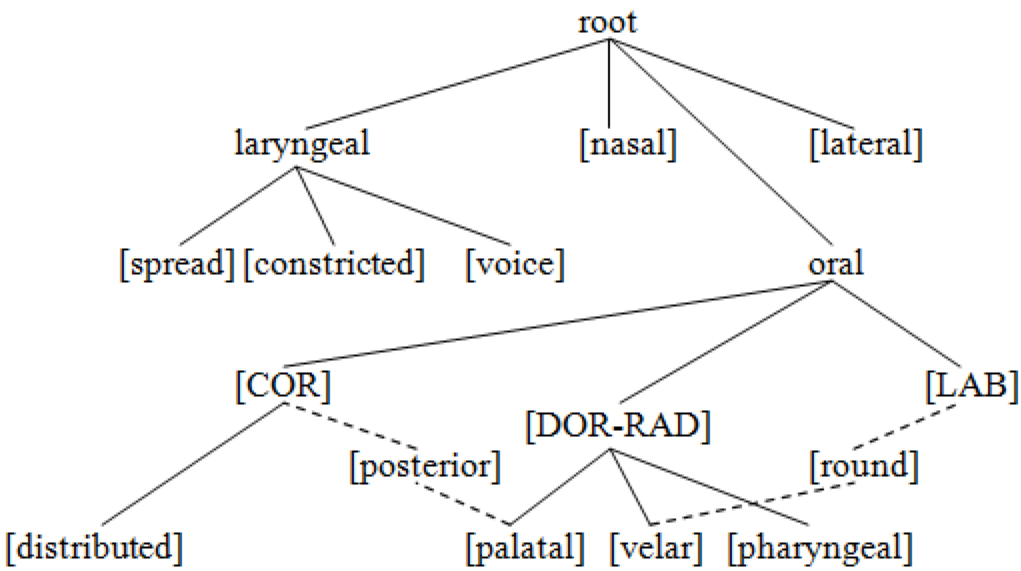


Figure 86

For the optimal value of [palatal(0.5), μ] [COR(0.8), μ] this indicates that a tongue gesture is present, which at a vocalising stage will almost definitely be the case, as the initial vocaliser will also have a variance where sometimes the coronal gesture will be consonantal for this speaker. From a listener's perspective however the coronal stricture is too small to be perceived as consonantal and a learner may therefore drop the gesture. However even they will sometimes hear the sound produced with a coronal gesture as this is an option for the original vocaliser, so we may be left with a vocaliser who regularly vocalises, but nevertheless has a coronal gesture (compare for example the study by Turton 2014 where she found l-vocalisations involved a reduced tongue tip gesture which may or may not still have been present).

The link between coronality and palatality is however not evidenced in Germanic vocalisations. Cases where a vocalisation would leave adjacent vowels in hiatus, and we find an epenthetic palatal [j], are implementing strategies to avoid the hiatus and not a result of the vocalisation. Where a voiced coronal is in a stressed syllable in word final position with no following vowel it does not vocalise to a palatal sound. We shall see in 13.3 that there may be evidence of a link between the two when discussing posterior coronal sounds as with rhotics.

We should also here consider a further case where underspecification could be useful. It should be noted that coda coronals very often assimilate to the place of articulation of a following consonant, such that ‘good book’ surfaces as [gʊb bʊk] etc. If we wish to incorporate this into our model then we could specify the sound’s stricture at the higher [oral] node. In this way the place of articulation would need to be filled by an adjacent consonant. This would however necessitate a default position of [COR] under the [oral] node to be established, such that [COR] will be chosen if there is no adjacent consonant. We shall show this default nature on our diagram with a dark line as in Figure 87. The usefulness of default values will be discussed further in the description of lateral and dorsal vocalisations in 13.4 and 13.5 respectively.

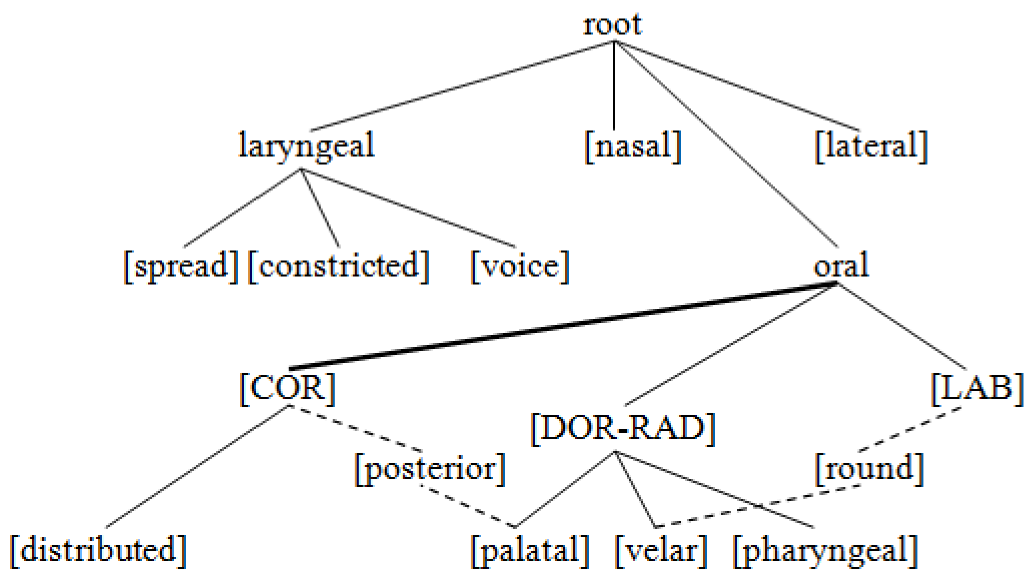


Figure 87

13.2 Labials

For labial sounds it was noted in 9.6 that they typically vocalise to a moraic high back vowel, i.e. [u]. For the feature geometry presented above in Figure 84 a link between labiality and velarity has been included under the node [round] though the Jakobsonian term [grave] may also have been used. Although rounding is produced at the lips a labial consonant is not necessarily produced with lip rounding, as demonstrated in Figure 39. Within our ranking we need to account for where the rounding comes from in the vocalisation process.

As with the coronal sounds, once the lips have a stricture smaller than 1 although there will still be an articulatory gesture they will no longer be perceived by a listener. If this is the case then we would expect them to have the same effect as coronals, just leaving a trace of the former consonant through its mora. This is however not the case and we do find that the trace is lip rounding which in turn produces a velar vowel. There must therefore be a perceptual need for labiality such that it is present even when the labial stricture goes beyond a perceived consonantal labial. From our feature geometry the [LAB] node has two branches, one to stricture and the other to roundness. In order to perceive labiality once the stricture has become less than 1 roundness must take place. We may speculate the presence of a constraint such as the following limiting the gestural perceptual faithfulness:

GEST(B-LAB)

For any labial consonant 'B' there must be a perceived labial gesture.

Ladefoged and Maddieson (1996:356-360) note that although rounding may be applied as a separate feature to labial stops (such as [p] and [m]) they do not mention labialisation of labial consonants with lower stricture. The UPSID database (Maddieson 1984) also contains no labialised non-stop consonants. I have found reference to a voiced labio-velarised labial fricative /β^w/ contrasting with a non-velarised /β/ in the Oceanic language of Tamambo spoken in Vanuatu (Riehl and Jauncey 2005:256). It is however noted here that for younger speakers the non-labialised fricative is frequently produced as labiodental [f] or [v] and the labialised phoneme is produced as [w]. The rarity of these sounds would indicate that roundness and stricture are actually on a scale where the lower the stricture the greater the degree of roundness. We would therefore expect a labial with a stricture of 1 (i.e. an approximant) to automatically be round. If this is the case then within the featural description of a labial approximant we should automatically include roundness which would make irrelevant the requirement for the GEST(B-LAB) constraint.

Within the feature geometry dotted lines were introduced between the feature [round] and both velarity and labiality. If we apply a value of 0.8, say, to the higher node [round] the link to these two features would therefore give a default stricture value of 0.8 to both velarity and labiality, i.e. a round back vowel [u]. The option is still available to override the default link, but this would lead to the marked situation of unrounded back vowels, rounded front vowels or labialised labial stops.

The following example shows a vocalisation of a labial following a generic vowel, V.

[Vβ̞] [μ] [round(1±0.2), μ]	S-W	IDENT-IO(stricture)	CAE(Coda)
[Vβ] [μ] [round(1.5), μ]		-1	-1.5
[Vβ̞] [μ] [round(1), μ]			-1
[V̹ ~ u] [μ, round(0.8)]	-1		-0.8
☛ [Vu] [μ] [round(0.8), μ]			-0.8

Table 32

We can also utilise the feature [round] without a stricture value to explain sounds which have secondary rounding. So a labial stop with rounding, [bʷ], could be described as [LAB(2), round, +voice]. A similar strategy will be used in the following section with the feature [posterior].

13.3 Rhotics

Although we have seen that the coronal consonants we discussed above do not vocalise with a palatal trace, we were only considering anterior consonants which go on a path of lenition d > ð > ð̞. The Germanic rhotics were discussed in length in Chapter 3 and it was shown that a vocalisation of a coda rhotic can have various results. The rhotic vocalisations found within the Germanic language group either fall into the category of being high front (of the [i] type), mid central (of the [ə ~ ɐ] type) or low back (of the [ɑ ~ ɔ] type). From our description based on the features we can describe these as [palatal(0.8)], [velar(0)] or [pharyngeal(0.8)] respectively. I have chosen velar to represent the schwa as the palatal and pharyngeal positions are already used, but it is irrelevant what feature is used here as a value of 0 for any of them will result in a schwa.

We considered a bunched-r, [ɹ̈], as being the most likely realisation of the PG coda rhotic (cf. section 3.1) and for an articulation of this sort all three features are indeed present. The pronunciation of the rhotic in the later languages shifted from this proto-rhotic and we find for example uvular articulations in many continental Germanic dialects. Also from evidence of vocalisations we find that dialects can result in any of the three sounds mentioned, but not more than one. Although all three features can be considered as being features of [ɹ̈] the perceptual cue as to which of these surfaces in the various dialects must have been ranked as was discussed in 3.3. Although the historical path towards the vocalisation process stems from this original rhotic, the rhotic itself just before it vocalises necessarily will therefore have different features depending on the path this sound has taken and which features dominated.

For example, although in English dialects we find rhotic vocalisations resulting in schwa-like vowels, and this can indeed also be found in some Dutch dialects, there are certain Dutch dialects where a similar rhotic results in a high front vowel. Similarly there are German dialects where a coda uvular rhotic has vocalised to a schwa, but there are others where we find the result to be a low back vowel. These differences cannot be explained by using the articulations alone, their result therefore necessarily occurs at a phonological level. We can represent these differences with the use of underspecification as will be explained below.

Let us first consider the coronal rhotics of the form [ɹ̈] which were inherited in Dutch and English and vocalise to either [i] or [ə]. On our feature geometry a feature [posterior] has been added in a similar way to the feature [round] in the previous section. I have chosen [posterior] as a designation and not [anterior] as a posterior coronal position is the more marked of the two features. Also in a similar way to the feature [round] it is attached with a dotted line to two other features, that of coronal stricture and that of palatal stricture.

It was noted for coronal sounds if the stricture is less than 1, then although there may (and probably will) be a coronal gesture for the speaker who vocalises, the listener will not hear this gesture. If therefore we have a [posterior] value with a stricture of 1 this will link to both a [COR(1)] and a [palatal(1)]. At this stage the coronal stricture will dominate as this node is higher in the geometry. A value of less than 1 for [posterior] will mean that the coronal gesture is no longer heard (although it may be present) and we are left with the palatal gesture as a high front vowel. Again we can show this using our model for vocalisations for a hypothetical example of [Vɪ̈]:

[Vɪ̈] [μ] [posterior(1±0.2), μ]	S-W	IDENT-IO(stricture)	CAE(Coda)
[Vʒ] [μ] [posterior(1.5), μ]		-1	-1.5
[Vɪ̈] [μ] [posterior(1), μ]			-1
[i] [μ, posterior(0.8)]	-1		-0.8
☞ [Vi] [μ] [posterior(0.8), μ]			-0.8

Table 33

There is a difference in the English case and for those varieties of Dutch with coronal rhotics with vocalisations resulting in schwa. By giving [posterior] a value we automatically also give [palatal] a value. However if we define [ɪ̈] as having a coronal stricture with the extra feature that it is [posterior] without a stricture value then we eliminate the link to palatal. We do however need to indicate that underlyingly in these dialects we have a schwa (which we have chosen to represent with [velar(0)]). This makes the description of [ɪ̈] a little more complex in these dialects but it also has advantages. A vowel which is described on the [DOR-RAD] in this way with the added feature [posterior] which will still be present will therefore describe rhotacised vowels. In this model we have:

[Vɚ] [μ] [COR(1±0.2), posterior, velar(0), μ]	S-W	IDENT-IO(stricture)	CAE(Coda)
[Vʒ] [μ] [COR(1.5), posterior, velar(0), μ]		-1	-1.5
[Vɚ] [μ] [COR(1), posterior, velar(0), μ]			-1
[ɚ] [μ, COR(0.8), posterior, velar(0)]	-1		-0.8
☞ [Və] [μ] [COR(0.8), posterior, velar(0), μ]			-0.8

Table 34

By describing the consonant in this way it emphasises the schwa-like nature of the sound both pre- and post-vocalisation, which is why I have represented the sound here as [ɚ] and not as [ɹ̈], although the two are very similar if not identical.

The situation with the uvular rhotics we find in German dialects again demonstrates a similar pattern although it is slightly more difficult to represent using our feature geometry as it stands. Uvular sounds in traditional feature geometries may be represented as Dorsal, [+back], [-high] and [-low]. In the feature geometry we have eliminated the binary distinctions for [back], [high] and [low] so we have a problem here. Uvular sounds are neither velar nor pharyngeal, but these are the only options open to us. One solution would be to introduce a further division of the DOR-RAD continuum of [palatal, velar, pharyngeal] in between the latter two of [uvular].

A further way we could show this which would be much more phonetic in nature would be to give not only stricture numbers for the places of articulation, but numbers could also be used to show the places of articulation, with 0, for example being palatal, 1 being velar and 2 being pharyngeal. We could then assign a value for uvular consonants and the mid back vowels as being around 1.5. This is a feature which could be further discussed as a possible refinement of the tree to show more accuracy, but I feel its usefulness would be restricted to very phonetic descriptions and it defeats the object of simplicity in descriptions which is an aim of phonology.

One final way to show uvulars, could be to describe them as pharyngeal but with a secondary velar feature. By describing the uvular approximant [ʁ̞] as being [pharyngeal(1±0.2), velar, μ] it could produce a sound between the velum and the pharynx.

I shall tentatively use the term [uvular] within the [DOR-RAD] continuum to describe the uvular rhotic as it occurs in some Germanic dialects which would give us the slightly more complex feature model as shown below in Figure 88. It should be noted that uvular vowels i.e. non-high, non-low back vowels are also by default rounded, so [round] also needs to attach to [uvular].

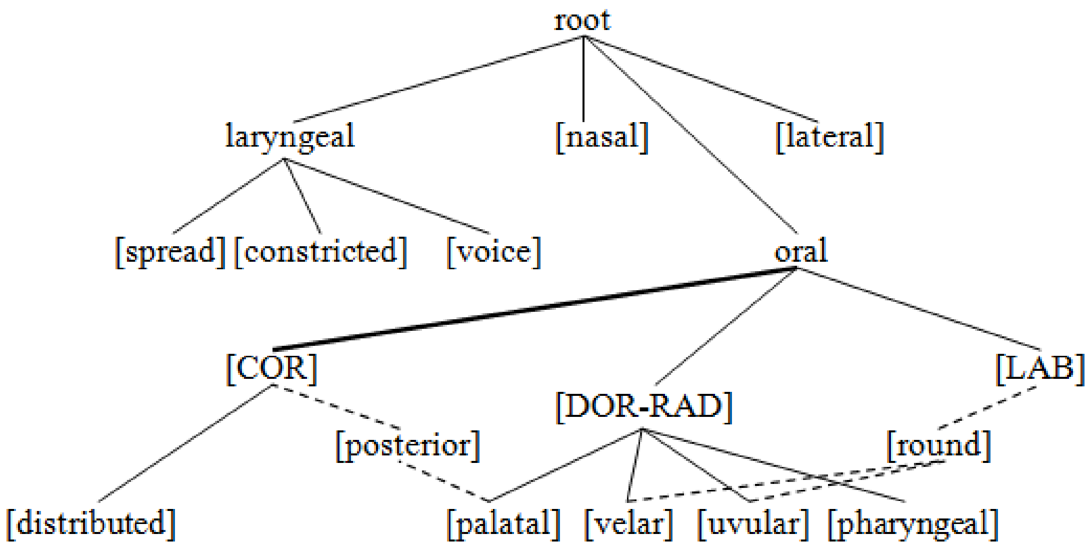


Figure 88

It was noted that the vocalisation of this uvular can range between anything from a schwa to a low back vowel in the range [ɑ ~ ɔ], with values in the 'lower right' quarter of the vowel space. Also the non-vocalised consonantal variety has a large range and can be produced as a trill, a fricative or an approximant. This would imply that for speakers with this sound they have a larger variance than for many other sounds. If we factor this in then we have the following picture for vocalisations. Again I have used an arbitrary value for the variance but one which is greater than for other sounds:

[Vʁ̞] [μ] [uvular(1±0.8), μ]	S-W	IDENT-IO(stricture)	CAE(Coda)
[Vʁ] [μ] [uvular(1.5), μ]			-1.5
[Vʁ̞] [μ] [uvular(1), μ]			-1
[ɔ] [μ, uvular(0.8)]	-1		-0.8
[Vɔ] [μ] [uvular(0.8), μ]			-0.8
☞ [Və̞] [μ] [uvular(0.2), μ]			-0.2

Table 35

The stricture value for a trill has not been shown here and this is a matter which could potentially complicate this model to a level beyond its usefulness. We could possibly introduce a feature [trill] within the model at a similar level to [lateral], i.e. attached to the root, but I have not found reference to such a feature being used elsewhere, so there are probably good reasons for avoiding its use. I shall avoid further discussion of this as it is not directly relevant to our current topic.

13.4 Laterals

The feature lateral has been attached to the root as it is possible to have lateral consonants at different places of articulation. Laterals are such that there is closure at the place of articulation but the sides of the tongue are lowered to allow air to flow, though it was noted in Chapter 4 that the closure at the place of articulation does not have to be complete. It is possible to have lateral fricatives which are produced with a constriction of the sides of the tongue to produce friction. The main feature of laterals therefore is the stricture at the sides of the tongue and not along the mid-sagittal plane. A coronal lateral approximant could be shown with both a coronal stricture and a lateral stricture, which would imply the need to describe this as [COR(2), lateral(1)], however as the coronal stricture is unimportant this can be underspecified to just [lateral(1)], as [COR] is the default place of articulation if non-specified. The laterals behave in the same way as coronals and labials in that once the stricture decreases below 1 the gesture may be produced but its effect can no longer be heard.

We saw from the discussion in 4.2 about the complex nature of laterals such that in coda position because of the narrowing of the tongue to allow for airflow along the sides there is a displacement of the tongue which is more evident in coda position than in onset position. We find two results of vocalisations of lateral consonants. The most common type of vocalisation is to a high back vowel which has been found in English, Dutch and Swiss German as well as many non-Germanic languages such as French, Brazilian Portuguese and Serbian. The second, much rarer, vocalisation is to a high front vowel which we find in Bavarian dialects and variously in other German speaking areas.

Coda /l/ areas where it vocalises to a high back vowel are areas where the /l/ in question is 'velarised'. This would imply a secondary raising of the tongue towards the velum, though the actual dorsal tongue constriction may occur lower and be better described as uvularised. For the purposes of demonstration of our model I shall stay with velarisation, however it should be remembered that we have the feature [round] which is attached to both velar and uvular which could also be utilised with a stricture value. This will give the coda sound [ɫ] to be described as [lateral(1), velar(0.8), μ] and variance will be added to show the vocalisation possible.

[Vɫ] [μ] [lateral(1±0.2), velar(0.8), μ]	S-W	IDENT-IO(stricture)	CAE(Coda)
[Vɮˠ] [μ] [lateral(1.5), velar(0.8), μ]		-1	-1.5
[Vl] [μ] [lateral(1), μ]		-1	-1
[Vɫ] [μ] [lateral(1), velar(0.8), μ]			-1
[u] [μ, lateral(0.8), velar(0.8)]	-1		-0.8
☞ [Vu] [μ] [lateral(0.8), velar(0.8), μ]			-0.8

Table 36

The default coronal gesture may still be present for a speaker who variably vocalises, just not heard.

The situation in Bavarian is such that the non-vocalised coda /l/ has been transcribed as [ʎ] by Niebaum and Macha (1999:72) but they describe it as an "ü-haltigem" /l/. This would imply an underlying secondary articulation in the palatal area with possible lip rounding, as opposed to a fully palatal lateral, so [lʲ] would appear to be a better transcription for this sound. The lip rounding only surfaces in some dialects (the areas marked with C and E in Figure 22 on page 72).

As such this sound can be described as [lateral(1), palatal(0.8), μ] for those areas where lip rounding does not occur and [lateral(1), palatal(0.8), round, μ] where lip rounding does occur which results in [Vi] or [Vy] respectively. In the latter case the lip rounding also spreads to the preceding vowel and may subsequently be lost from the second element, but these are later changes in the dialects. We thus have the two cases as follows:

[Vlʲ] [μ] [lateral(1±0.2), palatal(0.8), μ]	S-W	IDENT-IO(stricture)	CAE(Coda)
[Vɮʲ] [μ] [lateral(1.5), palatal(0.8), μ]		-1	-1.5
[Vl] [μ] [lateral(1), μ]		-1	-1
[Vlʲ] [μ] [lateral(1), palatal(0.8), μ]			-1
[i] [μ, lateral(0.8), palatal(0.8)]	-1		-0.8
☞ [Vi] [μ] [lateral(0.8), palatal(0.8), μ]			-0.8

Table 37

and

[Vlʲʷ] [μ] [lateral(1±0.2), palatal(0.8), round, μ]	S-W	IDENT-IO(stricture)	CAE(Coda)
[Vɮʲʷ] [μ] [lateral(1.5), palatal(0.8), round, μ]		-1	-1.5
[Vlʷ] [μ] [lateral(1), round, μ]		-1	-1
[Vlʲʷ] [μ] [lateral(1), palatal(0.8), round, μ]			-1
[y] [μ, lateral(0.8), palatal(0.8), round]	-1		-0.8
☞ [Vy] [μ] [lateral(0.8), palatal(0.8), round, μ]			-0.8

Table 38

13.5 Dorsals

For dorsals we saw from 9.6 that the result of a vocalisation is a mora and the underspecified [+high] with frontness or backness being determined by the preceding vowel. Within our model this is no problem if the vowel is [e] or [o] as they may be described as palatal and velar giving a vocalised form of [ei] and [ou] respectively. By eliminating the features high, low, front and back as we have done in this model this leaves us with the question of how to account for frontness and backness as described here.

One way to describe it, which would be accurate, though a little cumbersome would be to actually describe the dorsal consonant as either palatal or velar, but this does not explain why a low front vowel (which has been suggested to be mandibular here) or a low back vowel (which would be pharyngeal) should trigger a palatal or velar consonant. This could suggest that we need a subdivision within our [DOR-RAD] node of palatal (and mandibular) as opposed to everything else.

It should be noted from the feature geometry that we have the features [round] and [posterior]. For [round] it has been linked to [velar] but we actually find that uvular vowels are also by default [round]. In a similar way [posterior] has been linked to [palatal], but we also find lower front vowels may be linked to this value where, for example a coda rhotic in Rotterdam may be realised as [ẹ] (Sebregts 2014:103). This may suggest that we can incorporate the features round and posterior on the description of the vowel to capture the features of frontness and backness. A description of a dorsal consonant can therefore be made with a stricture value added to [DOR-RAD] and the [posterior] or [round] nature of the preceding vowel will determine if this is then [palatal] or [velar / uvular] in nature.

A problem that we find here is the case of [pharyngeal] vowels, i.e. low back vowels, which also trigger a velar consonant, although these are not linked to the [round] node, as they are not necessarily defaulted as round in the same way that [velar] and [uvular] vowels are. This would suggest the need to change the label for [round] to something like the Jakobsonian [grave] which would also enable [pharyngeal] sounds to be linked to this node. The node [grave] is still linked to labial features retaining the link between rounding and back vowels.

A further problem we have is that if the previous vowel is pharyngeal, say, we do not find a vocalisation of a dorsal element resulting in a pharyngeal vowel, instead we get a velar vowel (i.e. a high back vowel). We therefore also need a link between the ‘high’ positions in the mouth, i.e. those found on the hard and soft palates. If we return to our numerical values for the [DOR-RAD] continuum as suggested in section 13.3, with 0 being palatals and 1 being velars, we might suggest a place node of (0.5±0.5) allowing for a variance, with exact placement being determined by [posterior] or [grave] features, however this was an added complication we wished to avoid. It is therefore necessary to join the two features [palatal] and [velar] under an additional node, which will be unsurprisingly named [high]. Whether it surfaces as [palatal] or [velar] is then determined by the [posterior] or [grave] features of the preceding vowel. We thus have the following pictures for the assimilation process:

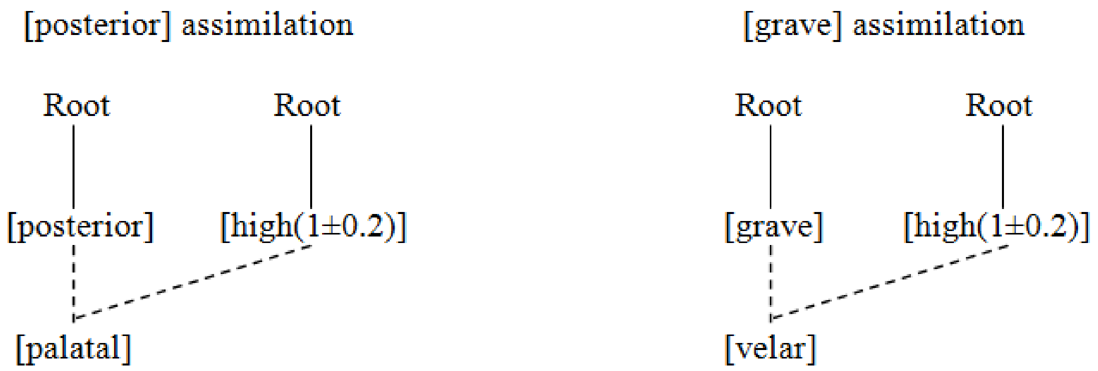


Figure 89

This means that we have a final feature tree as given in Figure 90:

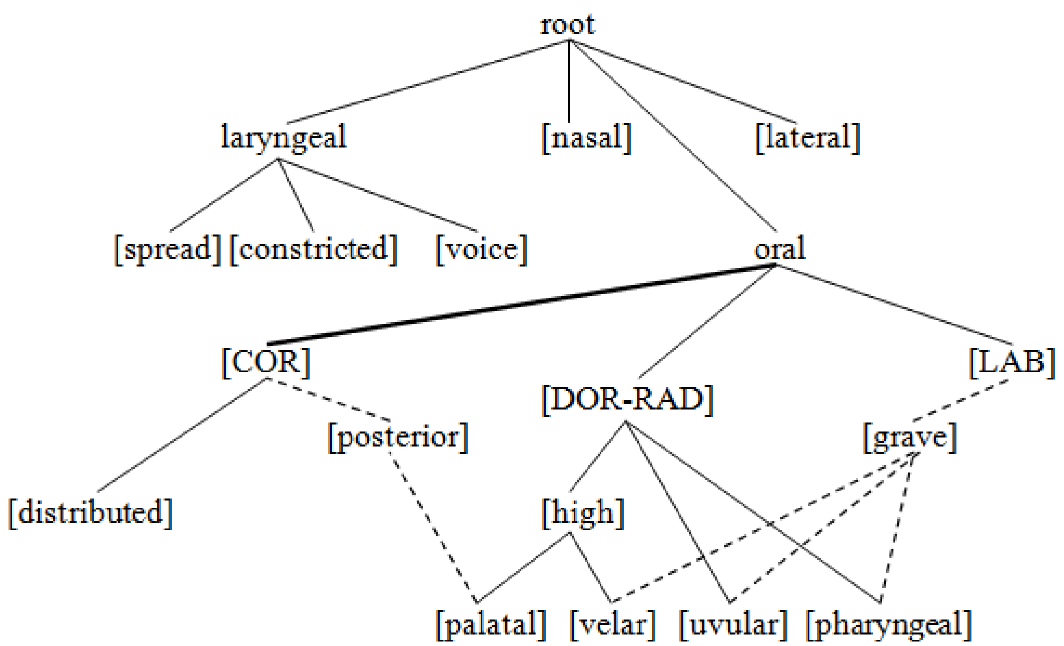


Figure 90

This will give us the following picture for a front vowel followed by a dorsal:

$V_{[-back]}C_{[DOR]}$ [posterior, μ] [high(1±0.2), μ]	S-W	IDENT-IO(stricture)	CAE(Coda)
[Vʝ] [posterior, μ] [palatal(1.5), μ]		-1	-1.5
[Vj] [posterior, μ] [palatal(1), μ]			-1
[i] [μ, palatal(0.8)]	-1		-0.8
☞ [Vi] [μ] [palatal(0.8), μ]			-0.8

Table 39

And for the variety following a back vowel we have:

$V_{[+back]}C_{[DOR]}$ [grave, μ] [high(1±0.2), μ]	S-W	IDENT-IO(stricture)	CAE(Coda)
[Vɣ] [grave, μ] [velar(1.5), μ]		-1	-1.5
[Vɰ] [grave, μ] [velar(1), μ]			-1
[u] [μ, velar(0.8)]	-1		-0.8
☞ [Vu] [μ] [velar(0.8), μ]			-0.8

Table 40

13.6 Nasals

For nasals we have a feature higher up on the tree connected to the root node. It was mentioned above in 12.3 that degrees of nasality could be introduced which may be relevant for a very few languages. As this is not relevant for Germanic languages, though, I shall be leaving further discussion of this aside. It was found that vocalisations involving nasals in Germanic languages leave just nasality as a marker that they were formerly present. We marginally find some rounding where /m/ vocalises. This would imply that when a nasal weakens, such that it becomes more vocalic, its original place of articulation becomes less important. Hajek (1997:65) showed a weakened stricture with a superscript nasal such that a weakened /n/ in a /Vn/ combination is shown with [V^n]. I shall do the same here.

We find cases in Germanic languages where a coda /m/ ‘weakened’ to [^{n}] before disappearing or vocalising. It would suggest that we have two separate lenition processes occurring here. One is the vocalisation as described here, but the second is a lenition on the feature tree, such that /m/ being described as [LAB(2), nasal] with a direct connection to the labial node is lenited up a node to [oral(2), nasal] such that it subsequently behaves like the ‘default’ coronal nasal. This latter lenition described occurs prior to the vocalisation process in most of the cases found in Germanic languages such that labiality usually does not leave a trace.

It was noted above that when coronals lenite they just contribute a mora. In the case of nasals we have both a mora and nasality added. This gives us the following picture:

[V^{n}] [μ] [oral(1±0.2), nasal, μ]	S-W	IDENT-IO(stricture)	CAE(Coda)
[Vn] [μ] [oral(2), nasal, μ]		-1	-2
[V^{n}] [μ] [oral(1), nasal, μ]			-1
[Ṽ] [μ, oral(0.8), nasal]	-1		-0.8
☞ [Ṽ:] [μ] [oral(0.8), nasal, μ]			-0.8

Table 41

Once again, for the person who occasionally vocalises there will be a coronal gesture which is shown in the optimal [oral(0.8)] which defaults to [COR(0.8)], but this is not heard by a listener, although it may be perceived as a coronal by them.

Dorsal nasals were non-phonemic in PG, although they have become phonemic in later varieties through subsequent changes. They were present in the environment when a phonemic coronal nasal was before a following velar consonant. We therefore have the following situation for the combination /ng/:

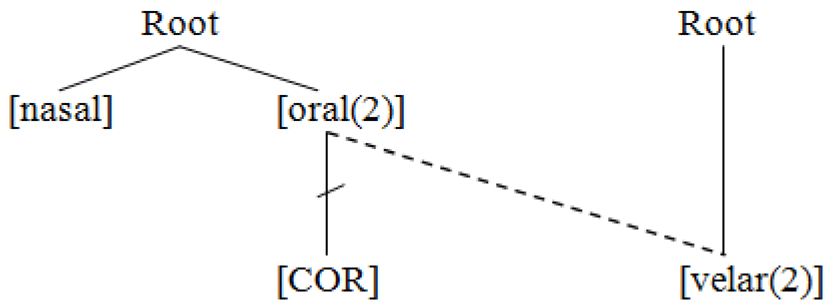


Figure 91

which would imply that the stricture value should be placed one level above the coronality on the oral node for all coronal nasals. This would also imply again that coronality is a default value if this is left underspecified.

For labial nasals we sometimes encounter rounding alongside the nasality, however this seems to be an optional feature and as described would indicate that the tree lenition of place would this time not occur prior to a vocalisation.

14 Conclusion

The main aim of this thesis has been twofold. In order to fully understand the process of vocalisations we need to understand firstly why vocalisations occur and secondly to understand what the likely result of a vocalisation will be, given any consonantal starting-point. This thesis has not only addressed both questions but has addressed issues regarding language change and representation which will be of interest to historical phonologists and Germanicists generally and has provided the ideas behind a model of representation which will go a considerable way to reconcile the disciplines of phonetics and phonology as well as allowing for a representation of variation within the production of sounds.

14.1 The data

Part 1 presented a comprehensive list of data from the Germanic languages of the type of vocalisations which have occurred. By working backwards in each case we can discover more about the nature of the original sounds as they were produced in Proto-Germanic. Of particular interest here is the exact pronunciation of the rhotic sounds, which has been much debated in the literature. By considering later Germanic manifestations of the sound, even including the result of modern vocalisations as has been done here, we can gain a better understanding of the nature of the original coda consonant.

For each sound presented and for each result of the vocalisation an explanation has been given providing articulatory evidence.

14.2 Why vocalisations occur

Chapters 10 and 11 in Part 2 addressed the question of why vocalisations have occurred so frequently in Germanic languages. We were shown how a sequence of events dating from when the Germanic languages split from the other PIE languages has determined the way the syllable behaves within the Germanic language family which subsequently has determined the fate of coda consonants.

Although constraints on language are redefined with each new generation and it is the differences between the reanalyses of constraints which are a major factor in language change, there are still restrictions on the exact path of change for related languages such that we may speak of trajectorial change restricting how these languages drift. Given identical starting points, natural lenition processes in related languages will tend to drift in similar directions. This has been the case with the Germanic languages. We find that the shift in stress to the initial syllable in the development of Proto-Germanic followed by the weakening and loss of unstressed syllables and other factors such as degemination have shaped the stressed syllable such that it is necessarily bimoraic. It is as a result of this bimoraicity which has determined that weakenings of coda consonants have not resulted directly in elisions as is often the case in other languages, but rather in vocalisations in the form of bimoraic diphthongs or long vowels.

In addition to showing how Germanic languages had the favourable prerequisites for vocalisations, Chapter 10 also provided an in-depth description of the stress shift from PIE to PG which will be of use to Germanicists.

14.3 How vocalisations occur

Based on the evidence from the Germanic data given in part 1, a model has been provided in Chapter 12 in Part 2 to represent sounds which allows for variation. By describing vowels and consonants using the same terminology the link between the two, which is so necessary in a description of vocalisations, can be better demonstrated.

Chapter 13 shows that the vocalisation process can be quite simply explained for each sound when the correct amount of representation of the sound in question has been provided. Although a nasalisation followed by nasal loss is traditionally regarded as a separate phenomenon, if the representation is presented in the same way as for the other sounds, it can be shown that the process is identical to that of vocalisations and it is at the level of representation where the two differ, which is the same case for all sounds. Although it has not been done here, any process involving lenition of stricture could be presented in the same way with an accurate result.

14.4 Future study

As with all studies of this size a number of questions have arisen which will require further study. The idea of trajectorial drift as a factor in language change has been discussed here. Drift has strong parallels with natural world evolution. A small innovative feature of a language which may go unnoticed at the time it appears may be inherited by daughter languages and may consequently lead them to develop features in a similar manner. We find this in the natural world where, for example, eight species of tarantula have evolved a unique shade of blue as innovations in their subspecies even though the ancestor to each of these subspecies was not blue (cf. Hsiung et al. 2015). Advances in our understanding of natural evolution may also provide us with a better understanding of how language evolves. This could help us understand such a phenomenon as /æ/-tensing in the Northern States of America, which has strong similarities with /æ/-lengthening in Southern Britain, Northern Ireland and Australian varieties which often coincide too accurately for them to be considered separate processes, though discussions of each have tended to treat them as separate innovations. This is an area of research which would help to further our understanding of diachronic change.

Another area which would need further research is the model provided to represent sounds. The model is designed to bring together phonological and phonetic data, by allowing degrees of description to be included depending on the problem being researched. By providing scalar descriptions of sounds as opposed to binary descriptions, the model has the advantage of being able to show variation at the level of representation and not as a separate phonological process. At the same time it can be used to show a degree of exactness, if required, which is difficult to show in many other systems of representation which can be a useful tool for phoneticists. A residual tongue tip gesture in the production of a vocalised /l/ is easily shown on the model, for example, even though this may be phonologically irrelevant.

Because of the nature of vocalisations I have avoided discussions of how the low front vowels can best be represented in such a model. For this model to be successful in other descriptions this issue would need to be addressed. Also although the labels ‘palatal’, ‘velar’, ‘uvular’ have been used here it might be worth considering making these a numerical scale, providing phoneticians with an extra level of accuracy, but this would be at the detriment of simplicity of the system. It would however be worth considering having an underlying scale where anything with a value between 0 and 1, say, would be on the palato-velar continuum with anything between 1 and 2 on the velopharyngeal continuum. This again raises questions about how to best represent the low front vowels.

The adaptability of such a model to other problems would obviously need to be more thoroughly tested which would be a paper waiting to be written, but we have however seen that it is at least a useful model for describing vocalisations.

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