Chapter Three

Domains and phonological regularities

3.1 Introduction

In the preceding two chapters we have seen that phonological representations of words consist of two separate tiers of which one - the skeleton - captures the linear and temporal order of units, while the other - the melody - provides the phonetic substance associated with skeletal positions. Crucially, we have seen that there does not have to be a one-to-one correspondence between the units of the melodic and the units of the skeletal subrepresentation: a certain melodic property may be associated with more than one position and, conversely, skeletal positions may have no melody attached to them and thus remain empty. Phonological regularities can hold between units of either of the two tiers or may invoke more complex structures at both levels. In subsequent chapters we will explore in greater detail the nature of phonological regularities by analysing individual phonological problems. However, the complexity of the problems will increase since it seldom happens that phonological phenomena can be formulated as single regularities: normally they are intertwined with other phenomena, and this often means that in order to interpret what looks like a simple regularity we need to study a number of other factors. Before we plunge into such complex patterns and the concomitant theoretical machinery we need to clear the stage a bit more.

In the present chapter we shall consider, among other things, the scope of phonological regularities. So far we have been assuming without justification that **words** constitute the domain of phonological phenomena. Quite apart from the fact that the notion **word** is very difficult to define, we will see that for phonological purposes we need a more subtle notion than words as found in a conventional dictionary. The relevant notion, called the **phonological domain** or just **domain** for short, will be introduced below in a discussion of several phonological regularities in English. This will give us a chance to broaden our view of the mechanisms which languages use in their sound structures. We will subsequently show how other linguistic regularities also need to refer to domain structure if they are to be formulated in a satisfactory manner. We start our investigation with an extended discussion of English nasal consonants.

3.2 The velar nasal consonant in English

Phonetically speaking there are a number of nasal consonantal sounds in English: the nasal in *smile* [smaɪl] differs from the one in *mile* [maɪl] since the former is partly devoiced and should be, strictly speaking, transcribed in a way reflecting this difference, say as [sm̥aɪl]; similarly the [n] of *tenth* [ten̪θ] is not identical to that found in *ten* [ten] as the place of the contact between the tip of the tongue and the teeth-ridge is different. Although the actual number of such distinct nasal consonants is quite large, it is normally recognised that only three such sounds are "significantly different", namely those broadly described as the bilabial [m], the alveolar [n] and the velar [ŋ]. Pairs and sequences of words differing in just these sounds can easily be found:

[1]

fan [fæn]	fang [fæŋ]	
lame [leɪm]	lane [leɪn]	
brim [brɪm]	bring [brɪŋ]	
sun [sʌn]	some [sʌm]	sung [sʌŋ]
win [wɪn]	whim [wɪm]	wing [wɪŋ]

Thus the phonetic contrasts seem to require that we treat the treat nasals as peers which differ in the place of articulation in exactly the same way as the triplet [b d g]. This phonetic conclusion is at odds with native speakers' intuitive judgements which seem reluctant to treat the velar nasal as yet another nasal consonant in the way they treat the velar plosive as another plosive consonant. Of course, speakers' intuitive judgements are not a very reliable criterion on which to base a phonological analysis. Fortunately, the structure of English reveals some deep-rooted evidence for the special status of the velar nasal in its sound pattern. The evidence has to do with distributional restrictions affecting the nasal consonants in the language.

Note first of all that both the bilabial and the alveolar nasal occur at the beginning of words: there is no shortage of words like *many* ['meni], *mist* [mɪst], *millionaire* [mɪlɪə'neə] or *noble* [nəʊbl], *knowledge* ['nɒlɪdʒ], *need* [niːd]. The same is true about bilabial and alveolar plosives, e.g.: *bite* [baɪt], *pail* [peɪl], *tale* [teɪl], *drum* [drʌm]. However, while velar plosives also occur initially, e.g.: *kind* [kaɪnd], *glib* [glɪb], no word beginning with [ŋ] exists in English; furthermore, artificial words like *[ŋəʊt], *[ŋaɪlə], *[ŋepi] seem impossible - they are not potential words. We would appear to need a separate statement in the form of a distributional restriction barring the velar nasal from word-initial position. If the velar nasal were just another nasal consonant, the existence of such a restriction would be somewhat puzzling.

Another remarkable property of the velar nasal is the fact that unlike the other two nasals, it cannot occur after a long vowel or a diphthong; we again find numerous words like *lime* [laɪm], *perfume* ['pɜːfjuːm] or *plain* [pleɪn], *balloon* [bə'luːn] but words like *[luːŋ] or *[blaʊŋ] are not even vaguely possible in English. If the three nasals differ only in their place of articulation, this restriction singles out - yet again - the velar nasal for special treatment.

Let us now consider nasals morpheme-internally, that is cases where these consonants appear in the middle of single morphemes. It is easy to point out to words like *summer* ['sʌmə], *rumour* ['ruːmə] or *minor* ['maɪnə], *annoy* [ə'nɔɪ] where the bilabial or alveolar nasal appear intervocalically; nothing of that sort is possible for the velar nasal *['krɒŋi], *[r'ŋaɪ]. The restriction of this regularity to the morpheme-internal position is important since in purely phonetic terms one does find the velar nasal intervocalically, e.g.: *singer* ['sɪŋə], *singing* ['sɪŋɪŋ] etc. It goes without saying, though, that these are not simplex words since they contain the vowel-initial suffixes *-er* [ə] and *-ing* [ɪŋ]; hence the preceding velar nasal is morpheme-final in these complex words. The fact that in purely phonetic terms the velar nasal appears intervocalically must be regarded as due to chance, i.e. due to morpheme combinations. Thus the properties found at some morpheme boundaries are different from those found within morphemes, a point to which we will return presently. Here let us stress again that if the velar nasal were just "an ordinary nasal" we should expect to find it within single morphemes between vowels just as we find the other nasals there, e.g.: *simmer* ['sɪmə], *honour* ['ɒnə]. This does not happen.

In sum then, the velar nasal cannot start a morpheme while morpheme-internally it cannot be followed by a vowel; wherever it does occur, it can only be preceded by a short vowel. These properties set it apart from the two other nasals and justify its special position. It appears then that the velar nasal - from the point of view of its behaviour - does not belong together with the bilabial and the alveolar nasals. If that is the case, then we might well ask what exactly it is. To try and answer this question we need to look at combinations of nasals with other consonants.

As we have just seen, morpheme-internally the velar nasal cannot appear before a vowel; in fact it can only be followed by a velar plosive, be it voiced [2a] or voiceless [2b]. It is practically impossible to find this nasal in any other contexts:

[2]
a. finger ['fɪŋgə]   angry ['æŋgri]   mango ['mæŋgəʊ]
    Bangor ['bæŋgə]   mongrel ['mʌŋgrəl]   bungalow ['bʌŋgələʊ]
    sanguine ['sæŋgwɪn]

b. anchor ['æŋkə]   tinkle ['tɪŋkl]   donkey ['dɒŋki]
    monkey ['mʌŋki]   wrinkle ['rɪŋkl]   uncle ['ʌŋkl]
    tankard ['tæŋkəd]   plankton ['plæŋktən]

Before proceeding further it is necessary at this point to revert to the issue of single morphemes. As we have indicated above, phonological regularities are to be sought morpheme-internally; although this statement will be sharpened and revised later, it is important to stress here that the domain of phonology in most cases will not coincide with traditional words. It might be objected that by restricting ourselves to smaller domains we are simplifying the facts of the language. This is not the case. In an attempt to discover the phonological regularities we have to make a number of assumptions, not in order to disguise the facts, but in an attempt to discover the **relevant** phonological facts of the language. This is because the linguistic reality does not display obvious or crude signals of its structure; furthermore, since larger linguistic units (sentences, phrases, words) are made up of smaller ones, it frequently happens that accidental properties which are the result of the mechanical joining together - or **concatenation** - of units occur together with systematic properties. It is the task of the phonologist to separate the true regularities from accidental pseudo-regularities in the domain of sounds; in doing so it becomes necessary to make assumptions and consciously restrict the facts selected for inspection. Obviously a complete analysis should be compatible with what was originally omitted or simplified. To make this question slightly more concrete, let us take orthographic words as the domain of our observations and ask what the velar nasal can be followed by. Here are some examples:

[3]
longs [lɒŋz]   longed [lɒŋd]   strongly ['strɒŋli]
prolongment [prə'lɒŋmənt]   nothingness ['nʌθɪŋnɪs]   kingship ['kɪŋʃɪp]
wrongful ['rɒŋful]   wellington ['welɪŋtən]   songster ['sɒŋstə]
strength [streŋθ]   longwinded [lɒŋ'wɪndɪd]

As the examples show, word-internally [ŋ] can be followed by
[z, d, l, m, n, ʃ, f, t, s, θ, w]; if we were to include proper names such as *Longbridge* ['lɒŋbrɪdʒ] or various compounds such as *stronghold* ['strɒŋhəʊld], *strongroom* ['strɒŋrʊm], we might well conclude that the velar nasal can be followed by any consonant whatsoever. To say that some sound can be followed by any other sound amounts to nothing more than saying that sounds follow each other. It is rather like saying that a word ending in [ŋ] can be followed by another word - in *long zebra crossing, long did they wait, strong local beer, prolong my subscription, nothing needs to be done* we find the sequences [ŋz, ŋd, ŋl, ŋm, ŋn] which correspond to the first five examples of the word-internal clusters in [3]. Examples can easily be constructed for all the remaining combinations of [3] since there is nothing unusual about some words ending with [ŋ] and others beginning with an arbitrary consonant; what we are saying in effect is that the two consonants are there by chance. Thus our observation that the velar nasal can be followed by any consonant is trivial. Is this a correct observation? The answer to this question depends on what we mean by *correct*. If it means not contradicted by the available data, then our statement is correct. But true generalisations of any nature make predictions with respect to data which are not taken into account in their construction; if approached in this way, the correctness of our generalisation can be seriously questioned. If it is the case that the velar nasal can precede any consonant in English, then we would predict

that this generalisation should hold for single morphemes just as well - we would expect to find words such as *to angmo* *[ˈæŋməʊ]*, *a bangsy* *[bæŋzi]*, *rangny* *[ˈræŋni]* and many others.

The absence of such words, and some speakers would claim that they are downright non-English and impossible, also counts as evidence: since all the examples in [3] are cases of words which can easily broken up into smaller component parts (*longs = long + s, wrongful = wrong + ful* etc.), the conclusion suggests itself that from the phonological point of view it is the component parts that are the proper domain of phonological generalisations rather than the words as orthographic wholes. The insignificance of consonantal combinations in complex words follows from the fact that the same combinations arise across word boundaries. In this way we arrive at an important theoretical concept, namely **the phonological domain**. This is the domain over which the phonological regularities of a language must be defined. It is important to note that phonological domains cannot be mechanically identified with the traditional word. Nor can they be identified with the morpheme: not every unit identified by a morphological analysis is necessarily a phonological domain - as we will see on a number of occasions below, there are morphemes which are invisible to phonological regularities. Both single morphemes and morpheme combinations need to be carefully inspected before correct generalisations of a phonological nature can be extracted from them. In our discussion of the English velar nasal we have settled upon monomorphemic words, which, as it happens, are a category that appears to constitute a morphological, lexical and phonological domain: *king* [kɪŋ] for example is a single morpheme, a lexical unit (a word), and also a string over which we may specify phonological regularities. For our purposes, it is the last feature which is essential; the others are incidental. If there are generalisations that hold over phonological domains, then they should also be detectable in more complex structures, perhaps in addition to regularities that arise as a result of morpheme concatenations.

Having clarified the theoretical reasons for selecting monomorphemic words as the basis for our phonological observations, we can now return to the discussion of the English nasal consonants.

Using the concept of the phonological domain we can claim that the examples in [2] show that the velar nasal must be followed by a velar plosive domain-internally. If we consider the domain-final situation we note that it differs from the domain-internal one and to some extent depends upon the particular dialect or variety of English. In RP the velar nasal can appear as the last segment of the domain [14a] or it can be followed by the voiceless velar plosive [k] as in [14b]. It can never be followed by the voiced velar plosive, i.e. a sequence such as [ŋg] is totally impossible domain-finally in RP (*long* *[lɒŋg]*).

[4]

a. wing [wɪŋ]   sing [sɪŋ]   bang [bæŋ]
    bring [brɪŋ]   hung [hʌŋ]

b. wink [wɪŋk]   sink [sɪŋk]   bank [bæŋk]
    brink [brɪŋk]   hunk [hʌŋk]

On the face of it pairs like *wink - wing* seem to differ in that their first members contain a segment, namely [k], which the second members do not; thus they might be seen to differ in the same way as the pairs in [5]:

[5]

  mill [mɪl]   milk [mɪlk]   skull [skʌl]   skulk [skʌlk]
  fat [fæt]   fact [fækt]   bar [bɑː]   bark [bɑːk]
 buy [baɪ]   bike [baɪk]   scope [skəʊp]   soap [səʊp]

Here, too, the left-hand member of each pair differs from its right-hand partner in not containing the consonant [k], but it is quite obvious that the presence or absence of this consonant is an accident in that certain words contain it while others do not. In the same way some words begin with a vowel and others with a consonant, or some begin with a nasal stop and others with a voiceless fricative. The velar nasal on the other hand must be followed by a velar plosive domain-internally, and either by a voiceless velar plosive or nothing domain-finally. There can be no doubt that the velar nasal is inextricably linked with a following velar plosive, and the only situation where this is not manifested phonetically is in the final position of the domain. It is this final position then that requires special attention. Let us summarise the observations about the occurrence of the velar nasal in RP English.

[6]

	domain-internally	domain-finally
	ŋg ŋk	ŋ ŋk
	*ŋV	*ŋg

We thus encounter two slightly different situations and we can assume that one of them is a modification of the other. If we take the domain-internal case as the more basic one, then the non-existence of the velar nasal intervocalically requires no special comment. The velar nasal and the following velar plosive are linked through their common place of articulation - they are **homorganic**. The homorganicity of the two consonants can be called an instance of **sharing** a certain phonetic property. Looked at in this way, the velar nasal can be seen to be a complex sound, consisting of its nasal properties and a place of articulation which is shared with the following plosive consonant. The velar nasal cannot stand before a vowel since it exists only when it shares its velarity with a following plosive. The place of articulation is thus associated with two skeletal positions - it is doubly associated. The situation can be represented graphically in the following manner:

[7]

```
        x               x
        |               |
      nasal          plosive
          \           /
            velarity
```
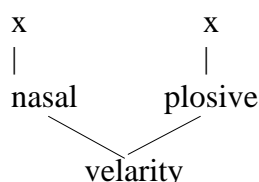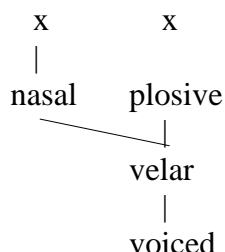
The representation in [7] shows two skeletal positions and the melodies associated with them. What is interesting about this structure is the absence of strict segmentation of the melody, since the place of articulation property straddles two skeletal positions. Unlike the pure long vowels or geminate consonants discussed in the previous chapter, where a single melodic complex is associated with two positions, here we have a case of partial identity of the two consonants; such segment combinations sharing a portion of the melody are referred to as **partial geminates**. The structure in [7] displays what is common to the [ŋk/ŋg] combinations in words like *anchor, finger;* obviously the two combinations differ as regards the voicedness of the final plosive.

The velar nasal is a good example of the complex nature of sounds. It constitutes a single sound unit in the sense that there is one skeletal position dominating parts of its melody, specifically nasality. Since, however, the element it shares with its neighbour, i.e. velarity is doubly attached, the nasal itself must be seen as being interwoven with or partly contained in the following segment. In this way the velar nasal can be said to be both a single consonant and a special kind of a consonantal or - more accurately - melodic cluster.

The domain-final situation, as we have seen, introduces a novel element since the voiced velar plosive cannot appear after the velar nasal. If we take the representation in [7] to be

generally true of the English velar nasal, then we need an additional statement in order to account for it in the final position. One way of looking at the situation is to say that the plosive in the sharing relation is not itself licensed, or supported, domain-finally when it is voiced and hence is not pronounced. In other words the plosive's unshared properties are inaudible or suppressed. To say that a melody is not licensed or is suppressed and remains silent is to claim that the association between the skeletal position and the melody has been severed. In our case this might be represented as in [8]:

 [8]

```
         x          x
         |
       nasal     plosive
               ⟍       ⌐
                    velar
                      |
                   voiced
```

In [8] the final skeletal position has no properties associated with it since they are either severed or - as in the case of velarity - they are attached to a different slot. If a precondition for pronounceability of melodies is their association to skeletal positions, then the absence of such an association - or its severing - amounts to what traditionally is called **segment deletion.** This, however, is not a very felicitous term, since what we see is that the domain-final voiced velar plosive sharing its place of articulation with the preceding nasal is suppressed with respect to all its properties apart from the shared one. Although not audible phonetically, the final plosive is manifested indirectly through the cluster of features that make the velar nasal different from the other two nasal consonants. It is phonologically present even if phonetically we only have a trace of it in the form of the velarity of the nasal.

To sum up the discussion so far: the velar nasal in RP is fundamentally different from the two other nasals because it is bound to the following velar plosive with which it shares its place of articulation. Domain-internally the velar nasal appears exclusively as part of such consonant sequences. Domain-finally, the voiced velar plosive is not pronounced but remains in the representation of individual words. The velar nasal in every case, then, is the first member of a specific consonantal cluster and never a single consonant.

We can find some striking support for this interpretation in other dialects of English. We will restrict ourselves to two more varieties, one found commonly in parts of the British Midlands (M) and another one documented in Scotland (S). Let us bypass other differences between the two dialects and concentrate just on the velar nasal. The two dialects differ radically in the way they treat the voiced velar plosive in a sharing relation with the preceding nasal. In M both domain-internally [9a] and domain-finally [9b] the velar nasal is accompanied by a following [g]; in S, on the other hand, we find [ŋ] prevocalically in [9a] and word-finally in [9b].

[9]
a.   finger, angry, mango, Bangor, mongrel , bungalow,
b.   wing, sing, bang, bring, hung, longs, longed, strongly, nothingness, kingship, wrongful,

The dialectal variation shows that the pronunciation of the voiced velar plosive after a nasal domain-internally is independent of the way the consonant is treated domain-finally. In RP, as we have seen, [g] is licensed domain-internally but not domain-finally while in M it is supported in all positions; in S on the other hand it is not accepted either internally or finally. This can be summarised in the following way:

[10]   **g**-support
                        domain-final   domain-internal

RP   **NO**   **YES**
M   **YES**   **YES**
S   **NO**   **NO**

Before concluding let us return to the main theoretical issue of this section, namely domain structure. We have seen clear cases where domain boundaries coincide with morphological divisions: the suffix *-ing* is separated from the base to which it is attached by such a domain boundary. This means that the sequence of a nasal and a velar plosive in the base (e.g. *sing*) is a domain final sequence even if phonetically - and orthographically - it makes up a single unit with the suffix (*singing* etc.). In such cases phonological behaviour goes hand in hand with morphological complexity. We have stressed, however, that domain structure is a phonological rather than a morphological concept, which means that we cannot always expect a one-to-one correlation between the two. Specifically, there are numerous cases which are morphologically complex but which behave as single domains phonologically; and, conversely, there are phonologically complex domains which can constitute single morphological units. In subsequent chapters we will frequently encounter cases where phonological regularities hold in the same way for simplex words and for certain morphologically complex ones. In such cases we will say that the morphological boundary of the word is **invisible** to phonology or that the word makes up a single phonological domain. As an example, compare the word *velocity* [vəˈlɒsəti], which is morphologically indivisible in Present-Day English with *validity* [vəˈlɪdəti], which contains the suffix *-ity* attached to the base *valid*. However both of them are stressed on the antepenultimate vowel, which suggests that from the point of view of stress placement the words have the same phonological structure. Thus the morphological complexity of *validity* is invisible to the phonology.

With regard to the second mismatch, i.e. the recognition of phonological domain structure without morphological evidence, we can offer some examples involving the velar nasal in English. There is a number of words for which it would be very difficult or downright impossible to justify a complex morphological structure. In such cases we would expect the velar nasal to be followed by a plosive on the pattern of *finger* words (in RP, of course), but this prediction is not always borne out. Some of these items are proper names such as *Birmingham* [ˈbɜːmɪŋəm], *Dingley* [ˈdɪŋli] or *Wellington* [ˈwelɪŋtən] where one might suggest pseudo-morphemes *-ham, -ley, -ton*. Others, such as *dinghy, hangar* admit two types of pronunciation, with and without a velar plosive following the nasal, i.e. [ˈdɪŋ(g)i, ˈhæŋ(g)ə]; the variant with the velar plosive requires no comment, as this is precisely what we would expect. The variants [ˈdɪŋi, ˈhæŋə] seem to call for a complex domain structure, a step which can be defended. The words *hangar, dingy* contain the vowels [ə] and [i] which frequently function as morphemes (e.g.: *hanger, Johnny*), hence an enforced morphological division is not an unlikely possibility. The point is that enforced domain division is not morphologically justified: *dinghy* is not 'a small *ding' in the same way in which *Johnny* is 'small John'. By introducing domain structure into words like *dinghy* we consciously embrace the possibility of *false morphological segmentation* resulting in **pseudo-morphemes**. It should be kept in mind that such doctoring of representations is only to be recognised when a small number of words appears to contradict a reasonably convincing analysis. In every case it should be applied with caution and avoided if alternative solutions can be found. As such, even this limited need for artificial domain structure is a warning that the analysis we have arrived at may not be the definitive one.

3.3 Preaspiration in Modern Icelandic

A rather striking example of the role of domains in the functioning of phonological regularities can be found in the phenomenon of **preaspiration** in Modern Icelandic. It consists in the presence of the segment [h] before certain consonants and consonant combinations. Before we look at preaspiration in greater detail, we will review and extend some general facts about Icelandic consonants in addition to what was already said about the language in 1.2. Other information about the phonetics of the language will be supplied in Chapter Seven which will be entirely devoted to selected Icelandic phonological phenomena; here let us note that stress is invariably initial, hence we do not include it in out transcriptions.

Plosives in Modern Icelandic are all invariably voiceless. They are divided into two classes distinguished by the presence and absence of aspiration, as in the examples below.

[11]

panna [pʰan:a] 'frying pan'   banna [pan:a] 'forbid, ban'
tala [tʰa:la] 'talk, vb.'   dala [ta:la] 'valley, gen. pl.'
kaldur [kʰaltʏr] 'cold'   galdur [kaltʏr] 'witchcraft'

The opposition between aspirated and non-aspirated plosives is most clearly visible in word-initial position, elsewhere in the word its presence is not always directly observable. As an example: after a sonorant aspirated plosives are never aspirated. This does not mean, however, that a sequence of a sonorant and a plosive is always the same: although only unaspirated plosives are possible in such combinations, the sonorants can be either voiced or voiceless. Thus we find that *orka* [ɔr̥ka] 'energy' and *vanta* [van̥ta] 'want' are distinct from *orga* [ɔrka] 'scream' and *vanda* [vanta] 'do something carefully'. We have evidence showing that it is the aspirated plosives that render preceding sonorants voiceless; the evidence in question is the morpheme *-t* [tʰ] which marks the neuter gender of adjectives. When the suffix is attached to a stem ending in a sonorant, what emerges is a sequence of a voiceless sonorant and an unaspirated plosive as in [12].

[12]

tóm [tʰou:m] 'empty, fem.'   tómt [tʰoum̥t] 'id. neut.'
gul [kʏ:l] 'yellow, fem.'   gult [kʏ̥lt] 'id. neut.'
dapur [ta:pʏr] 'sad'   dapurt [ta:pʏr̥t] 'id. neut.'
brýn [pri:n] 'urgent, fem.'   brýnt [prin̥t] 'id. neut.'

We can say that in such cases aspiration is realised as the devoicing of the preceding sonorant, but in strict terms it means that a sequence of a sonorant followed by an aspirated stop is pronounced as a voiceless stop followed by an unaspirated plosive (see also the examples [10b] in 1.2 above).

Another case where aspirated plosives appear without aspiration word-internally concerns geminate clusters; while geminate unaspirated plosives are pronounced as long consonants, e.g.: *vagga* [vag:a] 'cradle', *labba* [lap:a] 'walk', *oddur* [ɔt:ʏr] 'point', long aspirated plosives do not exist. If we take again the neuter adjective marker illustrated in [12] and attach it to stems ending in dental aspirated plosives, what emerges is a preaspirated plosive which itself is unaspirated, i.e. [ht]:

[13]

heit [hei:tʰ] 'hot, fem.'   heitt [heiht] 'id. neut.'
sæt [sai:tʰ] 'sweet, fem.'   sætt [saiht] 'id. neut.'
fráleit [frau:leitʰ] 'absurd'   fráleitt [frau:leiht] 'id. neut.'
hvít [kʰvi:tʰ] 'white, fem.'   hvítt [kʰviht] 'id. neut.'

Thus we see that a potential geminate consisting of aspirated plosives is realised as a preaspirated plosive without post-aspiration. Since this seems to be the general situation in the language, we conclude that preaspiration partly consists in replacing a sequence of aspirated plosives by the glottal spirant followed by a single unaspirated plosive.

Another context where preaspiration is found involves a sequence of a plosive and a stop sonorant, typically [l] and [n]. As above, the plosive must be unaspirated after preaspiration, hence we are talking about sequences [hpl, hpn, htl, htn, hkl, hkn], e.g.:
[14]

epli [ɛhplɪ] 'apple'	vopn [vɔhpn] 'weapon'
ætla [aihtla] 'intend'	batna [pahtna] 'improve'
hekla [hɛhkla] 'crochet'	læknir [laihknɪr] 'physician'

Although the plosives conditioning preaspiration are themselves not aspirated, they have to be distinguished from other unaspirated plosives. Phonetically the same consonantal sequences which in [14] are accompanied by preaspiration can be found without preaspiration:
[15]

efla [ɛpla] 'strengthen'	jafn [japn] 'even'
kalla [kʰatla] 'call'	barn [patn] 'child'
sigla [sɪkla] 'sail'	sagna [sakna] 'story, gen. pl.'

We encountered a similar situation above when sonorants were voiceless before some plosives but not others - recall the case of *vanta* [vann̥ta] 'want' - *vanda* [vanta] 'do something carefully'. We argued that the voiceless sonorants manifested the aspiration of the following plosive; in support of this claim we supplied independent evidence. The same procedure will be followed here: we can find examples where the plosive of the preaspirated clusters appears (post)aspirated in other forms of the same morpheme. Consider the alternations below:
[16]

deplar [tɛhplar] 'dot, nom. pl.'	depill [tɛ:pʰɪtl] 'id. nom. sg.'
opna [ɔhpna] 'to open'	opinn [ɔ:pʰɪn] 'open, adj.'
ketlar [cʰɛhtlar] 'kettle, nom . pl.'	ketil [cʰɛ:tʰɪl] 'id. acc. sg.'
gatna [kahtna] 'street, gen. pl.'	gata [ka:tʰa] 'street'
jöklar [jœhklar] 'glacier, nom. pl.'	jökul [jœ:kʰʏl] 'id. acc. sg.'
aukning [œihknɪŋk] 'increase, n.'	auka [œi:kʰa] 'increase, vb.'

The alternations in [16] show that the plosive is aspirated when followed by a vowel, as in the right hand column, but loses the aspiration when followed by a stop sonorant; in the latter case the cluster is preceded by preaspiration. Speaking rather impressionistically, we could say that aspiration emerges as preaspiration if a plosive is directly followed by a stop sonorant. Consequently in [15] - where no preaspiration is found - the right context is not met, i.e. the plosive does not contain aspiration which could be turned into preaspiration.

We can conclude this part of the description of preaspiration by repeating the two contexts where this phenomenon is found in Icelandic: 1. in place of the first part of an aspirated geminate 2. before an aspirated plosive followed by a stop sonorant. In both cases the plosive is phonetically unaspirated.

The description we have worked out so far covers a great number of forms of the language and appears general enough to qualify as a valid phonological generalisation. A question which must be answered at this stage is the scope of the generalisation, i.e. what is the domain within which the preaspiration generalisation holds?

At first glance it might seem that it is the dictionary word that constitutes such domains, since no preaspiration effects are found when words follow each other in a sentence, e.g. in *kjöt nokkurt* 'some meat' there is no preaspiration before the final [t] of the first word, which is followed by [n] in the next word. However, a closer inspection of the Icelandic lexicon reveals that such a simple solution is not adequate. For one thing, Icelandic abounds in compounds, sometimes of considerable length and complexity; the notion of the word would have to take them into account in some way. Some such compounds, which function as single lexical items but consist of independent words, follow in [17].

[17]

a.   hluttaka [l̥ʏ:t^h:ak^{h}a] 'participation' (hlut + taka)

b.   bakljós [pa:k^{h}ljous] 'back light' (bak + ljós)

c.   reknet [rɛ:k^{h}nɛt] 'drift net' (rek + net)

The compound in [17a] has a long aspirated plosive, something which is not found word-internally; where such a combination arises at morpheme junctures, it is interpreted as a preaspirated plosive - see examples in [13]. Similarly, as shown by [14], the combination of an aspirated plosive and a sonorant should result in preaspiration - this does not happen in the compounds in [17b-c]. Phonologically, then, compounds display different properties than single morphemes or morphologically complex derivatives. It is necessary to restrict the operation of preaspiration in such a way as to exclude it at word junctures within compounds, while admitting it at morpheme junctures within words. A simple way of achieving this is to analyse the compounds in [17] as consisting of two phonological domains; in such a case the relevant consonant sequences are separated in the same way as words in a sentence and hence do not qualify for preaspiration effects. However, not all cases are so persuasive or so straightforward: the examples in [17] involve compounds with clearly visible constitutent parts which delimit the area for the operation of phonological generalisations. Words with derivational suffixes are less clear in this respect.

Consider the stem *sjúk* [sju:k^h] 'sick, fem.'; when combined with the noun forming suffix *-lingur* [liŋgʏr] it derives the noun *sjúklingur* [sjuhkliŋgʏr] 'patient' with preaspiration appearing in the required context. When the same stem combines with the adjective-forming suffix *-legur* [lɛɣʏr] or the noun-forming *-leiki* [leic^{h}ɪ] we end up with derivatives without preaspiration: *sjúklegur* [sju:k^{h}lɛɣʏr] 'sickly, peaky', *sjúkleiki* [sju:k^{h}leic^{h}ɪ] 'sickness'. Note that in the cases without preaspiration we find the same consonant sequence as in the cases with preaspiration. In other words, it is not the presence of specific consonants or the very fact of morphological complexity that determine the emergence of a phonological effect such as preaspiration. The suffixes which do not evince preaspiration, i.e. *-legur, -leiki* behave in the same way as the members of the compounds in [17] do. On the other hand, the suffix that does, i.e. *-lingur* behaves as if it formed a single domain with the preceding stem. In sum, then, preaspiration appears in the simplex form like *vættur* [vaihtʏr] 'supernatural being' or the loan-word *sígaretta* [si:karehta] 'cigarette', and also in the morphologically complex *sjúklingur*. The latter word must be regarded as making up a single phonological domain.

It looks then as if certain suffixes are separated from the base by a domain boundary, while others form a single domain with the base. In [18] more examples are offered of the two types of derivatives: in [18a] the suffixes are invisible for the purposes of preaspiration, while in [18b] they form a barrier and no preaspiration is attested. The words in the right hand column show the alternants with single aspirated plosives appearing before a vowel.

[18]

a. bæklingur [paihkliŋgʏr] 'pamphlet, booklet'   bækur [pai:k^{h}ʏr] 'books'

    latneskur [lahtnɛskʏr] 'Latin, adj.'   latína [la:t^{h}ina] 'Latin language'

    vitneskja [vɪhtnɛsca] 'knowledge'   vita [vɪ:t^{h}a] 'know'

undantekning [ʏndantɛhkniŋk] 'exception'   undantaka [ʏndantakʰa] 'exclude'
b. hlutlaus [l̥ʏːtʰlœeis] 'neutral, disinterested   hluti [l̥ʏːtʰɪ] 'part, share'
   hlutleysi [l̥ʏːtʰleisɪ] 'neutrality'
   saknæmur [saːkʰnaimʏr] 'punishable'   saka [saːkʰa] 'accuse'
   saknæmi [saːkʰnaimɪ] 'punishability'
   sakleysi [saːkʰleisɪ] 'innocence'
   saklaus [saːkʰlœeis] 'innocent']

It thus seems that the lexical entries for individual words include information about their phonological domain structure (cf. *dinghy* etc. in the preceding section). This information is **unpredictable** or **idiosyncratic**: there is no way of knowing in advance that -*ning* is not separated from the base by domain structure while -*laus* is. This must be part of what is specific about a given word, together with the rest of its phonological representation, its morphological properties, syntactic peculiarities and its meaning. An additional argument in favour of the idiosyncratic nature of the domain structure of words comes from words which are exceptional. Here we will just consider two examples which should help us reach a better understanding of the role of domains in phonology.

In [17] we illustrated a case where the consonantal clusters which arise at the boundaries between component parts of a compound do not constitute the right context for preaspiration. This is predominantly the rule in the language, although individual cases can be found which depart from this generalisation: the word *kaupmaður* 'merchant' is clearly a compound of *kaup* 'trade, business' and *maður* 'man' and as such should disallow preaspiration. While the preaspiration-less pronunciation [kʰœiːpʰmaðʏr] is a possibility, so is a variant with preaspiration: [kʰœihpmaðʏr]; it is the latter possibility which indicates that domain structure cannot be mechanically identified with morphological complexity and hence needs to be entered in the lexicon. In this particular case two alternative domain structures for the compound have to be recognised: one separating the two parts with a concomitant absence of preaspiration, and an alternative one with a single domain for the compound as a whole and preaspiration.

A somewhat different case can be observed in the word *vitlaus* [vɪhtlœeis] 'crazy' with obligatory preaspiration. The suffix -*laus* is normally separated from its base by domain structure (cf. *hlutlaus* in [18b]) and thus its initial sonorant does not occur in a context inducing the emergence of preaspiration. The word *vitlaus*, however, having the morphologically transparent structure *vit* + *laus*, lit. 'wit-less', admits a pronunciation with preaspiration only. In our terms this means that the derivative does not contain an internal phonological domain. On a more general level the implication is that it is impossible to determine such domains for affixes once and for all. Rather, they belong to individual words and are subject to lexically unpredictable variation.

Domain structure is crucial for the statement of phonological regularities, most of which have a restricted scope. The point of the discussion above has been not so much the need for delimiting the areas where generalisations hold, but rather to demonstrate that domains must to some extent at least be regarded as arbitrary. While monomorphemic words usually automatically constitute domains, derivatives does not allow a simple solution. Some of them, although unquestionably complex morphologically, behave as if they were simplex forms, while in others morphological complexity goes hand in hand with domain structure. There is no single rule for deciding whether or not phonological domains can be identified with morphological ones. Phonology behaves in its own way, sometimes taking morphological structure as its own phonological domain, and at other times ignoring morphology altogether. We have seen cases where both options are taken (*kaupmaður* in Icelandic), or when phonological domain structure is introduced although it has no

morphological support (English *hangar, dinghy*). Phonological analysis consists not only in identifying the right generalisations, but also in specifying the phonological domain structure of words, something which is only partly derivable from their morphological structure.

3.4 Dorsal spirants in Standard German

Modern Standard German contains two **dorsal** spirants, i.e. consonants whose articulation involves the back of the tongue: the velar [x] and the palatal [ç], both of them voiceless. The position of these two consonants in the phonology of German has been subject to much discussion in the phonological literature. Here we will consider the most important aspects of the problem and their implications.

The most direct piece of evidence showing that the two spirants are not just phonetically close but also phonologically related can be seen in morphological alternations. There are numerous morphemes in German which display the velar spirant in some forms and the palatal one in others. Some examples follow.

[19]

Buch [buːx] 'book'	Bücher ['byːçɐ] 'id. pl.'
Loch [lɔx] 'lake'	Löcher ['lœçɐ] 'id. pl.'
Bach [bax] 'stream'	Bäche ['bɛçə] 'id. pl.'
Strauch [ʃtʁaʊx] 'shrub'	Sträucher ['ʃtʁɔɪçɐ] 'id. pl.'
Sprache ['ʃpʁaːxə] 'language'	sprechen ['ʃpʁɛçən] 'speak'
schwach [ʃvax] 'weak'	schwächer ['ʃvɛçɐ] 'weaker'
brach [bʁaːx] 'I broke'	brechen ['bʁɛçən] 'break'
brauchte ['bʁaʊxtə] 'I used'	bräuchte ['bʁɔɪçtə] 'I would use'

An inspection of the contexts where the two spirants occur shows that the velar spirant invariably follows some back vowel or glide, whereas the palatal one appears after a front vowel or glide. We are not concerned here with the relatedness of the back and front nuclei, but merely note that the backness or frontness of the vowel goes hand in hand with the velarity or palatality of the dorsal spirant. This seems to be generally the case in German, quite irrespective of the existing alternations: as the examples in [20a] document, the velar spirant is invariably preceded by a back vowel, while a front vowel requires the following spirant to be palatal [20b]. The length of the preceding nucleus is seen to be irrelevant to the character of the following dorsal spirant.

[20]

a.
Nacht [naxt] 'night'	nach [naːx] 'after'
Woche ['vɔxə] 'week'	hoch [hoːx] 'high'
Flucht [flʊxt] 'flight'	buchen ['buːxən] 'enter'
rauchen ['raʊxən] 'smoke, vb.'	

b.
Sicht [zɪçt] 'sight'	siech [ziːç] 'infirm'
Küche ['kyçə] 'kitchen'	psychisch ['psyːçɪʃ] 'psychological'
Fächer ['fɛçɐ] 'fan'	Leiche ['laɪçə] 'corpse'
meucheln ['mɔɪçəln] 'assassinate'	röcheln ['rœçəln] 'give the death rattle',

The combined evidence of [19] and [20] might suggest a very simple relation between a vowel and a following dorsal spirant: the vowel shares its frontness or its backness with the consonant, which is consequently pronounced in the two different ways. Thus the velar spirant [x] would be expected to appear exclusively after a back vowel, and the palatal spirant

[ç] could only appear after a front vowel. Unfortunately, this simple generalisation is only partly true: while the velar spirant does, indeed, only appear after back vowels, the palatal one is less restricted as it is also found after consonants [21a], and at the beginning of a word no matter what vowel follows, or whether the next segment is a vowel or a consonant [21b].

[21]

a.   Milch [mɪlç] 'milk'   Strolch [ʃtrɔlç] 'rascal'
     Fenchel ['fɛnçəl] 'fennel'   manche ['mançə] 'some'
     Archiv [ar'çi:f] 'archives'   horchen ['hɔrçən] 'listen'

b.   Chinin [çi'ni:n] 'quinine'   Chemie [çe'mi:] 'chemistry'
     Charisma ['ça:risma] 'charisma'   Cholesterin [çolɛste'ri:n] 'cholesterol'
     chthonisch ['çto:nɪʃ] 'earthly   Chrisam ['çri:zam] 'chrism'

It thus seems that while the velar spirant is crucially dependent on the preceding back vowel for its existence, the palatal variant is subject to fewer restrictions. In actual fact, the only restriction that it must obey is that it cannot follow a back vowel, since this is reserved for the velar consonant. It is this latter regularity that needs to be stated as a phonological sharing generalisation: a back vowel shares its backness with the following dorsal spirant. We may recast this in the form of a general formula of the following sort:

[22]

German backness sharing
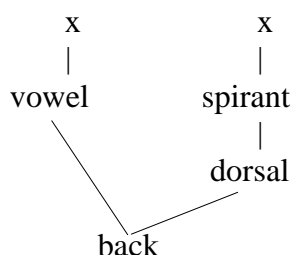
This generalisation restricts the occurrence of the velar spirant to a well-defined context, connecting a feature of the context, i.e. vowel-backness, with the required nature of the spirant. In other words, the spirant is velar because the vowel is back. What about the other spirant? As we saw above, the palatal spirant has a distribution which is complementary to the velar one: it appears in all contexts apart from those involving a back vowel. We can reformulate this by saying that a dorsal spirant, unless it shares its backness with a preceding back vowel, is pronounced as [ç] in all contexts. In other words, the dorsal spirant in German is pronounced as palatal unless directed otherwise. The palatal pronunciation of the dorsal spirant is just a **phonetic effect** without a phonological motivation. More will be said about the concept of the phonetic effect in the Summary below (3.5).

Let us now consider the other German spirants. These embrace:

[23]

labio-dentals: [f], [v], e.g.: *finden* ['fɪndən] 'find', *wieder* ['vi:dɐ] 'again'
alveolars: [s], [z] , e.g.: *beißen* ['baɪsən] 'bite', *reisen* ['ʁaɪzən] 'travel'
palato-alveolar [ʃ], e.g. *wünschen* ['vʏnʃən] 'wish'
glottal [h], e.g. *hundert* ['hʊndɐt] 'hundred'

Since the dorsal spirants vary between palatal and velar types, it might be suggested that the place of articulation is not an inherent property of theirs. As we have seen, the velar fricative [x] invariably shares its backness with the preceding vowel and for this reason it cannot appear at the beginning of a word or after a consonant. Thus the place of articulation

of the spirant is what it has in common with the preceding vowel. If no sharing is involved, the fricative is pronounced as [ç]. On this interpretation we can slightly modify the formulation of backness sharing in German and remove the awkward combination of dorsality and backness. The revised formulation follows below:

[24]

German backness sharing

```
        x                 x
        |                 |
      vowel            spirant
           \           /
              back
```
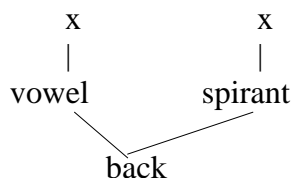
The condition states that a placeless spirant is back after a back vowel; otherwise it is palatal, with palatality being merely a phonetic effect with little phonological significance. The remaining fricatives in [23] contain place of articulation as part of their phonological specification.

The two dorsal spirants in German appear to show the predictability of distribution that is reminiscent of the RP dark and clear [l] as discussed in Chapter 1. There is a difference, however. It has been generally observed that the pattern with the velar spirant after back vowels and the palatal one elsewhere is disrupted by a handful of forms such as those in [25].

[25]

Kuchen ['ku:xən] 'cake'	Kuhchen ['ku:çən] 'cow, dim.'
tauchen ['taʊxən] 'dive'	Tauchen ['taʊçən] 'rope, dim.'

On the face of it, these pairs of words differ from the cases considered so far in that both spirants appear in exactly the same contexts. If the examples in [25] were to be taken at face value, we would have to conclude that our observations about the distribution of the spirants have to be revised, as the palatal spirant is also possible after a back vowel (*Kuhchen, Tauchen*) in contravention of the backness sharing constraint [24]. Before abandoning the generalisation we need to look a little more closely at the forms which appear to violate it, i.e. cases where the palatal consonant appears after a back vowel. What any morphological analysis of German reveals is that the forms in the right hand column in [25] are complex and consist of a stem *Kuh* [ku:] 'cow', *Tau* [tau] 'rope' and the diminutive-forming suffix *-chen* [çən]; the suffix is found in numerous other forms.

[26]

Hund [hʊnt] 'dog'	Hundchen ['hʊntçən] 'doggy'
Vogel ['fo:gəl] 'bird'	Vögelchen ['fø:gəlçən] 'birdie'
Fisch [fɪʃ] 'fish'	Fischchen ['fɪʃçən] 'little fish'
Schwester ['ʃvɛstɐ] 'sister'	Schwesterchen ['ʃvɛstɐçən] 'little sister'

This very productive suffix always appears as [çən], with a palatal spirant. This is what we would expect of the word-initial position (see [21b]); we can adopt the view that the suffix is separated from the base to which it is attached by a domain boundary. In such a case the appearance of the palatal spirant after a back vowel has nothing to do with backness sharing in German; if anything, it is an accident that the domain initial spirant follows a domain final back vowel. It is not any different from [ç] coming after [a:] in *sah Chirurg* [za: çi'rurk] 'saw a surgeon' where - phonetically speaking - a back vowel is followed by the palatal spirant. The -*chen* counterexamples to the generalisations established so far can be

dismissed as spurious: once domain structure is recognised, forms which initially appear to violate or contradict a generalisation turn out to support it.

3.5 Summary

Phonological regularities capture relations between consecutive skeleton-melody associations. What the evidence of this chapter shows is that these relations hold within chunks of the structure called phonological domains. The main point we have tried to make is that domains, just like regularities themselves, must be arrived at and established in the course of analysis. The difficulty facing an analysis is the necessity of disentangling both domain structures and phonological regularities: phonological regularities hold within domains, but domains can often be determined after achieving some preliminary understanding of the regularities. In the course of further analysis both domains and regularities should be made maximally precise. What must be kept in mind is that, in general, there are no mechanical methods of analysing the phonology of a language, whether we are dealing with regularities or domains.

What is relatively uncontroversial is that monomorphemic words, predominantly, constitute single phonological domains. This is true even if we have seen cases where morphologically simplex words may have to be assigned domain structure in order not to jeopardise a phonological generalisation. Words which are morphologically complex may but do not have to translate into phonologically complex domains. Whether they do or do not is an empirical question which can only be determined by an analysis of specific language data. In the case of complex units some mismatch between morphological structure and phonological domain organisation is the norm.

Although we have stressed the significance of domain structure for an adequate formulation of phonological generalisations, this is not to say that there are no phonological regularities holding between domains. In fact there is the ancient Sanskrit notion of **sandhi** phenomena, covering regularities emerging at word junctures. For the most part such phenomena lie outside the scope of this book.

Finally we introduced the notion of the phonetic effect, referring to sound properties which, in some sense, are not essential or are accidental. Phonetic effect covers that part of the phonetic substance which has little phonological significance and can vary a lot. The notion should be used with care as it can be abused in various ways. Its relevance cannot be doubted, however. A dramatic case in point is the variation in contemporary German among the various *r*-sounds; simplifying the matter considerably, two very different variants are normally identified in the language: the uvular fricative [ʁ] and the apical roll [r]. In phonetic terms these are very different sounds, one resulting from friction in the passage formed by the raising of the back part of the tongue towards the uvula, and the other one from the tapping of the tip of the tongue against the gums. Not only articulatorily but also perceptually these sounds are markedly different. In the structure of German, however, they appear to exhibit very minor differences and the variation is regional: Bavaria in the south-east and Schleswig-Holstein in the north preferring the apical roll, while the uvular fricative predominates elsewhere. Thus, for example, [ʁ] appears in exactly the same positions in some dialects where [r] appears in others. The actual phonetic constitution of the sound and its physical nature are secondary to its phonological status, which can be determined by phonological analysis. What is crucial is the fact that the phonetic realisation of a segment says very little, sometimes next to nothing about its phonological properties and positioning in the system of the language, hence the designation of the phonetic (side) effect.

In the following chapter we will need to broaden the notion of phonological organisation by considering units other than domains that determine the shape of regularities.

3.6 Sugested further reading

The velar nasal has figured prominently in the history of phonology, starting with Sapir (1925), whose paper involves both native speakers' judgements and language-internal arguments. For different analyses consult Vachek (1964, 1976), Chomsky and Halle (1968), Giegerich (1992), Gussmann (1998). See also Fromkin (1971) for a discussion of the status of the velar nasal as revealed through slips of the tongue.

Domain structure in phonology has been recognised in all frameworks, although sometimes under different names. The papers in Aronoff and Kean (1980) offer a selected survey of views; for an early statement and a relatively recent statement within the generative tradition, see Stanley (1973) and Kaye (1995) respectively.

Icelandic preaspiration has been described in traditional textbooks and grammars, such as Einarsson (1945), and interpreted phonologically in different ways in, e.g.: Thráinsson (1978), Árnason (1986), Gussmann (1999, 2000).

For an alternative analysis of the German dorsal spirants, see Hall (1992, Ch. 5).

Sandhi phenomena in a variety of European languages are discussed at length in the

papers in Andersen (1986).