12

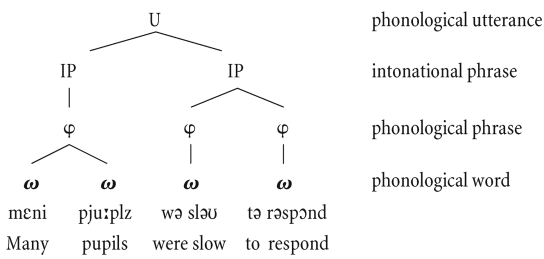
Phonology above the word

12.1 INTRODUCTION

The phonological structure of languages extends beyond the syllable and the foot. There is a hierarchy of phonological constituents, so that lower, and thus typically smaller, constituents are contained within higher, and thus typically larger, ones. For instance, the foot is contained within, or dominated by, the phonological word, and phonological words are grouped into phonological phrases, etc. Instead of 'phonological constituent', the term 'prosodic constituent' is often used, particularly for the higher constituents, like the phonological phrase, the intonational phrase and the phonological utterance. The entire structure above the syllable is often referred to as the 'Prosodic Hierarchy'. This line of research began with Selkirk (1978) and was consolidated by Nespor and Vogel (1986), Hayes (1989b) and, for the phonological word, Booij (1985), among others.

In this chapter, we discuss and illustrate the phonological utterance (U), the intonational phrase (IP), the phonological phrase (φ) and the phonological word (*ω*). In (1), an example of a sentence is given that has been parsed into these constituents. The next two lower constituents are the foot (chapter 11) and the syllable (chapter 9). Notice, for instance, that weak forms, the function words *were* and *to*, are not separate *ω*s, but are included with the following form in the same *ω*. In fact, they aren't even feet, since they have no stress. Before discussing the prosodic constituents in more detail, we first deal with three general questions. First, how do prosodic constituents manifest themselves? Second, what is the general structure of the prosodic hierarchy? And, third, what determines the prosodic structure of specific sentences?

(1)



12.2 GENERALIZATIONS INVOLVING PROSODIC CONSTITUENTS

Prosodic constituents manifest themselves in four ways:

1 Boundary strength. There is a greater degree of articulatory integration in lower constituents than in higher ones. For instance, within an English

syllable like [læmp] as in *Lampton*, the articulatory gestures occur relatively quickly after each other, but within higher-ranking constituents the sequence of movements in [læmp] will be less tightly coordinated, as in *A fu*[*ll amp*]*utation* or *A* [*lamb p*]*assed by.* That is, prosodic breaks between higher constituents are stronger than those between lower constituents. Boundary strength will reveal itself in a number of phonetic measures. The extent to which the articulation of a vowel is influenced by that of a vowel or consonant in a neighbouring syllable will depend on the strength of the boundary between the syllables containing the vowels. In general, **coarticulation** will cause a schwa to be closer in [əpiː] than in [əpɑː], in anticipation of the tongue position of the following vowel, but this effect will be stronger if the two vowels occur *within* an *ω*, as in [ə]*ppeal*, than when they occur in different *ω*s, as in *Emm*[ə] *Peel* (cf. Cho 2004). Also, the duration of the last syllable of a prosodic constituent is typically longer as the lengthening is stronger (or 'higher', thinking hierarchically), which is known as **final lengthening**, also known as **preboundary lengthening**. Equally, the initial segments of a constituent are more clearly pronounced as the boundary is stronger, which is known as **initial strengthening** (Keating et al. 2004).

2 Boundary tones. Higher constituents are often characterized by intonational boundary tones. When that happens, the boundary is particularly easy to hear. Examples of this will be given when we discuss the φ and the IP.

3 Postlexical phonological processes. Prosodic constituents frequently determine the distribution of segments and the application of phonological processes, as illustrated for the syllable and the foot in chapters 9 and 11. The ways in which reference is made to phonological constituents have been classed into three types (Selkirk 1980).

   a Domain limit constraints. Reference is made to the left or right edge of a constituent. In many languages, *ω*s must end in a consonant, as in Tagalog for instance, although syllables occur freely without a coda word-internally.

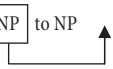
   b Domain span constraints. The context and the focus of some generalization must occur with a single constituent of some rank. For instance, as we will see below, Italian has a rule of s-VOICING, which causes [z], never [s], to appear between vowels contained within an *ω*.

   c Domain juncture constraints. The context of the generalization may include the left and right edges of adjacent constituents of some rank, provided this boundary occurs within some higher constituent. For instance, as we will see, [s] is optionally voiced to [z] in Dutch if it occurs finally in the *ω* and the next *ω* begins with a vowel, provided this boundary falls within an IP.

4 Phonology-sensitive syntax. Lastly, it has been observed that syntactic and morphological rules may be sensitive to the size of constituents (Zec and Inkelas 1990). English has HEAVY NP SHIFT, which allows the movement of the object in (3b) to clause-final position. However, a condition on the rule is that the object NP must consist of more than one φ. For this reason, (3a)

cannot move its NP. By contrast, (3b) shows that either order is fine if the object NP contains more than one φ.

(2) V NP to NP



(3) a He gave the book to her aunt (* . . . to her aunt the book).
b He gave to her aunt the book about Mozart (*or*: the book about Mozart to her aunt).

12.3 THE STRICT LAYER HYPOTHESIS

What does the prosodic hierarchy look like? A common view is that the constituents obey the Strict Layer Hypothesis, which is perfectly obeyed by representation (4).

(4)
( )U
( )( )IP
( )( )( )( )φ
( )( )( )( )( )( )ω

There have been a number of formulations of this principle (Selkirk 1984; Ladd 2008: 291), which can be given as (5).

(5) Strict Layer Hypothesis (SLH): A prosodic constituent of rank *n* is immediately dominated by a single constituent of rank *n* + 1.

An ω, for example, will be dominated by φ. If it isn't, as in (6a), the structure is non-exhaustively parsed, in this case into constituents of rank 2. As it happens, the seriousness of violations of SLH varies considerably. First, non-exhaustive parsing of syllables into feet frequently occurs when word-peripheral syllables are left unfooted (see section 11.3.1), an uncontroversial case of an SLH violation. Thus, segment A in (6a) may begin a syllable without at the same time beginning a foot. Second, if an ω were to be dominated by two φs, we would create the incoherent occurrence of a φ-boundary within an ω. This type of violation of the SLH, shown for the boundary between A and B in (6b) and known as 'improper bracketing', is ruled out completely. Third, if a constituent were to dominate a constituent of the same rank, we would have recursiveness. A structure is recursive if some constituent appears within a constituent of the same or a lower rank. In (6c), for instance, two constituents of rank 1 are contained within a constituent of the same rank. There have been various claims that same-rank recursiveness in prosodic phrasing must in fact sometimes be recognized.

(6)
a ( )3
( )2
(A)( )1

b ( )3
( )( )2
( )(A B)( )1

c ( )1
( )(A)1

As observed in section 1.4, recursiveness in the morphosyntactic structure is one of the hallmarks of human language. It explains why sentence length is infinite, as in *This is the cat that caught the rat that stole the cheese that lay on the table that* . . . , where every NP except *This* has the structure $[. . .[. . .]_S]_{NP}$, as in $[$*the cat* $[$*the cat stole the cheese*$]_S]_{NP}$, in which the S has an NP which takes the form $[. . .[. . .]_S]_{NP}$, and so on, *ad infinitum*. Similarly, sentences may appear as premodifiers within NPs, as in *an I-couldn't-care-less attitude*. In phonological structure, such spectacular cases of recursiveness are unknown. It will be safe to say, for instance, that we will never come across a language which places a *ω* in the nucleus of a syllable.

12.4 FACTORS DETERMINING PROSODIC PHRASING

What determines where these prosodic constituents begin and end? Not surprisingly, an important factor is the morphosyntactic structure. It would, to give an extreme example, be unexpected for the main break in (7a) to occur between *to* and *arrive*, with smaller breaks as indicated. Rather, we would expect something more like (7b). In fact, in (7b), the smaller domains are φs, and the larger ones IPs. As will be clear, they correspond with syntactic phrases, unlike the bracketed parts of (7a). By somehow marking off the meaningful constituents in the pronunciation, parsing of the expression will be easier for the listener.

(7) a {(The first) (train to)} {(arrive is the) (one from Paris)}
b {(The first train) (to arrive)} {(is the one) (from Paris)}

However, a secondary role is played by constituent length. Since morphosyntactic constituents of a given rank may vary hugely in length, a one-to-one correspondence between phonological and morphosyntactic constituents would put unreasonable demands on speakers. For instance, the large NP after *see* in (8a) is syntactically equivalent to the word *her* in (8b). It would be quite a strain on the speaker to produce a φ that runs all the way from *the old* to *road*, while it would equally be awkward to produce two in quick succession for *I can see* and *her*. In (8a) there is too much phonological structure and in (8b) too little for a comfortably rhythmic occurrence of prosodic breaks. Generally, there would appear to be a tendency for constituents to consist of two lower constituents (Selkirk 2000).

(8) a I can see the old customs office at the end of the bend in the road.
b I can see her.

Not surprisingly, a φ tends to be produced for each of the NP-internal phrases in (8a): *(the old customs office)*, *(at the end)*, *(of the bend)* and *(in the road)*. And in (8b) the NP *her* will be incorporated with the preceding *see* into a single *ω*, pronounced [siːə], to rhyme with *Maria*. This incorporation of phonologically weak words into adjacent words is called **cliticization**, and *her* here is a clitic that attaches to the host *see*, instead of forming a φ, which it would have been entitled to if it had been

a noun. Cliticization of phonologically weak words inside a *ω* with a regular word is a specific case of what is called **restructuring**, the incorporation of phonologically light structures with adjacent words into a phonological constituent of the rank which it would otherwise have had to itself.

In (8a), the correspondence between the syntactic and the phonological structure is still in a sense one to one, since inside the large NP, the 'maximal projection', there are smaller phrases, PPs and an NP, or XPs for short, which correspond to φs. However, also when the syntax is identical, different prosodic structures may be imposed on the grounds of length. For instance, an IP boundary is more likely after the subject NP in *Hippopotamuses like to swim in the river* than in *John likes to swim in the river.* Languages will vary in their preference for reflecting the morphosyntactic structure in the phonology at the expense of an even distribution of phonological constituents.

A third factor is the **information structure** of the sentence. If someone answers the question *When was Mozart born?* by saying *In January 1756*, all of the information expressed is new to the speaker who posed the question. However, if the same expression was said in response to *Was Mozart born in January 1756 or in February 1756?* only *January* would be the new information. These different focus constituents are indicated in (9a) and (9b), respectively. Languages that encode such differences in information structure, or focus structure, may do so in different ways. Frequently, this is done through contrasts in prosodic phrasing. We will see an example of this in the discussion of the φ in Bengali. Other languages, like English, use pitch accents for this purpose (section 10.6).

(9) a In [January 1756]$_{\text{FOC}}$
b In [January]$_{\text{FOC}}$ 1756

Alignment constraints will take care of the coincidence of morphosyntactic constituents and prosodic constituents. Selkirk's (2000) AlignXP, for instance, given in (10), can be used to describe the phonological phrasing of the Basque sentence in (11a). It explains why (11b) is ungrammatical, because the right edge of the XP meaning 'to Amaia's grandmother' does not end a φ. The coincidence of prosodic constituents and focus constituents can likewise be accounted for by means of alignment constraints.

(10) AlignXP: Align the right edge of an XP with the right edge of a φ.

(11) a $_{\varphi}$(Amaien amumari)$_{\varphi}$ $_{\varphi}$(liburua)$_{\varphi}$ $_{\varphi}$(emon dotzo)$_{\varphi}$
Amaia-GEN grandmother-DAT book give AUX
She gave the book to Amaia's grandmother
b *$_{\varphi}$(Amaien amumari liburua)$_{\varphi}$ $_{\varphi}$(emon dotzo)$_{\varphi}$

An example of a constraint that considers phonological length is Binary (Elordieta 1997), a specific form of the general phenomenon that constituents mustn't be too short or too long. In fact, syntactically well-behaved (13b) is ungrammatical, because (12) outranks (10).

(12) BINARY: The first φ of the sentence must contain minimally two *ω*s.

(13) a $_{\varphi}$(Amaiari amumen liburua)$_{\varphi\,\varphi}$(emon dotzo)$_{\varphi}$
Amaia-DAT grandmother-GEN book give AUX
She gave grandmother's book to Amaia

b *$_{\varphi}$(Amaiari)$_{\varphi\,\varphi}$(amumen liburua)$_{\varphi\,\varphi}$(emon dotzo)$_{\varphi}$

Q122 If the syntactic structure of (13a) were to be used as a response to *Did she give Joseba's book to Amaia?*, the focus constituent would be *amumen*, the 'new' information. The left edge of this kind of focus constituent must be aligned with a φ-boundary, as expressed in (1).

(1) ALIGNFOC: Align the left edge of a FOC-constituent with the left edge of a φ.

The prosodic structure of the reply, in translation 'She gave GRANDMOTHER'S book to Amaia', is the one given as ungrammatical in (13b) of the text.

1 How would you account for the fact that the first φ consists of a single *ω*?
2 What would the prosodic structure be of the equivalent of 'She gave grandmother's BOOK to Amaia'?

We now turn briefly to the four prosodic constituents. These are not the only prosodic constituents that are discussed in the literature. For instance, an 'accentual phrase' and an 'intermediate phrase' are often referred to, both of which would rank above the *ω* and below the IP. Their position relative to the φ may vary across descriptions.

12.5 THE PROSODIC CONSTITUENTS

12.5.1 The phonological utterance

Nespor and Vogel (1986) illustrate the domain span effect of the U, on r-LINKING in the standard variety of English spoken in England, RP (Received Pronunciation). Like many other varieties, RP disallows the [–cons] consonants [h j w r] in the coda. Morphemes that end in nonhigh vowels ([ə ɪə eə ɔː ɑː ɜː], as in *villa*, *idea*, *fair*, *paw*, *car*, *stir*) are followed by [r], if the next morpheme begins with an onsetless syllable, as illustrated in (14).[1] In (14a,b), r-LINKING is seen to apply within the word and across words. However, the upper limit is the U: while it can apply across

two sentences addressed to the same listener and not separated by a pause, it cannot apply across two sentences addressed to different listeners, even if they are spoken without an intervening pause. The examples (14c,d) illustrate that the U is not necessarily isomorphic with a single syntactic sentence, but that there is nevertheless an upper limit to what can be accommodated within the same U.

(14) a stɜ: *stir* $_{U}$(. . . sti[r]ing . . .)$_{U}$
b fɛə *fair* $_{U}$(A fai[r]idea)$_{U}$
c ˈʃi:lə *Sheila* $_{U}$(Hi Sheila! [r]Everything all right?)$_{U}$
d ˈpi:tə *Peter* $_{U}$(Hi Peter!)$_{U}$ *[r] $_{U}$(Open the window, Sheila)$_{U}$

12.5.2 The intonational phrase

The IP, also abbreviated as ι, tends to correspond to the root sentence, i.e. a single [NP VP] structure without extrapositions or interruptions. Selkirk (1978) gives (15b), in which the extraposition *in Pakistan* and the restrictive relative clause *which is a weekday* have been assigned to separate IPs, leaving the root sentence, which would otherwise be a single IP (15b), to be divided over two IPs. However, as was the case with U, the division of speech into IPs is not purely syntactically driven. In particular, when the subject is longer than a single lexical word there will tend to be an IP boundary between the subject NP and the VP, as shown in (15c).

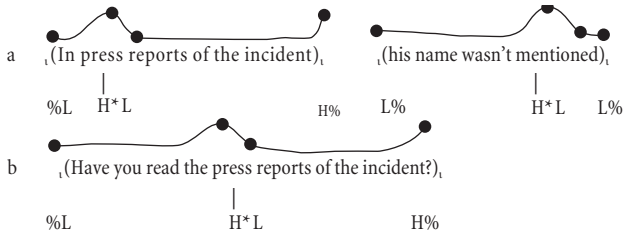
(15) a $_{\iota}$(In Pakistan)$_{\iota}$ $_{\iota}$(Tuesday)$_{\iota}$ $_{\iota}$(which is a weekday)$_{\iota}$ $_{\iota}$(is a holiday)$_{\iota}$
b $_{\iota}$(Tuesday is a holiday)$_{\iota}$
c $_{\iota}$(The second Tuesday of every month)$_{\iota}$ $_{\iota}$(is a holiday)$_{\iota}$

The domain span effect of the IP can be illustrated with a rhythmic accentuation affecting certain adverbials in Dutch, like [ɑltɛit] *altijd* 'always', which can appear in a variety of sentential positions in the IP. They are accented on the final syllable when no other pitch accented word follows in the same IP, as illustrated in (16a,b). The retraction of the accent to the first syllable occurs when they are followed by an accented word within the IP, as illustrated in (16c,d).

(16) a $_{\iota}$(Naar de WAterstanden luistert ze alTIJD)$_{\iota}$
to the water level reports listens she always
'The water level reports she will always listen to'
b $_{\iota}$(Waar ze alTIJD naar luistert)$_{\iota}$ $_{\iota}$(zijn de WAterstanden)$_{\iota}$
c $_{\iota}$(ALtijd luistert ze naar de WAterstanden)$_{\iota}$
d $_{\iota}$(Ze luistert ALtijd naar de WAterstanden)$_{\iota}$

As illustrated in chapter 10, the IP is bounded by intonational boundary tones in many languages, a domain limit phenomenon. English non-final IPs are frequently closed by H% after a H*L pitch accent, which causes the final syllable of *incident* in (17a) to have high pitch. In British English, the same H*L H% pattern may be used for questions, as shown in (17b).

(17)



12.5.3 The phonological phrase

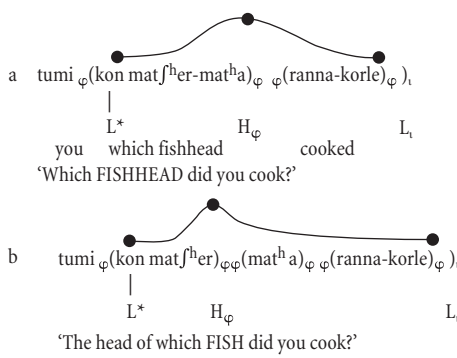
Although languages vary in the details of the correspondence, the φ tends to correspond to the syntactic phrase. Hayes (1989b) shows that the φ defines the domain of the English RHYTHM RULE. In (18a) *Chinese* is an adjective inside the NP *the Chinese dishes*, while in (18b) *the Chinese* is an NP, the indirect object *of gives*. An adjustment of the accentuation pattern from *CHINESE* to *CHInese* under the influence of the following accent on *DISHes* takes place in (18a), but not in (18b). Similarly, the German RHYTHM RULE is sensitive to the German φ in (19a), the headless object NP *das hell-blaue* forms a φ by itself, while in (19b) it forms part of the NP, and hence the φ, *das hell-blaue Bild*.

(18) a On Tuesdays, he gives$_{\varphi}$ (the CHInese DISHes)$_{\varphi}$
b On Tuesdays, he gives$_{\varphi}$ (the CHINESE)$_{\varphi\,\varphi}$(DISHes)$_{\varphi}$

(19) a Ich fand$_{\varphi}$(das HELL-BLAUe)$_{\varphi\,\varphi}$(SCHÖN)$_{\varphi}$
'I found the light-blue one beautiful'
b Ich fand$_{\varphi}$(das HELL-blaue BILD)$_{\varphi}$
'I found the light-blue picture'

In Bengali, the φ is phonologically marked by a final boundary tone H_{φ} if it contains an intonational pitch accent L*, as shown in (20a). Because the right-hand boundary of the φ is sensitive to the focus of the sentence in Bengali, (20a) contrasts with (20b), whose focus is confined to the first constituent of the compound word for 'fishhead'. Bengali also has IP-final boundary tones, like L_{ι}. The Bengali φ equally defines the domain of the rule of r-DELETION and a regressive voicing process (Hayes and Lahiri 1991; see Q48).

(20)



Again, syntactic constituency does not provide the only relevant information for deriving φ-structure. Constituents to the right of the NP head in English, such as the PP *of ancient China* in the NP *the CHINESE of ANcient CHIna*, form their own φ, as shown by the absence of an effect of the RHYTHM RULE on the word *Chinese*. However, when the postposed PP does not contain a lexical head, like the PP *on him* in the NP *that report on him*, a single φ is formed containing the whole NP. Recall from section 12.2 that Zec and Inkelas (1990) pointed out that the syntactic rule of HEAVY NP SHIFT, which places an object NP in sentence-final position, only applies if the NP is composed of at least two φs. This is shown in (21), taken from Inkelas (1989). In the ungrammatical b-example, the object is only a single φ, thanks to the prosodically restructured PP *on him*.

(21) a Mary gave to Susan$_{\varphi}$ (that report)$_{\varphi\,\varphi}$(on Dukakis)$_{\varphi}$
b *Mary gave to Susan $_{\varphi}$(that report on him)$_{\varphi}$

The examples in (22a,b) (Nespor and Vogel 1986) illustrate another way in which nonsyntactic information is relevant to φ-formation in (American) English, as revealed by the behaviour of the RHYTHM RULE. In (22a), [ˌriːprəˈduːs] *reproduce* has the main stress on the last syllable, which pronunciation is as expected when it is the last word in the φ. However, in (22b) it has undergone the RHYTHM RULE, a pronunciation that requires that it should be followed by another accented word in the same φ. This is explained by the assumption that if the Adverbial Phrase consists of a single *ω*, it can optionally be included in the φ on its left, instead of forming its own φ.

(22) a Rabbits $_{\varphi}$(REproDUCE)$_{\varphi\,\varphi}$(QUICKly and DILligently)$_{\varphi}$
b Rabbits $_{\varphi}$(REproduce QUICKly)$_{\varphi}$

Q123 What is the φ-structure of sentences (1) and (2)? Why is (2) ungrammatical?

(1) I was explaining to the students the problem of the double negation in Middle English.
(2) *I was explaining to the students the problem.

Q124 The English RHYTHM RULE can apply in (1) but not in (2). How would you account for this difference?

(1) This is REpresented in SIX. (i.e. 'in (6)')
(2) This is REpreSENted in SIX A. (i.e. 'in (6a)')

12.5.4 The phonological word

Frequently, when a phenomenon is said to be word-based, it is in fact confined to the domain of the *ω* (also known as the **prosodic word**). Crucially, *ω* does not correspond in a one-to-one fashion to the morphological word. For instance, while compounds represent 'words' in the sense of morphological categories like Noun, Verb or Adjective, in many languages each of the constituent parts forms a phonological domain for (consonant or vowel) harmony, word stress and syllabification. Thus, VOWEL HARMONY in Turkish (cf. section 6.4.2) is confined to the constituents of the compound, as shown in (23), where the vowels in the first constituent are [–back] and the vowels in the second are all [+back]. In German, the MAXIMUM ONSET PRINCIPLE (section 9.2) does not apply across the internal boundary in a compound, as shown in (24). In Greek, vowel hiatus between the members of the compound is tolerated, but not within non-compound words, while each of the constituents has its own word stress, exactly as if they formed an NP like [meˈɣalia erɣaˈsia] 'big works', as shown in (25) (Nespor and Vogel 1986; Nespor 1998).

(23)	a	køpek balɯgɯ (*køpek beligi)	'shark (*lit*. dog fish)'
	b	el jazɯsɯ (*el jezisi)	'handwriting'
(24)	a	mʊnt.aːrt (*mʊn.taːrt)	'dialect (*lit*. mouth type)'
	b	ais.lœfl (*ai.slœfl)	'ice spoon'
(25)	a	oˈmaða erɣaˈsias (*omaðerɣaˈsias)	'work team'
	b	ˈzoni asfaˈlias (*zonasfaˈlias)	'safety zone'

Italian S-VOICING, shown in (26), provides an example of an *ω*-domain span rule. It voices nongeminate [s] between vowels, as illustrated in (27) (Nespor and Vogel 1986). The rule applies in a simplex word in (27a) and in a suffixed word in (27b), but does not apply across a prefix and its base (27c) or a combination of a stem and a word (27d), even though all four items in (27) are single morphological words. The generalization that brings this disparate group of morphosyntactic constituents under one heading is the *ω*.

(26) ITALIAN S-VOICING $s \rightarrow z \,/\, {}_{\omega}(\ldots \overset{\text{V C V}}{\overset{|}{\underline{\quad}}} \ldots)_{\omega}$

(27)	a	ˈkaza		'house'
	b	kaˈzina		'house+DIM'
	c	a soˈtʃale	*azoˈtʃale	'a-social'
	d	ˈfilo soˈvjetiko	*ˈfilozoˈvjetiko	'pro-Soviet'

A constituency effect of the Dutch *ω* was noted by Booij (1985). Dutch coordinated NPs allow deletion of identical parts in the coordinated constituents. Schematically, the situation can be represented as *AB̸ and CB*, where the slash marks the deleted item. Crucially, the deleted portion in the left-hand coordinate is not a morphological (or syntactic) constituent. This is illustrated in (28). The deleted *B* corresponds to the head noun of an NP in (28a), to a noun within a compound

noun in (28b), to a verbal stem in (28c) and to an adjectival suffix in (28d). While the deleted portions are quite heterogeneous when viewed from a morphosyntactic perspective, their common phonological characteristic is that they form separate syllabification domains, i.e. *ω*s. Dutch does not generally syllabify across words, while all prefixes and certain suffixes like *-schap* and *-achtig* do not syllabify together with the base they are attached to, forming separate *ω*s.

(28) a [[grote]$_{Adj}$ [maten]$_{N}$]$_{NP}$ en [[kleine]$_{Adj}$ [maten$_{N}$]$_{NP}$
$_{\omega}$(grote)$_{\omega\ \omega}$(en)$_{\omega\ \omega}$(kleine)$_{\omega\ \omega}$(maten)$_{\omega}$
'small (sizes) and large sizes'

b [[minimum]$_{N}$ [maten]$_{N}$]$_{N}$ en [[maximum]$_{N}$ [maten]$_{N}$]$_{N}$
$_{\omega}$(minimum)$_{\omega\ \omega}$(en)$_{\omega\ \omega}$(maximum)$_{\omega\ \omega}$(maten)$_{\omega}$
'minimum (sizes) and maximum sizes'

c [in [voer]$_{N}$]$_{N}$ en [uit [voer]$_{N}$]$_{N}$
$_{\omega}$(in)$_{\omega\ \omega}$(en)$_{\omega\ \omega}$(uit)$_{\omega}$(voer)$_{\omega}$
'im(port) and export'

d [[zwanger]$_{Adj}$ schap]$_{N}$ en [[moeder]$_{N}$ schap]$_{N}$
$_{\omega}$(zwanger)$_{\omega\ \omega}$(en)$_{\omega\ \omega}$(moeder)$_{\omega\ \omega}$(schap)$_{\omega}$
'pregnant(hood) and motherhood'

The assumption that the deleted portion should minimally be an *ω* is supported by the impossibility of deleting suffixes that **do** syllabify with the base. Dutch has two adjective-forming suffixes meaning 'like'. The suffix *-achtig* [ɑχtəχ] is like *-schap* in (28d), and forms its own *ω*, but the suffix *-ig* [əχ] is incorporated into the *ω* of its base. Accordingly, deletion *of -achtig is* possible in (29a), while in (29b) no deletion is possible.

(29) a [[paars]$_{Adj}$ achtig]$_{Adj}$ en [[groen]$_{Adj}$ achtig]$_{Adj}$
$_{\omega}$(paars)$_{\omega\ \omega}$(en)$_{\omega\ \omega}$(groen)$_{\omega\ \omega}$(achtig)$_{\omega}$
'purple(-like) and green-like'

b [[paars]$_{Adj}$ ig]$_{Adj}$ en [[groen]$_{Adj}$ ig]$_{Adj}$
$_{\omega}$(paarsig)$_{\omega\ \omega}$(en)$_{\omega\ \omega}$(groenig)$_{\omega}$
'purple-like and green-like'

Q125 In Dutch, prevocalic [s] **is often voiced to** [z] **after voiced segments, as shown in (1). However, no voicing is possible in the examples in (2). What determines when** [s] **may be voiced?**

(1)	[[ˈhœys]$_{N}$ [ɑrts]$_{N}$]$_{N}$	[z]	'family doctor'
	[[ʋɑs]$_{Aux}$ [ˈaːrdəχ]$_{Adj}$]$_{VP}$	[z]	'was friendly'
	[[ˈmɛns]$_{N}$ [aːp]$_{N}$]$_{N}$	[z]	'orang-utan'
	[ˈmɪs [oːχst]$_{N}$]$_{N}$	[z]	'failed harvest'
	[[ˈɛis]$_{N}$ ɑχtəχ]$_{Adj}$	[z]	'ice-like'
(2)	[ˈhɛis]$_{V}$ ən]$_{V}$	*[z]	'hoist+INF'
	[ˈkɑns]$_{N}$ ən]$_{N}$	*[z]	'chance+PL'
	[ˈmɑsaː]$_{N}$	*[z]	'mass'

12.6 DERIVING PROSODIC CONSTITUENTS

With the *ω* we have come to the lowest prosodic constituent which can somehow be related to morphosyntactic constituency. What the *ω* and higher constituents have in common is that at least part of their formation is dependent on the morphosyntactic structure of the language. The question of how the relation between the two kinds of constituency is to be expressed has received different answers in the literature. In Nespor and Vogel (1986), the relation is based on a variety of morphosyntactic properties. A typical statement of such a relation might be 'Include the head of the syntactic constituent S, together with all the prosodic constituents of rank C on its non-recursive side, in Prosodic Constituent of rank C + 1.' (The non-recursive side is the left side in right-branching structures, and vice versa.) Selkirk (1986), with reference to a proposal in an earlier version of Chen (1987), suggested that the unifying element in the relation between prosodic and morphosyntactic constituency is reference to edges. This approach lay at the basis of the development of alignment constraints in Optimality Theory (chapter 4). We illustrate edge alignment with the Dutch *ω*. It can be derived with the help of morphological information only (cf. Booij 1977: 103; van der Hulst 1984: 85). As is the case in Italian, suffixes are syllabified with their base, but prefixes never are. This suggests that the *ω* co-begins with the beginning of the morphological category 'word', i.e. any stem or derived word, as expressed in (30). This excludes suffixes and, as we will see in section 12.6.1, certain function words, like pronouns and prepositions. Constraint (30) correctly predicts that prefixes and constituents of the compound form individual *ω*s.

(30) ALIGN(morphological word, *ω*, Left): The left edge of a morphological word aligns with the left edge of *ω*.

In (31a), the prefix begins a lexical category (the complex word), and so does the base. (The end of a non-final *ω* is of course defined by the beginning of the next.) Similarly, (31b) illustrates how separate domains are created for the constituents of compounds: each of them begins a lexical category, while the first, additionally but redundantly, begins the compound, another lexical category. In (31c), suffixes are included in the *ω* on the left, because suffixes do not begin lexical stems.

(31)		***Morphology***	***ω-structure***	***Syllabification***	
	a	$[ɔnt\ [ɛiχən]_V]_V$	$_ω(ɔnt)_{ω\ ω}(ɛiχən)_ω$	ɔnt.ɛi.χən	'dispossess'
		$[ɔn\ [e:vən]_{Adj}]_{Adj}$	$_ω(ɔn)_{ω\ ω}(e:vən)_ω$	ɔn.e:.vən	'uneven'
	b	$[[rɛin]_N\ [a:k]_N\ ]_N$	$_ω(rɛin)_{ω\ ω}(a:k)_ω$	rɛin.a:k	'Rhine barge'
		$[[kɛrk]_N\ [œyl]_N\ ]_N$	$_ω(kɛrk)_{ω\ ω}(œyl)_ω$	kɛrk.œyl	'barn owl'
	c	$[[te:kən]_V\ ŋ]_N$	$_ω(te:kənŋ)_ω$	te:.kə.nŋ	'drawing'
		$[[ʊɑndəl]_V\ a:r]_N$	$_ω(ʊɑndəla:r)_ω$	ʊɑn.də.la:r	'walker'

As pointed out by Inkelas (1989) and Booij (1996), prosodic structure, like any other aspect of the phonological representation of words or morphemes, can be included in underlying representations. As we saw in (28d) and (29) above, many

Dutch full-vowelled suffixes are not included in the *ω* on their left, like the nominalizing suffix *-schap* and the adjectival suffix *-achtig*, which do not syllabify with their base. In the lexicon, these suffixes will therefore be listed as *ω*s.

Selkirk (2011) re-evaluates the pervasive tendency for syntactically defined constituents to correspond to prosodic constituents like *ω*, φ and ι. Instead of requiring coincidence of either left or right edges, **Match Theory** claims that the correspondence between, say, a syntactic phrase and φ is direct, with edges on both sides coinciding. For some recent work on this position, see Selkirk and Lee (2015).

12.6.1 Clitics

Pronouns, auxiliary verbs, conjunctions and the like cannot be given *ω* status by (30) in Dutch, since they do not belong to a major word class. But since they are words, not affixes, they cannot attach to some other item in the lexicon that *is* a major-class item. Many function words are in fact included in *ω* postlexically. If (30) is also valid postlexically, the prediction is that function words in Dutch should behave like suffixes, i.e. be included in the *ω* to their left. This is indeed what we find. In (32a) the article [ən] encliticizes onto the preceding verb form [rip] 'called'. This explains why the article cannot, in natural speech, be pronounced [ʔən] in this context. The same goes for the preposition [ɪn] and the definite article [ət] in (32b) (Booij 1996).

(32) a [rip]$_{V}$ [ən]$_{Art}$ Hij $_{\omega}$(ri.pən)$_{\omega}$ kat
'he called a cat'

b [χa:t]$_{V}$ [ɪn]$_{Prep}$ [ət]$_{Art}$ Het $_{\omega}$(χa:.tɪ.nət)$_{\omega}$ putje
'it goes into the drain'

Other function words, also those that lack an onset, have a full vowel, like the conjunctions [ɔf] 'or' and [ɛn] 'and'. These words are at best only variably syllabified with the preceding word, and they will therefore have to be given *ω* status in the lexicon, along with the suffixes that form their own *ω*, like *-schap*. It has also been noted that certain function words and affixes behave neither as elements that are included in the same *ω* as their host word nor as elements that form an *ω* by themselves. Unlike other words, Italian object pronouns have no stress, but they nevertheless maintain their status as *ω*s, as shown by their phonology at the boundaries with stressed words. For one thing, they do not change the location of the stress on the 'real' words to their left, as in [teˈlefona lo] 'Call him!', whose pre-antepenultimate stress would be ungrammatical if [lo] were part of the same word. For another, RADOPPIAMENTO SYNTATTICO, which geminates a word-initial consonant after a stressed vowel, as in [ˈdal ˈliːbri] 'Give books!', as in a listing like *Don't donate clothes. Give computers! Give pens! Give books!*, from [ˈda ˈliːbri], equally applies to pronouns, as in [ˈdal lo] 'Give it!', from [ˈda lo]. On the basis of such data, Nespor and Vogel (1986) postulate the Clitic Group as a constituent immediately above the *ω*, which makes it possible to account for phonological processes that occur between words and such recalcitrant morphemes, but that

fail to occur in other morpheme combinations. Alternative accounts have been presented, however.

12.6.2 The syntactic residue

The U, ι, φ, *ω* and, perhaps, the Clitic Group are the prosodic constituents which define the relevant domains of processes that apply above the word level. Prosodic theory thus distinguishes itself from theories that claim that such rules can refer directly to syntactic structure, such as Kaisse (1985). Nevertheless, instances have been found of rules that apply across words which do apparently refer to syntactic categories, as would appear to be the case for French LIAISON (Hayes 1990; Post 2000). Hayes (1990) proposes that such 'residual' syntax-sensitivity should be accounted for in the lexicon. That is, the phonological rules that produce the required forms are in fact lexical rules, and the forms they produce are thus available in the lexicon, ready for insertion into syntactic phrases. For instance, the phonological rule that shortens final long vowels in Hausa verbs is syntactically conditioned: it only applies if a direct object that contains a major-class noun immediately follows. This is illustrated in (33a), which contrasts with (33b), two cases in which the morphosyntactic condition is not met.

(33)	a	ná: ká:mà kí:fí:	'I have caught a fish'
	b	ná: ká:mà: ʃĩ	'I have caught it'
		ná: ká:mà: wà mú:sá: kí:fí:	'I have caught Musa a fish'

The lexical rule is given in (34); its morphosyntactic conditioning is expressed by the 'Frame' given below it. (Because the only category that can occur initially in a VP before an NP is a V, it is not necessary to label the word as a Verb in the rule.) Thus, when a verb is to be inserted in a sentence, the more specific form produced by final vowel shortening is chosen if the morphosyntactic condition applies.

(34) FINAL VOWEL SHORTENING $V \rightarrow \emptyset$ / [. . . V __] $_{\text{Frame 1}}$
Frame 1: [__ NP. . .]$_{VP}$

The assumption that syntax-dependent rules are in fact lexical rules puts such alternations in a comparable position with phrasal allomorphy of the sort that is seen in the English indefinite article, which is [ən] before vowels but [ə] elsewhere. As the name suggests, phrasal allomorphs are rival phonological forms whose distribution is governed by properties of the surrounding words. There are, however, two differences between these two cases worth mentioning. First, the forms in (34) are generated by a rule, because they involve a whole class of words rather than a single morpheme, and, second, in (34) the conditioning is morphosyntactic rather than purely phonological. Hayes refers to forms like English [ən] and Hausa [ká:mà] as **precompiled**, the idea being that they come ready-made from the lexicon. A prediction of this treatment is that rules like (34) might have exceptions. In fact, in the context of (34), a restricted group of Hausa verbs, e.g. [sàjá:] 'bought', raise their final [a:], in addition to shortening it, as in [ná: sàjí àbíncí] 'I bought food'.

12.7 CONCLUSION

Phonological rules that apply above the level of the word are constrained by prosodic constituents that form a hierarchical structure. These constituents are not directly mappable onto the morphosyntactic structure. While the prosodic hierarchy above the *ω* is in large part derivable from the syntactic structure, mismatches do occur, mainly as a result of the incommensurate lengths of the phonological constituents (cf. Selkirk and Lee 2015). A syntactic constituent may be too long to fit into the phonological constituent it usually maps onto, with the result that it is divided over a number of such constituents, or too short, in which case it may be included in a constituent of the same (restructuring) or a lower rank (cliticization).

The structural separation of the morphosyntactic and phonological grammars may appear to be compromised in two ways. First, we have seen that prosodic constituents not only define the domains at or within whose edges phonological adjustments occur, but are arguably also referred to by rules of syntax, as in the case of HEAVY NP SHIFT. This may indicate that, just as foot structure may be available in the lexicon (cf. chapter 11), so morphosyntactic structure will exist simultaneously with the phonological structure. For the reverse case, phonological rules which appeal to syntactic information, Hayes (1990) provided a solution which upholds the distinction between lexical rules, which can refer to morphological information and which potentially have exceptions, and postlexical rules, which can only refer to phonological representations and which cannot have exceptions. He proposed that phonological rules for which syntactic information is relevant are in fact lexical rules. Such syntax-sensitive rules only apparently apply above the level of the word and actually produce the appropriate alternants in the lexicon. During the construction of the sentence, these precompiled forms are inserted in the specific contexts instead of their rival, more general alternant.

Prosodic structure appears to be more orderly than syntactic structure. The SLH, which forbids improper bracketing, recursivity and non-exhaustiveness, constrains the prosodic structure from the *ω* onwards reasonably successfully, since deviations appear to be limited. Phonological constituents below the *ω*, which are not derivable from the morphosyntactic structure, deviate from the SLH in limited ways. In particular, not all syllables need to be included in foot structure (stray syllables, section 11.3.1). We may safely predict that prosodic phonology will continue to be an exciting field of research for some time yet.

NOTE

1 The segment is known as 'linking *r*' if there is an <r> in the spelling and 'intrusive linking *r*' if there is not. In the latter case, speakers may feel that the pronunciation if [r] is 'incorrect'.