# Phonological analysis

## A coursebook

*Written by*

Zoltán G. Kiss

Ádám Nádasdy

Attila Starčević

Péter Szigetvári

Miklós Törkenczy

CONTENTS

(for detailed contents see the beginning of each chapter)

# PREFACE

This book is the prescribed coursebook for the "Advanced English Phonology" (BBN-ANG-243, Haladó hangtan) examination. Its prerequisites are the two previous exams in our field prescribed for BA students in English:

- BBN-ANG-141 *Foundations of Phonology*
- BBN-ANG-241 *Phonology (The Rules of English)*

The successful student will also have covered the *English Phonetics and Phonology Seminar* (BBN-ANG-242).

While building on these materials, the present book goes beyond their level. We add further observations, refine some rules, and we now question or debate many things which were presented there as solid facts. We want to show that in linguistics, as in any serious science, almost everything is up to criticism, debate, or alternative explanation.

The **small-print** passages (enclosed between horizontal lines) and the remarks in the **footnotes** are not required for the examination.

This is not a monograph or handbook in the usual scholarly sense: there are no references to sources, or bibliographies. It is a collection of notes, examples and definitions to help students revise for the exam.

If a student feels the need to revise the material of the previous courses, we recommend the textbook ***Background to English Pronunciation*** by Ádám Nádasdy (Budapest, 2006; abbreviated as BEP). That book presents phenomena and data in a simplified and unambiguous fashion, which will provide a good starting point for understanding the discussions in the present course, and in studying for the exam. *Background* has a detailed "Contents" at the beginning and an ample "Index" at the end, where you can find the sections relevant for the various chapters of the present book. Even if you covered the *Background* book in the past, it may be useful to recapitulate there the factual basis of what the current course is about.

Note that in *Background* only one explanation is given for every problem, presented as the "truth" about English phonetics and phonology – which is obviously an oversimplification, justified by the introductory nature of the book. Be prepared that the current textbook often says the opposite of what *Background* says – your task is to compare and evaluate them.

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The Authors

# Chapter 1

# Introduction: What is Phonological Analysis?

Miklós Törkenczy

**Contents**



Two subfields of linguistics deal with the 'sound aspect' of language: phonetics and phonology. Phonetics studies the production, the acoustic properties and the perception of speech sounds, while phonology studies the *sound patterns* in language. To put it differently, phonetics is about sound *substance* and phonology is about the sound *system*, the way speech sounds *'behave'* systematically (in a particular language or in languages in general). **Phonology** is categorical, i.e. its rules are clear-cut, 'black and white', as opposed to phonetics, which concerns itself with phenomena that are, by nature, gradual, 'shades of grey'.

As alphabetical spelling is always an imperfect reflection of sound shape (think of the

several different sounds the letter *O* can stand for in English: e.g. [oʊ] *go*, [ɒ] *got*, [ʌ] *son*, [ɪ] *women*, [ɔː] *story*, [uː] *lose*, [ə] *atom*), phonetic phenomena and phonological patterns are to be described irrespective of the spelling.

This course is an introduction to *phonological analysis*: our main topic is how sound patterns can be analysed.

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The analysis one comes up with can be interpreted in two ways. One may take a *realist* stance and claim that the 'right' analysis is psychologically real in that it is identical to the native speaker's internalised phonological grammar, i.e. it is what is actually represented or 'encoded' in some way in the native speaker's mind. Alternatively, one may be an *instrumentalist* in claiming that no such connection between analysis and psychological reality exists: if different analyses can account for the same facts equally well (i.e. they describe the same pattern), then one may be preferred to the other(s) on the grounds of simplicity (which one is the simpler analysis according to some measure), 'elegance' (whatever it means), etc., but not on the basis of 'reality'. An instrumentalist would argue that we do not know enough about the human brain to claim that our models are 'real' in this sense. Linguists of the realist inclination claim that phonological universals (recurrent phonological patterns in the world's languages) show what a possible phonological pattern is for humans in general, and thus argue for the psychological reality of the 'correct' analysis.

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Our principal aim is not so much to single out the one 'right' analysis, or argue about its interpretation, but

(a) to show that phonological analysis is 'non-unique' because, on the one hand, the possibility of a certain analysis depends on the theoretical framework that one assumes ('viewpoint creates the object' to be analysed), and, on the other, even within the same framework more than one 'observationally adequate' analysis is frequently possible (an observationally adequate analysis is one that can account for the facts in a fully explicit way: it can determine for any utterance (sentence) if it is well-formed or not); and

(b) to give the student an idea of how to argue for or against a particular analysis, how to identify the choices, decisions and consequences involved, to weigh the pros and cons, the 'costs and benefits' of alternative analyses by examining the predictions particular analyses make and confronting these predictions with data so that some of

the analyses may be falsified, i.e. shown to be false.

Throughout the course (which is part of an English BA programme) we shall analyse the sound pattern of English, primarily that of Southern Standard British English (BrE), but we shall also frequently discuss General American (AmE) and occasionally mention other accents of English.

## 1.1. Phonological patterns

There are three kinds of phonological patterns that we aim to account for in a phonological analysis:

(a) *allophonic patterns*, i.e. the distribution of non-contrastive sound features.
E.g. L-darkening (when is /l/ dark and when is it clear?)

(b) *morpho-phonological patterns*, i.e. the distribution of non-contrastive OR contrastive sound features in the allomorphs (alternants) of the same morpheme (i.e. how a sound feature alternates).
E.g. voicing in the allomorphs of the plural {-s} in English (when is the plural realised as [s] and when is it realised as [z]/[ɪz]?)

(c) *phonotactic patterns*, i.e. how sound segments can combine into words.
E.g. which consonants can occur initially in a three-term cluster at the beginning of an English word? (e.g. [#spl-] is possible in English but [*#psl-] is not )

In phonological analysis these patterns are described

(i) with reference to two *levels of representation*, the phonological/underlying representation (UR) and the phonetic/surface representation (SR) and

(ii) with reference to their relationship, the *mapping* of the underlying representation onto the phonetic representation (i.e. the derivation, see later).

We summarise the properties of the two levels of description in (1):

(1) The two levels of description

| | | |
|---|---|---|
| phonetic | ↔ | phonological |
| surface representation (SR) | ↔ | underlying representation (UR) |
| sounds | ↔ | phonemes |
| predictable + unpredictable features | ↔ | only unpredictable features |
| redundant + distinctive features | ↔ | only distinctive features |
| transcription: [ ] | ↔ | transcription: / / |

Each utterance has these two representations. The predictable properties of sound patterns (e.g. darkening of /l/ in BrE) are not part of the underlying representation, but are expressed by the mapping of the underlying representation onto the surface representation by phonological rules such as (2) below

(2) l → ɫ / __ {C, #}

Thus, the surface representation of an utterance consists of predictable ***and*** unpredictable features of sound and is basically the utterance as it is articulated/transmitted/heard.[1] The underlying representation, then, is an abstraction that only[2] 'records' the unpredictable sound properties, and thus encodes contrast (i.e. properties that can minimally distinguish morphemes/words from one another.)

[1]This is a(n over)simplification: the surface representation also abstracts away from certain sound properties that belong 'performance' (as opposed to competence), such as the individual characteristics of the speakers's voice, the effect of (various degrees of) drunkenness or fatigue on pronunciation, hypercorrection/overarticulation due to nervousness, etc.

[2]You will see in Chapter 3 that this view of the underlying representation may be questioned: contrast may utilise features that are actually predictable.

## The 'AS IF' assumption

The way in which the phonological 'behaviour' or 'value in the pattern' is encoded in this approach can be informally summarised in the 'AS IF' assumption. Phonological analyses in general are based on this assumptions which consists of two (related) parts

(3) The 'AS IF' assumption

a. If two or more units of the phonetic/surface representation 'behave as if they were' the same, then they ***are*** the same phonologically/underlyingly.
b. If a unit *X* of the phonetic/surface representation 'behaves like' unit *Y*, then *X* and *Y* ***are*** the same phonologically/underlyingly in some respect.

In (1a) the expression 'behave as if they were the same' means that the two or more units of the given surface representation do not contrast: again, an obvious example is dark [ɫ] and clear [l] – they are phonologically the same, namely the phoneme /l/ (they are in complementary distribution and hence, cannot contrast). It is not a trivial question how much significance the analyst should attribute to the presence or the absence of *surface* contrast (i.e. minimal pairs), whether the presence of contrast at the surface necessarily means the presence of underlying contrast as well. The answer will essentially determine the 'distance' between the two representations, i.e. how *abstract* the underlying representation is. We shall address the problem of abstractness in Chapter 2 (and in passing in Section 1.2 of this chapter).

In (1b) the expression 'behaves as' has a somewhat different meaning: *X* and *Y* are considered to behave in the same way if they follow the same pattern, if they have similar/identical distributions – in this case they belong to the same category, they are members of the same class of objects.

A simple example is the English consonant [w]. Phonetically, [w] is labio-velar, i.e. it has two places of articulation (two 'articulatory gestures'), a labial one and a velar one. Phonologically, however, it is clearly a labial (and not velar) since it patterns with the labials phonotactically. Consider the way stops and non-nasal sonorants combine into word-initial consonant clusters.

(4) Word-initial stop + non-nasal sonorant clusters

| | l | r | w | j |
|---|---|---|---|---|
| p | + | + | – | + |
| b | + | + | – | + |
| t | – | + | + | + |
| d | – | + | + | + |
| k | + | + | + | + |
| g | + | + | + | + |

Phonologists explain this pattern by saying that the missing combinations are those where the two consonants have the same place of articulation (they are 'homorganic'). */tl/ is not possible word-initially because both consonants are alveolar, but /kr/ is possible since /k/ is velar and /r/ is post-alveolar. This shows that /w/ is labial *phonologically/underlyingly* since */pw/ and */bw/ are missing and /p/ and /b/ are labial (not labio-velar or velar).

Another example is *á* [aː] in Hungarian. Phonetically [aː] is a central vowel, but phonologically/underlyingly it is a back one, since it patterns with the back vowels in vowel harmony: e.g. the suffix in ***h*á*z-b*a*n*** (where the stem vowel is *á* [aː]) is *-ban* just like in the word ***ó**l-b**a**n* where the stem vowel *ó* [oː] is phonetically truly back. Thus /aː/ is *phonologically/underlyingly* back – even if at the surface it is realised as a central vowel..

In section 1.2, we give you an illustration of how phonological analysis works.

## 1.2. Example: the phonological analysis of the velar nasal [ŋ] in English

Phonetically, there is nothing special about [ŋ]: it is like the other English nasals [m] and [n] (all three are sonorant, voiced, non-continuant), and differs from them only in place of articulation (velar as opposed to labial and alveolar, respectively). Distributionally, however, [ŋ] is curiously different from the other two. Consider Figure (5):

### 1.2.1 Limited contrast

(5) The distribution of [ŋ]: limited contrast

| | | | [m] | [n] | [ŋ] | possible contrast with other nasals |
|---|---|---|---|---|---|---|
| i. | morpheme-initially | #_ | ***m**ap* | ***n**ap* | – | NO |
| ii. | morpheme-medially | _V | *E**mm**y* | *a**n**y* | – | NO |
| | | _C | *li**m**p* | *li**n**t* | *li**n**k* [lɪ**ŋ**k] | NO |
| iii. | morpheme-finally | _# | *so**me*** | *su**n*** | *su**ng*** [sʌŋ] | YES |

As you can see in (4i), [ŋ] does not occur morpheme-initially. There are no morphemes/words in English like *[**ŋ**æp], for instance. In this property, it is unique among the consonants of English as all the other consonants can occur in this position.[3]

[ŋ] also does not occur morpheme-medially before a vowel, thus *[e**ŋ**i] is not a possible morpheme, see (4ii). (There are very few exceptional morphemes with a truly morpheme-medial prevocalic [ŋ], notably *hangar* [ˈhæŋə], and words ending in –*ingham*, e.g. *gingham* [ˈɡɪŋəm], *Nottingham* [ˈnɒtɪŋəm], etc. Note that words like *singer* [ˈsɪŋə], *longish* [ˈlɒŋɪʃ], *hanging* [ˈhæŋɪŋ] etc. are not counterexamples because in these words [ŋ] is not prevocalic *within the morpheme* since it is always followed by a (strong) morpheme boundary: [#sɪŋ#ə#], [#lɒŋ#ɪʃ#], [#hæŋ#ɪŋ#].) Again, the fact that [ŋ] does not occur in this position makes [ŋ] unique among the consonants of English: all the other consonants can occur in this position.

[ŋ] does occur morpheme-medially before a consonant, e.g. *li**n**k* [lɪ**ŋ**k], *ta**n**go* [ˈtæŋɡoʊ], etc.(2ii). This, however, does not mean that it contrasts with the other nasals in this position. The reason is that (due to another phonotactic constraint) nasals must be homorganic with the following consonant within the morpheme. Thus, preconsonantally within the morpheme [ŋ] can only occur before /k, ɡ/ (which are the other two velar consonants in English) – where the other nasals /m, n/ cannot occur as they are not velars. Note again that words like *banged* [bæŋd], *youngster* [ˈjʌŋstə] are not counterexamples because in these words [ŋ] is not preconsonantal

[3]With the possible exception of [ʒ], which only occurs initially in a few (typically learned) recent French loans like *genre* [ˈʒɑ̃ːrə] .

*within the morpheme* since it is followed by a (strong) morpheme boundary: [#bæŋ#d#], [#jʌŋ#stə#], etc.

Morpheme-finally [ŋ] is well-behaved: it does occur and this is the only position where it can contrast with the other nasals, cf. the minimal pair *sin* [sɪn] vs. *sing* [sɪŋ] (5iii).

The distribution of [ŋ] suggests that it belongs to a nasal phoneme of English that is distinct from /m/ and /n/ – if one accepts the 'once a phoneme, always a phoneme' principle. According to this principle (which was a tenet of taxonomic phonology, see Chapter 2), if two sounds contrast in *some* environment, their difference should *always* be assumed to be distinctive.[4]

However, a phonological analysis of [ŋ] should be able to explain its curiously unique distribution and (consequently) the extremely restricted possibility of contrast (its limited 'functional load') compared to other English consonants. We should be able to give an analysis that can connect this with other facts of English phonology and come up with a representation and mapping that explains these facts.

### 1.2.2 [ŋ] vs. [ŋg]

Another interesting distributional property can be seen if we compare the distribution of 'plain' [ŋ] (i.e. [ŋ] not followed by velar consonants) and [ŋ] plus velar consonant clusters ([ŋk, ŋg]):

(6) 'Plain' [ŋ] and [ŋg] in complementary distribution

| | [ŋ] | [ŋg] | [ŋk] |
|---|---|---|---|
| morpheme finally | *sing* [sɪŋ] | – | *sink* [sɪŋk] |
| morpheme medially | – | *anger* [æŋgə] | *anchor* [æŋkə] |

As can be seen in (6), [ŋ] and [ŋg] are in complementary distribution: [ŋg] *never* occurs before

[4]To put the same thing in a different way: if a sound is assumed to be the allophone of phoneme X, it must be the allophone of phoneme X only (this was referred to as the requirement of 'biuniqueness' by N. Chomsky later).

a morpheme boundary (e.g. *sing* [#sɪŋ#] but *[#sɪŋg #], *singer* [#sɪŋ#ə#] but *[#sɪŋg #ə#]) while [ŋ] can occur *only* before a morpheme boundary (e.g. *finger* [#fɪŋgə#] but *[#fɪŋə#]). (There are but a handful of counterexamples to this: (i) on the one hand, the word *hangar* and those ending in –*ingham* mentioned above, where 'plain' [ŋ] occurs without a following morpheme boundary, (ii) on the other hand, the words *longer, stronger, younger, longest, strongest, youngest*, all pronounced with [ŋg], where [ŋg] occurs before a morpheme boundary.[5]) This complementary distributional relationship between single segments and the clusters containing them does not generally hold for other single segments and clusters in English: compare e.g. [ŋ] - [ŋk]: *sing* [sɪ**ŋ**], *sink* [sɪ**ŋk**]; [n] - [nd]: *money* [mʌ**n**i], *Monday* [mʌ**nd**i], *ten* [te**n**], *tend* [te**nd**]; [s] - [st]: *soul* [**s**oʊl], *stole* [**st**oʊl], *decimate* [ˈde**s**ɪmeɪt], *estimate* [ˈe**st**ɪmeɪt], *miss* [mɪ**s**], *mist* [mɪ**st**], etc. Preferably, an analysis should explain this unique relationship between [ŋ] and [ŋg].

### 1.2.3 Pre-[ŋ] vowels

Only the phonologically short vowels [ɪ, e, æ, ʊ, ʌ, ɒ] can occur before [ŋ] – there are no words like *[eɪŋgə] or *[θiːŋ]. (Usually, *oink* [ɔɪŋk] is cited as the only counterexample. But note that *oink* is not a 'true' word, but an onomatopoeic expression.) This, again, is a unique characteristic of [ŋ]. Other single consonants place no restriction on the length of the vowel preceding them – phonologically long and short vowels can equally stand before them: e.g. *hat* [hæt] – *hate* [heɪt], *letter* [ˈletə] – *meter* [ˈmiːtə], etc.

We have seen that in many ways [ŋ] is distributionally unique among the English consonants. Let us now review some phenomena that are independent of [ŋ], but can be brought into an analysis that can account for the singular properties of [ŋ].

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[5]This may be attributed to the different status of the morpheme boundary before comparative *-er* and superlative *-est*, see Chapter 8.

## 1.2.4 Some independent facts

### 1.2.4.1. Nasal plus stop clusters

The first of these facts is one that has already been referred to: the phonotactics of morpheme-final nasal+stop clusters. Figure (7) shows the possible combinations of nasals followed by stops at the end of a morpheme.

(7) Word-final nasal-plus-stop clusters

| | voiceless stop | | | voiced stop | | |
|---|---|---|---|---|---|---|
| | p | t | k | b | d | g |
| m | lɪmp | – | – | – | – | – |
| n | – | tent | – | – | lend | – |
| ŋ | – | – | lɪŋk | – | – | – |

The following two generalisations can be made on the basis of (4) above:

(8) i. $C_{[nasal]}C_{[stop]}$ clusters must be homorganic (i.e. agree in place) within the morpheme.
ii. Non-coronal voiced stops do not occur after nasals morpheme-finally.

### 1.2.4.2. Onset clusters and sonority

The second fact concerns the phonotactics of the onset. As is discussed in the chapter on syllable structure (Chapter 4), onsets have a rising sonority in English, so syllables like *[**lp**eɪ],*[**rt**aɪ],*[**wt**ɪst] are ill-formed as opposed to syllables like *play* [**pl**eɪ], *try* [**tr**aɪ] and *twist* [**tw**ɪst], which are well-formed.

### 1.2.4.3. The length of vowels before morpheme-final consonant clusters

The last relevant independent fact is about the phonological length of vowels before morpheme-final consonant clusters. There is no restriction on phonological vowel length before **coronal clusters** (clusters both of whose consonants are coronal), i.e. both phonologically long (tense) and short (lax) vowels can precede a morpheme-final coronal cluster: *mount* [maʊnt], *sent* [sent], *field* [fiːld], *build* [bɪld], etc. However, before morpheme-final **non-coronal clusters** the following restriction applies:

(9) Only the phonologically short vowels [ɪ, e, æ, ʊ, ʌ, ɒ] can occur before morpheme-final non-coronal clusters

Thus, hypothetical English words like *[eɪŋk] and *[hiːlp] are ill-formed as opposed to *tank* [tæŋk] and *help* [help], which are well-formed.

### 1.2.5. Analysis

Based on the facts discussed in 1.2.1, 1.2.2, 1.2.3, and 1.2.4 above we can make the following observation:

(10) [ŋ] behaves as if it were a non-coronal cluster, specifically, a cluster of a nasal plus a voiced velar stop

In accordance with the 'AS IF' assumption this means that 'plain' [ŋ] is actually a cluster of a nasal plus a voiced velar stop *phonologically*: /$C_{[nasal]}$g/. This means that phonologically, there is no difference between [ŋ] and [ŋg], since both are underlyingly /$C_{[nasal]}$g/. This makes it possible to analyse [ŋ] as an allophone of /n/ since now (given the assumptions above) [ŋ] only occurs if it is followed by an underlying /k/ or /g/, a position where [n] never occurs (they are in complementary distribution). Therefore, [ŋ] (and [ŋg]) is underlyingly/phonologically /ng/.

### 1.2.5.1 Benefits

What are the benefits of analysing [ŋ] as /ng/? It is an attractive analysis since it manages to explain (by linking them with independent facts) the unique properties of [ŋ] we discussed above.

(i) It can explain why [ŋ] does not occur morpheme-initially (see 1.2.1): because morpheme-initially /ng/ would form an onset with falling sonority, which is ill-formed in general (see 1.2.4.2);

(ii) It can explain why the /g/ of /ng/ does not appear phonetically in words like *sing*: because non-coronal voiced stops do not occur after nasals morpheme-finally in general (see 1.2.4.1);

(iii) It can explain why 'plain' [ŋ] and [ŋg] do not contrast (see 1.2.2): because phonologically they are the same: both are surface realisations of /ng/;

(iv) It can explain why pre-[ŋ] vowels must be short (see 1.2.3): because only short vowels can occur before non-coronal consonant clusters in general and /ng/ is a non coronal cluster phonologically.

### 1.2.5.2 Costs

What does this analysis 'cost' us compared to the standard taxonomic one which analyses [ŋ] as a realisation of the phoneme /ŋ/ based on its surface contrast with [n, m] in morpheme-final position?

(i) *Theoretically*, the main item on the costs side is a higher degree of abstractness.[6] The phonological representation assumed by the **generative** analysis proposed in 1.2.5 is more abstract than the one assumed by the standard taxonomic approach. This manifests itself

(a) in the rejection of the 'once a phoneme always a phoneme principle' and, more

[6]See a detailed discussion of abstractness in Chapter 2.

importantly, the rejection of the idea that *surface* contrast is a surefire indicator of underlying/phonological contrast. In the generative analysis [ŋ] and [n] are realisations of the same underlying segment *although* [ŋ] and [n] *do* contrast at the surface;

(b) as the possibility that the location of underlying and surface contrast need not be the same: there is a surface contrast between the nasals [ŋ] and [n] in e.g. *sing* [sɪ**ŋ**] vs. *sin* [sɪ**n**], but in the generative analysis the underlying/phonological contrast is 'really' between the presence vs. the absence of /g/: /sɪn**g**/ vs. /sɪn/, i.e. not the nasals at all!

(ii) '*Technically*', the generative analysis is more complex than the taxonomic one. While the latter only has a simple allophonic rule referring to [ŋ], according to which the phoneme /ŋ/ is always realised as [ŋ], the generative analysis must have a more complex mechanism that maps underlying /ng/ sometimes to [ŋ] and other times to [ŋg] at the surface.

The difference between the phonological status of [ŋ] in a taxonomic and a generative analysis is illustrated in (10).

(11) The phonological status of [ŋ] in a taxonomic and a generative analysis

| | | taxonomic analysis | generative analysis |
|---|---|---|---|
| | SR | UR | UR |
| *sin* | [sɪn] | /sɪn/ | /sɪn/ |
| *sing* | [sɪŋ] | /sɪŋ/ | /sɪng/ |

It must be noted that if we decide that the benefits outweigh the cost, and choose the generative analysis proposed in 1.2.5, then we must work within a theoretical framework that allows for the abstractness discussed above. In this book we adopt such a framework called *generative phonology*.

## 1.3. Generative phonology

Generative phonology implements the 'AS IF' assumption in the following way. Phonological 'behaviour' is represented by the mapping between the phonological representation and the phonetic representation, i.e. by the mechanism of *derivation* in which the phonetic (surface) representation is derived from the phonological (underlying) representation by the application of a set of phonological *rules* which are *sequentially ordered*. Phonological rules change representations by adding predictable properties to the representation (input) to which they apply. The generalised format a phonological rule is this:

(12) $A \rightarrow B \,/\, C \_\_ D$

which means that *A* changes to *B* if it is between *C* and *D* (i.e. *CAD*→*CBD*) where *A*, *B*, *C* and *D* may be segments or features and *C*, *D* may also be morphological or prosodic boundaries or constituents (e.g. strong (#) or weak (+) morpheme boundary, syllable boundary, onset, rhyme etc.).

Phonological rules are only sensitive to their immediate input, so if the state of affairs required by a rule i.e. its *structural description* is satisfied by an input at the point in the derivation where the rule is ordered (*CAD*), then the rule applies and changes the input in the way described in the rule, i.e. the *structural change* (*CBD*).

Thus a generative phonological analysis aims to 'explain' the phonological pattern by (i) identifying what the phonological (underlying) representation is, (ii) identifying what the phonological rules are; and (iii) showing how the rules apply to derive the phonetic (surface) representation from the underlying one (by identifying their ordering and application). We illustrate this below using [ŋ] as an example.

### 1.3.1 Deriving **[ŋ]**

Assuming that the underlying representation of [ŋ] is /ng/, we need two rules to account for the surface distribution/realisation of [ŋ]. **Nasal Place Assimilation** expresses the regularity we

observed in (8i) ('*α*place' means 'the same place given elsewhere in the rule'):

(13) [nasal] → [*α*place] / __ [stop, *α*place]

Rule (13) applies within the morpheme and makes a nasal homorganic with the following stop. The other rule is **Post-nasal g-deletion**, a special case of the regularity observed in (8ii):

(14) g → ∅ / [nasal] __ #

Rule (13) deletes a /g/ after a nasal and before a strong[7] morpheme boundary.

The derivations of *sing*, *singer* and *finger* are as follows:

| | | | |
|---|---|---|---|
| (15) underlying representation | /#sɪng#/ | /#sɪng#ə#/ | /#fɪngə#/ |
| (13) Nasal Place Assimilation | #sɪŋg# | #sɪŋg#ə# | #fɪŋgə# |
| (14) Post-nasal g-deletion | #sɪŋ# | #sɪŋ#ə# | – |
| surface representation | [sɪŋ] | [sɪŋə] | [fɪŋgə] |

Note that crucially, (13) has to be ordered before (14) because if the /g/ is deleted first, Nasal Assimilation cannot apply since its environment is no longer satisfied. Given the underlying representations, the rules and their ordering in (15), the surface patterning of [ŋ] is accounted for, i.e. the correct surface forms are derived in all cases.

## 1.4. Summary

The main point of this chapter is that an analysis is *underdetermined* by facts: in addition to the observed facts the possibility of a particular analysis is crucially determined by (i) the *theoretical*

[7]It is possible to analyse the comparative and the superlative suffixes as having a weak boundary – hence the presence of [g] in words like *younger* [ˈjʌŋgə], see Chapter 9.

*framework* one adopts and (ii) *how much* importance one attributes to *which* facts – and this latter, at least partially, also derives from the theoretical framework (this is what is meant by 'viewpoint creates the object'). To take the example of [ŋ], if the analyst adopts a taxonomic framework, then (s)he will see the surface contrast (e.g. between *sin* vs. *sing*) essentially important and the analysis will treat the facts discussed in 1.2.1, 1.2.2, 1.2.3 *and* their relationship to those discussed in 1.2.4.1, 1.2.4.2 and 1.2.4.3 as accidents (and thus irrelevant). If however, the analyst adopts the framework of generative phonology, then the facts discussed in 1.2.1, 1.2.2, 1.2.3 and their relationship to those discussed in 1.2.4.1, 1.2.4.2 and 1.2.4.3 can be seen essentially important, facts that the analysis must account for while the actual surface contrast between *sin* [sɪn] vs. *sing* [sɪŋ] is no more than a by-product of the mapping.

## 1.5. Checklist

★ phonology vs. phonetics
★ allophonic patterns
★ morpho-phonological patterns
★ phonotactic patterns
★ underlying representation
★ surface representation
★ derivation/mapping
★ contrast
★ the distribution of [ŋ]
★ the taxonomic analysis of [ŋ]
★ the generative analysis of [ŋ]
★ generative phonology
★ generative phonological analysis
★ the formalism of phonological rules
★ rule ordering
★ Nasal Place Assimilation
★ Post-nasal g-deletion
★ 'viewpoint creates the object'
★ 'once a phoneme, always a phoneme' principle.

CHAPTER 2

# ABSTRACT ELEMENTS IN PHONOLOGY

**Ádám Nádasdy**

**Contents of this Chapter:**



## 2.1. Abstraction in analysing data

Any scientific description involves an amount of abstractness. When the chemist classifies water, snow, ice and steam as "water", he ignores their temperature and state, and considers only one feature to be relevant: the chemical composition $H_2O$. This is the **distinctive feature** serving as the label of the category, while their being liquid or solid or falling in flakes are considered **redundant features**, being of secondary importance.

Abstractness in phonology means that we suppose the existence of segments that are more or less different from the surface (i.e. from phonetic facts).[1]

## 2.2. The phoneme and its allophones

Let us take the example of English /l/ to discuss phonological abstraction. The two kinds of L-sound, Clear-L and Dark-L are both articulated as lateral sonorant consonants, but

[1] At all levels of language we find this duality of concrete vs. abstract: physically realizable, concrete data (allophones, morphs, word forms) versus their abstract equivalents (phonemes, morphemes, lexemes). Compare:

| Concrete | ↔ | Abstract |
|---|---|---|
| sound, allophone | ↔ | phoneme |
| morph, allomorph | ↔ | morpheme |
| word form, syntactic word | ↔ | lexeme |

- Clear-L, phonetically [l] *(leg)*, is pronounced with the tongue body in neutral position;
- Dark-L, phonetically [ɫ] *(belt)*, is velarized: the back of the tongue is raised towards the velum (the [o] position).[2]

These are the phonetic facts. But what does the phonologist say? How do we analyse this state of affairs?

### 2.2.1. The standard solution

The distribution of Clear-L and Dark-L is complementary. They are allophones, the realizations of an abstract category, a phoneme, which we represent as /l/. Any phoneme is an abstraction compared to the actual sounds. You cannot pronounce a phoneme:[3] you can only pronounce an allophone, either Clear-L or Dark-L. The phoneme is, perhaps, more than a sound; it is the sum of its allophones: /l/ = [l] + [ɫ]. The actual sounds (= allophones) are derived from the phoneme by means of rules. The standard solution is an "L-Darkening Rule":

(1) **L-Darkening Rule**

/l/ → [ɫ] / __ {(#)C, ‖}  = the phoneme /l/ is pronounced "dark" (= velarized) when followed by a consonant in the same or in the next word, or by a pause.

[l] / elsewhere  = the phoneme /l/ is "clear" (= not velarized) elsewhere.

### 2.2.2. Alternative solutions

**(a)** Let us point out that we could have chosen Dark-L to be the basic alternant of this phoneme, saying that underlyingly all English L's are dark, and they become clear by an "L-Clearing Rule" when followed by a vowel.

(2) **L-Clearing Rule**

/ɫ/ → [l] / __(#)V  = the phoneme /ɫ/ is pronounced "clear" (= unvelarized) when followed by a vowel in the same or the next word.

[ɫ] / elsewhere  = the phoneme /ɫ/ remains "dark" (=velarized) elsewhere.

Rules (1) and (2) are equally logical and scientifically correct. It is arbitrary which allophone we choose to represent the whole phoneme, i.e. in which direction we abstract away from the phonetic data. It is for practical reasons (simpler typography!) that we normally choose Clear-L to be the basic alternant, and speak of L-Darkening rather than L-Clearing.

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[2] In some positions English /l/ had become so "dark" (= so much like an [o]) that it was historically absorbed in the previous *a* or *o*, and disappeared from pronunciation, remaining only in spelling as a silent letter: *talk, walk; folk, yolk* and *half, calves, balm, Holmes, Stockholm*. Note that the consonant following this "absorbed" silent L is always noncoronal.

[3] We often get round this problem by pronouncing the name of the alphabetic letter which the phoneme is normally spelt with, so we say "the L phoneme", or "the Double-U phoneme" for /w/, the "voiced TH phoneme" for /ð/; or we use traditional names like "yod" for /j/ or "schwa" for /ə/.

**(b)** It would be equally logical to use a third symbol for the phoneme, one which is neither clear nor dark, for example capital /L/, and say that the abstract (and therefore unpronounceable!) phoneme /L/ is realized in two ways, either as Clear-L or as Dark-L, according to its position. This is probably closer to psychological reality: when learning English (either as mother tongue or later), people do not lexicalize L as clear or dark, but store a general L in their mental lexicon,[4] and pronounce it as clear or dark as appropriate. Of course certain L's will always turn up as clear (before a vowel inside the word, *leg*), others always as dark (before a consonant, *belt*), while final L's will alternate *(tell me – tell it)*, but this does not weaken the argument. This "general L" is less specified than its allophones, being unspecified for clearness or darkness, having only the characteristics "lateral sonorant consonant".

This leads us to turn round our previous statment (2.2.1) that a phoneme is more than a sound; actually, a phoneme is less than a sound, because it has fewer features – just like, say, a mammal is less than a horse, or $H_2O$ is less than snow, ice, etc. The higher the category, the less specified and more abstract it is.

**(c)** A different solution is offered by **Generative Phonology**. This approach says that any variant can be taken as the underlying one if, by applying the right rules in the right order, we can **derive** the required surface pronunciation. The rules will then "map" the underlying form of words onto their surface form, that is, they convert phonemes into speech sounds.

The derivation in (3) shows L-darkening (as well as other rules: Aspiration and Unstressed Vowel Reduction, to make the picture more complete).

(If a sound is affected, the changed sound is written under its starting form. The rules appear between the two horizontal lines. n.a. = not applicable.)

(3) Generative derivation: an example

| *Spelling:* | *leg* | *belt* | *tell us* | *tell me* |
|---|---|---|---|---|
| Underlying Represent. (=UR) | leg | belt | ˈtelʌs | ˈtelmi |
| L-Darkening | *n.a.* | ɫ | *n.a.* | ɫ |
| Aspiration | *n.a.* | *n.a.* | $t^h$ | $t^h$ |
| Unstr'd Vowel Reduction | *n.a.* | *n.a.* | ə | *n.a.* |
| Surface Representation (=SR) | [leg] | [beɫt] | [ˈ$t^h$eləs] | [ˈ$t^h$eɫmi] |

As we see, the L-Darkening Rule applies to *belt* and *tell me* (but not to *leg* or *tell us*, where the /l/ is before a vowel). The Aspiration Rule applies to the /t/ of *tell* (but not *belt*, where it is final). The Unstressed Vowel Reduction Rule applies to *us* (but not to *me*, because final /i/ is never reduced to /ə/).

[4] Interestingly, this is exactly what English spelling does: it uses the same letter *L* for both variants.

## 2.3. Natural classes

Consider the distribution of English [h] (the glottal fricative) and [ŋ] (the velar nasal).[5]

| (4) | **Before vowels** **__V** | **Before consonants** **__C** | **Word-finally** **__#** |
|---|---|---|---|
| [h] | **h**am, **h**istorical, be**h**ave | NEVER | NEVER |
| [ŋ] | NEVER[6] | ba**n**k, a**n**ger, Hu**n**garian | si**ng**, belo**ng**, to**ng**ue |

If we follow the principle of complementary distribution, we'll have to say that [h] and [ŋ] are allophones of one phoneme! This is counter-intuitive and ought to be avoided. We may point out that [h] and [ŋ] are not similar enough to be allophones of one phoneme – but this might sound vague and impressionistic, for what is "similar"? To put it more precisely, we say that they do not form a **natural class**: they do not share any feature which would not be shared by other sounds. Their only common feature is that they are both consonants; but that is not unique to them, as there are many other consonants. The allophones of a phoneme must exclusively share at least one distinctive feature (or feature-combination) not shared by other sounds. In the case of [l] and [ɫ] this feature was [+lateral], since no other sounds share this manner of articulation. The sounds [h] and [ŋ] do not satisfy this "**exclusive similarity**" requirement, so they must be analysed as two distinct phonemes even though they are in complementary distribution.

## 2.4. Neutralization

There are cases where two phonemes behave like allophones. Consider English /s/ and /ʃ/. These are phonemes, producing minimal pairs: ***s**o – **sh**ow, ma**ss** – ma**sh**, par**c**el – par**t**ial, (uni)ver**s**al – (contro)ver**s**ial,* etc. But there is one position in which their appearance is predictable: at the beginning of a word when followed by a consonant (the "initial-preconsonantal" position):

**(5) Distribution of /s/ and /ʃ/**

| **Position** | | **[s]** | **[ʃ]** |
|---|---|---|---|
| initial-preconsonantal (not *r*) | #__$C_{not\ r}$ | stub | *NEVER* |
| initial-preconsontl. before *r* | #__r | *NEVER* | shrub |

The symbolization "#__$C_{not\ r}$" means "before any consonant except /r/": in this position only /s/ can occur *(stub)*, because there are no English words beginning with /#ʃt-/, /#ʃm-/, etc. On

[5] Remember that orthographic *h* is silent before a consonant or word-finally, so words like *John, Sarah, shah, Noah* do not have [h] (BEP 4.41).

[6] There are words in which [ŋ] is before a vowel, but these are all made up of free stem plus suffix, so they do not belong here, e.g. *sing#er* [ˈsɪŋə], *slang#y* [ˈslæŋi]. A real irregularity is *hangar* /ˈhæŋə/.

the other hand, when the second consonant is /r/, only /ʃ/ can occur *(shrub)*, because there are no English words beginning with /#sr-/. This is complementary distribution. In this position /s/ and /ʃ/ do not contrast: their opposition is **neutralized**.

Here are some further examples of neutralization.

- /n/ and /ŋ/ are phonemes *(sin ↔ sing)*, but are neutralized before velars (/k, g/), where only /ŋ/ can appear *(bank, anger)*.
- /s/ and /z/ are phonemes *(seal ↔ zeal, rice ↔ rise)*, but are neutralized word-finally after an obstruent consonant, with which they have to agree in voicing (*backs* /s/ but *bags* /z/).
- /ʊ/ and /u:/ are phonemes *(look ↔ Luke, pull ↔ pool)*, but are neutralized word-finally, where only /u:/ can appear *(bamboo, menu, continue)*. [7]

Neutralization means that two phonemes suspend their contrast in a particular position. In this **neutralizing environment** the two sounds behave like allophones.

The /s/ – /ʃ/ problem is different from the /h/ – /ŋ/ problem because [s] and [ʃ] are really similar sounds, forming a natural class: they (and only they) are the voiceless alveolar fricatives of English. How can we answer the problem of their behaviour?

### 2.4.1. The taxonomic handling of neutralization

In introductory courses and practical dictionaries the **taxonomic** (or "phoneme-inventory") approach is followed (BEP 2.18). This is based on minimal pairs: if two sounds contrast in at least one minimal pair in the language, they are declared to be phonemes of that language, and are represented as phonemes in all other words. This is the "once a phoneme, always a phoneme" principle. Because [s] and [ʃ] do contrast elsewhere *(so–show)*, they are different phonemes (separate members of the phoneme inventory of English, the "taxonomy"); and they are analysed as such even in those neutralizing environments where they do not contrast. A [ʃ] sound always represents an underlying /ʃ/, so *shrub* is transcribed as /ʃrʌb/ (as if a contrasting */srʌb/ was possible).

This representation is logical, but it pretends that the /s/ ↔ /ʃ/ contrast is valid everywhere, even though in certain places it remains "unexploited" by the language. Such a solution is **surface-oriented**: it says that *shrub* is pronounced with /ʃ/ simply because it is represented in the lexicon with /ʃ/. This gives the wrong impression that it is an **accidental gap** in the lexicon of English that no words begin with /sr-/ and no words begin with /ʃ/+other consonant. The taxonomic approach then, can be criticized because it **misses a generalization**.[8]

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[7] Similar neutralizations from Hungarian:

- *n* and *ny* are phonemes *(kén* 'sulphur' ↔ *kény* 'whim'*)*, but are neutralized before *ty, gy*, where only *ny* can be pronounced: *hangya* [hanygya] 'ant', *pinty* [pinyty] 'finch'.
- *o* and *ó* are phonemes *(kor* 'age' ↔ *kór* 'illness'*)*, but are neutralized word-finally, where only *ó* can appear: *olló* 'scissors'.

[8] Hung. 'szem elől téveszt egy általánosítást'.

### 2.4.2. The generative handling of neutralization

We can handle the *stub/shrub* problem in a generative framework by assuming /s/ to be the underlying phoneme in all word-initial consonant clusters, so *shrub* would be UR //srʌb//. (We shall include in double slants //...// those UR forms that are different from the usual transcription.) Now we have to introduce a rule turning this UR /s/ into [ʃ] before /r/. This is the **S-Cluster Adjustment Rule**. It is not different from allophonic rules (e.g. L-Darkening) because it has no exceptions.

(6) S-Cluster Adjustment Rule

/s/ → [ʃ] / #__r *shrub* //srʌb// → /ʃrʌb/

A sample derivation involving this rule appears below:

(7) Generative derivation of words beginning with /s/ or /ʃ/ + Consonant

| *Spelling:* | *so* | *show* | *stub* | *shrub* |
|---|---|---|---|---|
| U. R. | soʊ | ʃoʊ | stʌb | srʌb |
| S-Cluster Adjustment | *n.a.* | *n.a.* | *n.a.* | ʃ |
| S. R. | [soʊ] | [ʃoʊ] | [stʌb] | [ʃrʌb] |

This mapping correctly expresses that in *stub/shrub* the /s/ ~ /ʃ/ choice is predictable (= rule-governed), as it is in allophonic rules. The generative approach recognizes that contrast can be locally determined, i.e. it is valid in some places but not in others.

## 2.5. Lexical representation: the problem of Vowel Shift

Lexical representation means the string of phonemes with which a word (or morpheme) appear in the lexicon, the mental "dictionary" of speakers. For example, *coach* is represented lexically as 3 phonemes, /k–oʊ–ʧ/. Allophonic detail is not included, namely that this /k/ is aspirated, this /oʊ/ is clipped, and this /ʧ/ is preglottalized, because all this is predictable.

### 2.5.1. The taxonomic handling of Vowel Shift

Many stems are pronounced in two forms, with a tense vowel and with a lax one: *gr**a**ve* ~ *gr**a**v-(ity)*. This is called Vowel Shift[9]. What could be their lexical representation? The /eɪ/ ~ /æ/ alternation cannot be regarded as allophonic alternation, since – as shown in (8b) – the same vowels are elsewhere opposed, producing minimal pairs.

(8) Vowel pairs in Vowel Shift and in minimal pairs

[9] See BEP 8.17-19 for details.

| *Vowel pairs* | *(a) in Vowel Shift* | *(b) in minimal pairs* |
|---|---|---|
| /eɪ/ ~ /æ/ | gr**a**ve – gr**a**v-ity | cape ↔ cap |
| /i:/ ~ /e/ | m**e**tre – m**e**tr-ic | feel ↔ fell |
| /aɪ/ ~ /ɪ/ | t**y**pe – t**y**p-ic-al | mile ↔ mill |
| /oʊ/ ~ /ɒ/ | s**o**le – s**o**l-itude | road ↔ rod |

Once a phoneme, always a phoneme, says the taxonomic school: in that approach Vowel-Shift must be regarded as alternation between phonemes, that is, **allomorphic alternation**, which assumes that these stems simply have two different lexical representations (just like *foot–feet* or *teach–taught*), from which the speaker chooses the appropriate form. But while *foot* and *teach* are really irregular, the vowel-shifting stems like *grave* behave quite predictably. So once again we see that the taxonomic approach is logical and disciplined, but it misses a generalization by treating *grave–gravity* the same way as *foot–feet* or *teach–taught.*

### 2.5.2. The generative handling of Vowel Shift

The way Vowel Shift is presented at a practical level (so in BEP) is actually a generative solution, suggesting that in *grave~grav-* the vowel is some abstract element which is realized as /æ/ in a laxing environment *(grav+ity, grav+itate)*, but as /eɪ/ elsewhere *(grave, grav#est, grave#ly, grave#ness)*. Let us symbolize this abstract vowel as //A//.

(9) Abstract Vowel Realization Rule in Vowel-Shift

//A// → /æ/ / in a laxing environment (Trisyllabic Laxing, Laxing Suffix, etc.)
→ /eɪ/ / elsewhere

There are four such abstract vowels, symbolized with letters of the alphabet (very much as it happens in English spelling!), in capitalized form. The absract vowels each have two "daughter" phonemes. They are listed in (10), with their properties. You will note that the properties are very vague if they are to embrace both "daughters" of the abstract phoneme.

| (10) | **lexically =UR** | **phonemically = SR** | **properties of the abstract vowel** |
|---|---|---|---|
| | //grAv// | /greɪv/ ~ /græv-/ | //A// = front, nonhigh/high? |
| | //mEtr// | /mi:tər/ ~ /metr-/ | //E// = front, nonlow? |
| | //tIp// | /taɪp/ ~ /tɪp-/ | //I// = nonback, nonmid? |
| | //sOl// | /soʊl/ ~ /sɒl-/ | //O// = back, nonhigh? |

In this approach *cape, favourite, basic* have lexical /eɪ/, and *cap, parody, matter* have lexical /æ/, because they do not undergo Vowel Shift; their vowel is stable (= non-alternating). Stems

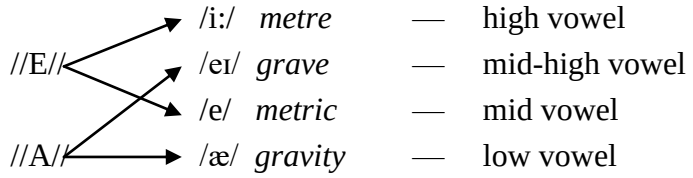
with alternating vowels, like *grave, nation, vain* have lexical //A//, so //grAv//, //nAʃən//, //vAn//.[10]

(11) Nonabstract and abstract vowels – an example

| spelling | UR | SR | |
|---|---|---|---|
| cape, favourite, basic | /eɪ/ | /eɪ/ | – nonalternating stems |
| cap, parody, matter | /æ/ | /æ/ | – nonalternating stems |
| grave, nation, vain } gravity, national, vanity } | //A// | /eɪ/ ~ /æ/ | – alternating stems |

This solution has a weakness: the abstract vowels //A, E, I, O// listed above do not have well-definable features that would distinguish their "daughter phonemes" on the basis of exclusive similarity (see 2.3 above). For example, the abstract element //A// in the lexical representation of *grave, nation, vain,* etc., has the daughter phonemes /eɪ/ and /æ/, of which [æ] is a low vowel, while the diphthong [eɪ] starts with mid [e] and ends with high [ɪ]. Unfortunately these properties cross over with the daughters of abstract //E//, namely /e/ and i:/ (the lexical representation of *metre–metric, severe–severity,* etc.). The diagram below shows that the vowel-height of the abstract vowels //A// and //E// cannot be specified exclusively, since their realizations cross over:

(12)




We must conclude that the abstract "vowels" in (10) are too vague and too cross-positioned to be proper phonological segments. They are useful as morpho-phonological abbreviations expressing the working of Vowel Shift in that stem.

Another solution would be to arbitrarily pick one "daughter" to be the underlying segment (say, /eɪ/ for *grave*) and turn it into the other when necessary (so *gravity* would be UR //greɪvəti// → SR /ˈgrævəti/); but the problem with this would be that there are cases like *basic* /ˈbeɪsɪk/ (and not */ˈbæsɪk/), *obesity* /oʊˈbiːsəti/ (and not */oʊˈbesəti/), where Vowel Shift fails to take place without apparent reason. These are called "**lexical exceptions**" because their sound shape does not explain their not undergoing a rule. They show that the rule is not a real phonological one, because a pronological rule (like L-darkening) never has any exceptions.

All in all, Vowel Shift has to be regarded as an 80 per cent reliable **morpho-phonological tendency**. True, the spelling usually has the same vowel-letter for the alternants, so

[10] An analogous Hungarian example is provided by stable vowels such as *gyár ~ gyárak* 'factory/ies' (lexical /a:/), *nyak ~ nyakak* 'neck/s' (lexical /ɔ/), as opposed to stem-internal shortening vowels such as *nyár ~ nyarak* 'summer/s' (lexically an abstract vowel, perhaps /A/).

the letters *a, e, i, o* act practically like abstract underlying segments – but the existence of lexical exceptions undermines the phonological status of Vowel Shift.

Study this table carefully:

(13) Various types of alternation

| **Example** | **Type of alternation** | **Do they ever contrast?** | **Do they have exceptions?** | **Is the choice predictable by rule?** | **UR** |
|---|---|---|---|---|---|
| [l]~[ɫ]<br>leg~felt | allophonic | **NO** | **NO** | yes, everywhere | /l/ |
| [s]~[ʃ]<br>stub~shrub | phonological | yes | **NO** | yes, in a particu-lar position | /s/~/ʃ/ |
| [eɪ]~[æ]<br>grave~gravity | morpho-phonological | yes | yes | 80 % certainty, but has lexical exceptions | //A// ?<br>/eɪ/~/æ/ |
| [ʊ]~[iː]<br>foot~feet | morphological | yes | all these are exceptions | no | /ʊ/~/iː/ |

## 2.6. Representations and rules

The phonology of a language is made up of representations and rules. By **representations** we mean the phoneme strings of the words and morphemes in the lexicon; by **rules** we mean the transformations that turn these underlying representations into surface pronunciation. This chapter was about making representations more abstract in order to deprive them of unnecessary (because predictable) detail. The predictable detail is furnished ("fleshed out") by the rules, as shown in (17).

- Column (a) gives the actual pronunciation in a fairly "narrow" phonetic script.
- Column (b) gives the traditional taxonomic analysis (= Gimsonian transcription). Here only allophonic (= subphonemic, non-neutralizing) rules are needed.
- Column (c) gives a more abstract lexical representation, which has to be mapped onto the surface by various phonological rules, including the allophonic rules under (b). The unusual-looking transcriptions enclosed in double slants //...// in column (c) are not incorrect, they are just more abstract than the taxonomic-Gimsonian transcriptions in column (b). The derivation goes from (c) through (b) to (a).

If we use surface-close representations (as in the Gimson system), we need few rules; if we use more abstract ("impoverished") representations, we need many rules. The advantage of the more abstract representation is having a single underlying form for alternants of a given morpheme. Observe for example, that *atom* and *atom-(ic)* have a single underlier in Column (c) even though they are pronounced differently.

(14) Phonetic, taxonomical, and abstract-lexical representations

| **(a) Phonetic**<br><br>*Actual pro-nunciation* | **(b) Taxonomical**<br>**Surface-close represent.**<br>(explicit, rich, phonetic)<br>**only alloph. rules needed** | **(c) Abstract**<br>**Lexical representation**<br>(implicit, poor, phonological)<br>**phonological rules needed** |
|---|---|---|
| *bank* [bæ̃ŋk] | **/bæŋk/**<br>– vowel nasalized bef. nasal | **//bænk//**<br>– Nasal Place Assimilation /n/ → [ŋ] |
| *bang* [bæ̃ŋ] | **/bæŋ/**<br>– vowel nasalized bef. nasal | **//bæng//**<br>– Nasal Place Assimilation /n/ → [ŋ]<br>– Postnasal-Final G-Drop /g/ → ∅ |
| *kissed* [kʰɪst] | **/kɪst/**<br>– aspiration | **//kɪs+d//**<br>– Voice Assimilation /d/ → [t] |
| *each* [iʔʧ] | **/iːʧ/**<br>– pre-voiceless clipping<br>– preglottalization | **//iːʧ//** |
| *beer* [bɪː] | **/bɪə/**<br>–smoothing of broken diph. | **//biːr//**<br>– Pre-R Breaking /iː/ → [ɪə]<br>– R-Dropping /r/ → ∅ |
| *atom* [ˈætəm] | **/ætəm/** | **//ætɒm//**<br>– stress assignment<br>– Unstressed Vowel Reduction /ɒ/ → [ə] |
| *atomic*<br>[əˈtʰɒmɪk] | **/əˈtɒmɪk/**<br>– aspiration | **//ætɒmɪk//**<br>– Stress fixed by suffix -*ic* (atómic)<br>– Unstressed Vowel Reduction /æ/ → [ə] |
| *gravity*<br>[ˈgrævəti] | **/ˈgrævəti/** | **//greɪvɪtɪ//**<br>– stress assignment<br>– Trisyllabic Laxing /eɪ/ → [æ]<br>– High Vowel Tensing /-ɪ/ → [-i]<br>– Unstressed Vowel Reduction /ɪ/ → [ə] |

We have shown that an abstract representation, which needs complex rules to map it onto the surface, is more economical and often more insightful than the "rich" (i.e. surface-close) representations used in introductory textbooks and practical dictionaries.

END OF CHAPTER 2

# Contents

# 3

# SEGMENTS AND FEATURES

*Zoltán G. Kiss*

## 3.1 Introduction

### 3.1.1 What is a segment inventory?

In this chapter, we focus on speech sound segment inventories, more specifically, the segment inventory of Standard Southern British English (SSBE).[1] We will consider some of the choices phonologists face when they want to set up the segment inventory of a language. When we establish the the sound inventory of English, we create a list of its speech sound segments. But what elements does the segment inventory contain?

As an example, let us consider the inventories proposed by two well-known and influential works on English phonology – Jones (1957) and Gimson (1970)[2] – for SSBE monophthongs (Table 3.1).

| | *Pete* | *pit* | *pet* | *pat* | *part* | *pot* | *port* | *put* | *boot* | *but* | *Bert* | *better* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Jones: | iː | i | e | æ | ɑː | ɔ | ɔː | u | uː | ʌ | əː | ə |
| Gimson: | iː | ɪ | e | æ | ɑː | ɒ | ɔː | ʊ | uː | ʌ | ɜː | ə |

Table 3.1: SSBE monophthongs in Jones (1957) and Gimson (1970)

[1] Before you read this chapter, it is highly recommended that you read chapters 2, 4, 5, 7 and 8 of BEP, and the "Acoustic Phonetics" lectures of the Foundations of Phonology (ANN–141) course. This chapter will describe what is also referred to as "conservative" Standard British English, or RP.

[2] Daniel Jones: *An outline of English phonetics* (8th edition), Cambridge: W. Heffer & Sons, 1957; A. C. Gimson: *An introduction to the pronunciation of English* (2nd edition), London: Edward Arnold, 1970.

The table above shows that the two authors disagree on certain portions of the inventory (we have highlighted the differences between the two inventories with colouring). These dissimilarities are not merely notational differences. For example, the vowel in *Pete* is transcribed as /iː/ by both authors; however, the vowel in *pit* is /i/ in Jones (1957), while it is /ɪ/ in Gimson (1970). This shows that according to Jones, the difference between *Pete–pit* is a vowel length difference (notice the lack of the length mark "ː" for the *pit*-vowel), whereas for Gimson there is also a difference in vowel quality (notice his choice of a different symbol /ɪ/ in addition to the lack of length mark).

The differences in the two approaches show that phonological analysis is non-unique, there can be alternative analyses for the same facts; much depends on the theoretical objective and the framework one chooses (see Chapter 1). The aim of the present chapter is to discuss some of these theoretical choices and frameworks, and weigh their benefits and costs, when deciding which elements are inventory-members and which are not. To put it simply: how many segments are there in English?

### 3.1.2 Segments

A segment is a *discrete* unit, with well-defined boundaries (one can specify where it begins and where it ends), it has a constant, indivisible quality, it is *atomic*. Such discrete units can be represented graphically like the letters used in writing, or just like the digits used in mathematics. A useful metaphor for segments is to think of them as beads on a string (Figure 3.1 and (1)).

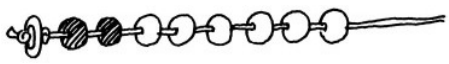


Figure 3.1: A sequence of sound segments is like a string of beads

(1) Words seen as strings of segments

| | | | |
|---|---|---|---|
| *very* | /v-e-r-i/ | *jam* | /ʤ-æ-m/ (or /d-ʒ-æ-m/?) |
| *ache* | /eɪ-k/ (or /e-ɪ-k/?) | *queue* | /k-j-uː/ (or /k-juː/?) |

A sound segment is a discrete, atomic unit of speech. However, speech is anything but a discrete phenomenon. It is a *continuum*, a speech stream with many overlapping properties. *Articulatorily*, speech is a rapid, continuous flow of speech-organ gestures that blend with each other. *Acoustically*, it is a continuously fluctuating wave of sound.

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As an example, let us consider the English word *pound*. If we focus on the articulatory gestures during the production of this word, it is very easy to see that what the discrete letter-symbols (*p–o–u–n–d*) suggest with respect to the articulation of this word is rather misleading. Speakers do not articulate one discrete speech sound at a time. Speech sounds are the result of many separate articulatory gestures

which are implemented simultaneously and in a continuous, scalar fashion. For instance, at the time the lips totally close at the beginning of the word, the tongue is already in a position to articulate an [a] kind of sound (the middle vowel of the word). In this way then, the initial stop is produced simultaneously with [a]. Furthermore, the velum is already half way lowered during the articulation of the vowel in anticipation of the production of the nasal stop [n]; as a result, the vowel is (partially) nasalized. There is not only a simultaneous implementation of the various articulatory gestures but also, the articulators move from one position to the other in a continuous manner, and not abruptly. For instance, the vowel in *pound* is transcribed as having two distinct segments: [a] plus the off-glide [ʊ], that is, [aʊ]. The symbolization suggests a discrete articulation: at one distinct point of time (and place) the tongue is low and rather front and the lips are spread (they are not rounded), and in the very next moment the tongue is high and back, while the lips are rounded *without any transition* between the two points in time. Similarly, the transcription suggests (as does the spelling) that there is a distinct break between the nasal and the final stop. This is obviously not the case: the articulators are changing constantly, without discrete intervals. In the case of the diphthong vowel, the tongue is moving continuously from low–front to high–back, and the lips are continuously changing from spread to rounded, whereas the nasal and final stop blend into each other, there is no distinct tongue release after the nasal, before the stop.

The non-discreteness of articulation has a very important consequence. On the level of precise phonetic description, the number of different sounds in any language will be potentially *infinite*, there will be an unlimited amount of *variation*. Variation is of course also due to individual factors, as the articulatory apparatus of each human is slightly different (for example, the length and thickness of the vocal cords result in different individual pitches, the difference in the size and shape of the oral cavity will result in different sound qualities, etc.).

---

In view of these phonetic facts, the following three questions arise:

(i) if speech is fundamentally non-discrete, how is it possible to segment the speech stream into discrete segments?,

(ii) if there is unlimited variation, if the number of sounds is potentially infinite, how is it possible to build up a limited inventory (a list of phonemes)?

(iii) even if we can isolate segment-size chunks from the speech stream, which of these are "important", in other words, which of them will be *inventory members* (phonemes of that language)?

It is these issues that this chapter will focus on.

---

Our approach to these issues will be *speaker-centred* (after all linguistics is a natural science involving humans): our assumption is that phonology (phonological competence, phonological categories, etc.) in the mind of speakers is internalized and abstracted away based on actual phonetic input (the speech signal they hear), in other words, phonology has a direct connection to (acoustic-perceptual) phonetic factors: *phonology is grounded in phonetics*, and consequently, our phonological analysis will also reflect this: the model we are assuming is also supposed to be phonetically-grounded.

### 3.1.3 Segmentation: How can we segment the speech stream?

It is a remarkable aspect of the human sound perception system that, despite the great amount of variability in speech, it can make sense of this variation and categorize certain sections in the speech stream as being "more similar" or "more different" than other sections. In other words, the human auditory system is capable of cutting up the speech stream into distinct chunks. This segmentation can be regarded as the very first step in the *abstraction* and *classification/categorization* of the phonetic reality, in which graduality and variability are partly disregarded.

SEGMENTATION as an analytic procedure means designating symbols (like the symbols of the IPA) to distinct sections of the speech stream. It is a process of cutting up the continuous speech stream into discrete chunks. It must be emphasized that even the most precise segmentation is an *abstraction*, as the potentially infinite variability and phonetic details of sound production and acoustics are necessarily disregarded. In a segmentation process, "large enough" similarities suffice for categorization as "the same segment". The end products of a segmentation procedure are SPEECH SOUND SEGMENTS, which thus constitute a low level abstraction. The segmentation of the speech signal into speech sounds is the very first step in any phonological analysis, including the classical TAXONOMIC–PHONEMIC analysis of sounds. It is this approach of phonology that we will focus on next.

## 3.2 The taxonomic–phonemic approach

### 3.2.1 The phoneme as an analytical category

As we have seen, the first step in a taxonomic analysis[3] is the segmentation of speech into speech sound segments. This segmentation is shown with symbols in NARROW PHONETIC TRANSCRIPTION. How "narrow" (i.e., detailed) the notation is is up to the analyst (and his aims). (2) shows an example for a narrow transcription of the utterance *This is a phonetic transcription.*

| | | |
|---|---|---|
| (2) | a. Gimson: | /ˈðɪs ɪz ə fəˈnetɪk trænˈskrɪpʃən/ |
| | b. Narrow transcription: | [ˈd̪ðɪs ɨz ə fə̃ˈnɛɾɨˀk t͡s̪ɹ̩ɛ̃ə̃nˈsk̟ɹ̩ɪpʃə̃n] |
| | c. Spelling: | *This is a phonetic transcription.* |

Even if we segment out sound chunks from the speech stream, the number of these sound segments will be still rather large. Are these all inventory-members? The answer of the taxonomic approach to sound systems is "no". If we turn from the physical aspects of speech

[3] For more details on the taxonomic–phonemic approach of sound patterns, see, for example, Chapter 2 of *BEP* and also Chapter 2 of this volume.

sounds to their FUNCTION in a language, the picture suggested by alphabetic writing systems, which employ few discrete symbols, becomes rather more appropriate. For example, while there is an infinite number of ways how a voiceless alveolar fricative [s] can be articulated, from a functional point of view, English imposes a much cruder classification: there is only *one* voiceless alveolar fricative in this language (/s/). But what do we mean by "function" here?

The linguistic function of speech sounds is their ability to CONTRAST (= oppose) the meanings of words/morphemes.The contrastive function of sound segments is discovered through examining their DISTRIBUTION (based on the segmentation of the surface data). If two segments are in COMPLEMENTARY distribution (like Clear and Dark L), the phonetic difference between them has *no* linguistic function, it is REDUNDANT (or NON-DISTINCTIVE) because they CANNOT CONTRAST different words. The distribution of such segments is PREDICTABLE from their environment, that is, it is generalizable with the help of phonological rules. These segments are called ALLOPHONES.

Allophones can be categorized into contrast-based functional classes, called PHONEMES. Phonemes are in OVERLAPPING distribution and they CONTRAST MEANING (they distinguish one word from the other), and their allophones are phonetically similar. The contrasting phonemes are used to distinguish words from one another in a language. The phoneme is, then, a functionally and distributionally defined abstraction over speech sounds.

As an example, let us consider the data in (3) and (4). (The diacritic ˘ (the breve) over a vowel symbol signals a clipped (= shortened) vowel, whereas ˜ (the tilde) a nasalized vowel.)

(3)

| | **long** | | | **clipped** | | | **nasalized** | |
|---|---|---|---|---|---|---|---|---|
| a. | *save* | [seɪv] | ~ | *safe* | [sĕɪf] | ~ | *sane* | [sẽɪm] |
| | *made* | [meɪd] | ~ | *mate* | [mĕɪt] | ~ | *main* | [mẽm] |
| | *maze* | [meɪz] | ~ | *mace* | [mĕɪs] | ~ | *main* | [mẽm] |
| b. | *side* | [saɪd] | ~ | *site* | [săɪt] | ~ | *sign* | [sãɪm] |

(4)

| | | | | | |
|---|---|---|---|---|---|
| *pale* | [peɪl] | ↔ | *pile* | [paɪl] |
| *Dave* | [deɪv] | ↔ | *dive* | [daɪv] |

In (3a) the vowels [eɪ] [ĕɪ] and [ẽɪ] are all different (of course they are still very similar phonetically), yet they are not analysed as separate phonemes in English as no MINIMAL PAIRS can be established that would differ in these phonetic properties only. The same goes for the vowels in (3b): although [aɪ], [ăɪ] and [ãɪ] are phonetically different, they do not function as phonemes. This is because the distribution of these vowels is complementary and absolutely predictable. The clipped vowels occur before voiceless consonants (like [f], [t], [s]), while the nasalized vowels occur before the nasals (in the example above: [m], [n]).

Since the differences between [eɪ] – [ĕɪ] – [ẽɪ] and [aɪ] – [ăɪ] – [ãɪ] have no contrastive function in English, there must be another phonetic property that makes the distinction possible in minimal pairs like *safe–save*. In these words the VOICING of the final fricative is responsible for the opposition between the two words. Thus, the sounds [f] and [v] will be analysed as phonemes (/f/ and /v/), whereas [ĕɪ] and [eɪ] will not be phonemes (but allophones of the phoneme /eɪ/).

---

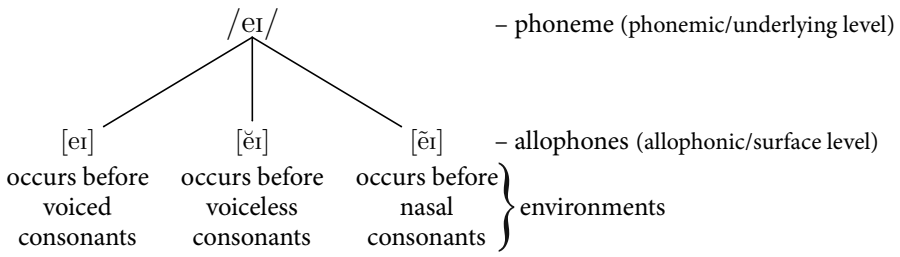
It would be logically possible to analyse [ĕɪ] and [eɪ] as phonemes and [f] and [v] as only allophones (that is, voicing being analysed as predictable) but this must be dismissed on grounds that the voicing distinction between the fricatives is contrastive in other positions, for example, word-initially: *file – vile, few – view,* etc., and if the phonemic status of a segment is established in one position, that segment will have phonemic status in all other positions (this is the "once a phoneme, always a phoneme" principle).

---

Since [eɪ] – [ĕɪ] – [ẽɪ] and [aɪ] – [ăɪ] – [ãɪ] are not different functionally, they are analysed as allophones of the phonemes /eɪ/ and /aɪ/, respectively. The contrast between /eɪ/ and /aɪ/ is shown by the minimal pairs in (4), which proves that these sounds are indeed phonemes: they contrast meaning; so they are different functionally, and not only phonetically (the phonetic difference between them is phonemic).

The relationship between the phoneme /eɪ/ and its allophones, based on the data in (4), is illustrated in (5).

(5)




### 3.2.2 Lexical representations

The lexical representation of words consists of phonemes, and contains only those phonetic properties that prove to be contrastive. Predictable or redundant information is omitted from the content of a phoneme. In theory then, the lexical representation of words (also called UNDERLYING REPRESENTATION) is REDUNDANCY-FREE. In this phonological model, redundant phonetic properties (like vowel clipping before voiceless consonants) are added by ALLOPHONIC RULES, and it is the more concrete, allophonic level (the SURFACE REPRESENTATION) that contains the redundant phonetic properties as well.

In the transcription practice of taxonomist phonemics, sequences of phonemes are represented in BROAD TRANSCRIPTION. Compare (2b), which is the narrow/allophonic/

phonetic transcription of the sentence *This is a phonetic transcription*, and (2a), which shows the broad/phonemic (redundancy-free) transcription of the same sentence. A taxonomic analysis includes the following (6).

(6) a. phoneme inventory (what phonemes are there?)
b. allophonic rules (what allophones are there?)
c. phonotactics (what orders/arrangements of phonemes are there?)

An important analytical step in the taxonomic approach is the setting up of a PHONEME INVENTORY (6a), a list of the *phonemes* of a language, out of which all the words are composed (7). This is why the underlying representation of words is also called LEXICAL REPRESENTATION.

(7) **Sound segment inventory** (phonemic version)
A list of the phonemes of a language.

Allophonic rules (7b) map the underlying phonemic level onto the surface allophonic level, they are often just a simple list of allophones for each member of the phoneme inventory, but can be formally expressed with REWRITE RULES (see section 3.4). PHONOTACTICS (7d) in a taxonomic analysis defines permissible strings of phonemes (e.g., that *pit* is a possible word in English but **pti* is not).

### 3.2.3 Problems with the taxonomic approach

Let us conclude this discussion of the taxonomic approach with a list of the objections that can be raised against it (8).

(8) a. the problem of phonetic similarity
b. are phonemes atomic?
c. natural classes
d. segmentation problems, problems of inventory membership (diphthongs, affricates)
e. the problem of surface contrast (limited contrast,[4] contrast transfer)

We will discuss these issues in the following sections.

[4] See the discussion of the velar nasal in chapter 1.

## 3.3 Phonetic similarity: the case of English [h] and [ŋ]

The problem of phonetic similarity and the distribution of [h] and [ŋ] in English is a classical example of the case when a mechanical collection and organization of segments into phonemes and allophones is not sufficient. As shown in 2.3., they are in complementary distribution: we will never find an example where [h] and [ŋ] would contrast. Accordingly, they might be analysed as allophones of a phoneme!

This analysis of [h] and [ŋ] is generally rejected on grounds of "insufficient phonetic similarity", as well as on mentalist grounds: speakers of English do not feel these two sounds to be "the same", which is otherwise the case for allophones. To express this, the criterion of phonetic similarity is brought in: the allophones of a phoneme should resemble one another to a particular degree. [h] and [ŋ] are not similar enough to be allophones of a phoneme. If we accept this reasoning, it is appropriate to say that these two sounds are separate phonemes in English, and that it is for independent reasons that they are unable to contrast.

There are several problems with this argumentation, however. We mention two here. The criterion of phonetic similarity is simply not explicit enough. How can we formally express phonetic similarity? What makes [eɪ] and [ẽɪ] more similar than [h] and [ŋ]? Also, it is difficult to see where the analyst can draw the line: what is the degree of similarity beyond which the grouping of sounds into a phoneme becomes impossible? To resolve these problems, we need to look beyond (or rather, "inside") phonetic symbols.

## 3.4 Natural classes and phonological features

The allophonic rule of vowel nasalization of /eɪ/ and /aɪ/, illustrated in the last column of (3a, b), can be expressed with the following two rewrite rules (9a, b):

(9) a. /eɪ/ → [ẽɪ] / ____ /n/

Interpretation: "/eɪ/ is nasalized before /n/".

b. /aɪ/ → [ãɪ] / ____ /n/

Interpretation: "/aɪ/ is nasalized before /n/".

Nasalization can be generalized for *all* vowels before *all* nasals (10):

(10) V → Ṽ / ____ [nasal]

Interpretation: "all vowels are nasalized before a nasal (/n/, /m/ and /ŋ/)".

But a rule like (11), which would nasalize vowels before non-nasal sounds is impossible (ungrammatical):

(11) $*V \rightarrow \tilde{V} \;/\; \_\_\_ \begin{Bmatrix} /p/ \\ /s/ \\ /l/ \end{Bmatrix}$

And similarly, the change of alveolar /s/ to post-alveolar [ʃ] before nasals is highly unlikely:

(12) $*/s/ \rightarrow [ʃ] \;/\; \_\_\_ \begin{Bmatrix} /m/ \\ /n/ \\ /ŋ/ \end{Bmatrix}$

Phonological processes involve NATURAL CLASSES of segments, that is, segments that pattern together. The set of segments which a rule affects (= the INPUT) share a phonetic property or set of phonetic properties (cf. "vowels" in (10)). Also, the segments appearing in the CONDITIONING ENVIRONMENT of a rule are almost always a set that shares a particular phonetic property or properties (cf. "nasals" in (10)). A natural class of segments is then any *complete* set of segments that share the same value for a phonetic property or set of properties: for example, all the nasals form a natural class.

For example, in English, only the *voiceless stops* /p/, /t/, /k/ can be aspirated, and not other sounds (as in e.g., *pat* [pʰæt], *tip* [tʰɪp], *kick* [kʰɪk], but not *bat* *[bʰæt] or *fat* *[fʰæt]). We see that the voiceless stops (the input of the Aspiration rule) form a natural class. Another well-known rule from English phonology is Pre-Fortis Clipping. According to this rule, vowels become clipped (shortened) before any *voiceless ("fortis") consonant* (/p/, /t/, /k/, /f/, /θ/, /s/, /ʃ/ and /ʧ/). In this case the conditioning sounds in the rule ("voiceless consonants") form a natural class.

It is phonetic properties, called FEATURES, that define and make up particular segments. The main hypothesis of this approach (the HYPOTHESIS OF DISTINCTIVE FEATURES) is that phonological rules and segment inventories are organized along distinctive phonetic features.

What are features exactly? They are defined phonetically, in other words, they are PHONETICALLY GROUNDED in articulation and perception. Every segment in phonology is represented as the product of BINARY choices for phonetic properties. For example, in the case of the stops /m/, /n/, and /p/, the following phonetic features can be relevant (= distinctive):

(13)

| | /m/ | /n/ | /p/ |
|---|---|---|---|
| is the velum lowered? | yes | yes | no |
| is the lower lip involved? | yes | no | yes |
| is the tongue tip/blade involved? | no | yes | no |
| is there an opening in the mouth? | no | no | no |
| … | … | … | … |

The phonetic properties in (13) can be expressed with features. For example, the raising or lowering of the velum is represented with the feature [nasal], whose "+" value corresponds to the velum being lowered (air can pass to the nasal cavity, and so the given sound is nasal), while its "–" value to the velum being raised (the sound is not nasal, it is oral).

The phonetic properties and binary ("yes"–"no") choices shown in (13) can be translated to the following BINARY FEATURE SYSTEM:

(14)

| | /m/ | /n/ | /p/ | |
|---|---|---|---|---|
| is the velum lowered? | + | + | – | **[nasal]** |
| is the lower lip involved? | + | – | + | **[labial]** |
| is the tongue tip/blade involved? | – | + | – | **[coronal]** |
| is there an opening in the mouth? | – | – | – | **[continuant]** |
| … | … | … | … | |

From this perspective, it is phonetic gestures, expressed with the help of distinctive features, that are the ultimate units of speech and not the segments themselves. *Segments are not really atomic:* they are *a collection of features* with specific values (plus or minus).

---

In this approach, segments are bundles of features that we call *feature matrices*. For example, the word *pin* will have the following input/underlying representation (on the definition of these features, see below):

(15) /p ɪ n/

$$\begin{bmatrix} -\text{syllabic} \\ -\text{sonorant} \\ -\text{continuant} \\ -\text{nasal} \\ +\text{labial} \\ -\text{voice} \\ \vdots \end{bmatrix} \quad \begin{bmatrix} +\text{syllabic} \\ +\text{sonorant} \\ +\text{continuant} \\ -\text{nasal} \\ -\text{back} \\ -\text{round} \\ +\text{high} \\ -\text{low} \\ \vdots \end{bmatrix} \quad \begin{bmatrix} -\text{syllabic} \\ +\text{sonorant} \\ -\text{continuant} \\ +\text{nasal} \\ -\text{labial} \\ +\text{voice} \\ \vdots \end{bmatrix}$$

If the phonological representation also includes features, this model will have many positive consequences for the issue of natural classes. Features provide the natural cuts of the phonetic space to understand phonological patterning. Phonological distance/similarity becomes possible to formalize in terms of shared feature values. The more values two segments share for various features, the more similar they are.

Natural classes will have a simple representation: they can be defined with just a few features, often just one. For example, the class containing /p/, /t/, /k/ shares the feature [−voice] and [−continuant], and it is *only* these sounds (and not others) that share these two features (all other sounds are either voiced or they are not a stop). This indicates that /p/, /t/, and /k/ form a natural class.

Vowel nasalization can now be expressed as the change of the [nasal] feature from minus to plus before segments that are [+ nasal]:

(16) **Vowel nasalization rule – featural version**

[+ syllabic, − nasal] → [+ nasal] / ____ [+ nasal]

(= any vowel becomes nasalized before a nasal)

---

As a result of the rule in (16), the output/surface representation of *pin* will be the following:

(17)

| [p | ĩ | n] |
|---|---|---|
| −syllabic | +syllabic | −syllabic |
| −sonorant | +sonorant | +sonorant |
| −continuant | +continuant | −continuant |
| −nasal | +nasal | +nasal |
| +labial | −back | −labial |
| −voice | −round | +voice |
| ⋮ | +high | ⋮ |
| | −low | |
| | ⋮ | |

Since non-nasal sounds will not have the feature [+ nasal] in their feature matrix, no nasalization is predicted to happen before non-nasal segments. (unlike in the rule in (11)). Furthermore, the non-palatal nasals will not induce palatalization as they are not specified for palatality (cf. (12)). Feature theory in this way makes phonological theory more restricted and gives it more predictive power.

---

(18) **Sound segment inventory** (feature-based version)

Sound segments are complexes of *distinctive features* that define or cross-classify the phoneme inventory into a network of segments.

This means that finding the contrastive segments in a language really means finding the contrastive features.

Features play the following functions in phonological theory:

(19) a. contrastive function
b. phonetic/descriptive function
c. classificatory function

The first function, contrastivity, means that features must express phonological contrast fully and economically, preferably without redundancy. For example, if /t/ and /d/ contrast (*tip – dip*), this contrast must be due to a feature difference. In this particular example they are in contrast because /t/ contains the [−voice] feature (= voiceless), while /d/ contains the [+voice] feature (= voiced). Thus, the feature [±voice] plays a contrastive function.

The second function of features is their phonetic/descriptive function (18b). On the phonetic/surface level of representation, the feature specification of every sound must describe accurately the phonetic content of the given segment. In other words, features must be phonetically "true".

Lastly (18c), features are required to have a classificatory function, too, i.e., features should serve in the expression of phonological generalizations: they should define natural classes that participate in phonological rules, they should cross-classify segments into natural classes.

Preferably, a phonological feature will serve all three functions simultaneously. We can check the usefulness of a feature against these three requirements. In the following sections, we will take a look at the features that can be used to define the segment inventory of SSBE (RP).

## 3.5 Distinctive features for English vowels

### 3.5.1 The feature [± syllabic]

We distinguish vowels from other sounds with the feature [± syllabic]. We define this feature in structural terms (see (20)).

(20) **[± syllabic]**
Sounds forming the nucleus of the syllable are [+syllabic]. All other segments in the syllable are [−syllabic].

For example, in the word *make* /meɪk/, /m/ and /k/ are [−syllabic], while the vowel /eɪ/ is [+syllabic] because it forms the nucleus of the syllable, like all the other vowels.

---

Syllabification – the arrangement of segments into syllabic constituents – depends on the SONORITY of the segments (see 4.3.1.). The MANNER of articulation of sounds can be arranged in a hierarchy

based on this sonority. In acoustic phonetic terms, sonority is related to periodicity in the sound signal. Sonorous sounds have periodic waveforms and show a clear formant structure (unaffected by noise) in spectrograms. This is because sonorous sounds are articulated with a relatively open oral cavity without occlusion or constriction.[5] The most sonorous sounds are the vowels, the least sonorous sounds are the obstruents. Sonorant *consonants* – glides and liquids (= the approximants), and nasals – have an intermediate sonority value.[6] Since syllabification depends on sonority, and since sonority is a phonetic property of sounds, the feature [±syllabic] is phonetically grounded after all (and not purely a structural feature).

### 3.5.2 The stressed vowel inventory of SSBE

Based on surface contrast, the following sound segments form the inventory of stressed (i.e., stressable or full) vowels of SSBE; these vowels possess the [+syllabic] feature; note that (21) is not the final version version of the inventory, the final version will be found in (50).

(21) The vowel inventory of SSBE (stressed vowels; interim list)

| **short monophthongs** | | **long monophthongs** | | **(long) diphthongs** | |
|---|---|---|---|---|---|
| /ɪ/ | bit | /iː/ | beat | /eɪ/ | bait |
| /e/ | bet | /ɑː/ | Bart | /aɪ/ | bite |
| /æ/ | bat | /ɜː/ | Bert | /aʊ/ | bout |
| /ʌ/ | but | /ɔː/ | bought | /oʊ/ | boat |
| /ɒ/ | bot | /uː/ | boot | /ɔɪ/ | boil |
| /ʊ/ | put | | | /ɪə/ | beer |
| | | | | /eə/ | bear |
| | | | | /ʊə/ | boor |

Our task now is to find the features that express the contrast between these vowels. First we will focus on monophthongs.

One obvious phonetic property is the PLACE of articulation. Figure 3.2 shows the IPA general phonetic vowel chart with the horizontal and vertical position of the vowels in the mouth. The position of the SSBE monophthongs is indicated by circles.

As figure 3.2 indicates, phonetics distinguishes five horizontal (front, near front, central, near back, back) and no less than seven vertical vowel places (close, near close, close mid, mid, open mid, near open, open). But do we need this many place categories to express the place contrast of the SSBE monophthongs? The answer is no. To fully account

[5] Openness of the oral cavity also has the consequence that voicing (the vibration of the vocal cordss) can be easily initiated and maintained due to favourable aerodynamic factors, for this reason, sonorous sounds are said to be SPONTANEOUSLY VOICED.

[6] For more on the sonority hierarchy and its role in syllabification, see the chapter "Syllable structure" of this volume.

for the contrast between these vowels (while also trying to be as truthful to their "surface" phonetic articulation as possible), we need only three horizontal (front–central–back) and five vertical (= height) place categories. This simplified division of SSBE monophthongs is shown in (22).

For example, the usual SSBE articulation of the vowel in *beat* is actually very close to the IPA vowel [i] (which is a front, close, unrounded vowel), this is why the circle coincides with [i]. The vowel in *bet* (which we transcribed as /e/) is close to IPA [ɛ]. The vowel in *bat* is between IPA [æ] and [a]. The vowel in *but*, which is traditionally transcribed as /ʌ/, is actually different from IPA [ʌ] (which is a back, open-mid, unrounded vowel): this vowel is articulated central, (near-)open and unrounded (so, it is around IPA [ɐ]). The vowel in *Bert* is really just the stressed (and phonologically long) version of the schwa [ə]. Lastly, the vowel in *bought* (and also in *boar*) is between IPA [ɔ] and [o].

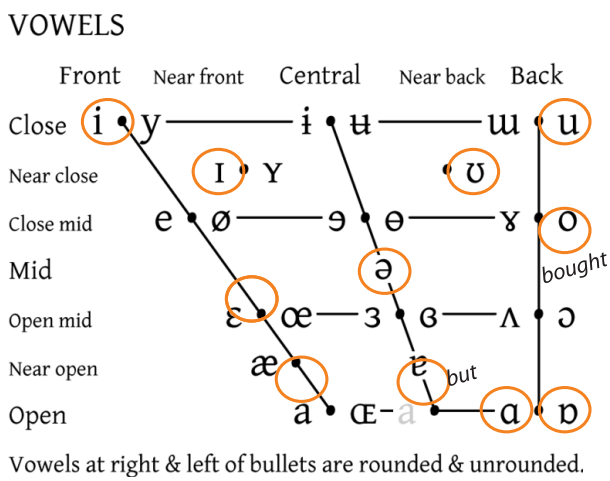



Figure 3.2: SSBE monophthongs (indicated by circles) in the IPA vowel space

(22) SSBE monophthongs (full vowels): phonological place classification

| | front | central | back |
|---|---|---|---|
| close | iː | | uː |
| half-close | ɪ | | ʊ |
| mid | | ɜː | ɔː |
| half-open | e | | |
| open | æ | ʌ | ɑː \| ɒ |

To see what features we can use to express these place categories, let us begin with the horizontal dimension: front–central–back.

### 3.5.3 Features for horizontal place: [±front], [±back]

We use two features to express the place contrast between front, central, and back vowels. The features and their definitions are shown in (23).

(23) **[±front], [±back]**

Front ([+front]) vowels are produced by advancing the tongue from the neutral position. Back ([+back]) vowels are produced by retracting it from the neutral position.

The "neutral position" is when the tongue is neither front nor back (and neither high nor low), but rests in the centre (as during the production of schwa). The central vowels (/ʌ/ and /ɜː/) are [– front, – back].

### 3.5.4 Height features: [±high], [±low]

We need to distinguish between several levels of height contrast (see (21)). To achieve this, we will use two features, [±high] and [±low]. Their definition is given in (24).

(24) **[±high], [±low]**

High ([+high]) vowels are produced by raising the tongue above the level that it occupies in the neutral position. Low ([+low]) vowels are produced by lowering it below that level.

Again, the "neutral position" refers to the point of articulation where schwa is usually produced. With the help of these two features, we can cut up the vowel space into three height levels: high–mid–low. This chopping up of the "vertical" vowel space is rather crude, as it groups close and half-close sounds into the "high" category (these sounds will be classified as [+high, –low]), whereas mid and half-open vowels will be classified as neither high, nor low (i.e., [–high, –low]), see (25). Thus, we now have only three "horizontal" levels (front–central–back) and only three "vertical" levels (high–mid–low).

(25)

| | front | central | back | |
|---|---|---|---|---|
| close | iː | | uː | [+high], [–low] |
| half-close | ɪ | | ʊ | |
| mid | | ɜː | ɔː | [–high], [–low] |
| half-open | e | | | |
| open | æ | ʌ | ɑː \| ɒ | [–high], [+low] |

High vowels as a natural class participate in high vowel gliding, for example (26a), the rule is shown in (26b):

(26) a. *lenient* /ˈliːniənt/ → /ˈliːnjənt/;
*usual* /ˈjuːʒuəl/ → /ˈjuːʒwəl/

b. [−stress, +high] → [−syllabic] / ___ [−stress]

= an unstressed high vowel becomes a glide before an unstressed vowel.

The inventory of the stressed monophthongs of SSBE, expressed with the four place features so far, looks like (27) at the moment:

(27)

| | iː | ɪ | e | æ | ɜː | ʌ | ɑː | ɒ | ɔː | ʊ | uː |
|---|---|---|---|---|---|---|---|---|---|---|---|
| [front] | + | + | + | + | − | − | − | − | − | − | − |
| [back] | − | − | − | − | − | − | + | + | + | + | + |
| [high] | + | + | − | − | − | − | − | − | − | + | + |
| [low] | − | − | − | + | − | + | + | + | − | − | − |

Note that there are three pairs of sounds that are still not successfully distinguished in this feature system (they are highlighted by colouring). Next, we will consider the representation of the contrast between these vowels.

### 3.5.5 Rounding, tenseness and length

What phonological property lies behind the contrast between *beat–bit, Luke–look,* and *lark–lock*? The Gimson transcription of these vowels (/iː/–/ɪ/, /uː/–/ʊ/, and /ɑː/–/ɒ/) suggests that there are two phonetic properties to express these phonological contrasts. First of all, there is a LENGTH (QUANTITY) difference, but there is also a QUALITY difference.

**Rounding.** The quality difference between /ɑː/–/ɒ/ is due to LIP ROUNDING: /ɑː/ is unrounded, /ɒ/ is rounded. This contrast can be handled by introducing the feature [± round]. Notice that this feature is only really needed for expressing the /ɑː/–/ɒ/ contrast, in all other cases, it is redundant because all front vowels are unrounded, and all non-low back vowel are rounded in English. We say that the FUNCTIONAL LOAD of [± round] is low.[7]

(28)

| | iː | ɪ | e | æ | ɜː | ʌ | ɑː | ɒ | ɔː | ʊ | uː |
|---|---|---|---|---|---|---|---|---|---|---|---|
| [front] | + | + | + | + | − | − | − | − | − | − | − |
| [back] | − | − | − | − | − | − | + | + | + | + | + |
| [high] | + | + | − | − | − | − | − | − | − | + | + |
| [low] | − | − | − | + | − | + | + | + | − | − | − |
| [round] | − | − | − | − | − | − | − | + | + | + | + |

[7] In Hungarian, the functional load of this feature is higher among front vowels, as this is the only feature that distinguishes between *i–ü*, for example.

**Tenseness.** What about the remaining pairs /iː/–/ɪ/ and /uː/–/ʊ/? The IPA chart (see figure 3.2) suggests that the difference between these vowels is due to a subtle difference in *height*. The long members of the contrast are somewhat higher than their short counterparts. Traditionally, however, this contrast is considered to be due to a quality difference between TENSE and LAX vowels. /iː/ and /uː/ are tense, while /ɪ/ and /ʊ/ are lax. Logically both [±long] and [±tense] would successfully differentiate between /iː/–/ɪ/ and /uː/–/ʊ/. Phonemic theory, however, requires that phonemes be redundancy-free: one contrast should be expressed with one phonetic property (see section 3.2.1). The analyst has to choose *either* [±long] *or* [±tense] as the distinctive feature for the contrast between these vowels. Which analysis fares better?

Let us consider [±tense] first. So far, we have been successful at providing phonetically-grounded definitions of features. The definition of tenseness–laxness is, however, rather vague:

(29) **Tense** sounds are produced with a maximally distinct articulatory tongue gesture that involves *considerable muscular effort, a tensing in the tongue muscles*. **Lax** sounds are produced rapidly, somewhat indistinctly, and *without tongue muscle tensing*.

---

Unlike the place features we have been considering, the mere tensing of muscles *does not affect the acoustic vowel quality* as it does not influence the shape of the vocal tract. Put simply, tongue muscle tensing has no significant acoustic, perceivable effect for vowel quality. Only changes in place of articulation can have important acoustic consequences. Some analysts therefore argue that the "tensing in the tongue muscles" is actually the result of a forward movement of the TONGUE ROOT: tense vowels are produced with an advanced tongue root, whereas in lax vowels there is no such advancement. For this reason, the [±ATR] ("advanced tongue root") feature is sometimes used instead of [±tense]. Based on this, tongue root advancement is hindered for low vowels for articulatory reasons, and so /ɑː/ is a [−tense] sound. However, the phonetic tense–lax status of some other vowels is not clear (/ɜː/, /ɔː/, diphthongs).[8]

---

If we include [±tense] in our feature inventory, SSBE monophthongs will have the following specifications (30):

(30)

| | iː | ɪ | e | æ | ɜː | ʌ | ɑː | ɒ | ɔː | ʊ | uː |
|---|---|---|---|---|---|---|---|---|---|---|---|
| [front] | + | + | + | + | − | − | − | − | − | − | − |
| [back] | − | − | − | − | − | − | + | + | + | + | + |
| [high] | + | + | − | − | − | − | − | − | − | + | + |
| [low] | − | − | − | + | − | + | + | + | − | − | − |
| [round] | − | − | − | − | − | − | − | + | + | + | + |
| [tense] | + | − | − | − | − | − | − | − | − | − | + |

[8] In this book, we assume that all diphthongs are tense, even if their prominent first element is often articulated with a non-advanced tongue root (like /ɔɪ/ or /aʊ/).

Notice that this system is only based on vowel quality (place, rounding, and tensing), in which length is redundant: there is no [±long] distinctive feature.

---

This means that the underlying inventory of stressed monophthongs in SSBE could be transcribed as /i ɪ e æ ɜ ʌ ɑ ɒ ɔ ʊ u/ (notice the lack of the length mark); vowel length is assumed to be derived in this framework. Similarly to [±round], the functional load of [±tense] for monophthongs is also rather low: it is only required for the distinction of two vowel pairs (assuming that /ɜː/ and /ɔː/ are [−tense]).

---

As far as the phonetic adequacy of [±tense] is concerned then, this feature performs rather badly. What about its classificatory function? Are there phonological processes in SSBE that refer to [+tense] or [−tense] segments, and only those?

Distributional rules are often cited in support of grouping SSBE vowels into tense and lax sets. Five of these are listed in (31), and discussed below.

(31) a. Trisyllabic Laxness: normally only /ɪ e æ ɒ ʌ ɑː ɜː ɔː/ occur in a stressed antepenult

b. Prevocalic Tenseness: within a morpheme, only /iː uː eɪ aɪ ɔɪ aʊ oʊ/ can occur before another vowel.

c. Word-Final Length: /ɪ e æ ʌ ɒ ʊ/ do not occur in a word-final open stressed syllable.

d. Closed Syllable Shortening: only /ɪ e æ ʌ ɒ ʊ/ can stand before /ŋ/ and non-coronal clusters.

e. Pre-R Breaking: /iː uː eɪ aɪ ɔɪ aʊ oʊ/ cannot occur before /r/ within a morpheme.

f. Pre-R Broadening: /ɪ e æ ɒ ʌ ʊ/ cannot occur before /r/ in the same syllable.

(31e) and (31f) are the topic of Chapter 5, and so the discussion of Pre-R Breaking and Broadening is not elaborated on further here.

(31a) is the rule of Trisyllabic Laxness.[9] The vowels participating in this phenomenon can neatly be classified as [−tense] (assuming that in addition to the low vowel /ɑː/, the vowels /ɜː/ and /ɔː/ are also lax).

According to (31b), only "plain" tense /iː uː eɪ aɪ ɔɪ aʊ oʊ/ can occur before another vowel, a phenomenon called Prevocalic Tenseness.[10] There are no words with a lax vowel in this position (/ɪ e æ ʌ ɒ ʊ/, or /ɑː ɜː/), suggesting that these behave like a natural class (and can be classified with the feature [−tense]).[11]

[9] See BEP, 8.3.

[10] See BEP, 8.25.

[11] /ɔː/ can sometimes stand before another vowel, but only when a suffix follows it, as in *drawer, drawing.*

(31c) claims that short vowels may not occur in word-final open syllables; however, in the feature system we have developed so far, we cannot refer to only /ɪ e æ ʌ ɒ ʊ/ and not the other lax vowels in a natural way. We cannot use [−tense] for the short vowels exclusively as /ɑː/, /ɔː/ and /ɜː/ are also [−tense]. But these three vowels – just like the other tense vowels – can stand in word-final open stressed syllables (cf. *spa, far, law, more, fur,* etc.). We have to conclude then that /ɑː ɔː ɜː/ this time pattern with the tense vowels (even though phonetically, they are lax!) and not with the lax vowels. Notice that if we used the [±long] feature, then the problems of expressing this distributional regularity would disappear: only the *short* vowels are excluded in word-final open stressed syllables.

According to (31d), only /ɪ e æ ʌ ɒ ʊ/ can occur before /ŋ/ (and before any non-coronal consonant cluster).[12] Here /ɑː ɔː ɜː/ pattern with /iː uː eɪ aɪ ɔɪ aʊ oʊ/ again because they do not occur before /ŋ/. This fact suggests that they are to be classified as [+tense]. Once more, using length, we could express this regularity much more neatly: only the *short* vowels may occur before /ŋ/.

Based on this discussion of a possible [±tense] feature in the SSBE vowel inventory, we have to conclude that this feature is not only rather problematic from a phonetic point of view, but also from a classificatory point of view, as various phonological phenomena may require contradictory classification of some of the vowels. Even if this feature is successful at expressing the contrast between certain vowel pairs (like /iː/–/ɪ/ and /uː/–/ʊ/), it fails phonetically, and it is dubious as far as natural classes are concerned.

**Length.** If [±tense] seems to be a problematic feature to be used for setting up the SSBE monophthong inventory, does [±long] perhaps fare any better?

(32) displays the monophthong inventory of SSBE, this time using the supposed [±long] feature.

(32)

| | iː | ɪ | e | æ | ɜː | ʌ | ɑː | ɒ | ɔː | ʊ | uː |
|---|---|---|---|---|---|---|---|---|---|---|---|
| [front] | + | + | + | + | − | − | − | − | − | − | − |
| [back] | − | − | − | − | − | − | + | + | + | + | + |
| [high] | + | + | − | − | − | − | − | − | − | + | + |
| [low] | − | − | − | + | − | + | + | + | − | − | − |
| [round] | − | − | − | − | − | − | − | + | + | + | + |
| [long] | + | − | − | − | + | − | + | − | + | − | + |

This system is very similar to what Jones (1957) proposes (see Table 3.1), and what can be found in older dictionaries, in which the emphasis is on the distinctive importance of length, and not quality. [13] In this length-based system, the phonological difference between

[12] See Chapter 1.

[13] Notice that [±round] is strictly speaking redundant since all the other features are capable of differentiating between all the possible phoneme pairs, including /ɑː/ vs. /ɒ/, which are now distinguished solely on the basis of the [±long] feature.

the vowels of *beat* vs. *bit* may simply be written as /iː/ vs. /i/ (as Jones (1957) does, see Table 3.1). In such a length-based analysis, certain qualitative differences (rounding and tenseness) can be disregarded, making the system simpler, but more abstract.

What can we say about the phonetic grounding of [±long]? Length is rather unstable in English. In certain contexts – before voiceless ("fortis") consonants – all vowels are shorter than before voiced ("lenis") consonants. This phenomenon is known as PRE-FORTIS CLIPPING (= PFC) (see (3) above). If we accepted that the underlying difference between *beat* and *bit* is due to length only (/biːt/↔/bit/), the derivation would run into trouble: PFC would NEUTRALIZE the contrast between the two words. But there is no neutralization here: the two words do not sound the same ([bit] but [bɪt])! There must be another phonetic property that makes the contrast possible: *quality*. This quality difference is due to a slight place of articulation difference (the vowel of *beat* is higher and fronter than that of *bit* – see Figure 3.2), but it may be regarded as a difference between tense vs. lax articulation. Since it is the quality difference that is preserved in all contexts (and not length), it should be this feature that underlies the contrast between words like *beat–bit*.

There are also problems with the classification function of [±long]. Stress assignment in English is sensitive to quantity and not quality. Which vowels receive main stress often depends on the *weight* of the syllable, which itself is related to whether the vowel in question is short or long.[14] We have also seen that certain distributional rules are most neatly expressed if reference is made to vowel length, and not quality ("only *short* vowels may occur before /ŋ/", "only "long" vowels may occur in a final open syllable"); however, certain other distributional rules seem to be sensitive to tenseness rather than length (cf. Trisyllabic Laxness or Prevocalic Tenseness).[15] Thus: in certain cases length (and not tenseness) is a useful feature for classification, in some other cases tenseness (and not length) is a handy feature.

We can summarize the benefits and costs of the **length-based** analysis of the SSBE vowel inventory as follows. It makes the underlying feature system simpler, but introduces a higher level of abstractness (e.g., the contrast of *port–pot* is presented as one of length, despite the quality difference). Certain rules are easier to state with the help of length, but it seems that **tenseness** as a feature expressing vowel quality cannot be expelled from the feature inventory, as other rules are sensitive to it. Furthermore, length is problematic as it is unstable in English: surface contrast in many cases is ensured by a quality difference between vowels.

[14] For more on English stress, see Chapter 6.

[15] See (31).

## 3.6 Is schwa a phoneme of English?

So far we have discussed the inventory of full vowels. We have not yet considered REDUCED vowels, which only occur in unstressed syllables. In this section we will turn our attention to these weak vowels, with special attention to the most frequent of them, schwa /ə/.

The taxonomic approach (such as Jones 1957 and Gimson 1970, see Table 3.1) recognized schwa as one of the phonemes of English, having the same status as all other vowel phonemes. This analysis was backed by minimal pairs, as shown in (33). Some of the pairs in (33) are "derived" contrasts, in which inflections are added to the stem (which may already end in a schwa, as in *Rosa's,* which is a minimal pair with *roses*).

(33) a. word-initial: ***i***llusion – ***a***llusion, ***e***ffect – ***a***ffect, ***e***xcept – ***a***ccept } /ɪ/ ⟷ /ə/

b. word-final: pit***y*** – pitt***a***, Soph***ie*** – sof***a***, rock***y*** – rock***e***r, cit***y*** – sitt***e***r } /ɪ/~/iː/ ⟷ /ə/

c. word medial: Len***i***n – Lenn***o***n, teach***e***s – teach***e***rs, ros***e***s – Ros***a***'s, pur***i***st – pur***e***st } /ɪ/ ⟷ /ə/

Based on the "once a phoneme, always a phoneme" principle, in a taxonomic analysis schwa is always considered an underlying phoneme where it occurs on the surface. However, there are two nagging facts that could be raised against the phonemic status of schwa.

The first is that it only occurs in *unstressed* syllables: schwa is never stressed. In this sense we can predict the occurrence of schwa.

The second is that it has a *limited contrast* in two senses: unlike other contrastive vowels, (a) it only contrasts with certain vowels (unstressed /ɪ/ or /i/), and (b) it only contrasts in certain positions.[16] These facts are not explained by the classical analysis, which treats schwa just like other full vowels.

Generative phonological analysis recognizes the special patterning of schwa. To express the fact that schwa only occurs in an unstressed syllable, the generative analysis sets up a NEUTRALIZATION rule, which we can call the VOWEL REDUCTION RULE;[17] this rule is displayed in (34):

[16] This last statement is mainly true of American English accents, in which morpheme-internal contrast with schwa is not possible, so both *Lenin* and *Lennon* sound the same.

[17] Also called UNSTRESSED VOWEL WEAKENING as in BEP 8.28.

(34) Vowel Reduction Rule

$$\begin{bmatrix} -\text{stress} \\ +\text{syllabic} \end{bmatrix} \rightarrow \text{ə}$$

"Any unstressed vowel is pronounced as schwa."

This rule expresses the fact that the contrast of full vowels is neutralized (suspended) in an unstressed syllable: unstressed syllables do not display the full range of vowels, only schwa is possible in such a position. This analysis has the consequence that schwa is not a member of the underlying phoneme inventory, but is a *derived* vowel. The rule in (34) is very general (actually, as we will see, it is too general) as it refers to "any" unstressed vowel.

But which vowel do we derive the schwa from? To ask it differently: which vowel is the input of the rule? Fortunately, in many words various ALTERNATIONS provide clues as to what is the underlying vowel. Some examples are listed in (35).

| (35) | **full** | **reduced** | | |
|---|---|---|---|---|
| | sent***é***ntial | ~ sént***e***nce | e | ~ ə |
| | syst***é***mic | ~ sýst***e***m | e | ~ ə |
| | mor***á***lity | ~ mór***a***l | æ | ~ ə |
| | symb***ó***lic | ~ sýmb***o***l | ɒ | ~ ə |
| | at***ó***mic | ~ át***o***m | ɒ | ~ ə |
| | harm***ó***nious | ~ hárm***o***ny | oʊ | ~ ə |
| | myst***é***rious | ~ mýst***e***ry | ɪə | ~ ə |
| | dr***á***ma | ~ dr***a***mátic | ɑː | ~ ə |
| | Arth***ú***rian | ~ Árth***u***r | jʊə | ~ ə |

(35) illustrates that when a vowel becomes unstressed, it is pronounced as [ə]. This "stressed vowel ~ schwa" alternation allows us to establish an intimate relationship between the two vowels. We may say that schwa is derived from this full vowel, which *underlies* [ə], becasue in the same word – when the word is suffixed for instance – this particular full vowel is pronounced. Based on this, the derivation of *atom ~ atomic* can be formulated in the following manner (36).

| (36) | underlying representation: | /ætɒm/ | /ætɒmɪk/ | (both vowels are full!) |
|---|---|---|---|---|
| | stress rules | ˈætɒm | æˈtɒmɪk | |
| | Vowel Reduction Rule | ˈætəm | əˈtɒmɪk | |
| | other rules | … | … | |
| | surface representation: | [ˈætəm] | [əˈtʰɒmɪk] | (only one vowel is full!) |

In the underlying representation all the vowels are full vowels. Then the stress rule designates which syllable receives the main stress, after which the Vowel Reduction Rule applies,

which reduces the full vowel to schwa in an unstressed syllable. In *atom,* it is the second vowel that becomes [ə] because it is unstressed. In *atomic,* it is the first vowel that comes under the effect of the Vowel Reduction Rule. In this generative analysis, the underlying representation is fairly abstract (= different from the actual surface representation) and a rule derives the output forms.

However, there are numerous other words that contain a schwa on the surface but for which no alternations are available. What is the underlying representation of those words? For example, what should be the underlying representation of the underlined vowels in (37)? (They are all pronounced with [ə].)

(37) sal<u>a</u>d, p<u>a</u>rade, butt<u>o</u>ck, gymnasi<u>u</u>m, decisi<u>o</u>n, oft<u>e</u>n, mel<u>o</u>n, All<u>e</u>n, mount<u>a</u>in, etc.

Generative phonology takes the abstract analysis one step further, and claims that in these words *any* vowel can potentially stand underlyingly in the place of schwa. This vowel is a "general" vowel, which is not specified with any vowel features, except that it is [+syllabic] (namely, that it is a vowel), and we represent it with a capital "V". According to this analysis, *salad* and *parade* will have the following underlying representation and derivation:

(38)

| underlying representation: | /sælVd/ | /pVreɪd/ |
|---|---|---|
| stress rules | ˈsælVd | /pVˈreɪd/ |
| Vowel Reduction Rule | ˈsæləd | /pəˈreɪd/ |
| other rules | … | |
| surface representation: | [ˈsæləd] | [pəˈreɪd] |

The most important drawback of the Vowel Reduction Rule is that surface schwa is not always predictable. First of all, there are words where schwa contrasts. For instance, in the environment in (39a), both [ə] (*sofa*) and [iː] (*Sophie*) are possible outputs. The Vowel Reduction Rule wrongly predicts that only [ə] should occur here. And secondly, it is not true that only schwa may pop up in unstressed syllables. Other vowels may also stand in such a position, they are most typically /ɪ i(ː)/ and /ʊ u(ː)/ (39b). We also find words in which other *full* vowels such as /æ/, /ɒ/, /e/ stand in syllables that are neither primary nor secondary stressed, i.e., in non-major stressed syllables (39c).

(39) a. /souf_____/ – *sofa? Sophie?*

b. r***i***gídity /ɪ/, d***e***báte /ɪ/, stúp***i***d /ɪ/, páss***a***ge /ɪ/
síll***y*** /iː/, demócrac***y*** /iː/, Índ***i***a /i/
sìt***u***ation /ju/, etc.

c. /æ/ g***a***strónomy (but: ***a***strónomy with /ə/)
***a***ctívity ***a***ddíction
c***a***ntéen c***a***ntáta
/ɒ/ ápric***o***t ább***o***t
M***o***ntána c***o***ntáin
/e/ cónt***e***nt pár***e***nt
S***e***ptémber s***e***léct

One may argue that the bold and underlined vowels in (39c) are actually TERTIARY STRESSED, and so we can maintain the generalization that only reduced vowels may occur in unstressed syllables. If the first syllable in *activity* is claimed to have "some" stress, the fact that we find a full vowel (/æ/) there does not contradict the Vowel Reduction Rule. The problem is that there is no phonetic evidence that those syllables contain any stress (there is no rise in pitch and/or loudness for example). Phonetically they are just like other unstressed syllables – except that they happen to contain full vowels. This is why they may be called "strong-unstressed syllables".

The possible distribution of full and weak vowels in major stressed and non-major stressed syllables is summed up in Table 3.2. It shows that non-major stressed syllables may (*actívity*) or may not have full vowels (*contáin*), and sometimes there is free variation (e.g., the first vowel in *diréctor* can be full /aɪ/ or reduced /ə/ or /ɪ/), and this distribution is unpredictable (lexical).

| **Major stress** | | **No major stress** | | |
|---|---|---|---|---|
| Primary stressed | Secondary stressed | Strong-unstressed (="Tertiary" stressed) | Strong-unstressed or Zero stressed | Zero stressed |
| full V<br>*c**á**talogue*<br>/æ/ | full V<br>*à**c**tivátion*<br>/æ/ | full V<br>*actívity*<br>/æ/ | full V or weak V<br>*diréctor*<br>/aɪ/ or /ɪ/ or /ə/ | weak V<br>*contáin*<br>/ə/ |

Table 3.2: The distribution of full and weak vowels in major stressed and non-major stressed syllables

We need to give up on the idea of simplicity and economy, and accept the fact that the vowel inventory of English is more *layered*: reduced vowels can be grouped into two subinventories based on their patterning (see (40)). "Contrastive/non-variable" reduced vowels occur in words for which we cannot predict the quality of the vowel in their unstressed syllable(s), and so, these must be specified in the underlying representation (they are not derived). These vowels typically (but not exclusively) occur in *word-final* or *word-initial* position. These vowels do not normally show a wide range of free variation in their actual articulation (they are "non-variable").

The "noncontrastive/variable" reduced group of vowels contains /ə/ (or /ɪ/ or /jʊ/), typically (but not exclusively) in word-medial position before consonants. The actual place of articulation of this schwa is more variable and it is usually shorter than the reduced vowels in the "contrastive" group.

(40) vowel inventory

- main inventory: full vowels in stressed syllables
- subinventory: reduced vowels in unstressed syllables
  - contrastive/non-variable: /ə/, /ɪ i/, /jʊ ju/ — *sófa, Sóphie, agó, uníte, válue…*
  - noncontrastive/variable: /ə/~/ɪ/~/jʊ/ — *ménace, eráse, cómmunist…*

An acoustic-phonetic experiment on American English speakers' articulation of reduced vowels (Edward Flemming and Stephanie Johnson: 'Rosa's roses: Reduced vowels in American English', *Journal of the International Phonetic Association*, 37, 83–96, 2007) has shown that there are indeed two kinds of reduced "schwa vowels" (see Figure 3.3). *Word-final* "contrastive" schwas were found to be articulated quite differently from the other reduced vowels, front-high /ɪ i/ and back-high /ʊ u/: the schwas were typically mid-low, ranging from [ə] to low [ɛ], and were relatively long. This type of schwa and the other reduced vowels in this particular position are widely dispersed in the vowel space, which is not surprising considering their contrastive function. On the other hand, *word-medial, preconsonantal* "noncontrastive" schwas were realized relatively high and short, and they showed a wide range of variation horizontally from high-front [i] through mid-central [ə] and high-central [ɨ] to high-back [u]. These schwa realizations and the rest of the reduced vowels (/ɪ i/, /ʊ u/) often overlap each other, their dispersion in the vowel space is small. Based on this, we may assume that these words contain an underspecified vowel, whose actual realization varies around the mid-high ranges of the vowel space.

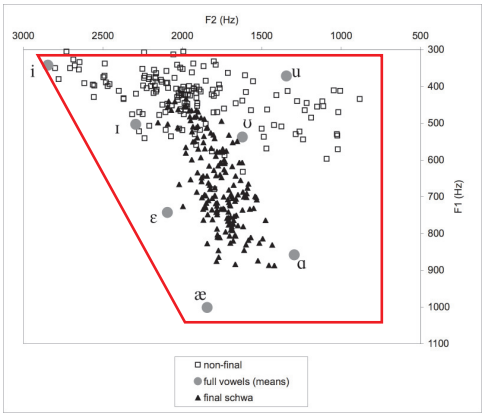



Figure 3.3: Realizations of schwa in American English

## 3.7 Vowel plus /j/: diphthong or not?

We have not yet considered the diphthong vowels: *bate, bite, bout, boat, boy, beer, bear, boor*. The pre-/r/ vowels will be discussed in Chapter 5, so we will concentrate on the "plain" ones, with special emphasis on analysing vowel plus yod /j/ sequences in English.

Phonetically considered, English diphthongs are sequences of a full vowel (/e a ɔ o/) plus a short glide (/i̯ u̯/) or schwa /ə/. Phonologically, such a sequence can be analysed as:

(i) a diphthong (complex nucleus = peak of a syllable), i.e., a member of the vowel inventory,

(ii) a hiatus (a sequence of two vowels belonging to different syllables),

(iii) a vowel plus consonant sequence (this is an option when the second half is a glide, as in *bite*).

Phonetic information alone is of not much help in deciding between the three analytical choices. We need to consider their phonological patterning to choose one or the other analysis. That means that *time* could theoretically be analysed as:

(i) /taɪm/ (diphthong),

(ii) /ta.ɪm/ (hiatus),

(iii) /tajm/ (vowel+consonant)

Let us look at /a/ plus /j/ sequences (*time, high, my*, etc.) from the viewpoint of their phonological behaviour. Compare /a/ plus /j/ sequences in Hungarian and English. Phonetically, H. *máj* 'liver' and E. *my* are the same: both are [maːj]. In Hungarian, the distribution of /j/ is rather free: it occurs after (and before) practically any vowel: *baj, táj, fej, kéj, mily, díj, moly, rój, bögöly, lőj, paszuly, fúj, süly*... In English, however, there are phonotactic restrictions between vowels and /j/: the yod can only occur after /a/, /e/, /ɔ/ *(my, fine, day, play, toy, soil...)*, but there is no */ʌj/, */æj/, */ɒj/, */ɑːj/, etc. If a sequence like /aj/ is regarded as a vowel-plus-consonant sequence, the restriction is rather surprising, as consonants usually occur freely after vowels, there are no limitations on their combinations. On the other hand, we do see restrictions between the members of DIPHTHONGS. This suggests that in English, /a/ plus /j/ is not VC, but a diphthong, one complex *vowel*, in which the glide is part of a diphthong: /aɪ/, as in Gimson.

Also, in English we find alternations between long and short monophthongs (Vowel Shift, see (41)) in exactly the same environment where we also see wowel + glide sequences alternating with the short monophthongs (42). This thus suggests that the vowel + glide sequences behave like vowels.[18]

(41) *intervene* /iː/ ~ *intervention* /e/
*penal* /iː/ ~ *penalty* /e/
*metre* /iː/ ~ *metric* /e/
*goose* /uː/ ~ *gosling* /ɒ/, etc.

(42) *crime* /aɪ/ ~ *criminal* /ɪ/
*rite* /aɪ/ ~ *ritual* /ɪ/
*type* /aɪ/ ~ *typical* /ɪ/
*divide* /aɪ/ ~ *division* /ɪ/
*shade* /eɪ/ ~ *shadow* /æ/
*vain* /eɪ/ ~ *vanity* /æ/, etc.

English /aɪ/ and all the other diphthongs have the same distribution as long monophthongs. For instance, only long monophthongs *and* diphthongs can occur in a word-final open syllable (see (31c), Word-Final Length Rule). Also, it is only long monophthongs *and* diphthongs that are banned before noncoronal consonant clusters (*/piːmf/, */paɪmf/, etc.), or before the velar nasal (*/piːŋ/, */paɪŋ/, etc., see (31d), Closed Syllable Shortening Rule). Long monophthongs and diphthongs thus form a natural class. We can conclude that English /a/ plus /j/ sequences *(my)* are diphthongs phonologically, while Hungarian /a/ plus /j/ sequences *(máj)* 'liver' are vowel-plus-consonant sequences. This is why we transcribe the *my* (phonetically [maj]) as /maɪ/ and not /maj/.

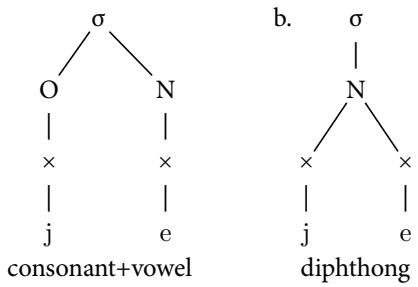
## 3.8 /j/ plus vowel sequences

Let us turn now to the analysis of /j/ plus vowel sequences. For example, [je] (as in *yet*) can in theory be analysed as either a sequence of a consonant /j/ plus the vowel /e/ (i.e., an onset–nucleus sequence in syllabic terms, see (43a)) or forming a complex syllable nucleus (diphthong, see (43b)).[19]

[18] Hungarian /j/ behaves like a consonant after vowels; this is further illustrated by its behaviour when a *v*-initial suffix (such as *-val*) is added after /j/, e.g., *vajjal* 'with butter'. Since /v/ fully assimilates to the last consonant (cf. *lábbal* 'with leg' vs. *szóval* 'with word'), /j/ must also be analysed as a consonant (*vajjal, héjjal, *vajval, *héjval*).

[19] See Chapter 4 on the syllable.

(43) a. b.




Which of these representations can be argued for in the case of English /j/ plus vowel sequences? To answer this, we will take a closer look at two environments where such sequences can occur: (i) word-initial (when no other sound precedes the yod), and (ii) post-consonantal, when a consonant precedes the yod.

### 3.8.1 Word-initial /j/ plus vowel

In word-initial position, we do not find any distributional restrictions between /j/ and the following vowel: any vowel may follow the yod.

(44) /jæ/: *yankee* /je/: *yet*
/jɔː/: *yawn* /jɒ/: *yacht*
/jʌ/: *young* /jɪ/: *Yiddish*
/jiː/: *yeast* /juː/: *yule*

Indeed, we do not find phonotactic restrictions between onset consonants and following vowels. The distributional patterning of /j/ word-initially means we must analyse it as a *consonant*.

There are other reasons which indicate that the yod here behaves like a consonant. For example, the allomorph of the indefinite article is *an* before the yod (45a), and there is no linking /r/ before it (45b).

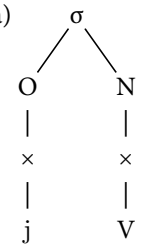
(45) a. *an apple* BUT *a car, a unit, a year* – initial consonant

b. *car is* /kɑːr ɪz/, *car park* /kɑː pɑːk/,
BUT *car yard* /kɑː jɑːd/, *car unit* /kɑː juːnɪt/ – no Linking-R

Let us add that in spelling, word-initial /j/ plus vowel sequences are represented by the grapheme *y* plus vowel graphemes/digraphs (or by *u, ue, ui, eu, ew*).

We conclude that in word-initial /j/ plus vowel sequences, /j/ is a consonant, standing in the syllable onset:

(46) = (43a)




### 3.8.2 Post-consononantal /j/ plus vowel

Let us turn to /j/ plus vowel sequences when /j/ follows a consonant. The distribution of /j/ in this context is very different from the one we discussed above. Here there are severe restrictions as to what vowels can follow the yod, see (47).

(47) *compute, beauty, confuse, view, tune, duke, super, presume, cute, huge…*

As (47) shows, only /uː/[20] can stand after /j/ after consonants. This indicates a very close relation between /j/ and the following vowel, suggesting that they form a unit, i.e., they form a complex nucleus, a diphthong and not a C+V sequence.[21]

What can we say about the relationship between the yod and the preceding consonant? If /j/ was analysed as a consonant (rather than part of a vowel), then we ought to find phonotactic restrictions between the consonant and the yod. This is because in an onset, the distribution of consonants is limited. Generally speaking (and disregarding /s/ for now), in two-member onsets the first consonant can be the stops and /f/ or /θ/, and the second consonant can only be /l/, /r/, /w/ and /j/. That is, we do not find for example $C_1C_2$ clusters beginning with /z/ or /h/, or any of the sonorants. If, on the other hand, we consider C + V sequences, practically any consonant can stand before any vowel. Now, /j/ follows non-sonorants far more freely than any other sonorant. In some cases, it occurs after non-sonorants that otherwise do not normally occur in clusters at all (cf. /vj/: *view*, /zj/: *Zeus, exuberant*,[22] /hj/: *humid, humour, huge, hew…*). /j/ can occur after sonorants, too:

(48) a. /mj/, /nj/: *mute, mule; new, knew, neuter*

b. /lj/: *lukewarm, lubricant, lucid, lewd*[23]

[20] And its phonological "relatives": "broken" /ʊə/ or /ɔː/, and /ʊ/, /u/ or /ə/ in unstressed syllables.

[21] See BEP 8.2.

[22] /zjuː/ occurs mostly in "conservative" SSBE.

[23] /ljuː/ occurs mostly in "conservative" SSBE.

The only consonants after which /j/ does not occur in SSBE are the post-alveolars: /ʃ/, /ʒ/, /ʧ/, /ʤ/, /r/ (Yod-Dropping, see BEP 5.24, 8.2).[24]

To sum up: post-consonantally, we see severe restrictions between /j/ and the following vowel, whereas we practically do not see any restrictions between it and the preceding consonant. This suggests that /j/ belongs to the vowel: /juː/ is a complex nucleus, an ON-GLIDING DIPHTHONG.[25] In English, this vowel is the only "on-gliding" diphthong (i.e., the prominent element of the diphthong is the second segment, preceded by glide /j/), all other diphthongs are "off-gliding" (i.e., the prominent element in the diphthong is the first segment, followed by a glide).[26]

There are some other arguments for /juː/ as a complex vowel. Firstly, it participates in alternations with /ʌ/ (49), secondly, orthographically considered, words with /juː/ are spelt with *u, ue, ui, eu, ew,* but *not* with *y* (plus another vowel grapheme).[27]

(49) *introduce* /juː/ ~ *introduction* /ʌ/
*presume* /juː/ ~ *presumption* /ʌ/

We conclude that /juː/ (as well as its broken counterpart /jʊə/) are members of the SSBE vowel inventory:

(50) English vowel inventory (complete)

| **short monophthongs** | | **long monophthongs** | | **(long) diphthongs** | |
|---|---|---|---|---|---|
| /ɪ/ | bit | /iː/ | beat | /eɪ/ | bait |
| /e/ | bet | /ɑː/ | Bart | /aɪ/ | bite |
| /æ/ | bat | /ɜː/ | Bert | /aʊ/ | bout |
| /ʌ/ | but | /ɔː/ | bought | /oʊ/ | boat |
| /ɒ/ | bot | /uː/ | boot | /ɔɪ/ | quoit |
| /ʊ/ | put | | | **/juː/** | beauty |
| | | | | /ɪə/ | beer |
| | | | | /eə/ | bear |
| | | | | /ʊə/ | boor |
| | | | | **/jʊə/** | cure |

[24] As we saw, this is true of "conservative" SSBE; in "contemporary" SSBE, no yod occurs after /s/, /z/, /θ/ and /l/ either.

[25] On-gliding diphthongs are also called RISING diphthongs.

[26] Off-gliding diphthongs are also called FALLING.

[27] Historically /juː/ derives mostly from the diphthongs /iu̯/, /eu̯/. This pronunciation is still preserved in Welsh English, where *suit* /siu̯t/ and *boot* /buːt/ do not rhyme, and where the selection of the indefinite article is *an*: *an union* /ən ˈiu̯nɪən/, *an uvular R* /ən ˈiu̯viu̯lər ˈaː/ Another argument in favour of /juː/ being a complex vowel could be that this vowel contrasts with vowels, such as /uː/ (cf. *food–feud, do–due, booty–beauty,* etc.); but this argument is misleading as we could reason that /rɪ/ or /lɪ/ or /we/ are also rising diphthongs as there are contrasts like: *pick – prick, pop – plop, dealt – dwelt,* etc.

## 3.9 Distinctive features for English consonants

In this section, we will take a look at the features that cross-classify the English consonant inventory. Based on surface contrast, the following segments constitute the consonant inventory of English:

(51) **The consonant inventory of SSBE (based on surface contrast)**

a. sonorants
   i. glides: /j w/
   ii. liquids: /l r/
   iii. nasals: /m n ŋ/[28]

b. obstruents
   i. stops: /p b  t d  k g/
   ii. fricatives: /f v  θ ð  s z  ʃ ʒ  h/
   iii. affricates: /ʧ ʤ/

### 3.9.1 Manner features

It is useful to arrange the manners of articulation in a hierarchical scale, called the SONORITY HIERARCHY. The more open the articulation of a sound, the more sonorous it is. (52) shows the sonority scale and the position of the manner groups of sounds on it.[29]

(52) *greater sonority* ⟵⟶ *less sonority*

vowels  glides  liquids  nasals  obstruents

To capture the various cutoff points along the sonority hierarchy between the manner classes, we use four binary features: [± syllabic] (section 3.5.1), [± consonantal], [± approximant], [± sonorant]. These features cut up the SONORITY HIERARCHY the following way:

(53)

| **vowels** | **glides** | **liquids** | **nasals** | **obstruents** |
|---|---|---|---|---|
| [+ syllabic] | [− syllabic] | | | |
| [− consonantal] | | [+ consonantal] | | |
| [+ approximant] | | | [− approximant] | |
| [+ sonorant] | | | | [− sonorant] |

[28] On the dubious phonemic status of /ŋ/, see Chapter 1.

[29] More in 4.3.1.

These features define natural classes of sounds that are well-known to pattern together in various phonological phenomena. For example, the feature-value [+approximant] groups vowels, glides, and liquids into one set, and it is precisely these sounds that can occur after initial stops in English (cf. *pay, puke, pray, twin, cry, clip* etc.).

The manner features that we proposed so far do not distinguish between the various kinds of [−sonorant] (=obstruent) sounds, that is, stops, fricatives, and affricates. Let us concentrate now on these segments.

### 3.9.2 Contrast within obstruents: stops, fricatives, and affricates

Two features will be used to differentiate between stops and fricatives: [±continuant] and [±strident]. Their definition is given in (54).

(54) a. **[± continuant]**

[−continuant] sounds (=stops) are produced with a full closure in the oral cavity, e.g., /p/, /g/, /ʧ/.[30] Sounds without a full closure are [+continuant], e.g., /s/, /l/, /w/, /æ/.

b. **[± strident]**

[+strident] sounds (usually called SIBILANTS) are acoustically noisy and nonperiodic/turbulent, e.g., /s/, /ʒ/, /ʧ/. All other sounds are [−strident].

These two features divide the obstruents in the following way:

(55)

| **stops** | **affricates** | **fricatives** | |
|---|---|---|---|
| p b t d k g | ʧ ʤ | s z ʃ ʒ | f v θ ð h |
| [−continuant] | | [+continuant] | |
| [−strident] | [+strident] = sibilants | | [−strident] |

The sibilant fricatives and affricates /s z ʃ ʒ ʧ ʤ/ all have the [+strident] feature. As an example, let us show four coronal obstruents /t ʧ s θ/ which have the following specifications with respect to continuancy and stridency:

(56)

| | /t/ | /ʧ/ | /s/ | /θ/ |
|---|---|---|---|---|
| [continuant] | − | − | + | + |
| [strident] | − | + | + | − |

[30] Nasals are also [−continuant], but in this section we only deal with obstruents and not sonorants.

As (56) shows, /t/ is a non-sibilant stop, whereas /ʧ/ is sibilant stop; on the other hand, /s/ is a sibilant fricative, while /θ/ is a non-sibilant fricative. The natural classes that these features express are fairly well-known. For example only voiceless non-sibilant stops ([−voiced, −continuant, −strident]) can be aspirated (/p t k/),[31] the *-s* plural allomorph is /ɪz/ only after sibilant [+strident] sounds, etc.

### 3.9.3 Voicing contrast in English stops

Traditionally, the contrast between *pie – by* or *sip – zip* is taken to be VOICING, i.e., /p/ and /s/ are VOICELESS, while /b/ and /z/ are VOICED (BEP 4.8–10). The feature [± voice] would handle the contrast successfully. But what about its phonetic content? Voiced sounds are articulated with vocal cord vibration. Is it true that sounds classified as "voiced" are voiced phonetically? We will take a closer look at the phonetic content of the "voicing" contrast of *stops* in English in various positions, i.e., the difference(s) between /p/ – /b/, /t/ – /d/, and /k/ – /g/. We will disregard sonorants (which have no voiceless counterparts and are all SPONTANEOUSLY VOICED – see footnote 5), as well as affricates and fricatives.

The following phonetic properties may play a role in the voicing difference between stops. These characteristics are also used in the *perception* of the contrast between /p/ – /b/, /t/ – /d/, and /k/ – /g/: these properties function as acoustic CUES to the voicing contrast of stops.

**Vocal cord vibration.** Vocal cord vibration is the most important phonetic feature of voiced stops. It is an important fact about English that in certain positions, vibration only occurs partially during the closure of stops, or does not occur at all. English stops are only articulated with vocal cord vibration during the whole closure phase when they stand between two vowels or sonorants, in other positions (e.g., word-finally or word-initially) they are (partially) voiceless. Thus while /b/ in *habit* is voiced, both /b/'s are partially/completely voiceless in *Bob*. We can say that English voiced stops are only "weakly" voiced, if at all, or LENIS. In contrast, in Hungarian, voiced stops are completely voiced in these positions, thus in *bab* 'bean' both /b/'s are voiced.

**Voice Onset Time (VOT).** This phonetic feature refers to the timing relation of the release of a stop and the voicing of a vowel or sonorant consonant following it. We can distinguish 3 cases of VOT:

[31] In other languages where even affricates are aspirated – like Mandarin Chinese – the group of sounds that are aspirated is larger, and can be expressed simply as [−voiced, −continuant].

(57) a. **Positive VOT:** there is a short "silent" break between the release of the stop and the voicing of the vowel/sonorant following it (voicing does not begin immediately after the release). This break is perceived as a short /h/, and we call it ASPIRATION. *Aspirated–voiceless* stops are called FORTIS, e.g., *pit* [pʰ], *time,* [tʰ], *cat* [kʰ] , etc.[32]

b. **Zero VOT:** the voicing of the vowel or sonorant begins immediately after the release of the stop. These stops are thus *unaspirated–voiceless*. In English, the "voiced" stops are actually articulated like this word-initially, thus the first stop of *bat* is phonetically partially devoiced [b̥] or completely voiceless [p]. Hungarian voiceless stops are articulated with zero VOT, and so Hungarian *pap* 'priest' sounds very much like English *Bob*.

c. **Negative VOT:** vocal cord vibration occurs during the closure of the stop and continues into the following vowel or sonorant. These stops are what we can call "truly" voiced stops: they are *unaspirated–voiced*. As we saw, these stops typically occur in English if they stand between two vowels or sonorants *(habit)*.

Based on VOT, we can distinguish two types of languages as far as stop contrast is concerned:

(58) a. **Aspirating** languages: the contrast of stops is due to positive VOT vs. zero VOT, i.e., aspiration vs. unaspiration: *pat–bat, tie–die, came–game,* etc. Vocal cord vibration does not play a role in the contrast of stops in these languages (despite what spelling suggests!). English belongs to this group (also German, Danish, Norwegian, Swedish, Icelandic).

b. **Voicing** languages: the contrast of stops is due to zero VOT vs. negative VOT, i.e., voicelessness vs. voicing. Aspiration does not play a role in the contrast of stops in these languages. E.g., Hungarian, Spanish, French belong to this group.

Based on these findings, we can assume that the fundamental phonetic property that distinguishes stops in minimal pairs like *tie–die* is not voicing but actually aspiration: the initial stop is aspirated–voiceless in *tie* but unaspirated–voiceless in *die*. Thus, aspiration is what underlies stop contrast in English, and voicing can be derived by an allophonic rule, which voices intervocalic unaspirated–voiceless stops (e.g., *rider, reading, read it, bigger…*).

As known, aspiration is lost in certain positions (such as after /s/ or word-finally), in those cases, we can introduce a Deaspiration rule. However, there is no neutralization between *bead* and *beat* (they are not homophones), even though the final consonants in both words are unaspirated and (largely) voiceless. There are other phonetic properties that help maintain the contrast:

[32] See BEP 4.11; 5.2.

(59) a. **Pre-Fortis Clipping:** in *beat* the vowel is clipped (= shorter than) in *bead*, while the closure duration of the final stop in *beat* is longer than in *bead*.

b. **Pre-Glottalization:** the final stop in *beat* is pre-glottalized [ʔt] (= the vocal cords close quickly, ending the voicing of the vowel before the closure of the final stop) while there is no pre-glottalization in *bead*.[33]

(60) shows the proposed underlying representation and derivation of *pea, Pete, beat* and *bead*:

(60)

| spelling: | *pea* | *Pete* | *beat* | *bead* |
|---|---|---|---|---|
| UR: | /pʰiː/ | /pʰiːtʰ/ | /piːtʰ/ | /piːt/ |
| Pre-Fortis Clipping: | — | i | i | — |
| Pre-Glottalization | — | ʔ | ʔ | — |
| Deaspiration: | — | t | t | — |
| SR: | [pʰiː] | [pʰiʔt] | ≠ [piʔt] | ≠ [piːt] |

Thus, none of the rules apply in *pea*, and it is articulated with an aspirated–voiceless stop. In *Pete*, the final stop undergoes Pre-Glottalization and Deaspiration, plus the vowel becomes clipped (because the final consonant is fortis (=aspirated–voiceless)), but the initial stop will not be deaspirated (because it is word-initial and followed by a stressed vowel). In *beat* the final stop undergoes the same changes as the last stop in *Pete*, but none of the rules will affect the first stop as it is lexically specified as voiceless-unaspirated. Lastly, in *bead* the underlying (lexical) representation is not changed by any rule: the vowel remains long, and the two stops are unaspirated–voiceless.

[33] See BEP 4.14.

# Chapter 4: Syllable structure

Péter Szigetvári

As we have seen, continuous human speech can be sliced into speech sounds, represented on paper by IPA symbols. Our question now is whether these segments can be grouped into larger units, what these larger units are, how they are organized, and whether they are of real use in phonological theory.

## 4.1 Our topic

Although the term SYLLABLE sounds familiar, it will be useful to first identify what phonologists mean, and what they do not mean, by this term.

### 4.1.1 Syllables vs. morphemes

The existence of groups larger than segments but smaller than words is obvious: in the string *catlike* the first three segments, **k**, **æ**, and **t** form a unit larger than a single segment, and so do the last few segments **laɪk**. That their structure is similar: both have a vowel at the middle, surrounded by consonants at both edges. Units like **kæt** and **laɪk** are called SYLLABLES. Incidentally, these two units are meaningful, they are MORPHEMES. But syllables and morphemes are not necessarily the same: for example, *butter* consists of two syllables, *syllable* of three, and *category* of four, but all three are a single morpheme, while *cats* is one syllable, but two morphemes. The sound string **rɒkɪt** may be analysed as a single morpheme (*rocket*), or two morphemes (*rock it*), but since the phonological shape is identical, this string is two syllables in either case. SYLLABIFICATION (the segmentation of sound strings into syllables) is related to the phonological shape of the word, while analysing into morphemes is dependent on meaning. The correlation of syllables and morphemes will be the topic of chapter 8.

### 4.1.2 Syllabification vs. hyphenation

For the layman, the terms syllabification and HYPHENATION are synonymous. We must draw a clear distinction between the two, however.

Hyphenation is an orthographical device. The point of separation within a written word is a printer's convention. For example, the word *English* is usually hyphenated as *Eng-lish* by British, but as *En-glish* by American printers, similarly to the different spelling conventions in the case of *colour* and *color.* Such conventions are to a large extent arbitrary.

Syllabification, on the other hand, is a theoretical issue: in normal speech syllable boundaries are not expressed by a pause (nor are morpheme boundaries, for that matter).

Accordingly, there is room for debate on where syllable boundaries fall: some analyst would argue that *letter* should be syllabified as in (1a) because this is what explains certain facts, while another comes to the conclusion that it should be as in (1b), since this is what fits her principles.

(1) *Possible syllabifications of* letter

a. lett.er b. le.tter

(Note that the word is hyphenated as *let-ter,* which suggests that the consonant belongs to both syllables, it is AMBISYLLABIC.) This shows that hyphenation and syllabification are different businesses. Note also that hyphenation is indicated by hyphens, while syllable boundaries are represented by dots, as in (1).

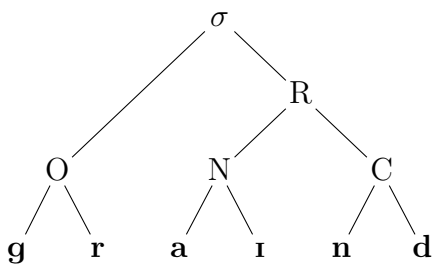
## 4.2 The structure of the syllable

Accepting that the notion of the syllable is a useful one, let us see its structure.[1] (The lowercase Greek sigma, $\sigma$, represents the syllable by convention.) We may encode the fact that the consonants at the beginning of a syllable, as well as the vowels after them, are more closely related to each other than the consonant(s) to the vowel(s), by packing them into syllabic constituents. The syllabic constituent typically holding the vowel of a syllable is called the NUCLEUS.[2] In some languages the nucleus may be occupied by certain consonants. The consonants preceding the nucleus occupy the ONSET, those that follow it are in the CODA. For reasons to be explained in §4.4.1 and §4.5.1, the nucleus and the coda together form a fourth syllabic constituent, called the RHYME. Lines of a poem rhyme when they contain the same sounds from the last (stressed) vowel to the end. It is not an accident that this is also called rhyme: it is the identity of the rhyme of the last syllables that make them rhyme: e.g., *cat* and *bat* rhyme, but *cat* and *cap*, or *cat* and *cut* do not.

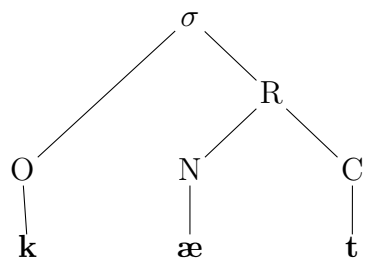
(2a) shows the tree diagram of the complex syllable **graɪnd** (*grind*) and (2b) that of **kæt** (*cat*).

(2) *Syllable trees for* grind *and* cat

a.




b.




The syllable **graɪnd** in (2a) is special in that all of its constituents contain two segments, they are branching. It is more usual for syllabic constituents not to branch, but to contain only a single sound, as in *cat* in (2b).

[1] Note that with this we already take it for granted that syllables do have an internal structure, although there is an alternative option, namely, that they do not.

[2] Some authors refer to the nucleus by the name PEAK.

## 4.3 Finding syllable boundaries

To syllabify sound strings, we need guidelines that decide in an unambiguous manner where syllable boundaries fall. We will first look at two universal principles organizing syllable structure, the SONORITY SEQUENCING PRINCIPLE and the ONSET MAXIMIZATION PRINCIPLE. Then some considerations against the latter principle are discussed.

### 4.3.1 Sonority Sequencing

SONORITY is a scalar property of speech sounds, that is, some sounds are less sonorous, others more sonorous, and yet others even more so. Sonority is related to the loudness or vocalicness of sounds: vowels are very sonorous, sonorant consonants are less so, obstruents are the least sonorous sounds.

Speech sounds can be organized into a SONORITY HIERARCHY. One — rather elaborate — hierarchy is given in (3).

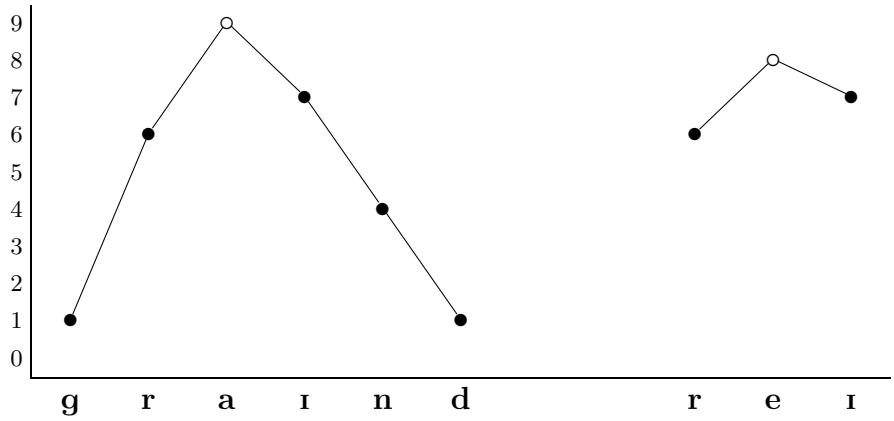
(3) *A standard sonority hierarchy*

| sonority index | | sounds |
|---|---|---|
| more | 9 | low vowels (e.g., **a ɑ ɒ**) |
| sonorous | 8 | mid vowels (e.g., **e ɛ ə ɔ o**) |
| ↑ | 7 | high vowels/glides (e.g., **i j u w**) |
| | 6 | rhotics (e.g., **r ɾ**) |
| | 5 | laterals (e.g., **l**) |
| | 4 | nasals (e.g., **m n ŋ**) |
| | 3 | voiced fricatives (e.g., **v ð z ʒ**) |
| ↓ | 2 | voiceless fricatives (e.g., **f θ s ʃ x**) |
| less | 1 | voiced plosives (e.g., **b d g**) |
| sonorous | 0 | voiceless plosives (e.g., **p t k**) |

The sonority sequencing principle states that in any syllable the segment in the nucleus has the highest sonority, and the sonority of any other segment is lower than that of its neighbour in the direction of the nucleus and higher than that of its neighbour in the direction of the edge of the syllable. In the sonority profile of a syllable the nucleus constitutes the peak,[3] and sonority is falling in both directions away from the nucleus; there may be no sonority fall before the nucleus and no sonority rise after the nucleus within the syllable. (4) illustrates this in the case of *grind* and of *ray.*

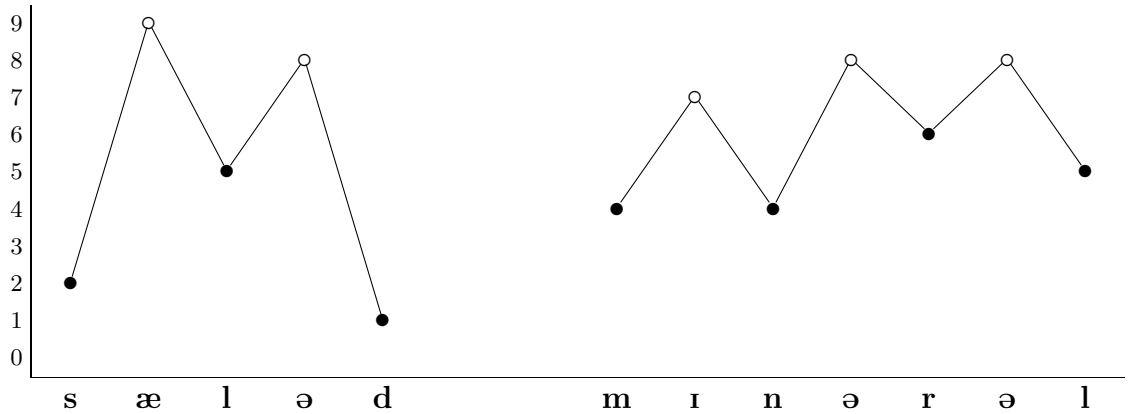
[3] Recall, peak is an alternative name for the nucleus.

(4) *The sonority profiles of* grind *and* ray



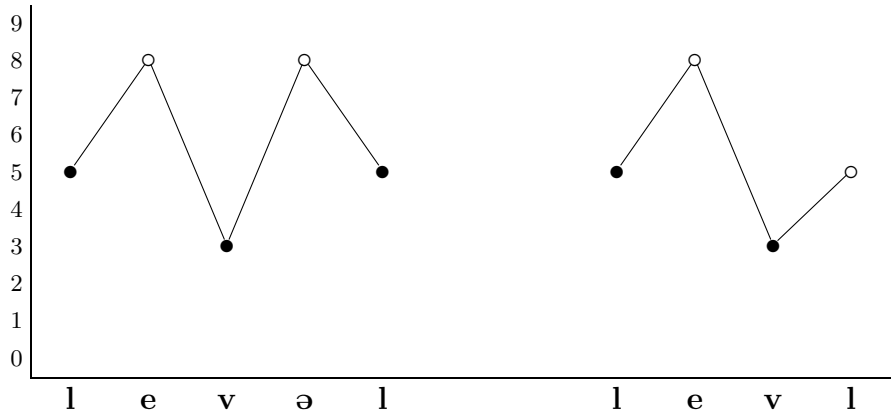

Being MONOSYLLABIC (having one syllable), both of these words exhibit one peak in their sonority profile, here shown in white. BISYLLABIC (two-syllable long) words will obviously have two sonority peaks, as *salad,* and TRISYLLABIC (three-syllable long) words three, as *mineral,* both shown in (5).

(5) *The sonority profiles of* salad *and* mineral




We have already mentioned that a nucleus may be occupied by a consonant. This is illustrated by the pronunciations of *level* (**levəl** and **levl**) in (6).

(6) *The sonority profiles of* level *with schwa and with syllabic* **l**




The sonority profiles of **levəl** and **levl** both have two peaks. While in the first case, these two peaks are occupied by two vowels, **e** and **ə**, in the case of **levl**, the second syllable has no vowel. Nevertheless, since the word-final **l** of this word constitutes a sonority peak itself, **levl** is also bisyllabic. A consonant which is a sonority peak (which is in the nucleus) is called a syllabic consonant.

If we believe that a given segment has to unambiguously belong to one of the neighbouring syllables, we need a way of deciding whether this should be the first or the second. That is, in the cases of (6), whether the syllabification is **le.vəl** or **lev.əl**. Neither of these options violates the sonority sequencing principle. To make a principled decision, we need further guidance.

### 4.3.2 Onset maximization

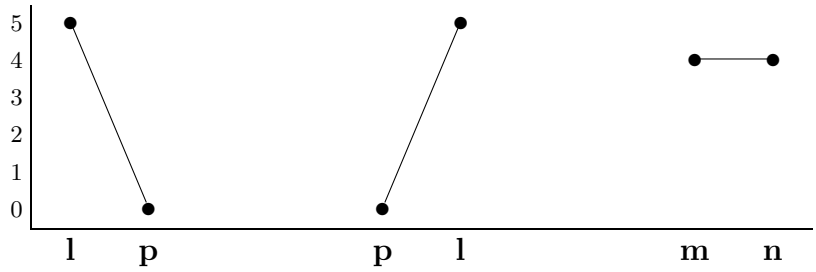
The ONSET MAXIMIZATION PRINCIPLE says: if a segment may belong to both the coda of the first and the onset of the second syllable, it belongs to the onset of the second syllable.

The principle gives preference to the syllabification **le.vəl** over **lev.əl**. A single INTERVOCALIC consonant (i.e., a consonant between two vowels) is always the onset of the second syllable, rather than the coda of the first: VCV is syllabified V.CV and never VC.V.[4]

The situation with consonant clusters is more complex. The sonority profile of a consonant cluster may be falling, rising, or level, as (7) illustrates. (Examples: **lp** as in *alpine,* **pl** as in *apply,* **mn** as in *chimney.*)

[4] Note that by maximizing the onset we inevitably minimize the coda. Thus the principle could equally be called "coda minimalization principle". As we are going to see at the end of this chapter, there is a universal preference in human languages for onsets over codas.

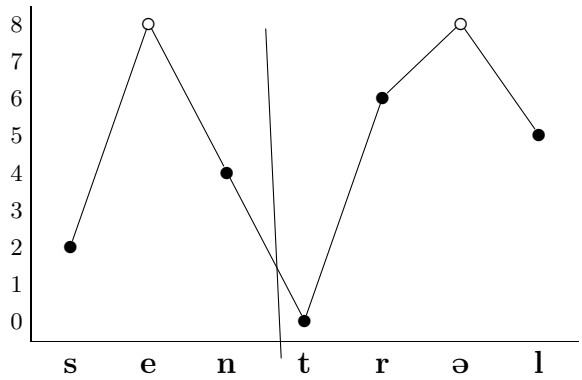
(7) *Falling-, rising-, and level-sonority clusters*




The sonority sequencing principle rules out the syllabifications *a.lpine* and *appl.y,* but does not select any of the other two possibilities: *al.pine* or *alp.ine* and *app.ly* or *a.pply.* But onset maximization rules out *alp.ine* and *app.ly,* leaving us with the intuitively correct syllabifications: *al.pine* and *a.pply.* Thus, we may conclude that the gross pattern is the following: in the case of a falling-sonority cluster the first consonant is a coda, the second an onset; in the case of a rising-sonority cluster, both consonants are in an onset.

(8) illustrates this with an **-ntr-** cluster as in *central.*

(8) *Syllabifying* central




The syllabification of *chimney* depends on whether our version of the sonority sequencing principle allows sonority plateaus within a syllable (that is, whether segments of equal sonority can occur next to each other in the same syllable), or not. In the latter case, that is, if consonants of equal sonority my not occur in the same syllable, the only possibility is *chim.ney,* since stuffing both nasals on either one side of the syllable boundary (*chi.mney* or *chimn.ey*) results in the unwanted sonority plateau.

The two principles, sonority sequencing and onset maximization, do not always provide the right syllabification. Consider, for example, a string like **ætləs** (*atlas*). Of the two divisions allowed by sonority sequencing (*a.tlas* and *at.las*), onset maximization will dictate the first one. Yet there is reason to believe that this is not right (see §4.4.3), the correct syllabification ought to be *at.las,* despite onset maximization. Apparently, we need a further principle to determine the correct syllabification.

### 4.3.3 Word edges

Many phonologists say that the onset-hood of a consonant cluster can be tested at the beginning of words. That is, if a given cluster occurs word initially (which is an empirically easily decidable question), then it also occurs syllable initially (which, as we have seen, is a theoretical issue). To take the example at hand: the syllabification of *atlas* cannot be *a.tlas,* because words in English do not begin with the cluster **tl**.

If we extend the argument in the other direction, and claim that word-initial clusters are all potential syllable-initial clusters, we will end up claiming that a string like **dɪstəns** (*distance*) is syllabified as **dɪ.stəns**, since **st** is possible word initially, therefore syllable initially, so onset maximization lobbies for this division. Note, however, that sonority sequencing is violated by a syllable beginning with a fricative (whose sonority index is 2) followed by a less sonorous plosive (with a sonority index of 0).

Further extending the word-edge test to the end of words, one is forced to discard onset maximization. It is a well-known fact of English that plain lax vowels (stressed **ɪ ʊ e ʌ æ ɒ**) do not occur at the end of words. Consequently, some analyst might be tempted to claim, they do not occur at the end of syllables either. Accordingly, a string like **lemən** (*lemon*) cannot be syllabified as **le.mən**, since this would create syllable-final **e**, which should be impossible, since word-final **e** is impossible, it must be syllabified as **lem.ən**. To achieve this syllabification overriding the output of onset maximization, a CODA CAPTURE rule is needed, which resyllabifies an onset consonant into coda position. Only stressed syllables are strong enough to capture the onset of the following syllable, and to force it into their own coda, so the noun *récord* **ˈrekɔːd** is resyllabified to *rec.ord,* but the verb *recórd* **rɪˈkɔːd** is not, it remains *re.cord.*

---

The same consideration underlies English hyphenation conventions, cf. *lem-on,* with short **e** in the first syllable vs. *de-mon,* having a tense vowel **diːmən**, or the noun *rec-ord,* again with short **e** in the first syllable, as opposed to the verb *re-cord,* with reduced **ə** in the first syllable.

---

Although it offers a trivial explanation of the syllabification of *atlas,* the idea that word boundaries and syllable boundaries should coincide is far from obvious. On the practical side, it leads us into several difficult situations, two of which are presented below.

If it is impossible for a syllable to end in a sound that words cannot end in, then we cannot syllabify words like **pærɪʃ** (*parish*), **feri** (*ferry*), **sɒroʊ** (*sorrow*), or **nʌrɪʃ** (*nourish*), since the syllable boundary before the **r** in these words is inhibited by the fact that words cannot end in a short (that is plain lax) vowel, while **r** is also impossible word finally, so the boundary cannot be after it either. Another difficulty with the variable syllabification of intervocalic consonants is with l-darkening and r-dropping. Both of these phenomena are very neatly formulable by syllabic constituency: both processes occur in the syllable coda, but not in the onset (see §4.4.1 and §4.4.2 below). Yet neither process is sensitive to the tenseness or laxness of the preceding vowel, which is unexpected if the syllabic affiliation of a consonant depends on the tense vs. lax status of this vowel.

In addition to these empirical counterarguments, it is not even a theoretical necessity that syllables begin and end exactly where words do. Another suprasegmental unit, the rhythmic foot ignores word boundaries, and easily incorporates segmental material from

two neighbouring morphemes, or words. Consider, for example, the sentence *Amanda should ignore the children,* its morphological and metrical structure shown in (9).

(9) A|mánda # should # ig|nóre # the |# chíldren

---

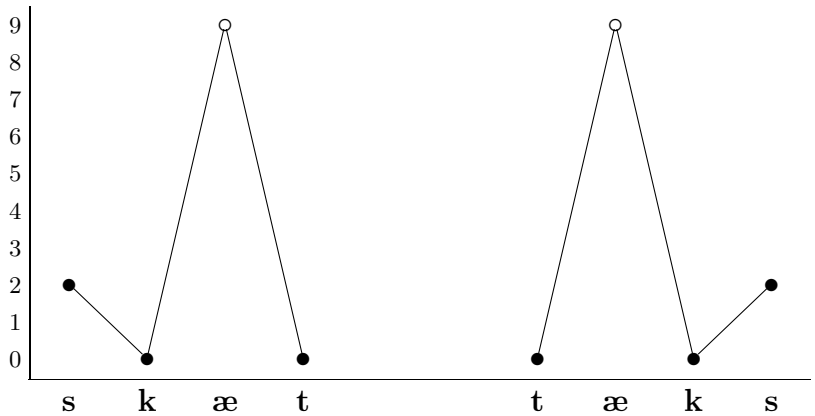
A foot contains a stressed syllable and the following unstressed syllables. If there are two stressed syllables next to each other, the first foot will only contain a single syllable. If two stressed syllables are separated by many unstressed syllables, the first foot will be very long.

---

In this sentence, foot boundaries (|) and word boundaries (#) do not coincide, except for the last foot/word. This is because when determining the foot boundaries word boundaries are not taken into consideration. Therefore the two coincide only when two consecutive words or the last word of a sentence (*chíldren*) begin with a stressed syllable. We also see that the sentence begins with a degenerate foot, one which does not begin with a stressed syllable (*A*-), thus is an incomplete foot, consisting only of an unstressed syllable, which is otherwise the ending of a foot. In fact, there is no reason to assume that foot and word boundaries should coincide: feet are defined on purely phonological (rhythmic) grounds, while words are units of meaning or syntax.

Given that the syllable is also a purely phonological category, one may easily hypothesize an analogous situation where it is not an absolute necessity that syllable boundaries coincide with word boundaries. In this case, word-initial (and -final) consonant clusters which seem to violate sonority sequencing are analysable as the end or the beginning of a "degenerate" syllable. (10) shows two such "offending" words, **skæt** (*scat*) and **tæks** (*tax*).

(10) *Syllables violating sonority sequencing*




Although these words behave as monosyllabic, they both contain two sonority peaks. This contradiction is solved by supposing that the **s** in **skæt** is the end (the coda), and in **tæks** it is the beginning (the onset) of a "degenerate" syllable (see §4.5.1.3 for more details).[5]

[5] There still remain a number of unsolved issues in this analysis. For exmaple, we have no explanation for why only **s** occurs in such "degenerate" syllables in English.

## 4.4 Some phonological phenomena

So far we have seen one reason for assuming syllables: some pairs of neighbouring sounds are more closely related than other pairs. This relationship can be well expressed by assigning interdependent sounds to the same syllabic constituent, while sounds which are not related to each other will not be part of the same constituent. We now look at some well-known phonological phenomena of English to see if they can be expressed in terms of syllabic constituents, and whether this formulation is simpler than one in terms of neighbouring segments. If so, we gain further arguments for the notion of the syllable.

### 4.4.1 L-darkening within the word

At first glance, the syllable-less formulation of the l-darkening rule looks very simple: **l** is clear before vowels, and dark (i.e., velarized) elsewhere, that is, before consonants and word finally. The relevant rules are given in (11). These are linear rules, that is, they refer to the surrounding segments, the alternation is conditioned by what precedes or follows the segment.

(11) *L-darkening: the linear formulation*

a. $\mathbf{l} \rightarrow \mathbf{l} \;/\; \_\; \mathrm{V}$

b. $\mathbf{l} \rightarrow \mathbf{ɫ} \;/\; \_\; \left\{ \begin{matrix} \mathrm{C} \\ \# \end{matrix} \right\}$

Thus the **l** in *look, play, pillow, calling* is clear, while that in *kill, belt, silky* is dark.[6]

A more thorough examination of the l-darkening rule, however, reveals that (11) is oversimplified. On the one hand, we do find clear **l** before a consonant (notably **j**): e.g., in **vælju:** (*value*); on the other, dark **l** may precede a vowel: e.g., in **trævɫɪŋ** (*travelling*). In the latter case, the **l** is dark because it is syllabic. The word is syllabified as **træ.vl.ɪŋ**, the middle syllable has no vowel, its nucleus is occupied by a consonant, the **l**. It is called syllabic **l**. Syllabic **l** is dark, irrespective of what follows it, consonant or vowel.

This small detail of the l-darkening rule hints at an interesting way of expressing the regularity: perhaps it is not the following segment that counts, but the syllabic affiliation of the **l**. Since in the case of syllabic **l** reference must be made to the syllabic constituent holding the segment (the nucleus), it may be more economical to formulate the whole rule in this way. Incidentally, the status of the **l** before **j** also becomes clear in the syllabic approach. (12) gives the details.

(12) *L-darkening: the syllabic formulation*

a. **l** is clear in the onset

b. **l** is dark in the rhyme

[6] We deliberately ignore here the alternation of clear and dark **l** found in word final position. To deal with this case we need a theory of syllabification across words, an issue taken up only in chapter 8.

An onset **l** is followed by a vowel in all cases except one, when it is followed by **j**. In a branching onset, **l** usually occupies the second position (**pl**, **bl**, **fl**, **kl**, **gl**), but there is one cluster in which it is the first: **lj** (e.g., **ljuːd** *lewd* or **vælju:** (*value*). Thus, an **l** that precedes a **j** is the only preconsonantal **l** that is in an onset. Syllabic **l** occupies the nucleus, which is in the rhyme. Coda **l**, which is also in the rhyme, is either followed by a consonant (the onset of the next syllable), or is word final. (As already mentioned, here we do not treat word-final **l** followed by a vowel-initial word. We will deal with this case in chapter 8.)

The fact that **l** behaves similarly in both the nucleus and the coda is one reason to claim that these two syllabic constituents form a group, called the rhyme.

### 4.4.2 R phenomena

In rhotic accents of English (like General American), **r** is found both before vowels and before consonants, while in nonrhotic accents (like Standard Southern British English) **r** occurs only before vowels. The distribution reminds us of that of clear and dark **l**, therefore the syllabic formulation may also be the same, given in (13).

(13) *Distribution of* **r** *(attempt 1)*

In nonrhotic accents, **r** occurs only in the onset.

The statement in (13) suggests that there is no syllabic **r**, that is, no **r** in the nucleus, in nonrhotic accents. This is not the case, however, we do find syllabic **r** in SSBE, too, as the words in (14a) show.

(14) *Syllabic* **r** *in SSBE*

a. **ˈkæmr̩ə** (*camera*),,**sɪgr̩ˈet** (*cigarette*)
b. ***dezr̩t** (**dezət** *desert*) or ***ɒfr̩** (**ɒfə** *offer*)
c. **bærn̩** (*barren, baron*), **vetr̩n̩** (*veteran*)

Crucially, in SSBE syllabic **r** does not occur before a consonant or word finally, forms like those in (14b) are impossible. In fact, not just syllabic but any **r** occurs not only before vowels, but before any syllabic segment, as (14c) shows. (This also likens the distribution of clear **l** and **r**, since **l** is clear before syllabic **r** too: e.g., **selr̩i** (*celery*).) Thus it is not (only) the syllabic affiliation of the **r** that decides whether it is pronounced or not, but the syllabic affiliation of the *following* segment. An **r**, whether in the onset or in the nucleus, is pronounced if immediately followed by a segment that is in a nucleus. This distribution is different from that of clear and dark **l** (recall, syllabic **l** is dark, irrespective of what follows), and hints at a mixed type of conditioning: it is not the host of the **r** that matters, but the host of the following segment. We will not speculate any further here on possible solutions of this anomaly. The distribution of **r** can thus be given as (15).

(15) *Distribution of* **r** *(attempt 2)*

In nonrhotic accents, **r** occurs only before a segment in a nucleus.

In most accents of English an **r**, whether pronounced or just etymological/orthographical, influences the preceding vowel. Put alternatively, a following **r** influences the distribution of vowels in English. This is not the case in Hungarian, for example, where any vowel can occur before an **r** (e.g., *mar, már, mer, mér,* etc.). Of some tense vowels (the narrow diphthongs, namely, **iː**, **eɪ**, **oʊ**, and **uː**), only their so-called broken versions occur before a TAUTOMORPHEMIC **r** (that is, an **r** within the same morpheme). Thus **iːr** is only possible if the vowel and the **r** are HETEROMORPHEMIC (in separate morphemes, e.g., **siːroʊm** *see Rome*), within a morpheme only **ɪər** is possible (e.g., *serum* **sɪərəm**, ***siːrəm**). The other tense vowels (the wide diphthongs, namely, **aɪ**, **ɔɪ**, and **aʊ**) exhibit their broken version in pre-**r** position only if the **r** is TAUTOSYLLABIC (member of the same syllable). That is, coda **r** influences these vowels, onset **r** does not, as the examples *spire* **spaɪə** vs. *spiral* **spaɪrəl**[7] show. Lax vowels show a pattern similar to that of the wide diphthongs, thus broad vowels occur before coda **r**, plain ones before onset **r**: *err* **ɜː** vs. *error* **erə**. This was referred to as the *carrot*-rule in your earlier studies.

While these distributions can be expressed neatly in using the syllabic terminology, the distribution of **r** itself, as we have seen, does not necessarily invite the syllabic formulation, at least in the case of syllabic **r**.

### 4.4.3 Aspiration

(16a) contains the environments where voiceless plosives (here exemplified by **p**) are aspirated, (16b) contains cases where aspiration is missing. (For uniformity's sake, aspiration is marked by the superscript **h** even when a sonorant follows, where the transcription **pl̥** is also used in other publications.)

(16) *Aspirated and unaspirated* **p**

| | | | | |
|---|---|---|---|---|
| a. | pain | **pʰeɪn** | b. Spain | **speɪn** |
| | plain | **pʰleɪn** | splay | **spleɪ** |
| | apace | **əˈpʰeɪs** | leper | **ˈlepə** |
| | complain | **kʰəmˈpʰleɪn** | explain | **ɪkˈspleɪn** |
| | pagoda | **pʰəˈgoʊdə** | specific | **spəˈsɪfɪk** |
| | placenta | **pʰləˈsentə** | lap | **læp** |

We see that voiceless plosives are pronounced as **pʰ**, **tʰ**, **kʰ** when followed by an optional approximant (**l**, **r**, **j**, or **w**) and a stressed vowel, unless preceded by **s**. If the plosive is word initial, the following vowel may be unstressed.

This rather complicated description seems to call for a reformulation along syllabic lines. Phonologists do not hesitate to provide the alternative shape of the rule, running as in (17).

(17) *The aspiration rule: syllabic formulation*

Voiceless plosives are aspirated at the beginning of a word or a stressed syllable.

[7] It must be noted that old-fashioned speakers might have the pronunciation **spaɪərəl** for this word, that is, for them breaking is possible both before a tautosyllabic and a heterosyllabic **r**.

This formulation of the rule explains the optional approximant on the one hand, and the aspiration-inhibiting effect of **s** on the other. A syllable-initial voiceless stop is followed either by a vowel, or by an approximant which in turn is followed by a vowel. Furthermore, if **s**C clusters are thought to be tautosyllabic, then a voiceless plosive preceded by **s** is not at the beginning of a syllable.

But in §4.3.3, we argued that **s**C clusters were in fact not tautosyllabic, that is, the **s** of a word-initial **s**C cluster is a "degenerate" syllable. The elegance of the syllabic formulation of the aspiration rule (in (17)) appears to undermine this view. However, explaining the absence of aspiration by the tautosyllabicity of the pre-plosive **s** is flawed. It is not only **s** that inhibits the aspiration of the following voiceless plosive, but any other fricative. The appearances mislead us only because fricative+voiceless plosive clusters within a morpheme are overwhelmingly **s**C clusters. The only other instance of this cluster is **ft**, but then **ft** does not occur word initially and is very rarely followed by a stressed vowel. But when it is, the plosive may be unaspirated: e.g., in **fɪfˈtiːn** *fifteen.* It is unlikely that any analyst would be ready to syllabify this word as **fɪ.ftiːn**, except to explain the possible absence of aspiration.

Recall our discussion of the syllabification of the **-tl-** cluster in §4.3.3. Although onset maximization would prefer this cluster to be tautosyllabic (*a.tlas*), the fact that it does not occur word initially casts doubt on this. Aspiration in fact also supports the HETEROSYLLABIC analysis (namely, that the two segments are in separate syllables, *at.las*): in the rare cases of **-tl**V́- strings (that is, **-tl-** followed by a stressed vowel, e.g., *Atlántic*), when the plosive is expected to be aspirated if tautosyllabic with the vowel, we do not find aspiration. The conclusion is that here the syllable boundary falls between the plosive and the liquid: *At.lán.tic.*

Accordingly, we may establish that for a voiceless plosive to be aspirated being at the beginning of a stressed or word-initial syllable is a necessary, but not sufficient condition. In addition, it must not be preceded by a fricative, even though such a fricative is necessarily heterosyllabic, even in *Spáin, específic.*

### 4.4.4 Flapping

Another phenomenon involving plosives, though only coronal plosives, but then both voiceless and voiced ones (**t** and **d**), is flapping. Flapping is untypical of Southern British English, but occurs commonly in Irish and American accents. It is a neutralizing rule: the contrast between the two plosives is lost, since they both get pronounced as a flap, **ɾ**.

(18a) collects words in which flapping occurs and (18b) shows others in which it does not. The data reflect the pronunciation of a flapping dialect, General American.[8]

[8] These data are somewhat simplified, for example, they do not include cases to demonstrate the Withgott effect: while flapping is possible for the **t** in *càpi*[**ɾ**]*alístic,* it is not in *mìli*[**t**]*arístic.*

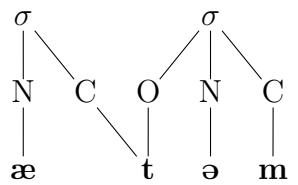
(18) *Flapping and its absence in GA*

| | | | | | |
|---|---|---|---|---|---|
| a. | atom | **ˈæɾəm** | b. | Tom | **tɒm** |
| | Adam | **ˈæɾəm** | | atomic | **əˈtɑmɪk** |
| | precipitate$_n$ | **prəˈsɪpəɾət** | | precipitate$_v$ | **prəˈsɪpətɛɪt** |
| | later | **ˈleɪɾɚ** | | sultan | **ˈsʌltən** |
| | vital | **ˈvaɪɾl̩** | | golden | **ˈgoʊldən** |
| | Clinton | **ˈklĩɾən** | | Aston | **ˈæstən** |
| | abandon | **əˈbæ̃ɾən** | | often | **ˈɔftən** |
| | party | **ˈpɑɾi** | | chapter | **ˈʧæptɚ** |
| | pardon | **ˈpɑɾən** | | abdomen | **ˈæbdəmən** |

The first two words of (18a) exemplify neutralization resulting from flapping. What is true of all the words in the flapping group is that the plosive is intervocalic with an unstressed vowel following. To achieve this generalizations we must accept the common assumption that syllabic consonants behave like a reduced vowel. This makes sense since a syllabic consonant (e.g., **vaɪtl̩**) can always be replaced by schwa and the nonsyllabic counterpart of the consonant (**vaɪtəl**). The postnasal flaps may also be seen as intervocalic, preceded by a nasalized vowel, as shown by the nonphonemic transcriptions. On the other hand, the plosive in the words where flapping is impossible is either not intervocalic, or followed by a stressed vowel, containing any degree of stress, from primary (as in *atómic*), to tertiary (as in the verb *precípitāte*).[9]

The environment where flapping occurs is V__V$^0$ (where V$^0$ stands for a zero stressed vowel). This is rather peculiar in that both neighbours of the consonant undergoing the change are specified. The plosive to undergo flapping must be both preceded *and* followed by a vowel (or syllabic consonant, which behaves as a reduced vowel). In syllabic terms, the flapping site is a nonbranching onset position, which is preceded by a codaless syllable. The complexity of this formulation prompted some analysts to propose a special status to such consonants. Recall that stressed syllables are supposed to capture the onset of the syllable following them (cf. §4.3.3). Taking *atom* for the sake of illustration, this would mean that the **t** is flapped because it is a coda in *at.om.* This solution is flawed, however, because coda **t**'s and **d**'s not followed by a vowel are not flapped. According to this view, it is AMBISYLLABIC coronal plosives that are flapped. The representation of *atom* is shown in (19).

(19) *Ambisyllabic* **t** *in* atom

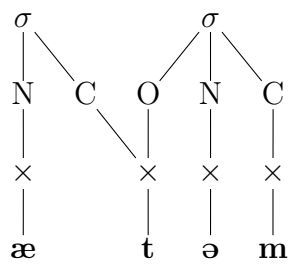



[9] The possibility of flapping in words like *Otto* **ˈɑɾoʊ** or *Toronto* **təˈrɑ̃ɾoʊ** hint at the suspicion that these word final **oʊ**'s are not stressed: it is an oversimplification to say that an unreduced vowel is never unstressed.

The difficulties with this solution are numerous. For one thing, flapping does not only occur after a stressed syllable, but also after an unstressed one. It was only stressed syllables that were supposed to be capable of coda capture. More importantly, coronal plosives ought to be ambisyllabic after tense vowels (since flapping occurs here, just like after lax vowels, cf. *later*), but coda capture in this context would create a structure claimed to be impossible (see (30c)). Furthermore, it has to be stipulated why preconsonantal **t** and **d** do not become ambisyllabic in words like *petrol.* Without this stipulation such a plosive is also expected to undergo flapping, counter to facts: the form *ˈ**peɾrəl** is impossible.

In addition, the representation in (19) suggests that we are dealing with a geminate (long) **t** here. This false appearance can be dispelled by introducing a further level, the timing tier (also called skeleton, see chapter 3), which was ignored so far to avoid overcrowding the representations. With it, (19) becomes (20), in which no geminate **t** is implied.

(20) *Ambisyllabic* **t** *in* atom *with the skeleton*




The representation in (20) is still strange: we do not find such two-mothered nodes elsewhere in either phonological or syntactic trees. Therefore it seems justified to discard the notion of ambisyllabicity: any segment belongs to only one syllable, never two.

### 4.4.5 Yod-dropping

The distribution of yod (**j**) is not only more easily formulated by making reference to syllabic constituents, but also provides arguments about syllabic constituency. For our current purposes an examination of stressed syllables with yod is sufficient, therefore we will not be concerned with the somewhat different distribution of yod in unstressed syllables.

After consonants morpheme internally, the distribution of yod is rather constrained in English: it can only occur if followed by **uː** (or its pre-R version, **ʊə**, or its monophthongized variant, **ɔː**). Accordingly, sequences like C**je**, or C**jɒ** do not occur. This suggests that the yod and the following vowel share a syllabic constituent (most probably the nucleus), since, recall, phonotactic constraints hold within syllabic constituents (see §4.2). Surprisingly, a postconsonantal yod is also in a phonotactic relationship with the preceding consonant. English accents vary to some extent with respect to the distribution of postconsonantal **j**, we examine a conservative version of Standard Southern British English (also known as Received Pronunciation). (21) collects some of the relevant data.

(21) *The distribution of postconsonantal yod in RP*

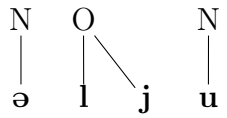
| | | | | | |
|---|---|---|---|---|---|
| a. | compute | **kəmˈpjuːt** | b. | enthuse | **ɪnˈθjuːz** |
| | rebuke | **rɪˈbjuːk** | | consume | **kənˈsjuːm** |
| | confuse | **kənˈfjuːz** | | exude | **ɪgˈzjuːd** |
| | revue | **rɪˈvjuː** | | minute | **maɪˈnjuːt** |
| | amuse | **əˈmjuːz** | | volute | **vəˈljuːt** |
| | | | | obtuse | **əbˈtjuːs** |
| c. | agglutinate | **əˈgluːtɪneɪt** | | deduce | **dɪˈdjuːs** |
| | peruse | **pəˈruːz** | | | |
| | assure | **əˈʃʊə** | d. | acute | **əˈkjuːt** |
| | eschew | **ɪsˈʧuː** | | ambiguity | **ˌæmbɪˈgjuːɪti** |
| | adjudicate | **əˈʤuːdɪkeɪt** | | exhume | **eksˈhjuːm** |

The words in (21a) contain a labial consonant before the yod, those in (21b) a dental or alveolar consonant, and those in (21d) a velar or glottal one. In all these classes, the yod remains intact. It is only in the type in (21c) that the yod is lost (or, put alternatively, cannot occur).

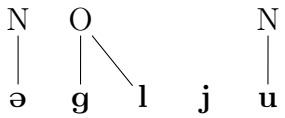
Apart from *agglutinate,* all the words in the yodless group contain a postalveolar consonant before the **uː**. The accepted syllabic explanation for the absence of the yod in this position is that postalveolar consonants cannot form a branching onset with yod in second position. This hypothesis is supported by at least two pieces of evidence: on the one hand, postalveolar consonants *can* precede yod, provided the two are not in the same onset. Unfortunately, this only occurs if the two are in separate morphemes, e.g., in *fresh urine* (**-ʃj-**), *church use* (**-ʧj-**). It is a stronger argument that branching onsets *generally* inhibit HOMORGANIC clusters: after labials the labial glide does not occur (***pw**, ***bw**, ***fw**, ***mw**), after dentals and alveolars there is no **l** (***tl**, ***dl**, ***θl**), **r** is impossible after postalveolars (***ʧr**, ***ʒr**).[10] If so, we expect the glide yod not to be possible exactly after postalveolars.

The case of yod following **l** is more complicated. Yod may follow **l** only if the **l** is "lone", that is, it is not preceded by a consonant. This is a strange rule: apparently the yod can "see through" the preceding **l** to check the properties of the sound before it. If, however, we suppose that the onset of the syllable can host a maximum of two consonants, the phenomenon falls into place: a consonant together with the following **l** occupy both available slots, not leaving any place for the yod, as is shown in (22b). On the other hand, a single **l** occupies only the first slot, the second being vacant for receiving the yod, as is shown in (22a).

(22) *The impossibility of yod after consonant+***l**

a.


**əljuːd** *allude*

b.


**əgluːtɪneɪt** *agglutinate*

[10] Note that the fact that there are English words beginning with **ʃr** does not warrant that the cluster in them is a branching onset.

Intriguingly, a yod appears after an **sl** cluster in the accent under examination: *sleuth* is **sljuːθ**. That is, the **sl** cluster behaves like a single **l**. If we are to maintain the explanation of the presence and absence of yod in the V**l**__ and #**l**__ environments, as opposed to the C**l** environment, then we must conclude that the **sl** cluster's syllabic affiliation is similar to that of single onset **l**'s and not to that of branching onset C**l**'s. This is a strong piece of evidence for the claim made in §4.3.3, namely, that syllable and word boundaries do not necessarily coincide. In a word like *sleuth* the **l** belongs to an onset, but the **s** before it does not, at least not to the same onset as the **l**.

The same situation prevails with any consonant cluster of the shape **s**C. Thus if yod may appear after a given consonant $C_x$ and **s**$C_x$ is also a possible cluster, then yod may appear also after the **s**$C_x$ cluster. (23) gives an example for each cluster in question. (The $C_x$**j** clusters not appearing here do not have an **s**$C_x$ counterpart, hence obviously also lack their **s**$C_x$**j** pair. We take the nonexistence of **snj-** to be an accidental gap.)

(23) C**j** *and* **s**C**j** *clusters in English*

| $C_x$**j** | | **s**$C_x$**j** | |
|---|---|---|---|
| pure | **pj-** | spurious | **spj-** |
| mew | **mj-** | smew | **smj-** |
| tube | **tj-** | student | **stj-** |
| new | **nj-** | — | |
| lewd | **lj-** | slew | **slj-** |
| cute | **kj-** | skew | **skj-** |

As we have seen, the distribution of postconsonantal yod provides a significant argument for claiming that word-initial clusters do not automatically qualify as syllable-initial clusters, that is, as branching onsets. Furthermore, we see that **s** is singled out as the only consonant that may occur in the "degenerate" word-initial syllable.

It is hardly accidental that **s**C clusters are not treated as branching onsets in other languages either. Latin, Rumanian, and many Italian dialects allow words to begin with an **s**C cluster (e.g., Latin *via strata* 'paved road', Rumanian *stradă*, Italian *strada* — actually English *street* goes back to the same word.) Other Romance languages, however, did not allow for such a cluster to occur at the beginning of a word, these therefore inserted a vowel at the beginning (e.g., Spanish *estrada*, Old French *estrée*). It is only word-initial **s**C clusters that were thus "amended", other clusters are acceptable in Spanish and French (e.g., Latin *clavis* 'key', Spanish *clave*, French *clé*; Latin *tres* 'three', Spanish *tres*, French *trois* **trwɑ**, etc.). Hungarian, which for a long period did not have any word-initial consonant cluster, also treated the two types differently. The usual branching onsets were nativized by inserting a vowel between the two consonants (e.g., Slavic *brat,* Hungarian *barát* 'friend'; Latin *claustrum,* Hungarian *kolostor* 'cloister'). The fate of **s**C clusters was different: Latin *schola,* Hungarian *oskola* or *iskola* 'school'; Latin *Stephanus,* Hungarian *István,* etc. Farsi (Persian) follows the same strategy synchronically: **pelastik** 'plastic', **felæʃ** 'flash', but **ʔeski** 'ski', **ʔesnæk** 'snack'.

## 4.5 Types of syllable

Any given language has a set of segments, an inventory, selected from the larger pool of human speech sounds. Some languages have voiced obstruents, others do not. Some have

front rounded vowels, others have affricates, yet others have both. We can also detect certain patterns in this selection. For example, a language has voiced obstruents only if it also has voiceless ones. Or a language has front rounded vowels only if it also has front unrounded vowels. Such observations enable us to establish IMPLICATIONAL HIERARCHIES: the presence of voiced obstruents implies the presence of voiceless obstruents in a given language, and the presence of front rounded vowels imply the presence of front unrounded vowels, but not vice versa.

Similarly, the syllable inventories of languages vary: English and Hungarian have long vowels, French and Spanish do not. (Note that this is a syllabic difference if long vowels are represented as a single segment belonging to both slots of a branching nucleus.) All these four languages have codas, Hawaiian does not. Syllable types can also be arranged into implicational hierarchies. If a language has long vowels, it also has short vowels, that is, long vowels imply short vowels. The reverse is not true: a language with short vowels may or may not have long vowels, there is no implication here. We can use the following notation to communicate this fact.

(24) *Implications of short and long vowels*

a. $\mathrm{VV} \supset \mathrm{V}$ b. $\mathrm{V} \not\supset \mathrm{VV}$

---

It must be admitted that vowel length is a relative property, what languages may lack is not long vowels, but the contrast between short and long vowels. The length of the vowels in a no-contrast system is immaterial: the vowels of such a language are systematically analysed as short. Thus the implication becomes trivial.

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In §4.5.3, we are going to see further implicational relationships of syllable types. But before that we have to get acquainted with traditional names for some syllable types: OPEN, CLOSED, LIGHT, and HEAVY syllables.

### 4.5.1 Syllable weight

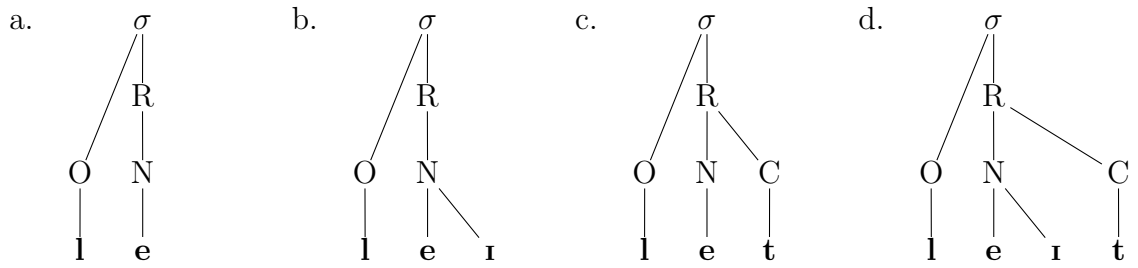
Syllables may end in a consonant, or in a vowel. A syllable that ends in a consonant is a CLOSED syllable (viz., closed by that consonant, e.g., the first syllable of *panda* **pændə** is closed by the coda **n**); one which does not is OPEN (e.g., the second syllable of *panda,* or the first syllable of *paddock* **pædək** is open).

One may be tempted to identify syllable weight with graphic positions. There is indeed some similarity between the notions of FREE graphic position and open syllables on the one hand, and COVERED graphic position and closed syllables on the other. For example, the word *cinema* contains three open syllables, and its three vowels are each in free graphic position, while *map* is a closed syllable, and its vowel is in covered graphic position. But equating the two pairs is unwarranted, as the above example clearly shows: the first syllable of **pæ.dək** is open, but the first vowel of *paddock* is in covered position. And vice versa: the vowel of *make* is in free position, but **meɪk** is a closed syllable — see §4.5.1.2 though. It is also difficult not to notice that stop+liquid clusters, which do not "cover" the vowel letter preceding them (e.g., *maple*), are reminiscent of branching onsets, the type of consonant cluster which does not "close" the preceding syllable. The parallel, however, is again incomplete: *tl* and *dl* are stop+liquid clusters, but not branching onsets.

In many respects, however, it is not open and closed syllables that pattern together, rather, open syllables with a short vowel are opposed to open syllables with a long vowel *and* to closed syllables. An open syllable with a short vowel is called a LIGHT syllable, a syllable which is either closed or has a long vowel (diphthongs in English all count as long) is called a HEAVY syllable. Thus, the above *cinema* **sɪ.nə.mə** is three light syllables, *shampoo* **ʃæm.puː** is two heavy syllables. Sometimes a third category is also identified: a syllable that contains both a long vowel and a coda consonant closing it, as the first syllable of *mountain* **maʊn.tən**, or a short vowel but two coda consonants, as in *lamp,* is called SUPERHEAVY. In most cases, a heavy and a superheavy syllable are equivalent.

In English, as in many other languages, stress assignment is sensitive to the heavy–light distinction (cf. chapter 6). The relevant kinds of syllable are illustrated in (25). The syllables in (25a–b) are open, those in (25c–d) are closed. The syllable in (25a) is light, those in (25b–d) are heavy, that in (25d) is also called superheavy.

(25) *Branching in light, heavy, and superheavy syllables*



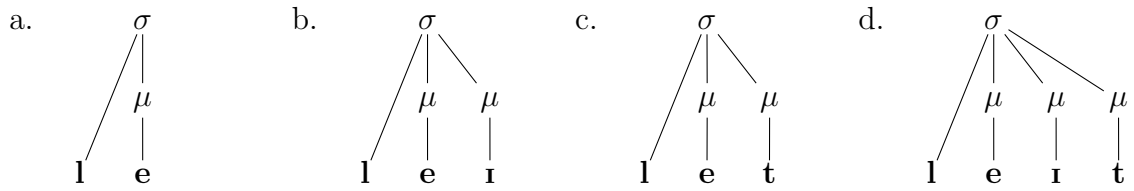

We can see that the relevant notion for syllable heaviness is *branching* in or below the rhyme. While in a light syllable neither the nucleus nor the rhyme branches, (25a), in a heavy syllable either the nucleus, (25b), or the rhyme branches, (25c). If both branch, as in (25d), we have a superheavy syllable.

Interestingly, the onset has no bearing on the weight of the syllable. Only the rhyme counts: an onsetless closed syllable (like **eg** *egg*) is heavy, just like one with a single onset consonant (like **peg** *peg*), or a cluster, that is, a branching onset (like **greg** *Greg*).

#### 4.5.1.1 Moras

Syllable weight is measured in MORAS. Each segment in a nucleus is worth one mora, and in some languages (English among them) coda consonants are also moraic. Some phonologists would therefore represent the syllable types in (25) without syllabic constituents, with only moras (usually symbolized by the lowercase Greek mu, $\mu$).

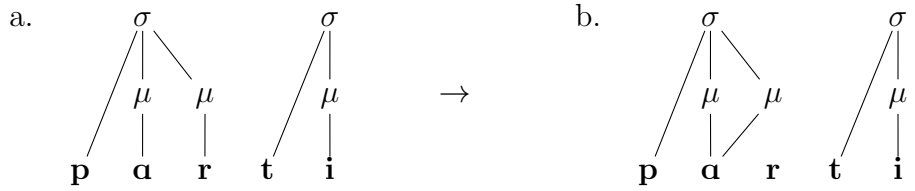
(26) *Moras in light, heavy, and superheavy syllables*




The weight of a light syllable is one mora, (26a), that of a heavy is two, (26b–c). Superheavy syllables contain three moras, (26d). Note that this definition of syllable heaviness avoids the awkward formulation of the previous approach: "branching somewhere in the rhyme."

A way of justifying the phonological existence of moras is the phenomenon of COMPENSATORY LENGTHENING. In this change, which is frequently found in the history of various languages, the loss of a segment is made up for by the lengthening of another, neighbouring segment. A case in point is the lengthening of the broad vowels in nonrhotic accents of English. Before coda **r**'s were lost, the first syllable of *party* was closed, hence heavy (**par.ti**). The weight of this syllable was retained even after the **r** was lost and it became open. The change is illustrated in (27).

(27) *Compensatory lengthening in* party




The only difference between the two representations is the relinking of the second mora of the first syllable: in (27a) it is linked to the coda **r**; in (27b), the nonrhotic form, it is linked to the vowel, just like the first mora. The **r** is now not linked to any suprasegmental node ($\sigma$ and $\mu$ in this theory), and as a result it remains unpronounced. This simple change encodes a complex phenomenon: the loss of the **r** and the subsequent lengthening of the preceding vowel. Languages provide many examples of compensatory lengthening: Old English **nixt** turns into Middle English **niːt** (Modern English **naɪt** *night*), Hungarian **ɲolts** (*nyolc* 'eight') turns into **ɲoːts**, etc. In all these changes, we can see that syllable structure, the number of moras or, alternatively, the branching structure in the rhyme is stable, it is only the segmental material linked to them that changes. This justifies the hypothesis that the two exist independently of each other.

Quantitative poetry also supports the claim made by moraic theory, namely, that two light syllables are equivalent to a heavy one. For example, in a hexameter, a line made up of six dactylic feet (heavy–light–light), any foot, except for the second from the end, may be realized by a spondee (heavy–heavy). Since the weight of both a dactyl and a spondee is four moras, their interchangeability is all but surprising. Note, however, that the first heavy of the dactyl cannot be replaced by two light syllables: light–light–heavy or light–light–light–light will not do for a foot in a hexameter.

Stressability of a syllable is often bound to syllable weight, as the English stress rule mentioned in §4.5.1.2 shows. The same idea underlies the notion of coda capture, mentioned in §4.3.3: by capturing the onset of the following syllable, a light stressed syllable becomes heavy, which then gives justification for the fact that it is stressed.

Other languages also subscribe to the if-stressed-then-heavy inference. In Italian, for example, if an open syllable receives stress, its vowel will lengthen: the stressed vowel of *fátto* **fatːo** 'fact' remains short, but that of *fáto* **faːto** 'fate' becomes long. Since vowels may not lengthen word finally in Italian, stressed syllables here will get closed by the initial consonant of the following word: *città nera* **ʧitˈtanˈneːra** 'black city'. There is no **n** at the end of *città,* and the **n** is not geminate in **neːra** in isolation: it is because of the word-final stress that the last syllable must become bimoraic.

A similar tendency is observable even in Hungarian: word-final high vowels are long when stressed (e.g., *sí* 'ski', *bú* 'sorrow', *tű* 'needle'), but short when unstressed (e.g., *nasi* 'candy', *bábu* 'puppet', *tet*[**y**] 'louse'). It must be admitted that Hungarian also has a minimal word constraint to the effect that a single light syllable cannot constitute a content word. This constraint in itself is enough to force the lengthening of the final vowel in monosyllabic content words, stress does not have to be invoked.

#### 4.5.1.2 Extrametrical consonants

Examining the place of stress in English verbs (also see chapter 6), we find a curious pattern. (28) contains the relevant data.

(28) *Verbal stress patterns*

| | penultimate stress | | | final stress | |
|---|---|---|---|---|---|
| a. | consíder | **kənˈsɪdə** | b. | lamént | **ləˈment** |
| | cárry | **ˈkæri** | | salúte | **səˈluːt** |
| c. | cáncel | **ˈkænsəl** | d. | agrée | **əˈgriː** |
| | devélop | **dɪˈveləp** | | defý | **dɪˈfaɪ** |

The data in (28a) show that verbs with a light ult are stressed on their penult. Verbs that end in a closed syllable, that is, contain a heavy ult, also have penultimate stress, as in (28c). So far it is only verbs with a superheavy ult, those in (28b), that are stressed on their ult, thus the division seems to be between light and heavy syllables on one side and syperheavy syllables on the other side. The data in (28d), however, upset this generalization, since here plain heavy (i.e., not superheavy) syllables are stressed. Although there is a difference between the heavy syllables of (28c) and of (28d), the former are heavy by virtue of a closed syllable, the latter of a long vowel, it is not

particularly neat to include such a distinction in a stress rule. In fact, this cannot even be done in a moraic theory, where both *-cel, -lop* and *-gree, -fy* are equally bimoraic.

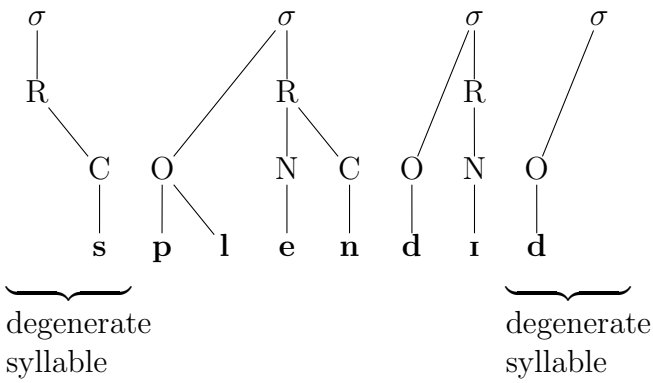
By applying a little trick, the whole picture becomes much simpler. If we disregard the final consonant in each of these words, the choice boils down to the difference between heavy and light syllables. The analysis of the types of verb in (28a) and (28d) remains, because these verbs are vowel final. The verbs in (28b) and, especially, in (28c) change their category. Without the final consonant, the ult of *cancel* is light (**-sə-**), so the verb will follow the pattern of *carry.* The verbs that end in a superheavy syllable (*lament* **-ment**, *salute* **-luːt**) will still contain a heavy syllable without the last consonant (**-men-**, **-luː-**), accordingly they will have stress on their ult. In fact, by ignoring the last consonant, we get rid of most superheavy syllables of English altogether, since these mostly occur word finally. A word-final consonant which does not count in stress calculation is said to be EXTRAMETRICAL.

The notion of extrametricality is, nevertheless, a problematic one. We have seen above (in §4.3.3) that short lax vowels cannot occur word finally. Now if word-final consonants are extrametrical, lax vowels are expected not to occur in the __C# context. Yet they do (e.g., *cat, dog, nut, regret*), so one has to make arbitrary claims about why at the point of stress assignment the consonant is invisible, while at the point when phonotactic constraints are obeyed the consonant becomes visible.

#### 4.5.1.3 Degenerate syllables

An alternative is to assume that a word-final consonant is part of a "degenerate" syllable, similarly to a word-initial **s**. In this way, the consonant is visible throughout the calculations, but does not contribute to the weight of the last syllable. (29) shows the representation of the word *splendid* along these lines.

(29) *The syllables of* splendid



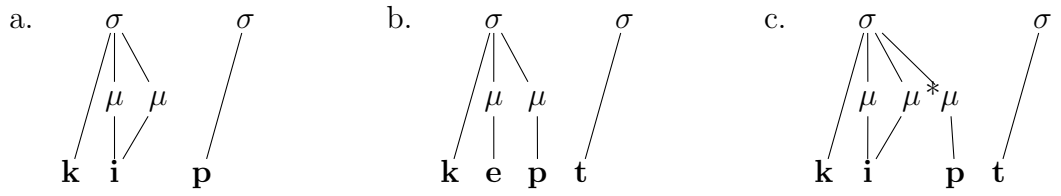

In (29) the degenerate syllables occur at the edges of the word. This is a general, perhaps exclusive pattern. If so, then it is a totally misguided idea to base syllabification (notably the decision of what is a possible onset) on what occurs at the beginning of the word and what does not, as suggested in §4.3.3.

### 4.5.2 Closed syllable shortening

The phenomenon of CLOSED SYLLABLE SHORTENING may also be explained by mora counting. English exhibits some traces of this phenomenon (which indicates that it must have been active at some stage of the history of the language), but there are large portions of the vocabulary that do not show it.

A verb like *keep* **kiːp** is represented as in (30a). Its past form *kept* **kept** is shown in (30b), while a hypothetical past form—occurring in child language—***kiːpt** is in (30c). (Note that other verbs, like, e.g., *seep,* have the "regular" past form **siːpt** (*seeped*). How this is possible will be discussed in chapter 8.)

(30) *Moras in* keep *and its past forms*




The word-final consonant is extrametrical, hence the rhyme of *keep* weighs two moras. With the addition of the past tense suffix the word has two consonants at the end, only the second of which can be extrametrical. If the stem-final **p** were simply pushed into the rhyme without any further changes, the rhyme would end up with three moras, (30c), a SUPERHEAVY rhyme, which is (or rather was, at least when this form developed) impossible. As a result, the nucleus has to shorten, hand over one of its two moras to the now coda **p**. This is closed syllable shortening. The change of the quality of the vowel (**iː** to **e**) is clear evidence that this change is a historical relic in the phonology of English. If this were a phonological process happening now, the resulting short vowel would have to have the same quality as the long one, that is, **i**.

### 4.5.3 Typology

Languages differ with respect to the possible maximum size of their syllables, as well as the types of segment that may occur in different syllabic constituents. In this section, we are going to see some of this variability.

Languages like English and Hungarian have very complex syllable templates. Both languages have short and long vowels, that is, nuclei can branch in them. They also have coda consonants, so rhymes can also branch. Onsets can branch in English, but it is debatable whether the same is true of Hungarian onsets, too. It is certainly the case that words in this language may begin with more than one consonant (e.g., *próba* 'trial', *tréfa* 'joke'), nevertheless that, as we have seen, is no reason to conclude that these clusters are branching onsets. The fact that syllables whose vowel is followed by what looks like a branching onset (a stop+liquid cluster) count as heavy, e.g., *paprika,* is a dactyl (heavy–light–light, so *pap.ri.ka*) support the view that these clusters are heterosyllabic in Hungarian, just like any other consonant cluster.

Languages usually allow any member of their whole inventory of consonants to occur in the syllable onset.[11] On the contrary, the set of potential coda consonants is often severely limited. English and Hungarian are quite liberal also in this respect, but constraints do exist, a coda nasal followed by a plosive, for example, cannot have its own independent place of articulation, it must assume that of the plosive. This is referred to as nasal place of articulation assimilation.[12]

Returning to CODA CONSTRAINTS, many accents of English do not allow the feature rhotic (or whatever is responsible for distinguishing **r** from other segments) in the coda. English also does not allow a coda position to copy all the features of the following onset, that is, this language does not have GEMINATES (Hungarian does have geminates, e.g., *Anna* **ɑnːɑ**, English has **ænə**). Whenever a consonant is long in English the two halves are separated by a word boundary, that is, we are dealing with a fake geminate (e.g., *keen#ness* **kiːnnəs**). A true geminate **n** is shown in (31a), its fake counterpart in (31b).

(31) *A true and a fake geminate*


Recall that word-final consonants were here analysed as the onset of a degenerate syllable, thus even the syllabic affiliation of the segments in a true and a fake geminate are different.

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The coda is much more radically constrained in Japanese. Here it can independently contain the feature nasality only, all other properties of a coda consonant must come from the following onset consonant. The effect of this CODA CONSTRAINT is that there are only two types of consonant cluster in Japanese: (true) geminates and HOMORGANIC (of the same place of articulation) nasal+plosive clusters (recall, nasals are stops, i.e., their stopness must also come form the following position, which is only possible if there is a plosive there). In geminates, all properties of the coda come from the following onset (cf. (31a)), in nasal+plosive clusters, nasality is the coda's own property, but others, like, for example, place of articulation, come from the following onset. So consonant clusters like in *Nippon* 'Japan' or *Honda* (a brand name) are the only possible types in Japanese, other clusters are broken up, like *arubaito* 'part-time work' (from German *Arbeit* 'work'), or simplified, like *ōkesutora* 'orchestra' (from English *orchestra*).

The ultimate coda constraint is one that does not allow anything to occur in coda position, in fact, one that does not allow a coda position at all. Hua (a Khoisan language spoken in South Africa) and Cayuvava (an Amerindian language spoken in Bolivia) are examples of languages which do not have codas, i.e., the rhyme cannot branch in these languages, they have exclusively open syllables. It is interesting to note the asymmetry existing between onsets and codas: while codas do not even exist in some languages, they are not obligatory in any language (that is, all

[11] Actually, this is another reason why the membership of **ŋ** in the English segment inventory is doubtful: it is the only segment with an alleged phonemic status which does not occur in the syllable onset.

[12] Actually, the fact that phonotactic constraints exist between a coda and the following onset seriously undermines the argument for a hierarchical syllable based on these constraints: the coda and the onset following it are very distantly related as far as the canonical syllabic — onset, nucleus, coda, and rhyme — constituents are concerned.

languages have open syllables); onsets on the other hand exist in all languages, in fact, they may be obligatory (for example, they are so in Hua: *all* syllables must begin with a consonant; the obligatoriness of the onset also hints at why hiatus tends to be filled in most languages: this is a way to avoid onsetless syllables). It is difficult not to see the onset maximization principle as an instantiation of this universal preference for onsets vis-à-vis codas.

The syllable nucleus is also subject to variation across languages. We have already seen that one choice a linguistic system has to make is whether it allows its nuclei to branch: English and Hungarian do, Spanish and French do not. Another parameter is what type of segments are allowed to occur in the nucleus. To capture this variable, we can again make use of the sonority hierarchy shown in (3). It is usually enough to specify the lowest sonority index of what may be a nuclear segment, as any other segment with a higher sonority index will also be found there. This means that the set of possibilities is limited: we do not find linguistic systems in which some segment with a given sonority index may be syllabic, whereas another with a higher sonority index may not. The chart in (32) illustrates some possibilities.

(32) *Possible nuclear segments in some languages*

| | Hungarian | Serbo-Croat. | Czech | Eng. unstressed | Eng. stressed |
|---|---|---|---|---|---|
| 9 | hat ‘six’ | brat ‘brother’ | vlak ‘train’ | — | cup **ʌ** |
| 8 | fej ‘head’ | nov ‘new’ | led ‘ice’ | alga **-ə** | peg **e** |
| 7 | fül ‘ear’ | vuk ‘wolf’ | zub ‘tooth’ | city **-i** | beat **iː** |
| 6 | — | vrh ‘peak’ | vrch ‘hill’ | leper **-r̩** | — |
| 5 | — | — | vlk ‘wolf’ | label **-l̩** | — |
| 4 | — | — | — | reckon **-n̩** | — |
| 3 | — | — | — | — | — |
| 2 | — | — | — | — | — |
| 1 | — | — | — | — | — |
| 0 | — | — | — | — | — |

In Hungarian the lowest sonority value for a syllabic segment is 7, that is, all vowels may be sonority peaks, but consonants may not. Serbian and Croatian (or Serbo-Croatian) allow **r** besides vowels to be the syllable peak, that is, any segment with a sonority index of 6 or higher. Czech (and Slovak) are even more liberal, they allow segments down to sonority index 5 to assume the function of the head of the syllable: beside the vowels, **r** and **l** may also be syllabic, but nasals and obstruents may not. English is both more and less strict in this respect: in stressed syllables, we find only vowels as syllable peaks (like in Hungarian), in unstressed syllables any sonorant may occur in the nucleus, so the lowest sonority index here is 4. Interestingly, low vowels do not occur in unstressed syllables in English.[13]

[13] Although transcribed with the symbol ə, the English word final schwa is a rather low vowel.

There are reports of languages (Imdlawn Tashlhiyt Berber, spoken in North-West Africa, and Nuxálk (earlier known as Bella Coola), spoken in British Columbia, are the celebrated examples) where even voiceless stops can be syllabic, that is, there are no constraints whatsoever on the type of segment that is allowed in the nucleus. Whether these are genuine cases of syllabic obstruents is debatable and debated by phonologists.

The variability of syllable types in languages is quite large, we have only scratched the surface here. The parameters discussed in this section also go under the heading of phonotactic constraints, but most of those mentioned are independent of the neighbouring segments, it is only the syllabic constituent holding the segment that imposes restrictions on it.

## 4.6 Conclusion

We have seen that there is a phonologically defined level between segments and morphemes/words: that of syllables, which often enable an economical formulation of phonological phenomena. Syllables have an internal, hierarchical structure. The calculation of syllable boundaries is guided by universal principles. Languages show well-definable variability with respect to the complexity of their syllable types.

Despite all the positive evidence for syllables, we have also encountered cases that argue against syllable structure by making this level of abstraction unnecessary. Alternatives for explaining syllable-related phenomena without syllable structure do exist, but are beyond the scope of this book.

# Chapter 5: R Rules

Attila Starčević

## *5.1 Introduction*

This chapter deals with the behaviour of the phoneme /r/, which usually appears in spelling as <r(r)>. A number of points should be mentioned. First, the capital letter R will be used when making statements about the behaviour of this consonant (pronounced or silent). Second, not all spelt occurrences of R are pronounced and, conversely, there are pronounced Rs that are not spelt: in *Kafkaesque,* for example, there is an R between *Kafka* and *-esque* (/ˌkæfkəˈresk/) whereas in *card* (/kɑːd/) there is a silent R in a non-rhotic dialect. The two reference dialects are SSBE (Southern Standard British English) and GA (General American). When we discuss a general property of both dialects, the cover term 'English' is used. Occasionally, other (non-standard) dialects are mentioned. SSBE has 'intrusive' R, which appears after /ɑː/, /ɔː/, /ɜː/ and /ə/ if these are followed by a vowel (*shah* **R** *is, law* **R** *and, cordon blue* **R** *is, China* **R** *and*). The primary emphasis in this chapter is on **how the behaviour and influence of R on vowels in SSBE can be modelled.** The chapter is organised as follows: Broadening (5.2.2) and Breaking (5.3.4) in SSBE and a number of analyses of their status in SSBE (5.3).This is followed by check questions (5.4).

## *5.2 Broadening and Breaking and their status in SSBE*

### 5.2.1 Introduction

The loss/retention of coda-R is used in the classification of English dialects: generally, those that have R in all positions are **rhotic** (or R-full), whereas those that only have it in prevocalic positions are **non-rhotic** (or R-less). GA is a rhotic dialect, SSBE is non-rhotic. In some dialects Rs are lost in stressed syllables only (e.g. in *flour*, but not in *butter*, in which it can be analysed as syllabic R which coalesces with the schwa, giving /ɚ/), as in the dialects in North Yorkshire; in others only pre-consonantal Rs are lost (e.g. in *beard*, but not in *far*), as in Jamaican English. These dialects are known as **semi-rhotic**.

(1) Rhoticity: Classification of English dialects

(a) RHOTIC (e.g. General American, South Western dialects of England)

(b) NON-RHOTIC (e.g. SSBE, some Southern American dialects)

(c) SEMI-RHOTIC:

(i) R lost at the end of stressed syllables (*flour*), but not in unstressed ones (*butter*), where it is syllabic (e.g. North Yorkshire, Humberside)
(ii) R lost in __C (*beard*), not in __# (*far*) (e.g. Jamaican English)

Before we continue, let us look at the (traditional) vowel inventory of SSBE (2). The phonemes are based on **surface contrast** ('you get what you see principle'). These are the **raw data**. There are a number of ways in which these surface contrasts can be analysed. The data in themselves are no analysis. Analysis comes with **abstraction** and involves a move away from the 'you get what you see principle'. The table in (2) shows the traditional classification of vowels in SSBE into tense and lax. Each group has two subgroups: plain-tense vs. broken-tense and plain-lax vs. broad-lax.

(2a) (traditional) Vowel inventory of SSBE (using traditional transcription)

| TENSE VOWELS | |
|---|---|
| PLAIN | BROKEN |
| /iː/ - *meet* | /ɪə/ - *mere, idea* |
| /juː/ - *mute* | /jʊə/ - *cure, rural* |
| /eɪ/ - *pay* | /eə/ - *share* |
| /əʊ/, /oʊ/- *pony* | /ɔː/ - *porous* |
| /aɪ/ - *tie* | /aɪə/ - *tire, pious* |
| /ɔɪ/ - *boy* | /ɔɪə/ - *Moira* |
| /aʊ/ - *now* | /aʊə/ - *tower* |

| LAX VOWELS | |
|---|---|
| PLAIN | BROAD |
| /æ/ - *parity, cat* | /ɑː/ - *tar, bra, bah* |
| /e/ - *pet, deterrence* | /ɜː/ - *deter, fir, fur* |
| /ɪ/ - *knit* | |
| /ʊ/,/ʌ/ - *put, cut* | |
| /ɒ/ - *snot, warrior* | /ɔː/ - *snort, salt, war* |

(2b) (traditional) Spelling-based explanation of Broadening

| | (A) phonemes | (B) allophones |
|---|---|---|
| | **unpredictable**:<br>no <r> in spelling (__C) | **predictable**:<br>followed by <r> in spelling (__R{C, #}) |
| /ɑː/ | (holy) mass, photograph, class, after, aunt, father, drama | la**r**k, fa**r**m, ca**r**, fa**r**thing |
| /æ/ | mass, lass, maths, ant | NONE |
| /ɔː/ | haul, water | fo**r**m, no**r**th, no**r** |
| /ɒ/ | doll, otter | NONE |

Breaking of the tense vowels, with the exception of /əʊ/, means that their second half becomes /ə/: *mere*, *cure* and *share*. In the case of /iː/, /juː/ and /eɪ/, this change can be understood as the loss of the second half of the long vowel (recall that /iː/ is a shorthand notation for /ii/). This involves the 'smoothing' of a triphthong: /iiə/ → /ɪə/, /juuə/ → /jʊə/ (with additional laxing of /i/, /u/ to /ɪ/, /ʊ/) and /eɪə/ → /eə/. In the case of the wide diphthongs, a schwa is added to the original vowel (sometimes only optionally, depending on morphological structure), yielding /aɪə/, /ɔɪə/ and /aʊə/.[1] We will not analyse the broken wide diphthongs.

If Breaking (by and large) means that tense vowels develop a schwa after them, Broadening produces vowels that are both qualitatively and quantitatively different from their plain counterparts. We will discuss these processes in detail.

Before we give an explanation of Breaking and Broadening using phonological terminology, a reminder is necessary about what the traditional, spelling-based approach says about predicting vowel quality. This should be familiar from the core phonology courses.

We will look at Broadening (2b). The spelling-based approach has to admit that plain-lax and broad-lax vowels are phonemes (2a (A)): their appearance is unpredictable, so their distribution is contrastive (/ɑːnt/ vs. /ænt/). In this case, there is no <r> in spelling.

If the spelling contains <r>, the vowels are no longer in contrastive distribution (2a (B)): before <r> only broad-lax vowels are possible. We can interpret this as an archiphoneme //A//, which always becomes broadened to /ɑː/ before <r>, as in *farm*. The problem is that Broadening in *farm* cannot be motivated (explained) because there is no R (preconsonantal <r> is always silent). The same holds for //O//: it becomes broadened to /ɔː/ in *north*. This preconsonantal <r> is also silent.

R can only be tested word-finally. We *can* say that *car* has an R because when it is followed by a vowel-initial word, the R is pronounced (*car is*). Compared to word-final <r>, preconsonantal <r> is always silent. This analysis is based on spelling. We must look beyond this approach for a more phonologically-based analysis. (Check questions in 5.4.1)

[1] These can also undergo optional 'smoothing': /aɪə/, /ɔɪə/, /aʊə/ → /aə/, /ɔə/, /aə/.

### 5.2.2 Broadening

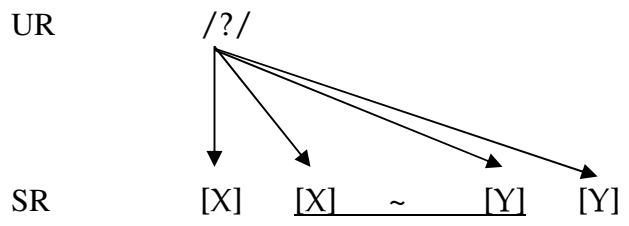
Broadening means that the lax monophthongs are found as their broad counterparts if they are followed by an R which is word-final or pre-consonantal (i.e. an R in coda position): e.g. *fat* /æ/ vs. *far* /ɑ/, *tuft* /ʌ/ vs. *turf* /ɜ/. In both GA and SSBE the *qualitative difference* between these vowels (/æ/ vs. /ɑ/) can be described as an effect of coda-R. In SSBE there is a further, quantitative difference: the vowel of *far* is long (in addition to being a back non-round vowel: /ɑː/). This lengthening can be explained as the loss/deletion of coda-R with compensatory lengthening: /fɑr/ → /fɑː/ (see Chapter 3). In the case of words spelt *ir/ur/er* (*fir*, *confer*, *fur*), the three historically different vowels have merged into a central vowel (/ɜ/).

The non-trivial question arises as to why the plain-lax ~ broad-lax vowel pairs are set up this way: why is /æ/ paired with /ɑː/, and /e/ with /ɜː/, rather than /æ/ with /ɜː/? **Is there any rationale behind this?** The most important task for a phonologist when devising an analysis is to check if there are alternations and what they show.

When do we generally say that **(surface) [X] = (underlying) /Y/** in an analysis (where 'X' and 'Y' represent any two segments at SR and UR levels of representation)? **If there are productive/frequent alternations of (surface) [X] and (surface) [Y].** Of course, [X] may also independently be derived from /X/, see (3a) below.

(3) Surface alternations and underlying representations

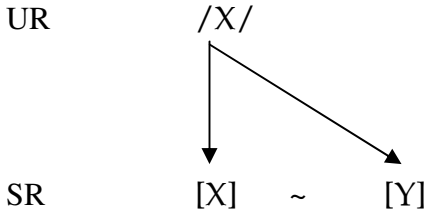
(a) [X] ~ [Y]




As a first approximation, the abstract scheme in (3a) shows that (a yet unidentified) phoneme /?/ may have surface (derived) realisations that involve alternating (as well as non-alternating) instances of [X] and [Y]. If [X] productively alternates with [Y], we have reasons to suppose that [X] and [Y] may both be the surface realisations of /?/. Bringing it closer home, we can see that **some instances of [e] alternate with [ɜː] within the same stem** (*deterrence* [dɪˈterəns], *deterrent* [dɪˈterənt] ~ *deter* [dɪˈtɜː]). The appearance of [e] as [ɜː]

before coda-R is Broadening. There are also non-alternating instances of [e] (as in *pet*), as well as of [ɜː] (as in *term*). Let us restrict the argumentation to the alternating instances of [X] and [Y] in (3a). If [X] alternates with [Y] we may be tempted to say that one of them is derived from the other: the underlying segment may be either /Y/ or /X/ (3b).

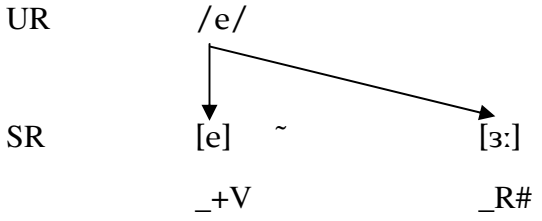
(3b) Alternating [X] and [Y] derived from /X/




(3b) shows that /X/ has two surface realisations: [Y] and [X] (with [X] appearing in one set of environments, and [Y] in another).

Let us see how we can apply this to SSBE. In the example at hand (*deter* ~ *deterrence/deterrent*) we have two options: we can either say that the mystery phoneme in (3a) is /e/ or /ɜː/ (from which both [e] and [ɜː] can be derived, see (3c)).

(3c) Alternating [e] and [ɜː] derived from /e/




| | | | |
|---|---|---|---|
| *deterrence* | [dɪˈterəns] | *deter* | [dɪˈtɜː] |
| *deterrent* | [dɪˈterənt] | *deterred* | [dɪˈtɜːd] |
| | | *deterred* | [dɪˈtɜːrɪŋ] |

The questions boils down to the following: can we claim that [ɜː] (a broad-lax vowel) is derived from /e/ (a plain-lax vowel)? Such an analysis must rely on productive/frequent (and thus easily accessible) alternations of [e] and [ɜː]. If such alternations are non-existent (or are found only in a handful of examples), we have no reason to suppose that surface [ɜː] is derived from underlying /e/. We will see that the evidence of alternations can sometimes be overridden by other considerations (e.g. the wish to arrive at a reduced set of underlying

oppositions).[2] As a matter of fact, alterations involving the various plain and broad-lax for the same stem are very rare (4).

(4) Alternations involving broad-lax and plain-lax vowels **in the same stem**

(a) rare (untypical) cases (NB: bl = broad-lax, pl = plain-lax)

| ALTERNATIONS: $\mathbf{V_{bl} \sim V_{pl}RV}$ | | |
|---|---|---|
| STEM | LAX VOWELS | TYPE |
| *par ~ parity,*<br>*bar ~ barrister*<br>*car ~ carriage* | /ɑː/ ~ /æ/ | RARE |
| Examples with no <r> in spelling:<br>*drama ~ dramatise*<br>*photograph ~ photographic*<br>*pass ~ passive*<br>*class ~ classic* | | |
| *abhor ~ abhorrence*<br>*war ~ warrior* | /ɔː/ ~ /ɒ/ | |
| *deter ~ deterrence*<br>*mirth ~ merry* | /ɜː/ ~ /e/ | |
| *occur ~ occurrence*<br>*fur ~ furrier* | /ɜː/ ~ /ʌ/ | |
| *???* | /ɜː/ ~ /ɪ/<br>/ɜː/ ~ /ʊ/ | |

[2] Note that a number of questions have been left unanswered, e.g. the possibility (or impossibility) of deriving [e] from /ɜː/, or the question of what one is supposed to do with non-alternating [ɜː] (as in *term*). Some of these questions will be answered below.

(b) typical cases (absence of alternations)

| | | |
|---|---|---|
| *car* ~ Ø<br>… | /ɑː/ ~ Ø | TYPICAL |
| *blur, fir, pertain* ~ Ø<br>… | /ɜː/ ~ Ø | |
| *nor* ~ Ø<br>… | /ɔː/ ~ Ø | |
| Ø ~ *cat*<br>… | Ø ~ /æ/ | |
| Ø ~ *pet, pus, fit, bull*<br>… | Ø ~ /e/, etc. | |
| Ø ~ *dot*<br>… | Ø ~ /ɒ/ | |

(c) summary: surface alternations in the same stem

| **$V_{pl}$C#**<br>(C≠R) | ~ | **$V_{bl}$**<br>(R silent) | ~ | **$V_{bl}$R#V**<br>(R pronounced) | ~ | **$V_{pl}$RV**<br>(R pronounced) | |
|---|---|---|---|---|---|---|---|
| ***cat*** | ~ | Ø | ~ | Ø | ~ | Ø | *typical* |
| Ø | ~ | ***star, law*** | ~ | ***star is, law is starring, law-abiding*** | ~ | Ø | |
| Ø | ~ | ***deter*** | ~ | ***deter us, deterring*** | ~ | ***deterrent*** | *rare* |

If we disregard the rather small set of examples of alternating vowels (4a), we must conclude that the alternating pairs of plain- and broad-lax vowels in (2a) are, to a large extent, set up on the basis of spelling (*cat* has a plain-lax vowel, *car* a broad-lax, but there is no alternation and the two words do not even have the same stem, the only similarity being that they have the same vowel, spelt <a>, see (4b)). Note that sometimes there does not even have to be an <r> spelling: *drama ~ dramatise, photograph ~ photographic, class ~ classic, pass ~ passive.*

If English had no spelling, the pairs in (2) would be even less convincing. This does not mean that we have no arguments for subclassifying the lax vowels. The most important evidence comes from their distribution: only the broad-lax vowels are found word-finally (/ɪˈtɜː/ is possible, */ɪˈte/ is not). This, of course, does not mean that the two groups are always in complementary distribution (see (6) for details).

The (absence of) alternations between plain- and broad-lax vowels is only one side of the matter. The other side concerns the alternation of some of the Rs that accompany the lax vowels (see (5)).

(5) Unrecoverable vs. recoverable R

(a) *card* [kɑːd] ~ Ø (**no alternation**)

(b) *far* [fɑː] vs. *far off* [fɑːrɒf] (**alternation**)

(c) Consequence of absence of alternation in (5a): **there are broad vowels that are not the result of Broadening** (*card*)

Let us see (5) in detail. What evidence is there for the R in *card*? Synchronically (i.e. from the perspective of the language as it stands today), none. This R is **unrecoverable**. As opposed to this, the R at the end of *far*, for example, is **recoverable**: if a vowel follows, the R is pronounced (*far* [fɑː] vs. *far off* [fɑːrɒf]). The last consonant of *card* cannot be 'cut off' by any (morphological) process and so the presence of R cannot be tested. Do not forget that spelling is no evidence in phonology. The letter R is at best a diacritic mark. It shows a special feature of the preceding vowel: in this case that it must be pronounced as a long vowel (of some quality). A very important consequence emerges: **there are broad-lax vowels that cannot be proved to be the result of Broadening.**

If a lax vowel is word-final (i.e. before '#'), it can only be broad. No English word ends in a plain-lax vowel. The same, of course, applies to words formed with strong-boundary suffixes (e.g. *star(r)#ing* 'starring' /ɑː/). Typically, word-final broad vowels are followed in spelling by R: e.g. *far*, *fur*, *nor*. If such words are followed by a vowel, R is pronounced: cf. *far* vs. *far off*. Again, spelling is nothing to go by: *sh<u>ah</u>*, *Panam<u>a</u>, lav<u>a</u>* (/ɑː/), *mili<u>eu</u>, (cordon) bl<u>eu</u>* (/ɜː/), *cl<u>aw</u>, l<u>aw</u>, Sh<u>aw</u>* (/ɔː/) end in a broad vowel, yet there is no R in spelling. The presence of R has to be tested with phonological phenomena, such as alternations, not spelling.

The situation in word-internal position is more complex. In mono-morphemic words there is no Broadening if a lax vowel is followed by R in onset position (cf. *car* /ɑː/ vs. *carrot* /æ/). This is traditionally known as the 'Carrot rule'. However, the picture is more complicated than this. There *are* broad vowels before onset-R in mono-morphemic words. What's more, broad vowels can also be found before consonants other than R (see (6)).

(6) Distribution (surface contrast) in SSBE

| | | LAX VOWELS | |
|---|---|---|---|
| | | PLAIN | BROAD |
| (a) | __# | NEVER | pɑː, ˈpænəmɑː, nɔː, lɔː, blɜː, mɪˈljɜː, brɑː |
| (b) | __V | NEVER | NEVER |
| (c) | __C(C)#<br>(C ≠ R) | bɪg, nɒt, hæt | ʃɑːft, kɑːd, fɔːm, pɔːz, lɜːtʃ |
| (d) | __RV | ˈkærət, ˈlɒri, ˈhʌri,<br>ˈmɪrə, ˈveri, ˈkʊriə | ˈklɑːrə, ˈhɑːrəm, tiˈɑːrə, ˈtɔːrəs<br>(!) no ɜːrV (accidental gap in SSBE)[3] |
| (e) | __R+V | bɑːˈbærɪk, əˈkʌrəns, dɪˈterənt, əbˈhɒrənt | æmˈhɑːrɪk, kəˈtɑːrəl, ˈflɔːrəl<br>(also non-standard BrE: dɪˈtɜːrəns, dɪˈtɜːrənt) |
| (f) | __R#V | NEVER | ˈfɜːri, ˈstɑːri, ˌdɪˈtɜːrɪŋ, ˈbɔːrɪŋ |
| (g) | __$C_1(C_2)$ V<br>($C_1$ ≠ R)<br>CC=br.onset | ˈsɪti, ˈsʌmə, ˈstɪklə, ˈbælət, ˈlemən, ˈkɒblə<br>ˈbɒdi, ˈbʊtʃə | ˈlɑːvə, səˈlɑːmi, ˈʃɑːlətən<br>ˈtɔːni, ˈtɔːdri, ˈtɜːbjʊlənt, ˈmɜːtʃənt |

Examples by rows: (a) pa, Panama, nor, law/lore, blur, milieu, bra (c) big, not, hat, shaft, card, form, pause, lurch, (d) carrot, lorry, hurry, mirror, very, courier, Clara, harem, tiara, Taurus, (e) barbaric, occurrence, deterrant, abhorrent, Amharic, catarrhal, floral, (f) furry, starry, deterring, boring, (g) city, summer, stickler, ballot, lemon, cobbler, body, butcher, lava, salami, charlatan, tawny, tawdry, turbulent, merchant

The highlighted area shows the distribution of lax vowels before pronounced R (one of our concerns here).

The table in (6) shows that while there is complementary distribution between plain- and broad-lax vowels before '#' (6a, f), no such relationship exists word-internally (6d, e). Broad-lax vowels *do* appear before any onset consonant in mono-morphemic words (including R): *h**a**rem*, *sal**a**mi*, *r**a**ther* /ɑː/. In addition, plain-lax vowels can appear in the same position

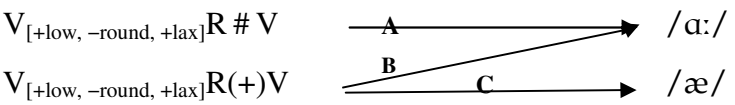
[3] This gap is filled in GA and non-standard British English by a number of words in which SSBE has /ʌ/ (or less frequently /ɪ/) followed by onset R in mono-morphemic words: *hurry, flurry, curry, worry, squirrel, worry,* etc.

before any consonant: *carrot*, *ruddy*. In a mono-morphemic word, the broad/lax value of a vowel cannot be determined ('guessed') on the basis of the following consonant. Thus, in the environment __CV, the vowel can be either broad- or plain-lax: *harem* /ɑː/, *carrot* /æ/, *rather* /ɑː/, *salad* /æ/, *tawny* /ɔː/, *body* /ɒ/. Conversely, the consonant following a broad-lax vowel can be (practically) any consonant, including R: e.g. /ɑː/ can be followed by either R (*harem*) or any other consonant (*banana*).

Note how unpredictable the plain vs. broad value of a lax vowel is in a word like *balaclava*. It is a matter of lexical knowledge that this particular word is /ˌbæləˈklɑːvə/, rather than /ˌbɑːləˈklævə/ (or any other combination of vowels). If there is no regularity, no rule can be set up.

(8) Predictability of plain vs. broad lax vowels before RV

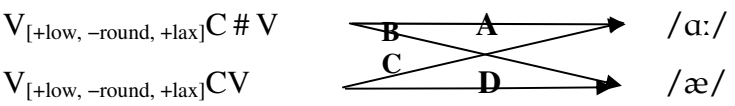
**Rule I: $V_{plain\text{-}lax}$ –> $V_{broad\text{-}lax}$ /__ R # V**




**A**: *barring, drawing, starry; car is, bra is*
**B**: *harem, Amharic* **(the broad-lax vowel is not the result of Broadening)**
**C**: *carrot, deterrent*

(8) shows that the only position in which a rule can be set up is before final R followed by a vowel (_R#V) (8A), where only a broad-lax vowel is possible (in *drawing,* as in *He is drawing an apple,* there is an (intrusive) R between *draw* and *ing*, discussed below). For the pre-R position before a vowel in mono-morphemic words (_RV) no rule can be set up as there is no ground to choose between (8B) and (8C). An important consequence of this is that the **broad-lax vowel in *harem*, for example, is *not* the result of Broadening.**

(9) Predictability of plain vs. broad lax vowels before CV (C ≠ R)




**A**: *bard is, carting* **B**: *plan, planning* **C**: *party* **D**: *salad*

(9) is identical with (8) with the exception that here C now covers (practically) any consonant except R. **In the environment of __ CV (C ≠ R) no rule can be set up at all.**

Another rule can, however, be set up for the position _R#C (the R is silent here, but it alternates otherwise), see (10).

(10) Predictability of plain vs. broad lax vowels before R#C (otherwise alternating R)

**Rule II: $V_{plain\text{-}lax}$ –> $V_{broad\text{-}lax}$ /__ R # C**

$V_{[+low, -round, +lax]}R\#C$ ⟶ /ɑ:/ *car was, bra was*

In the above environment the presence of a broad-lax vowel *is* predictable, hence the rule. Another environment is shown in (11) below.

(11) Predictability of lax vowels word-finally (otherwise alternating R)

**Rule III: $V_{plain\text{-}lax}$ –> $V_{broad\text{-}lax}$ /__ R #**

$V_{[+low, -round, +lax]}R\#$ ⟶ /ɑ:/ *car, bra*

In word-final position before a silent (yet otherwise alternating) R only a broad-lax vowel is possible. The rules mentioned so far are summarised in (12).

(12) Conclusion (Rules I, II and III)

**Pre-R Broadening Rule: $V_{plain\text{-}lax}$ –> $V_{broad\text{-}lax}$ /__ R #**

This leaves us with the conclusion that the broad vs. plain value of a lax vowel is only partially predictable. While only broad-lax vowels are possible before '#' (i.e. word-finally and before strong boundary suffixes), word-internally either can occur before any consonant (*bard, bad*, *harem, salami, carrot*). Therefore, **word-internally the broad/plain value of a vowel is a matter of lexical knowledge rather than a phonological regularity.**

The 'Carrot rule' does not exist as a phonological rule. Strictly speaking it is not a rule, not even in the original formulation: it simply shows the absence of Broadening. It is not an 'anti-Broadening' rule, as it were: it does not create a plain lax vowel out of a broad lax vowel. It is more of a filter which says that there is no Broadening in mono-morphemic words before onset R (*carrot*), as well as words containing a '+' boundary after R (*deterr* + *ent*). But, not even this is true: there *do* exist broad-lax vowels before onset R in mono-morphemic words (*harem*), and there also exist words with broad vowels before R followed by a '+' boundary (*Amhar* + *ic*). You might ask why the 'Carrot rule' was formulated at all. The reason for this is that most of the words that go

against this filter are unusual (rarely used) words or recent borrowings (*harem, tiara,* etc.). Still, one must admit that these words are just as English as any of the more common words (*carrot, hurry*) and their number is on the increase as borrowing continues in modern English.

Before we leave off this section, it must be noted that the R in the Broadening Rule (12) is normally silent. This is due to the R-deletion Rule (13).

(13) R-deletion Rule

**R –> ∅ / _ # (C)** *car, bra; car was, bra was*

The R-deletion Rule is responsible for making the Broadening Rule (13) **opaque** (non-transparent): the "reason" for the broad vowel in (13) cannot be seen in some of the environments (more specifically, word-finally when no V follows or when a C-initial word follows: *car, bra*; *car was, bra was*). The trigger (R) is no longer visible in pronunciation (it is taken away by (13)). Does this mean that we are forced to give up our analysis of Broadening as a process that depends on R? No. We still have alternations that show that the trigger (R) is still present (i.e. it is only silent *sometimes*): *ca***R** *is***,** *bra***R** *is*. Alternations such as these allow the analyst to move away from the surface (away from the 'you get what you see principle') and come up with an account that is more abstract but still relies on R ~ zero alternations ('you do not always get what you see') to explain those data that do not contain R. (Check questions in 5.4.2)

### 5.2.3 Explaining the data

Let us see what we have to show for an analysis. On the one hand, we have a limited set of alternations involving the lax vowels (*par ~ parity, deter ~ deterrence* and a handful of others). On the other, we have totally regular and predictable R ~ zero alternations (*car, bra* vs. *car is, bra is*). The choice we make about handling the data involving the few existing plain ~ broad-lax vowels will have an impact on our analysis.

All decisions have their consequences. We have seen that Pre-R Broadening as a *phonological* (non-spelling based) process is restricted to a few alternating pairs only. This makes the rule problematic: **rules are rules because they are meant to apply to as many words as possible, not isolated examples** (basically, Pre-R Broadening as a rule applies only to the *deter* and *par* part of the *deter ~ deterrence* and *par ~ parity* pairs of alternating lax vowels). This jeopardises the notion of rules: **rules cannot be set up to refer to (a handful**

**of) individual items**. We must thus reject Pre-R Broadening as a phonological rule in SSBE. This gives (14).

(14) No Pre-R Broadening

| | *car* | *bra* | *deter* | *deterrence* | *harem* | *carrot* | *card* |
|---|---|---|---|---|---|---|---|
| *UR* | kɑːr | brɑːr | dɪˈtɜːr | dɪˈterəns | ˈhɑːrəm | ˈkærət | kɑːd |
| **R-deletion** | kɑː | brɑː | dɪˈtɜː | -- | -- | -- | -- |
| *SR* | kɑː | brɑː | dɪˈtɜː | dɪˈterəns | ˈhɑːrəm | ˈkærət | kɑːd |

We have now arrived at a completely new interpretation: **there is no Pre-R Broadening**. The words shown in (14) are stored in UR with their respective vowels (plain or brad lax). **Broad vowels are NOT derived from plain-lax vowels**. Broad-lax vowels still exist and they do differ from plain-lax ones in terms of their distribution in certain environments (see (6)), but they are no longer viewed as derived from plain-lax ones (not even in those environments in which this seemed possible at first sight). We must also conclude that the pairing of plain-lax and broad-lax vowels in SSBE (shown in (2a)) has no phonological justification, i.e. it cannot be analysed in such a way as to show the systematic relationship between these two types of lax vowels.

Observe the URs in (14): there is an R in *car, bra, deter*. Why is this so, if this R does not appear in SR? It does in some of the environments: in pre-vocalic position, R surfaces (*car is, bra is*). There are alternations that support the presence of this R, so it is shown in the UR (*card* has its UR without R as it can never be proved to exist: there are no alternations). We will later revisit this issue, but it is time to summarise the costs/benefits of the approach presented in (14), shown in (15).

(15) Consequences of the analysis of lax vowels in (14)

(a) <u>For the lax vowels</u>

- no Broadening Rule (broad Vs are NOT derived from lax ones): NO plain-lax ~ broad-lax V 'pairs'
- UR opposition between plain- and broad-lax vowels exists in: __C(CV), __RV
- occurrence of plain-lax vowels is restricted in UR: they do not appear in __R#
- related stems have different underlying forms: cf. *deter* ≠ *deterrent*

- analysis remains close to the surface: no broad-lax vowel is derived from a plain-lax one (NO /æ/ → [ɑː] rule because there are NO productive [æ] ~ [ɑː] alternations)
- there are no R-related rules affecting the vowels: if /æ/ and /ɑː/ start off as /æ/ and /ɑː/ they will end up as [æ] and [ɑː]

(b) <u>For the R</u>

- only alternating and stable Rs in the UR (*car, bra ~ car, bra is, harem*)
- environments in which R occurs: __V, __# (but not before C)
- analysis remains close to the surface (only alternating segments can disappear/appear; in this case, R)

(Check questions in 5.4.3)

### 5.2.4 Breaking: its status in SSBE

Let us see the set of surface contrasts that can be established for plain-tense and broken-tense vowels in (16). Just to remind ourselves, these are the raw data. We will see how they can be analysed.

(16) Distribution of plain- and broken-tense vowels (surface oppositions)

| | | TENSE VOWELS | |
|---|---|---|---|
| | | PLAIN | BROKEN |
| (a) | __# | siː, fjuː | fɪə, pjʊə |
| (b) | __V | ˈniːəʊn, ˈnəʊə, ˈvaɪə | NEVER |
| (c) | __RV | NEVER | ˈdʒʊəri, ˈstɔːri, ˈpeərənt, ˈsɪərəm |
| (d) | __R+V | NEVER | ˈnjʊərəl, ˈmeərəl, ˈsfɪərɪkəl, ədˈhɪərəns, sʌlˈfjʊərɪk |
| (e) | __C(C)V (C≠ R) CC=br.onset | ˈkəʊlə, ˈmiːtə, ˈeɪprən | ˈwɪədəʊ, ˈskeədi |
| (f) | __C (C ≠ R) | speɪs, pruːn | bɪəd, skeəs, gʊəd |

Examples by rows: (a) see, few, fear, pure; (b) neon, Noah, via; (c) jury, story, parent, serum; (d) neural, mayoral, spherical, adherence, sulphuric; (e) Cola, metre, apron, weirdo, scaredy; (f) space, prune, beard, scarce, gourd

Cases in the frame show the distribution of tense vowels before R (one of our concerns in this chapter), the shaded area shows rare examples.

The distribution of the tense vowels is not identical to that of the lax vowels. While both plain-tense and broken-tense vowels can be found word-finally and pre-consonantally, as well as before consonants other than R, there is a distributional restriction: before R only broken-tense vowels can appear. Cases like *show room* /-əʊr-/ are exceptions to this generalisation because they are compounds (*show##room*). Nor can Breaking apply across two words in a phrase (*see##red* /siːred/, not */sɪəred/). This shows that Breaking is a lexical rule (i.e. it cannot apply across a strong/'#' boundary), so such words are not counterexamples (they strengthen, as it were, the distributional facts in (16)).

There is one major difference between the Breaking of the 'wide' diphthongs and the rest of the tense vowels: it is obligatory only before a strong boundary (__#): *tower#, tower#ing* /aʊə/, *fire#, fir(e)#ing* /aɪə/. In mono-morphemic words it is optional: /ˈbaɪ(ə)rəʊ/ *biro,* /ˈmɔɪ(ə)rə/ *Moira,* /ˈsaʊ(ə)rɒn/ *Sauron.*

We see that broken-tense vowels occur before R which is either stable/non-alternating (as in *jury*) or final, thus alternating with zero (as in *pure*). Broken-tense vowels are extremely rare before consonants other than R (as in *weirdo, scarce*). In this environment broken-tense vowels occur before non-alternating R.

What would the spelling-based approach say? It would claim that broken-tense vowels occur before spelt Rs. Some of these Rs are alternating (*fea**r***), some non-alternating (*ju**r**y*). The non-alternating Rs are either always pronounced/stable (*ju**r**y*) or always silent (*sca**r**ce*). From a phonological point of view, when we look at the surface distribution of Rs (16), we must say that the R in *sca**r**ce, gou**r**d* cannot be motivated (it is always silent).

Let us see if any rules can be set up. Observing a regularity means being able to set up a rule, describing the set of environments in which only one class of segments can be found to the exclusion of the other (this is what a rule does: it describes/explains/prescribes in which of the possible environments which class of segments can occur). There are three such rules for broken-tense vowels (see (17), a conflated version of which is found in (18)).

(17) Rules for Breaking

Rule I: $\mathbf{V_{plain\text{-}tense} \rightarrow V_{broken\text{-}tense} \ /\_\_\ R(+)V}$ *jury, mayoral*

Rule II: $\mathbf{V_{plain\text{-}tense} \rightarrow V_{broken\text{-}tense} \ /\_\_\ R\#V}$ *pure and*

Rule III: $\mathbf{V_{plain\text{-}tense} \rightarrow V_{broken\text{-}tense} \ /\_\_\ R\#C}$ *pure gold*

(18) Breaking in SSBE

$\mathbf{V_{plain\text{-}tense} \rightarrow V_{broken\text{-}tense} \ /\_\_\ R}$

These rules all hinge on R, which is either **stable** (always pronounced: Rule I) or **alternating**, pronounced before a vowel-initial word (Rule II), or silent before a consonant-initial word (Rule III). These rules can be conflated into one rule (18), called Breaking. Phonologically, no Breaking rule can set up for those environments in which R never appears (*weird, scarce*): here we cannot assume that the broken vowel is derived by a rule: it is there as such in the UR. That is, some broken-tense vowels are not derived with the rule in (18).

### 5.2.5 Tense vowels paired up

Let us see if we have any justification for setting up plain-tense ~ broken-tense vowel pairs, as we assumed in (16). We have found no justification for plain-lax ~ broad-lax vowel pairs. Let us see what conclusion we can reach for the tense vowels.

(19) Alternations in the same stem

| TENSE ~ TENSE | LAX ~ LAX | |
|---|---|---|
| | *par ~ parity* /ɑː/ ~ /æ/<br>*abhor ~ abhorrence* /ɔː/ ~ /ɒ/<br>*deter ~ deterrence* /ɜː/ ~ /e/<br>*occur ~ occurrence* /ɜː/ ~ /ʌ/ | RARE |

| TENSE ~ LAX |
|---|
| *sane ~ sanity*<br>*repair ~ reparatory*<br>*Bible ~ Biblical*<br>*meter ~ metric*<br>*tone ~ tonic,* etc. |

(19) shows that there are no alternations within the same stem with tense vowels.[4] However, there *are* alternations across these two classes, i.e. alternations involving tense and lax vowels within the same stem. These alternations are due to laxing brought about by certain weak/'+' boundary suffixes (*-ity, -ic,* etc.), where there is justification for vowel shift, that is for setting up tense ~ lax pairs like /eɪ/ ~ /æ/ or /aɪ/ ~ /ɪ/. The question remains whether there are plain-tense ~ broken-tense pairs suggested by (19). The answer is yes (see (20)).

[4] Recall the class of lax vowels where alternations within the same stem are very rare.

(20) Alternating broken/plain-tense ~ plain-lax vowels

| VOWELS | | ALTERNATING BROKEN-TENSE ~ PLAIN-TENSE V PAIRS |
|---|---|---|
| PLAIN/BROKEN-TENSE | PLAIN-LAX | |
| *s**a**ne* /eɪ/<br>*st**a**te*<br>*prep**a**re* /eə/<br>*barb**a**rian* | *s**a**nity*/æ/<br>*st**a**tic*<br>*prep**a**ratory* /æ/<br>*barb**a**ric* | /eɪ/↘<br>/æ/ ➔ /eɪ/ ~ /eə/<br>/eə/↗ |
| *t**y**pe* /aɪ/<br>*sat**i**re* /aɪə/ | *t**y**pical* /ɪ/<br>*sat**i**rical* /ɪ/ | /aɪ/↘<br>/ɪ/ ➔ /aɪ/ ~ /aɪə/<br>/aɪə/↗ |
| *ser**e**ne* /iː/<br>*sev**e**re* /ɪə/ | *ser**e**nity* /e/<br>*sev**e**rity* /e/ | /iː/↘<br>/e/ ➔ /iː/ ~ /ɪə/<br>/ɪə/↗ |
| *t**o**ne* /əʊ/<br>*euph**o**ria* /ɔː/ | *t**o**nic* /ɒ/<br>*euph**o**ric* /ɒ/ | /əʊ/↘<br>/ɒ/ ➔ /əʊ/ ~ /ɔː/<br>/ɔː/↗ |

The basis for classifying the plain-tense and broken-tense vowels into pairs (e.g. /iː/ ~ /ɪə/) is that they alternate with the same plain-lax vowel: *sane/prepare ~ sanity/preparatory*, *satire/type ~ satirical/typical*, etc. While we had no justification for pairs of plain-lax and broad-lax vowels, we do have proof for pairs of plain-tense and broken-tense vowels on the basis of the alternation with the same plain-lax vowel. (Check questions for 5.2.4 and 5.2.5 in 5.4.4)

### 5.2.6 Is Breaking the only source of broken-tense vowels?

The answer must be in the negative. There is another source for what appear to be broken-tense vowels. This is smoothing. Sequences of high long monophthongs and (some) diphthong + /ə/ are 'smoothed' into what appears as a broken-tense vowel.

(21) Smoothing

- high long monophthongs and (some) diphthongs + ə:

/aɪˈdiːə/, /mjuˈziːəm/, /ˈskɔːri(ː)ə/, /ˈskjuːə/, /ˈmæntju(ː)ə/, /ˈpleɪə/

- after smoothing (optional):

/aɪˈdɪə/, /mjuˈzɪəm/, /ˈskɔːrɪə/, /ˈskjʊə/, /ˈmæntjʊə/, /ˈpleə/

(idea, museum, scoria, skewer, Mantua, player)

The vowels of *idea, museum,* etc. can be optionally pronounced with what appears to be broken-tense vowels. Is there a difference between a 'true' broken-tense vowel and a smoothed 'quasi' broken-tense vowel? The answer is in the affirmative now.

### 5.2.7 'True' vs. 'quasi' broken-tense vowels

The behaviour of 'true' and 'quasi' broken vowels is diametrically opposed: what one set of vowels can do, the other cannot (see (22)).

(22) 'Quasi broken' vs. 'true' broken vowels

| | BROKEN VOWELS | |
|---|---|---|
| | 'QUASI' | 'TRUE' |
| | /pleə/, /mjuˈzɪəm/, /aɪˈdɪə/ | /keə/, /bɪəd/, /bɪə/ |
| BI-SYLLABIC PRONUNCIATION ('.' shows syllables) | /pleɪ.ə/, /mjuˈzi:.əm/, /aɪˈdi:.ə/ | */ keɪ.ə/, */bi:.əd/, */bi:.ə/ |
| MONOPHTHONGISATION | */plɛ:/, */mjuˈzɪ:m/, */mɪ:/ | /kɛ:/, /bɪ:d/, /bɪ:/ |
| | *player, museum, idea* | *care, beard, beer* |

We have two tests to go by: the possibility of a bi-syllabic pronunciation and monophthongisation. 'Quasi' broken vowels can have a bi-syllabic pronunciation (as opposed to 'true' broken vowels that that count as a single nucleus). 'True' broken vowels, on the other hand, can be monophthongised (an option which is not available for the 'quasi' broken ones).

### 5.2.8 Broken-tense vowels as a single constituent

Let us see the evidence there is for claiming that broken-tense vowels behave like a long nucleus (/ɪə/) rather than a bi-syllabic sequence of a short vowel (/ɪ/) followed by a schwa (/ə/). If segments are part of the same

constituent (here a branching nucleus, i.e. a long vowel), there are constraints between the two members. One proof comes from phonotactics. The vowels that occur before schwa are /ɪ/, /(j)ʊ/ and /e/ only (*near, pure, rural, care*).

Another proof comes from monophthongisation. Broken vowels are increasingly undergoing monophthongisation in SSBE: e.g. /ʊə/ can be monophthongised to /ɔː/ (*pure*). The lowering of /ʊ/ to /ɔ/ shows that schwa interacts with the preceding vowel. The other vowel before schwa used to be /ɔ/ but it has now been completely replaced by /ɔː/ (*porous*, formerly pronounced with /ɔə/). Note that /ɪə/ and /ɛə/ can also be monophthongised to /ɪː/ and /ɛː/. In these long vowels, schwa has been completely lost. These lowering and/or monophthongisation processes show that the schwa and the vowels preceding it are closely connected. This can only be so because the schwa and the preceding vowel are part of the same constituent. The monophthongisation of /ɔə/ (*story*) and /(j)ʊə/ (*pure*) has brought about a merger with the broad-lax /ɔː/. As a consequence, *story*, *pure* and *storm* all have the same vowel today.

Proof that broken-tense vowels are long comes from their distribution: broken-tense vowels can stand word-finally (recall that if a vowel is stressed in word-final position it can only be long: cf. *spa*, *flu, bee, bear,* etc.). The broken-tense vowels must thus be analysed as monosyllabic long (often diphthongally pronounced) vowels.

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### 5.2.9 Classification of non-rhotic dialects

Let us give a classification of non-rhotic dialects on the basis of where R can appear. There are non-rhotic dialects in which only historical Rs (those shown in spelling) are pronounced, and there are non-rhotic dialects such as SSBE in which R also appears in those positions in which it has not always been there (as in *spa* **R** *in Bath, law* **R** *and order* or *idea* **R** *is*). Non-spelt Rs are known as 'intrusive Rs', whereas those that also appear in spelling (e.g. *car engine, store and cool* or *beer is*) are known as 'linking' Rs.

(23) Classification of non-rhotic dialects with respect to word-final R

| R | | DIALECTS |
|---|---|---|
| LINKING | INTRUSIVE | |
| ✓ | ✓ | e.g. SSBE |
| × | × | e.g. Southern US English |
| ✓ | × | e.g. South African English, very traditional RP (?) |
| × | ✓ | NEVER[5] |

The dialect we continue to examine is SSBE.

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[5] The interesting aspect of the table is that there are no dialects on record in which historical (linking) Rs have been lost and non-historical (intrusive) ones introduced. We will not comment on this.

### 5.2.10 Linking R

We have seen that word-final R is recoverable: *beer is* /bɪərɪz/. It is called linking R because it links two words (or a word and a vowel-initial suffix): /bɪə/ and /ɪz/. A vowel-vowel sequence belonging to two syllables is called *hiatus*. A hiatus is a heterosyllabic vowel-vowel sequence with no intervening consonant. In such a vowel-vowel sequence there usually appears a hiatus filler, a consonant that provides for the smooth transition between the two vowels. This is what R does. The domain of operation of linking R is the utterance. As long as a stretch of words or a number of short sentences are pronounced as one 'breath group' (i.e. without a pause) linking Rs will appear. Some examples are given in (24).

(24) Linking R

(a) sentence internally

She had fou***r*** ostrich feathers in he***r*** amazing hat.
The royal face drew mo***r***e attention than the race itself.
Just last yea***r***, ove***r*** a hundred new dinosaur droppings we***r***e uncovered in Inne***r*** India.

(b) across sentences

She's the***r***e. I saw her.
Don't sta***r***e! It's rude!
Don't just sta***r***e! Ask him nicely.

In (24b) the sentences must be said by the same speaker and addressed to the same listener(s). Otherwise, there is no linking R (25a).

(25) Absence of linking R

(a) No linking R across listeners

SPEAKER A TO LISTENER B: Now, that's a nice car!
SPEAKER A TO LISTENER C: ****r***Is it yours?

Linking R cannot appear in a pause (25b).

(b) No linking R in a pause

I'm looking for my car… *[hesitation]* ****r***Is it in your garage?

### 5.2.11 Intrusive R

Intrusive R appears after /ɑː/, /ɔː/, /ɜː/ and /ə/, i.e. after the non-high vowels (including schwa-final diphthongs). That is, **intrusive R appears exactly in those environments in which linking R appears.** Some examples follow in (26).

(26) Intrusive R

The idea***/r/*** is not new.
It's magenta***/r/*** ish in colour.
I hate Kafka***/r/*** esque nightmares.
The withdraw***/r/***al symptoms are serious.
That llama***/r/*** over there looks Noa***/r/*** ish!
Not Judea***/r/*** again, he exclaimed!

Ancient Mesopotamia***/r/*** is divided between Syria***/r/*** and Iraq.
Rowena***/r/*** Archer is someone I've met.
The Havana***/r/*** of the East is Shanghai.
Teach your cat not to claw***/r/*** on the sofa.
Cordon bleu***/r/*** is 'blue ribbon' in French.

Intrusive R appears in exactly the same environment as linking R: across sentences, but not across speakers or listeners (see (27) and (28)).

(27) Intrusive R across sentences

It's Anna***/r/***. Open the door!
Where's the saw***/r/***? I need it.
What a nice sofa***/r/***! Is it new?

(28) No intrusive R

(a) Across listeners

SPEAKER A TO LISTENER B: Now, that's a comfy sofa! (TO LISTENER C:) ****/r/***Is it new?

(b) In a pause

SPEAKER A: Have you seen Pisa… *[hesitation]* ****/r/***and its famous tower?

**Intrusive R is phonetically identical with linking R and it occurs in exactly the same set of environments as linking R.** Both processes are post-lexical (i.e. they apply across word-boundaries).

## *5.3 Analyses of (intrusive and linking) R in SSBE*

In a non-rhotic dialect like SSBE, linking R is lost if there is no vowel after it (*car was*) and, conversely, it is pronounced when there is a vowel after it (*car is*). With intrusive R there is no R word-finally (*spa*). Notice that this description relies on spelling, not phonology. Phonologically, *car* and *spa* behave in the same way: R appears (or not) whenever the

conditions are right. So, **tests for intrusive and linking R will always produce the same results**. A community with no orthography could never differentiate between *car* and *spa*. They always sound the same. It is time to remind ourselves of the raw data (29).

(29) The data (surface oppositions)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| bi: | bɪə | bɪəwəz | bɪərɪz | bi:d | aɪˈdɪə | aɪˈdɪəwəz | aɪˈdɪərɪz | bɪəd | kɑ: | kɑ:rɪz |
| *bee* | *beer* | *beer was* | *beer is* | *bead* | *idea* | *idea was* | *idea is* | *beard* | *car* | *car is* |

### 5.3.1 Insertion-only analysis

One way to analyse broken-tense and broad-lax vowels and their distribution with respect to R is to suppose that word-finally there are inserted Rs only. This analysis assumes that speakers have restructured the underlying representation of R-final words like *car*: a word with a historical R was reanalysed as vowel final (*car* is now stored in the lexicon as /kɑ:/ rather than /kɑ:r/). As a result, the R in /kɑ:rɪz/ *car is* and /spɑ:rɪz/ *spa is* is inserted by a rule.

If we follow this analysis, words like *beer*, *lava*, *star*, *nor*, etc. are all vowel-final: /bɪə/, /ˈlɑ:və/, /stɑ:/, /nɔ:/. When they are followed by a vowel, the R that appears is the result of R-insertion, which means that every word-final R is an inserted (i.e. non-underlying) one (30).

(30) The R-insertion approach

| | | beer | | | | idea | | | | car | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *bee* | *beer* | *beer is* | *beer was* | *bead* | *idea* | *idea was* | *idea is* | *beard* | *car* | *car is* | *carrot* |
| *UR* | bi: | bɪə | bɪə ɪz | bɪə wəz | bi:d | aɪˈdɪə | aɪˈdɪəwəz | aɪˈdɪəɪz | bɪəd | kɑ: | kɑ:ɪz | ˈkærət |
| **R-insertion** | -- | -- | bɪərɪz | -- | -- | -- | -- | aɪˈdɪərɪz | -- | -- | kɑ:rɪz | -- |
| *SR* | bi: | bɪə | bɪərɪz | bɪəwəz | bi:d | aɪˈdɪə | aɪˈdɪəwəz | aɪˈdɪərɪz | bɪəd | kɑ: | kɑ:rɪz | ˈkærət |

(30) shows that the insertion-only analysis relies on the R-insertion rule (31a).

(31a) R-insertion rule in hiatus

Ø → [r] / {ɑ: ɔ: ɜ: ə} __ # V

The R-insertion rule works only if a final non-high vowel is followed by another vowel. In such a case, the hiatus is filled with an R. In case the non-high vowels are followed by a consonant or are at the end of the utterance, there is no R-insertion.

The R-insertion rule applies across the board, to both native and foreign words. Similarly, homorganic hiatus fillers after high vowels are used just as spontaneously: [w] after the high back vowels /u/ and /ʊ/ (e.g. *follow* [w] *Anne*) and [j] after the high front vowels /i/ and /ɪ/ (e.g. *see* [j] *it*), see (31b). The glottal stop can be used whenever the other glide fillers are not used (e.g. *see* [ʔ] *Anne*). There is no reason to have the underlying representation for *see* as /siːj/ if the hiatus filler is predictable. Similarly, if the hiatus filler (/r/) is predictable after the non-high vowels, it should not be present in the underlying representation either. Thus, *beer* ends in a vowel just like *see*.

(31b) Hiatus fillers in SSBE

- [j] after a **high front vowel** (/i/ or /ɪ/):
  *see* [j] *Anne*, *pay* [j] *us*, *buy* [j] *another*, *a boy* [j] *and a girl*
- [w] after a **high back vowel** (/u/ or /ʊ/):
  *two* [w] *evenings*, *follow* [w] *Anne*, *a cow* [w] *and a bull*
- [r] after **non-high vowels** (/ɑː/, /ɔː/, /ɜː/ and /ə/):
  *car* [r] *insurance*, *spa* [r] *is*, *gnaw* [r] *on the bone*, *a sore* [r] *ankle*, *spur* [r] *of the moment*, *milieu* [r] *of…*, *meander* [r] *along*, *Panama* [r] *is on the map*

Although R-insertion is generally applied by all SSBE speakers, some speech conscious individuals (very conservative RP speakers) suppress it because they regard it as pronouncing something 'improper'. In such cases the hiatus filler is a glottal stop: e.g. *Camilla* [ʔ] *and Charles*. Let us focus on some of the consequences of the insertion-only analysis:

(i) there is neither Broadening, nor Breaking (broken-tense and broad-lax vowels are present in the UR),

(ii) as a direct consequence of (i) there is an UR (phonemic) opposition between plain-tense and broken-tense vowels (/iː/ vs. /ɪə/), as well as plain -lax and broad-lax vowels (/æ/ vs. /ɑː/),

(iii) R occurs only in prevocalic position (i.e. in the __V environment) in UR (e.g. *bread, very, red*) and

(iv) alternating Rs are not part of UR.

What other evidence is there in support of this analysis? It comes from 'transfer' evidence: from (i) intrusive Rs in foreign words when used in English (32a), and (ii) English speakers' pronunciation of foreign languages (32b).

(32) Transfer evidence

(a) Intrusive R in foreign words

the social milieu***[r]*** of Alexander Pope ([miˈljɜːr əv])
the junta***[r]*** in Chile ([ˈhʊntər ɪn])
the Stella***[r]*** Artois***[r]*** event ([ˈstelər ˈɑːtwɑːr ɪˈvent])
the óvoda***[r]*** is open ([ˈəʊvədər ɪz])

(b) English speakers' pronunciation in foreign languages

| | |
|---|---|
| German: | ich habe***[r]*** einen Hund ([ˈhɑːbər ˈaɪnən]) |
| Latin: | Hosanna***[r]*** in excelsis ([həˈzænər ɪn]) |
| | dona***[r]*** eis requiem ([ˈdɒnər eɪs]) |
| Hungarian: | kola***[r]*** és csipsz ([ˈkəʊlər eɪʃ]) |

It seems that 'transfer' evidence is a good indicator of the presence of an R-insertion rule.

One problem with this analysis is the question of why it is exactly /r/ that is inserted, rather than, say, /t/ or /p/ for words ending in non-high vowels: /lɔːrɪz/ ~ */lɔːtɪz/ ~ */lɔːpɪz/ for *law is* or *lore is*. In case of words ending in high vowels (*bee, cow*), the quality of the hiatus filler is predictable on phonetic grounds (and so no comparable rule of [j]- or [w]-*insertion* is required). An analysis that has an R-insertion rule (but no w-insertion rule) has to admit that it has such a rule exactly because the quality of the inserted consonant is *un*predictable. It seems then that the hiatus filler is supplied on two different grounds: a phonetic (*bee* [j] *is, cow* [w] *is*) and a phonological basis (i.e. by a stipulated rule: *law* [r] *is*. (Check questions in 5.4.5)

### 5.3.2 Deletion-only analysis (Approach 1)

An alternative approach assumes that words ending in non-high vowels have been reanalysed as R-final. In this approach a word like *spa* is UR /spaːr/. There are two ways in which this can be approached. The first approach is shown in (33). It remains close to the 'surface' (it

does not assume UR segments that never appear in SR and only alternating segments can be deleted from the UR: Rs in this case).

(33) R-deletion approach 1

| | | beer | | | | idea | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | *bee* | *beer* | *beer is* | *beer was* | *bead* | *idea* | *idea was* | *idea is* | *beard* | *car* |
| *UR* | bi: | bɪər | bɪərɪz | bɪərwəz | bi:d | aɪˈdɪər | aɪˈdɪərwəz | aɪˈdɪərɪz | bɪəd | kɑ:r |
| **R-deletion** | -- | bɪə | -- | bɪəwəz | -- | aɪˈdɪə | aɪˈdɪəwəz | -- | -- | kɑ: |
| *SR* | bi: | bɪə | bɪərɪz | bɪəwəz | bi:d | aɪˈdɪə | aɪˈdɪəwəz | aɪˈdɪərɪz | bɪəd | kɑ: |

(33) shows that there are UR broken-tense and brad lax vowels (*beer, beard, car*). This seems a fair analysis: there is no alternation between broken-tense and plain-tense vowels in the same stem (*beer* always appears with a broken-tense vowel). As there is no alternation, there is no reason for assuming an UR plain-tense vowel (*/bi:r/ *beer*). The same holds for broad-lax vowels (we have no justification for */kær/ *car*).

Let us see some consequences of this analysis: there is UR opposition between plain-tense and broken-tense vowels (/i:/ vs. /ɪə/). The two types of vowels are phonemes (broken-tense vowels are not derived from plain-tense ones). R occurs only in pre-vocalic position (__V, e.g. *red, carrot*) and word-finally (__#: e.g. *beer, idea*).

All this seems very good, but there are problems: /i:/ and /ɪə/ are in complementary distribution before R (but not before other consonants, see (34)), which is a case of neutralisation (Chapter 2). This means that this analysis assumes **underlying allophones**. If the distribution *is* predictable, why show it in the UR?[6]

[6] Remember: allophones traditionally only exist in the SR, UR can only contain phonemes, i.e. contrastive segments.

(34) Phonemes or allophones?

| | iː | ɪə |
|---|---|---|
| ***allophones*** | ***UR complementary distribution*** *before R*: *e.g.* bɪər/*biːr, dʒʊəri/*dʒuːri | |
| ***phonemes*** | ***UR contrastive distribution*** *before C* (C ≠ R): *e.g.* biːd ↔ bɪəd | |

If the distribution of /iː/ vs. /ɪə/ is predictable before R we can say that the opposition between the two is **neutralised** before R (only a broken vowel can appear in this position). We can also say that the opposition between /iː/ vs. /ɪə/ is partial: it is only found before Cs other than R.[7]

This analysis fails to relate the suspension of contrast between plain-tense and broken-tense vowels before R to a systematic cause (the very presence of R). It is for this reason that we have to discard it. (Check questions in 5.4.6).

### 5.3.3 Deletion-only analysis (Approach 2)

There is another R-deletion analysis we have to consider. This analysis also relies on the deletion of UR Rs and takes the **suspension of contrast between plain-tense and broken - tense vowels before R as an indication that the two are the same** (35). The difference between them is down to a systematic reason (the presence of R), so an R-related rule can be set up.

(35) R-deletion approach 2

| | | beer | | | | idea | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | *bee* | *beer* | *beer is* | *beer was* | *bead* | *idea* | *idea was* | *idea is* | *beard* | *car* | *card* |
| *UR* | biː | biːr | biːrɪz | biːrwəz | biːd | aɪˈdiːr | aɪˈdiːrwəz | aɪˈdiːrɪz | biːrd | kær | kærd |
| *Pre-R break* | -- | bɪər | bɪərɪz | bɪərwəz | -- | aɪˈdɪər | aɪˈdɪərwəz | aɪˈdɪərɪz | bɪərd | -- | -- |
| *Pre-R broad* | -- | -- | -- | -- | -- | -- | -- | -- | -- | kɑːr | kɑːrd |
| **R-deletion** | -- | bɪə | -- | bɪəwəz | -- | aɪˈdɪə | aɪˈdɪəwəz | -- | bɪəd | kɑː | kɑːd |
| *SR* | biː | bɪə | bɪərɪz | bɪəwəz | biːd | aɪˈdɪə | aɪˈdɪəwəz | aɪˈdɪərɪz | bɪəd | kɑː | kɑːd |

[7] Recall that a similar suspension of contrast between /s/ and /ʃ/ is neutralised before R: of the two only /ʃ/ is found before R, so it does make sense to assume UR /sruː/ for *shrew*.

Observe *bee* and *beer*. Now *beer* has an UR plain-tense vowel followed by R. We now must have a Pre-R Breaking rule to take care of the difference in quality between *bee* and *beer*. This means that all occurrences of broken-tense vowels can be expressed as 'Breaking of plain-tense vowels before R'.

The same applies to broad-lax vowels: they can also be derived from plain-lax vowels (observe the UR of *car* and *card* which have a plain-lax vowel). Recall that we have not been able to set up alternating pairs across plain-lax and broad-lax vowels, so the choice of /æ/ in *car* is arbitrary. We will come back to Pre-R Broadening in a little while.

Let us weigh the pros and cons of this approach. On the plus side, **the system as a whole has been simplified**: we have no UR broken-tense vowels. R has **no defective distribution** now as it does in all previous analyses (it occurs in all possible environments in the UR: __V, __C, __#).

On the minus side, **this analysis lacks empirical justification**: there is no alternation between plain and broken-tense vowels within the same stem (*beer* always has /ɪə/). Although the set of **UR oppositions now has fewer elements** (plain-tense and plain-lax vowels only), the **rule component has been enlarged** (we now have Pre-R Breaking and Pre-R Broadening). Although word-final R does alternate with zero (*bee~~r~~* vs. *bee**r** is*), there is no proof for such Rs in pre-consonantal position (*beard*).

As you can see, **there is no such thing as a perfect analysis**. So, which R-deletion analysis is better: Approach 1 or Approach 2? **Approach 2 is systematic** (it looks at the set of oppositions in a principled way) and **non-redundant** (it does not show UR oppositions that are predictable), as apposed to Approach 1 which is redundant in its treatment of neutralisation (suspension of contrast before R): it shows **UR allophones**, an idea incompatible with the distinction between UR and SR.

Is there any further proof for the R-deletion analysis, for the fact that speakers of SSBE really apply R-deletion across the board? Evidence comes from 'transfer' (36).

(36) Transfer evidence

(a) Deletion of R in foreign words in English

Alexander Pope's social milieu~~r~~ ([mɪˈljɜː], compare *milieu is* [mɪˈljɜː**r** ɪz])
his name is Schwa~~r~~tz ([ʃwɔːts], *[ʃwɔːrts])
it's in Alga~~r~~ve ([ælˈgɑːv], *[ælˈgɑːrv])
Peter has a villa in Beaulieu-sur-me~~r~~ ([ˌbəʊljɜːsəˈmeə], compare *Beaulieu-sur-mer is beautiful* [ˌbəʊljɜːsəˈmeə**r** ɪz])

(b) English speakers' pronunciation of foreign languages

| | |
|---|---|
| German: | das ist, was ich ich habe~~r~~<br>([ˈhɑːbə], compare *ich habe einen Hund* ([ˈhɑːbə**r** aɪnən]) |
| Latin: | Hosanna~~r~~ ([həˈzænə], compare *Hosanna in* ([həˈzænə**r** ɪn]) |
| Hungarian: | csipsz és kóla~~r~~ van ([ˈkəʊlə], compare *kola és csipsz* ]ˈkəʊlə**r** eɪʃ]) |
| French | Beaulieu-sur-me~~r~~ se trouve sur la Côte d'Azur<br>([ˈbəʊljɜːsəˈmeə sə ˈtruːv], compare *Beaulieu-sur-mer a une villa* [ˈbəʊljɜːsəˈmeə**r** ɑː yn]) |

The examples in (36) show that in foreign words English speakers delete Rs in non-prevocalic positions. What is more, English speakers' pronunciation of foreign languages also show that R is *impossible* in exactly those positions in which it would be *impossible* to have them in native words (*habe* ends in a vowel just like *tuba* or *super*).

This evidence *does* support our analysis of R deletion. Or does it? Not really, because the same transfer evidence in (36) shows the complementary behaviour to the one observed in (32): it is the *same* data in a *different phonological environment* ((32) has the data in the pre-vocalic environment, (36) in the word-final and pre-consonantal environment). Look again at *milieu*, for example: if it is prevocalic, R will appear (*milieu* **R** *is*), if it is word-final or pre-consonantal, there is no R (*milieu* ~~**R**~~ *was*; *it's his milieu* ~~**R**~~). **Transfer evidence shows nothing of theoretic relevance**: it can be used to support both an R-deletion and an R-insertion analysis and as such is not decisive.

**The R-insertion and R-deletion analyses are each other's complementaries.** Both describe the same empirical data using different approaches and both approaches have their set of consequences. (Check questions in 5.4.7)

### 5.3.4 R-Deletion-only analysis: Pre-R Broadening again

The analysis in Section 5.3.3 is abstract in that it assumes UR segments that never appear in the SR (*beer* /biːr/ has an /iː/ that never appears as such in the SR). An abstract representation has the advantage of reducing the set of UR segments. Let us see if it is possible to reduce the number of lax vowels (37). Assume that there is no UR /ɑː/, but every SR [ɑː] is the result of Broadening of lax /æ/. So *car* is /kær/, *bra* is /brær/, *ask* is /ærsk/, *laugh* is /ˈlærf/, *harem* is /ˈhærrəm/ (with a geminate R).

(37) R-Deletion-only analysis for Broadening (simplified UR = fewer phonemes)

| | *car* | *bra* | *carrot* | *card* | *ask* | *harem* |
|---|---|---|---|---|---|---|
| *UR* | kær | bræ**r** | kærət | kæ**r**d | æ**r**sk | hæ**rr**əm |
| *Pre-R broad* | kɑːr | brɑːr | -- | kɑːrd | ɑːrsk | hɑːrrəm |
| **R-deletion** | kɑː | brɑː | -- | kɑːd | ɑːsk | hɑːrəm |
| *SR* | kɑː | brɑː | kærət | kɑːd | ɑːsk | hɑːrəm |

The analysis in (37) shows that it *is* possible to reduce the number of lax vowels: all broad-lax vowels are now derived from plain-lax ones. There is one negative aspect to this approach, as you will have worked out: there are **no alternations** that support an UR plain-lax vowel for *car*. The presence of R, however, is justified: there are R ~ zero alternations (*ca~* vs. *car is*). But in *card* there is no proof for either the lax vowel or the pre-consonantal R. In *harem* there is an UR geminate R (for which there is no empirical proof), the first member of which is deleted by the R-deletion rule.[8] Another drawback of this analysis is that the postulation of /æ/ in *car*, for example, is **arbitrary** (there is no proof from alternations for the /æ/ ~ /ɑː/ pair). Still, we can say that broad-lax /ɑː/ is qualitatively closest to plain-lax /æ/: both of them are lax, low and unrounded. The difference between them is that the former is back, the latter front. The members of the following pairs are also qualitatively close to each other: /ɒ/ – /ɔː/ (both are lax, back and rounded, the difference is that the former is low, the latter mid-low), /e/ – /ɜː/ (both are lax, non-back and mid-high). So, we can say that UR /kær/ for *car* comes phonologically closest to what we can set up for its UR. (Check questions in 5.4.8)

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### 5.3.5 R-deletion *and* R-insertion

There is a third possibility: some Rs are present in the underlying representation (linking Rs), while others are inserted (intrusive Rs). Such an analysis, involving both types of R, relies on evidence shown in (38).

(38) Alternation with and without R

| | | |
|---|---|---|
| Homer /ˈhəʊmə/ | ~ | Hom*e*ric /həˈmerɪk/ |
| doctor /ˈdɒktə/ | ~ | doct*o*ral /ˈdɒktərəl/ |
| danger /ˈdeɪndʒə/ | ~ | dang*e*rous /ˈdeɪndʒərəs/ |

[8] Note that Pre-R Broadening must be ordered before R-deletion to derive the right results. If R-deletion was to precede Pre-R Broadening, it would 'bleed' the rule of Pre-R Broadening producing forms like [kæ] for *car* or [kæd] for *card*. As this is not the case, this ordering of rules is called 'counter bleeding' (they are ordered in such a way as to prevent one rule from taking away the environment on which the other one(s) can work).

| | | | |
|---|---|---|---|
| | manor /ˈmænə/ | ~ | mano***r***ial /məˈnɔːriəl/ |
| | tutor /ˈtjuːtə/ | ~ | tuto***r***ial /tjuˈtɔːriəl/ |
| BUT | algebra /ˈældʒəbrə/ | ~ | algebraic /ˌældʒəˈbreɪɪk/, */ˌældʒəˈbrærɪk/ |
| | idea /aɪˈdɪə/ | ~ | ideal /aɪˈdɪəl/, */aɪˈdɪərəl/ |
| | bacteria /bækˈtɪərɪə/ | ~ | bacterial /bækˈtɪərɪəl/, */bækˈtɪərɪərəl/ |
| | larva /ˈlɑːvə/ | ~ | larval /ˈlɑːvəl/, */ˈlɑːvərəl/ |

The data in (38) all end in /ə/. However, some words have R before vowel initial '+' (or weak) boundary suffixes like *-ic*, *-ous*, *-(i)al* (*Homeric*), others do not (*prosaic*). One solution is to suppose that while *Homer* ends in R (/ˈhəʊmər/), *algebra* (/ˈældʒəbrə/) does not. *Algebra*, however, does have an R if a vowel-initial word follows: *algebra**/r/** and geometry*. The two different forms of *algebra* (*algebraic, algebra**/r/** is*) can only be explained if both R-insertion and R-deletion exist. R-deletion takes away Rs word-finally (*Home~~r~~*), while R-insertion inserts Rs before vowel-initial words (*algebra* R *is*). Of course, words with an underlying R keep their Rs if a vowel-initial word follows (*Home**r** is* with linking R), whereas words like *algebra* acquire one by insertion (*algebra* R *is*).

The first argument can be refuted by claiming that words like *algebraic* are not derived productively, but are stored in the lexicon as they stand. The data in (39) show that when *-ic* is added to a vowel-final word, it is impossible to predict which consonant will appear (if any). Sometimes even the word-final vowel(s) disappear(s). The unpredictable behaviour of the stem is also apparent with consonant final words: sometimes a vowel appears before the suffix.

(39) The unpredictable behaviour of stems before *-ic*

**'ia' lost:**

| | | | |
|---|---|---|---|
| phobia | /ˈfəʊbiə/ | ~ | phobic /ˈfəʊbɪk/ |
| encyclopaedia | /ɪnˌsaɪkləˈpiːdiə/ | ~ | encyclopaedic /ɪnˌsaɪkləˈpiːdɪk/ |

**'t' appears:**

| | | | |
|---|---|---|---|
| opera | /ˈɒpərə/ | ~ | operatic /ˌɒpəˈrætɪk/ |
| drama | /ˈdrɑːmə/ | ~ | dramatic /drəˈmætɪk/ |
| aroma | /əˈrəʊmə/ | ~ | aromatic /ˌærəˈmætɪk/ |

**'n' appears':**

| | | | |
|---|---|---|---|
| pharaoh | /ˈfeərəʊ/ | ~ | pharaonic /fəˈrɒnɪk/ |

**'a' appears':**

| | | | |
|---|---|---|---|
| prose | /ˈprəʊz/ | ~ | prosaic /prəˈzeɪɪk/ |

**No consonant before the suffix:**

| | | | |
|---|---|---|---|
| algebra | /ˈældʒəbrə/ | ~ | algebraic /ˌældʒəˈbreɪɪk/ |

**Stem final consonant exchanged with another:**

| | | | |
|---|---|---|---|
| chaos | /ˈkeɪɒs/ | ~ | chaotic /keɪˈɒtɪk/ |

**No consonantal change in stem:**

| | | | |
|---|---|---|---|
| gnome | /nəʊm/ | ~ | gnomic /ˈnəʊmɪk/ |
| scene | /siːn/ | ~ | scenic /ˈsiːnɪk/ |
| hero | /ˈhɪərəʊ/ | ~ | heroic /hɪˈrəʊɪk/ |

The data show that the behaviour of stems before *-ic* is so unpredictable that it is safe to say that these words are not produced on the fly, but are stored individually in the lexicon (i.e. *algebraic* is not derived from *algebra*). If this is so, they do not belong to phonology but to morphology, and so the argument for intrusive R based on *algebra* is no longer solid.

Is there is any convincing proof for an analysis that has both R-deletion and R-insertion? Some evidence for this comes from 'quasi' and 'true' broken-tense vowels. A reminder is given in (40).

(40) 'Quasi broken' vs. 'true' broken vowels

| | BROKEN VOWELS | |
|---|---|---|
| | 'QUASI' | 'TRUE' |
| | /pleə/, /mjuˈzɪəm/, /aɪˈdɪə/ | /keə/, /bɪəd/, /bɪə/ |
| BI-SYLLABIC PRONUN. | /pleɪə/, /mjuˈziːəm/, /aɪˈdiːə/ | */ keɪə/, */biːəd/, */biːə/ |
| MONOPHTHONGISATION | */plɛː/, */mjuˈzɪːm/, */aɪˈdɪː/ | /kɛː/, /bɪːd/, /bɪː/ |
| | *player, museum, idea* | *care, beard, beer* |

We have seen that 'quasi' broken vowels behave differently from 'true' broken vowels. As they behave differently in the SR they should receive a different UR: the vowel at the end of *idea* cannot be identical to the one in *beer* (although they may optionally become identical after the application of the Smoothing rule). Let us see how this can be represented (41).

(41) Both R-deletion and R-insertion

| | *bee* | *beer* | *beer is* | *idea* | *idea is* | *China* | *China is* | *museum* |
|---|---|---|---|---|---|---|---|---|
| *UR* | biː | biːr | biːrɪz | aɪˈdiːə̲ | aɪˈdiːə̲ɪz | tʃaɪnə̲ | tʃaɪnə̲ɪz | mjuˈziːə̲m |
| *Pre-R Breaking* | -- | bɪər | bɪərɪz | -- | -- | -- | -- | -- |
| *Smoothing (optional)* | -- | -- | -- | --/aɪˈdɪə | --/aɪˈdɪəɪz | -- | -- | --/ mjuˈzɪəm |
| **R-deletion** | -- | bɪə | -- | -- | -- | -- | -- | -- |
| **R-insertion** | -- | -- | -- | -- | aɪˈdiːərɪz/aɪˈdɪərɪz | -- | tʃaɪnərɪz | -- |
| *SR* | biː | bɪə | bɪərɪz | aɪˈdiːə/aɪˈdɪə | aɪˈdiːərɪz/aɪˈdɪərɪz | tʃaɪnə | tʃaɪnərɪz | mjuˈziːəm / mjuˈzɪəm |

(41) shows some of the assumptions we have discussed in the previous sections and take now for granted (e.g. the idea that broken-tense vowels are derived from plain-tense ones). The problem we should be focussing on is the representation of the schwa in, for example, *idea* and *China*. As *idea* shows 'quasi' broken vowels can be represented as a sequence of a plain-tense vowel plus a schwa. Whereas 'true' broken-tense vowels can be derived from plain-tense ones followed by R (see *beer*), the same cannot be said for a schwa. There is no evidence that a schwa can be derived from any *plain-tense vowel plus R sequence* (there are no schwa ~ tense vowel alternations to support such an analysis). If a schwa cannot be derived from a plain-tense vowel + R then we have little justification for assuming */aɪˈdiːeɪr/, for example, as an UR for *idea*. If this is so, then the R that appears after a schwa in pre-vocalic position in *idea* R *is* or *China* R *is*, for example, must be accounted for with an R-insertion Rule (as done in (41)). The consequences are obvious: we now have two R-related rules: an insertion and a deletion rule. We also have schwa as a phoneme in the UR (in the examples we have looked at so

far, some schwas appeared only after Pre-R Breaking has applied, see *beer* above). We must conclude that other schwas must be underlying (as the one in *idea*).

The analysis has reduced the number of UR phonemes (there are no broken-tense vowels), but it now has an enlarged rule component. This is no problem in itself. The problem lies in the fact that we have no alternations in support of some of our UR phonemes (*beer* always has a broken-tense vowel in the SR). The other problem is that the R-insertion Rule has only been set up on the basis of 'quasi' broken vowels: it has no further use apart from the explanation of the data on the basis of which it has been set up, which makes the argument circular. The 'machine' works, no doubt about it, but we are not sure whether it describes the 'truth', i.e. whether it is an accurate description of what actually takes place, i.e. of native speaker competence (see Chapter 2 in which it is claimed that a phonological analysis should describe the 'truth' behind a process as much as it is possible to access it with phonological means).

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### 5.3.6 R-insertion only

Let us give the final word on the issues raised by R by imposing a very strict constraint on the structure of the UR: we will assume that **only alternating segments** can be made to appear/disappear with the help of a rule. This gives (42).

(42) R-insertion only

| | *bee* | *beer* | *beer is* | *idea* | *idea is* | *China* | *China is* | *car* |
|---|---|---|---|---|---|---|---|---|
| *UR* | biː | bɪə | bɪəɪz | aɪˈdɪə | aɪˈdɪəɪz | tʃaɪnə | tʃaɪnəɪz | kɑː |
| **R-insertion** | -- | -- | bɪərɪz | -- | aɪˈdɪərɪz | -- | tʃaɪnərɪz | -- |
| *SR* | biː | bɪə | bɪərɪz | aɪˈdɪə | aɪˈdɪərɪz | tʃaɪnə | tʃaɪnərɪz | kɑː |

(42) shows an analysis that remains close to the surface: **only alternating Rs can disappear/appear**. This is achieved by an R-insertion Rule. This also means that R has no influence on the vowel preceding it, which makes the rules of **Pre-R Breaking and Pre-R Broadening** unnecessary. This in turn means that plain-tense and broken-tense, as well as plain-lax and broad-lax, vowels are underlying (non-derived): there is an UR opposition between /iː/ vs. /ɪə/, as well as between /æ/ vs. /ɑː/. **The set of UR phonemes has been enlarged, but now the rule component is less intricate** (the SR is closer to the UR). We only have one R-related rule: R-insertion. The analysis has another consequence: R now has a defective UR distribution (it only appears pre-vocalically, as in *bread, very* or *red*).

No analysis is perfect, but then perfection depends on one's assumptions on what shape an analysis should take. The table in (43) contains some additional data.

(43) R-insertion only analysis

| | *bee* | *beer* | *idea* | *idea is* | *beard* | *car* | *bad* | *car is* | *harem* | *carrot* | *Shah* | *Shah is* | *card* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *UR* | biː | bɪə | aɪˈdɪə | aɪˈdɪəɪz | bɪəd | kɑː | bæd | kɑːɪz | hɑːrəm | kærət | ʃɑː | ʃɑːɪz | kɑːd |
| **R-insertion** | -- | -- | -- | aɪˈdɪərɪz | -- | -- | -- | kɑːrɪz | -- | -- | -- | ʃɑːrɪz | -- |
| *SR* | biː | bɪə | aɪˈdɪə | aɪˈdɪərɪz | bɪəd | kɑː | bæd | kɑːrɪz | hɑːrəm | kærət | ʃɑː | ʃɑːrɪz | kɑːd |

Consequences (summary):

(i) R occurs only in _V (*very, red*),

(ii) UR opposition between plain-tense vs. broken-tense, and plain-lax vs. broad-lax vowels (no Pre-R Breaking/Broadening),

(iii) analysis remains close to the surface (only alternating Rs can disappear/appear),

(iv) only one R-related rule is needed (R-insertion)

### 5.3.7 R as a hiatus filler

There is yet another possibility. We can analyse R as a hiatus filler that is not supplied by a rule, but rather as an element that is always present in the phonological 'material'. In English the distribution of hiatus fillers is as follows: [j] after a high front vowel and [w] after a high back vowel. The third class of vowels involves the non-high vowels. It is exactly in this environment that R appears (44).

(44) Hiatus fillers in SSBE

- [j] after a high front vowel (/i/ or /ɪ/):
  *see* [j] *it*, *pay* [j] *us*, *buy* [j] *another*, *a boy* [j] *and a girl*
- [w] after a high back vowel (/u/ or /ʊ/):
  *two* [w] *evenings*, *follow* [w] *Anne*, *a cow* [w] *and a bull*
- [r] after non-high vowels (/ɑː/, /ɔː/, /ɜː/ and /ə/):
  *car* [r] *insurance*, *spa* [r] *is*, *gnaw* [r] *on the bone*, *a sore* [r] *ankle*, *spur* [r] *of the moment*, *milieu* [r] *of…*, *meander* [r] *along*, *Panama* [r] *on the map*

The first two hiatus fillers can be called I-glide and U-glide hiatus fillers. They are not specified in the UR: *cow* is /kaʊ/, not */kaʊw/, and similarly *see* is /siː/, not */siːj/. They are supplied from the representation ('material') of the various vowels.

Let us call the third glide A-glide: this hiatus filer is pronounced /r/. Like the other two, this glide is not specified in the lexicon, but is supplied from the phonological material. Just to be emphatic, this analysis assumes that word-final spelt Rs show nothing of relevance: *beer* behaves like *idea*. The same applies *follow* vs. *two*: both have an U-glide (*follow* [w] *it*, *two* [w] *evenings*). The parallel behaviour of [j], [w] and [r] as hiatus fillers makes us conclude that R is a hiatus filler. While there is no glide in *see them*, *follow them* and *fear them*, there is one in *see it, follow it* and *fear it*.

A number of problems should be mentioned. **First**, there is nothing in the phonetic characterisation of the non-high vowels (/ɑː/, /ɔː/, /ɜː/ and /ə/) that anticipates the appearance of [r] when before a vowel-initial word. If anything, one would expect [w] after /ɔː/: *law* [w] *is*. While [j] and [w] can be claimed to be the non-syllabic pronunciation of the high vowels /i/ and /u/, the same cannot be said about the non-high vowels and [r]. Also, there is no R in the phonological representation of the non-high vowels (compare it with, for example, /eɪ/ which does contain a front high vowel in the UR). While /j/ and /w/ are generally known as glides, the only grounds on which R can also be called a glide is its parallel behaviour with the rest of the glides as hiatus fillers. Strictly speaking, **it does not follow that R is also a glide**. If the intrusive consonant after the non-high vowels were /p/, for example, it could not be called a glide. In that case, we would say that hiatus is resolved with the two glides [j] and [w] and a consonant that is specified lexically (or, alternatively, inserted by a rule).

**Second**, while many non-rhotic dialects have developed linking/intrusive R, rhotic dialects do not have intrusive R (but they do have [j] and [w] as hiatus fillers). This is shown in (45).

(45) Hiatus fillers in GA
(a) I-glide, U-glide fillers
*see it*: siːjɪt, siːʔɪt
*cow is*: kaʊwɪz, kaʊʔɪz

(b) No R-glide filler

*law is*: lɑːɪz, lɑːʔɪz, *lɑːrɪz

*milieu is*: miˈljɜːɪz, miˈljɜːʔɪz, *ˈmɪljɜːrɪz

*China is*: tʃaɪnəɪz, tʃaɪnəʔɪz, *tʃaɪnərɪz

(44) shows that in GA the only hiatus fillers are the two glides (or the glottal stop). After non-high vowels there is either no hiatus filler or the hiatus is filled by a glottal stop. The crucial point, however, is that R does *not* appear as a hiatus filler. This seems to be true for all rhotic dialects. If [r] were present phonologically in the non-high vowels, we should expect it to behave like [j] and [w]. This, however, is not the case (*[tʃaɪnərɪz] in GA). This shows that the status of R as a glide is questionable. Of course, R appears in, for example, *lore is* [lorɪz], but this does not prove that R is a hiatus filler as *lore* has a word-final R in isolation (/lor/) in a rhotic dialect like GA. If R as a glide was such a natural process of resolving hiatus (as it does seem to be the case with I-glide and U-glide), we should be able to find at least some rhotic dialects with such a process. Such dialects, however, do not seem to be on record, which must be more than just a coincidence.

Another problematic aspect of the R-as-glide analysis comes from data involving the monophthongisation of diphthongs whose second part does not end in schwa in SSBE (see (46)).

(46) Monophthongisation of some of the non-schwa ending diphthongs in SSBE (/aɪ/, /əʊ/, /aʊ/)

*fire*: faɪə > faːə~ *faːrə

*going*: gəʊɪŋ > gɜːɪŋ ~ *gɜːrɪŋ

*so early*: səʊɜːli > sɜːɜːli ~ *sɜːrɜːli

*towering*: taʊərɪŋ > taːərɪŋ ~ *taːrərɪŋ

The data above show the resulting monophthongs from non-schwa ending diphthongs: they are some of the non-high vowels (/aː/, /ɜː/). The hiatus, however, cannot be filled with R. If filling a hiatus after a non-high vowel were a process that depended on the features of the preceding vowel (as in the case of the high vowels), we would expect R in this position. The reason for the absence of R may simply be that words like *go* and *so* have no underlying R (/səʊ/, rather than */səʊr/). Their monophthongised forms continue the 'R-less' representation (/sɜː/) and thus no R can appear in hiatus (*[sɜːrɜːli]). This means that R as a hiatus filler cannot be supplied from the representation of the preceding vowel. It follows that R as a hiatus filler must either be specified in the underlying representation (as in the R-deletion analysis) or inserted by a rule (R-insertion analysis).

However, two arguments still speak in favour of Rs being a glide: first, its manner of articulation is approximant, just like that of [j] and [w]. Second, historically it has coalesced with the preceding vowel into a constituent (known as Breaking and Broadening). The same *vowel-glide* coalescence has happened in the case of /j/ and /w/ (*day* /eɪ/, *cow* /kaʊ/). See Chapter on Features and Syllable as to why we analyse the diphthong of *day* as /eɪ/ rather than /ej/ although it is phonetically [ej].

It seems that all analyses highlight certain aspects of linking/intrusive R, but no analysis is capable of accounting for all aspects of the problem.

Before we leave off, a reminder about the classification of non-rhotic dialects is given in (47).

(47) Classification of non-rhotic dialects with respect to the appearance of word-final R

| R | | DIALECTS |
|---|---|---|
| LINKING | INTRUSIVE | |
| ✓ | ✓ | e.g. SSBE |
| × | × | e.g. Southern US English |
| ✓ | × | e.g. South African English<br>very conservative RP (?) |
| × | ✓ | NEVER |

Non-rhotic dialects either extend R to all possible environments (as in SSBE), drop it altogether, i.e. decide to extend the R-less forms to all possible environment (as in some dialects of Southern US English). Some dialects preserve the original (historical) situation and have linking R only. It seems, however, that there are no dialects on record that have intrusive, but no linking R.

---

### 5.3.8 Comparative table of the various R-related analyses

| Analysis | Distribution of R | R-insertion or R-deletion | Opposition between *tense* vowels | Opposition between *lax* vowels | UR for *bee, beer, cat, card, car, spa, ask, laugh, harem* |
|---|---|---|---|---|---|
| Spelling-based | anywhere | | no (only plain tense vowels, which are broken before <r>) | • **no**: before <r>{C, #}<br>• **yes**: before C ≠ <r><br>*(broad, water vs. brad, otter)* | |
| R-Insertion-only (5.3.1, 5.3.6) | __V | insertion | /iː/ ↔ /ɪə/ | /æ/ ↔ /ɑː/ | /biː/, /bɪə/, /kæt/, /kɑːd/, /kɑː/, /spɑː/ /ɑːsk/, /lɑːf/, /ˈhɑːrəm/ |
| R-Deletion-only w/o R-influence (5.3.2) | __V<br>__# | deletion | /iː/ ↔ /ɪə/ | /æ/ ↔ /ɑː/ | /biː/, /bɪər/, /kæt/, /kɑːd/, /kɑːr/, /spɑːr/ /ɑːsk/, /lɑːf/, /ˈhɑːrəm/ |
| R-Deletion-only w/ R-influence (5.3.3) | anywhere | deletion | no | no | /biː/, /biːr/, /kæt/, /kærd/, /kær/, /spær/ /ærsk/, /lærf/, /ˈhærrəm/ |

## *5.4 Check Questions*

### 5.4.1 (for 5.2.1)

1) In what way are the vocalic contrasts in (2a) 'traditional'?
2) What do we mean by 'raw data'?
3) What does an analysis always involve?
4) What does the spelling-based explanation say about the distribution of plain-lax and broad-lax vowels? What is problematic about this approach?

### 5.4.2 (for 5.2.2)

5) When do we say that surface [X] can be derived from underlying /Y/?
6) Why are alternations important and what do they show?
7) What are the traditional pairs of plain-lax ~ broad-lax vowels?
8) In reality, what sets of alternations do we have for the lax vowels? What do we mean by 'there are broad-lax vowels that are not the result of Broadening'?
9) Explain recoverable/unrecoverable R.
10) What do we mean by 'R is a diacritic mark'?
11) In which environment are plain and broad-lax vowels in complementary distribution?
12) In which environment are they in parallel (contrastive) distribution? Make sure you can always interpret an environment, e.g. __R+V, which means 'a given segment before an R followed by a weak morphological boundary ('+'), which is in turn followed by a vowel.
13) Which broad-lax vowel is not found in the environment __RV?
14) When do we say that a rule can be set up?
15) Explain the difference between 'lexical knowledge' and 'phonologically predictable'?
16) Which R-deletion rule can be set up based on surface alternations?

### 5.4.3 (for 5.2.3)

17) Why is it 'not good' to have rules that handle only a handful of examples?
18) What do we mean by 'broad vowels are not derived from lax vowels'? What impact does this have on lexical representations and the rule component?
19) In what way does an analysis always have its consequences? What do we mean by this?

### 5.4.4 (for 5.2.4 and 5.2.5)

20) What are the differences between the distribution of lax and tense vowels?

21) Which class of tense vowels is not found before R?
22) Which rules can be set up for the broken-tense vowels?
23) Explain ‘stable’ vs. ‘alternating’ R.
24) Are there plain-tense–broken-tense vowels alternations in the same stem? What kind of alternations do we get? Are there plain-tense ~ broken-tense vowel pairs? How do we establish these pairs? Give a list and discuss.

### 5.4.5 (for 5.3.1)

25) What does the Insertion-only analysis claim?
26) After which vowels is there R-insertion?
27) What is inserted R? Is there /j/ or /w/ insertion?

### 5.4.6 (for 5.3.2)

28) Explain the problems the Deletion-only analysis (Approach 1) faces from the point of view of underlying allophones.
29) In this analysis where can broken-tense vowels only be found?

### 5.4.7 (for 5.3.3)

30) In the Deletion-only analysis (Approach 2), where does R occur? What do we mean by ‘R has no defective distribution’?
31) Are there UR broken-tense vowels? And broad-lax vowels?
32) What are the pros and cons of this analysis?
33) What is transfer evidence?
34) What do we mean by ‘The R-insertion and R-deletion analyses are each other’s complementaries’?

### 5.4.8 (for 5.3.4)

35) Why do we need UR geminate R in explaining *harem*?
36) What are the pros and cons of the Deletion-only analysis for Broadening?
37) Why can we say that *card* [kɑːd] is UR /kærd/, rather than /kʊrd/?

# Chapter 6

# WORD STRESS

Miklós Törkenczy

## Contents

## 6.1 Introduction: word stress

This chapter is about stress assignment in words, i.e. about the location of stress(es) in words when they occur in isolation (what happens to these stresses when words are combined into sentences is discussed in Chapter 7).

Stress is a *suprasegmental* feature. Unlike the features discussed in Chapter 3, it is not realised on a single segment, but it extends over more than one segment: it is associated with a syllable.

Stress is not an absolute property: it is the *relative* prominence of syllables. In contrast to features like [voice] or [coronal], whose value is determinable independently of the environment of the segment, it is not possible to tell whether a particular syllable is stressed or unstressed without comparing it to other (neighbouring) syllables.

Notation: *primary stress* is indicated by an acute accent on top of a vowel letter in spelling, e.g. *átom*, and the phonetic symbol / ˈ/ before the first segment of a syllable in transcription, e.g. /ˈætəm/; *secondary stress* is indicated by a grave accent on top of a vowel letter in spelling, e.g. the first syllable of *àtomístic*, and the phonetic symbol /ˌ/ before the first segment of a syllable in transcription, e.g. the first syllable of /ˌætəˈmɪstɪk/.

*Metrification* means determining where the stresses are in a word. For example, the word *cigarette* is metrified as *cìgarétte* /ˌsɪgəˈret/.

### 6.1.1 Weight sensitivity

In some languages metrification is influenced by the *weight* of the syllables that make up a word. These languages are weight-sensitive: they distinguish heavy (H) and light (L) syllables (see 4.5.1). In these languages heavy syllables tend to attract stress. English is a *weight-sensitive* language. Hungarian is weight-insensitive because in Hungarian, a word-initial syllable of any weight is stressed regardless of the weight of any other syllable of the word.

### 6.1.2 The domain of metrification

In English, certain parts of the word are systematically excluded when the stresses are determined. These portions of the word (a) do not get stress and (b) do not count for the placement of stress. This means that metrification is restricted to a *domain* which is smaller than

the word. Thus, the domain of metrification is the portion of the word within which stress(es) can occur and which may influence the placement of stress.

Some parts of the word may be outside the domain of metrification for *morphological* reasons. English strong boundary affixes belong here (see 6.3.1.4.1); e.g. the suffix *-ing* is never stressed and never changes the place of the stresses of the stem to which it is added (compare *èxcommúnicate* with *èxcommúnicating*). Notation: strong boundary affixes are separated from the stem by a number sign # in spelling and transcription, e.g. *#excommunicat#ing#* (the same symbol # also appears at the beginning and the end of a word).

Some parts of the word may be outside the domain of metrification for *phonological* reasons. These may be segments or syllables at the edges of words. Such phonological material is called *extrametrical* (for extrametricality in English see 6.3.1.1). Extrametrical parts of the word do not get stress and do not count for the placement of stress. Notation: extrametrical material appears in angled brackets < > in spelling and transcription, e.g. *ani<mal>*.

In what follows we discuss the stress patterns of English words, focussing on two issues: the degrees of stress and the predictability of stress(es). In the discussion we often have to refer to specific syllables of a word. We will call

(i) the last syllable of the word (the ultimate syllable) the ***ult***,
(ii) the second-last syllable (the penultimate syllable) the ***penult*** and
(iii) the third-last syllable (the antepenultimate syllable) the ***antepenult***.

We will use the terms ult, penult and antepenult to refer to the actual syllables occurring in the phonetic form of a word, i.e. regardless whether the final syllable is analysed as extrametrical or not. For example, the underlined syllables of the words *melon* /ˈmɛlən/ and *balloon* /bəˈluːn/ are the ultimate syllables of these words although the last syllable is extrametrical in the former, but not in the latter *me<lon>* vs. *balloon* (see 6.3.1.1 and 6.3.1.2).

## 6.2 Degrees of English stress: how many?

As opposed to Hungarian, where there is only one stress in every word, a long(er) English word may have more than one prominent syllable, e.g. *CIgaRETTE*, *ExcoMUniCATE*, *CIRcumNAviGAtion*, etc. However, these relatively more prominent syllables are not necessarily felt equally prominent. We can illustrate this with columns of stars (where the numbers of stars correspond to levels of relative prominence within the word):

(1)

```
                    *                    *
        *   *       *            *   *   *
    *   *   *       *    *       *   *   *
    * * * * * *     * * * * *    * * * * * *
  ˌsɪgəˈret     ˌekskəˈmjuːnɪkeɪt     ˌsɜːkəmˌnævɪˈgeɪʃən
```

Most analyses would agree that the last syllable of *excommunicate* is more stressed than the second and the fourth syllables, but less stressed than the first, and the first is less stressed than the third, which is the strongest stress in the word.[1] Given this, the question is how many degrees of stress must be distinguished in English *phonologically*?

The traditional answer is that four degrees of stress are needed to describe the stress patterns in words and these degrees are distinguished by a combination of factors: (i) the loudness of the syllable, (ii) the pitch change occurring on the syllable, and (iii) the vowel quality of its nucleus. This is shown in (2):

(2) Stress degrees

| | 1 | 2 | 3 | 0 |
|---|---|---|---|---|
| pitch change | + | – | – | – |
| loudness | + | + | – | – |
| full vowel | + | + | + | – |

*Cìgarétte* /ˌsɪgəˈret/ and *cìrcumnàvigátion* /ˌsɜːkəmˌnævɪˈgeɪʃən/ have the stress patterns 2 0 1

[1]Note that in this form, the star notation does not allow comparison of relative prominence *across* words. The third syllable of *cigarette* is not less prominent (less stressed) than the third syllable of *excommunicate*.

and 2 0 2 0 1 0, respectively, and the word *èxcommúnicate* /ˌekskəˈmjuːnɪkeɪt/ 2 0 1 0 3, exemplifies all four degrees of stress: primary (1ry), secondary (2ry), tertiary (3ry) and zero (0).

As can be seen in (2), 1ry stress (the 'main' stress of the word) is distinguished from 2ry stress(es) by pitch change: when we say the word in isolation, a 1ry stressed syllable (also called the 'tonic' syllable) is associated with a change in pitch (of any direction) while a 2ry stressed syllable is not. 1ry stress and 2ry stress, called the *major stresses* (which I will abbreviate as 'M'), are distinguished from 3ry stress and zero stress, called the *minor stresses* (which I will abbreviate as 'm'), by loudness (i.e. rhythmic prominence): the former are relatively loud compared to the latter. 0 stress is distinguished from all the others by vowel quality: only reduced vowels can occur in a zero stressed syllable. In English (as opposed to Hungarian) only a restricted set of vowels (ə, i, u, ɪ, (j)ʊ) can occur in a zero stressed syllable[2] – otherwise the syllable must have a full vowel (this is called the rule of Vowel Reduction).

Even if we accept that all four degrees are distinguishable *phonetically*, it is not obvious that all of them are *necessary* phonologically. Indeed, there are analyses that only distinguish two degrees of word stress: stressed and unstressed.

### 6.2.1 1ry stress vs. 2ry stress

The difference between 1ry stress and 2ry stress can be shown to be a sentence/phrase level distinction rather than a word-level one. If we say a word in isolation, we say it as a sentence, with the appropriate tone on the tonic syllable of the sentence (e.g. falling if it is a statement). If the same word occurs in a sentence consisting of more than one word, it may occur in such a position that pitch change does not occur on any of its syllables, therefore the place of 1ry stress in a word is the place of *potential* pitch change:

[2]Syllabic nasals and liquids can also occur as the nuclei of 0 stressed syllables, e.g. the second syllable of *written* [ˈrɪtn̩]. We ignore this here for the sake of simplicity.

(3) 2 1

Cigarette.

2 2 2 2 1

I quit smoking cigarettes for good.

This means that at the word level, phonologically, we only need to know the location of major stresses because the difference between the two kinds of major stresses, the actual place of pitch change (the 1ry stressed syllable) is determined at sentence/phrase level. The location of the 1ry stressed syllable is predictable: in a neutral sentence it is the rightmost major-stressed syllable (see Chapter 7 on sentence stress). Since we are looking at isolated words here, all we need to know is the location of major stresses – the rightmost one will be the potential bearer of pitch change in a sentence, i.e. the rightmost one is the 1ry stress. For ease of reference, we will continue to use the terms 1ry and 2ry stress as shorthand for rightmost and non-rightmost major stress in a word, respectively.

### 6.2.2 3ry stress vs. other stresses

If we want to find out whether 3ry stress is phonologically different from the other stresses (major stresses and zero stress), we have to find phonological regularities that treat them differently, i.e. we must demonstrate that 3ry stress patterns differently from the major stresses on the one hand, and zero stress on the other.

Notation: 3ry stress is unindicated in spelling and transcription by any special phonetic symbol. A 3ry stressed syllable is one that has a full vowel but bears no stress mark.

#### 6.2.2.1 3ry stress vs. major stress(es)

In isolated words, 3ry stressed syllables can be found (i) immediately preceding major-stressed syllables,(ii) word-medially after a major stress and (iii) in word-final position.

(4) i. tormént /tɔːˈment/, còndensátion /ˌkɒndenˈseɪʃən/

ii. órgasm /ˈɔːgæzəm/, còndensátion /ˌkɒndenˈseɪʃən/

iii. róbot /ˈroubɒt/, séparate$_V$ /ˈsepəreɪt/

In some positions 3ry stress is in complementary distribution with 2ry stress. (i) 3ry stress never occurs on the second syllable preceding a major stress (where major stresses do) and (ii) 3ry stress can occur after the last major stress in the word, i.e. the 1ry (where by definition a major stress cannot). This is exemplified in (5i, ii) and summarised in a table in (5iii).

(5) i. àcadémic /ˌækəˈdemɪk/, cìrcumnàvigátion /ˌsɜːkəmˌnævɪˈgeɪʃən/[3]

ii. róbot /ˈroubɒt/, séparate$_V$ /ˈsepəreɪt/

iii.

| | position | |
|---|---|---|
| | 2 σ before 1ry stress | after 1ry stress |
| 2ry (=major) stress | ***à**cadémic* | – |
| 3ry stress | – | ró**bot** |

A position in which a 3ry stress and a major stress seem to contrast is word-initial position preceding a major stress ( # _ M ) because they are treated differently by the Rhythm Rule. The Rhythm Rule[4] (also called Rhythmic Stress Deletion/Shift or Iambic Reversal) is an optional postlexical[5] rule that can downgrade a major stress for rhythmic reasons if in the sentence it occurs 'too close' to other major stresses. The downgraded syllable retains its full vowel. The word *èverlásting* (2 0 1 0) has two major stresses, but the second one can be downgraded to 3ry stress by the Rhythm Rule in a sentence like *She shivered in the everlasting rain* because it

[3]The third syllable of *cìrcumnàvigátion* can lose its major stress but not its full vowel (*cìrcumnavigátion*) as a result of the Rhythm Rule, see below and Chapter 7.

[4]See Chapter 7

[5]See Chapter 8

occurs between two major stresses that are close.[6]

(6) 2 2 2 1 2 2 3 1
She shivered in the everlasting rain → She shivered in the everlasting rain

As a result, the prominence relations of *èverlásting* , whose third syllable is more prominent than the first in isolation and in some sentences (*The rain is everlasting.*), are reversed by the Rhythm Rule: *èverlasting*, as in (6).

This cannot happen to a word like *Octóber*, which looks very similar superficially, having a full-vowelled syllable followed by a more prominent full-vowelled syllable /ɒkˈtoʊbə/. If we put this word in a shifting context where the Rhythm Rule could apply, we find that the rule does not apply and the prominence relations do not change. The second syllable always remains more prominent that the first. We can explain this by claiming that this is due to a difference in stress: the first syllable of *everlasting* has 2ry stress, but the first syllable of *October* has 3ry stress. A major stress can be downgraded to 3ry stress by the Rhythm Rule, but a minor stress (like 3ry stress) cannot be upgraded to become a major stress for rhythmic reasons.

(7) 2 3 2 1 2 2 3 1
She shivered in the October rain → *She shivered in the October rain.
/ɒkˈtoʊbə/ */ˈɒktoʊbə/

This means that there *is* a regularity that treats these two types of stresses differently, so they have to be distinguished: 3ry stress exists as a separate stress-degree.

A full-vowelled syllable that is two syllables before a major stress can always undergo the Rhythm Rule, i.e. behaves like a major stress (in accordance with (5iii) above), but a full-vowelled syllable that immediately precedes a major-stressed syllable can behave in two ways. Some words (8i) undergo the Rhythm Rule, others do not (8ii):

[6]Defining what counts as close enough is a complicated and interesting question we will not discuss here.

(8) i. sàrdíne ˌsɑːˈdiːn → sàrdine sándwich ˌsɑːdiːn ˈsænwɪdʒ

ii. Octóber ɒkˈtoʊbə → Octòber ráin ɒkˌtoʊbə ˈreɪn

iii.

| | position | | |
|---|---|---|---|
| | 2 σ before 1ry stress | after 1ry stress | 1 σ before 1ry stress |
| 2ry (=major) stress | **à**académic | – | sàrdíne |
| 3ry stress | – | ró**bot** | Octóber |

In this position then 3ry stress and a major stress appear in contrast: the first syllable of *Octóber* ( # 3 1 0 ) seems to have 3ry stress and the first syllable of *sardíne* ( # 2 1 ) seems to have major stress (8iii). However, even this position of potential contrast (# _ M ) disappears if we consider the larger environment within the word. All words in which there is a full-vowelled syllable (F) followed by a major stress and are *bisyllabic* ( # F M #) seem to behave like *sardine* and undergo the Rhythm Rule (9i); and all trisyllabic words in which a completely unstressed syllable follows the major stress ( # F M 0 # ) seem to behave like *October* and fail to undergo the Rhythm Rule (9ii):

(9) i. Two-syllable words # F M #

| | | | |
|---|---|---|---|
| sàrdíne | ˌsɑːˈdiːn | sàrdine sándwich | ˌsɑːdiːn ˈsænwɪdʒ |
| dìréct | ˌdaɪˈrekt | dìrect débit | ˌdaɪrekt ˈdebɪt |
| Bàhréin | ˌbɑːˈreɪn | Bàhrein Ísland | ˌbɑːreɪn ˈaɪlənd |
| cartóon | ˌkɑːˈtuːn | càrtoon nétwork | ˌkɑːtuːn ˈnetwɜːk |

ii. Three-syllable words # F M 0 #

| | | | |
|---|---|---|---|
| Octóber | ɒkˈtoʊbə | Octòber ráin | ɒkˌtoʊbə ˈreɪn |
| Titánic | taɪˈtænɪk | Titànic's bánd | taɪˌtænɪks ˈbænd |
| salvátion | sælˈveɪʃən | Salvàtion Ármy | sælˌveɪʃən ˈɑːmi |
| Montána | mɒnˈtænə | Montàna béar | mɒnˌtænə ˈbeə |

Given this regularity, the Rhythm Rule provides no argument for distinguishing 3ry stress from

major stress. There is no need to say that words like (9i) are different from those in (9ii) ***because*** their initial syllables have different stress (major in the former, minor in the latter) since we can distinguish them with reference to their syllabic structure ( # F M # vs. # F M 0 # ) and say that the Rhythm Rule does not apply in the latter because of the syllabic environment. Then, we could maintain that both groups have the same kind of stress, i.e. 2ry stress, in their first syllable.

There are other rules too that group 3ry stress together with major stresses in English. One of them is the phonotactic constraint that restricts [h] to word-initial position and to a position before a full vowel. As can be seen in (13), it makes no difference if this full vowel occurs in a major-stressed syllable or in a . 3ry stressed one:

(10) The distribution of /h/

| | /h/ pronounced | | | | /h/ not allowed | | |
|---|---|---|---|---|---|---|---|
| before a σ with _ stress | 1ry | 2ry | 3ry | any | 0 | any | |
| position | any | | | # _ | | _ C | _ # |
| | a.**h**éad<br>ə'**h**ed | appre.**h**ènsibility<br>ˌæprɪˌ**h**ensɪ'bɪləti | Só.**h**o<br>'soʊ**h**oʊ | **h**elló<br>**h**ə'loʊ | Gra**ħ**am<br>greɪəm | Jo**ħ**n<br>dʒɒn | Sha**ħ**<br>ʃɑː |

These arguments suggest that the traditional distinction between 3ry stress and major stresses is *phonologically* questionable.

### 6.2.2.2 3ry stress vs. zero stress

The difference between a 3ry stressed syllable and a zero stressed syllable is that the former contains a full vowel while the latter contains a reduced one. This seems a neat distinction, but unfortunately, in addition to the vowels that only occur in unstressed syllables /ə, i, u/, there are vowels that can occur in both unstressed syllables and under major stress /ɪ, (j)ʊ/, i.e. there is an overlap between full and reduced vowels:

| (11) | full V | reduced V | |
|---|---|---|---|
| ə | – | machíne | məˈʃiːn |
| ʊ | búsh ˈbʊʃ | ámulet | ˈæmjʊlət |
| ɪ | kiss ˈkɪs | áttic | ˈætɪk |

In some cases (e.g. *áttic*) this makes it impossible to tell if a syllable has 3ry stress or zero stress – so there is no difference. These syllables are indeterminate between 3ry and zero stress, as there is no contrast between them, we can safely (and arbitrarily) consider them unstressed.

There seem to be no rules of English phonology that consistently group 3ry stress with 0 stress.

## 6.3 The predictability of stress in English words

As opposed to a language like Hungarian, which has *fixed* stress (always on the first syllable of a word), English stress is *free* in that stress can be on any syllable of the word.

There are two conflicting views about English stress. One view, the *'no-pattern view'* maintains that there is no stress *pattern* in English, i.e. English stress is not predictable. According to the other view, the *'pattern-with-exceptions view'*, there *is* a very intricate pattern (with many rules and exceptions).

### The 'no-pattern view'

According to proponents of the no-pattern view no rules that are sufficiently general can be formulated about the place of word stress, therefore English word stress is *lexical*, it has to be memorised for every word by native speakers.

There are some regularities, e.g. 1ry stress has to fall on one of the last three syllables of an English word, i.e. within 'the final three-syllable window', but the place of stress is unpredictable within the limits of these regularities.

Take syllable weight as an example. English stress is often claimed to be weight-sensitive, i.e. the weight of the syllables influences the place of 1ry stress. The proponents of the no-pattern

view would argue that this is not true because it can be shown that within the final three-syllable window, a syllable of *any* weight in *any* position (ultimate: σσ**σ**#, penultimate: σ**σ**σ#, antepenultimate: **σ**σσ#) may be 1ry-stressed. Consider (12) below (where V is a short vowel, Vː is a long vowel and 1ry stressed syllables are emboldened). There are no word-final stressed light syllables in English (*V#, e.g. */pæ#/), this is why the cell in the top right corner is empty.

(12) A syllable of any weight may be stressed (within the final σσσ# window)

| | antepenult stress **σ**σσ# | penult. stress σ**σ**σ# | ult. stress σσ**σ**# |
|---|---|---|---|
| LIGHT | ***á**nimal* ˈ**æ.**nɪ.məl | *va**ní**lla* vəˈ**nɪ.**lə | – |
| HEAVY | ***díg**nity* ˈ**dɪg.**nə.ti | ***eníg**ma* əˈ**nɪg.**mə | *pìctu**résque*** ˌpɪk.tʃəˈ.**resk** |

Furthermore, not only is the location of 1ry stress independent of the weight of the 1ry stressed syllable itself, but the location of 1ry stress is also independent of the weight of *any other syllable* within the final three-syllable window.

(13) below shows that any syllable may have 1ry stress within the final three-syllable window independently of the weight of the *ultimate* syllable (1ry stressed syllables are emboldened and the ultimate syllables are underlined).

(13) The location of stress and the weight of the ULT

| | LIGHT ULT | HEAVY ULT |
|---|---|---|
| **σ**σσ# | ***cí**ne<u>ma</u>* ˈ**sɪ.**nə.<u>mə</u> | ***dý**na<u>mite</u>* ˈ**daɪ.**nə.<u>maɪt</u> |
| σ**σ**σ# | ***eníg<u>ma</u>*** əˈ**nɪg.**<u>mə</u> | *po**tá**<u>to</u>* pəˈ**teɪ.**<u>toʊ</u> |
| σσ**σ**# | – | *Jàpa**nése*** ˌdʒæ.pəˈ**<u>niːz</u>** |

(14) shows that any syllable may have 1ry stress within the final three-syllable window independently of the weight of the *penultimate* syllable (1ry stressed syllables are emboldened and the penultimate syllables are underlined).

(14) The location of stress and the weight of the PENULT

| | LIGHT PENULT | HEAVY PENULT |
|---|---|---|
| **σ**σσ# | ***á**nimal* ˈ**æ.**nɪ.məl | ***cár**penter* ˈ**kɑː**.pən.tə |
| σ**σ**σ# | *va**ní**lla* və.ˈ**nɪ**.lə | *e**níg**ma* əˈ.**nɪg.**mə |
| σσ**σ**# | *cìga**rétte*** ˌsɪ.gə.ˈ**ret** | *chìmpan**zée*** ˌtʃɪm.pən.ˈ**ziː** |

(15) shows that any syllable may have 1ry stress within the final three-syllable window independently of the weight of the *antepenultimate* syllable (1ry stressed syllables are emboldened and the antepenultimate syllables are underlined).

(15) The location of stress and the weight of the ANTEPENULT

| | LIGHT ANTEPENULT | HEAVY ANTEPENULT |
|---|---|---|
| **σ**σσ# | ***á**nimal* ˈ**æ**.nɪ.məl | ***scé**nery* ˈ**siː**.nə.ri |
| σ**σ**σ# | *va**ní**lla* və.ˈ**nɪ**.lə | *No**vém**ber* noʊˈ**.vem**.bə |
| σσ**σ**# | *cìga**rétte*** ˌsɪ.gə.ˈ**ret** | *mú**tinéer*** ˌmjuː.tɪ.ˈ**nɪə** |

## The 'pattern-with-exceptions view'

According to the pattern-with-exceptions view, there *is* a stress pattern in English, stress is (mostly) predictable: it is the result of several factors (partly morphological and phonological) and there are exceptions (English stress *is* partly lexical).

The argument is that

(a) some of the stress patterns we have seen in (12, 13, 14, 15) above are ***rare*** or ***less frequent*** than others. The words *ánimal* and *vanílla* are very similar in terms of weight structure:[7] L L σ # and both of them are nouns, but *ánimal* has antepenultimate and *vanílla* has penultimate 1ry stress. The stress pattern of the former is much more frequent than that of the latter, therefore

[7]Remember: H stands for a heavy syllable, S for a superheavy syllable, L for a light one and σ is a syllable of any weight. For the definitions of heavy, light and superheavy syllables, see 4.5.1 on syllable weight.

*ánimal* can be seen as regular and *vanílla* as an exception;

(b) ***word-class matters*** in stress placement. The verb *objéct* and the noun *óbject* have different stress patterns both of which are regular and follow the stressing of verbs and nouns;

(c) ***native speakers have intuitions*** about the place of stress: if they are required to guess the place of stress in the nonsense noun *phalidon* they are much more likely to say /ˈfælɪdən/ or /fəˈlaɪdən/ than /*fæˈlɪdən/, /*ˈfælaɪdən/ or /*ˌfælɪˈdɒn/. This also shows that stress in English is sensitive to syllable weight (in this case the weight of the penultimate syllable which gets the stress if it is heavy (see the details later)).

(d) some ***suffixes*** determine the place of 1ry stress (e.g. *-ity* places 1ry stress on the immediately preceding syllable: *cívil* but *civílity*) and the way they do is related to their phonological shape. Compare *civíl-ity* and *ánimal* – both are nouns, both have the weight structure[8] L L σ # in the final three-syllable window (underlined above) and both have antepenultimate stress.

Therefore, in the rest of this chapter we follow the pattern-with-exceptions view and examine the regularities of stress placement in English words

## 6.3.1 Determining the place of primary stress within the word

### 6.3.1.1 Primary stress in words with a short-vowelled ult

If we first examine underived words whose *last syllable does not have a long vowel*, we find the following two patterns:

[8]For the definitions of heavy (H), light (L) and superheavy (S) syllables, see 4.5.1 on syllable weight.

(16) THE NOUN PATTERN

i. 1ry stress falls on a H penult, if there is one ˈ**H** σ #

examples: *a**gén**da, a**ppén**dix, ho**rí**zon*

ii. **otherwise** 1ry stress falls on the antepenult ˈ**σ** L σ #

examples: *A**mé**rica, **á**sterisk*

(17) THE VERB PATTERN

i. 1ry stress falls on a Superheavy ult, if there is one ˈ**S** #

examples: *pre**vént**, con**dúct***

ii. **otherwise** 1ry stress falls on the penultimate σ ˈ**σ** σ #

examples: *in**há**bit, i**má**gine*

Nouns (typically), suffixed adjectives (typically) and *some* unsuffixed adjectives follow the noun pattern and verbs (almost always) and *some* unsuffixed adjectives and adjectives ending in *-ic* follow the verb pattern.

(18) Examples

THE NOUN PATTERN

(a) Nouns

i agénda, veránda, synópsis, uténsil, horízon, aróma, macaróni, Minnesóta

ii América, cínema, vértebra, ánimal, vénison, président

(b) Adjectives (suffixed)

i dialéctal, moméntous, triúmphant, contíngent, mediéval, inhérent, anecdótal

ii pérsonal, dángerous, máximal, vígilant, díffferent

(c) Adjectives (unsuffixed)

i pérfect, éarnest, ádult (BrE), éxpert, áwkward, bástard

ii móribund, dérelict, difficult, mánifest, táciturn

THE VERB PATTERN

(a) Verbs

i prevént, collápse, tormént, eléct, adópt, reláx

ii imágine, astónish, embárrass, prómise, detérmine

(b) Adjectives (unsuffixed)

corrúpt, ovért, diréct, defúnct, absúrd, adúlt (AmE)

(c) Adjectives in *-ic*

atómic, cosmétic, económic, fanátic, sadístic, terrífic

The two basic patterns, the noun pattern and the verb pattern are *phonologically* the same. The only difference between them is the domain of metrification. Specifically, *extrametricality* (see 6.1.2) is different for noun pattern items and verb pattern items. In noun pattern items it is the *last syllable* of the word that is extrametrical, while in verb pattern items it is only the *last consonant* (if there is one).

(19) Noun pattern extrametricality: the last syllable is extrametrical

$\sigma\ \#\ \rightarrow\ \langle\sigma\rangle\ \#$

(20) Verb pattern extrametricality: the last consonant is extrametrical

$C\ \#\ \rightarrow\ \langle C\rangle\ \#$

Thus the main stress rule that accounts for the basic patterns can be given as follows:

(21) Main Stress Rule (MSR)

*Within the domain of metrification*

i. the rightmost syllable gets 1ry stress if it is heavy

ii. otherwise: the syllable preceding the rightmost syllable gets 1ry stress if the rightmost syllable is light

This gives us the following metrifications for the patterns examined (and correctly predicts the

place of primary stress).

| | | | | | |
|---|---|---|---|---|---|
| (22) | N-pattern | i. Heavy penult | ˈH<σ># | *agén<da>* | əˈdʒendə |
| | | ii. antepenult | ˈσL<σ># | *Améri<ca>* | əˈmerɪkə |
| | V-pattern | i. Superheavy ult | ˈH<C># | *prevén<t>* | prɪˈvent |
| | | ii. penult | ˈσL<C># | *inhábi<t>* | ɪnˈhæbɪt |

Note that the weight of the rightmost syllable is determined only *within* the domain of metrification, i.e. disregarding the extrametrical material. For example, the superheavy ult of *prevent* counts as heavy for metrification and the heavy ult of *inhabit* counts as light because the last consonant in both is extrametrical and only *ven* and *bi* are considered by the Main Stress Rule.

### 6.3.1.2 Primary stress in words with a long-vowelled ult

Underived words that have a long vowel in their ult behave in the following way:

(i) long vowels in final syllables are *regularly* stressed in bisyllabic words (even in nouns), and (ii) a word *regularly* has antepenultimate stress if it is longer than two syllables and has a long vowel in its final syllable (even if it is a verb):

| | | | |
|---|---|---|---|
| (23) | i | 2 σ | *brocáde*$_N$ /brəˈkeɪd/, *canóe*$_N$ /kəˈnuː/, *sedáte*$_V$ /səˈdeɪt/, *obéy*$_V$ /əˈbeɪ/ |
| | ii | 2+ σ | *dýnamite*$_N$ /ˈdaɪnəmaɪt/, *pédigree*$_N$ /ˈpedɪgriː/, *óperate*$_V$ /ˈɒpəreɪt/, *pétrify*$_V$ /ˈpetrifaɪ/ |

Note that this stress pattern is independent of morphological class membership: in words of this type there is no difference between the stressing of nouns and verbs.

This pattern is handled by two rules: Long Vowel Stressing (LVS) and the Alternating Stress Rule (ASR):

(24) Long Vowel Stressing (LVS)

Stress long vowels in final syllables

LVS overrides extrametricality and prevents it from applying: *brocáde* brəˈkeɪd, not **bró<cade>*.

(25) The Alternating Stress Rule (ASR)

σ σ ˈσ # → ˈσ σ σ # (if a word-final syllable has been stressed by some rule *and* it is preceded by two or more syllables, move the stress to the antepenultimate syllable)

ASR applies to the output of LVS, e.g. *dynamíte* → *dýnamite* /ˈdaɪnəmaɪt/. ASR only applies to *final* stressed syllables and it applies to *all* final stressed syllables, not only to those stressed by LVS but also to those stressed by the general Main Stress Rule (MSR): *genufléct* → *génuflect*. Sample derivations are shown in (26), and table (27) summarises the working of LVS and ASR:[9]

(26) Long Vowel Stressing and/or the Alternating Stress Rule in derivations

| | Verb | Noun | Verb | Verb |
|---|---|---|---|---|
| UR | *#sedate#* | *#caraway#* | *#operate#* | *#genuflect#* |
| LVS | *#sedáte#* | *#carawaý#* | *#operáte#* | – |
| Extr | – | – | – | *#genuflec<t>#* |
| MSR | *#sedáte#* | *#carawaý#* | *#operáte#* | *#genufléc<t>#* |
| ASR | – | *#cáraway#* | *#óperate#* | *#génuflec<t>#* |
| SR | [səˈdeɪt] | [ˈkærəweɪ] | [ˈɒpəreɪt] | [ˈdʒenjʊflekt] |

[9]Word-final /oʊ/ does not seem count as a long vowel. *vé<to>* not **vetó*; *potá<to>* not **pótato.*

(27) Summary of Long Vowel Stressing and the Alternating Stress Rule

i. Words with a long-vowelled ult

| | 2+ σ | 2σ |
|---|---|---|
| Nouns | ánecdote<br>LVS + ASR | ballóon<br>LVS |
| Verbs | décorate<br>LVS + ASR | debáte<br>LVS |

ii. Words with a short-vowelled ult

| | 2+ σ | 2σ |
|---|---|---|
| Nouns | not relevant[10] | not relevant |
| Verbs | génuflect<br>MSR + ASR | eléct<br>MSR |

### 6.3.1.3 Some complications

#### 6.3.1.3.1 Word-medial /s/ plus consonant clusters (sC)

In some words a medial sC cluster appears to syllabify as an onset (V.sC), in others as a coda+onset sequence (Vs.C). If the vowel preceding the sC cluster is short, then its syllable should count as light under the former syllabification, but as heavy under the latter one (because a closed syllable is heavy even if its vowel is short). Compare the nouns *mínister* /ˈmɪnɪstə/ and *asbéstos* /æsˈbestəs/. The correct stress pattern is predicted if they are analysed like this:

(28) Syllabification of sC clusters and stress

[10]Not relevant because the short-vowelled ult of nouns is extrametrical and cannot get stress.

| i. /s/ in onset | | | ii. /s/ in coda | | |
|---|---|---|---|---|---|
| mi.ni.ster | → | míni<ster> | as.bes.tos | → | asbés<tos> |
| an.ce.stor | → | ánce<stor> | A.las.ka | → | Alás<ka> |
| or.che.stra | → | órche<stra> | Fran.cis.can | → | Francís<can> |
| in.du.stry | → | índu<stry> | a.spi.dis.tra | → | aspidís<tra> |
| Pro.te.stant | → | Próte<stant> | con.tes.tant | → | contés<tant> |

This is a problem for syllabification, because the same sequence of segments must be syllabified in two different ways and it is unpredictable which sC words syllabify in which way.

### 6.3.1.3.2 Some 'prefixes' of Latin origin in verbs

(e.g. *o=, ex=, im=, con=, re=, inter=, contra=, intro=, re=*[11], etc.)

These are not proper prefixes[12] in the sense that in English they do not have an identifiable meaning and the bases that they precede do not have an identifiable meaning either (e.g. *omit, explain, confess, intervene*, etc.). However, they may interfere with the stress rules (MSR, ASR) discussed. Typically, they fall outside the domain of 1ry stress placement, may not receive 1ry stress (although they receive 2ry stress regularly) and only the base is visible to the stress rules discussed above. E.g. the verb *omít* should be **ómit* according to the MSR (**ómi<t>*, compare *édi<t>*), but it must be analysed as *o=mít* to get the actual stressing /əˈmɪt/; the verb *ìntervéne* should be **íntervene* according to LVS and ASR (**íntervene*, compare *óperate*), but it must be analysed as *inter=véne* to get the actual stressing /ˌɪntəˈviːn/. The problem is that, as there is no real morphological motivation for analysing these word-initial sequences as prefixes, the analysis is circular: the 'prefix' analysis is only motivated by the anomalous stressing it is designed to explain. According to this 'explanation' *omít* has final stress because is has a '=' boundary in the middle; and it must have a '=' boundary in the middle because it has final stress!

[11]not the prefix *re-* 'again'

[12]This is indicated here by the special boundary symbol "=", see 8.1.2

### 6.3.1.3.3 Conversion and stress

In English, verbs can be freely derived from nouns by conversion (zero derivation) without any change in pronunciation (including stress). Take, for instance, the nouns *plátypus* (Ornithorhynchus anatinus, 'kacsacsőrű emlős') and *chihuáhua* ('a Mexican breed of dog '), both of which follow the noun pattern: *pláty<pus>* /ˈplætəpəs/ and *chihuá<hua>* /tʃɪˈwɑːwə/. In the pair of sentences below the word for the same animal is a noun in one sentence and a verb in the other – nevertheless the stressing does not change, it remains *chihuahua* /tʃɪˈwɑːwə/ and *platypus* /ˈplætəpəs/:

(29) *Don't you chihuáhua*$_V$ *my plátypus*$_N$*!* (‘Don’t call my platypus a chihuahua!’)

*Don't you plátypus*$_V$ *my chihuáhua*$_N$*!* (‘Don’t call my chihuahua a platypus!’)

The problem is that in this way there is a great number of verbs that actually follow the noun stress pattern. A possible analysis is to say that conversion applies after the stress rules:[13]

(30)

| | |
|---|---|
| UR | *#platypus#*$_{NOUN}$ |
| Extr | *#platy<pus>#*$_{NOUN}$ |
| MSR | *#pláty<pus>#*$_{NOUN}$ |
| **conversion** | *#plátypus#*$_{VERB}$ |
| SR | [ˈplætəpəs] |

[13]Note that it is sometimes not possible to tell when conversion happens and when it does not: deceptively similar pairs of words may be related by conversion in one instance and have different (noun or verb) stress patterns in the other: e.g. *có<mment>*$_N$; *có<mment>*$_V$ /ˈkɒment/ (conversion) vs. *ré<cord>*$_N$ /ˈrekɔːd/; *recór<d>*$_V$ /rɪˈkɔːd/ (noun and verb patterns respectively).

### 6.3.1.4 Primary stress in derived words: suffixes

Phonologically, there are two kinds of suffixes: (i) *stress-placing suffixes* determine the place of primary stress in the word, they may 'overwrite', i.e. not preserve, the stress of the base, (ii) *stress-neutral suffixes* leave the original stress of the base intact.[14]

#### 6.3.1.4.1 Stress-neutral suffixes[15]

The following are some common stress-neutral suffixes: *-able, -ly, -ing, -ed, -es, -er, -ist, -ism, -ful, -less, -ness, -hood,* $-ish_{adj}$ *, -ment, -wise*.

Stress-neutral suffixes are outside the domain of metrification (see 6.2.1), i.e. neutral suffixes are disregarded when primary stress placement is determined and the rest of the word is metrified without the suffix:

| | | | | |
|---|---|---|---|---|
| (31) | *#electr+ic+ity#wise#* | → | *#electríci<ty>#~~wise~~#* | (by MSR: N-pattern) |
| | *#erot+ic#ism#* | → | *#eróti<c>#~~ism~~#* | (by MSR: V-pattern) |
| | *#class+ifi#able#* | → | *#clássify#~~able~~#* | (by LVS + ASR) |

#### 6.3.1.4.2 Stress-placing suffixes[16]

Words (only) containing stress-placing suffixes are metrified in the same way as underived words, i.e. (i) the reason why stress-placing suffixes influence the placement of stress is that *they are metrified together with the base they are added to* and (ii) (ideally) the way a particular stress/placing suffix influences the placement of primary stress derives (a) *from the phonological shape of the suffix* and (b) its morphological properties (i.e. whether it derives nouns, verbs, etc.).

---

[14]See BEP 12.15-33 for examples.

[15]These suffixes are also called 'strong-boundary', '#-boundary', 'Level 2'

[16]These suffixes are also called 'restressing', 'non-neutral', 'weak-boundary', '+boundary', 'level 1', 'stress-fixing'

For example the suffix *-ity* places the stress on the syllable preceding the suffix because it derives a noun, so its final *syllable* will be extrametrical according to (19) and its initial syllable is light, *-ity* is -Lσ, so it has to be the rightmost syllable of a *bisyllabic* left headed foot according to the MSR: (σL)<σ>. Therefore, the syllable preceding it will be stressed:

(32) *electr+ic+ity* → *electríci<ty>* (by MSR: N-pattern)

### 6.3.1.4.3 Types of stress-placing suffixes[17]

**A. Pre-stressed 1**

1ry stress falls on the syllable preceding the suffix. There are two subclasses according to suffix shape:

SHAPE

(i) +Lσ *-uble, -ity, -ety, -erie, -ion*[18]*, -ular, -logy, -meter, -graphy, -poly, -tomy, -pathy, -thesis, -gamy*

These suffixes consist of a light syllable followed by another syllable. They follow the noun pattern and stress placement follows from their shape: *abíli<ty>* *confórmi<ty>*

(ii) +H *-ic, -id, -ish*$_V$

These suffixes consist of a single heavy syllable. They follow the verb pattern and stress placement follows from their shape: *anatómi<c>, militarísti<c>*

**B. Pre-stressed 1/2**

1ry stress falls on the syllable preceding the suffix if it is H, but on the second syllable preceding the suffix if the syllable preceding the suffix is L. There are two subclasses according to suffix shape:

---

[17]Some of these 'suffixes' are 'endings' rather than suffixes proper, i.e. (i.e. they do not have any meaning).

[18] Note that *-ion* counts as two syllables for stress purposes, e.g. definíti<on>

Suffix shape

(i) +σ *-age, -al, -ous, -ive, -ure, -ant, -ance, -ent, -ence*

These suffixes consist of a single vowel-initial syllable. They follow the noun pattern and stress placement follows from their shape: *medíci<nal>, parén<tal>*

(ii) +σσ *-ative, -ature, -ible, -ary, -ory*

1ry stress placement does not follow from the shape of these suffixes.

**C. Pre-stressed 2**

1ry stress falls on the 2nd syllable preceding the suffix

Suffix shape

+(C)V:(C) *-ate$_V$, -ize, -ite, -ene, -ine, -cide, -oir, -ose, -tude, -(i)fy*

As all these suffixes consist of a single, long-vowelled syllable, they regularly get 1ry stress by Long Vowel Stressing and the Alternating Stress Rule. (Of course, if there is only one syllable before the suffix, only LVS can apply and the suffix gets the stress). Thus, stress placement follows from their shape: *rádiate, sedáte*

**D. Auto-stressed**

1ry stress falls on the suffix itself. Auto-stressed *verbal* endings that consist of a superheavy syllable are not special in bisyllabic words – they simply follow the basic verb pattern: ***-ain$_V$*** *maintái<n>*. Otherwise, auto-stressed suffixes are exceptional and 1ry stress placement does not follow from their shape. There are three subclasses according to shape:

Suffix shape

(i) +(C)V:(C) *-ade, -ese, -ique* /iːk/, *-ee* /iː/, e.g. *lemonáde*

(ii) +VCC *-esque* /esk/,; e.g. *picturésque*

(iii) +VC *-elle, -enne, -esse, -esce, -ette*; e.g. *novelétte*

#### 6.3.1.5 Primary stress patterns unaccounted for by the analysis

There are some primary stress patterns in English which are not predicted by this analysis. We consider them irregular here,[19] e.g. *cemént*$_N$ /sə'ment/, *vanílla*$_N$ /və'nɪlə/, *téndency*$_N$ /'tendənsi/, *céremony*$_N$ /'serəməni/, *haráss*$_V$ /hə'ræs/[20], *rábbi* /'ræbaɪ/, *kàngaróo* /ˌkæŋgə'ruː/, *ellípsoid* /ɪ'lɪpsɔɪd/.

#### 6.3.1.6 Summary of primary stress patterns

1ry stress is

(i) calculated right-to-left from a strong (#) boundary,

(ii) weight-sensitive,

(iii) not stress preserving (1ry stress placement can change the 1ry stress of the base in words derived by + boundary suffixes) and

(iv) partially unpredictable (there are exceptional patterns).

### 6.3.2 Determining the place of stresses preceding the primary stress

If we distinguish between 2ry stress and 3ry stress, both of these stresses can precede 1ry stress, e.g. *còn<u>den</u>sátion* /ˌkɒn<u>den</u>'seɪʃən/ (where the . 3ry stress is underlined). In this subsection we examine the predictability of these stresses.

#### 6.3.2.1 Determining the place of 2ry stress within the word

The place of 2ry stress is predictable and is due to the interaction of *constraints,* i.e. restrictions

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[19]There are analyses which postulate additional rules to account for (some of) these patterns. .

[20]*Harass*$_V$ has a regularly stressed pronunciation in traditional RP: /hæ'rəs/. According to Wells (2008), while there is a 68% to 32% preference for /hæ'rəs/ in RP, there is a 60% to 40% preference for /hə'ræs/ among 'younger' people.

on the occurrence of 2ry stress, some of which are violable. These constraints are not equally important, they are *ranked*, i.e. some are more important to obey than others. These constraints are:

(33) NO STRESS CLASH * #...MM...#
There should be no adjacent major stresses (2ry and 1ry)
(= *#...21...#; *#...22...#)

This constraint does not hold in bisyllabic words with a final major (i.e. 1ry) stress, e.g. *sàrdíne, prìncéss, fòurtéen*, etc. see Section 6.2.2.1. So #MM# is permitted.[21]

(34) EARLY STRESS *#mm...
There must be a major stress on one of the two syllables at the beginning of a word
(= *#00; *#30; *#03)

This constraint seems to be inviolable, i.e. there are no exceptions.

(35) STRESS PRESERVATION A derived word has to preserve the placement of the major stress(es) of its base.

We have seen that 1ry stress (i.e. the rightmost major stress) is not stress-preserving, compare *átom* and *atómic*. In 2ry stress placement, however, there is a tendency to preserve the major stresses of the base if possible. The reason why there is a difference between the placement of 2ry stress in ***chà**racterístic* and *o**rì**ginálity* is that their bases (***chá**racter* and *o**rí**ginal*[22]) have their 1ry stresses on different syllables, and the derived words *both* preserve the place of the 1ry stress of their bases. However, stress preservation is not always possible. STRESS PRESERVATION is a violable constraint: it applies as long as NO STRESS CLASH and EARLY STRESS are not violated. It is not possible to preserve the major stress of *Japán* in the derived form *Jàpanése*, because the hypothetical form that would preserve it (**Japànése)* would violate NO STRESS CLASH. It is more

[21]We will not analyse #MM# words here.

[22]Notice that it is the *immediate* base that counts: the base of *o**rì**ginálity* is *o**rí**ginal* not ***ó**rigin*.

important to obey NO STRESS CLASH and EARLY STRESS than STRESS PRESERVATION. This can be expressed as the ranking of these constraints:

(36) NO STRESS CLASH, EARLY STRESS >> STRESS PRESERVATION

What happens in *underived* words in which 1ry stress falls later than the third syllable from the beginning of the word? In these words EARLY STRESS and NO STRESS CLASH permit 2ry stress placement either on the first or the second syllable of the word, but STRESS PRESERVATION cannot decide between these two candidates[23] since there is no base whose major stress should be preserved. In this case the place of 2ry stress is unpredictable (and therefore lexical): compare *Wìnnipesáukee* /ˌwɪnəpəˈsɔːki/ and *Monòngahéla* /məˌnɒŋgəˈhiːlə/.

#### 6.3.2.1.1 Summary of secondary stress patterns

2ry stress is

(i) calculated from the location of 1ry stress,
(ii) weight insensitive,
(iii) iterative (there may be more than one 2ry stress in a word),
(iv) stress preserving (if possible) and
(v) partially unpredictable in **underived** words (when 1ry stress is later than the third syllable from the beginning of the word).

### 6.3.2.2 The location 3ry stress before the 1ry stress

A 3ry stressed syllable is a syllable with a full vowel not bearing 2ry or 1ry (i.e. major) stress. In other words, it is a non-major-stressed syllable in which Vowel Reduction has not applied. So the question is if we can predict when Vowel Reduction applies to a syllable without major stress. The answer is mostly negative. There are some tendencies, but 3ry stress is mainly lexical.

Immediately preceding the 1ry stress, 3ry stress can occur (i) word-initially, e.g. <u>tor</u>mént

[23]unlike in the case of derived words

/tɔːˈment/ and (ii) word-medially còndensátion /ˌkɒndenˈseɪʃən/. In both positions there are some *tendencies* that predict the presence/absence of reduction, but they are not categorical.

*In word-initial closed syllables* immediately preceding the 1ry stress Vowel Reduction may be suspended (there is free variation between 3ry and zero stress), but in open syllables in the same position there is a strong tendency for it to apply. We call this the *closed-syllable tendency* for 3ry stress.

(37) i. initial open syllable

| | | |
|---|---|---|
| *A.mérica* | *æˈmerɪkə | əˈmerɪkə |
| *a.trócious* | *æˈtroʊʃəs | əˈtroʊʃəs |
| *lamént* | *læˈment | ləˈment |

ii. initial closed syllable

| | | |
|---|---|---|
| *Mon.tána* | mɒnˈtænə | mənˈtænə |
| *Oc.tóber* | ɒkˈtoʊbə | əkˈtoʊbə |
| *segmént*$_V$ | segˈment | səgˈment |

However, the closed syllable tendency is only a tendency because we can find words with initial unreduced vowels in an open syllable e.g. *va.cátion* /veɪˈkeɪʃn, vəˈkeɪʃn/[24], and with compulsory vowel reduction in an initial closed syllable e.g. *con.trást*$_V$ /*kɒnˈtrɑːst, kənˈtrɑːst/.

*Word-medial* 3ry stress can be seen as the result of *stress preservation*, where the unreduced vowel immediately preceding the 1ry stress preserves the vowel quality of the base word in which the same syllable is major stressed, compare *còndensátion* /ˌkɒndenˈseɪʃn/ (because of *condénse* /kənˈdens/) and *còmpensátion* /ˌkɒmpənˈseɪʃn/ (from *cómpensate*; no related word has stress on *-pen-*). However, stress preservation here is also only a tendency since there are words which do not preserve the vowel quality of the major stress of their bases in this way. Compare the words in (a), which do, with the similar words in (b), which do not.

(38) a. stress preservation: 3ry stress in the derived word

| | | | |
|---|---|---|---|
| augmént | ɔːgˈment | àugmentátion | ˌɔːgmenˈteɪʃn |
| impórt | ɪmˈpɔːt | ìmportátion | ˌɪmpɔːˈteɪʃn |
| condémn | kənˈdem | còndemnátion | ˌkɒndemˈneɪʃn |

[24]According to Wells (2008), there is a 91% to 8% preference for /veɪˈkeɪʃn/ in AmE and there is a 61% to 39% preference for it even in BrE.

b. no stress preservation: zero stress in the derived word

| | | | |
|---|---|---|---|
| consúlt | kənˈsʌlt | cònsultátion | ˌkɒnsəlˈteɪʃn |
| infórm | ɪnˈfɔːm | ìnformátion | ˌɪnfəˈmeɪʃn |
| consérve | kənˈsɜːv | cònservátion | ˌkɒnsəˈveɪʃn |

We have to conclude that 3ry stress is mainly lexical when it precedes 1ry stress.

### 6.3.3 3ry stress after the primary stress

3ry stress is also unpredictable (lexical) when it is after the 1ry stress. We can find syllables with unreduced vowels (a) in a non-final syllable immediately following the 1ry stress (39i), (b) in a final syllable immediately following the 1ry stress (39ii) and (c) in a final syllable not immediately following the 1ry stress (39iii):

(39)[25] i. 1 **3** 0 órgasm ˈɔːgæzəm, sárcasm ˈsɑːkæzm

ii. 1 **3** róbot ˈroubɒt, fórmat ˈfɔːmæt, ellípsoid əˈlɪpsɔɪd

iii. 1 0 **3** séparate$_V$ ˈsepəreɪt, cáravan ˈkærəvæn, récognize ˈrekəgnaɪz

However, we can find syllables with reduced vowels in the same positions:

(40) i. 1 **0** 0 vanity ˈvænəti, elítism ɪˈliːtɪzm,

ii. 1 **0** clímate ˈklaɪmət, ábbot ˈæbət

iii. 1 0 **0** séparate$_{Adj}$ ˈsepərət, Ánglican ˈæŋglɪkən

Therefore, we conclude that 3ry stress following the 1ry stress is (also) essentially lexical.

[25]Rarely, (39i) and (39iii) can combine with the result of having two 3ry stresses after the 1ry stress, e.g. démarcate /ˈdiːmɑːkeɪt/

## 6.4. Checklist

★ suprasegmental feature
★ metrification
★ weight sensitivity
★ weight-insensitive
★ extrametricality
★ degrees of English stress
★ pitch change
★ loudness
★ 1ry stress
★ 2ry stress
★ major stresses
★ 3ry stress
★ zero stress
★ minor stresses
★ reduced vowel
★ full vowel
★ Vowel Reduction
★ Rhythm Rule
★ Rhythmic Stress Deletion/Shift
★ Iambic Reversal
★ ‘no-pattern view’
★ ‘pattern-with-exceptions view,’
★ 1ry stress: the noun pattern
★ 1ry stress: the verb pattern
★ Noun pattern extrametricality
★ Verb pattern extrametricality
★ Main Stress Rule (MSR)
★ Long Vowel Stressing (LVS)
★ Alternating Stress Rule (ASR)
★ /s/ plus consonant clusters

★ ‘prefixes’ of Latin origin

★ conversion

★ stress-placing suffixes

★ stress-neutral suffixes

★ types of stress-placing suffixes

★ Pre-stressed 1 suffix

★ Pre-stressed 1/2 suffix

★ Pre-stressed 2 suffix

★ Auto-stressed suffix

★ NO STRESS CLASH

★ EARLY STRESS

★ STRESS PRESERVATION

★ ranking of constraints

★ closed-syllable tendency

**CHAPTER 7**

# PROSODY

**Ádám Nádasdy**

**Contents of this Chapter:**



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*Note. For a more teaching-oriented treatment of these (and many other) phenomena, with numerous examples, see BEP 12.34 to 14.34.*

# 7.1. WHAT IS PROSODY?

Prosody in linguistics means the study of stress, rhythm and intonation in units larger than the word. The elements of prosody are also called **suprasegmentals** because they appear "above" the segments.

Stress means pronouncing the syllable louder than others. Intonation, on the other hand, means the "melody" – falling or rising – with which the sentence is spoken. Observe how we can change one without changing the other:

| | *(1)*<br>*Main stress on last word* | *(2)*<br>*Main stress earlier* |
|---|---|---|
| *(a) Falling intonation* | (1a)<br>She ′spent a ′year in the ↘forest. | (2a)<br>She ′spent a ↘YEAR in the forest. |
| *(b) Rising intonation* | (1b)<br>′Did she ′spend a ′year in the ↗forest? | (2b)<br>′Did she ′spend a ↗YEAR in the forest? |

All combinations exist, proving that stress and intonation are independent variables, both having distinctive (contrastive, "phonemic") value.

Even though italics and punctuation may represent some prosodic features, it often happens that the same written sentence can be spoken with differing stress or intonation patterns. Ordinary spelling can only express some features of prosody, e.g.

She spent a *year* in the forest! (emphatic stress on ↘*year*)

# 7.2. THE END-WEIGHT PRINCIPLE

It is a general rule of English that if there is a sequence of equal stresses, the last must become the strongest. The prosodic "weight" of an utterance must be at the end: this is the End-Weight Principle. Observe the examples:

| | | |
|---|---|---|
| new bóok | Amanda Cóllinder | sit dówn |
| considerable expénses | utterly destrúctive | he criticized éverything |

Unstressable function words (printed here in *italics*) do not count:

right in fróntof *you* – John dránk *some* – what I lóok *for* – Mary couldn't dó *it for me*

Longer stretches of speech also obey the End-Weight Principle. The last (and therefore strongest!) stress is called the **tonic**. In the following sentence the tonic is underlined:

The children managed to carry the suitcases as far as the edge of the róundabout.

The End-Weight Principle is satisfied through a Tonic Assignment Rule:

**Tonic Assignment Rule**

1 1 → 2 1 = of several primary stresses, downgrade each to secondary, except the last, which will be the tonic.

Example: 1 1 1 1 → 2 2 2 1
Rachel was happy to cycle home Rachel was happy to cycle home

The same mechanism is at work in many compounds:

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | → | 2 | 1 | 1 | 1 | 1 | → | 2 | 2 | 1 |
| photo | montage | | photomontage | | second | world | war | | Second | World | War |

It follows that the "secondariness" of secondary stress is predictable: a secondary stress is actually a stress which is followed by another stress and has therefore been downgraded. Secondary stress is thus an "allophone" of primary stress. Lexically, we may represent words like *reformation, satisfactory, sardine* with two equal "primary" stresses:

//ˈrefəˈmeɪʃən// //ˈsætɪsˈfæktəri// //ˈsɑːˈdiːn//

because the Tonic Assignment Rule will turn the first stress into secondary anyway:

/ˌrefəˈmeɪʃən/ /ˌsætɪsˈfæktəri/ /ˌsɑːˈdiːn/

We conclude that primary and secondary stress in an allophonic relationship (complementary distribution), and can be seen as two realizations of the same thing: stress (or "major stress")

## 7.2.1. Stress Degrees in connected speech

The effects of the End-Weight Principle are well known in the analysis of word stress:
– if a word has two (rarely three) stresses, the last must be the **primary**, the one(s) before it **secondary**. Consequently, there cannot be a secondary after the primary. [1]
– **strong-unstressed syllables** (*fórmat* /-mæt/, *diréct* /daɪ-/) are also called **"tertiary-stressed"** because their vowel does not reduce (as it would in completely unstressed syllables like *sálad* /-ləd/ or *Óxford* /-fəd/). From the prosodic point of view, however, 3ry and zero stresses do not count as stresses because the End-Weight Principle does not "see" them: they can never become 1ry-stressed.

We conclude that in prosody there are only two phonologically relevant stress degrees: stressed (1ry or 2ry) and unstressed (3ry or zero).

STRESS DEGREES

| *example (underlined)* | *urbanization* /ˌɜːbənaɪˈzeɪʃn/ | *urbanization* /ˌɜːbənaɪˈzeɪʃn/ | *urbanization* /ˌɜːbənaɪˈzeɪʃn/ | *urbanization* /ˌɜːbənaɪˈzeɪʃn/ |
|---|---|---|---|---|
| word-level: | primary str. | secondary str. | tertiary str. | zero str. |
| prosodic: | **stressed** (= major-stressed) | | **unstressed** (strong) | (weak) |

We shall occasionally mention (and indicate) secondary stress, but generally we shall just speak of stressed and unstressed syllables – or, more simply, stressed and unstressed words (meaning that their primary-stressable syllable is stressed or unstressed).

[1] In transcription, it is customary to use a secondary-stress mark on the originally stressed (now tertiary-stressed) syllable of the second element if it is longer than one syllable: **fíre** alarm /0faɪər əˌlá:m/.

# 7.3. COMPOUND WORDS

A compound is a lexical unit (a lexeme) made up of two or more free stems (= words), e.g. *gréenhouse, to ill-tréat, car ferry, unemployment benefit*. Compounds usually have a specialized meaning: a *bláckbird* is a special type of bird, not any bird that is black. Compounds behave as units from the point of view of grammar (syntactically) and meaning (semantically).

From a phonological point of view there are two types of compound:

- **initially-stressed compounds**, pattern # 1 # 3 #
  primary stress on the first element: *gréen*house, *cár ferry*, *compúter virus*
- **finally-stressed compounds**, pattern # 2 # 1 #
  primary stress on the second element: *trade únion, fruit sálad, Victoria Státion*

The type depends on the syntactic relationship between the two elements, their frequency, or degree of lexicalization. The meaning or communicative "importance" of the elements is not decisive.

The spelling of compounds in English is not consistent. Some are written as one word *(gréenhouse)*, some with a hyphen *(wòrd-fínal)*, but the majority are written as two words *(cár ferry, geógraphy teacher, dòuble chín)*. The latter may be called **"invisible compounds"**, since the spelling does not show that they are compounds.[2]

When two words are just an ordinary phrase *(new book)* and not a compound, both elements are stressed, the second has the primary stress according to the End-Weight Principle. Observe the examples, where (a) and (b) have the same stress pattern, while (b) and (c) are compounds:

| | |
|---|---|
| a. (We are using a) néw ↘**bóok**. | – phrase; finally-stressed by End-Weight Princ. |
| b. (I'll make some) fruit ↘**sálad**. | – compound, finally-stressed |
| c. (We drove to the) ↘**cár** ferry. | – compound, initially-stressed |

## 7.3.1. Initially-stressed compounds

These sound like one word: the first element carries the stress. This pattern is the same as in Hungarian, German, and many languages (e.g. ***te**lefonnévjegyzék*). The second element is downgraded to 3ry stress. This is expressed by the following rule:

(3) Compound Stress Rule

# 1 # # 1 # → # 1 # 3 # = when compounding two words, downgrade the primary stress of the second word to strong-unstressed (3ry) level.

Examples for initially-stressed compounds, with the stressed element underlined:

- **NOUNS**: gréenhouse, cár ferry, scréensaver, cán-opener, a búyout, a wríte-off, shóplifting, Cánon Street, páperback, páperback writer, lánguage teaching, ùnemplóyment benefit
- **ADJECTIVES**: wáterproof, fún-loving, chócolate coloured, súnlit
- **VERBS**: to báby-sit, to héadhunt, to bélly-dance, to áir-condition, to whítewash

[2] In Hungarian invisible compounds are less frequent, e.g. *túrós csusza, mérges kígyó*.

**Obscured compounds.** In a small group of initially-stressed compounds the second element has zero stress, a reduced vowel: *póst|man* /-mən/, *wél|come* /-kəm/, *nónsense* /ˈnɒnsəns/, Éng*land* /ˈɪŋgləɪnd/, Jóhn*son* /ˈdʒɒnsn/. These are called "obscured" compounds. Their stress pattern is #10# and not #1#3#. They are always spelt as one word.

## 7.3.2. Finally-stressed compounds

In these the second element is primary-stressed, the first element has secondary stress, e.g. *tràde únion, Victòria Státion*. They sound like two words, their stress pattern is identical to a phrase (*nèw bóok, Amànda's fáther*). We give some examples for finally-stressed compounds, with remarks on the semantic or syntactic relationship between the elements:

• The compound is a **NOUN**:
– *the "Y is (made) of X" relationship:*
brìck wáll, frùit sálad, potàto crísps, rùbber bóots, gàs fíre
– *the "Y is (an) X" relationship:*
tòy sóldier, twìn bróther, wòman wríter, bòy scóut, quèen bée, chìld áctor
– *names of places (but not those ending in* "Street"*, which are initially-stressed!):*
Victoria Státion, Cròmwell Róad, Fìfth Ávenue, Cèntral Párk, Hèroes' Squáre
– *various others:*
Sòcial Démocrat, blàck márket, lìving condítions, trade únion, Còca Cóla, wèekénd[3]
– *"initialisms" (letters pronounced as their alphabetical names):*
DJ /ˌdi: ˈdʒeɪ/, etc.
• The compound is an **ADJECTIVE**:
èasy-góing, dìrt chéap, ùser-fríendly, dùty frée, dàrk brówn
– *the second element is a Past Participle:*
bàd-témpered, clèar-cút, àbsent-mínded, well-deserved
• The compound is an **ADVERB**:[4]
hèad-fírst, dòwnstréam, ùpstáirs, òffhánd, wèll-óff, wày óut, fàr awáy, Nòrth-Éast
• The compound is a **VERB**:
*to dòwngráde, to cròss-exámine, to òutnúmber, to òversléep, to ìll-tréat.*

There are no clear-cut rules as to which compound is finally-stressed and which initially-stressed:[5] this is a lexical property of the given compound. The following guiudelines must be remembered:

(a) if the compound expresses the idea of "for..." (an object relationship), it is initially-stressed.

---

[3] *Weekend, ice cream* are true compounds in AmE, having initial stress. There are a number of such differences between the accents of English.

[4] Observe that finally-stressed compound adverbs and verbs are normally spelt with a hyphen or as one word.

[5] This uncertainty only arises when the compound is spelt as two words. (Only one or two finally-stressed compounds are spelt as one word: *wèek**énd**, aròma**thérapy**.*) Good dictionaries give the stress pattern of compounds even when they are "invisible", spelt as two words.

(b) if the compound it expresses the idea of "is a...", "is made of...", "is characterized by..." (a subject relationship), it is finally-stressed.[6]

a Énglish teacher (teaches English; object)
b Èngliśh téacher (she is English, subject)

a tóy factory (it makes toys, object)
b tòy sóldier (the soldier is a toy, subject)

a páper bag (bag for putting paper in)
b pàper bág (the bag is made of paper)

a drínking water (we drink it; object)
b rùnning wáter (the water runs; subject)

But in many cases such a semantic or logical explanation is not easy to find, and the two types of stressing seem to be arbitrary, i.e. lexical, and have to be memorized as part of the pronunciation of the compound.

**SUMMARY TABLE OF COMPOUNDS**

| | **phrase**<br>*new* ***bóok*** | **compound**, finally-stressed<br>*trade* ***únion*** | **compound**, initially-stressed<br>***cár*** *ferry* | **obscured** compound<br>*Énglan*d |
|---|---|---|---|---|
| Is it a grammatical word? | NO | YES | YES | YES |
| Is it a phonological word? | NO | NO | YES | YES |
| Is the second element de-stressed? | NO | NO | YES | YES |
| Is the second element reduced? | NO | NO | NO | YES |

We have included "obscured compounds" for the sake of comparison, but phonologically they do not count as compounds because their final element is reduced, i.e. not a free stem.

## 7.4. THE TONE-UNIT

A tone-unit is a stretch of speech whose last stress is a tonic (the stressed syllable on which the voice begins to fall or rise). The tone-unit usually corresponds to a sentence. If a sentence is longer, the speaker usually breaks it up into several tone-units. A typical tone-unit is *We decided to come back in October*.

The tone-unit has the following parts:

– **Pre-head**: the unstressed syllables before the first stress *(We de-)*.
– **Head**: the part beginning with the first stress and leading up to the tonic syllable *(-cided to come back in Oc-)*.
– **Tonic**: the last stressed syllable *(-to-)*.
– **Tail**: anything after the tonic *(-ber)*.

[6] Hungarian makes no such distinction, pronouncing (and spelling) both types as initially-stressed compounds: *ivóvíz, folyóvíz; játékgyár, játékkatona*.

| *We de-* | ***'cided to 'come 'back in Oc-*** | ***↘to-*** | ***ber.*** |
|---|---|---|---|
| Pre-head | Head | **Tonic** | Tail |
| non-obligatory | non-obligatory | **obligatory** | non-oblig. |
| no stress | stress(es) | **stress** | no stress |
| incomplete foot | one or more feet | one foot | |
| **TONE-UNIT** | | | |

Many tone-units are not complete sentences. In the list below; each row is a tone-unit. Observe their parts. Only the tonic is obligatory, the other parts may be missing.

| *Pre-head* | **Head** | **Tonic** | Tail |
|---|---|---|---|
| We de- | ˈcided to ˈcome ˈback in Oc- | ↘to- | ber. |
| | ˈJeremy ˈplayed the gui- | ↘tar, | |
| but the | ˈothers ˈweren't | ↘li- | stening. |
| I re- | | ↘mem- | ber. |
| In | ˈfront of the ˈSwan | ↘The- | atre, |
| there's an in- | ˈcredibly ˈugly | ↘pe- | trol station. |
| | ˈNot on ˈtop of the | ↘car, | please! |
| | ˈJim was ˈinterested in 1interˈnational | ↘law. | |
| | | ↘No. | |
| I | ˈthink AˈmandaˈshouldˈwriteˈJennifer a | ↘le- | tter. |
| | ˈUnbe- | ↘lie- | vable! |
| A- | ˈmanda was upˈset because ˈJohn had ˌdisa- | ↘ppeared. | |

In connected speech the general rule is to stress every content-word, and leave function-words unstressed. For example:

I ˈthink AˈmandaˈshouldˈwriteˈJennifer a ˈletter.
/aI 0FINk ə0mAndə Səd 0raIt 0dZenIfər ə 0letə/

When we say that "a word is stressed", we mean that the primary-stressed syllable of that word is stressed. The place of stress within the word is not important now, that is a lexical question (Chapter 6). In this chapter it will be practical to indicate stress with separate stress marks (as in transcription), rather than with accent marks above vowels. So instead of *Amánda, Jénnifer* we will write *A'manda, 'Jennifer*, etc. Of course the two notations are equivalent.

While in isolation (as in a dictionary) one-syllable words *(think, write)* need not get a stress-mark, in connected speech they, too, must be stress-marked if actually stressed. Certain unstressed function-words have their "weak form" (here *should* /ʃʊd/ weakens to /ʃəd/).

Punctuation (dots, commas, apostrophes, etc.) and capital letters are not shown in transcription. The only thing shown is the space between words.

**Content-words** are the four major word classes: nouns, verbs, adjectives, and adverbs (including adverbial particles like *up* in *get up*). Numerals (e.g. *two*), interrogative and demonstrative pronouns (e.g. *who?, this*), and negative words (e.g. *not, couldn't*) are stressed like content-words. **Function-words** are all others: auxiliaries, most pronouns, articles, and conjunctions. Note that prepositions (e.g. *with, along*) also behave like function-words.[7]

**The tonic**

We have seen the working of the End-Weight Principle: if a longer word has several stresses, the last one is the strongest (the primary, as in *jùstifi**cá**tion*). Similarly, in an English sentence the **last stressed word** has the strongest stress, called the **tonic**. The tonic is, properly speaking, a syllable (since stress is always attached to a syllable), but we will often refer to the tonic-bearing word as "the **tonic word**" or simply "the tonic".[8] For example, in *We met in Oc**to**ber*, the tonic is really the syllable *-to-*, but we may also express this by saying that *October* is the tonic: *We met in **October***.

In transcription it is not necessary to show the tonic specially, since it is by definition the last stress. If necessary, the tonic can be highlighted by underlining the syllable (or the word that contains it), and by placing an arrow in front of the tonic syllable (↘ or ↗, depending on whether the voice falls or rises there).

# 7.5. RHYTHM

## 7.5.1. The Rhythmic Foot

— The way stressed syllables follow each other in the "head" of the tone-unit is called rhythm. The unit of English rhythm is the **rhythmic foot**.[9] A foot is a stressed syllable plus the unstressed syllables that follow it. Each tone unit is made up of one or more such feet. The first foot may be incomplete, consisting of unstressed syllables only: this is pre-head. The last foot always begins with the tonic: this is the tonic foot (consisting of tonic + tail).

The following sentence is a tone-unit consisting of five feet. (Foot boundaries are shown here with a vertical line. The missing stress in the pre-head is shown by ^.)

| ^ We de|'**ci**ded to |'**come** |'**back** in Oc|↘**to** ber. |

Rhythmic feet need not coincide with words or grammatical structures. There exist feet like "*cided to*" or "*back in Oc*".

## 7.5.2. The Rhythm Rule: stress-deletion

[7] Content-words are also called "lexical words". Function-words are also called "grammatical words" or "form-words". Some authors in syntax consider **prepositions** to be content words rather than function words.

[8] The tonic is also called nucleus, or sentence-stress, or accent.

[9] The notion of „foot" is borrowed from poetry. Note, however, that poetic (= 'metrical') feet may be more varied than ours.

When three stresses come too closely together, English tends to delete the middle one to make the rhythm smoother. This is called the Rhythm Rule. The deletion means that the syllable is downgraded from 2ry to 3ry stress. There are two subcases: in one case the deleted middle stress is a short word *(nice old lady)*; in the other it is the second stress of a word having a 2ry+1ry lexical stress *(afternoon tea)*.

### 7.5.2.1. Rhythmic stress deletion ("nice old lady" rule)

When three stresses come closely together, with maximally one unstressed syllable between them (ˈ*nice* ˈ*old* ˈ*lady*), the middle one of the three stresses may optionally be deleted ("de-stressed") to make the rhythm smoother: ˈ*nice old* ˈ*lady*. Such de-stressing does not depend on the meaning or grammatical role of the word affected, just the rhythmic pattern

In the examples below all stresses are underlined. The deleted middle stress (downgraded to 3ry) is shown with a small circle ($_o$).

| ***three stresses close together*** | | ***Medial Stress-Deletion*** |
|---|---|---|
| a ˈnice ˈold ˈlady | → | a ˈnice $_o$old ˈlady |
| ˈvery ˈnice ˈpeople | → | ˈvery $_o$nice ˈpeople |
| my ˈson ˈspeaks ˈHindi | → | my ˈson $_o$speaks ˈHindi |
| ˈJohn 1disaˈppeared | → | ˈJohn $_o$disaˈppeared |

The deletion also happens in the middle of very long words which have two secondary stresses before the primary:

| | | |
|---|---|---|
| ˌpsycho ˌanaˈlytical | → | 1psycho $_o$anaˈlytical |
| ˌunde ˌnomiˈnational | → | 1unde $_o$nomiˈnational |

In *We de'cided to 'come 'back in Oc'tober*, stress deletion is not normal because though there are two stresses (*come, back*) next to each other; there isn't a third stress close enough.

Medial Stress-Deletion causes short content words to lose their stress, or a secondary stress to be lost in the middle of a longer word (or finally-stressed compound). The result is the deletion of a foot, as the de-stressed word now becomes attached to the previous foot. Observe the examples:

| foot1 | foot2 | foot3 | | foot1 | foot2 |
|---|---|---|---|---|---|
| \| nice | \| old \| | lady \| | → | \| nice old | \| lady \| |
| \| psycho- | \| ana- \| | lytical \| | → | \| psychoana- | \| lytical \| |
| \| North | \| Sea \| | oil \| | → | \| North Sea | \| oil \| |

### 7.5.2.2. Stress-shift ("afternoon tea" rule)

If a word with two stresses (e.g. *1after'noon*) is immediately followed by a stressed word, three stresses fall closely together: *1after'noon 'tea*. This is subject to the Rhythm Rule, which deletes the middle stress: *'after$_o$noon 'tea*. But as a result, the original [2 0 1] stress pattern of the word *1after'noon* is replaced by a [2 0 3] stressing *'after$_o$noon*. The word's lexical primary-stressed syllable *(noon)* is degraded to strong-unstressed (tertiary) status.This gives the impression that the major stress in the word has "shifted" leftwards to the place of the secondary, and instead of the normal /ˌɑːftəˈnuːn/ we now have /ˈɑːftənuːn/.

Due to this Stress-Shift, the stressing of many longer words or compounds is variable, depending on whether they are followed by a stressed word or not.[10] Stress-Shift is most frequent in adjectives and nouns in attributive position, but it can affect practically any word that has two stresses. Examples:

1Japa**′nese** → ′Japa $_{o}$nese **′gar**den; 1demo**′cra**tic → ′demo $_{o}$cratic **′coun**try
1unde**′clared** → ′unde $_{o}$clared **′goods** to 1de**′ice** → to ′de $_{o}$ice **′ev**erything

It may also hit the second element of a finally-stressed compound, causing the compound to sound initially-stressed. For example, *1North 'Sea*, when followed by *óil*, loses the stress on *Sea* and appears with shifted stress as *'North Sea*.

1North **′Sea** → ′North $_{o}$Sea **′oil** 1New **′Year** → ′New $_{o}$Year's **′Eve**
1duty **′free** → ′duty $_{o}$free **′goods** 1World **′War** → ′World $_{o}$War **′Two**

The two applications of the Rhythm Rule, Medial Stress-Deletion and Stress-Shift, are basically the same: they eliminate a stress between two other stresses. They have no communicative significance: they are not applied to emphasize any part of the message. They are mechanical means to ensure a smoother rhythm in speech. Observe:

2 2 2 2 2 1 → 2 *3* 2 2 *3* 1
We had a nice old lady for afternoon tea. We had a nice *old* lady for after*noon* tea.

## 7.6. TONIC PLACEMENT

*Note. For a more pedagogical treatment of these phenomena, see BEP Chapter 13.*
This section will examine the rules for tonic placement, that is, choosing the word that receives the strongest (= last major) stress in a tone unit.[11] The place of the tonic can be **neutral**[12] (i.e. unmarked), or **dislocated** (i.e. marked, typically contrastive). The neutral tonic has no special communicative value, and is prescribed by general rules. The dislocated tonic is placed by the speaker on some other word than where it would normally fall, in order to express some communicative surplus by highlighting some element.

### 7.6.1. Neutral Tonic

#### 7.6.1.1. On the last content word

The neutral tonic falls on the last content-word of the tone-unit. This is the **Last Content-Word Rule**. If the last words are function-words, they remain unstressed because these are

[10] Words undergoing Stress-Shift *(afternoon, North Sea)* are also called "level-stressed", because their stressing can "tilt" either way.

[11] Tonic placement is also called "tonicity". All sentences in 7.6.1 have neutral tonicity.

[12] This use of the term „neutral" has nothing to do with „neutralization"! (see Chapter 2).

not “tonic-bearing”. The neutral tonic is mechanically assigned: the tonic need not be the most “important” or communicatively most informative word. For example:

ˈPat’s ˈfather is an exˈtremely ˈrich ↘man.
Aˈmandaˈmadeˈsomeˈdeˈliciousˈfruit ↘salad.
ˈTurn ˈleft towards the ↘car ferry.
I ˈhope you can re↘member them.
ˈWhat was your um↘brella like?
They ˈcouldn’t ↘wait for us.

## 7.6.1.2. On a function-word

The neutral tonic may, in well-defined cases, fall on some function word. We will discuss only two of these cases: neutral tonic on an auxiliary, and on an adverbial particle.

• **Neutral tonic and auxiliaries.** An auxiliary (including the finite forms of *be, do, have*) has the tonic if there is no further stressable word in the sentence: ˈYes, we ↘may. – ˈJim ˈalways ↘does. – This includes questions where the auxiliary is followed by its unstressed personal pronoun subject: ˈHow exˈpensive ↘is it? – ˈWhere ↘am I? – ˈHow ↘are you?

However, when a sentence-final auxiliary is preceded by its own stressed subject, the tonic falls on the subject and the **auxiliary is unstressed** (but strong, i.e. tertiary-stressed!):

You ˈplay ˈbetter than ↘Joe *does*.
ˈThat’s the ˈpub where my ↘friends *are*.
I ˈwonder ˈwhen the e↘xam *will be*.
It ˈfits me ˈbetter than ↘yours *would*.

A final auxiliary is never reduced to zero stress.

**Neutral tonic and adverbial particles.** An adverbial particle[13] forms part of a phrasal verb: *get up, put off*. The particle has no weak form, and is usually stressed:

You should ˈget ˈ**up** before ↘six. – I ˈcouldn’t ˈring you ˈ**back** on ↘Tuesday.

• Sentence-finally (possibly followed by non-stressable words), it can have two kinds of stressing:

**(a)** It is tonic-bearing after a verb or after an unstressed pronoun:

ˈGet ↘**up**!
ˈPlease ˈput that ↘**down**.
The ˈmeeting was ˈcalled ↘**off**.
ˈIt’ ˈhard to ˈget ↘**out** of it.
ˈShall I ˈwrap one ↘**up** for you?

**(b)** It is unstressed after a noun. This is the only case when a final adverbial particle is unstressed:

ˈTake your ↘coat *off*!
ˈPlease ˈput that ↘gun *down*.
ˈTim’s ˈgot to ˈcall his ↘mother *back*.
ˈLiz ˈpromised to ˈput the ↘children *up*.

The verb before the particle may lose its stress due to Medial Stress-Deletion, as *break* in *The ˈcar ˈdidn’t ₒbreak* ***↘down***. A phrasal verb is thus stressed either on both components *(ˈget ˈup)*, or on the particle only *(get ˈup).*

Let us remark that prepositions behave differently from adverbial particles in syntax as well as in prosody. *Laugh at, deal with, sit on* are **Prepositional verbs**[14] (verbs requiring a prepositional complement), while *call off, break up, put on* are **Phrasal Verbs** (Verb + Ad-

[13] Hung. ‘igekötő’.

[14] Hung. ‘elöljárós v. vonzatos ige’.

verbial Particle). There is a syntactic differene: *I [put on] the hat – I sat [on the hat]*. A preposition normally appears in a reduced ("weak") form, while adverbial particles have no weak form. The words *at, for, from, of, to, with, without* are only used as prepositions, never as adverbial particles, while other words (*up, off,* etc.) can function as either.

A phrasal verb may be followed by a preposition, e.g. *hang on to* ('insist'), *get away with* ('escape'), *go in for* ('enjoy'). The stress of such combinations follows the rules outlined so far: the adverbial particle is stressed, the preposition unstressed. Examples:

ˈDon't hang ˈ**on** *to* this ˈstupid i↘dea. ˈDon't hang ↘**on** *to* it.

ˈWhat is he ˈhanging ↘**on** *to*? ˈDon't hang ˈ**on** *to* ↘THAT!

## 7.6.2. Dislocated Tonic Placement

In order to focus some part of the message, to contrast it with something, or to highlight it as new information, the tonic may be dislocated, i.e. placed elsewhere than the neutral-placement rules would prescribe. Compare:

(a) She spent a year in the ↘forest. – neutral tonic placement

(b) She spent a ↘YEAR in the forest. – dislocated tonic placement

A dislocated tonic need not be louder than the other stresses – it is just earlier or later than it would be in the neutral stress pattern. (In the following examples the dislocated tonic is printed in CAPITALS.)

In everyday life people use the word "stress" exactly for this kind of emphasis, and not for the syllabic prominence that "stress" means to the linguist. People say: *The headmaster stressed that our school was a traditional one,* meaning that he laid special emphasis on tradition. (The same is done in Hungarian, where the everyday meaning of *"hangsúly(oz)"* is similarly "emphasis, emphasize": *Az igazgató hangsúlyozta...*). The layman would say that in sentence (a) above we "didn't stress anything", while in (b) we "stressed" that it was a whole year. From a linguistic point of view, the word *year* is stressed in both (a) and (b); but in (b) it is made emphatic by receiving a dislocated tonic.

### 7.6.2.1. Dislocated tonic for contrast

The tonic may be dislocated in order to contrast one element (a word, a morpheme, or a grammatical feature, like tense).

**• (A) LEXICAL CONTRAST**

A frequent case of dislocated tonic placement is **lexical contrast**, when the speaker emphasizes a word which is earlier than the tonic. For example

Jane ↘BOUGHT three rabbits at the market. (She did not sell them.)

Tim was so drunk he literally ↘CRAWLED out of the pub. (instead of walking)

Even the verb *be* can be lexically contrasted:

(She sounds Welsh to me.) — ˈThat's beˈcause she ↘IS Welsh.

(It tasted like bad wine.) — It ↘WAS bad wine.

**• (B) VERBAL CONTRASTS: MODALITY AND YES/NO POLARITY**

Another type of contrast that we express with a dislocated tonic concerns the mood, tense, or positive/negative value (the "polarity") of the verb. The two sentences below show these three types of difference:

(a) Tim will enjoy the per↘formance. (neutral tonic)
(indicative mood, future tense, positive polarity)

(b) Tim ↘WON'T enjoy the performance.
(indicative mood, future tense, negative polarity)

This is not lexical contrast since the verb *(enjoy)* is the same: the speaker is not contrasting one verb with another, but is contrasting the accompanying values of the same verb. In modality and polarity contrast, the dislocated tonic always falls on an auxiliary. If there is no auxiliary (in the simple present or past), the auxiliary *do* has to come in to bear the tonic.

**•• (i) Verbal modality (mood and tense) contrast**

"Mood", for our purposes, includes not only indicative and conditional, but also meanings expressed by the modal auxiliaries (*can, could, ought to,* etc.). The category "tense" covers all verbal categories including aspect like continuous (= progressive), passive, etc.

(Has Sue gone to France?) — No, but she ↘MIGHT go.
(When will the students write the application?) — They ↘ARE writing it.
(Why don't you try the cheesecake?) — I ↘HAVE tried it, thanks.
(I think Tim works at a hospital.) — He ↘DID work there (...but doesn't any more).
(You should use this dictionary.) — We ↘DO use it.
(Shouldn't Joe study classical music?) — He ↘DOES study classical music.

**•• (ii) Yes/No polarity (positive/negative) contrast**

The other type of non-lexical contrast in verbs concerns "polarity", namely, positive (= affirmative) versus negative meaning. Polarity contrast (answering "yes" to "no", or vice versa) is again achieved by placing the tonic on the auxiliary:

(Sue can learn it on her own.) — She ↘CAN'T learn it on her own.
(You can't come in because you're not members.) — We ↘ARE members.
(I'm glad you've bought the tickets.) — We ↘HAVEN'T bought them.
(You don't like fish and chips, I suppose.) — I ↘DO like fish and chips.
(It's a shame you didn't write to Liz.) — I ↘DID write to her.

Remember that *do*- forms or other auxiliaries are not needed in cases of lexical contrast, where the verb itself must be stressed:

(Was Tim ill in hospital for so long?) — No, he ↘WORKED there.
(Why don't you throw away this old dictionary?) — We ↘USE it!
(Joe teaches classical music, doesn't he?) — He ↘STUDIES classical music.

## 7.6.2.2. Dislocated tonic for highlighting new information

The speaker may consider some part of his sentence as “old” information, known both to him and the listener. If this old information is at the end of the sentence, the speaker will de-stress the words which express it, and move the tonic leftwards to the (end of the) “new” information. In such cases there is no contrast or emphasis involved; the tonic-bearing word is not opposed to anything, it is just highlighted as new.

In the examples below the *old information* is printed in italics; the DISLOCATED TONIC which highlights the (last stress of the) new information, is capitalized:

(Was the headmaster angry about it?) — I ′didn’t ↘SPEAK to *the headmaster*.
(We only serve Indian food here.) — I ↘WANT *Indian*.
(My wife comes from Singapore.) — Oh, I ′grew ↘UP *in Singapore*!

Sometimes the fact that the information is “old” (= “given”) is only obvious from the situation or from the hearer’s knowledge of the general background:

′Here’s the C↘D *I promised to bring you*.
(Leeds is a very busy town.) — I know, my ↘PARENTS *live there*.

**Anaphoric words de-stressed for old information**

The speaker may, alternatively, choose to express the old information with unstressed content-words, usually synonyms or other words which refer to the things mentioned:

(Why’s that man looking at you?) — I ′went to ↘SCHOOL with *the guy*.
(Everyone was talking Chinese to me,) but I ′don’t ↘SPEAK *the language*.
(Joe ran away) be′fore I could ↘ASK *the idiot*.

In all these cases the tonic counts as dislocated because it is not on the last content word.

## 7.7. INTONATION

In the preceding sections we discussed one component of prosody: stress. We now turn to the other prosodic component: intonation. While stress concerns the loudness of syllables, intonation concerns their height, called “pitch” in linguistics.[15] People easily confuse a high pitch with a loud stress: these often appear together, but are not the same (see the examples in 7.1). Intonation includes two things only: the melodies or “tones” (with their meanings and functions), and the division of speech into tone-units (that is, where one intonation pattern ends and the next one begins).[16]

The pitch of the speaker’s voice is influenced by several factors. (a) natural factors (= “symptoms”) like sex and age: women and children have a higher pitch than men, and every person has a characteristic pitch; (b) paralinguistic factors: an excited speaker will use a higher pitch than someone who is tired or bored; (c) linguistic factors: the pitch may depend

[15] Hung. ‘hangmagasság’.

[16] Some authors claim that intonation includes all features of connected speech, so they treat all suprasegmental phenomena (including rhythm and tonic-placement rules) under the heading “Intonation”. We prefer a narrower definition.

on whether the utterance is a question or a command, old or new information, encouraging or neutral. These linguistic factors belong to the field of intonation.

Besides pitch, speech has other features like loudness and tempo, and is accompanied by gestures and facial expressions (sometimes called “body language”), all of which are important for communication, but do not form part of the linguistic system.

## 7.7.1. The components of intonation

In speech the height of a given syllable is called **pitch**. In phonology the linguistically relevant (= “phonemic”) **pitch changes** are examined: this is what we call intonation. In every tone-unit, the last stress, the **tonic**, is accompanied by pitch change, i.e. the voice falls or rises on that syllable. The pitch-change attached to a tonic syllable is a **tone**.

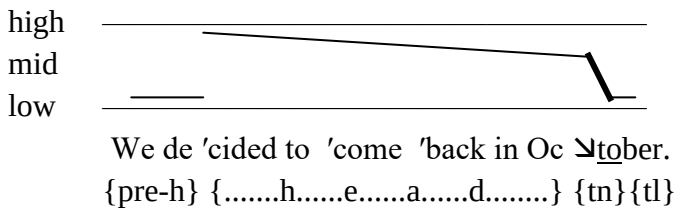
**The English tones**

English has four phonologically distinct tones. One is falling, three are rising.

| *Type* | ***Name of tone*** | *Diagram* | *Example* | *Meaning* |
|---|---|---|---|---|
| *Falling* | **Fall** | | ↘Blue | neutrality, definiteness, finality |
| *Rising* | **Fall-rise** | | \↗Blue | implication; softening; old info |
| | **Low rise** | | ↗Blue | indifference; encouragement |
| | **High rise** | | ↗Blue | inquiry; Yes/No question |

Intonation can be represented with lines actually depicting the rising or falling of the voice. The tone (= the pitch change on the tonic syllable) is shown with a thick line.

***Example 1. Falling tone.***




The following points deserve comment:

– The pre-head *(We de-)*, containing only unstressed syllables, is spoken at a low pitch.

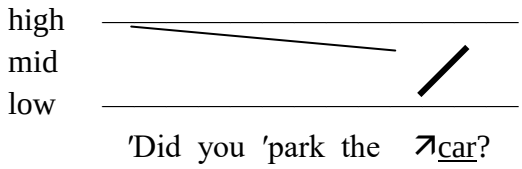
– The head *(-cided to come back in Oc-)* begins with a high pitch, and gradually becomes lower as we proceed towards the tonic (“downdrift”).[17]

– The tonic syllable *(-to-)* has the only radical pitch change: the tone starts here. The height of the voice suddenly changes on this syllable. (Our example has a falling tone).

– The tail *(-ber)* adds nothing to the intonation, it simply continues where the tonic has pushed it (in this case at a low level).

[17] Some textbooks use the lower stress mark / 1 / for indicating low-pitch stress in the head (and not for secondary stress as we do).

***Example 2. High-rising tone.*** The rise here is realized on one syllable *(car)*, as there is no tail. There is no pre-head either. The head starts high, the pitch descends gradually as far as the end of the head; there the pitch suddenly breaks its descent, and rises from low to high on the tonic syllable:



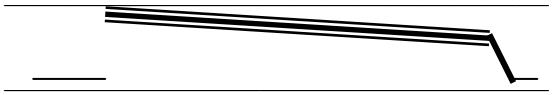

ˈDid you ˈpark the ↗car?

The falling or rising nature of the intonation of a tone-unit is determined by the tonic. If the tonic has a falling tone, we call the whole intonation falling, no matter where it began or what happened in the pre-head or head. If the tonic is rising, we call the whole intonation rising, though the sentence may actually end on a lower pitch than where it began.

**Downdrift**

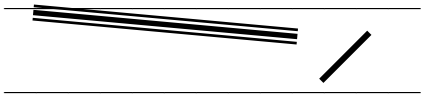
The gradual lowering of the pitch within the tone unit's head is called **downdrift**.[18] Downdrift itself does not count as falling intonation. Compare the examples again: the downdrifting heads are highlighted with parallel lines:

FALLING INTON.



We de ˈcided to ˈcome ˈback in Oc ↘tober.

HIGH-RISING INTON.



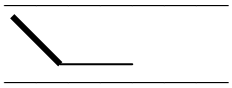
ˈDid you ˈpark the ↗car?

Both sentences have downdrift in their heads. However, the first sentence has falling intonation, the second rising, because their tonics are falling and rising respectively.

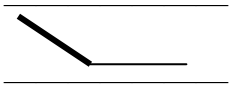
**The intonation of the tail**

If there is a tail, the tone spreads out over the tail: the syllables in the tail continue the movement set by the tonic.

Falling tone:

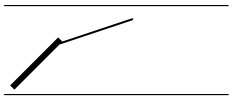


↘Usually.

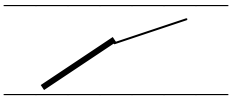


↘Using it.

High-rising tone:



↗Usually?



↗Using it?

[18] Hung. 'lesodródás'.

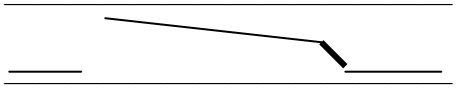
We see that when the tone is falling, the syllables in the tail continue low. When the tone is rising, the syllables in the tail continue to rise. The tail is thus not an independent factor in intonation.

## 7.7.2. The four tones and their use

### 7.7.2.1. The falling tone

**Form**

The voice falls on the tonic from high (or mid) to low. If there is a tail, its syllables continue low.



The ˈpapers ˈaren't ↘interesting

**Function**

The falling tone has the following functions/meanings:

**(a) Definiteness.** The fall is the most neutral intonation. In statements and commands it expresses definiteness and finality. It suggests that what we say is plain new information.

- Statements:

  There ˈisn't eˈnough ↘time. Her ˈbook was ˈpublished in ↘French.
- Commands (serious, businesslike, not too polite):

  ˈKeep your ˈdoor ˈsafely ↘locked. ˈOpen your ˈbooks at ˈpage fif↘teen!
- Exclamations (to express surprise, etc.).

  ˈWhat a ˈmarvellous ↘picture! ˈHow ˈutterly dis↘gusting!

**(b) Wh-questions.** The fall is used for Wh-questions (i.e. questions beginning with a question-word such as *who, what, where, how,* etc.):

ˈWhat's her ˈnew a↘ddress? ˈWho'll be the ˈchief ↘editor?

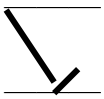
↘When? How ↘much? ˈWhat ↘size are they?

To sum up: the fall is used for statements, commands, exclamations and Wh-questions.

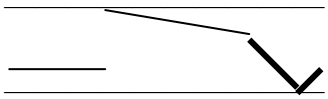
### 7.7.2.2. The falling-rising tone

**Form**

The voice falls from high (or mid) to low, then immediately rises to mid-high again. Thus the second half of this tone is a low rise. If there is a tail, its syllables continue to rise to mid-height.



\↗Fine



You can ˈask the \↗porter.

The \↗first part is interesting.

**Function**

The fall-rise has the following functions/meanings:

**(a) Implications.** What we say is not the whole truth. The speaker has reservations, does not agree completely, or is hesitant to plainly say his opinion: "yes, but..." We call it implicational because it implies something that remains unsaid (this is added after three dots in the examples below).

(Shall we go by car?) — \↗Fine. (...but I won't drive)
We ˈlike to \↗travel. (...but not to silly places like that)

Such sentences often have a dislocated tonic:

The \↗FIRST part is interesting. (...but the rest isn't)

The implication conveyed by the fall-rise is often that something should be done:

\↗Dinner's ready! (...so come and sit down)
I ˈcan't \↗lift this. (...so please help me)

**(b) Partial negation.** The fall-rise is able to express partial negation (see the (b) sentences below), implying that the thing is true on the whole, but some part of it is negated. While ordinary full negation (a), expressed by the fall, simply means "no", the partial negation expressed by the fall-rise means "yes, but...". Compare:

(a) I ˈwon't ˈeat ↘anything. (full negation; 'I will eat nothing')
(b) I ˈwon't ˈeat \↗anything. (partial negation; 'I'll eat, but not everything')

(a) We ˈhaven't ˈheard them ↘once. (full negation; 'never heard them')
(b) We ˈhaven't ˈheard them \↗once. (partial negation; 'heard them many times')

(a) It ˈwasn't ˈpublished because a ↘woman wrote it.
(full negation; 'it wasn't published, and the reason was that a woman wrote it')
(b) It ˈwasn't ˈpublished because a \↗woman wrote it.
(partial negation; 'it was published, though not for this reason')

**(c) Softening.** Another use of the fall-rise is to soften the directness of commands or questions, which might sound rude or too official with the falling tone.

- Polite commands (said rather like requests):

\↗Wait a minute! ˈKeep your \↗passports ready! ˈHave a\↗nother one!

- Polite Wh-questions:

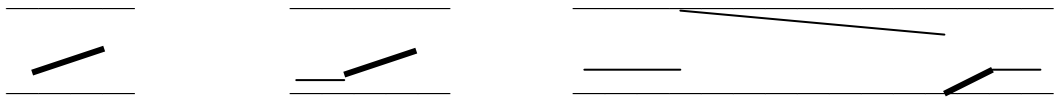
ˈWhat's your \↗name? ˈHow \↗old is she? \↗When?

To sum up: the fall-rise is used for implications (including partial negation); to soften a command or a Wh-question.

## 7.7.2.3. The low-rising tone

**Form**

The voice rises from low to mid. If there is a tail, its syllables continue at mid-height. Examples in diagrammatic notation:



↗Blue. She ↗knows. We could ˈask them ˈover for ↗coffee.

The low rise does not indicate a question, as opposed to the high rise, which does. Compare these two pronunciations of *Really?*:

↗Really? LOW RISE (just a polite way of saying "I see" or "I heard what you said")

↗Really? HIGH RISE (a true question asking for confirmation of something surprising)

These two tone-units are a prosodic minimal pair, whose meaning difference is expressed by the intonation difference. Tthe low rise is not an "allo-" form of the high rise but a distinct "intonation phoneme", an independent tone of English.

**Function**

The low rise is mostly used in response to what someone else has said. It expresses the following meanings or attitudes:

**(a) Indifference.** "What I'm saying is true but I don't think it's important or interesting or relevant." It sounds as if the speaker was shrugging while saying these sentences.

(What's your favourite colour?) — ↗Blue. (What a childish question.)

(I suppose you don't dare to tell your wife.) — She ↗knows. (It makes no difference.)

(Did you enjoy the performance?) — It was all ↗right. (Nothing special.)

**(b) Encouragement.** The low rise is used to encourage or comfort the hearer and to sound reassuring. It sounds as if the speaker meant, "no problem, nothing serious, relax".

- Encouragement to do something, not to worry, etc. Often used to children.

ˈDon't ↗worry. I ˈdon't ↗mind. We ˈshouldn't be a↗fraid.

- Encouragement to continue speaking ("I'm listening, go on!"):

↗Yes. Is ˈthat ↗so? ˈThat's ↗interesting. ↗No. (but tell me)

It is also used with the polite tag *...will/won't you?*, attached to imperatives. The imperative base sentence has a falling tone:

Help your↘self, | ↗won't you? Come and lend a ↘hand, | ↗will you?

**(c) Greetings, thanks, apologies.**

ˈGood ↗morning. ˈNo ↗thanks. ˈBye-↗bye.

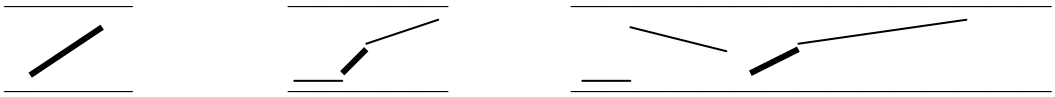
I'm ↗sorry. Ex↗cuse me. ˈSee you ↗soon.

To sum up: the low rise is mostly a response, something added to other sentences. It can express indifference and lack of importance. Due to its "lightness" it can also be used to express encouragement and greetings. It is not used for questions.

## 7.7.2.4. The high-rising tone

**Form**

The voice rises to a high pitch.



↗You? To ↗Jennifer? And ˈis she ↗permanently there?

The English high rise is distributed over the tonic plus the tail, so sometimes five or six syllables keep rising steadily (as above in ...***per****manently there?*). [19] If there is a tail in the English high rise, Hungarian learners will tend to use their rise-fall. This is dangerous for communication as the English ear will only hear the fall at the end, and interpret the intonation as falling, i.e. not a question.

**Function**

**(a)** The high rise is mostly used in **Yes/No questions**, whether they are grammatically well-formed interrogative sentences or not.

ˈDid you ˈpark the ↗car? ˈCould I ˈbring it ˈback on ↗Saturday?
ˈOne of the ↗editors? ↗Are you? ↗Birmingham?

**(b) "Please-repeat" questions.** These are Wh-questions asking for the repetition of something just heard. Such "please-repeat" questions have a dislocated tonic on the question word.

(Jennifer is in Kuala Lumpur.) — ↗WHERE's Jennifer??
(Watson will be the new chief editor.) — ↗WHO'll be the new chief editor??
(My girlfriend is thirteen.) — ↗HOW old is she??

The question-word bearing the tonic can also remain in the syntactic place where the questioned element stands in the statement. In this case the word order is not question-like:

(She bought herself a platypus.) — She bought herself a ↗WHAT??
(We've got tickets for the 2am performance.)
— You've got tickets for ↗WHICH performance??

---

In Hungarian questions the tone only ends in a real rise if the last syllable is the tonic (e.g. *Ez vajon ↑zöld?*); otherwise the last syllable has to fall. If there are two or more syllables after the tonic *(Zöl↑de↓ket? Zöldsé↑ge↓ket?)*, only the penult will rise and the ult will fall back. This is the characteristic Hungarian "rise-fall", used for Yes-No questions. For example:

↗Zöld? ↗Zöldek? ↗Zöldeket? ↗Zöldségeket?

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19

### 7.7.3 Question-intonations: a summary

Because English questions may have a variety of tones, let us summarize them.[20] The numbers refer to the examples below.

| TONE | Question type |
|---|---|
| Falling tone | Wh-questions (2) |
| High-rising tone | Yes/No questions (1)<br>Please-repeat questions (4) |
| Low-rising tone | — |
| Falling-rising tone | Polite Wh-questions (3) |

The following list illustrates the various question intonations, using very short tone units:

(1) Ordinary Yes/No question: HIGH-RISING TONE.
↗Here? (neutral question)
(2) Ordinary Wh-question: FALLING TONE.
*(I know a much better pub.)* — ↘Where? (neutral question)
(3) Polite Wh-question: FALLING-RISING TONE.
(I know a much better pub.) — \↗Where? *(= "Oh, really? Tell me!")*
(4) "Please-repeat" question: HIGH-RISING TONE.
*(There's a better pub in Yahoo Street.)* — ↗Where?? *(= "Sorry, couldn't hear.")*

END OF CHAPTER 7

[20] In this short chapter we cannot deal with Tag Questions, an interesting and complex subfield.

# Phonological analysis, 8: The phonology–morphology interface

Péter Szigetvári

The morphological structure of words often influences their phonological shape. Experiments have shown that in some cases (like *may name* vs. *main aim*) people are usually unable to locate the word boundary out of context, in others (like *may cough* vs. *make off*) the word boundary produces an evident phonological difference. A simple phonemic transcription of these two strings (/**meɪkɒf**/) does not make the difference predictable, unless supplemented with an indication of whether there is a word boundary in the string (or not, as in the name *Makoff*) and where it falls. Allophonic rules can then refer to this word boundary, to aspirate the **k** of the first, and to preglottalize that of the second phrase. The three parses are shown in (1).

(1) *Possible parses of* **meɪkɒf**

a. *may cough* **meɪ#k$^{h}$ɒf** b. *make off* **meɪ$^{ʔ}$k#ɒf** c. *Makoff* **meɪ$^{ʔ}$k$^{h}$ɒf**

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Classical phonemic analyses involved segmental, prosodic, and juncture phonemes. The last category, juncture phonemes, was necessary because of the contemporary obsession with the idea that phonological analysis cannot involve elements of a higher level of the analysis. Linguistic analysis was carried out in strict sequentiality: morphological analysis followed a completed phonological analysis. Accordingly, the formulation of allophonic rules could not make reference to contexts like "at the end of the word", since that would have involved a higher level, the morphological level of analysis, which was not available at that point. An analysis mixing these levels was deprecated. Thus, such a framework used juncture phonemes, of which the different types of boundary symbols used descriptively today ("#", "+", "=") are direct descendants.

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## 8.1 Phonological boundaries in the generative model

Standard generative phonology applies several different kinds of boundary markers. (2) contains a list of these.

(2) *Boundary markers*

a. the syllable boundary (.)
b. the verbal prefix boundary (=)
c. the morpheme (or formative) boundary (+)
d. the word boundary (#)
e. the phonological phrase boundary (‖)

The syllable boundary, as we have seen, is different form the others in that it is phonological in its nature, its location is not (fully) dependent on the morphological structure

of the word.[1] The phonological phrase boundary is the strongest of all. An **l** in English is dark before consonants and also before a phonological phrase boundary, that is, when the speaker pauses. This is all we have to say about this boundary here, we will not be concerned with it any further in this chapter.

In what follows we are going to have a closer look at the remaining three boundary types: the morpheme boundary (also called the weak boundary), the verbal prefix boundary, and the word boundary (also called the strong boundary).

### 8.1.1 The morpheme boundary

The morpheme boundary (represented by '+') is found between the morphemes that make up the word. In some cases a free stem and a suffix are joined by a morpheme boundary, though in most cases such stems are bound. (3a) lists examples for the former, (3b) for the latter case.

(3) a. *free stem*
odd+ity **ɒdəti**
post+al **pəʊstəl**

b. *bound stem*
opac+ity **əʊpæsəti** (cf. **əʊpeɪk** *opaque*)
acid+ic **əˈsɪdɪk** (cf. **ˈæsɪd**)

Rules applying in a given context, that is, to a segment occurring before and/or after certain segments, apply irrespective of the presence of a morpheme boundary in that string. To put it more technically: if $Y$ changes in the environment $X\_\_Z$, this change will happen in any of the contexts $X + Y + Z$, $X + YZ$, $XY + Z$, as well as in $XYZ$. This means that any phonological change that occurs within a morpheme also occurs across the morpheme boundary, so morphemes separated by '+' behave exactly like MONOMORPHEMIC forms, that is, a word consisting of a single morpheme. The morpheme boundary, +, is *invisible* to the phonology. This observation will gain significance later in this chapter.

The opposite is not true: if a phonological rule is stated with the morpheme boundary in its environment, it does not necessarily occur in a boundaryless context. Consider, for example, velar softening, a simplified formulation of which is given in (4).

(4) *Velar softening (the voiceless part)*

$$\mathbf{k} \rightarrow \mathbf{s} \;/\; \_\_ + i$$

The case of *opaque* **əʊpeɪk**∼*opac+ity* **əʊpæsəti** illustrates the rule: the stem final **k** turns into **s** before the morpheme boundary that is followed by $i$.[2] However, it is not generally the case that a **k** turns into **s** before $i$ in English: the change does not occur

[1] Interestingly, this kind of boundary was not applied in the most important representative of standard generative phonology, Noam Chomsky and Morris Halle's *Sound Pattern of English* (usually referred to as SPE, published in 1968).

[2] Note the peculiarity that the rule includes an orthographical symbol, $i$, in its formulation, the pronunciation varies, it can be **ɪ**, **ə**, **aɪ**.

within morphemes (see §8.2.5), *kiss* is not pronounced **SIS**, else there would be no cases of **KI** in the language (except perhaps across a word boundary, like in *Eric is*).

Another regularity dependent on the presence of a morpheme boundary is trisyllabic laxing. As is well known, the antepenultimate stressed vowel tends to be lax in English words. Counting starts from the closest word boundary to the right, accordingly the stressed vowel of *#cāter#ing#* is not lax, but that of *#crĭmin+al#* (cf. *crīme*) is. A large part of the exceptions to this rule are monomorphemic words, like those in (5).

(5) *Monomorphemic words with a tense vowel in the antepenult*

stēvedore, nīghtingale, Ābraham, Ōberon, ōmega

If we formulate the rule with reference to the morpheme boundary, monomorphemic words are not expected to exhibit trisyllabic laxing. The lax vowel in the antepenultimate syllable of a large set of monomorphemic words (e.g., *ănimal, crŏcodile*) is, in this case, as unexpected as that in the penult or ult of other words, like *măther* or *măt* (cf. *cāter, māte*).

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One may object that words with a lax antepenult (like *ănimal*) are much more frequent than those with a tense vowel there (like *Ābraham*). The situation is rather similar to that of front–back vowel harmony in Hungarian. It works across a morpheme boundary: *ház-ban* 'in a house' vs. *kéz-ben* 'in a hand', but it fails to operate within a morpheme: *hárem* 'harem', *Géza* name. It is nevertheless true that the majority of morphemes do have only front or only back vowels, morphemes like *sofőr* 'chauffeur', *öko-* 'eco-' with both a back and a front rounded vowel are very rare.

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### 8.1.2 The verbal prefix boundary

In English the stress rule stresses the ult of a verb if it is heavy, as in (6a), and the penult if the ult is light, as the verbs in (6b) show (cf. §4.5.1.2). This rule regularly fails on a set of verbs that have a stressed light ult, as shown in (6c).

(6) *Stress patterns in bisyllabic words*

| a. | b. | c. |
|---|---|---|
| torménT | édit | forgét |
| salúte | cáncel | compél |
| defý | devélop | omít |
| agrée | abándon | begín |
| secréte | mánage | attách |

Regarding their syllabic structure, the words in (6c) are not different from those in (6b), what they differ in is their morphological structure: the verbs with a stressed light ult all contain a verbal prefix. This is marked as *for=get, com=pel,* etc. The stress rule cannot assign stress to a verbal prefix (i.e., to the left of the prefix boundary, =). The same boundary is present in a large set of verbs like *re=sist, ob=serve, e=volve, pro=pose, con=struct, for=sake* etc., but since the ult of these verbs is heavy, and thereby attracts stress anyway (making them like the verbs in (6a) above), stress placement does not reveal the presence of the boundary.

Another property of stress in English also necessitates reference to the verbal prefix boundary. In verbs of three (or more) syllables, stress regularly falls on the penult if the ult is light (just like in regular shorter verbs), but on the antepenult if the ult is heavy, as shown in (7a) and (7b), respectively.

(7) *Stress patterns in trisyllabic words*

| a. | b. | c. |
|---|---|---|
| astónish | víolàte | ìntrodúce |
| imágine | sátisfỳ | còmprehénd |
| consíder | cómplemènt | ìntervéne |
| embárass | cólonìze | rèpresént |

As we have seen in chapter 6, the pattern in (7b) is standardly claimed to be the result of a rule (the Alternating Stress Rule) that moves stress two syllables back from the end of the word. The same rule applies in nouns (e.g., *húrricàne, ánecdòte, Árkansàs*) and adjectives (e.g., *ábsolùte, mánifèst, móribùnd*) with a heavy ult.[3] The peculiarity of the verbs in (7c) is that the Alternating Stress Rule does not apply to them: stress is on their heavy ult. What distinguishes words of three or more syllables with stress on the antepenult (as in (7b)) and stress on the ult (as in (7c)) is the = boundary: if it is right before the last syllable, stress cannot move forwards to the antepenult. With the exception of *complement,* none of the verbs in (7b) contain a verbal prefix, and even in *com=plement* the prefix boundary is *not* before the last syllable. On the other hand, the verbs in (7c) contain either a bisyllabic prefix, or two monosyllabic ones, but in either case there is a prefix boundary before their last syllable (*intro=duce, com=pre=hend, inter=vene, re=pre=sent*).

In some of these verbs, the boundary can be detected by other phonological tests, like, for example, **s** voicing. While ⟨s⟩ is not normally voiced intervocalically in English (cf. *analy*[**s**]*is, epi*[**s**]*ode*), it is when the prefix boundary comes between the vowel and the ⟨s⟩ (cf. *re=*[**z**]*ist, pre=*[**z**]*erve, de=*[**z**]*ign, re=*[**z**]*ume* etc., vs. *in=*[**s**]*ist, con=*[**s**]*erve, con=*[**s**]*ume*). Comparing pairs like *re=*[**z**]*olve* 'determine' vs. *re-*[**s**]*olve* 'solve again', or *re=*[**z**]*erve* 'withhold' vs. *re-*[**s**]*erve* 'serve again' clearly shows that it is the verbal prefix boundary that must be referred to if this pattern is to be explained as a phonologically regular alternation.[4]

The voicing of **s** is sensitive to historical contexts that are only preserved in the spelling. For example, there is no voicing in *assign* or *persist,* although they contain the verbal prefix boundary followed by an **s**, which in current (Standard Southern British) English is intervocalic. Their spelling shows that they were not intervocalic in some earlier stage of the language.

[3] The Alternating Stress Rule leaves a stress on the last syllable. This stress is here marked as secondary, but it may be analysed as tertiary as well, in either case it is less prominent than that on the antepenult.

[4] Although counterexamples are rare, it must be noted that there is no such voicing in the case of the Germanic verbal prefix *be-,* cf. *be=*[**s**]*eech.*

### 8.1.3 The word boundary

Word boundaries occur between words. The problem is that it is far from obvious what it means to be a word in linguistics. Furthermore, words are hierarchically organized: a word may contain other words. For example, *blackbird* is a word which contains two other words, *black* and *bird,* accordingly one would posit *#black#bird#* as its representation. This, however, does not show the difference between *blackbird* and *black bird,* although the phonological representation of the two must be distinguished, since their stress patterns differ (it is 13 for the type of bird, and 21 for any bird which is black; see chapter 7).

A word is a free form, that is, a free morpheme. Bound morphemes (affixes, like *re-, un-, -ing, -ness*; bound stems, like *opac-(ity), wive-(s)*) cannot be considered words, since they are not free forms. Taking a "word" like *pitiless* then, we must conclude that there is a word boundary around the stem *pity,* since that is a free form here: *#piti#less* (note that the *i/y* "alternation" is merely orthographical). In *#piti#less#ness* both *pity* and *pitiless,* as well as *pitilessness* are words. Accordingly, we can represent the latter one as *#piti#less#ness#*.

The representation above is still not acceptable. It falsely implies that the suffixes *-less* and *-ness* are on a par with the stem *pity,* that is, that they are words themselves: there is no difference between the representations of *#piti#less#* and *#black#bird#*. But this is wrong: *-less* and *-ness* are *not* free forms. The reason for the faulty implication is that the word boundary symbol is undirected, it suggests that wherever a word finishes another one begins. In reality, except for exclusively isolating languages, this state of affairs rarely occurs. In most cases words end without a following word beginning, and a word begins without a previous word ending. In $\#_1 piti \#_2 less \#_3$, $\#_2$ indicates the point were the word *pity* ends but no word begins here. To show this asymmetry, the directionless symbol # may be replaced by a pair of square brackets that indicate the beginning and the end of the word separately. Accordingly, *pitilessness* is represented as $[_1[_2[_3 piti]_3 less]_2 ness]_1$. The initial three brackets show that three words (*pity, pitiless,* and *pitilessness*) begin there. There is also a closing bracket at the end of each of these strings. Crucially, closing and opening brackets are not necessarily adjacent at the points where we previously had a word boundary symbol, but each opening bracket has a closing pair, these are coindexed above. (Nevertheless, in what follows, we will keep using the symbol # when it is more convenient.)

### 8.1.4 Identifying boundaries

We now face a more practical problem: how to determine whether a certain morpheme boundary is to be represented with the morpheme boundary proper (+), or with the word boundary (#).

One criterion might be whether the stem is free or not. If not, we are strongly persuaded to posit a morpheme boundary. In the case of a word like *opacity* or *acidic,* the vowel shift (**eɪ** ∼ **æ**) and the velar softening (**k** ∼ **s**) in the first, or the stress change (*ácid* ∼ *acídic*) in the second are reason enough not to suppose a word boundary: the stems are evidently not free. But if we supposed that in words like *oddity* or *postal,* in which the stems are free, there is a word boundary between stem and suffix, our

"explanation" would be circular: if the stem is a free form there is a word boundary after it, *and* there is a word boundary after a stem if it is free. This is not acceptable. Instead, we would want some clearcut method, which always enabled us to tell the type of boundary between morphemes. A great majority of the relevant data suggest that suffixes and prefixes come in two types, one connecting to the stem with a morpheme boundary, the other with a word boundary. Thus, if *-ity* proves to be a morpheme-boundary suffix, inducing velar softening, vowel shift, and stress shift, then it attaches to the stem with a morpheme boundary even when the stem is such that none of these changes are applicable (is not velar-final, has a lax vowel anyway, is monosyllabic, etc.), as in *odd+ity.* Twisting the well-known wisdom about phonemes, we could say "once a morpheme-boundary suffix, always a morpheme-boundary suffix."

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Nevertheless, there are cases when an affix, like *-ity,* which we get to know as a weak-boundary affix, behaves unexpectedly, for example, it fails to cause trisyllabic laxing in *obēsity.* There are two possible cures for such a problem. We either claim that there exist two *-ity* suffixes, one attaching to stems with a morpheme boundary, the other with a word boundary. Alternatively, we may suggest that the morpheme boundary does not exist: both *opăcity* and *obēsity* are monomorphemic, the fact that one has a lax vowel in its stressed antepenult, the other a tense one is no more significant than the same difference between *Ănnabel* and *Ābraham.*

---

Another useful test for boundary types is phonotactic constraints. There are very few such constraints about clusters separated by a word boundary, phonotactic constraints typically regulate TAUTOMORPHEMIC clusters (clusters not separated by a word boundary). These constraints on the other hand are rather strict. Therefore, many consonant clusters are only possible when separated by a word boundary. Faced with the string **tæktfəl** (*tactful*), for example, the analyst has but to posit a word boundary between the **t** and the **f**, since we never encounter **tf** within a morpheme in English.

## 8.2 Clitics

For people growing up in a literate society, it always comes as a surprise to learn that orthography is a very unreliable indicator of phonological structures. As we have seen, orthography does not indicate a significant portion of phonological word boundaries, in *pitiless,* for example, spelling does not show the word boundary after the free form *piti-.* At the same time, orthography may indicate a word boundary where there is none (like in *at all* **ət$^{h}$ɔːl**, aspiration shows that this is one word, at least in SSBE, where the **t** is aspirated). One might think that solitary boundaries (i.e., ']' and '[') are not indicated in spelling, but double boundaries (i.e., '][' are.[5]. To take an example: [[*pity*]*less*] is written as one word, but [[*less*][*pity*]] as two.

However, there are a number of "words" that orthographically appear to be full-fledged words, but are not free forms. Articles are an obvious example: forms like **ðə**, **ðɪ**, **ə**, and **ən** do not appear in isolation, as utterances. (When they seem to occur in isolation, in metalinguistic use, when talking *about* the article itself, it is another allomorph, **ðiː** and **eɪ** or **æn**, that appears.) They also lack an important phonological characteristic

[5] Note that '[ ]' is not an occurring configuration.

of wordhood, stress, and the full vowel that always accompanies stress. Other examples of this category include auxiliaries, prepositions, many kinds of pronoun, etc., basically monosyllabic function words. Such phonologically dependent units are called CLITICS. Clitics (like affixes) come in two types: some cliticize to a host to the right, these are called PROCLITICS, others to a host to the left, they are the ENCLITICS. (8) shows the parallelism between clitics and affixes.

(8) *Affixes and clitics*

| scheme | example | |
|---|---|---|
| prefix–stem–suffix | [ un [ [ friend ] ly ] ] | = *unfriendly* |
| proclitic–host–enclitic | [ will [ [ like ] it ] ] | = *will like it* |

Phonologically there is little if any difference between clitics and affixes. The reason the two categories are distinguished terminologically (and also orthographically) is syntactic, i.e., combinatorial: it is possible to insert words between a clitic and its host, e.g., *will* ***never*** *like* ***all of*** *it,* while there is no such possibility in the case of affixation. The phonological structure of such phrases is radically modified, the host of the clitics change, as shown in (9).

(9) *Clitics attach to a different host*

[ will [ never ] ] [ like ] [ [ [ all ] of ] it ]

Note that the bracketing in (9) does not reflect syntactic structure, only hosts and clitics. Units consisting of a host and its enclitic(s) usually make up a foot, but it may occur that a host itself consists of more than one foot (i.e., contains more than one major stressed syllable): e.g., *she íntrodúced him.*

## 8.3 Types of phonological rules

We have seen that rules like velar softening and trisyllabic laxing, as well as stress rules are blocked by a word boundary. Other rules, like l-darkening or r-dropping, are not, the word boundary is invisible to them. This is a major split in the realm of phonological rules. The first type (those that are sensitive to the presence of a word boundary) are called LEXICAL RULES (or structure-dependent rules), the second type (those that are insensitive to word boundaries, and work "across the board") are called POSTLEXICAL RULES. (10) collects points where the two types of rules differ.

(10) *Some properties of lexical and postlexical rules*

| | lexical rules | postlexical rules |
|---|---|---|
| a. | apply only between #s | apply between and across #s |
| b. | produce phonemic changes | produce allophonic changes |
| c. | may have exceptions | do not have exceptions |
| d. | are not blocked by pauses | may be blocked by pauses |
| e. | their outcome cannot be undone | their outcome can be undone |

One can only hope that the properties listed above characterize each phonological rule, that each rule shows properties of either only the lexical, or only the postlexical type. (We return to the cryptic-sounding property in (10e) in §8.5.) We are now going to examine some examples of the two types of affixes, looking for cases when our expectations of their behaviour are frustrated. The affixes that trigger lexical rules are going to be referred to as LEXICAL AFFIXes, those that do not will be called NEUTRAL AFFIXes.

### 8.3.1 Aspiration

The rule of aspiration is sensitive to three factors: stress on the following vowel, a word boundary preceding the voiceless stop, and a fricative preceding the voiceless stop. (You may check §4.4.3 for details.)

The fact that the word boundary is referred to in the rule strongly suggests that we are dealing with a lexical rule. Other properties of the rule corroborate this. The **t** of *hit Éve* is unaspirated, although it is followed by a stressed vowel. This is because the intervening word boundary shields that vowel off. The **t** of *mistime* is aspirated on the other hand, although it is preceded by an **s**. This is because the word also contains a word boundary (*mis#time*), which makes the preceding fricative invisible. It is telling that pronunciation dictionaries, which intend to mark only phonemic features of words, indicate whether a voiceless stop is aspirated or not by placing the stress mark either before it (in which case it is aspirated, as, e.g., in *mistime* **ˌmɪsˈtaɪm**) or before the preceding **s** (in which case the stop is not aspirated, as, e.g., in *mistake* **mɪˈsteɪk**). This amounts to the admission that aspiration is not predictable merely from the sequence of segments and the location of stress in a string, morphological structure also influences it.

At the same time, aspiration is held to be an allophonic rule. This is problematic, because, as (10b) suggests, lexical rules ought to produce phonemic changes.

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This apparent paradox can be resolved by assuming (as chapter 3 proposes) that the two series of plosives (**p t k** vs. **b d g**) are not distinguished by voicing, but, among other things, by aspiration. Accordingly, aspiration *is* a contrastive feature of voiceless plosives. Under such a scenario the two series of plosive in English are **p**$^{h}$ **t**$^{h}$ **k**$^{h}$ and **p t k** (the first typically spelt ⟨p⟩, ⟨t⟩, ⟨c⟩/⟨k⟩, the latter set ⟨b⟩, ⟨d⟩, ⟨g⟩). We now do not need an aspiration rule any more: what we need instead is a voicing rule that will make unaspirated plosives voiced. This rule would indeed be allophonic, and, as expected, postlexical (it would not affect the **d** of *read to her,* but it would voice that of *read it*). In this analysis the voiceless unaspirated stops following the **s** in, e.g., *spot, stop, scope* are in fact instantiations of ⟨b⟩, ⟨d⟩, and ⟨g⟩, respectively. Unfortunately, even such a change of the relevant contrast does not solve the problem, since now the deaspiration rule is allophonic, but lexical.

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### 8.3.2 The peculiarities of *-ize*

The suffix *-ize* embarrasses the analyst. The fact that it causes velar softening (e.g., *criti*[**s**]*ize*, *Catholi*[**s**]*ize*) categorizes it as a lexical affix. Despite this, trisyllabic laxing often fails to apply before it: e.g., *fīnalize, pēnalize.* Although one could argue that we are facing two *-ize* suffixes, one lexical, the other neutral, such a solution would yield a circular explanation. Furthermore, it turns out to be untenable, since in some

cases the same *-ize*-suffixed word exhibits both phenomena: the lack of velar softening in *diphthon*[**g**]*ize* implies a neutral suffix, but the fact that the **g** is pronounced at all implies a lexical suffix, as we are going to see in §8.3.3.

### 8.3.3 The comparative *-er*

Recall that comparative forms like *stronger* **strɒŋgə** were analysed as counterexamples to the generalization that postnasal **g** is dropped before a morpheme boundary. The difficulty of explaining why **g** is not dropped in this case disappears if we take *-er* to be a lexical suffix. If so, we do not expect the **g** to be dropped in comparative adjectives, since there is no word boundary following them. In fact, we are claiming that there are two *-er* suffixes: *-er*$_1$, which is neutral and *g*-dropping takes place before it (e.g., *si*[**ŋ**]*er*), and *-er*$_2$, which is lexical and *g*-dropping does not take place before it (e.g., *stro*[**ŋg**]*er*). The two suffixes are also distinct in their functions: *-er*$_1$ is an agentive suffix producing nouns out of verbs, *-er*$_2$ is a comparative suffix added to adjectives to get their comparative form. The superlative *-est* has the same properties, thus it may also be analysed as a lexical suffix.

It is not only the **ŋg** cluster that is banned in word-final position in English, but also the other noncoronal nasal+voiced stop cluster, **mb**. Alternations are fewer in number, but examples like *iamb* **aɪəm** ∼ *iambic* **aɪəmbɪk**, *rhomb* **rɒm** ∼ *rhomboid* **rɒmbɔɪd** show the pattern clearly. Intriguingly, the comparative forms *number* **nʌmə** and *dumber* **dʌmə** do not contain a **b**, counter to our current predictions. (Note the homograph of **nʌmə**: *number* **nʌmbə**!) Actually, there is no other reason than their spelling to assume that these comparatives *should* contain a **b**, phonologically they are no different from other adjectives like *dim* or *calm,* which simply end in an **m**, and have the comparative forms *dimmer* **dɪmə** and *calmer* **kɑːmə**. That is, phonologically there is nothing peculiar about the comparatives *number* **nʌmə** and *dumber* **dʌmə**, only their spelling is misleading.

Another factor that distinguishes lexical and neutral suffixes is the obligatoriness or optionality of syncope before them. Adjectives ending in a syllabic **l** contain a nonsyllabic **l** in their comparative (and superlative) form, as shown in (11b). This alternation is typical of lexical suffixes, but not of neutral ones, as the lexical *-ic* and the neutral *-ing* show in (11a).[6]

(11) *Losing syllabicity before a lexical suffix*

a. cyc[**l̩**] ∼ cyc[**l**]+ic (*cyc[**l̩**]ic), but cyc[**l̩**]#ing
b. simp[**l̩**] ∼ simp[**l**]er (*simp[**l̩**]er), but samp[**l̩**]ing

Most adjectives that end in a syllabic **l** loose the syllabicity in the comparative and superlative forms (*abler, ampler, feebler, gentler, humbler, idler, nimbler, nobler, suppler*). However, *littler* and *subtler* may preserve it: **lɪtl̩ə** or **lɪtlə** and **sʌtl̩ə** or **sʌtlə**.

[6] It must be admitted that no such alternation is found for **r** before the comparative and superlative suffixes (cf. *clev*[**r̩**]*er, tend*[**r̩**]*er,* but **clev*[**r**]*er, **tend*[**r**]*er*), although the alternation holds before other suffixes (cf. *cent*[**r**]+*al* ∼ *cent*[**r̩**]#*ing*).

In §8.6, we are going to introduce another test, which, unfortunately, argues for a neutral comparative and superlative suffix.

### 8.3.4 Velar softening and *-ic*

The suffix *-ic,* as has been argued up to now, is clearly a lexical suffix. Since it begins with *i,* we expect velar softening to apply before it. In some cases, it indeed does (e.g., *pedago*[**g**] ∼ *pedago*[**ʤ**]*ic*), but in others it does not (e.g., *mónar*[**k**] ∼ *monár*[**k**]*ic*). Claiming that in the latter case we are dealing with another *-ic,* one which is attached to stems with a word boundary, is not an option since, as shown in the example, this hypothetical *-ic*$_2$ shifts stress, something that neutral suffixes can never do. A more promising solution is offered in the next section.

## 8.4 The status of lexical rules

In §8.1.1 it was noted that words containig only a morpheme boundary behave like monomorphemic forms, that is, *crimin+al* and *animal* are not different from the viewpoint of phonology. According to the as-if principle of chapter 1, this means that words containing a morpheme boundary *are* monomorphemic phonologically, that is, phonological rules treat them as they treat single morphemes. The phonology cannot tell whether such a word is morphologically simplex or complex, it is not sensitive to the morpheme boundary, +, at all. The repercussions of this claim are far reaching.

If words like *opacity* are monomorphemic, rules like trisyllabic laxing lose their validity. *Opacity* now just happens to be a word that contains a lax vowel in its antepenultimate syllable, and there is no point in positing a rule about this, since (as has been argued) antepenultimate-stressed monomorphemic words are not subject to trisyllabic laxing: their stressed vowel may be tense or lax alike. Or, to take another example, velar softening is not a rule anymore: it would take an excessively hard-core generative phonologist to *derive* the **s** of a monomorphemic word like *city* from a **k**. Being monomorphemic, the **s** in *opacity* is not any different. What is more, exceptions are trivially managed this way: the **k** in *monarchic* needs no more of an explanation *vis-à-vis* the **s** in *opacity* than the **k** in *Kitty* or the **s** in *city.* The same considerations will prove any lexical rule to be useless and redundant. In fact, when a lexical rule has no exceptions (like aspiration or breaking), it produces absolute neutralization (see chapter 2): no alternations will be found, since *opacity* is now not derived from *opaque* any more than *went* is from *go.*

## 8.5 Word and syllable boundaries

We have seen in chapter 4 that certain phonological rules are well describable by reference to syllable boundaries: some phonological changes occur in coda (others in onset) position. Also recall that onset maximization was claimed to be a universal principle, that is, a string VCV is always expected to be syllabified as V.CV. The question in this section is how boundaries affect syllabification.

The case of the morpheme boundary is clear: it has no effect on syllabification. Indeed, the data in (12) show that in a C + V string the consonant is unambiguously in onset position.

| | | | | |
|---|---|---|---|---|
| (12) | a. atmosphĕric | b. sincĕrity | c. sett$^{h}$ée | d. spitt$^{h}$óon |
| | histŏric | parĭty | escap$^{h}$ée | block$^{h}$áde |
| | lŷric | minŏrity | marq$^{h}$uée | escap$^{h}$áde |

The words in (12a) and (12b) each contain a morpheme boundary between the **r** and the *-ic* or *-ity* suffix. The lack of broadening shows that the **r** must be in the onset of the last syllable (just like in *carrot*). The words in (12c) and (12d) show the same thing: the stem final voiceless plosive is aspirated, which it can only be if it is in the onset of the last syllable. This fact is not surprising if $A + B$ strings are treated by the phonology as monomorphemic; onset maximization prevails as in any other monomorphemic form.

The situation is more intricate in the case of word boundaries. Recall that broadening and the breaking of true diphthongs occurs when the vowel and the following R are in the same syllable (see §8.4.4.2). Now consider the data in (13).

| | | | |
|---|---|---|---|
| (13) | a. st[**ɑː**]rry | b. wiry **waɪəri** | c. hilly |
| | f[**ɜː**]rry | scourer **skaʊərə** | filler |
| | abh[**ɔː**]rring | devouring **dɪvaʊərɪŋ** | peeling |

The fact that the vowel is broad in (13a) and the true diphthong is broken in (13b) is evidence that the following **r** is tautosyllabic, hence VC#V is syllabified with the consonant (**r**) in coda. However, the **l**'s in (13c) are all clear, and the **r**'s in (13a) and (13b) are pronounced. This is an indication that the word-final consonant (**r** or **l**) is now in onset.

The contradiction is only apparent: breaking and broadening are lexical rules, i.e., they apply to a string between word boundaries (cf. (10a)), and their result cannot later be undone (cf. (10e)). R-dropping (or R-insertion), as well as L-darkening are, on the other hand, postlexical. Thus at the point where breaking and broadening applies the string *#star#*, *#wire#*, etc. is considered. In them, the **r** is in coda position and tautosyllabic with the preceding vowel. Postlexically, the string *starry* is considered. Here the **r** is in the onset of the second syllable, it is pronounced, but lexical breaking cannot be undone.

---

You may have noticed another trick in the discussion: at one point word-final consonants were claimed to be the onset of a degenerate syllable, whereas now they are treated as in coda position. In some respects word-final consonants do exhibit coda-like behaviour (e.g., in the case of **l** and **r** here), in others they are unlike codas (they do not make the last syllable of a word heavy). We do not have the space here to elaborate a theory that explains this double behaviour of word-final consonants, but there do exist plausible explanations.

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## 8.6 Remaining paradoxes

There remain some unsolvable paradoxes. Some of them will be listed here, without any attempt at an explanation.

As hinted at in §8.3.3, the categorization of comparative and superlative suffixes is made dubious by the "breaking test." The diphthong of *sourer* and *sourest* is broken.

This is problematic if *-er* and *-est* are taken to be lexical suffixes. It does not help blaming the exceptionality on (10c), namely, that lexical suffixes may have exceptions. The breaking rule does not have exceptions, if *sourest* were monomorphemic the form ***saʊrɪst** would be acceptable, but it does not exist.

---

Note that claiming comparative *-er* and *-est* to be neutral suffixes is even worse a solution. Although it explains the breaking facts, now *stron*[**g**]*er* and *stron*[**g**]*est* become exceptional in having **g** before the alleged word boundary.

---

The phonological shape of the word *grateful* '**greɪtfəl** suggests the structure [[*grate*]*ful*] for several reasons. For one thing, the cluster **tf** does not occur tautomorphemically in English. For another, we do not expect a tense vowel to occur before a noncoronal cluster like **tf** even if it did occur tautomorphemically. Since *-ful* bears no stress, it must be a suffix (or enclitic), with *grate-* as its stem. Unfortunately, **grate* is not a free morpheme, despite the prediction made by this theory. Although there are two morphemes pronounced **greɪt**, *great* and *grate*, neither can be the stem of *grateful* for semantic reasons.

The case of *wives* **waɪvz** is similar: the stem alternation (**waɪf** ∼ **waɪv**) suggests that there is no word boundary involved in this plural suffixation, but the cluster **vz** and the tense vowel preceding it are possible only with a word boundary separating the two consonants. In *dreamt* **dremt** and *depth* **depθ** the vowel shortens (cf. *dream* **driːm**, *deep* **diːp**), but the clusters **mt** and **pθ** do not occur within a morpheme—except in these two words, provided they *are* monomorphemic from the viewpoint of phonology.

The categorization of the suffix *-ly* is highly problematic. In many respects it behaves like a neutral suffix. In a word like *logically* '**lɒʤɪkəli** it does not affect the place of the stress, for example. If *-ly* were a lexical suffix, there could hardly remain pre-antepenultimate stress in a word containing it. At the same time, if *-ly* were indeed a neutral suffix, we would not expect degemination, the word should be ***lɒʤɪkəl#li** (cf. *drunken#ness* **drʌŋkənnəs**), which it is not.[7] To add to the confusion, stem-final unstressed **-i** also changes as if it became stem internal before *-ly*: *happy* ∼ *happily* **hæpəli** (***hæpili**). Neutral affixes do not influence the stem-final vowel: *happy* **hæpi** ∼ *happiness* **hæpinəs**, *carry* **kæri** ∼ *carried* **kærid** ∼ *carrying* **kæriɪŋ**, *copy* **kɒpi** ∼ *copies* **kɒpiz**. The suffix *-ly* does.

---

The stem final tense **i** is laxed and/or reduced not only before *-ly,* but also before two other, allegedly neutral suffixes, *-less* and *-ful*: *mercy* **mɜːsi** ∼ *merciless* **mɜːsələs**, *beauty* **bjuːti** ∼ *beautiful* **bjuːtəfəl**.

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In fact, *-ly may* alter the location of the stressed syllable: *nécessary* ∼ *nècessárily* is an optional alternation. These properties of *-ly* categorize it as a lexical suffix, a status which is incompatible with the fact that we find fake geminates and other tautomorphemically unprecedented consonant clusters resulting from *-ly*-suffixation (e.g., *promptly, beastly, worldly, laxly,* etc.).

[7] We do find a fake geminate **l** at the end of monosyllabic stems containing a tense vowel, suffixed with *-ly*: *coolly* **kuːlli**, *foully* **faʊlli**, *palely* **peɪlli**, *vilely* **vaɪlli**, *wholly* **hoʊlli**, as well as in *dully* **dʌlli**, with a lax stem vowel, but the same pattern is expected for any **l**-final stem.

## 8.7 Conclusion

The aim of this chapter was to provide a glimpse of how morphology and syntax seep down to phonology, what the phonology machine gets to know of these higher organizational modules of language, and what it does not get to know. As is usually the case, the analyses are not fully hygienic, paradoxes remain to be solved by future analysts. Perhaps you.

## 8.8 Checklist

The following list serves for you to check whether you have understood the topics discussed in this chapter. If you know what the items mean, you are on the right track.

- ⋆ morpheme (formative) boundary (+) vs. word boundary (#)
- ⋆ the effects of the verbal prefix boundary (=) on stress rules
- ⋆ the invisibility of the morpheme boundary
- ⋆ velar softening, trisyllabic laxing and the morpheme boundary (+)
- ⋆ clitics: proclitics, enclitics
- ⋆ the difference between a netural affix and a clitic is only syntactic
- ⋆ the word boundary (#) and phonotactic constraints
- ⋆ lexical vs. postlexical rules
- ⋆ lexical vs. neutral affixes
- ⋆ aspiration is lexical but allophonic
- ⋆ the peculiarities of *-ize, -er, -est, -ly*
- ⋆ the redundancy of lexical rules
- ⋆ breaking and broadening vs. R-dropping/insertion (e.g., *wiry* **waɪəri**)