

A N I N T R O D U C T I O N T O
PHONOLOGICAL ANALYSIS

**Stephen Marlett
Summer Institute of Linguistics
and University of North Dakota**

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steve_marlett@sil.org

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PREFACE

Phonology is a broad topic of study and currently comprises many theories, each of which requires (at least) a course and a book for adequate treatment. This book is an introduction to phonology in general, and a very brief introduction to the ideas addressed by various of these theories, including generative phonology, lexical phonology, underspecification theory, autosegmental phonology, feature theory, phonemics, and CV phonology. We believe that each of these has contributed in a significant way to our understanding of language, regardless of how the theories themselves may fare in the future.

We expect that some users of this book may not find these theories inherently interesting. Nevertheless, someone who wishes to use linguistic theory for practical problems (such as language learning, orthography development, literacy programs) will benefit from learning more about how languages work. Thus we encourage all to jump in and try to master each topic.

The presentation of material in this book is different from many other books. Most importantly for those who are studying phonology in order to do field work, it does not present theory in the same order that one might apply theory. We know that not everyone approaches problems in the same way or in the same order. The book does not begin with the same kind of facts that usually first confront a linguist in a field situation. Nevertheless, after one has completed reading the book, one should have a clear idea of how to work in such situations.

One of the major reasons for presenting material in the order chosen is that it allows us to present phonological detail in small steps. Many introductory books begin with phonetics and then lead the user through the morass of detail to graphically simpler levels of representation. But since many students are not well-trained in phonetics at the time when they take their first phonology course—or at least could use some review—we have opted to teach simple but not necessarily phonetic processes early in the course and postpone discussions of phonetic detail until after the general principles of phonological description and analysis are understood. Of course, this means that careful attention must be paid to helping the students apply the principles that are taught.

The various interactive exercises included in the book refer to the end of each chapter where a suggested answer is provided (called ‘feedback’). The suggested answer is not meant to stifle all alternative solutions, but is intended as an additional teaching aid to the user.

This edition of the book incorporates a section called Postscript for Teachers, which provides additional background and explanation that instructors may find helpful.

We thank the help of phonology teachers, teaching assistants, and students at SIL North Dakota and others for their input over the years. These include Gayle Aasen, Anita Bickford, Steve Clark, Mark Datson, Margie Doty, Roy Eberhardt, Mary Huttar, Andreas Joswig, Mike Maxwell, Jim Meyer, Steve Parker, Steve Quakenbush, Jim Robertson, Amy Schondelmeyer, Doug Trick, Cathy Marlett, and Stephen Walker. All are absolved of responsibility for deficiencies that remain.

Corrections and suggestions for further improvements are welcome and may be directed to: Steve Marlett, PO Box 8987, Catalina, Arizona, 85738-0987; or e-mail: steve_marlett@sil.org.

CHAPTER 1 - INTRODUCTION

Human beings have an extraordinary and unique communicative ability. With a limited set of sounds, a speaker of any language can express an infinite number of sentences. This ability is extremely complex; in reality, we are still unable to characterize its nature with any degree of precision.

This book is an introduction to one facet of human communication: phonology, the study of sounds and how they are organized and used in natural languages. Before jumping into the study of phonology, however, it is helpful to see a bit of the bigger picture in order to know how phonology fits in.

Syntax

Syntax has to do with the positioning of words. There are many ways in which one could give an explicit account of the syntax of a language, and it is not our purpose here to recommend one over another. A commonly used notation is the **rewrite rule**. For example, suppose we were trying to describe a language which had noun phrases (some longer, some shorter) such as the following:

- (1) work
- the work
- interesting work
- the interesting work
- the very interesting work

We might propose that a noun phrase is composed of at least a noun (N), or a noun preceded by a determiner (D) *the*, or a noun preceded by an adjective phrase (AP), or a noun preceded by a determiner and an adjective phrase. An adjective phrase consists of at least an adjective (A), or an adjective preceded by a degree adverb (Deg) such as *very*. The rewrite rules to describe these facts would be something like:

- (2) NP → N
- NP → D N
- NP → AP N
- NP → D AP N
- AP → A
- AP → Deg A

We might even propose ways to combine these rules into one rule in order to show that they are related in some way. The parentheses in the rules shown in (3) indicate optional elements in the phrase.

- (3) NP → (D) (AP) N
- AP → (Deg) A

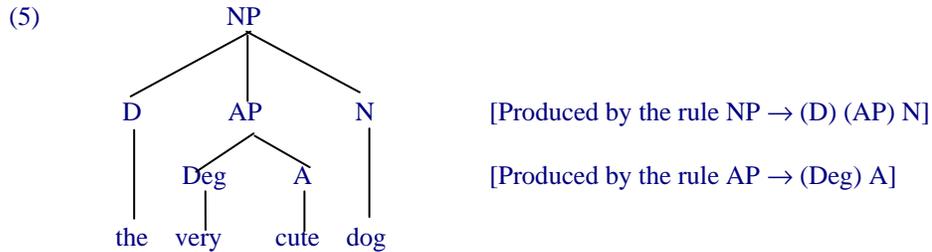
The point is that we are being explicit about the position and organization of words in this language. Notice also that we are going ‘from the top down’, from the bigger units to the smaller units, from the phrases to the individual words.

The rewrite rules we have given above are part of the grammar (or syntax) of English. But we also need to tell what the actual words of English are. This is done through the **lexicon**. The lexicon is (at least) a list of words of the language, such as the following:

- (4) N → *work*
- N → *flower*
- N → *dog*
- D → *the*
- D → *a*
- A → *interesting*
- A → *pretty*
- A → *cute*
- Deg → *very*

The lexicon also contains lots of information about these words in some fashion or another, including pronunciation, meaning and usage. And the lexicon may actually be quite different in appearance or form than the kind of rules that were just presented. Those details are irrelevant here.

If we combine all of the rules we have given so far, we can appropriately generate phrases such as:



Morphology

Morphology has to do with the structure of words. And just as with the positioning of words in a language, we need to be explicit about the order in which the different parts of a word go together. For example, it is part of your knowledge of English that the plural suffix *-s* must follow the stem of the word, rather than precede it.

- (6)
- dog-s*
 - cat-s*
 - tree-s*
 - stone-s*

Each functional piece of a word is called a **formative** or, (almost) alternatively, a **morpheme**.^a The word *dog* has one morpheme, the word *dogs* has two morphemes (*dog-s*), and the word *editors* has three (*edit-or-s*). In the next chapter we consider ways in which the structure of words may be described.

Phonology

Phonology is the study of the organization of sounds in language. Our study of phonology looks at two major aspects. One aspect that we consider is the inventory of sounds that a language has. For example, English has sounds which do not occur in French, and vice versa. If one is studying a language that has never been analyzed or written down before, this is an important area of study.

A second aspect we consider is the set of rules which specify exactly how each sound is pronounced and how sounds affect and are affected by the sounds around them. Understanding this part of language is also crucial for the design of writing systems for languages. It is also important for learning the language. Every language has internal structure and organization, regardless of the social position of its speakers, but until one unlocks the secrets, it may remain mysterious and seem difficult.

Phonetics

Phonetics deals with the physical aspects of the sounds of languages, especially how sounds are articulated and perceived, but not how they are organized. A person trained in phonetics is able to transcribe words from virtually any language. This transcription is most often the basis on which phonological analysis is done, although acoustic studies may also play an important role.

A couple of brief examples may help clarify the distinction between phonetics and phonology. A phonetic transcription of a language may include sounds that are similar to the *t*, *d*, *th*, and *r* of English, as well as other sounds. As a result of analysis, however, we may discover that there is in fact only one *t*-like sound phonologically in the language. The other sounds that we hear are variations of this one *t*-like sound. Consequently, it is likely that the alphabet of the language will include a single symbol to represent these sounds instead of four or five symbols.

^a These terms are not exactly synonymous, but enough so for our purposes here.

Consider also the words *vain* and *vanity* in English, or the pair *sane* and *sanity*. The first word in each pair has the phonetic vowel (or diphthong) [ej] and the second has the phonetic vowel [æ]. If we were to write the words ‘scientifically’, then these are the symbols we should use, one might say. But these vowels, be what they may be phonetically, are typically referred to in traditional studies of English as ‘long a’ and ‘short a’, and often written as the letter *a* with and without a macron over the letters. This transcription is not phonetic—what does the letter *a* have to do with the phonetic transcription [ej]? However, the names ‘long *a*’ and ‘short *a*’ are important in that they point to a systematic correspondence between phonetic sequences which is fundamental to understanding the sound patterns of English. This correspondence is captured in the imperfect English spelling system by the use of the letter *a* for both the long and the short version, with an additional something added for the long version (the use of the silent *e* in *sane* and the combination with *i* in *vain*). Successful literacy programs in other languages also depend on similar knowledge of how the sound systems in those languages work—of their phonologies. Our understanding of these systems may begin with phonetics, but it does not end there.

Key Concepts

syntax

rewrite rule

morphology

formative / morpheme

phonology

phonetics

Postscript for Teachers

The formalisms adopted for syntactic and morphological generalizations are not a major issue for our purposes. We are primarily interested in clarifying the distinction between and interrelatedness of the major components of formal structure. However, this chapter does introduce the rewrite rule notation, which is used extensively in the book. It also introduces the idea of developing explicit rules as a means to describe recurrent patterns found in language. It should be noted that we are embedding phrases within phrases. Therefore, it is important that the noun phrase be described as containing an optional adjective phrase, not an optional adjective.

1.1 Try it for yourself with English

Use the following rewrite rule and lexicon, in addition to the rules and lexicon found in the chapter, and determine at least eight good English phrases that may be described by them. (Check your answers with the feedback section at the end of this chapter.)¹

$PP \rightarrow P NP$

$P \rightarrow to$

$P \rightarrow on$

$P \rightarrow for$

1.2 Try it for yourself with Seri

Examine the following rewrite rules and lexicon. Determine which of the phrases provided are possible and which are not possible according to the grammar of Seri. (Check your answers with the feedback section at the end of this chapter.)²

$PP \rightarrow NP P$

$NP \rightarrow N (D)$

$P \rightarrow ano$ (“in”) $P \rightarrow iti$ (“on”)

$N \rightarrow xepe$ (“sea”) $N \rightarrow hasaj$ (“basket”)

$D \rightarrow com$ (“the”)

To evaluate:

- (a) *ano xepe*
- (b) *iti hasaj com*
- (c) *xepe com*
- (d) *com xepe*
- (e) *xepe com ano*
- (f) *iti com hasaj*

Feedback for Chapter 1

1.1

¹ Some possible answers: *on the dog, on a dog, on the flower, to a flower, to work, for the flower, for work, for the dog, to the pretty flower, to the very pretty flower, on the cute dog.*

1.2 Seri²

- (a) *ano xepe* (ungrammatical: P must follow NP)
- (b) *iti hasaj com* (ungrammatical: P must follow NP)
- (c) *xepe com* (grammatical)
- (d) *com xepe* (ungrammatical: D must follow N)
- (e) *xepe com ano* (grammatical)
- (f) *iti com hasaj* (ungrammatical: P must follow NP, D must follow N)

SECTION 1

MORPHOLOGICAL RULES

In this section we show that it is important to account for every piece of every word in the grammar of a language. We introduce morphological rules—rules having to do with the structure of words and the shapes of morphemes in words. We also introduce some basic notions such as features.

It should be noted that most of the topics in this section do not pertain to phonology *per se*, and so one may choose to begin with Section 2 instead if one has already had an introduction to morphology previously. Nevertheless, certain concepts that are helpful later are introduced in this section. These concepts may be reviewed by examining the "key concepts" box at the end of each section.

CHAPTER 2 - WORD STRUCTURE

Some words consist of only one formative (or morpheme), such as *table*. Others consist of several, such as *disappearances* (*dis-appear-ance-s*). If a language had only one morpheme in each word (and some languages may be almost like this), there would not be much to say about word structure in that language. But most languages do have combinations of morphemes in words, so rules specifying how the formatives may be combined are necessary. (Note: These rules do not tell us how we *should* make words and sentences; they tell us how we *do* make words and sentences. Don't confuse these with the rules you remember from high school which told you not to use dangling participles, etc.)

Just as there are many approaches to syntax, so there are many approaches to morphology, and there are many issues of importance. But any approach must specify the order in which formatives appear. We adopt here a fairly simplistic approach. For simple cases like *dog-s*, we write a rule such as the following:

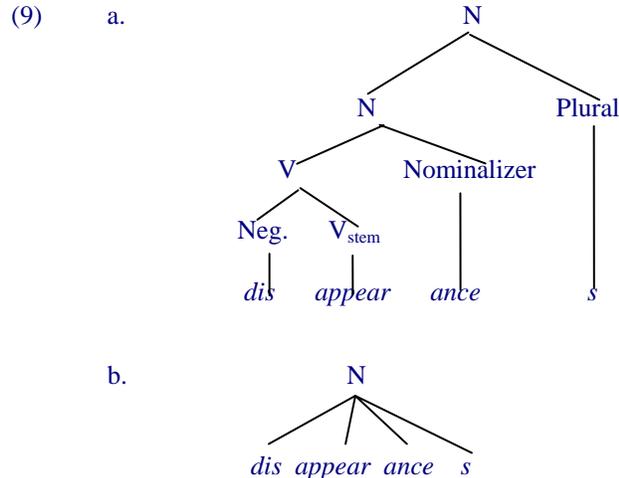
- (7) $N \rightarrow N - \text{PLURAL}$
 (A noun may consist of a noun and a plural morpheme.)

The lexicon of English must then also include information about how the Plural morpheme is realized (the most common form being *-s*, of course). (This is discussed more in chapter 3.)

For more complicated words, such as *disappearances*, we assume the following additional rules:

- (8) a. $V \rightarrow \text{NEGATIVE} - \text{Verb}_{\text{stem}}$ cf. *dis-appear*
 b. $N \rightarrow V - \text{NOMINALIZER}^a$ cf. *appear-ance*

The rules in (7) and (8) are somewhat different in productivity. Most nouns can be pluralized, but most verbs cannot occur with the prefix *dis-* and most verbs cannot occur with the suffix *-ance*. But rule (8a) creates verbs from which rule (8b) can form nouns, from which rule (7) can form plural nouns. Given rules such as these, we see that words such as *disappearances* have a 'nested' structure like (9a) rather than the 'flat' structure of (9b).



Nevertheless, as long as we know the exact order in which the morphemes occur, we have the information we need for most of our present purposes.

If one were looking only at simple English words, one would not understand well how other languages construct words. For example, one can take off each of the formatives from the word *disappearances* and find another word: *disappearance*, *appearances*, *appearance*, *disappear*, *appear*. This is not always the case in other languages.^b Consider the following example from Seri:^c

^a A Nominalizer is a morpheme that changes some category of word (such as Verb, for example *appear*) into a Noun (*appear-ance*).

^b Of course, it is not always possible in English either. We have chosen simple examples here to illustrate. But

verb in the present participle (the “ing” form). Each row is a different verb. (The English data are presented here with phonetic symbols.)^g

(15)		Present (1 st)	Present (3 rd)	Past	Present Participle
	<i>fake</i>	fejk	fejks	fejkt	fejkɪŋ
	<i>dip</i>	dɪp	dɪps	dɪpt	dɪpɪŋ
	<i>nick</i>	nɪk	nɪks	nɪkt	nɪkɪŋ

Any time a morpheme appears in more than one combination, a paradigm (however small or large) can and should be constructed to help in the analysis.

The next step is to identify, as much as possible, the phonological material in each column or row that contributes the ‘meaning’ of that column or row. Looking across the first row above, for example, we can see that the morpheme *fake* is represented consistently through the paradigm by the string [fejk]. Looking down the first column, we can see that there is no phonological material associated with the present tense, first person. The phonological material associated with the second column is an [s], that of the third column [t], and that of the fourth [ɪŋ]. We then make (tentative) morpheme cuts as shown below:

(16)		Present (1 st)	Present (3 rd)	Past	Present Participle
	<i>fake</i>	fejk	fejk s	fejk t	fejk ɪŋ
	<i>dip</i>	dɪp	dɪp s	dɪp t	dɪp ɪŋ
	<i>nick</i>	nɪk	nɪk s	nɪk t	nɪk ɪŋ

Rule of Thumb: Going down a column which relates to an affix, try to keep as much identical or similar phonological material with the affix as possible. Going across a row which relates to a single stem, try to keep as much identical or similar phonological material with the stem as possible. If there is discrepancy or doubt, draw a circle around the sound(s) for which you have questions and keep your options open.

We can then make note of the results by putting the individual morphemes at the top of the columns and at the beginning of the rows. (We have written the suffixes with a hyphen before them.)^h

(17)		(no suffix)	-s	-t	-ɪŋ
	fejk				
	dɪp				
	nɪk				

The combination of the morpheme {fejk} and the morpheme {s} gives the form [fejks], as desired. Likewise, the other morpheme combinations give the correct surface forms (the forms which we are trying to account for). Sometimes the facts are more complicated, as we will see in later chapters. Nevertheless, the techniques for cutting morphemes are basically the same.

^g The symbols used in this book are, for the most part, drawn from the set used by the International Phonetics Association.

^h One can only make hypotheses at this time since we don’t know much for sure yet; perhaps one column has two suffixes rather than only one, or other facts will be brought to bear on the decisions, as we will see later. If there are two affixes, one needs to set up a column for the combination, if the affixes cooccur.

Key Concepts

word structure rule

paradigm

morpheme cut

Postscript for Teachers

When several inflectional affixes appear in the same word, such as in the Seri verbs in this chapter, approaches to morphology differ as to how they should be handled. Some approaches add one formative at a time, whereas others add them all at once, as in rule (13). This difference in approach is irrelevant to the issue here. All that we care about is that the various formatives be put in the right order.

2.1 Try it for yourself with Walmatjari

The data for this exercise are in Appendix F at the back of this book. These data contain a number of complications; nevertheless, you should be able to determine the word structure rule for nouns (which are inflected for "case") in this language, even by looking at only one noun.³

2.2 Try if for yourself with Manam

Give a word structure rule for the following data and a list of the morphemes. (Check the feedback section at the end of this chapter.)⁴

- | | | | |
|------------|--------------------------|--------------|--------------------------|
| 1. tamagu | <i>my father</i> | 6. debugu | <i>my hand</i> |
| 2. taman | <i>your (sg.) father</i> | 7. matagu | <i>my eye</i> |
| 3. tama | <i>his/her father</i> | 8. wasagu | <i>my breath</i> |
| 4. tamadi | <i>their father</i> | 9. malonamin | <i>your (pl.) voices</i> |
| 5. tamamin | <i>your (pl.) father</i> | | |

2.3 Now try it again with Selepet

Give word structure rules for the following data and a list of the morphemes. (Morpheme breaks have been given for you.)⁵

- | | | | |
|-----------------|---------------------------|-----------------|-----------------------|
| 1. ata-ne | <i>my elder brother</i> | 5. barat-lip-ge | <i>your daughters</i> |
| 2. barat-ne | <i>my daughter</i> | 6. tebe-ge | <i>your bow</i> |
| 3. barat-lip-ne | <i>my daughters</i> | 7. emet-ne | <i>my house</i> |
| 4. ata-ge | <i>your elder brother</i> | 8. emet-ge | <i>your house</i> |

2.4 Try it once more with Manam

Give a word structure rule (showing positions for the subject and object agreement affixes) and a list of the morphemes for the following data.⁶

- | | | | |
|------------|-------------------|--------------|-----------------------|
| 1. u-pile | <i>I spoke</i> | 5. u-noku | <i>I jumped</i> |
| 2. di-pile | <i>they spoke</i> | 6. u-te-di | <i>I saw them</i> |
| 3. u-lako | <i>I went</i> | 7. di-te-a | <i>they saw me</i> |
| 4. di-lako | <i>they went</i> | 8. u-baga-di | <i>I brought them</i> |

CHAPTER 3 - SUPPLETIVE ALLOMORPHY

3.1 Word classes

Many languages of the world have their lexicons divided into classes of one sort or another. People who have studied or learned Romance languages know about ‘masculine’ and ‘feminine’ words. One fact of a Romance language such as Spanish happens to be that the word for ‘the’ which occurs before plural nouns has two alternating shapes: *los* and *las*. Sometimes one is correct to use and sometimes the other. One has to memorize that the word *casas* ‘houses’ takes the form *las* and the word *hogares* ‘homes’ takes *los*. It’s just an arbitrary fact of Spanish. A noun belongs to either one class or to the other.

It is also very common to find that word classes such as nouns or verbs have subclasses with respect to morphology. For example, one group of nouns—especially body part nouns—might *require* an affix to indicate the possessor. Another group of nouns might never allow such an affix to occur on them. The lexicon of the language must include this information since we want to reflect the speaker’s knowledge about the words. A sample set of morphemes is given for Seri, where +Poss means that the word must occur with a possessive prefix, -Poss that it never does, and +/-Poss that it may or may not.^a

(18) Morphemes

<i>hast</i>	stone	-Poss
<i>tom</i>	money	±Poss
<i>caac</i>	nephew/niece	+Poss
<i>lit</i>	head	+Poss

With this information, we understand why some words exist and some words do not exist in Seri, as shown below (nonexistent words are given with an asterisk before them).

(19) Words

<i>hast</i>	stone	* <i>hihast</i>	(my stone)
<i>tom</i>	money	<i>hitom</i>	my money
* <i>caac</i>	nephew/niece	<i>hicaac</i>	my nephew/niece
* <i>lit</i>	head	<i>hilit</i>	my head

The word *hihast* does not exist because the word *hast* is a -Poss noun and cannot take a possessive prefix. The words *caac* and *lit* do not exist because the roots in question are +Poss nouns and cannot occur without a possessive prefix.

This is one type of morphological subclassification of roots; the roots are divided into groups based on whether or not they may co-occur with other morphemes. The particular type of classification illustrated in the examples above is very common: body part words and kinship terms often are the only words that may or must have possessive affixes in a language. One often sees the terms **alienable class** for words like *stone*, and **inalienable class** for words like *head* and *mother*, since the latter do not occur without the mention of the possessor in many languages. These classes of words do not line up exactly from language to language, however.

Other times we find that we must posit classes of words to account for other facts. For example, consider the following illustrative words from Seri:

(20)

	<i>hi-lit</i>	my head	<i>camiz</i>	shirt
	<i>mi-lit</i>	your head	<i>hi-camiz</i>	my shirt
	<i>i-lit</i>	his/her head	<i>mi-camiz</i>	your shirt
			<i>i-camiz</i>	his/her shirt

(21)

<i>hi-xiiha</i>	my older brother	<i>hi-quipaz</i>	my grandchild
<i>ma-xiiha</i>	your older brother	<i>ma-quipaz</i>	your grandchild
<i>a-xiiha</i>	his/her older brother	<i>a-quipaz</i>	his grandchild

^a If the language uses the lack of an overt affix to indicate third person, the difference between +Poss and -Poss nouns cannot be determined simply by examining whether or not the noun occurs without a person affix.

Notice that there are two shapes each for the second person and third person possessive prefixes. With one class of words the prefixes *mi-* and *i-* occur, and with the other class of words the prefixes *ma-* and *a-* occur. When a formative, such as third person possessor, has two shapes, we say that it has two **allomorphs**.

Allomorphs must be handled one way or another in the description of a language. If they are handled in the lexicon, they are called **suppletive allomorphs**.^b If they are handled by the phonological component of the language, they are phonological allomorphs. The latter are a major emphasis of phonological theory and we look at them in the second section of this book. The difference between the two is fairly simple, and will be developed in the next few chapters. Suppletive allomorphy is essentially allomorphy which is a property of *one* morpheme, and for that reason is in the lexicon. Phonological allomorphy is something that is a property of the sound pattern of the language and is not limited to one morpheme.

The lexicon must include some way to handle suppletive allomorphs. We might think of a lexicon as a set of rewrite rules that map from a semantic label, such as DOG, to the language particular form, as shown below.^c

(22)	(English)	DOG → <i>dog</i>	(Spanish)	DOG → <i>perro</i>
	(French)	DOG → <i>chien</i>	(Seri)	DOG → <i>haxz</i>

The realizations of affixes could also be indicated by such rules.^d

(23)	(English)	Plural → <i>-s</i>
	(Seri)	1st Singular Possessor → <i>hi-</i>
	(Seri)	2nd Singular Direct Object → <i>ma-</i>

When a morpheme has suppletive allomorphs, *both* of these must appear in the rule. The Seri rules for second and third person possessor are given below.

(24)	2 nd POSSESSOR →	<i>ma-</i> with kinship nouns <i>mi-</i> elsewhere
	3 rd POSSESSOR →	<i>a-</i> with kinship nouns <i>i-</i> elsewhere

The allomorphs *mi-* and *i-* were chosen as the 'elsewhere' cases since they have the widest distribution in the language.^e

In the Seri examples above, the word classes worked out fairly neatly: kinship nouns worked one way, and body part nouns another. This is not always the case, however. Often there are simply two or more arbitrary classes of roots, and some may be quite small. Consider the following English plurals:

(25)	Singular	Plural
	<i>dog</i>	<i>dog-s</i>
	<i>cat</i>	<i>cat-s</i>
	<i>cow</i>	<i>cow-s</i>
	<i>deer</i>	<i>deer</i>
	<i>sheep</i>	<i>sheep</i>
	<i>ox</i>	<i>ox-en</i>

The noun *ox* is one of the very few nouns in English which still pluralize with the Old English plural suffix *-en* (*children* and *brethren* are more complicated examples). The lexical entry for PLURAL in English must mention this small class of nouns, and also the class of nouns which have no suffix for plural. The lexical entries for the nouns of English must tell the class to which the noun belongs (if it is not in the 'elsewhere' class, at least).

^b Morris Halle (1989) On Abstract Morphemes and Their Treatment (paper presented to the Arizona Phonology Conference), refers to morphemes with suppletive allomorphs as abstract morphemes.

^c These are sometimes called spell-out rules.

^d Although there is no linguistic reason to include hyphens with affixes in these rules, we will do so simply to remind the reader that a given morpheme is an affix. But it is really not important.

^e There are more non-kinship possessed nouns than kinship nouns. In addition, the allomorphs *mi-* and *i-* occur with 'nominalized' verbs as well as simple nouns. It is not always so clear what the 'elsewhere' case is.

(26)	PLURAL →	- <i>en</i> with class A	Nouns:
		-∅ with class B	<i>cow</i>
		- <i>s</i> elsewhere	<i>deer</i> [Class B]
			<i>ox</i> [Class A]
			<i>sheep</i> [Class B]
			<i>table</i>
			etc.

(You have probably thought of other words which don't use the *-s* suffix. We discuss some of them in a later chapter.)

It is appropriate that the *-s* allomorph is chosen as the elsewhere case in English. This allomorph occurs with by far the largest class of words (which class is in fact so large as never to be enumerated exhaustively as Classes A and B could be). It also is the suffix that people use when they have not learned the special lists of words which take the other allomorphs, as in the children's speech form *foots*, rather than *feet*.

Of course, such arbitrary classes are harder to remember, and therefore more unstable over time, than classes which are based on something tangible (such as classes composed of body part nouns). For this reason, they tend to get smaller with passing generations, as illustrated by the gradual replacement of brethren with brothers.

An illustration from Kikuyu

The following data are from Kikuyu which, like other Bantu languages, has prefixes on both singular and plural nouns. Take a quick look at the data and make some morpheme cuts to see that the noun stems follow the morphemes that indicate singular and plural.

(27)		<i>Singular</i>	<i>Plural</i>
	1. <i>teacher</i>	murutani	arutani
	2. <i>girl</i>	muiretu	airetu
	3. <i>woman</i>	mutumia	atumia
	4. <i>buyer</i>	muguri	aguri
	5. <i>root</i>	muri	miri
	6. <i>tree</i>	muti	miti
	7. <i>lion</i>	muroodi	miroodi
	8. <i>mattress</i>	muuto	miuto
	9. <i>chair</i>	geti	eti
	10. <i>yam</i>	gikoa	ikoa
	11. <i>tray</i>	gitaruru	itaruru

We can therefore propose the following word structure rule:

(28)	$N \rightarrow \text{Singular/Plural } N_{\text{stem}}$
------	---

You will also notice that the prefixes aren't the same for all nouns. The singular prefix is sometimes **mu-** and sometimes **g-** (we think). The plural prefix is sometimes **a-**, sometimes **mi-**, and sometimes null. So how many classes of nouns are there? For the singular prefix, there are two classes. For the plural prefix, there are three classes. There is more than one way to describe these results, but we will just present one. Let's try to get by with just three classes. The plural prefix would have the following lexical entry:

(29)	PLURAL →	a- with Class A nouns
		mi- with Class B nouns
		∅- with Class C nouns

By this analysis, *tumia* is a Class A noun stem, *ti* is a Class B noun stem, and *koa* is a Class C noun stem. This information about these noun stems must be included in the lexicon so that one will know how to form the actual singular and plural words.

Writing up the results

A quasi-formal write-up of an analysis is appropriate for some audiences, but not all. Here, as elsewhere, we are going to suggest prose descriptions that might be more appropriate in many cases, making the results available to a wider set of audiences. The following paragraph says the same thing as the formal statement (29) above, accounting only for the data that we have at hand. A proper write-up would probably include more examples.

Nouns in Kikuyu typically have two forms: singular and plural. A singular prefix appears on each singular noun, and a plural prefix appears on each plural noun. There are two singular prefixes: *mu-* and *g-*; and there are three plural prefixes: *α-*, *mi-*, and null. Each noun in Kikuyu belong to one of several arbitrary or partially arbitrary groups, or “classes”, depending on which of these prefixes the noun occurs with. Class A nouns (which may all be human beings?) take the plural prefix *α-*. Class B nouns (which include animals and some plants?) take the plural prefix *mi-*. Class C nouns (which include inanimate objects and some plants?) take the null plural prefix. The singular prefix for Class A and Class B nouns is *mu-* (as in *mu-ti tree*). It is *g-* for class C nouns (as in *g-eti chair*).

	<i>Singular</i>	<i>Plural</i>	
Class A	<u>m</u> uguri	<u>α</u> guri	<i>buyer</i>
Class B	<u>m</u> uti	<u>mi</u> ti	<i>tree</i>
Class C	g <u>e</u> ti	e <u>t</u> i	<i>chair</i>

Basic Practice with Kikuyu

How would you complete the following lexical entry, making reference to just the classes shown above?⁷ Check your answer before continuing.

(30) Singular → mu-
g-

3.2 Syntactic Conditioning

Arbitrary word classes are a last ditch measure. If there is suppletive allomorphy, one should always check out the possibility of some conditioning for the allomorphy which doesn’t need to be memorized separately from the other information about the word. In this chapter and those that follow, we look at cases where suppletive allomorphy is determined by something other than arbitrary word classes.

The distribution of suppletive allomorphs may be sensitive to ‘syntactic’ factors. When this is true, the language learner does not have to memorize lists of words.

The Seri first person singular subject prefix (for *I*) has two suppletive allomorphs, *hp-* and *h-*. The distribution of these allomorphs depends on whether the clause is superficially transitive or intransitive (whether there is an overt direct object in the clause or not).^f

(31) *hp-yo-m-afp* I didn’t arrive *h-yo-m-aho* I didn’t see it
hp-yo-m-atax I didn’t go *h-yo-m-pii* I didn’t taste it
hp-yo-m-panzx I didn’t run *h-yo-m-azt* I didn’t tattoo him/her
hp-yo-m-p-azt I wasn’t tattooed *ma-h-yo-m-azt* I didn’t tattoo you

The rule for this morpheme does not need to refer to arbitrary classes of verbs. Rather, it can refer to something which is a basic characteristic of verbs—or more accurately, perhaps, of the clauses in which they occur—that we find in many languages, their transitivity.

(32) FIRST PERSON SINGULAR SUBJECT → *h-* in transitive clauses
hp- in intransitive clauses

^f These words would actually also have an *i* at the beginning of them if they were said in isolation.

It is important to recognize the advantages of this kind of solution over one which simply posits arbitrary classes. An arbitrary class solution would have to specify for every single verb in the language which allomorph of the first person singular subject prefix it may occur with. This would imply that speakers have to learn that fact as a random fact for every verb which they use. The solution given above, however, takes advantage of the fact that we already know from other sources whether a verb is transitive or not; the speaker also knows this (although perhaps not consciously) and can use this information to decide on the correct allomorph of this prefix. The arbitrary class solution would add a great deal of complexity to the grammar of Seri. The syntactic conditioning solution, on the other hand, is extremely simple, although it is outside of the word itself. We choose the solution which adds the least complexity to the description of the language.

3.3 Phonological Conditioning

It is not uncommon for suppletive allomorphy to be sensitive to the phonological shape of an adjacent morpheme rather than to some morpheme class (arbitrary or otherwise). When this is true, the lexicon does not have to list classes of morphemes since a simple inspection of the sounds makes the choice of allomorph clear.

A simple example from English illustrates this. The indefinite article has two shapes: *a* and *an*. The first allomorph occurs before consonant-initial words and the second before vowel-initial words: *a tree*, *an orange*.^g Speakers of English don't memorize which word occurs with *a* and which with *an* and then guess at words they don't know. They figure out the rule, use it, and apply it to new words. The same thing happens in Korean where the article has the shape *i* after words which end in consonants, and *ka* after words which end in vowels: *salam i* (man Article), *ai ka* (boy Article).

The passive morpheme in Seri has two suppletive allomorphs, and the choice depends primarily on whether the next morpheme begins with a consonant or with a vowel.^h

(33)	<i>t-ah-cazni</i>	was s/he bitten?	<i>t-p-azt</i>	was s/he tattooed?
	<i>t-ah-tiip</i>	was s/he pinched?	<i>t-p-ahit</i>	was it eaten?
	<i>t-ah-fain</i>	was it tied up?	<i>t-p-am</i>	was it swallowed?
			<i>t-p-ezi</i>	was s/he defeated?
			<i>t-p-emen</i>	was it winnowed?

The lexical entry for the passive morpheme would look something like the following:

(34)	PASSIVE →	<i>ah-</i> before consonants
		<i>p-</i> before vowels

Somewhat more formally, this rule can be written with the following notation, where the slash (/) is short for 'in the environment' and the placement of the dash (_) indicates whether the item precedes or follows the environment on the right of the slash:

(35)	$X \rightarrow Y / _ Z$
	X is rewritten as Y if X precedes Z.

(36)	$R \rightarrow S / T _$
	R is rewritten as S if R follows T.

The Seri rule would be the following, where C represents 'any consonant' and V represents 'any vowel':

(37)	PASSIVE →	<i>ah-</i> / $_ C$
		<i>p-</i> / $_ V$

^g It is the sounds that count, not the spelling. Notice that the allomorph *a* occurs before *unicorn* since the noun begins with a glide and not a vowel phonetically: [ˈjuniko.n].

^h It also matters in Seri whether the next morpheme is a prefix or a root, but we ignore this complication here.

There are two important cross-linguistic observations which we mention here but do not elaborate on. First, roots do not exhibit phonologically conditioned suppletive allomorphy, unlike affixes. Second, morphemes are sensitive to the shape of morphemes closer to the root, but not to morphemes farther out.

From this rule we know that the shape of the passive morpheme in Seri depends on whether the morpheme following it begins with a consonant or a vowel.

The conditioning for the suppletive allomorphy could be something more specific than consonant vs. vowel, of course. For example, consider the object nominalizer in Seri, which turns a verb stem like *eat* into a noun which means *what (someone) eats/ate*. It has three shapes of relevance to us here: null, *y*-, and *o*-. Some examples of the roots with which these allomorphs occur are given below.

(38)	Null	- <i>ip</i> straighten, - <i>ii</i> hear, - <i>iic</i> plant, - <i>iip</i> carry on head, - <i>ixim</i> fear
	<i>y</i>	- <i>aazi</i> carry, - <i>aat</i> cook in ashes, - <i>aatjc</i> spread around, - <i>eefel</i> stumble on
	<i>o</i>	- <i>quesejc</i> gnaw, - <i>afmoj</i> carry firewood, - <i>pii</i> taste, - <i>oocta</i> look at, - <i>oi</i> delouse

This allomorphy depends on the kind of vowel that the verb begins with. If the verb begins with a close front vowel (*i* or *ii*), then it takes the null allomorph. If it begins with a long open vowel (*aa* or *ee*), then it takes the allomorph *y*. Otherwise, before all other vowels and before all consonants—this is the ‘elsewhere’ case—the allomorph *o* occurs.

In Walmatjari, the emphatic morpheme has two shapes: [-**ŋi**] following vowels, and [-**paŋi**] following consonants. Similarly, the morpheme for *then* has two shapes: [-**la**] following vowels, and [-**pala**] following consonants.ⁱ

Also in Walmatjari, certain suffixes have allomorphs which are accounted for partially by the number of syllables in the stem to which they attach: one allomorph occurs only when the host word has exactly two syllables (the minimum), while the other occurs with host words which are longer.

Basic Practice

Write the following rules in formal notation and check your answers before continuing.

- The infinitive prefix has the shape *a*- before consonants and *n*- before vowels.⁸
- The negative suffix has the shape *-t* after vowels and *-on* after consonants.⁹
- The dative suffix has the shape *-wu* after vowels, and *-ku* after consonants (Walmatjari, Australia).¹⁰

3.4 Morphological Conditioning

The shape of a morpheme is sometimes sensitive to the presence of other morphemes in the word, regardless of their shape. (Syntactic conditioning had to do with some factor outside of the word form itself.)

A simple example from English is found with some basic adjectives. You probably know that many adjectives occur in three forms: basic, comparative, and superlative, such as *blue*, *bluer*, *bluest*, and *tall*, *taller*, *tallest*. The suffixes *-er* and *-est* are added to the adjective stem. The adjective *good* has three suppletive stems, however; compare *good*, *bett-er*, and *b-est*.

In Spanish, some verbs have suppletive stems that depend on some other morphological fact of the word. For example, the regular stem for ‘know’ is *sab-* (cf. *saber*, *sabemos*, *sabes*, *sabía*, *sabiendo*), but the stem *sep-* occurs when the verb is in the present subjunctive (cf. *sepa*, *sepamos*, *sepas*). The regular stem for ‘do’ is *hac-* (cf. *hace*, *hacemos*, *haces*, *hacía*, *haciendo*), but the stem *hag-* occurs in the present subjunctive (cf. *haga*, *hagamos*, *hagas*). One could view these cases as ones where there is a special stem (*sep-*, *hag-*) that occurs when the verb is inflected for present subjunctive, and regular stems (*sab-*, *hac-*) otherwise.^j

ⁱ There are a couple of things that are a bit odd about this set of facts. The first is that both morphemes have the same ‘extra’ syllable [pa]. The second is that in each case one allomorph contains the other. One might want to look at these facts more carefully.

^j These particular verbs happen to have other stems as well, and other contexts where these stems may be used.

Now consider a slightly more complicated example, the negative subject nominalized form ‘what is not eaten’. The steps are the same, but one morpheme (PASSIVE) has phonologically-conditioned allomorphs and another (NOMINALIZER) has morphologically-conditioned allomorphs.

- (47) Nominalizer - Negative - Passive - Verb_{stem}
- (48) (i) NOMINALIZER - NEGATIVE - PASSIVE - *ahit*
- (ii) NOMINALIZER - NEGATIVE - *p* - *ahit*
- (iii) NOMINALIZER - *m* - *p* - *ahit*
- (iv) *i* - *m* - *p* - *ahit*

In step (i) the root is inserted. In step (ii) the Passive allomorph is chosen; according to rule (37) the allomorph *p*- must be used since the passive morpheme precedes a vowel. In step (iii) the Negative morpheme is inserted. In step (iv) the Nominalizer allomorph is chosen; according to rule (41), the allomorph *i*- must be used since the Nominalizer is in a verb which also contains the Negative morpheme. This is why the order of the subparts of rule (41) is important: to provide an economical and accurate account of the facts.

Key Concepts

morphological subclassification	allomorphs	suppletive allomorphs
non-arbitrary word classes	alienable class	inalienable class
arbitrary word classes	C, V	"slash-dash" notation
suppletive allomorphy conditioned by syntactic, phonological, and morphological factors		

Postscript for Teachers

The concept of suppletion is one that figures in a minor way in some books on morphology and phonology, but it usually is not developed very much, and often in a rather unsatisfying way. In addition, the term ‘partial suppletion’ is also introduced, although that term seems oxymoronic and unhelpful. How does that designation affect the formal analysis? Either a morpheme has one underlying form which is changed by rules of one sort or another, or it has more than one underlying (suppletive) forms which replace each other. In the case of the latter, these suppletive forms may be totally unlike each other, or they may be somewhat similar. The term ‘partial suppletion’ has been used to refer to the situation where they are somewhat similar.

This chapter introduces the first kind of conditioning for suppletive allomorphy that we present in this book. Most books do not discuss facts such as these at all, perhaps because phonologists usually ignore suppletive allomorphy, or because of lack of familiarity with such facts. Many descriptions of suppletive allomorphy consider only the kind of suppletive allomorphy which relies on arbitrary word classes. We believe that this is a serious mistake.

The question may arise as to whether a given pair of allomorphs are suppletive allomorphs or not. (Students learn about non-suppletive allomorphy in the next major section of the book.) One cannot say whether two allomorphs are suppletive or not based on the facts alone, but only as one sees how the facts are treated within an analysis. One analyst may treat two allomorphs as if they were suppletive, and another analyst may analyze them as non-suppletive. The real question is whether the allomorphs should be treated as suppletive or non-suppletive. This can only be answered by comparing the competing analyses.

When there are several morphemes which are being looked up in the lexicon, one might wonder which one of them should be looked up first, especially if the shape of one may depend on the shape of another. In general, it seems that one starts with the root and works outwards. Prefixes may depend on the shape of the following morpheme, and suffixes may depend on the shape of the preceding morpheme.

3.1 Try it for yourself with Seri

Examine the following data and quickly make some tentative morpheme cuts. The singular form precedes the plural form.

1. <i>cáait, cáaitj</i>	black jewfish	11. <i>cáamopxa, cáamopxaj</i>	moth (sp.)
2. <i>cáar, cáaroj</i>	sheep	12. <i>cacámama, cacámamatoj</i>	stink bug (sp.)
3. <i>cáay, cáaytaj</i>	horse	13. <i>cascaréera, cascaréeraj</i>	ladder
4. <i>saráapi, saráapitaj</i>	blanket	14. <i>siimeníl, siimeníloj</i>	Cooper's Hawk
5. <i>canóaa, canóaataj</i>	boat	15. <i>santáar, santáaroj</i>	soldier
6. <i>sáh, sáhtaj</i>	owl (species)	16. <i>joéne, joénetaj</i>	<i>Passiflora</i>
7. <i>tóaaaz, tóaaazoj</i>	handkerchief		<i>palmeri</i> (plant)
8. <i>xtáasi, xtáasitoj</i>	estuary	17. <i>cahícosa, cahícosaj</i>	young deer
9. <i>sír, síroj</i>	saddle	18. <i>nóosi, nóosilc</i>	Mourning Dove
10. <i>otéye, otéyej</i>	bottle		

Which of the following word structure rules is correct?¹¹

$$N \rightarrow N_{\text{stem}} - \text{Pl} \quad \text{or} \quad N \rightarrow \text{Pl} - N_{\text{stem}}$$

List the allomorphs of the plural suffix that you see.¹²

Do you see any way to predict to tell which noun takes one allomorph instead of another?¹³

Propose a lexical entry for the plural morpheme that is appropriate for these facts.¹⁴

3.2 Try it for yourself with Huajuapán Mixtec

Examine the following data (given in a broad phonetic transcription). You will note that there are two allomorphs for the pronoun meaning *our*. (The nouns also sometimes change a bit, but you can ignore that fact here.)

		<i>our ...</i>	<i>your (pl.)</i>	
1.	nāmā	nāmā so	nāmā ndo	<i>soap</i>
2.	tōmī	tōmī so	tōmī ndo	<i>feather</i>
3.	tīnā	tīnā so	tīnā ndo	<i>dog</i>
4.	ðyki	ðyki o	ðyki ndo	<i>niece</i>
5.	katʃi	katʃi so	katʃi ndo	<i>cotton</i>
6.	ʃita	ʃita o	ʃita ndo	<i>grandmother</i>
7.	zeʔe	zeʔe so	zeʔe ndo	<i>door</i>
8.	ʒaa	ʒa o	ʒaa ndo	<i>tongue</i>
9.	tifi	tif o	tifi ndo	<i>stomach</i>
10.	ndaʔa	ndaʔ o	ndaʔa ndo	<i>hand</i>
11.	tʃika	tʃika o	tʃika ndo	<i>chest</i>

Complete the following lexical insertion rule for the pronoun *our* assuming that there is no way to predict which noun takes which allomorph.¹⁵

1 PLURAL POSSESSOR → o /
so /

Now quickly make a list of each group of nouns and examine the nouns in each group. Are there any unifying characteristics that would suggest that these are not just arbitrary lists of nouns? Recall that arbitrary classes are something the language learner has to memorize and so alternatives to arbitrary classes should always be explored.¹⁶

Propose a revised lexical entry for this pronoun that takes this information into consideration.¹⁷

After checking your answer, propose a prose write-up of these facts.¹⁸

3.3 Try it for yourself with Madija

The prefix for third person subject has two shapes: i- and null, as shown below.¹ Give the lexical entry for third person subject. Write your analysis up in quasi-formal format and also in prose.¹⁹

1.	i-neboherani	<i>he did not leave her</i>
2.	da i-nabak ^h i	<i>she did not give it to them</i>
3.	babo pore i-hidza	<i>he plucked the tick from him</i>
4.	dzoho i-nahonaharo	<i>he carried her toward there</i>
5.	kapi i-nineharo	<i>she vomited it</i>
6.	∅-madii	<i>he lives</i>
7.	howa howa ∅-nahari	<i>he shouted and shouted</i>
8.	wehe wehe ∅-naharo	<i>she sways and sways</i>
9.	∅-watidze	<i>s/he is/was happy</i>

3.4 Now try it for yourself with Seri

Look over the following data quickly and provide the word structure rule for infinitives.²⁰ (Morpheme breaks have been provided for you. And again, see the appropriate endnotes at the end of this chapter for answers to these questions after you have jotted down your own answers.)

1.	<i>iha-nifz</i>	to kick (something)	7.	<i>iha-nip</i>	to buffet (something)
2.	<i>iha-tis</i>	to point at (something)	8.	<i>iha-tiixp</i>	to squeeze (something)
3.	<i>iha-poin</i>	to close (something)	9.	<i>iha-pii</i>	to taste (something)
4.	<i>ica-panzx</i>	to run	10.	<i>ica-xapz</i>	to congeal
5.	<i>ica-xaplc</i>	to tremble	11.	<i>ica-poct</i>	to be full
6.	<i>ica-poozi</i>	to be pear-shaped	12.	<i>ica-needni</i>	to be stooped

Make a list of the roots according to which allomorph they take. Do you think that you need to posit arbitrary classes in order to account for them?²¹

Why is the best solution not one in which simply two arbitrary classes of verbs are posited?²²

¹ This is a slight oversimplification.

3.5 Try it for yourself with Seri

Examine the following data and make the morpheme cuts. The Negative prefix is *m-*.

	Positive Imperative	Negative Imperative	
1.	<i>hoocta</i>	<i>cmoocta</i>	look
2.	<i>hexl</i>	<i>cmexl</i>	take
3.	<i>hoonl</i>	<i>cmoonl</i>	stir
4.	<i>haat</i>	<i>cmaat</i>	cook in ashes
5.	<i>haanj</i>	<i>cmaan</i>	poison arrowheads

Give the word structure rule for imperative forms.²³

Now give the lexical entry for the imperative prefix, making reference to the presence of the Negative prefix for one allomorph. The allomorph which occurs in non-negative verbs should be the ‘elsewhere’ case. (Although from these data it may look like the answer has something to do with consonants and vowels, it does not. Unfortunately, the data needed to show this present other complications that you do *not* want to see yet.)²⁴

The following data complicate the picture somewhat. How would you integrate them into your analysis (in particular, the lexical entry for the imperative prefix)? In this case, the fact that all of these verb stems begins with the vowel *a* (not double *aa*) is significant.²⁵ It is a coincidence that the Imperative prefix has the same shape (*c-*) in this context as in negative verbs.

	Positive Imperative	Negative Imperative	
6.	<i>catax</i>	<i>cmatax</i>	go
7.	<i>caitom</i>	<i>cmaitom</i>	speak
8.	<i>camjc</i>	<i>cmamjc</i>	bring (something)
9.	<i>catni</i>	<i>cmatni</i>	touch (something)
10.	<i>casquim</i>	<i>cmasquim</i>	paddle
11.	<i>caxpx</i>	<i>cmaxpx</i>	get mad at (someone)

Now write up all of these facts in prose.²⁶

3.6 Try it for yourself with Tzotzil

Examine the following data and give the word structure rule(s) necessary to describe these facts. (The data are given in a practical orthography in which the *j* represents a velar fricative and *y* a palatal glide/semivowel. Don't forget to take care of the words for *wives*, as compared with *wife*.)²⁷

	his/her/their...	my/our...	
1.	<i>stot</i>	<i>jtot</i>	father
2.	<i>stzek</i>	<i>jtzek</i>	skirt
3.	<i>svex</i>	<i>jvex</i>	trousers
4.	<i>sbi</i>	<i>jbi</i>	name
5.	<i>yajnil</i>	<i>kajnil</i>	wife
6.	<i>yajnilik</i>	<i>kajnilik</i>	wives
7.	<i>yixlel</i>	<i>kixlel</i>	younger sister
8.	<i>yalak'</i>	<i>kalak'</i>	chicken

5. jɔ-n *my hand* 10. zɔ-da *my bean*

3.10 Try it for yourself with Mengen

The ‘transitive’ suffix has two allomorphs. What does the lexical entry for this suffix look like?³⁴ Note: the vowels in this language are either front (*i, e*) or back (*a, u, o*).

	Infinitive	Transitive	
1.	amo	amoe	<i>rub</i>
2.	ba	bae	<i>send</i>
3.	kovu	kovue	<i>chop</i>
4.	kiau	kiaue	<i>call</i>
5.	tao	taoe	<i>walk</i>
6.	mate	matea	<i>like</i>
7.	ossi	ossia	<i>lose</i>
8.	sai	saia	<i>sew</i>
9.	tae	taea	<i>climb</i>

3.11 Try it for yourself with Ch’ol

Analyze the following data and provide a lexicon for the prefixes, assuming the allomorphs of each are suppletive.³⁵

	<i>my ...</i>	<i>your ...</i>	<i>his/her ...</i>	<i>Unpossessed</i>	
1.	kpusik’al	apusik’al	ipusik’al	pusik’al	<i>heart</i>
2.	kot ^h ot	awot ^h ot	ijot ^h ot	ot ^h ot	<i>house</i>
3.	hk’aba?	ak’aba?	ik’aba?	k’aba?	<i>name</i>
4.	hko?	ako?	iko?	ko?	<i>grandmother</i>
5.	kiʃim	awiʃim	ijiʃim	iʃim	<i>corn</i>
6.	kbuhk	abuhk	ibuhk	buhk	<i>blouse</i>
7.	kpam	apam	ipam	pam	<i>forehead</i>
8.	hkehlob	akehlob	ikehlob	kehlob	<i>shoulder</i>
9.	hkutʃ	akutʃ	ikutʃ	kutʃ	<i>load</i>
10.	kmut	amut	imut	mut	<i>chicken</i>
11.	kats’am	awats’am	ijats’am	ats’am	<i>salt</i>
12.	kti?	ati?	iti?	ti?	<i>lips</i>

3.12 Try it for yourself with Madija

Make some quick morpheme cuts on the following data, which are given in a very broad phonetic transcription (some detail has been omitted). You may ignore the change from *e* to *a* in the word for *hair*.

	<i>my ...</i>	<i>your ...</i>	<i>his ...</i>	<i>her ...</i>	
1.	okone	tikone	kone	konani	<i>hair</i>
2.	otat ^h i	titat ^h i	tat ^h i	tat ^h ini	<i>head</i>
3.	opano	tipano	pano	panoni	<i>face</i>
4.	onats ^h ope	tinats ^h ope	nats ^h ope	nats ^h opani	<i>saliva</i>
5.	otone	titone	tone	tonani	<i>bone</i>
6.	owene	tene	ene	eneni	<i>nose</i>
7.	owebeno	tebeno	ebeno	ebenoni	<i>tongue</i>
8.	owati		wati	watini	<i>liver</i>
9.	owaribo		waribo	wariboni	<i>ear</i>
10.	owipo	tipo	ipo	iponi	<i>lower lip</i>

Give the word structure rule for possessed nouns. You may refer to the suffix *-ni* as the ‘Feminine’ suffix (used only in third person). The third person possessor prefix is null.³⁶

There are two allomorphs for the first person possessor prefix and two allomorphs for the second person possessor prefix. Assume they are suppletive allomorphs for now (they aren’t really, but you don’t know that and it doesn’t make any difference at this point). Give the lexical entry for each of them.³⁷

Feedback for Chapter 3

Basic Practice with Kikuyu⁷

The allomorph *mu-* occurs with Class A and B nouns, and the allomorph *g-* occurs with Class C nouns.

Basic Practice

⁸ Infinitive → a- / __ C
n- / __ V

⁹ Negative → -t / V __
-on / C __

¹⁰ Dative → -wu / V __
-ku / C __

(The allomorphs of the Dative are similar enough to suggest that another analysis might be possible, as we will see later, especially if some other morphemes have similar allomorphy, as is the case.)

3.1 Seri

¹¹ The first word structure rule is correct, of course. The plural morpheme follows is a suffix.

¹² The allomorphs of the plural suffix are: *j*, *oj*, *taj*, *toj*, *lc*.

¹³ There doesn’t seem to be any way to predict which noun takes which allomorph.

-
- ¹⁴ PLURAL → -*j* with Class A
 -*oj* with Class B
 -*taj* with Class C
 -*toj* with Class D
 -*lc* with Class E

The labels for these arbitrary classes don't have any significance. We could have used Class 1, etc., or Declension 150, etc., or whatever. This rule does not give any indication that one of these allomorphs is the 'elsewhere' case. That would be determined, if possible, by looking at more facts.

3.2 Huajuapán Mixtec

- ¹⁵ *o* with Class A, *so* with Class B.

¹⁶ The nouns that take the allomorph *o* are body part nouns and kinship nouns, whereas the other nouns are not (the only possible exception is *feather*; it would be interesting to know how a group of birds would say *our feathers!*).

- ¹⁷ 1 Plural Possessor → *o* with inalienable nouns
 so elsewhere

This rule assumes that the class of alienable nouns (like *door*) is much larger than the class of inalienable nouns. (After all, there are only so many body part names and names for relatives.)

¹⁸

There are two pronouns for *our* (first person plural possessor): *o* and *so*. The pronoun *o* is used with inalienable nouns—those which require the expression of some possessor, such as body parts and kinship terms. Example: ʒa *o* *our tongues*, and ʒita *o* *our grandmother(s)*. The pronoun *so* is used with all other nouns. Example: ʒeʔe *so* *our doors*.

3.3 Madija¹⁹

- ³rd SUBJECT → *i-* in transitive clauses
 ∅- in intransitive clauses

A third person subject in Madija is indicated on the verb by two different prefixes. One of these is null, and is used on verbs in intransitive clauses. The other is *i-*, and is used on verbs in transitive clauses.

3.4 Seri

- ²⁰ The word structure rule would be: Infinitive → INFINITIVE PREFIX - Verb_{stem}

²¹ No. The verbs that take the allomorph *iha-* are all transitive verbs. Those that take the allomorph *ica-* are all intransitive.

²² Arbitrary classes require extra, but unnecessary, information to be included in the lexicon (the class labeling). The classes are not arbitrary, however, and the language learner does not have to memorize these facts.

3.5 Seri

- ²³ Word Structure Rule: Imperative Verb → IMPERATIVE - (NEGATIVE) - Verb_{stem}

- ²⁴ IMPERATIVE → *c* / <Negative>
 h / elsewhere

- ²⁵ IMPERATIVE → *c* / <Negative>
 c / __ *a*
 h / elsewhere

3.11 Ch'ol³⁵

Each of the prefixes has two suppletive allomorphs.

1st SG POSSESSOR → h / __ k-sounds
 k / elsewhere

2nd SG POSSESSOR → aw / __ V
 a / __ C

3rd SG POSSESSOR → ij / __ V
 i / __ C

3.12 Madija

³⁶ Noun → Possessor - Noun_{stem} - FEMININE

³⁷ 1st POSSESSOR → o / __ C 2nd POSSESSOR → ti / __ C
 ow / __ V t / __ V

CHAPTER 4 - MULTIPLE FUNCTION FORMATIVES

Formatives (morphemes) do not always carry a single ‘meaning’. They may indicate two (or more) ‘meanings’, such as tense and aspect, person and number, or tense and person. We may refer to them as **multiple function formatives** (although this is not a commonly used term).^a You are well aware that *I* in English indicates first person singular, and *we* first person plural. These morphemes therefore indicate both person and number.

In Manam there are two sets of subject agreement prefixes, one for realis mood (present and past), the other for irrealis (future):

(49)		<i>Realis</i>	<i>Irrealis</i>
	1 singular	u–	m–
	2 singular	ʔu–	go–
	3 singular	i–	ŋa–
	1 plural exclusive	ʔi–	ga–
	1 plural inclusive	ta–	ta–
	2 plural	ʔa–	ʔama–
	3 plural	di–	da–

Since the difference between these two sets is related to the mood of the verb, we do not consider the formatives {u-} and {m-}, etc. to be allomorphs; rather, they are simply two different morphemes. They are formatives that have two functions: to indicate person/number and to indicate mood.

In Greek there are ‘case suffixes’ that occur on nouns. But a suffix such as **-os** actually indicates three things: case (nominative), number (singular), and word class (masculine). The suffix cannot be further dissected so as to reveal a formative for each of these functions. The rule might look something as follows:

$$(50) \quad \left[\begin{array}{l} +\text{Masculine} \\ -\text{Plural} \\ +\text{Nominative} \end{array} \right] \rightarrow \text{os}$$

In Seri there are several words for *the*. The choice between them largely has to do with the position and number of the noun: *cop* if it is erect, *com* if it is prone, *quij* if it is squat or seated, *coi* if it is plural, etc. We also view these as separate morphemes with more than one function, not allomorphs of a single morpheme.

Examples like the Greek case suffixes are not uncommon; the morphology is built around these multiple function formatives. In some languages, however, the multiple function formative is unusual since the typical formatives in the paradigm do not conflate multiple functions.

Some multiple function formatives have been given the special name of **portmanteau** (a term coined by Charles Hockett). A portmanteau conflates two or more morphemes which otherwise occur independently in the language. For example, *was* in English could be considered a portmanteau; it conflates the verb *be* and Past tense (which is elsewhere manifested as *-d*). The word *am* conflates three things: the verb *be*, Present tense, and first person singular subject. The word *worse* conflates two morphemes: the adjective *bad* and the comparative (which is usually *-er*). The morpheme *du* in French is a portmanteau that conflates *de* ‘of’ and *le* ‘the’ (masc. sg.). The verb form *sé* ‘I know’ in Spanish is a portmanteau that replaces what one might otherwise expect based on the regular stem and regular morphology (*sab-* plus *-o*).

The verb *go to (somewhere)* in Seri has two shapes: one if the subject is singular and another if the subject is plural. Since the plural stem displaces the regular affixes that normally indicate agreement with a plural subject in this language, the plural stem in this case may be considered a portmanteau.

(51)	<i>i-t-yaai</i>	did s/he go to it?
	<i>i-t-oziiit</i>	did they go to it?

^a One recent book (Andrew Radford, Martin Atkinson, David Britain, Harald Clahsen, and Andrew Spencer, 1999, *Linguistics: an introduction*; Cambridge, New York, Melbourne: University of Cambridge Press) uses the term “cumulation” for situations like this; a morpheme “cumulates” various properties (e.g. case and number).

We will write the lexical entry for a portmanteau morpheme as follows, with the understanding that it displaces the ‘regular’ morphemes.

(52) GO TO, PLURAL → *ozit*

The singular form will have the following lexical entry.

(53) GO TO → *yaai*

There are two question particles in Madija: *ki* and *ko*. The word *ki* is used if the subject of the verb is feminine, and the word *ko* is used if the subject of the verb is masculine.^b In this sense, there is a kind of agreement going on between the Question particle morpheme and some other element in the clause. (These are not portmanteaux since there aren’t any other morphemes that these forms displace.)

(54) tok^ha ki *Did she go?*

tok^ha ko *Did he go?*

The lexical entry for this morpheme would be:

(55) QUESTION PARTICLE → *ko* QUESTION PARTICLE → *ki*
[-Feminine] [+Feminine]

Key Concept

multiple function formative

portmanteau

4.1 Now try it for yourself with French

In French there is a word for *to* [a], and a word for *the* (masc. sg.) [lə]. These two morphemes are displaced by a portmanteau, [o], when they co-occur. (This does not happen when [a] *to* precedes the feminine singular word for *the* [la].) Give the lexical entry for the portmanteau.³⁸ Try stating this in prose as well.

^b This is a slight oversimplification. The conditioning factor is actually the gender of the absolutive of the clause (the subject of an intransitive clause, the direct object of a transitive clause).

4.2 Try it for yourself with Swahili

Give the word structure rule and the lexicon (affixes and stems). (This problem draws on topics presented in various of the preceding chapters.)³⁹ Three of the morphemes have two suppletive allomorphs each.^c There is also one portmanteau.

1. ninapenda	<i>I love</i>	17. ninaona	<i>I see</i>
2. unapenda	<i>you (sg.) love</i>	18. unaona	<i>you (sg.) see</i>
3. anapenda	<i>s/he loves</i>	19. anaona	<i>s/he sees</i>
4. tunapenda	<i>we love</i>	20. tunaona	<i>we see</i>
5. mnapenda	<i>you (pl.) love</i>	21. mnaona	<i>you (pl.) see</i>
6. wanapenda	<i>they love</i>	22. wanaona	<i>they see</i>
7. ninampenda	<i>I love him/her</i>	23. ninamwona	<i>I see him/her</i>
8. ninamleta	<i>I carry him/her</i>	24. ninamwomba	<i>I ask him/her</i>
9. nitapenda	<i>I will love</i>	25. nitaona	<i>I will see</i>
10. nilipenda	<i>I loved</i>	26. niliona	<i>I saw</i>
11. sitapenda	<i>I won't love</i>	27. sikupenda	<i>I didn't love</i>
12. hutapenda	<i>you (sg.) won't love</i>	28. hukupenda	<i>you didn't love</i>
13. hatapenda	<i>s/he won't love</i>	29. hakupenda	<i>s/he didn't love</i>
14. hatutapenda	<i>we won't love</i>	30. hawakupenda	<i>they didn't love</i>
15. hamtapenda	<i>you (pl.) won't love</i>		
16. hawatapenda	<i>they won't love</i>		

^c At least you should treat them as suppletive for the purposes of this exercise.

4.3 Try it for yourself again with Swahili⁴⁰

The verb form which these data introduce is called the *infinitive* (so-called because it does not show any reference to time or tense). The form which is glossed “for (someone)” is often called the *applicative* (who knows why!). Another term you might use (for other forms) is *inversive* (opposite). And there is something else that you should analyze here as a formative that you can just call *Final Vowel*.

Account for all morphemes by providing: (1) the word structure rule for infinitives, (2) a lexicon for morphemes which do not vary, (3) rules for the morpheme(s) displaying variation. (Assume they are suppletive.)

Some traditional vowel labels might be helpful to you.

HIGH	i	u
MID	e	o
LOW	a	

For the morpheme(s) showing variation, explain *in prose of sufficient length* why you analyze it/them the way you do (conditioned by syntactic factors, conditioned by phonological factors, conditioned by morphological factors, or simply completely unpredictable and therefore requiring arbitrary classes).

- | | | | |
|--------------|-------------------------|------------------|--------------------------------|
| 1. kupenda | <i>to love</i> | 17. kufiṭʃa | <i>to hide</i> |
| 2. kupata | <i>to get</i> | 18. kufiṭʃua | <i>to reveal</i> |
| 3. kuanza | <i>to start</i> | 19. kupikia | <i>to cook for (someone)</i> |
| 4. kuleta | <i>to carry</i> | 20. kulipia | <i>to pay for (someone)</i> |
| 5. kula | <i>to eat</i> | 21. kubebea | <i>to carry for (someone)</i> |
| 6. kusema | <i>to speak</i> | 22. kuimbia | <i>to sing for (someone)</i> |
| 7. kuenda | <i>to go</i> | 23. kufungia | <i>to close for (someone)</i> |
| 8. kulipa | <i>to pay</i> | 24. kupatia | <i>to get for (someone)</i> |
| 9. kupika | <i>to cook</i> | 25. kuendea | <i>to go for (someone)</i> |
| 10. kubeba | <i>to carry</i> | 26. kuombea | <i>to pray for (someone)</i> |
| 11. kuandika | <i>to write</i> | 27. kufonea | <i>to sew for (someone)</i> |
| 12. kuɟona | <i>to sew</i> | | |
| 13. kufunga | <i>to close</i> | Extra challenge: | |
| 14. kufungua | <i>to open</i> | 28. kufungulia | <i>to open for (someone)</i> |
| 15. kufuma | <i>to weave</i> | | |
| 16. kufumua | <i>to loosen, untie</i> | 29. kufumulia | <i>to loosen for (someone)</i> |

Feedback for Chapter 4

4.1 French³⁸

TO, THE (masc. sg.) → o

When the preposition “a” is expected in front of the masculine singular article “le”, the expected sequence “a le” does not occur. Instead, a single word “o” appears.

4.2 Swahili³⁹

Word Structure Rule: (NEGATIVE) - Subject Agr. - Tense - (Object Agr.) - Verb_{stem}

Lexicon:

1s Subject	ni-	PRESENT	na-	penda	love
2s Subject	u-	FUTURE	ta-	ona	see
3s Subject	a-	PAST (see below)		leta	carry
1p Subject	tu-			omba	ask
2p Subject	m-				
3p Subject	wa-				

PAST → ku- / <NEGATIVE>
li- / elsewhere

3s OBJECT → mw- / __ V
m- / __ C

NEGATIVE → h- / __ V
ha- / __ C

NEGATIVE, 1s SUBJECT → si-

The final vowel of the verb is actually a suffix, but this is not apparent from the data given.

4.3 Swahili⁴⁰

Word structure rule for infinitives:

V_{infinitive} → Infinitive Prefix - Root - (Inversive) - (Applicative) - Final Vowel

The order of the Inversive and Applicative morphemes is only known from the examples given in (28-29).

Lexicon for morphemes which do not vary:

-pend	love	ku-	Infinitive Prefix
-pat	get	-u	Inversive*
-l	eat	-a	Final Vowel
-fum	weave		
-etc.			

* An alternative analysis to the one presented here would posit two suppletive allomorphs of the Inversive: -ul / __ <Applicative> and -u / elsewhere.

Rules for the morpheme displaying variation:

APPLICATIVE → li / V __
e / root with mid vowel
i / (elsewhere)

The Applicative suffix has three forms (assuming the *l* to be part of it rather than part of the Inversive suffix). It has the shape **-li** when it follows a vowel — which in the data shown is only the Inversive suffix. The analysis given is that the conditioning is phonological. It is also possible to say that it has the shape only after the Inversive suffix, in which case the conditioning is morphological.

Otherwise, the Applicative suffix is **-e** following roots/syllables which have a mid vowel, and **-i** elsewhere (i.e., following roots/syllables with high vowels or low vowels—not a natural class, and therefore appropriately treated as the elsewhere case). This is phonological conditioning and it adequately handles all of the cases shown. Therefore it is not necessary to look for other conditions; it is certainly not a matter of arbitrary classes.

While it certainly may not be true that the Inversive suffix may co-occur with just any verb of Swahili, there is no evidence given in the data of any restrictions. The facts discussed above would not be affected by any such restrictions.

CHAPTER 5 - MORPHOLOGICALLY TRIGGERED RULES

Consider the following data from English:

(56)	Singular	Plural
	<i>leaf</i>	<i>leaves</i>
	<i>knife</i>	<i>knives</i>
	<i>wife</i>	<i>wives</i>
	<i>half</i>	<i>halves</i>
	<i>loaf</i>	<i>loaves</i>

Notice that the final consonant of the noun changes between the singular and the plural. It would seem unfortunate to have to list each of these nouns in the lexicon with two roots, as follows:

(57)	WIFE →	<i>wive</i> / <Plural>
		<i>wife</i> / elsewhere

The forms are just too similar to treat in this way. An alternative would be to choose one of them as more basic than the other and derive one allomorph from the other. Let us assume that the singular form is the basic form, and the plural form of these nouns is created by adding the suffix *-s* plus a ‘tweak’ on the consonant. We refer to this ‘tweak’ as a consonant mutation rule. The rule might be stated as follows (ignoring the English spelling convention using the ‘silent’ *e*):

(58)	F/V Rule:	Change the last <i>f</i> of a root to <i>v</i> if the root is of the class <i>leaf, loaf, etc.</i>
------	-----------	--

We have to indicate somewhere that nouns like *leaf* are subject to the F/V Rule when they are pluralized; this rule does not apply to nouns such as *puffs, coughs, cliffs, chiefs, waifs, and fives*. Since this rule is restricted to a small subset of nouns only under very restricted circumstances, we refer to it as a **minor rule**.

The realization of the plural morpheme in English should therefore look something like the following:

(59)	PLURAL →	<i>-en</i> with class A (<i>ox, etc.</i>)
		<i>-∅</i> with class B (<i>deer, etc.</i>)
		<i>-s</i> plus F/V Rule elsewhere

We can illustrate the steps we have taken so far with a **derivation**. A derivation shows the steps from the input to the output.^a

(60)	Word Structure Rule	Noun - PLURAL
	Lexical Insertion	<i>leaf - s</i>
	F/V Rule	<i>leave - s</i>
	Final Output	<i>leave - s</i>

A similar kind of rule would be posited to account for the alternations seen in *mouse/mice*, and *goose/geese*. A rule that changes a vowel in this way is often referred to as an **ablaut rule**. These rules for English are also minor rules, as are the ones that change the vowels in some verbs to form the Past tense (*sing/sang, sit/sat*).^b

(61)	Minor Rule (Ablaut):	Change <i>ou</i> to <i>i</i> if the word is <i>louse, mouse, etc.</i>
------	----------------------	---

(62)	Minor Rule (Ablaut):	Change <i>oo</i> to <i>ee</i> if the word is <i>goose</i> .
------	----------------------	---

(63)	Minor Rule (Ablaut):	Change <i>i</i> to <i>a</i> if the word is <i>sing, sit, etc.</i>
------	----------------------	---

The zero allomorph of PLURAL in English therefore also triggers a minor rule for some nouns. For nouns like *deer* and *moose*, the zero allomorph occurs, but since these roots do not appear in the list of words which undergo Ablaut, there is no change between singular and plural.

^a This derivation is a bit informal since it still utilizes English spelling conventions. Lexical insertion means going to the lexicon and choosing a Noun, the appropriate plural suffix, etc., and combining them.

^b Remember that for the sake of convenience we are using the English spelling here rather than a technical alphabet.

- (64) PLURAL → -en with class A (*ox*, etc.)
 -∅ plus Ablaut with class B (*deer, moose, goose, louse*, etc.)^c
 -s plus F/V Rule elsewhere

Not all morphologically triggered rules are minor rules; it depends if they specify a special class of morphemes in the lexicon. For example, in Seri the passive allomorph {p-}, which we saw earlier, also triggers a rule of ablaut on every morpheme that immediately follows it. It does not refer to any ad hoc class of morphemes, unlike the English examples above. Among other things, the rule changes an *o* (long or short) to short *a*. (Morphologically triggered rules are often rather odd.) This is illustrated by the following derivation of the passive verb *tpanl*.

- | | | |
|------|---------------------|--------------------------------|
| (65) | Word Structure Rule | Tense - PASSIVE - Stem |
| | Lexical Insertion | <i>t - p - oonl</i> |
| | Ablaut Rule | <i>tpanl</i> |
| | Final Output | <i>tpanl</i> 'was it stirred?' |

A rather unusual case of a morphologically triggered rule in Seri (one of many in that language) is one that happens in a number of verbs when they form the plural. Consider the following data:

- | | | | |
|------|------------------|--------------------------------|-------------------|
| (66) | Singular Subject | Plural Subject (with suffixes) | |
| | - <i>sic</i> | - <i>scooc-xam</i> | grind |
| | - <i>zip</i> | - <i>zcoop-xam</i> | kiss |
| | - <i>fiz</i> | - <i>fcooz-xam</i> | tie knot |
| | - <i>ziim</i> | - <i>zcoom-t</i> | enjoy |
| | - <i>ficj</i> | - <i>fcoocl</i> | wrap oneself with |
| | - <i>püi</i> | - <i>pcoo-yo</i> | taste |
| | - <i>sii</i> | - <i>scoo-yo</i> | smell |

In each of these verbs, the vowel of the stem is changed to *coo* when the stem for a plural subject is formed. The minor rule would look something as follows, and it would apply only in the formation of Plural stems of verbs that are marked to use it (which all have a close front vowel):

- (67) Minor Rule: Vowel of stem → *coo*

Underlying forms

In the preceding section we chose one allomorph as basic, and derived another allomorph from it by applying a rule to it. This is a very important concept in generative phonology since all allomorphs other than suppletive allomorphs are derived in this way. It is important to know how and why one form is chosen as basic instead of another one. In this chapter we discuss this issue.

In the case of *leaf* and *leaves*, we had an alternation between *f* and *v* that we needed to account for. We saw that we could not simply let the Mutation rule apply to any noun ending in *f* because of words such as *chief/chiefs* (no change). But what if we chose *leave* as the basic form and derived *leaf* from it by doing the Mutation rule in the opposite direction? That also will not work across the board since there are words such as *cove/coves* and *wave/waves* where we have *v* in both forms. These facts establish that we have three groups of words: words whose stems end in *f* in singular and plural, words whose stems end in *v* in singular and plural, and words that have an alternation between *f* and *v*.

But we still have not shown any reason for choosing *f* as the input to the minor rule. Why not have a rule like (68)?

- (68) Minor Rule: Change *v* to *f*.

One piece of evidence in favor of having the rule change *f* to *v* rather than the other way around is that the form *leaf* is used as the base for the adjective *leafy*. It also appears in the compound *leaf-like*.

Also, evidence from language acquisition indicates that the rule is learned the other way around, that the basic, or **underlying form** of the stem in *leaves* is *leaf*. Children say *leafs* until they learn that this word undergoes a funny rule. In another hundred years or so, the rule may disappear altogether and the plural of *leaf* will be *leafs* in standard English. (Or it just may persist, as it has!)

^c The exact subclasses of words (some very small) would need to be listed.

The underlying form of a morpheme is the form from which all of the non-suppletive variants (allomorphs) may be derived. In other cases, the reasons for choosing one form as the underlying form are clearer. This was the case with the Seri plurals which we just saw in chapter 5. A few forms are repeated below.

(69)	Singular	Plural	
	<i>téepol</i>	<i>téepł-oj</i>	blacktailed jackrabbit
	<i>mojépe</i>	<i>mojép-toj</i>	saguaro cactus

A minor rule deleting the vowel in the plural is possible; it would be impossible to formulate a rule inserting a vowel in the singular because we wouldn't know which vowel to insert. Therefore the underlying form of the stem for 'saguaro cactus' is *mojépe* rather than *mojép*, and the underlying form for 'blacktailed jackrabbit' is *téepol* rather than *téepł*. Other reasons for making the choice of underlying form are given in later chapters. This issue of choosing one underlying form of a morpheme from which to account for allomorphs is one of central importance in phonology and we will spend more time on it.

Key Concepts

minor rules

consonant mutation rules

ablaut rules

derivation

underlying (or basic) form

5.1 Try it for yourself with Seri

Consider the following data. You may recall from chapter 3 that Seri words pluralize with various suffixes. Two of these suffixes are represented in the data below: *-toj* and *-oj*. But besides that fact, the noun stems sometimes show the presence vs. absence of a vowel in the syllable after the stressed vowel (which may be long or short). (Note: the change from *qu* to *c* in the word for 'her child' is just a spelling convention of Seri similar to that of Spanish.)

	Singular	Plural	
1.	<i>séepol</i>	<i>séepł-oj</i>	shrub (species)
2.	<i>cascamáma</i>	<i>cascamáma-toj</i>	stink bug (species)
3.	<i>téepol</i>	<i>téepł-oj</i>	blacktailed jackrabbit
4.	<i>úiquet</i>	<i>úict-oj</i>	her child
5.	<i>icahéme</i>	<i>icahém-toj</i>	abandoned camp
6.	<i>xtáasi</i>	<i>xtáasi-toj</i>	estuary
7.	<i>mojépe</i>	<i>mojép-toj</i>	saguaro cactus

Is the vowel that appears in the singular stems the same vowel or a variety of vowels?⁴¹

Which of the following rules is correct?⁴²

- Delete the first vowel in the syllable after the stressed syllable.
- Delete the first vowel in the syllable after the stressed syllable in the Plural.
- Delete the vowel in the syllable after the stressed syllable in the Plural if the noun belongs to Class Q.

5.2 Try it for yourself again with Seri

Provide an account for the following data: word structure rule and lexicon. Assume that the prefix for *you* (subject) is *in-*, and that the prefix for interrogative past is *t-*. The data are not entirely representative of the language as a whole; some important data are omitted in order to keep the problem manageable at this stage. The hypothesis that you will probably come up with will not be entirely unlike what is true for the language, however.⁴³

	<i>did you it?</i> (transitive)	<i>did you ...?</i> (no direct object mentionable)	
1.	in'tka:o	into'ka:o	<i>chew</i>
2.	in'tkakx	into'kakx	<i>chop</i>
3.	in'tnaix	into'naix	<i>dream</i>
4.	in'tsap	into'sap	<i>slap</i>
5.	in'tʃip	into'ʃip	<i>kiss</i>
6.	in'timoχ	in'tæmoχ	<i>butcher</i>
7.	in'tinx	in'tænχ	<i>yell at</i>
8.	in'tip	in'tæp	<i>straighten</i>
9.	in'ti:p	in'tæp	<i>carry on head</i>
10.	in'ti:k	in'tæk	<i>sow</i>
11.	in'ta:	in'ta:	<i>grab</i>
12.	in'ta:om	in'ta:om	<i>beg</i>
13.	in'taix	in'taix	<i>fetch water</i>
14.	in'tamx ^w	in'tamx ^w	<i>hunt</i>
15.	in'tasakim	in'tasakim	<i>comb (hair)</i>

Feedback for Chapter 5

5.1 Seri

⁴¹ A variety of vowels. This means that the vowel which appears in the singular stem must be part of the underlying form since it is not predictable.

⁴² The third rule, a minor rule which applies only to certain nouns, is correct. The other rules apply too generally and would delete vowels where they shouldn't.

5.2 Seri

⁴³ The word structure rule would be: Subject Agreement – Tense – (Detransitivizer) – Root

Lexicon: 2nd person (singular) subject: n-
 past interrogative: t-
 kɑ:o *chew*, inx *yell at*, a: *grab*, ...

Detransitivizer (causing the omission of the direct object from the clause) →

o / __ consonants
 Ø / __ low vowels
 Ø plus Ablaut / __ high vowels

Ablaut rule: Change the first vowel of the root to the vowel æ (the short low equivalent of the high vowel that it started out as).

CHAPTER 6 - FEATURES AND NATURAL CLASSES

There are other words that display consonant mutations in the plural besides *f/v*, although the change is not shown in the spelling system of English. You will have to listen carefully to hear the difference; the square brackets enclose **phonetic transcriptions** (transcriptions that include exact details of pronunciation using a standard international alphabet):^a

(70)	<i>house</i>	hou[s]e	<i>houses</i>	hou[z]es
	<i>bath</i>	ba[θ]	<i>baths</i>	ba[ð]s
	<i>path</i>	pa[θ]	<i>paths</i>	pa[ð]s

Again, this is a small group of words (compare these with *myth/myths*, *death/deaths*, *douse/douses*, *noose/nooses*, *grouse/grouses*.)

There is a similarity between the alternations found here and the *f/v* alternation seen earlier. The sounds that occur in the singular forms are pronounced without vibration of the vocal cords—they are **voiceless**; those which occur in the plural are all pronounced with vibration of the vocal cords—they are **voiced**.^b

(71)	Voiceless	Voiced
	f	v
	s	z
	θ	ð

It would be simple (and easy) to generalize the minor rule we developed earlier to handle these alternations as a group if we refer to the voicing of the sounds.

(72) **Minor Rule:** Change the final consonant from voiceless to voiced if the word is of the class *leaf*, *house*, *path*, etc.

By referring to the voicing of these sounds, we are picking out a single **feature**, namely voice, which they share, and changing its value. This step has a big advantage over a rule that simply lists the sounds out (such as “change *f* to *v*, *s* to *z*, etc.”). It enables us to state the rule simply. If the consonants in question were *v*, *k*, and *s*, and the change was to make them *f*, *t*, and *z* (respectively), a simple rule would not be possible. Therefore, we can look at the kind of rule we come up with and evaluate how difficult these changes are for the language learner to acquire. The use of features is part of a system for measuring the **simplicity** of a description; simplicity is considered to be a favorable attribute. The use of symbols may be simpler to use in informal situations, but the use of symbols such as *f* does not permit the straightforward comparison and evaluation of competing analyses.

Another fact about the consonant mutations illustrated above should not go unnoticed. The consonants which undergo the minor rule are all fricatives, sounds in which there is just enough obstruction in the oral cavity to cause the air stream to produce friction upon passing. Sounds which function alike cross-linguistically are called **natural classes**. They are singled out by specifying one or few features. For example, fricatives is one natural class and voiceless fricatives is another natural class (a subset of the former). The more features that are specified, the smaller the natural class that is being designated. To see this more clearly, examine the following noun-verb pairs in English. They show an alternation which is not always represented in the spelling system.

^a The fact that both [θ] and [ð] are spelled th in the English spelling system probably makes it more difficult for some English speakers to even realize that they are in fact saying two different sounds here. The difference between [θ] and [ð] is clear in *ether* and *either*.

^b The vocal cords (or folds) are membranes that are found in the larynx and which are manipulated to modify the airstream. If these are relaxed and separated, a voiceless sound is produced, like *h* or *f*. But if they are pulled together so that they vibrate when the air passes, a voiced sound is produced, like *a* or *v*. There are other possible configurations of the vocal cords also. See Appendix A.

(73)	Noun	Verb	
	<i>house</i>	<i>house</i>	[s], [z]
	<i>advice</i>	<i>advise</i>	[s], [z]
	<i>breath</i>	<i>breathe</i>	[θ], [ð]
	<i>mouth</i>	<i>mouth</i>	[θ], [ð]
	<i>bath</i>	<i>bathe</i>	[θ], [ð]
	<i>strife</i>	<i>strive</i>	[f], [v]
	<i>belief</i>	<i>believe</i>	[f], [v]
	<i>grief</i>	<i>grieve</i>	[f], [v]
	<i>thief</i>	<i>thieve</i>	[f], [v]

You should recognize that the feature [voice] is again consistently changing in these pairs. The voiceless fricative in the noun is replaced by its voiced counterpart in the verb. If the noun is considered basic (simply an assumption at this time), then one might propose a rule such as the following that operates in the derivation of the verb form:

(74) Make the final consonant of the stem [+voice].

But again, it is not just any consonant that participates in this change. There are no noun-verb pairs in English such as *stick*–**stig*, or *pipe*–**pibe*. And it is not just a haphazard set of consonants, but a natural class. The following chart includes the consonants of English and the feature specifications for two important features. (The definitions of these features are not important at this point; but see Appendix A.)

(75)

	p	b	t	d	k	g	tʃ	dʒ	ʃ	ʒ	f	v	θ	ð	s	z
sonorant	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
continuant	–	–	–	–	–	–	–	–	+	+	+	+	+	+	+	+

	m	n	l	ɹ	j	w	h
sonorant	+	+	+	+	+	+	–
continuant	–	–	–	+	+	+	+

Of these two features, neither one by itself selects exactly the set of consonants that participate in the noun-verb alternations. The feature [+continuant] comes very close. The combination [–sonorant, +continuant] comes even closer; it specifies the natural class of “fricatives”. If we really wanted to specify a smaller set, “fricatives that are pronounced in the front of the mouth”, we would have to add another feature. This illustrates the point that we made above that the fewer the features specified, the larger the set, while the more the features specified, the smaller the set.

Key Concepts

features

[voice]

natural class

evaluation of simplicity

6.1 Try it for yourself (features and natural classes)

Assume the following inventory of sounds:

p t k b d g f s ʃ v i a u

Which of the above sounds would be included in the natural classes that each of the following features or feature combinations define:⁴⁴

1. [+voice]
2. [+labial] (sounds made with the lips as active or passive articulators)
3. [-voice], [+labial]

6.2 Try it for yourself with English

The consonants which may appear in the same syllable following the diphthongs [aw] and [ɔj] in English seem to be restricted. Consider the following data:

Consonants which appear: t, d, tʃ, dʒ, θ, ð, s, z, n, l, ɹ

Examples: *route, quoit, loud, tabloid, crouch, gouge, mouth (n.), mouth (v.), house, voice, rouse, noise, town, groin, cowl, boil, hour.* (Not all appear after [ɔj].)

Consonant sequences which appear: nd, st

Examples: *mound, joust, hoist*

Consonants which do not appear: p, b, k, g, f, v, h, ʃ, ʒ, m, j, w

Consonant sequences which do not appear:^c nk, mp, sp

Using the features shown on the following charts, what feature(s) define class of consonants which appear after [aw], apparently a natural class, as closely as possible?⁴⁵ (See Appendix A for definitions of the features.)

Based on this natural class, what consonants unexpectedly do not occur after these diphthongs?⁴⁶

	p	b	t	d	k	g	tʃ	dʒ	ʃ	ʒ	f	v	θ	ð	s	z
Labial	+	+	-	-	-	-	-	-	-	-	+	+	-	-	-	-
Coronal	-	-	+	+	-	-	+	+	+	+	-	-	+	+	+	+
Dorsal	-	-	-	-	+	+	-	-	-	-	-	-	-	-	-	-

	m	n	l	ɹ	j	w	h
Labial	+	-	-	-	-	+	-
Coronal	-	+	+	+	-	-	-
Dorsal	-	-	-	-	+	+	-

6.3 Try it for yourself with Misanla Totonac

Assume the following (partial) inventory of segments and features:

	l	ts	tʃ	ʈ	s	ʃ
sonorant	+	-	-	-	-	-
continuant	-	-	-	+	+	+
strident	-	+	+	+	+	+
lateral	+	-	-	+	-	-

^c The word *oink* is exceptional in that it does have the sequence [ɔjŋk].

There are at least two reasons in this language to group the sounds t , s , and ʃ together as a group, distinguishing the group from the other sounds in this chart. What feature or features define this natural class? (Use more than one feature only if necessary.)⁴⁷

Feedback for Chapter 6

6.1 Features and Natural Classes⁴⁴

[+voice]: b d g v i a u

[+labial]: p b f v u

[-voice], [+labial]: p f

6.2 English

⁴⁵ The feature [+coronal] defines a class that includes all of the correct consonants, plus two.

⁴⁶ The sounds [ʃ] and [ʒ] are included in the class, but do not occur (in the same syllable) after these diphthongs. (Interestingly enough, this is probably due to another factor. They do not occur after *any* long or tense vowel in English, with one exception, *leash* (and *unleash*), besides loanwords such as *microfiche*, *quiche*, and *hashish*.)

6.3 Misantla Totonac⁴⁶

The feature [+continuant] defines a class that includes the correct sounds. (This feature would also include vowels and glides, so in reality another feature such as [-sonorant] is also needed.)

CHAPTER 7 - REDUPLICATION

In the preceding chapters we have seen cases where formatives are realized by a string of sounds, and other cases where they are realized by changing sounds (ablaut and mutation). In this chapter we see an example of a quite different kind of formative.

Consider the following data from Madija:

(76)	Verb		Noun	
	kosi	<i>whip</i>	kokosi	<i>whip</i>
	hipa	<i>eat</i>	hihipa	<i>food</i>
	ba	<i>weave</i>	baba	<i>shuttle</i>
	do	<i>pound</i>	dodo	<i>pestle</i>
	dzobi	<i>dance</i>	dzodzobi	<i>dance</i>
	koro	<i>throw</i>	kokoro	<i>hook, net</i>

If we try to isolate some common consonants and/or vowels for the morpheme which changes a verb into a noun in this language, we find that we are unable to do so. Rather, the nominalization of a verb is indicated by the **reduplication** of the first syllable of the word. For example, you take the verb for *whip* (kosi), take the first syllable of this word (ko) and put it in front of the verb, and you have the noun *whip*. The word structure rule and lexicon for Madija would include the following:

(77) $N \rightarrow \text{NOMINALIZER} - \text{Verb}_{\text{stem}}$

NOMINALIZER \rightarrow Syllable Reduplication^a

kosi *whip*
hipa *eat*
ba *weave*
etc.

Reduplication is not always an entire syllable. It may be the first consonant, the first consonant and vowel, or something else. Reduplication is found in many languages around the world, with all kinds of variations on the theme. Discussion of the many various interesting complications which reduplication presents is not relevant here, however.^b The point is that reduplication is another type of realization of a morpheme that is rule governed.

Key Concept

reduplication

^a The fact that it is the first syllable that is reduplicated need not be indicated in this rule since the word structure rule indicates that the nominalizing morpheme is a prefix.

^b Relevant work to consult is: E. I. Broselow and J. McCarthy (1984) A Theory of Internal Reduplication, *Linguistic Review* 3; A. Marantz (1982) Re Reduplication, *Linguistic Inquiry* 13:435-82.

7.1 Try it yourself with Tohono O'odham

Give the word structure and the lexicon for the following data, including the lexical entry for the plural morpheme (which may be written in simple, concise prose).⁴⁸

	Singular	Plural	
1.	juḍum	jujuḍum	<i>bear</i>
2.	komkcuḍ	kokomkcuḍ	<i>desert tortoise</i>
3.	gogs	gogogs	<i>dog</i>
4.	kui	kukui	<i>mesquite tree</i>
5.	hodai	hohodai	<i>rock</i>
6.	kolhai	kokolhai	<i>fence</i>
7.	pilsa	pipilsa	<i>blanket</i>

Feedback for Chapter 7

7.1 Tohono O'odham⁴⁸

Word Structure Rule Noun → (PLURAL) - Noun_{stem}

The stems for the nouns are identical to the singular forms.

The plural morpheme is a reduplicative prefix that consists of the first consonant and vowel of the stem.

CHAPTER 8 - WORD OR AFFIX?

We have been discussing the realization of morphemes within words in the past few chapters. But how does one know that a given morpheme is to be accounted for by a syntactic rule or a word structure rule? You may have thought that this is a simple matter, but that is because you have been relying on the spelling system of English.

Especially problematic are unstressed morphemes which follow the noun. We assume that morphemes which are part of words are properly accounted for by word structure rules, and that morphemes which are part of phrases are accounted for by syntactic rules.

Case suffixes in Greek and Latin, like the plural suffix *-s* of English, are part of the nouns. Therefore they should be described by word structure rules.

Morphemes like the English prepositions *in* and *to* precede noun phrases and are part of the prepositional phrases in which they occur. Their placement should be described by syntactic rules.

Morphemes like the *'s* in *the Queen of England's hat*, attach to noun phrases; they are not grammatically part of the preceding word. (However, *'s* does interact with the preceding word phonologically as if it were an affix. Notice that the words *judges* and *judge's* are phonologically identical.) The position of such morphemes, known as phrasal affixes, is described by syntactic rules.

We posit the following test to decide if an unstressed morpheme is to be accounted for by the syntax (like *in* or *'s*) or by the morphology (like *-s*).

- (78) If an independent word, or a phrase, can appear between two morphemes, the morphemes in question are not part of the same morphological word.^a

This test works positively for *'s*, as in *the Queen's hat* vs. *the Queen [of England]'s hat*; and for *in time* vs. *in good time*. It does not give a positive result for the plural morpheme: *days*, **day [gone by]s*.

Other examples

The words *the* and *a(n)* are typically unstressed and pronounced with the word which follows them. Are they prefixes, as in *the-student* and *a-lesson*, or are they separate words, as in *the student* and *a lesson*? The intervention test given above establishes the latter: *the careful student*, *a simple lesson*. This does not mean that there is no phonological interaction or dependency between the morphemes in question. We know, for example, that the indefinite article is *an* when the next morpheme begins with a vowel and *a* when it begins with a consonant. Likewise, the definite article is *th[i]* when the next morpheme begins with a vowel, and *th[ə]* when the next morpheme begins with a consonant.

Consider the morpheme *dza* in Madija. It follows nouns, as in expressions such as *toninidza* 'in her nest' (possible word breaks purposely omitted). Now is *dza* a Locative suffix which is part of the word 'her nest', or a Locative morpheme which is part of the noun phrase 'in her nest' (either as a phrasal affix or a **postposition**)?^b Note that *dza* follows the adjective *onii* 'other' in the expression *tonini onii dza* (her.nest other in) 'in her other nest' (word breaks purposely included now). This is indicative that it should be analyzed as part of a phrase rather than part of a word. Therefore the position of the morpheme *dza* should be accounted for by a syntactic rule rather than a word structure rule.

In Madija there is also a morpheme *deni* which means 'plural'. One might easily think that it is just a suffix like *-s* in English from expressions such as *madihadeni* 'the (Madija) people' and *taminedeni* 'the chiefs' (possible word breaks purposely omitted). The fact that *deni* follows the relative clause in the following expression indicates that it is part of the phrase and not part of any word: *bani [tokehenahari] deni* (animal who.became plural) 'the ones who became animals'.

^a Exceptions to this criterion are presented by some cases of noun incorporation.

^b A postposition is the counterpart to preposition which is found in many languages. Rather than preceding its complement, it follows the complement.

This topic is not simple and we are purposely omitting discussion of morphemes which have been labeled ‘clitics’ in the literature since these issues would lead us far astray of our central concern.^c

Key Concepts

part of word vs. part of phrase

postposition

Postscript for Teachers

The issue of the distinction between words and affixes is not trivial. We have not addressed all of the issues here, obviously. We have ignored the phenomenon of noun incorporation, for example. We feel that in the past undue attention has been given to the question of whether a morpheme may constitute an utterance in and of itself. This criterion may provide a good test for what may be an independent utterance (naturally), but not for what may be a word. Some language analyses are unduly complicated by trying to account for certain unstressed morphemes through the morphological component rather than through the syntactic component. The criterion we are trying to use does not say whether a particular word is stressed or unstressed, or whether it may lean on or interact with another word phonologically.

8.1 Try it for yourself with Isthmus Zapotec

Discuss whether the morpheme *ka* is part of a word or part of a phrase. (No word breaks have been given.)⁴⁹

- | | | |
|----|-------------------|---------------------------|
| 1. | <i>ngju</i> | <i>man</i> |
| 2. | <i>ngjuka</i> | <i>that man</i> |
| 3. | <i>ngjuro?ka</i> | <i>that big man</i> |
| 4. | <i>lefu</i> | <i>rabbit</i> |
| 5. | <i>lefuka</i> | <i>that rabbit</i> |
| 6. | <i>lefuwɨnika</i> | <i>that little rabbit</i> |

8.2 Try it for yourself with Houailou

Discuss whether the morphemes *rre* (*that*) and *na* (subject case) are parts of words or parts of phrases and show your interpretation of the facts by writing the data again according to your analysis. (No word breaks are given.)⁵⁰

- | | | |
|----|---------------------|----------------------------------|
| 1. | <i>bwe?</i> | <i>woman</i> |
| 2. | <i>bɛarɨ</i> | <i>old</i> |
| 3. | <i>bwe?rre</i> | <i>that woman</i> |
| 4. | <i>bwe?bearɨrre</i> | <i>that old woman</i> |
| 5. | <i>kamɔ?</i> | <i>man (not subject)</i> |
| 6. | <i>nakamɔ?</i> | <i>man (subject)</i> |
| 7. | <i>dɛyɔs</i> | <i>other, some</i> |
| 8. | <i>nadɛyɔskamɔ?</i> | <i>(the) other man (subject)</i> |

^c See Arnold M. Zwicky (1985) Clitics and Particles, *Language* 61:283-305; and Arnold M. Zwicky and Geoffrey K. Pullum (1983) Cliticization vs. Inflection: English n't, *Language* 59:502-13.

8.3 Try it once more with Damana

Discuss whether the morphemes [gə] (Ergative case), [mba] (Locative case), and [nʒe] (Genitive case) are parts of words or parts of phrases. (The names of these cases are irrelevant to the problem. No word breaks have been given.)⁵¹

- | | | |
|----|------------------|-------------------------|
| 1. | dumagagə | <i>lion</i> |
| 2. | ənagə | <i>s/he</i> |
| 3. | ragə | <i>I</i> |
| 4. | suzigə | <i>bird</i> |
| 5. | suzibənfigə | <i>white bird</i> |
| 6. | iɲgunamba | <i>on the road</i> |
| 7. | iɲgunazukwegamba | <i>on the good road</i> |
| 8. | menanʒe | <i>the woman's</i> |
| 9. | menatʃukkweganʒe | <i>the big woman's</i> |

8.4 Try it for yourself with Corongo Quechua

Discuss whether the morphemes which are not nouns (like *oven*) or not adjectives (like *red*) are affixes or words. Your discussion should include the words like *this*, *that*, *one*, and *two*.⁵² Write the Corongo Quechua word or phrase meaning *in those enormous vehicles* according to your analysis. (The data are given in a non-phonetic transcription.)

1.	urnu	<i>oven</i>
2.	urnuta	<i>oven (when direct object)</i>
3.	urnuman	<i>into the oven</i>
4.	urnumanxa	<i>into the oven (topicalized)</i>
5.	puka	<i>red</i>
6.	utsu	<i>hot pepper</i>
7.	pukautsuta	<i>red hot pepper (when direct object)</i>
8.	ka:rru	<i>vehicle</i>
9.	ka:rruta	<i>vehicle (when direct object)</i>
10.	ishkeyka:rruta	<i>two vehicles (when direct object)</i>
11.	ukka:rrullata	<i>just one vehicle (when direct object)</i>
12.	akshu	<i>potato</i>
13.	akshukuna	<i>potatoes</i>
14.	ishkeyakshu	<i>two potatoes</i>
15.	akshukunaxa	<i>potatoes (topicalized)</i>
16.	ishkeysurkullapik	<i>from just two furrows</i>
17.	keykajunman	<i>in this box</i>
18.	keylugar	<i>this place</i>
18.	lugar	<i>place</i>
18.	tseylugar	<i>that place</i>
19.	tseylugarman	<i>at that place</i>
20.	tseyna:nikunataxa	<i>those roads (topicalized, direct object)</i>
21.	tseyatusaxka:rrukunach'ow	<i>in those enormous vehicles</i>
22.	atusax	<i>enormous</i>
23.	atun	<i>large^d</i>
24.	ukatunkorona	<i>one large crown</i>

^d Don't try to relate this word to the word for *enormous*.

Feedback for Chapter 8

8.1 Isthmus Zapotec⁴⁹

Since the morpheme [ka] may be separated from the nouns for *man* and *rabbit* by the words *big* and *little*, we consider [ka] to be part of the noun phrase.

8.2 Houailou⁵⁰

Since the morphemes [rre] and [na] may be separated from the nouns by other words, we should consider [rre] and [na] to be parts of the noun phrase. The phrases would be transcribed as [bweʔ rre], [bweʔ beārī rre], [na kamɔʔ], [na deʔās kamɔʔ], etc.

8.3 Damana⁵¹

Since the morphemes [gə], [mba], and [nʒe] may be separated from the nouns by other words, we should consider these morphemes to be parts of a phrase. (They are phonologically dependent in some way, as a matter of fact, but their distribution is accounted for by the syntax, not by word structure rules.) The phrases would be transcribed as [dumaga gə], [ra gə], [suʒi bənfɪ gə], [iŋɡuna mba], [iŋɡuna zukwega mba], [mena tʃukkweɡa nʒe], etc.

8.4 Corongo Quechua⁵¹

There are no cases where the following morphemes are separated from the nouns by other words:

ta (Direct Object), man (*into, at*), xa (Topicalizer), kuna (Plural), lla *just*,
pik *from*, and ch'ow *in*.

This does not mean that these morphemes are suffixes, although one or more of them may be. We simply do not have direct evidence from these data (if any) in favor of analyzing them as separate words.

On the other hand, the numbers and demonstratives may be separated from the nouns by an adjective. Based on this evidence, it is arguable that the demonstratives and numbers are separate words.

The word meaning *in those enormous vehicles* could be written in one of three ways, depending on how one decides about the post-nominal elements:

tsey atusax ka:rru kuna ch'ow	(those enormous vehicle Plural in)
or	
tsey atusax ka:rrukuna ch'ow	(those enormous vehicles in)
or	
tsey atusax ka:rrukunach'ow	(those enormous vehicles/Locative)

At this point, we simply do not know what is the correct (or best) analysis.

SUMMARY AND REVIEW QUESTIONS FOR SECTION 1

In these chapters we have considered various kinds of rules which are needed to account for the distribution and realization of morphemes within words.

Word structure rules describe the order of morphemes within words. (Under the appropriate analysis, they may also describe the internal, layered structure of words).

The lexicon contains items which can be inserted into the appropriate positions in the structure. Most lexical items have a single underlying form, and where they do not, explicit rules must give the suppletive allomorphs and their distribution. The distribution may be related to syntactic, morphological, and/or phonological factors, and/or arbitrary word classes. (Recall that the latter are the last resort.)

Sometimes a morpheme is realized by effecting a change on an existing form: the mutation of a consonant, the ablaut of a vowel, or reduplication of some material from the word.

A complete description of a language must therefore include, among other things: (1) word structure rules to account for the way morphemes are combined into words, (2) a lexicon to give an inventory of morphemes, including rules for suppletive allomorphs, and (3) rules to account for changes in morphemes which are triggered by other morphemes, if there are any such rules.

If you have mastered the material in this section, you should be able to examine data and

- a. identify formatives
- b. write and understand rewrite rules
- c. construct paradigms
- d. write and understand word structure rules that describe the order of morphemes within words
- e. provide and understand lexicons of stems and affixes
- f. provide and understand lexical entry rules for suppletive allomorphs; these rules make reference to phonological, syntactic, morphological, or other factors (including arbitrary classes)
- g. understand and use the abbreviations C and V
- h. explain and illustrate the notions *multiple function formative* and *portmanteau*
- i. explain and illustrate the concept of *morphologically triggered rule*
- j. identify common word class distinctions such as *inalienable vs. alienable* nouns, *transitive vs. intransitive* verbs
- k. be able to use the feature [voice] to distinguish sounds
- l. explain the idea of *natural class*
- m. explain the idea of *underlying form*
- n. understand the idea of *reduplication*
- o. be able to argue that a morpheme is an affix or a separate word

For Further Reading:

- Aronoff, Mark. 1976. Word formation in generative grammar. *Linguistic Inquiry Monograph 1*. Cambridge, Mass: MIT Press.
- Carstairs, Andrew. 1988. On some implications of phonologically conditioned suppletion, *Yearbook of Morphology 1*.
- Dressler, Wolfgang. 1985. *Morphology: The dynamics of derivation*. Ann Arbor, Mich., Karoma.

- Hammond, Michael and Michael Noonan. 1988. *Theoretical morphology: approaches in modern linguistics*. New York, London, Academic Press.
- Matthews, P. H. 1974. *Morphology*. Cambridge, London, New York: Cambridge University Press.
- McCarthy, John. 1981. A prosodic theory of nonconcatenative morphology. *Linguistic Inquiry* 12:373-418.^a
- Nida, Eugene. 1949. *Morphology: the descriptive analysis of words*. Ann Arbor: University of Michigan Press.

Review Questions

The following questions are to help you review the material in the preceding section.⁵³ The numbers in brackets refer to the most relevant page number which deals with the topic.

1. _____ is the part of linguistic theory that deals with the positioning of words. [1]
2. The list of words and meaningful parts of words is called the _____ of the language. [1]
3. _____ is the part of linguistic theory that deals with the structure of words. [2]
4. The word *dogs* is composed of two functional pieces called _____. [2]
5. NP → (Art) (AP) N is an example of a _____ _____. [1]
6. The phonology of a language deals with the organization of the _____ of that language. [2]
7. Word structure rules indicate the order of _____ in words. [2]
8. A collection of words which share morphemes and which are organized in rows and columns is called a _____. [8]
9. When a morpheme has more than one shape, it is said to have more than one _____. [13]
10. A rule such as
3 POSS → *a-* with kinship nouns, *i-* elsewhere
is included in the lexicon of a language to handle _____. [13]
11. *-en* and *-s* are _____ of the morpheme for PLURAL in English. [13]
12. The lexical entry of a morpheme may refer to various facts, including arbitrary classes, phonological information, morphological information, and syntactic information. Identify which of the following is of which type:
 - (a) X → Y / ___ consonants _____ [16]
Z / ___ vowels
 - (b) X → Y / ___ transitive clauses _____ [15]
Z / ___ intransitive clauses
 - (c) W → X / ___ Class I _____ [14]
Y / ___ Class II
Z / ___ Class III
 - (d) X → Y / ___ PASSIVE _____ [18]
Z / ___ elsewhere
13. An affix which simultaneously indicates number, gender, and case is an example of a _____ formative. [29]

^a There is a kind of morphology which we have not considered, which is important for understanding languages such as Arabic and Hebrew. This is discussed in McCarthy 1981 and much later work.

14. A rule which is caused to apply by the presence of a morpheme is a _____. An example is the rule changing *f* to *v* in the plural of certain words (e.g. *leaf/leaves*). [35]
15. An explicit demonstration of the application of rules, starting from the input and ending with the output, is called a _____. [35]
16. The basic form of a morpheme, which serves as the input to the rules of the phonology, is the _____ form. [36]
17. Some rules affect one characteristic of a sound. For example, the change from *f* to *v* in certain nouns of English when they are pluralized is a change in one _____, namely _____. [40]
18. Groups of sounds which function alike cross-linguistically because they share certain features are called _____. [40]
19. (T or F) The larger the natural class, the fewer the features are needed to specify it. [40]
20. (T or F) One of the reasons features are used in phonological analysis is that by using features we are able to capture generalizations where informal notation using segments often fails to do so. [40]
21. Different forms of the same morpheme are called _____. [13]
22. A special kind of multiple function formative that displaces two or more other formatives is called a _____. [29]

Feedback on Review Questions⁵³

1. syntax 2. lexicon 3. morphology 4. morphemes 5. rewrite rule
6. sounds 7. morphemes 8. paradigm 9. allomorph
10. suppletive allomorphs 11. suppletive allomorphs
12. (a) phonological (b) syntactic (c) arbitrary classes (d) morphological
13. multiple function formative 14. morphologically triggered rule
15. derivation 16. underlying 17. feature, voice 18. natural classes
19. T 20. T 21. allomorphs 22. portmanteau

SECTION 2

PHONOLOGICAL RULES: ASSIMILATION

In this section we begin to look at phonology proper. We assume that morphological rules have inserted all of the morphemes in a form that might be thought of (informally) as a string of sounds, as shown below.

Syntactic rules yield: Noun Verb Noun

Lexical insertion and morphological rules yield:

VAL	SELL-3SG	SHOE-PLURAL
væɪ	sɛɪ-z	ʃu-z

At this point, phonological rules apply. Phonological rules account for the exact pronunciation of the morphemes since there is evidence that some phonological information about morphemes is not stored in the lexicon.

We have as a goal that any kind of predictable information about the phonological shape of a morpheme should be extracted from its lexical representation and stated in the phonology. For example, the fact that the first consonant of *Val* is voiced and not voiceless is not predictable from anything else—English has an *f* as well as a *v*. Therefore this fact must be included in the lexical representation of *Val*. But the fact that the *l* is voiced and not voiceless *is* predictable (within English) since the sonorants of English are all voiced; the fact that it is voiced should not be included in the lexical representation.

CHAPTER 9 - VOICING ASSIMILATION

In the previous section on morphological rules we examined primarily allomorphs which were quite different from each other (although that is not necessarily the case with suppletive allomorphs). We now look at allomorphs which tend to be very similar, and we see that they are properly treated in a fashion which is different from that of suppletive allomorphs.

Consider again English plurals, but this time we look at the precise pronunciation of the final consonants (bracketed because of the phonetic transcription).

(79)	<i>caps</i>	[ps]	<i>cabs</i>	[bz]
	<i>fats</i>	[ts]	<i>fads</i>	[dz]
	<i>books</i>	[ks]	<i>rags</i>	[gz]
	<i>graphs</i>	[fs]	<i>graves</i>	[vz]
	<i>myths</i>	[θs]	<i>times</i>	[mz]
			<i>pins</i>	[nz]
			<i>pills</i>	[lz]

We see here that PLURAL has another allomorph which we have been ignoring up until now: [z]. Shall we simply add this allomorph to our list of suppletive allomorphs for PLURAL? This would not seem appropriate for at least three reasons. First, the allomorphs [z] and [s] are very similar phonologically; they differ only in the feature voice. We refer to them as **phonological allomorphs**. Suppletive allomorphs are generally more distinct. Second, the feature voice by which they differ is also the feature that distinguishes the consonants which precede them. [s] follows voiceless consonants, and [z] follows voiced consonants. Third, there are other morphemes in English which show a similar set of allomorphs, although they have nothing to do with plural.

(80)	Third person singular, present tense			
	<i>sips</i>	[ps]	<i>grabs</i>	[bz]
	<i>lets</i>	[ts]	<i>rids</i>	[dz]
	<i>looks</i>	[ks]	<i>drags</i>	[gz]
	<i>laughs</i>	[fs]	<i>raves</i>	[vz]
			<i>rhymes</i>	[mz]
			<i>grins</i>	[nz]
			<i>sells</i>	[lz]
(81)	Possessive			
	<i>cap's</i>	[ps]	<i>cab's</i>	[bz]
	<i>cat's</i>	[ts]	<i>fad's</i>	[dz]
	<i>Jack's</i>	[ks]	<i>Greg's</i>	[gz]
	<i>leaf's</i>	[fs]	<i>Marv's</i>	[vz]
	<i>Keith's</i>	[θs]	<i>Jim's</i>	[mz]
			<i>Ann's</i>	[nz]
			<i>Bill's</i>	[lz]

If the allomorphs of 3SING, POSS, and PLURAL are all treated as suppletive, the description of English would have to contain rules for their realization which are embarrassingly similar. If something has to be said in exactly the same way twice or three times in the grammar/phonology of a language, we start to look for an alternative solution which avoids the repetition.

To account for the distribution of such allomorphs, the strategy in generative phonology has been to propose a single underlying form and provide phonological rules that adjust this form according to the context in which it occurs, as necessary. In the case of Plural, one of the underlying forms which we have given earlier is *-s*. But now we need to make this underlying form explicit and not continue to use English spelling conventions (which mask the [s]/[z] distinction). We need to choose one of these allomorphs (or perhaps something else) as the underlying form. For now, we will choose [z] (reasons will come later). Therefore the lexicon includes the following rule:

- (82) PLURAL → -en with class A
 -Ø plus Ablaut with class B
 -z plus F/V Rule elsewhere

Using this rule and other items in the lexicon of English, we put together words such as the following, putting curly braces around underlying forms:

- (83) Underlying Forms
 tags *tacks*
 {tæg-z} {tæk-z}

Underlying forms of words contain all of the morphemes in the words juxtaposed, and each of the morphemes appears in its underlying form.

If we were to pronounce the morphemes {tæg} and {z} together, the result would be just like it needs to be phonetically: [tægz]. But of course, the pronunciation of *tacks* is not [tækz]; it is [tæks]. So a phonological rule is necessary.

As we have seen, the *s* allomorph occurs after voiceless consonants. This fact is important. Evidently the *z* is becoming more like the preceding consonant; it is assimilating to it. The vocal cords, which are not vibrating during the pronunciation of the *k*, are not reactivated during the pronunciation of the next consonant, so the plural suffix is pronounced voiceless, as an *s*.

We can make the following generalization for English:^a

- (84) A consonant assimilates in voicing to an immediately preceding consonant.

This is a rule of **voicing assimilation**. As a phonological rule, it refers to features of sounds, rather than to particular morphemes. And we have stated it as generally as we can; it refers to consonants generally rather than to a specific class of consonants such as fricatives or sibilants. A first guess at a rule may be incorrect, but it is generally preferable to start out with too general a rule than too specific a rule.

Rule of Thumb: When writing a rule, start out with as simple a formulation as possible. Add extra features only as necessary to prevent it from making incorrect claims.

To show how the rule works in the phonology of English, we set up a **derivation**, as shown below. When a rule applies, the output of the rule is indicated. A rule may apply vacuously; the output may be the same as the input. When it does not apply because the conditions are not met for it to apply, then a line is inserted to show this.^b

- | | | | | |
|------|----------------------|---------|---------|-------|
| (85) | Underlying Form | {tæg-z} | {tæk-z} | {tæk} |
| | Voicing Assimilation | tæg-z | tæks | — |
| | Phonetic Form | [tægz] | [tæks] | [tæk] |

As one can see, the combination of appropriate underlying form and appropriate phonological rule yields the correct phonetic results. We therefore conclude that the phonology of English includes a rule which is something along the lines of (84).^c

Consonants may become voiced in the context of vowels, especially when between vowels. In Japanese, for example, consonants are voiced in compounds such as the following:

^a This rule makes incorrect predictions as stated here. See the discussion in chapter 14.

^b Note: a phonological rule must always be attempted on all forms. A phonological rule is meant to have a general application. If the rule is formulated in too broad a fashion and would make incorrect claims, it must be made more specific in an appropriate way or else reformulated entirely.

^c The rule is somewhat more complicated, however, since the suffix *-ster* does not show voicing allomorphs at all: *mobster* (not *mob[z]ter*), *gangster*, *roadster*. Similarly, the suffix *-ship* does not show voicing allomorphs: *friendship*, *readership*.

(86)	iro <i>color</i>	+	kami <i>paper</i>	→	[irogami] <i>colored paper</i>
	jo <i>night</i>	+	sakira <i>cherry</i>	→	[jozakira] <i>blossoms at night</i>
	mizi <i>water</i>	+	seme <i>torture</i>	→	[mizizeme] <i>water torture</i>
	jama <i>mountain</i>	+	tera <i>temple</i>	→	[jamadera] <i>mountain temple</i>
	ji <i>hot water</i>	+	toofi <i>tofu</i>	→	[jidoofi] <i>boiled tofu</i>

Vowels can also assimilate to neighboring consonants in voicing. In Tataltepec Chatino, for example, an unstressed vowel becomes voiceless when it occurs between voiceless consonants. The word /ki'su/ *avocado* is pronounced [ki'su], with a voiceless *i*.

Similarly, in Mokilese, the vowels *i* and *u* tend to be pronounced voiceless when they occur in unstressed syllables between voiceless consonants: [ki'sa] *we two*, [sup'wo] *pile of firewood*.

Key Concepts

phonological allomorphs

phonological rule

derivation

assimilation of a sound to its context

9.1 Try it for yourself with Lithuanian

Examine the following data. (Morpheme cuts have been made for you.)

	1 Sg. Present	1 Sg. Past Frequentative	
1.	iljip-u	iljib-dava-u	<i>get in</i>
2.	djirb-u	djirb-dava-u	<i>work</i>
3.	suk-u	sug-dava-u	<i>turn</i>
4.	vjez-u	vjez-dava-u	<i>transport</i>
5.	injef-u	injez-dava-u	<i>bring in</i>

You will have noted that some verb stems end in voiceless consonants in the first column, but none of them do in the second column. We want to set up underlying forms for these verbs and provide a phonological rule that will account for the allomorphs. The rule should be true for all of the data, not just for some verbs.

Which of the following solutions will work, using the verb *turn* to illustrate? Why?⁵⁴

- The underlying form of the verb is {sug} and the rule is: A consonant becomes voiceless when it precedes a vowel.
- The underlying form of the verb is {suk} and the rule is: A consonant assimilates in voicing to an immediately following consonant.

Fill in all of the boxes below, as shown in (85) in this chapter, to complete the derivation of the words shown.⁵⁵

	TURN-1 SG	TURN-FREQUENTATIVE-1 SG
Underlying Form		
Phonological Rule: (name)		
Surface	[suku]	[sugdavau]

9.2 Try it for yourself with Yatzachi el Bajo Zapotec

You may assume that the underlying forms of the nouns are the forms that appear without a prefix. The prefix {ʂ-}, which is a voiceless retroflex sibilant, is added when the noun is possessed (it turns the noun from a noun which cannot co-occur with a possessor to one which must co-occur with a possessor).

	Unpossessed	Possessed	
1.	bej	ʂpej	<i>handkerchief</i>
2.	tas	ʂtas	<i>cup</i>
3.	do	ʂto	<i>cord, string</i>
4.	koʃ	ʂkoʃ	<i>pig</i>
5.	ɡonn	ʂɡonn	<i>ox</i>
6.	sij	ʂsij	<i>chair</i>
7.	za	ʂsa	<i>bean</i>
8.	ʃib	ʂʃib	<i>goat</i>
9.	ʒin	ʂʃin	<i>work</i>
10.	ʒil	ʂʃil	<i>tortilla griddle</i>

Which of the following rules is the best one to account for the allomorphy displayed by the stems?⁵⁶

- b* changes to *p*, *d* to *t*, *g* to *k*, *z* to *s*, and *ʒ* to *f* when they follow *ʂ*.
- A consonant becomes voiceless when it follows *ʂ*.
- A consonant becomes voiceless when it follows a fricative.
- A consonant assimilates in voicing to an immediately preceding consonant.

Provide a derivation, as shown in this chapter, for the two forms of *bean*. Use the label ‘POSS’ for the prefix.⁵⁷

9.3 Try it for yourself with Copainalá Zoque

Two suffixes have been underlined in the following data. One is the ‘incompletive’ suffix, and one indicates plurality of the subject (first and second person only).

- | | | |
|----|----------------------|-------------------------|
| 1. | mus <u>pa</u> | <i>s/he can</i> |
| 2. | wan <u>ba</u> | <i>s/he sings</i> |
| 3. | tʃʌk <u>pa</u> | <i>s/he does it</i> |
| 4. | nʌm <u>ba</u> | <i>s/he says</i> |
| 5. | min <u>ba</u> | <i>s/he comes</i> |
| 6. | pojah <u>pa</u> | <i>they run</i> |
| 7. | tʃʌkjah <u>pa</u> | <i>they do it</i> |
| 8. | mind <u>amu</u> | <i>you (pl.) came</i> |
| 9. | ndzʌkt <u>amumis</u> | <i>you (pl.) did it</i> |

You are able to formulate a phonological rule to account for this allomorphy even without deciding on the underlying forms of these suffixes. That is, whether it is underlyingly {pa} or underlyingly {ba} makes no difference at this point.

Provide a phonological rule that accounts for the allomorphy of the morphemes which are underlined.⁵⁸

9.4 Walmatjari

Examine the Walmatjari data set in Appendix F. Under what conditions are consonants voiced or devoiced? What rule is needed to account for voicing alternations?⁵⁹

Feedback for Chapter 9

9.1 Lithuanian

⁵⁴ Solution (b). The first solution does not work for all of the data. Not all of the stem-final consonants become voiceless when they precede a vowel. Solution (b) also makes some sense in that it is an assimilation rule (unlike the first). The consonants are becoming more like each other (voiceless becomes voiced in the context of voiced). This is not true of Solution (a).

55	TURN-1 SG	TURN-FREQUENTATIVE-1 SG
Underlying Form	{suk-u}	{suk-dava-u}
Phonological Rule: Voicing Assimilation	-----	sugdavau
Surface	[suku]	[sugdavau]

9.2 Yatzachi el Bajo Zapotec

⁵⁶ The best rule is (d). Rule (a) is a list and not a rule. Rules (b) and (c) are still too specific and don't mention anything about the fact that the first consonant is voiceless, even though this is what is relevant to the rule. Rule (d) follows the rule of thumb given in this chapter in eliminating as much detail as possible and keeping only what is absolutely necessary to show what is going on and to make correct statement about the data.

57	<i>bean</i>	<i>POSS-bean</i>
Underlying Form	{zɑ}	{ʂ-zɑ}
Voicing Assimilation	—	ʂsa
Surface Form	[zɑ]	[ʂsa]

9.3 Copainalá Zoque⁵⁵

The rule would be the same as we have seen already: A consonant assimilates in voicing to an immediately preceding consonant.

9.4 Walmatjari⁵⁹

A consonant assimilates in voicing to an immediately preceding nasal consonant.

CHAPTER 10 - CHOOSING UNDERLYING FORMS

When a morpheme has two (or more) allomorphs which are related by phonological rule, one of them is usually chosen as the underlying form. (It is also possible that the underlying form is not equivalent to either of the surface forms.) The question which must then be decided is which of the allomorphs is the underlying one? The answer is simple to articulate but not always easy to perform: choose as underlying form the form from which the surface allomorphs can be most easily derived.

In this chapter we give some preliminary instructions as to how underlying forms are chosen. But first we dispel some common misconceptions. The underlying form is:

- not necessarily the most common form of the morpheme
- not necessarily the morpheme as it occurs in isolation (if it does in fact occur in isolation at all)
- not necessarily any one of the surface allomorphs
- not necessarily a complete syllable.

Now for some positive advice: *if one allomorph has a feature which cannot be explained by its context, that feature is probably part of the underlying form of the morpheme.*

For example, the fact that the plural suffix in English is a fricative, rather than a stop, is not explainable from the context. Similarly, it is not explainable from the context that it is pronounced with the tongue rather than with the lips (it is *s* rather than *f*). So the underlying form of the plural suffix must include such information.

So how does one choose between the voiced *-z* and the voiceless *-s* (or some other shape) as the underlying form of the plural suffix? The allomorph *-s* always follows voiceless sounds, and the allomorph *-z* always follows voiced sounds. Either way it looks like the context could be responsible for the voicing (or lack of). In this case, other facts need to be taken into consideration, as we will see in later chapters.

At this point we also wish to introduce an important division between sounds which shows up repeatedly in phonology. Sounds are classified as being either **obstruents** or **sonorants**. Obstruents are those sounds which are produced with enough obstruction in the vocal tract to significantly increase the air pressure in the mouth. More air pressure is required to produce such sounds, which include the fricatives (such as *f* or *s*), and stops (such as *p* and *t*). Nasal stops are not obstruents because the open nasal cavity allows air to escape through the nose, keeping air pressure lower. Sonorants, on the other hand, involve less obstruction and are produced with a resonance in the vocal tract. They include nasals, liquids (such as *l*), and vowel-like sounds (such as *j* or *i* or *a*). A sound is classified as either [+**sonorant**] or [-sonorant]. (Certain sounds, such as glottal stop, have been difficult to classify. In some languages they appear to function as sonorants, and in others as obstruents.) Sonorants are usually voiced (all languages have voiced vowels; no language has only voiceless nasals). Obstruents are more commonly voiceless. Of course, many languages have voiced stops or fricatives, but if they do, they also usually have voiceless stops and fricatives.

Key Concepts

choosing underlying form

sonorant vs. obstruent

[sonorant] (the feature)

10.1 Try it for yourself with Pengo

The following stems have two allomorphs each. One ends in a voiced consonant and the other in a voiceless consonant.

	Gerund	2 sg. Imp.	3 sg. Past	
1.	tu:b-dʒi	tu:b-a	tu:p-tan	<i>blow</i>
2.	tog-dʒi	tog-a	tok-tan	<i>step on</i>
3.	ra:g-dʒi	ra:k-a	ra:k-tan	<i>offer worship</i>
4.	hi:b-dʒi	hi:p-a	hi:p-tan	<i>sweep</i>

Complete the following observations as to the distribution of these allomorphs.⁶⁰

- Before voiceless consonants (like the suffix *-tan*), the allomorph which ends in a _____ consonant always occurs.
- Before voiced consonants (like the suffix *-dʒi*), the allomorph which ends in a _____ consonant always occurs.
- Before vowels, _____.

Of these three contexts (a-c), which permits the underlying form of the stems to show through—is the least likely to be causing some change to the stem?⁶¹

What is the phonological rule which accounts for the voicing alternations?⁶²

Give derivations for all three forms of the word for *sweep*.⁶³

Provide a prose account of what is going on here as it might be written for a grammar of the language intended for teaching Pengo to foreigners who are not linguistically trained, but who do know about roots and suffixes and voiceless/voiced consonants.⁶⁴

Feedback for Chapter 10

10.1 Pengo

⁶⁰ (a) voiceless; (b) voiced; (c) both kinds of allomorph occur.

⁶¹ The underlying form is seen in the pre-vocalic context. In the other contexts, the voicing of the stem-final consonant is being affected by the following consonant. When the underlying form precedes a vowel, the voicing of its final consonant is not affected.

⁶² Voicing Assimilation: A consonant assimilates in voicing to an immediately following consonant.

⁶³	UF	{hi:p-dʒi}	{hi:p-a}	{hi:p-tan}
	Voicing Assimilation	hi:bdʒi	————	hi:ptan
	SF	[hi:bdʒi]	[hi:pa]	[hi:ptan]

⁶⁴ A verb root in Pengo may end in either a voiceless or voiced consonant. This is seen by looking at the imperative form, which has the suffix *-a*: *hi:pa* ‘sweep!’ and *tu:ba* ‘blow!’. When a consonant-initial suffix is added, the root-final consonant changes to agree in voicing with that suffix-initial consonant: *hi:bdʒi* ‘sweep (gerund)’, and *tu:ptan* ‘blow (3 sg. Past)’.

CHAPTER 11 - PLACE ASSIMILATION (NASALS)

In the previous chapter we saw instances of where the value of the feature [voice] of one sound affected that feature in another sound. In this chapter we examine cases where several features act as a group. These are the **major place features**.

Some sounds (such as [p] and [f]) are pronounced with the lips; they are said to be **labial**. Some consonants (such as [t], [s], and [ʃ]) are pronounced with the front of the tongue; they are said to have the feature **coronal** (as in ‘crown’ of the tongue). Yet other sounds (such as [k] and [g]) are pronounced with the back of the tongue; they are said to have the feature **dorsal**. These three labels are the important place labels in phonology. (Finer distinctions are built on them; for example, the difference between bilabial and labiodental is a subdivision under labial. See Appendix A. Phonological features are different from phonetic labels in that the former force a coarse generalization first (labial, coronal, dorsal) and then allow for details to be added as necessary.)

With that background, consider the following forms from Seri (in broad phonetic transcription):

(87)	i-m-ii	<i>who doesn't hear it</i>
	i-m-pii	<i>who doesn't taste it</i>
	i-m-φit	<i>who doesn't stand up</i>
	i-n-sii	<i>who doesn't smell it</i>
	i-n-tis	<i>who doesn't point at it</i>
	i-n-ʃæmx	<i>who doesn't dive</i>
	i-n-jaa	<i>who doesn't own it</i>
	i-n-kaa	<i>who doesn't look for it</i>
	i-N-χap	<i>who doesn't dig it</i>

The negative prefix has five allomorphs here: [m], [n], [ɲ], [ŋ], and [N]. Since these are similar phonologically to each other, we suspect that this is not a case of suppletive allomorphy. The distribution of these allomorphs is regular: [m] (a bilabial nasal) occurs before bilabial consonants and before vowels; [n] (a coronal nasal) occurs before coronal consonants, [ɲ] (a palatal nasal) occurs before palatals, [ŋ] (a velar nasal) occurs before velar consonants, and [N] (a uvular nasal) occurs before uvular consonants.

Since the allomorphs which occur before consonants have a predictable place of articulation (it is always the same as the following consonant), this information can be extracted and stated as a rule in the phonology of Seri:

- (88) **Place Assimilation: A nasal consonant assimilates to the place of articulation of an immediately following consonant.**

We have given this rule in broad general strokes. Other data may show that it should be narrowed down some (and they do, but they are not relevant here). Rules such as this are very common, however. Especially in the case of the pronunciation of nasal consonants, the tongue and lips are moved into position in anticipation of the next consonant.

What is the underlying form of the negative prefix in Seri? The only allomorph whose shape appears not to be determined by its context is the allomorph which appears before vowels: [m]. Vowels do not usually have a major influence on the place of articulation of an adjacent consonant and therefore usually represent the most neutral context for cases like this. Since the labial feature of this allomorph is not predictable, it must be specified in the lexicon. Therefore we choose {m} as the underlying form of the Negative prefix.

(89)	Underlying	{i-m-ii}	{i-m-tii}	{i-m-kaa}
	Place Assimilation	—	intii	iŋkaa
	Phonetic Represent.	[imii]	[intii]	[iŋkaa]

Features

An important claim of generative phonology (among other theories) is that the basic building blocks of phonology are not the consonants and vowels (such as *p* and *e*), but the features. A symbol such as *p* is an abbreviation for a configuration of features, including some specification that the features [labial] and [-voice] are present. If the feature specification for voice is changed, the resulting sound will be different (it will be a *b* rather than a *p*). More details about features are presented in ensuing chapters and also in Appendix A.

Key Concepts

major place features

[Labial]

[Coronal]

[Dorsal]

Relevant Phonetic Information

The following information, grouping sounds by point of articulation and showing other features, will be helpful in doing the exercises for this chapter. The grouping of the sounds may not be precise in the alveopalatal and palatal regions.

[+voice]			j	w	[+sonorant]
[+voice]	m	n	ɲ	ŋ	[+sonorant]
[+voice]	b	d		g	[-sonorant]
[-voice]	p	t		k	[-sonorant]
[-voice]			ʃ		[-sonorant]
[+voice]			ʒ		[-sonorant]

Sounds without major place features: glottal stop and [h].

11.1 Try it for yourself with Wantoat

The suffixes for *my* and *our* have two allomorphs each. Choose an underlying form for each suffix and give reasons for your choice.⁶⁵

	<i>my</i>	<i>our</i>	
1.	katak-ɲa	katak-ɲin	<i>hand</i>
2.	kepi-na	kepi-nin	<i>foot</i>
3.	jot-na	jot-nin	<i>house</i>

Give the phonological rule necessary to account for the allomorph. You should make it as general as possible, making predictions for data which you do not have, in the absence of counterexamples.⁶⁶

11.2 Try it for yourself with English

The negative prefix in English has two allomorphs in the following data. Which one is the result of the environment in which it occurs and which one is best chosen as the underlying form?⁶⁷

1. [in]edible
2. [in]alienable
3. [im]possible
4. [im]partial
5. [in]flexible
6. [in]variable
7. [in]competent
8. [in]combustible
9. [in]sincere
10. [in]testate

Give the phonological rule needed to account for the allomorphy, in as general form as possible. The rule cannot be as general as the Place Assimilation rule shown in this chapter because the nasal does not become velar in the last two examples.⁶⁸

11.3 Try it for yourself with Min Nan Chinese

The word for *very* has three allomorphs in the following data. Choose an underlying form and give reasons for your choice.⁶⁹

- | | | |
|----|----------|-------------------|
| 1. | tsim pe | <i>very white</i> |
| 2. | tsim bai | <i>very ugly</i> |
| 3. | tsin ta | <i>very dry</i> |
| 4. | tsin sin | <i>very new</i> |
| 5. | tsin ho | <i>very good</i> |
| 6. | tsin o | <i>very black</i> |
| 7. | tsij kao | <i>very thick</i> |

Give the phonological rule needed to account for the allomorphy.⁷⁰

11.4 Try it for yourself with Sierra Popoluca

The prefix for *my* has several allomorphs. Choose an underlying form and give reasons for your choice.⁷¹

- | | | |
|-----|------------|-----------------------|
| 1. | ampetkuj | <i>my broom</i> |
| 2. | ampiɟu | <i>my hen</i> |
| 3. | amme:me | <i>my butterfly</i> |
| 4. | anhe:pe | <i>my cup</i> |
| 5. | aɲkawah | <i>my horse</i> |
| 6. | aɲjemkuj | <i>my fan</i> |
| 7. | anha:ja | <i>my husband</i> |
| 8. | aɲwɔtʃo:mo | <i>my wife</i> |
| 9. | ansuunɟ | <i>my cooking pot</i> |
| 10. | aɲʃapun | <i>my soap</i> |

Give the phonological rule necessary to account for the allomorphy.⁷²

11.5 Try it for yourself with Javanese

Suggest an underlying form for the verbalizer morpheme and a reason for your choice.⁷³

	Noun		Verbalized	
1.	bubor	<i>porridge</i>	mbubor	<i>to make porridge</i>
2.	doɲɲ	<i>story</i>	ndoɲɲ	<i>to tell a story</i>
3.	gunteɲ	<i>scissors</i>	ɲgunteɲ	<i>to make scissors</i>
4.	atʃar	<i>pickle</i>	ɲatʃar	<i>to pickle</i>

Give the rule needed to account for the surface forms.⁷⁴

11.6 Try it for yourself with Nabak

Give a word structure rule for the data below.⁷⁵ Suggest underlying forms for the suffixes and reasons for choosing each.⁷⁶

	<i>my</i>	<i>his</i>	
1.	ibm	ibmaɲ	<i>sister</i>
2.	bibm	bibmaɲ	<i>father</i>
3.	bon	boɲaɲ	<i>pig</i>
4.	mkan	mkaɲaɲ	<i>house</i>
5.	dadn	dadnaɲ	<i>elder brother</i>
6.	tadn	tadnaɲ	<i>parents-in-law</i>
7.	sogɲ	sogɲaɲ	<i>grandmother</i>
8.	segɲ	segɲaɲ	<i>skin</i>

Give a single phonological rule to account for all the allomorphs.⁷⁷

11.7 Try it for yourself with Nuyoo Mixtec

Assume the following underlying forms for the data below. Two rules are needed, one for each type of change. Give the two rules. Give a derivation of the word for *served* to show the application of the rules. (The morpheme {n-} indicates completed action.)⁷⁸

1.	{n – tesoʔo}	→	[ndesoʔo]	<i>heard</i>
2.	{n – kiku}	→	[ŋgiku]	<i>served</i>
3.	{n – k ^w ini}	→	[ŋg ^w ini]	<i>wanted</i>
4.	{n – saʔa}	→	[nzaʔa]	<i>did, made</i>
5.	{n – ʃiko}	→	[ŋʒiko]	<i>sold</i>
6.	{n – tʃiso}	→	[ŋdʒiso]	<i>have put on</i>
7.	{n – xaʔa}	→	[ŋɣaʔa]	<i>passed</i>

11.8 Try it for yourself with Pastaza Quechua

Propose a word structure rule to account for the words below (including the word [wasinda] *at his house*, which has three morphemes), a list of underlying forms, and the phonological rules necessary. (Recall that nasal stops are sonorants and that oral stops and fricatives are obstruents; obstruents are [-sonorant]. This will be important to know since obviously place assimilation is not happening everywhere in these data.)⁷⁹

	<i>to...</i>	<i>at..</i>	<i>in...</i>	<i>of...</i>	
wasi	wasima	wasita	wasipi	wasipa	<i>(the) house</i>
wasij	wasijma	wasinda	wasimbi	wasimba	<i>his house</i>

11.9 Try it for yourself with Copainalá Zoque

Propose phonological rules to account for the allomorphy shown below (two rules are needed).⁸⁰ The stems of these nouns all begin with stops. Nouns which begin with other sounds are purposely omitted. The rules you write should be as simple as reasonably possible.

	Unpossessed	<i>my ...</i>	
1.	pama	mbama	<i>clothing</i>
2.	potso	mbotso	<i>younger sibling</i>
3.	tatah	ndatah	<i>father</i>
4.	tʌk	ndʌk	<i>house</i>
5.	tuwi	nduwi	<i>dog</i>
6.	kaju	ŋgaju	<i>horse</i>
7.	kama	ŋgama	<i>cornfield</i>
8.	kose	ŋgose	<i>older sister</i>

11.10 Try it for yourself with North Puebla Nahuatl

Relevant morpheme breaks have been given for you in the following data. Assign a gloss to each morpheme. Assume that the simple present tense contains the full stem of the verb and that other tenses are formed by adding a suffix and deleting the last vowel of the stem (a kind of morphologically triggered rule, as described in chapter 5). Give the underlying form of the verb for *walk* and the noun for *house*; and the phonological rule necessary to account for their allomorphs.⁸¹

1.	kalan	<i>outside</i>
2.	kalam-pa	<i>the place outside</i>
3.	no-tʃan	<i>my house</i>
4.	tʃam-pa	<i>the place where the house is</i>
5.	nemi	<i>he walks</i>
6.	nen-tok	<i>he is walking</i>
7.	tatʃpana	<i>he sweeps</i>
8.	tatʃpan-tok	<i>he is sweeping</i>
9.	tatʃpan-ka	<i>he had swept</i>
10.	motema	<i>he bathes</i>
11.	moter-ka	<i>he had bathed</i>

Feedback for Chapter 11

11.1 Wantoat

⁶⁵ The suffixes both begin with a coronal nasal in the most neutral context, following a vowel. Therefore the best choices for underlying forms are {-na} and {-nin}.

⁶⁶ Place Assimilation: A nasal consonant assimilates in place to an immediately preceding consonant.

11.2 English

⁶⁷ The allomorph [im] occurs only before bilabial consonants and is probably due to the environment in which it occurs. The allomorph [in] occurs in a variety of contexts, including before vowels and before labio-dental consonants, and is the best choice for underlying form.

⁶⁸ Place Assimilation: A nasal consonant assimilates in place to an immediately following bilabial consonant.

11.3 Min Nan Chinese

⁶⁹ The allomorph [tsin] occurs before vowels and before [h]; these sounds are less likely to affect the place of articulation of the nasal consonant. Therefore [tsin] is the best choice for the underlying form of the word *very*.

⁷⁰ Place Assimilation: A nasal consonant assimilates in place to an immediately following consonant. [h] has no place features, so there is no assimilation before this consonant.

11.4 Sierra Popoluca

⁷¹ The allomorph [an] is the only one which occurs in a context, before [h], which does not have place features to affect the nasal consonant.

⁷² Place Assimilation: A nasal consonant assimilates in place to an immediately following consonant.

11.5 Javanese

⁷³ The best choice for underlying form is [ŋ], which appears in the most neutral context (preceding a vowel).

⁷⁴ Place Assimilation: A nasal consonant assimilates in place to an immediately following consonant.

11.6 Nabak

⁷⁵ Word Structure Rule: $N \rightarrow N_{\text{stem}} - \text{Possessor}$

⁷⁶ Underlying forms: *my* {-n}, *his* {-ŋaŋ}. These are the allomorphs which appear after vowels, the most neutral context so far as place assimilation is concerned.

⁷⁷ Place Assimilation: A nasal consonant assimilates in place to an immediately preceding consonant.

11.7 Nuyoo Mixtec

⁷⁸ Phonological Rules:

Place Assimilation: A nasal consonant assimilates in place to an immediately following consonant.

Voice Assimilation: A consonant assimilates in voicing to an immediately preceding consonant.

Underlying Form {n-kiku}

Place Assimilation ŋkiku

Voice Assimilation ŋgiku

Surface Form ŋgiku

11.8 Pastaza Quechua

⁷⁹ Word structure rule: $N \rightarrow N_{\text{stem}} - (\text{Possessor}) - (\text{Case})$

Morphemes: *wasi house*, *-ma to*, *-ta at*, *-pi in*, *-pa of*, *-ŋ his*.

Phonological rules:

Place Assimilation: A nasal consonant assimilates in place to an immediately following obstruent.

Voice Assimilation: A consonant assimilates in voicing to an immediately preceding consonant.

11.9 Copainalá Zoque

⁸⁰ The rules would be:

Voicing Assimilation: A consonant assimilates in voicing to an immediately preceding consonant.

Place Assimilation: A nasal consonant assimilates in place to an immediately following consonant.

11.10 North Puebla Nahuatl

⁸¹ Underlying forms: *house* {tʃan}, *walk* {nemi}.

Place Assimilation: A nasal consonant assimilates in place to an immediately following consonant.

CHAPTER 12 - FEATURES IN THE LEXICON

Recall again the Seri data presented in chapter 11.

(90)	i-m-ii	<i>who doesn't hear it</i>
	i-m-pii	<i>who doesn't taste it</i>
	i-m-φit	<i>who doesn't stand up</i>
	i-n-sii	<i>who doesn't smell it</i>
	i-n-tis	<i>who doesn't point at it</i>
	i-n-ʃæmx	<i>who doesn't dive</i>
	i-n-jaa	<i>who doesn't own it</i>
	i-n-kaa	<i>who doesn't look for it</i>
	i-N-χap	<i>who doesn't dig it</i>

We saw that the various allomorphs of the negative prefix could be derived from the underlying form {m}. As a matter of fact, all of the occurrences of the sounds [ŋ] and [ɲ] and [N] in the language can be derived. There are no occurrences of these sounds which are unpredictable.^a If there are no unpredictable occurrences of these sounds, then there is no reason to have [ŋ] or [ɲ] or [N] in any underlying forms.

We say then that whereas we must posit features that would yield *m* in the lexicon of Seri, we do not posit a combination of features which would yield [ŋ] or [ɲ] or [N] in the lexicon of Seri.^b If a rule or set of rules completely account for the occurrences of a feature, that feature is not contrastive in the language in question. In common parlance, [m] is a **phoneme** of Seri, but [ŋ], [ɲ] and [N] are not.

A sound which is the result of a combination of features including one or more non-contrastive features is referred to as an **allophone**. We might say that [ŋ] and [ɲ] and [N] are allophones of the phoneme /m/ in Seri. (Diagonals are often used around a symbol when we have phonemes in mind rather than phonetic entities.)

In contrast to Seri, the language Nabak has a combination of features in underlying representations which will result in /ŋ/: /ŋ/ is a phoneme of Nabak. In solving the Nabak problem from the previous chapter, you saw that the underlying form of the third person possessive suffix was {-ŋɔŋ}. If we posit /ŋ/ in underlying forms, we are saying that it cannot be described as a rule-governed variant of another sound in all cases. We couldn't get by with positing {-nɔn} as the underlying form for this morpheme in Nabak because we wouldn't be able to tell the conditions under which the sound *n* became [ŋ].

In later chapters we will look at other ways in which the contrastive (or 'distinctive') features of a language are found.

Key Concepts

contrastive features and combinations of features

allophone

phoneme

^a Well, almost. The name for a certain species of duck ['kto:ŋk] unpredictably has the velar nasal. It is unpredictably velar because otherwise in the language (i) *n* does not assimilate at all, and (ii) *m* does not assimilate in stressed syllables. This word is simply extraordinarily exceptional.

^b Or in other terms, [m] is a phoneme of Seri, but [ŋ], [ɲ], and [N] are not. We follow the position outlined in Diana Archangeli and Douglas Pulleyblank (in preparation) *The Content and Structure of Phonological Representations*, who point out that we really must think of inventories of features and their combinations, rather than inventories of phonemes.

Postscript for Teachers

The notion of “phoneme” has been in the everyday vocabulary of linguists for many decades now and yet continues to be problematic in definition and place in phonological theory. This book does not take the view of some versions of “classical phonemics” in which certain strong claims are made about the relationship between phonetic representations and phonemic representations hold. For that reason, some of the procedures for doing “phonemic analysis” are less rigidly applied in this book than in the past.

12 Try it for yourself

Using the data provided in the problems, decide whether the sounds in question should be considered as being phonemes of the language or not. To do this, decide whether the rule that was formulated for the data generates all of the instances of the sound in question. If it does, then one should hypothesize (until there is strong evidence to the contrary) that the sound in question is *not* a phoneme of that language.

- 12.1 Lithuanian (chapter 9): Is [ʒ] a phoneme of Lithuanian?⁸²
- 12.2 Javanese (chapter 11): Is [ŋ] a phoneme of Javanese?⁸³
- 12.3 Nuyoo Mixtec (chapter 11): Are [n], [ɲ], [ŋ] and [z] phonemes of Nuyoo Mixtec?⁸⁴
- 12.4 Pastaza Quechua (chapter 11): Are [d] and [b] phonemes of Pastaza Quechua?⁸⁵
- 12.5 North Puebla Nahuatl (chapter 11): Is [ŋ] a phoneme of North Puebla Nahuatl?⁸⁶

12.1 Lithuanian⁸²

Yes, [ʒ] must be a phoneme since only some occurrences of this sound are generated by the voice assimilation rule. Underlying forms include this sound.

12.2 Javanese⁸³

Yes, [ŋ] must be a phoneme of Javanese since only some occurrences of this sound are generated by the place assimilation rule. Underlying forms include this sound.

12.3 Nuyoo Mixtec⁸⁴

[n] must be a phoneme because it is posited in the underlying forms, and is needed there. The sounds [ɲ], [ŋ] and [z] are not phonemes because they are not needed in underlying forms (so far as we know). The rules of place assimilation and voice assimilation account for them.

12.4 Pastaza Quechua⁸⁵

[d] and [b] are not phonemes of Pastaza Quechua since they are not needed in underlying forms; they are accounted for by the rule of voice assimilation.

12.5 North Puebla Nahuatl⁸⁶

[ŋ] is not a phoneme of Puebla Nahuatl since it is not needed in underlying forms and is generated entirely by the rule of place assimilation.

CHAPTER 13 - FEATURE SPREADING

In chapter 9 we saw that one sound was affecting another sound in a particular feature. Various attempts have been made in the history of linguistics at formalizing rules that capture the essence of what is happening. A common informal way to show an assimilation rule simply uses the phonetic symbols themselves, as shown below. The following rule says that *p* becomes *b* when it follows *m*.

$$(91) p \rightarrow b / m _$$

There are two major problems with this informal notation. First, one cannot easily express generalizations. What would one do if *p* became *b*, *t* became *d*, and *k* became *g* when they followed *m*, *n*, *z*, etc.? A laundry list is not the same as a simple generalization. Second, this kind of notation does not allow us to evaluate the rule's simplicity. A simple ordinary rule is just as easy to write in this notation as a very odd unlikely rule such as the following:

$$(92) z \rightarrow p / r _$$

We want our theory of phonology to help us evaluate the rules that we write.

In standard generative phonology of the 1960's and 1970's, a common notation for rules used features, such as [voice] in the following way.^a

$$(93) C \rightarrow [+voice] / \begin{array}{c} C \\ [+voice] \end{array} _$$

This rule claims that any consonant becomes voiced after a voiced consonant. If the rule should be more specific, more features would be included; if it should be more general, fewer features would be included. For example, if only *p* and never *t* were voiced in this environment, we could write the rule as shown below.

$$(94) C \rightarrow [+voice] / \begin{array}{c} C \\ [+labial] \end{array} \begin{array}{c} C \\ [+voice] \end{array} _$$

This type of notation is superior to the use of phonetic symbols in that odd rules usually require many features whereas common rules require few features. The latter are formally simpler.^b

But this kind of notation still has certain deficiencies. The following rule is not any more complicated in terms of features than (93), but it is certainly not a typical rule.

$$(95) C \rightarrow [+voice] / \begin{array}{c} C \\ [+labial] \end{array} _$$

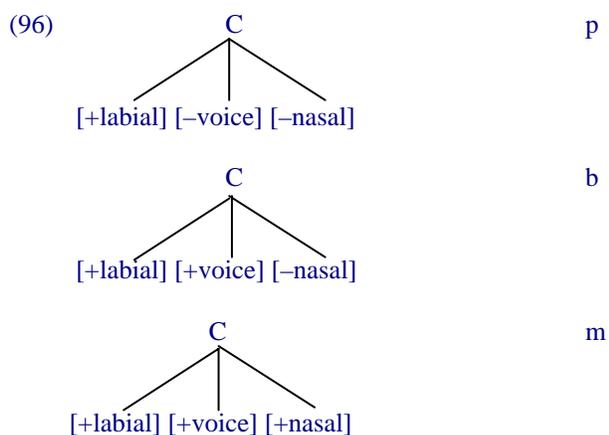
New formalism has attempted to solve this problem. In current theory, assimilation is seen as one or more features spreading to another sound. To understand how it works, however, some background on the architecture of the representation of sounds is necessary.

We assume that sounds are composed of features. One way to think of them is as individual components of a sound which are linked to some 'anchor'. For example, the sounds *p*, *b*, and *m* might be thought of as consonant positions (C) with the features [\pm voice], [\pm labial], and [\pm nasal].^c

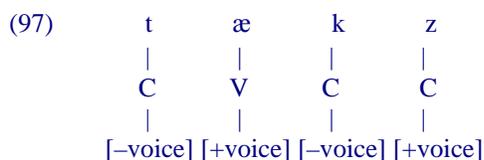
^a The most influential work of the period was Noam Chomsky and Morris Halle (1968) *The Sound Pattern of English*, Evanston, New York, and London, Harper and Row (reprinted in 1991 by MIT Press).

^b This didn't always turn out to be the case, however. Sometimes very common and natural rules required more features than uncommon rules. This has led to some revisions in the theory.

^c We ignore here the important issue of whether a feature may be completely absent rather than be specified with a negative value. We also ignore here the important issue of how the features are organized. See Appendix A.



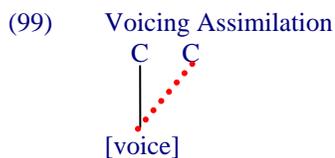
With this in mind, therefore, we might represent the underlying form of *tacks* as follows, omitting for the sake of presentation all those features which are not relevant to the rule of Voicing Assimilation:



A rule of Voicing Assimilation spreads the feature [-voice] from the *k* to the following sound. This spreading can be indicated by a dotted line, as below. Once [-voice] spreads to the *z*, the feature [+voice] that is already there is canceled or dropped, and this is indicated by the "x" on the line.^d



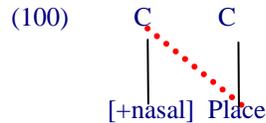
The rule of Voicing Assimilation can be somewhat formalized as:



This rule has a simple interpretation: the value of the feature [voice] which the first consonant has—note the solid line—is associated with the second consonant—note the dotted line. (Note that we have stated the rule as spreading [voice]—whatever value it may have—rather than just spreading [-voice]; this makes the rule a bit more general.)

The rule of Place Assimilation in Seri which was discussed in chapter 11 might be viewed as spreading the place of articulation features of a consonant to the preceding nasal consonant. Rather than mention each particular place feature (labial, coronal, back, etc.), we can state the rule quite simply as shown below, where 'Place' is a category label (in itself it is not a feature):

^d This cancellation of an incompatible feature when another feature is added on the same C or V position) is commonly considered to happen by convention.



The first consonant in this rule must be specified as being [+nasal], since only nasal consonants assimilate in this way to following consonants in Seri (as in many languages). And again, the rule has a simple interpretation: the first consonant (which may or may not have a specified place of articulation before the application of the rule) becomes associated with the Place features of the following consonant.

Key Concepts

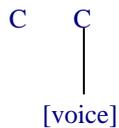
feature spreading

Place

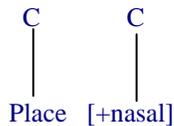
13 Try it for yourself with formalization

Complete the formalization of the assimilation rules for the following problems by drawing the dotted line that shows the change.

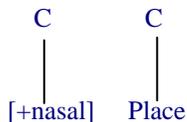
13.1 Pengo (chapter 10): A consonant assimilates in voicing to an immediately following consonant.



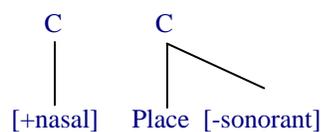
13.2 Nabak (chapter 11): A nasal consonant assimilates in place to an immediately preceding consonant.



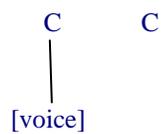
13.3 Nuyoo Mixtec (chapter 11): A nasal consonant assimilates in place to an immediately following consonant.



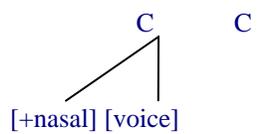
13.4 Pastaza Quechua (chapter 11): A nasal consonant assimilates in place to an immediately following obstruent.



13.5 Pastaza Quechua (chapter 11): A consonant assimilates in voicing to an immediately preceding consonant.

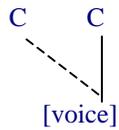


13.6 Walmatjari (chapter 9): A consonant assimilates in voicing to an immediately preceding nasal consonant.

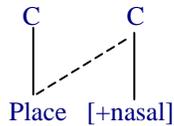


Feedback for Chapter 13

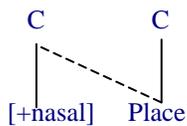
13.1 Pengo: A consonant assimilates in voicing to an immediately following consonant.



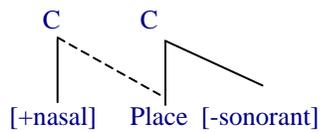
13.2 Nabak (chapter 11): A nasal consonant assimilates in place to an immediately preceding consonant.



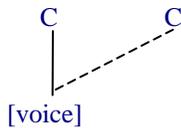
13.3 Nuyoo Mixtec (chapter 11): A nasal consonant assimilates in place to an immediately following consonant.



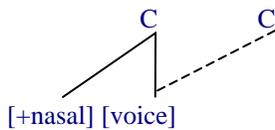
13.4 Pastaza Quechua (chapter 11): A nasal consonant assimilates in place to an immediately following obstruent.



13.5 Pastaza Quechua (chapter 11): A consonant assimilates in voicing to an immediately preceding consonant.



13.6 Walmartjari (chapter 9): A consonant assimilates in voicing to an immediately preceding nasal consonant.



CHAPTER 14 - CONSTRAINING RULE APPLICATION

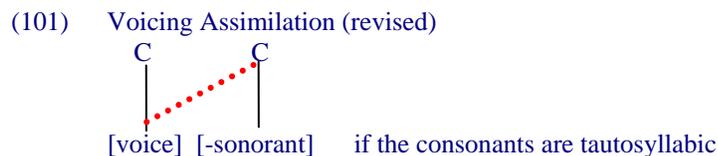
When a rule such as that of Voicing Assimilation (99) is proposed in the phonology of a language, the expectation is that it will apply everywhere that it can apply, except as specifically stipulated (by adding conditions to its context) or as generally constrained.

The most interesting rules are those which have a wide application, and so the attempt is to avoid making the rules any more complicated than they have to be. If a rule such as Voicing Assimilation (99) is a rule of English, one must know why it doesn't also apply to words such as *flagship* (it's not pronounced with a [ʒ] sound instead of the [ʃ] sound, and also words such as *goldsmith* and *pigsty* (they are pronounced with [s] and not [z]). Voicing is not spreading to a following consonant. These facts suggest that it is necessary to make the rule more specific in some way, and of course the dilemma will be to decide how. Let us assume that the rule should be fixed by adding the constraint (we'll ignore the problem of notation at this point) "both consonants must be in the same syllable". In other words, voicing assimilation in English takes place only when the two consonants are tautosyllabic (in the same syllable).

This amendment does not take care of words such as *slip* and *shriek*, however. These words contain voiceless consonants followed by voiced consonants: the *l* and *r* do not become voiceless, even though they are in the same syllable with the preceding voiceless consonant.

There are various ways in which Voicing Assimilation (99) could be made even more complicated so that it will not apply to words such as *slip* and *strip*, but still allow it to correctly produce words such as *tacks*. For example, one might make the rule apply only if the two consonants are at the end of a syllable (in *slip* the consonants are at the beginning of the syllable), or at the end of a word. Or one might propose that the devoicing takes place only if the second consonant is a sibilant (that is, an *s*-like sound). But there are other ways to constrain the rule which are of more interest cross-linguistically since they have to do with the nature of the sounds involved. Situations like the one we are encountering here happen in language after language, with rules that are very different.

One observation is that the voicing assimilation rule in question applies to *z*, an obstruent, whereas it does not apply to *l* and *r*, which are sonorants. The distinction between sonorants and obstruents shows up in many languages and could be the relevant fact. If so, rule (99) would be revised to specify that only obstruents undergo the rule.



While this kind of revision works, it is not the most interesting way to 'fix' the problem of a rule that applies in the wrong places. Sometimes a feature does have to be added to the rule, but other times there is a better solution. We note in this case that the sound to which we see Voicing Assimilation applying in English is *z*, a sound which is a phoneme of English. The result of the application of Voicing Assimilation is *s*, also a phoneme of English. But if Voicing Assimilation were to apply to *slip*, the result would be a voiceless *l*, which is not a phoneme of English. If Voicing Assimilation were to apply, a novel combination of features for English (one which does not occur in underlying forms) would result. If we stipulate that Voicing Assimilation in English is a **structure preserving rule**, this would correctly prevent it from applying to the word *slip*.^a The output of a structure-preserving rule is similar to the kinds of 'structures' that occur as input to the rule; for example, such a rule does not produce sounds which do not occur in

^a Elaborate and interesting attempts have been made to make structure preservation relate to other facts in the phonology, especially in the theory of Lexical Phonology. For an introduction to that theory (within the generative tradition), including problems that arise, see Michael Kenstowicz (1994) *Phonology in Generative Grammar*, Cambridge, Mass, Blackwell. The idea of structure preservation in particular is discussed first in Paul Kiparsky (1982) *From Cyclic Phonology to Lexical Phonology*, H. van der Hulst and N. Smith (eds.), *The Structure of Phonological Representations*, Parts I and II, Dordrecht, Foris; and Paul Kiparsky (1982) *Lexical Morphology and Phonology*, I.-S. Yang (ed.), *Linguistics in the Morning Calm*, Seoul, Hanshin.

underlying forms. If Voicing Assimilation in English is stipulated to be a structure preserving rule, the rule may apply where the conditions are right *except that* it is blocked from applying in those specific cases where it would produce something novel (such as a voiceless *l* or *r*). To argue that a rule is structure preserving, one must have direct evidence such as this where its application is actually blocked.

We might also note that rule (99) applies in English only in **derived environments**, such as when morphemes come together. In the case of the word *slip*, the *s* and *l* occur next to each other in the underlying form; rule (99) does not apply to them. But in a word such as *tacks*, the morphemes *tack* and *-z* are juxtaposed by means of a word formation rule, creating a derived situation to which (99) can apply. If we stipulate that (99) is a ‘derived environment only’ rule, the facts would be accounted for correctly without complicating the rule in any specific way.^b

All this is meant to show that not every fact about how a rule applies to a form is necessarily encoded directly into the formulation of the rule. A **constraint** such as that a rule be structure preserving or apply only in derived environments might be added to it (or somehow result from the theory), greatly restricting it without directly complicating it. Linguists are constantly looking for ways to generalize, to relate facts, and to find explanations that go beyond the nitty-gritty details of a particular case.

Key Concepts

constraints on rules

structure-preserving rule

derived environment

14.1 Try it for yourself with English

How do words such as *felt*, *smelt* (compare with *feel*, *smell*) affect the way that you view the formulation of Voicing Assimilation. Are the consonants *lt* in the same syllable? Are they in a derived environment? Would the application of Voicing Assimilation be blocked by stipulating that it is structure preserving?⁸⁷

14.2 Try it for yourself with American English

The two suffixes with the form $-\theta$ in English, unlike the suffix $-s$ $\{-z\}$, cause regressive voicing assimilation in some words; voicing spreads to the left. (Ignore the vowel alternations in these data.) The rule might be formulated as: A consonant assimilates in voicing to a consonant that immediately follows it.

Discuss two distinct ways in which the voicing assimilation rule could be formulated or constrained so that it will properly change *v* to *f* (as in *twelfth*) but not devoice *n* (as in *ninth*). Which way is to be preferred and why?⁸⁸

^b The notion of a structure-preserving rule or a rule that applies only in a derived environment has some affinity with ‘morphophonemic rule’. The latter term, introduced in structuralist phonology, is still commonly used in an informal way to refer to rules which do not generate allophones. The term is often used in opposition to ‘allophonic rules’ and/or ‘phonetic rules’. Rules of the latter sort, which are not structure preserving and which do apply in nonderived environments, are discussed in detail in chapter 23.

1.	fajv	<i>five</i>	fɪf-θ	<i>fifth</i>
2.	sɪks	<i>six</i>	sɪks-θ	<i>sixth</i>
3.	sɛvən	<i>seven</i>	sɛvən-θ	<i>seventh</i> ^c
4.	ejt	<i>eight</i>	ejt-θ	<i>eighth</i>
5.	naj̃n	<i>nine</i>	naj̃n-θ	<i>ninth</i>
6.	tɛn	<i>ten</i>	tɛn-θ	<i>tenth</i>
7.	twɛlv	<i>twelve</i>	twɛlf-θ	<i>twelfth</i>
8.	twʌni	<i>twenty</i>	twʌni-əθ	<i>twentieth</i> ^d
9.	waj̃d	<i>wide</i>	wɪt-θ	<i>width</i> ^e
10.	bɪɔd	<i>broad</i>	bɪɛt-θ	<i>breadth</i>
12.	wɔɪm	<i>warm</i>	wɔɪm-θ	<i>warmth</i> ^f
11.	lɔŋ	<i>long</i> ^g	lɛŋk-θ	<i>length</i>
12.	strɔŋ	<i>strong</i>	strɛŋk-θ	<i>strength</i>

14.3 Try it for yourself with American English

In these data you see that there are three allomorphs of the suffix. Does the underlying form of the suffix begin with a voiced or a voiceless sound? How do you know?⁸⁹

Assume that the last consonant of *eight* deletes when it precedes this suffix. Also, you may assume that a rule changes a coronal stop into a flap when it occurs following a continuant sonorant. (Note: this gives evidence from English that the “r” of English is [+continuant] and that nasals are [-continuant].)

Two voicing assimilation rules are needed. One is regressive (spreading to the left), and one is progressive (spreading to the right). What are the rules?⁹⁰ Can you keep them simple? Are they structure preserving or not or can't we tell?⁹¹ (These rules do not apply only to tautosyllabic consonants—another challenge for the correct formulation of Voicing Assimilation in English!)

1.	foɪ	<i>four</i>	foɪ-ri	<i>forty</i>
2.	fajv	<i>five</i>	fɪf-ti	<i>fifty</i>
3.	sɪks	<i>six</i>	sɪks-ti	<i>sixty</i>
4.	sɛvən	<i>seven</i>	sɛvən-di	<i>seventy</i>
5.	ejt	<i>eight</i>	ej-ri	<i>eighty</i>
6.	naj̃n	<i>nine</i>	naj̃n-di	<i>ninety</i>

^c For many speakers with this dialect, there is an ‘intrusive’ voiceless stop between the *n* and the *θ* in word such as this: [sɛvəntθ]. For this exercise, consider this dialect (perhaps artificial at this point) that does not have this intrusive stop.

^d The allomorph -əθ occurs after vowels.

^e The devoicing of the root-final consonant is true of this dialect of English; it is apparently not true of all dialects.

^f There may be an intrusive voiceless bilabial stop in this word: [wɔɪmpθ]. See note c.

^g Assume that these roots have an underlying final *g* which deletes in word-final position and that the *k* which appears before -*θ* is not an intrusive consonant (see footnote 2).

14.4 Now try it on some other languages

Decide whether the rules for the following problems are structure preserving rules or not. The way to do this is to show that the rule produces a sound which does *not* appear in underlying forms. If it does produce such a sound, then the rule is *not* structure preserving. It does *not* produce such a sound, and we think that it *should* in a given environment, then the rule *is* structure preserving. If the rule does not produce such a sound but we don't know what it does in the crucial cases, then we simply don't know whether it's structure preserving or not.

If the data are very limited, you won't have much to go on for your decisions. But do the best you can.

14.4.1 Nuyoo Mixtec (chapter 11); Voicing Assimilation and Place Assimilation⁹² Assume that the symbols which appear in the underlying forms are representative of all of the phonemes of the language.

14.4.2 Copainalá Zoque (chapter 11); Voicing Assimilation and Place Assimilation⁹³ Assume that the symbols which appear in the Unpossessed column are representative of all of the phonemes of the language.

Feedback for Chapter 14

14.1 English⁸⁷

The consonants are in the same syllable (they are tautosyllabic). Therefore that condition is met. They are also in a derived environment, since the words are a combination of a verb plus a past tense suffix *-t*. The application of Voicing Assimilation would not be blocked by stipulating that it is structure preserving since the output *d* is a phoneme of English. The output is consistent with structure preservation. It appears that the rule simply has to be formulated to be fairly specific in its context.

14.2 American English⁸⁷

One way to account for the facts would be to complicate the rule by stipulating that only obstruents undergo the rule (including *v*, *d*, and *g* and excluding *n* and *m*). An alternative is to stipulate that the rule is structure preserving. This would prevent the rule from applying to *n* and *m* since there are no voiceless sonorant phonemes in English. This is to be preferred in principle because it makes recourse to a general constraint rather than a feature-specific constraint.

14.3 American English

⁸⁹ The suffix must begin with a voiceless sound. Otherwise, we would have no way to account for the devoicing of the *v* to *f* in the derivation of *fifty*.

⁹⁰ Regressive Voicing Assimilation: A consonant assimilates in voicing to a consonant that immediately follows it. (This accounts for the devoicing of *five* in the word *fifty*.)

Progressive Voicing Assimilation: A consonant assimilates in voicing to a consonant that immediately precedes it. (This accounts for the voicing of *-ty* in words such as *ninety*.)

⁹¹ To keep these rules simple, we must first require Regressive Assimilation to be attempted before Progressive Assimilation. Otherwise underlying *five-ty* would yield *fivdy* instead of the correct *fifty*. Also, we must stipulate that Regressive Assimilation is structure preserving, because it does not apply in the derivation of *ninety*; the output contains a voiced *n* rather than a voiceless *n*.

14.4 Other languages

14.4.1 Nuyoo Mixtec⁹²

Neither rule is structure preserving since they both produce sounds that do not occur in underlying forms.

14.4.2 Copainalá Zoque⁹²

Neither rule is structure preserving since they both produce sounds that do not occur in underlying forms.

CHAPTER 15 - PALATALIZATION AND LABIALIZATION

In chapter 11 we saw cases where a consonant assimilated to a neighboring consonant in its place features. In this chapter we look at cases where consonants assimilate to neighboring vowels with respect to place features.

Consonants sometimes are pronounced with the tongue body drawn toward the hard palate.^a For example, a ‘back’ consonant, such as *k*, is often pronounced slightly forward before a front vowel. The *k* of *key* is pronounced farther forward than the *k* of *Kool-Aid*, for example.

In some languages the assimilation of a consonant to a vowel results in a transitional *j* off-glide between the consonant and the vowel. In Tataltepec Chatino, a *k* has an audible *j* off-glide when it precedes an *e*. For example, the word /*kee*/ *head* is pronounced [k^jee].

Both of the preceding kinds of processes have been referred to as **palatalization** (since there is an attraction towards the hard palate), although the resulting sound may not necessarily be a ‘palatalized’ consonant in the terminology used in a phonetics class. High front vowels and glides are especially common environments for palatalization.

Palatalization in this broad sense may result in an even more noticeable change in the sound. For example, in Dakota Sioux, a /*k*/ becomes [tʃ] when it follows an /*i*/ (and also precedes a vowel). For example, the /*k*/ of the morpheme {*kax*} *make* becomes [tʃ] when the prefix {*i-*} precedes it, as in the word [itʃaye] *instrument* (the morpheme {*kax*} is the part [tʃay] in this word).

English has many examples of palatalization which originated with Latin, such as where *k* becomes *s* before *i*. Compare *elastic* [k] with *elasticity* [s], and *analogue* [g] with *analogy* [dʒ]. See also pairs such as *Egypt* [t] and *Egyptian* [ʃ], *Greece* [s] and *Grecian* [ʃ]. Other examples of “historical” palatalization in English are: *regen*[t] / *regen*[s]y, *na*[t]ive / *na*[ʃ]ion.

But there are also many more instances of palatalization in English that are going on today. Consider the commonly heard pronunciations of the words *issue* (with [ʃ] in American English, [s] in British English) and *mature* (with [tʃ] in American English generally). The *t* of the root of *captive* palatalizes to [tʃ] in the word *capture*. The *d* of the word *fraud* palatalizes to [dʒ] in the word *fraudulent*. The *s* of *miss* is typically palatalized in American English in a phrase such as *I’ll miss you*, especially in casual speech. Similarly, the *t* of *let* (and other words) is pronounced as [tʃ] in phrases such as *If I let you read this....* And there is a distinct palatalization of *t* and *d* before *r* in many dialects of English, such that children often begin writing words like *truck* with *ch* because they hear the distinctive palatalization.

15.1 Try it for yourself with Yaqui

What kind of alternation is seen in the following data? What is the likely conditioning factor for this?⁹⁴

(102)	teput	flea
	teputʃ-im	fleas

15.2 Try it for yourself with Karuk

What kind of alternation is seen in the following data? What is the likely conditioning factor for it?⁹⁵ Based on these very limited data, is the process structure-preserving?

(103)	<i>s/he...</i>	<i>I...</i>	
	ʔu-skak	ni-ʃkak	<i>jump</i>
	ʔu-suprih	ni-ʃuprih	<i>measure</i>
	ʔu-si:tva	ni-ʃi:tva	<i>steal</i>

^a The hard palate is the bony part of the upper side of the mouth; the soft palate is behind it. If you move your tongue along the upper side of the mouth, you can feel the place where the hard palate stops.

Palatalization is an area that has been challenging to formalize properly. For some very helpful current proposals, see Clements and Hume 1995.^b

Labialization

Rounded vowels such as *u* also sometimes influence consonants around them, causing them to become rounded. This is known as **labialization**. Back consonants are especially susceptible.

In some cases, the lips are simply rounded because the following vowel has lip rounding, as in English *tour* (the *t* is pronounced with rounded lips). In other cases, the consonants may be pronounced with a *w* off-glide before the round vowel, although this situation is apparently less common than simple rounding of the lips.

Key Concepts

palatalization (in the broad sense)

labialization

15.3 Try it for yourself with Ukrainian

Give the underlying form of each suffix and give the underlying form of each stem. Give the necessary phonological rule.⁹⁶ Indicate whether the rule appears to be structure-preserving or not, based on these very limited data.

	Nom. Sg.	Gen. Sg.	Loc. Sg.	
1.	tʲilo	tʲila	tʲilʲi	<i>body</i>
2.	koleso	kolesa	kolesʲi	<i>wheel</i>
3.	ozero	ozera	ozerʲi	<i>lake</i>
4.	slovo	slova	slovʲi	<i>word</i>

15.4 Try it for yourself with Paresí

Give the underlying form of each prefix and give the underlying form of each stem. Give the necessary phonological rule.⁹⁷ Indicate whether the rule appears to be structure-preserving or not. [Some phonetic detail has been omitted.]

	<i>your ...</i>	<i>my ...</i>	
1.	hikʲano	nokano	<i>arm</i>
2.	himʲa	noma	<i>cloth</i>
3.	himʲeli	nomeli	<i>skin</i>
4.	hihʲani	nohani	<i>house</i>

^b G. N. Clements and Elizabeth V. Hume (1995) The internal organization of speech sounds. In John A. Goldsmith, ed., *The handbook of phonological theory*, Blackwell, Cambridge, Mass. and Oxford, pp. 245-306.

15.5 Try it for yourself with Seri

Consider the morphemes below which have allomorphs that are different only in the feature of [+round]. Give the phonological rule that is appropriate in its simplest form. How can this rule be prevented from applying to *s* and *t*?⁹⁸

	<i>did ... / was ...?</i>	<i>s/he will ...</i>	<i>s/he was going to ...</i>	
1.	toop	soop kaʔa	soop ta	<i>make basket</i>
2.	tiim	siim kaʔa	siim ta	<i>sleep</i>
3.	tʰit	sʰit kaʔa	sʰit ta	<i>arise</i>
4.	tis	sis kaʔa	sis ta	<i>be raw</i>
5.	itoon	soon kaʔa	soon ta	<i>carry (them)</i>
6.	itkoof	skoof kaʔa	skoof ta	<i>rob (him/her)</i>
7.	taaix	saaix kaʔa	saaix ta	<i>dizzy</i>
8.	itamx ^w	siimx ^w k ^w aʔa	siimx ^w ta	<i>hunt (it)</i>
9.	tæk	sæk kaʔa	sæk ta	<i>sow (unspec. object)</i>
10.	itak ^w	siik ^w k ^w aʔa	siik ^w ta	<i>kill (it/him/her)</i>
11.	tiipχ	siipχ kaʔa	siipχ ta	<i>lay egg</i>
12.	itiisχ ^w	siisχ ^w k ^w aʔa	siisχ ^w ta	<i>hide (it/him/her)</i>
13.	k-atikpan	<i>who works</i> (morpheme break indicated)		
14.	k ^w -k ^w -atikpan	<i>who works like him/her</i>		
15.	k ^w -s-atikpan	<i>s/he will work like him/her</i>		

15.6 Try it for yourself with Modern Greek

The words are given as they appear when followed by a vowel-initial word. Sometimes a word has more than one possible pronunciation. Account for the allomorphy; two optional rules will be needed. Present the results in the form of a discussion, with argumentation and evidence. Be concise but also clear. (The rules *do* have some complications.) An asterisk means that the form is not correct. It is not possible to include all of the words that one can't say in Greek, but the ones included are important as a sample of data that may be relevant.⁹⁹

- | | | |
|-----|--|--------------------------------|
| 1. | 'klistika ~ 'klistika | <i>I was shut</i> |
| 2. | 'ferθika ~ 'ferθika | <i>I was brought</i> |
| 3. | pe'taxtika ~ pe'taxtika | <i>I was thrown</i> |
| 4. | tre'laθika ~ tre'laθika | <i>I became insane</i> |
| 5. | ro'tiθika ~ ro'tiθika | <i>I was asked</i> |
| 6. | simba'θo ~ *sɨmba'θo ~ *sɨmba'θo | <i>I like</i> |
| 7. | sindi'ro | <i>I support</i> |
| 8. | ipox'eθika ~ ipox'eθika | <i>I promised</i> |
| 9. | pa'θeno ~ *pɔ'θeno | <i>I suffer</i> |
| 10. | po'li ~ po'li ~ *pɔ'li | <i>much</i> |
| 11. | 'liɣo ~ 'liɣo ~ *liɣo | <i>little</i> |
| 12. | ni'si ~ ni'si ~ *ni'si | <i>island</i> |
| 13. | 'skoni ~ 'skoni | <i>dust</i> |
| 14. | para'lipo ~ para'lipo | <i>I omit</i> |
| 15. | 'kɨrii ~ *'kɨrii | <i>gentlemen</i> |
| 16. | krif'to ~ *krɨf'to | <i>I shall hide myself</i> |
| 17. | epi'strefo ~ epɨ'strefo | <i>I give or come back</i> |
| 18. | a'nixtik'e ~ a'nixtik'e ~ a'nixtik'e ~ *a'nixtik'e | <i>it was opened</i> |
| 19. | nix'isu 'kopik'e ~ nix'isu 'kopik'e ~ nix'isu 'kopik'e
~ nix'isu 'kopik'e | <i>Your fingernail is cut.</i> |

Feedback for Chapter 15

15.1 Yaqui⁹⁴

The alternation is one of palatalization, with the [t] becoming [tʃ] before [i].

15.2 Karuk⁹⁴

The alternation is one of palatalization, with [s] becoming [ʃ] after [i]. The process is not structure-preserving since [ʃ] does not appear in underlying forms.

15.3 Ukrainian⁹⁵

The underlying forms of the affixes are: {-o}, {-a}, and {-i}.

The underlying forms of the stems are: {tʲil}, {koles}, {ozer}, and {slov}, so far as we can tell.

Rule: A consonant is palatalized (has a *j*-offglide) preceding *i*.

The rule is not structure-preserving since some of the outputs do not appear in underlying forms.

15.4 Paresi⁹⁷

The underlying forms of the prefixes are: {hi-} and {no-}.

The underlying forms of the stems are {kano}, {ma}, {meli}, and {hani}.

Rule: A consonant is palatalized (has a *j*-offglide) following *i*.

The rule is not structure-preserving.

15.5 Seri⁹⁷

The labialization rule spreads the feature [+round] to an immediately following consonant.

The rule is structure preserving: it does not spread the feature [+round] to *s* and *t* because the only rounded consonants in underlying forms are the back consonants, as is evident from their usage in roots. If one did not stipulate this, one would have to complicate the rule and specify that it spreads the feature [+round] only to Dorsal consonants.

15.6 Modern Greek

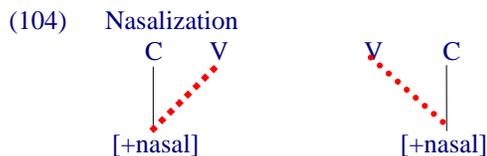
⁹⁹ Two rules are needed:

Palatalization: The consonants *n* and *l* palatalize before *i* except when they follow a consonant. Other consonants do not palatalize in this position. This rule is optional.

Devoicing of vowels: High vowels (*i* and *u*) devoice when they occur between two voiceless sounds and are not stressed. This rule is optional.

CHAPTER 16 - NASALIZATION

The feature [+nasal] characterizes some consonants, such as *m*, in that they are produced with air escaping through the nose. Vowels can also be produced with the feature [+nasal]. For example, many speakers of English slightly nasalize the vowel of a word such as *can*, and some do it more than others. This process of nasalization, where a sound assimilates to a neighboring sound with respect to the feature nasal, is very common. In some languages it is more noticeable than in others. It might be formalized as follows (depending on whether the nasal consonant precedes or follows the vowel):



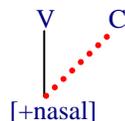
In some languages, the nasality of a vowel affects neighboring consonants. Consider the following data from Waorani:

(105)

a-bo	<i>I see</i>
a-kĩ-mo	<i>I shall see</i>
a-dã	<i>she sees</i>
a-kĩ-nã	<i>she will see</i>

The first person singular suffix has two allomorphs, [-bo] and [-mo]; and the third person singular feminine suffix has two allomorphs: [-dã] and [-nã]. Assuming that the underlying forms of these suffixes have oral consonants, we can posit a rule nasalizing consonants when they follow nasalized vowels.^a

(106) Consonants become [+nasal] following [+nasal] vowels.



In Copainalá Zoque, a nasal consonant merges with a non-consonantal sonorant that follows it to produce a nasalized version of that sonorant. The first person singular possessive prefix (*my*) is a nasal consonant (see the exercise in chapter 11).^b

(107)

Unpossessed	<i>my ...</i>	
jomo	ʃomo	<i>wife</i>
waka	w̃aka	<i>basket</i>
hɔjah	h̃ɔjah	<i>husband</i>

In Kikongo, the presence of a nasal consonant in a stem affects the nasality of coronal consonants in suffixes. Nasality is spreading to the suffix. Thus the morpheme for perfective active has two allomorphs: [-idi] and [-ini]; and the perfective passive has two allomorphs: [-ulu] and [-unu].

(108) Stems without nasals:

n-suk-idi	<i>I washed</i>
n-suk-ulu	<i>I was washed</i>
m-bud-idi	<i>I hit</i>

^a We are uncertain about the analysis. The data provided in William R. Merrifield et al., eds. (1987) *Laboratory manual for morphology and syntax*, Dallas, SIL, contain examples with [t] following nasalized vowels.

^b The merger, or coalescence, of two sounds is more complicated than the simple spreading of a feature from one to the other. A formalism for this is not presented here.

Stems with nasals:	
tu-kun-ini	<i>we planted</i>
tu-nik-ini	<i>we ground</i>
masangu ma-nik-unu	<i>the maize was ground</i>

Key Concepts

[nasal]

nasalization

16.1 Try it for yourself with Lalana Chinantec

Assuming that the underlying form of the first person plural inclusive suffix is {-ra}, give the rule(s) needed to account for the allomorph [-nã]. Give the rule(s) in prose and in formal notation.¹⁰⁰

- | | | | |
|--------------|----------------------------|--------------|-------------------------------|
| 1. zo:ʔra | <i>we (incl.) practice</i> | 5. ʔnũ:ʔʔnnã | <i>we (incl.) tie him</i> |
| 2. kudʒeʔnnã | <i>we (incl.) send</i> | 6. ʔu:nnã | <i>we (incl.) pour on him</i> |
| 3. ʔmĩ:ra | <i>we (incl.) mend</i> | 7. zuʔnnã | <i>we (incl.) fold over</i> |
| 4. ʔi:ʔra | <i>we (incl.) receive</i> | | |

Feedback for Chapter 16

16.1 Lalana Chinantec

¹⁰⁰ Nasalization of Consonants: A consonant (perhaps only coronals, perhaps only the coronal sonorant) becomes nasal following a nasal consonant.

Nasalization of Vowels: A vowel becomes [+nasal] following a [+nasal] consonant.

Perhaps these can be combined into one rule: A segment becomes [+nasal] following a [+nasal] consonant. Assuming this, the rule could be formalized as follows (with a dotted line going from the feature [+nas] to the X). This rule would have to be apply more than once — iteratively — in words like *we pour on him*.

C	X	(where X = C or V)
[+nas]		

CHAPTER 17 - MANNER ASSIMILATION

Consonants may take on features of neighboring sounds. One common change is for the feature **[continuant]** to spread to contiguous sounds. Sounds that are [+continuant] include those in which the air stream is not completely blocked at the primary constriction in the vocal tract (Chomsky & Halle 1968:317). Vowels, of course, are [+continuant], as are fricatives. Sounds that are [-continuant] include those in which the air stream is prevented from escaping through the oral cavity, which includes oral stops, affricates, and nasal stops, as well as *l* (by this somewhat controversial definition), because the air stream is blocked at the primary stricture.

(109)	[+continuant]	[-continuant]
	Vowels, Glides	
	Fricatives ^a	Oral Stops, Glottal Stop, Affricates
	Flaps, Trills	Nasal Stops, Lateral Stop

A common example of [+continuant] spreading to a consonant is when a stop becomes a fricative either before or after a vowel or between vowels. For example, in Salasaca Quichua, the Locative suffix {-bi} has the allomorph [-βi] when it follows a vowel-final morpheme, as in [wasɪβi] (house-Loc). And the Plural suffix {-guna} has the allomorph [-ɣuna] when it follows a vowel-final morpheme, as in [tajtayuna] (father-Pl).

In Spanish, some obstruents are pronounced as fricatives after vowels and flaps, e.g. the *d* in *nada* ‘nothing’ and *arder* ‘to burn’; but as stops when they follow nasals or a lateral, as in *andar* ‘to go’ and *balde* ‘bucket’.

In some languages, the combination of [+continuant] and [coronal] results in an r-like continuant instead of a fricative. In American English, for example, the consonants *t* and *d* are both pronounced as a ‘flap’ when they occur between vowels: *city*, *Heidi*.

Key Concept

[continuant]

^a Strictly speaking, this may be limited to the non-lateral fricatives.

17.1 Try it for yourself with Ejagham

Give the rule(s) necessary to account for the alternations, using the features in the table given in this chapter. You should be able to do this in prose and also in formal notation. You will need to consider carefully about the underlying form of the root. Discuss how you came up with your decision. Assume that the underlying form of the prefix for *I* is {n-}. Provide a derivation for the words *I broke* and *I danced*.¹⁰¹

	<i>I</i> ...	<i>he</i> ...	
1.	mbən	abən	<i>broke</i>
2.	mbən	aβən	<i>danced</i>
3.	mbɛ	abɛ	<i>escaped</i>
4.	mbɛ	aβɛ	<i>planted</i>
5.	ndi	adi	<i>ate</i>
6.	ndi	ari	<i>cried</i>
7.	ndaŋ	adaŋ	<i>tried</i>
8.	ndaŋ	araŋ	<i>touched</i>

Feedback for Chapter 17

17.1 Ejagham¹⁰¹

Rule 1: The feature [-continuant] spreads from a consonant to an immediately following consonant. (Fricatives and flaps are changed into stops.)

C C (dotted line needed from the feature to the second consonant)
|
[-cont]

Rule 2: A nasal consonant assimilates in place to an immediately following consonant.

C C (dotted line needed from the Place node to the first consonant)
|
Place

The underlying form of the stem is more clearly revealed in the second column, when it follows a vowel. In that column, we see two different forms for the verbs *break* and *dance*, for example, whereas in the first column the differences between these two verbs are obscured (by the spreading of the feature [-cont], as a matter of fact).

Derivations: (the UF of the prefix is assumed to be n-)

	<i>I broke</i>	<i>I danced</i>	<i>I cried</i>
UF	n - bən	n - βən	n - ri
Manner Assim.	nbən	nbən	ndi
Place Assim.	mbən	mbən	ndi
SF	mbən	mbən	ndi

The rules apply in all three of these words even though they only actually make a change in certain instances.

CHAPTER 18 - VOWEL CHANGES

Vowels sometimes take on features of neighboring consonants. We have already discussed how they can become nasalized contiguous to nasal consonants.

Sometimes vowels also are changed to be higher or lower, more front or more back, depending on the point of articulation of a contiguous consonant. In Seri, for example, an *i* is backed and lowered considerably if it precedes a uvular fricative (a sound which is produced in the back of the throat without raising the back of the tongue). Therefore a word such as {jiiχ} is pronounced [ʃiiχ].

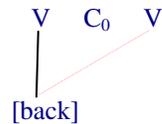
A vowel can also assimilate to a vowel in another syllable. This type of assimilation has been called vowel harmony. For example, in Hungarian, [u] (back rounded) becomes [y] (front rounded) when the preceding syllable has a front vowel, but not when the preceding syllable has a back vowel.^a (The vowel *a* in these data represents a vowel that is farther back than the more central vowel usually represented by the symbol *a* in this text.)

(110) *1 plural Subjunctive*

roo-juŋk	scold
kap-juŋk	obtain
tud-juŋk	know
tæj-yŋk	put
vid-jyŋk	carry
fækyd-jyŋk	recline

The rule might be stated tentatively as:^b

- (111) Backness Harmony: A vowel assimilates in backness to the vowel in the immediately preceding syllable.



This rule is given in a fairly general form, and predicts that vowels other than *u* will also assimilate in backness. If this is not true, then the rule must be modified. But other Hungarian data do show that *o* also becomes [-back] in the same environment.

(112) *3 singular Subjunctive*

roo-jon	scold
kap-jon	obtain
tud-jon	know
fækyd-jøn	recline

The rule also predicts that the back vowel *a* will also be fronted when the preceding syllable contains a front vowel. And it is.

^a Facts from situations like this in a language that has central vowels are usually similar, suggesting that vowels should be classified phonologically as being either [+back] or [-back], where so-called ‘central’ vowels are [+back]. That is, the IPA labels ‘front’, ‘central’, and ‘back’—a three-way distinction, are replaced by a binary distinction in the phonology which is [-back] and [+back]. The phonological feature [back] therefore must be clearly distinguished from the phonetic label ‘back’.

^b The C subscript 0 is a way to indicate that the number of consonants is irrelevant.

- (113) *1 singular Subjunctive*
- | | |
|---------|---------------|
| roo-jak | <i>scold</i> |
| kap-jak | <i>obtain</i> |
| tæj-æk | <i>put</i> |
| vi-j-æk | <i>carry</i> |
| kær-jæk | <i>ask</i> |

Now for the wrinkle. Sometimes the *o* also becomes [-round] as well as [-back]. Instead of just becoming [ø] (front rounded) as the Backness Harmony rule predicts, it becomes [æ] (low front unrounded). Compare the data below with those in (113)—presumably the underlying form of the suffix is *-jon*.

- (114) *3 singular Subjunctive*
- | | |
|---------|--------------|
| tæd-jæn | <i>put</i> |
| vid-jæn | <i>carry</i> |

If we assume that Backness Harmony rule (111) takes care of the fronting, all we need to do now is have a rule that in addition to that rule makes *o* into an unrounded vowel in the right context, and low.

The Backness Harmony rule applies to all vowels (so far as we know at this point), but the Roundness Harmony rule applies only to [-high] vowels (namely *o*) and only when the preceding syllable contains a front vowel. (Note that the sequences *a...u*, *a...o*, *e...y*, and *i...y* are found above, with no rounding harmony having taken place.)

The combination of the application of these two rules, Backness Harmony and Roundness Harmony, to *o* almost yields the correct result. They should give the vowel [e], but the result is actually [æ]. So the situation is slightly more complicated.^c

- (115) Roundness Harmony: Nonhigh vowels assimilate in rounding to a front vowel in the immediately preceding syllable.

Since Backness Harmony and Roundness Harmony affect different subsets of vowels and cause distinct changes (one fronts, one unrounds), we consider them as two separate and independent phonological rules of Hungarian.

Vowel Features

The discussion above uses certain features to refer to vowels. As mentioned, the feature [back] is commonly used to distinguish between front vowels on the one hand, and central and back vowels on the other.

- (116)

[-back]	[+back]
Front vowels	Central & Back Vowels
Eg.: i e æ y	Eg.: u o a ʊ ɨ

The phonological features [high] and [low] have been used to distinguish close, near-close, near-open, and open vowels.^d

^c This discussion is all quite tentative in the absence of a complete set of facts. The vowel system of Hungarian would need to be looked at in more detail.

^d The term ‘close’ is standard terminology, but the term ‘near-close’ is not. “Near-close” vowels like [ɪ] are called “mid-centralized close” vowels in the IPA system. See *Handbook to the International Phonetic Association: a guide to the use of the International Phonetic Alphabet* (1999) Cambridge University Press, Cambridge.

(117)

	[high]	[low]	
Close and near-close vowels	+	–	i y ɯ u ɪ ʊ
Close-mid, mid, and open-mid vowels	–	–	e ø ʏ o ə ɛ ʌ ɔ
Near-open and open vowels	–	+	æ a ɑ

The feature [advanced tongue root], or [ATR] is commonly used to distinguish close from near-close, and close-mid from open-mid vowels. (See Appendix A for more discussion.)^e

(118)

close, close-mid	i u e o	[+ATR]
near-close, open-mid, open	ɪ ʊ ɛ ɔ	[–ATR]

Some languages exhibit vowel harmony with respect to the feature [ATR]. This can be seen in Yoruba where the nominalizing prefix takes on the same value of ATR as the vowel of the next syllable. (Ignore the alternation in rounding.)

(119)	Noun	Verb	
	ɔdɛ	dɛ	<i>hunt</i>
	ɛro	ro	<i>think</i>
	ɛɔ	ɛɔ	<i>fabricate</i>
	ɔta	ta	<i>shoot</i>
	oku	ku	<i>die</i>

Key Concepts

vowels assimilating to consonants

vowel harmony

[back]

[high]

[low]

[ATR]

^e It is also noted that the IPA has some special diacritics for marking [±ATR], although the distinct letters presented here are often used in actual practice.

18.1 Try it for yourself with Lamba

The Applied suffix has two allomorphs. What are they?¹⁰²

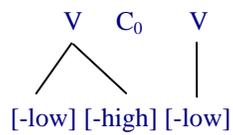
	Past	Passive	Applied	Reciprocal	
1.	tʃita	tʃitwa	tʃitila	tʃitana	<i>do</i>
2.	tula	tulwa	tulila	tulana	<i>dig</i>
3.	tʃeta	tʃetwa	tʃetela	tʃetana	<i>spy</i>
4.	soŋka	soŋkwa	soŋkela	soŋkana	<i>pay tax</i>
5.	pata	patwa	patila	patana	<i>scold</i>
6.	tʃesa	tʃeswa	tʃesela	tʃesana	<i>cut</i>
7.	kosa	koswa	kosela	kosana	<i>be strong</i>

What vowels occur in the syllables preceding each of these allomorphs?¹⁰³

Which of these allomorphs has the most restricted (and therefore most explainable) distribution?¹⁰⁴

Which allomorph is the best choice for the underlying form?¹⁰⁵

Complete the following rule.¹⁰⁶



18.2 Try it for yourself with Turkish

Consider only the vowel alternations (a chart of useful features is provided below the data). Two fairly simple rules are needed to account for the following data (plural suffix and various case suffixes). What are they? (You will not be able to determine the exact underlying form of the suffixes at this point, but you will discover some facts about them.)¹⁰⁷

You might start this investigation by listing the kinds of alternations that occur in the suffixes and the kinds that do not. Provide derivations for the Genitive forms (singular and plural) of *tooth* and *slave*; include a line for the rule that palatalizes a lateral consonant before a front vowel. Assume that the underlying form of the Plural is {-lar} and of the Genitive is {-in}.¹⁰⁸

	<i>tooth</i>	<i>hand</i>	<i>rose</i>	<i>village</i>	<i>daughter</i>	<i>stalk</i>	<i>slave</i>	<i>end</i>
Sg. Nom.	diʃ	eɫ	ʃyɫ	cøj	kuuz	sap	kul	son
Acc.	diʃi	eɫi	ʃyɫy	cøjy	kuuzu	sapɯ	kulu	sonu
Dat.		eɫe		cøje		sapa		sona
Gen.	diʃin	eɫin	ʃyɫyn	cøjyn	kuuzun	sapɯn	kulun	sonun
Pl. Nom.	diʃɫer	eɫɫer	ʃyɫɫer	cøjɫer	kuuzlar	saplar	kullar	sonlar
Acc.		eɫɫeri		cøjɫeri		saplarɯ		sonlarɯ
Dat.		eɫɫere		cøjɫere		saplara		sonlara
Gen.	diʃɫerin	eɫɫerin	ʃyɫɫerin	cøjɫerin	kuuzlarɯn	saplarɯn	kullarɯn	sonlarɯn

	[-round]		[+round]	
	[-back]	[+back]	[-back]	[+back]
[+high]	i	u	y	u
[-high]	e	a	ø	o

18.3 Try it for yourself with Turkish again

Consider the following data. Can you account for all of these data? If not, tell what is the problem.¹⁰⁹

	<i>come</i>	<i>laugh</i>	<i>see</i>	<i>take</i>	<i>run</i>
<i>to ...</i>	geɫ	ʃyɫ	gøɾ	al	kos
<i>I ...</i>	geɫim		gørym	alum	kosum
<i>I am ... ing</i>	geɫijorum	ʃyɫyjorum	gøryjorum	alɯjorum	kosujorum
<i>he is ... ing</i>	geɫijor		gøryjor	alɯjor	kosujor

Feedback for Chapter 18

18.1. Lamba

¹⁰² The allomorphs are [-ila] and [-ela].

¹⁰³ The allomorph [-ila] follows syllables with [i], [u] and [a]; the allomorph [-ela] follows syllables with [e] and [o].

¹⁰⁴ The allomorph [-ela] is the most restricted. It only follows syllables with close-mid vowels, whereas [-ila] occurs following syllables with close vowels and also near-open vowels.

¹⁰⁵ The allomorph [-ila], because we could not explain why it follows syllables with open vowels.

¹⁰⁶ Add a dotted line from the [-high] feature of the first V to the second V.

18.2 Turkish

¹⁰⁷ The plural suffix only shows the alternation between **e** and **a**. The other suffixes show alternations between front rounded, front unrounded, back rounded, and back unrounded. None of the alternations is between high and non-high vowels.

¹⁰⁸ Derivations:

UF	kul-in	kul-lar-in	diɟ-in	diɟ-lar-in
Roundness Spread	kulun	kullarin	diɟin	diɟlarin
Backness Spread	kulun	kullarun	diɟin	diɟlerin
Lateral Palatalization	—	—	—	diɟʎerin
SF	kulun	kullarun	diɟin	diɟʎerin

18.3 Turkish

¹⁰⁹ The suffix {-im} is no problem since it does exactly what we expect. The first vowel of the suffix {-iɟor} also changes as expected, but the second vowel changes neither for backness nor for roundness. Since it is not a high vowel, we don't expect it to change for roundness, but we do expect it to change for backness. It is a problem if we expect our rule of Backness Spreading to apply to all suffixes, as we saw happening in the noun data. (The solution to this situation has been proposed as following: some suffixes are specified underlyingly as being [\pm back], but some suffixes are not specified for this feature. The feature spreads only to those suffixes that are not underlyingly specified.)

CHAPTER 19 - PLACE ASSIMILATION (NON-NASALS)

Consonants sometimes assimilate partially or wholly to neighboring consonants. Consider the following data from Seri.

(120)	i-s-pii	<i>s/he will taste it</i>	i-ʃ-ʃain	<i>s/he will fence it in</i>
	i-s-tis	<i>s/he will point at it</i>	i-s-mis	<i>s/he will resemble it</i>
	i-s-kaa	<i>s/he will look for it</i>	i-s-naix	<i>s/he will grab it</i>
	i-s-sii	<i>s/he will smell it</i>	i-s-xast	<i>s/he will step on it</i>

The future prefix has two allomorphs in these data: [s] and [ʃ]. The allomorph [ʃ] occurs only before [ʃ]. The morpheme obviously has an underlying form containing an *s* and it assimilates to the point of articulation of a following alveopalatal consonant. A rule such as the following can be written:

(121) *s* becomes ʃ before ʃ

If this rule can be stated more generally and still be accurate, this would be desirable. We might have thought that perhaps we could have the rule be more general in the following way:

(122) *s* becomes identical to a following fricative

But (122) is inaccurate because it claims that *s* should become *x* before *x*, but it does not. Rule (121) is correct even though it is very specific.

The following data show another example of assimilation.

(123)	i-[m]-ataχ	<i>who didn't go</i>
	po-[m]-ataχ	<i>if s/he doesn't go</i>
	t-[m]-ataχ	<i>if s/he didn't go</i>
	s-[m]-ataχ	<i>who will not go</i>
	k-[w̃]-ataχ	<i>don't go!</i>

The negative morpheme shows up as [m] in these forms, except when it follows a *k*. After *k*, a velar consonant, it becomes a velar consonant, a nasalized *w*. The rule (informally stated) is:

(124) *m* becomes a nasalized labiovelar approximant after a velar consonant

The Place features of the *k* are spreading to the nasal consonant, but it remains labial even though it is also velar.

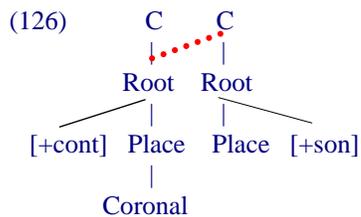
The feature [lateral] may also spread to adjacent consonants (sometimes even if a vowel is intervening, an important fact that we will ignore here). In Teralfene Flemish, the suffix {-n} assimilates to a preceding lateral; underlying {spe:l-n} becomes [spe:l̥] (the final consonant is also syllabic). This happens when the negative prefix *in-* of English is added to a stem such as *legible* — *illegible*. It has been proposed that the feature [lateral] is dependent on the Coronal node (see Appendix A). Therefore if the Place features spread, the feature [lateral] will also automatically spread.

Often an assimilation is very slight and only noticed if the words have been described with a narrow phonetic transcription. For example, the ʃ of Seri is typically retroflexed, but when it precedes *t*, it loses its retroflexion. Also, the *s* which is usually alveolar in Seri, is made dental when it follows the (usually) dental *t*.

But the assimilation may also be very drastic, even where a consonant changes to become totally identical to an adjacent consonant which is very different from it. Consider the following data from Hungarian:

- (125) *3 sg. Subjunctive*
- | | |
|-----------|---------------|
| roo-jon | <i>scold</i> |
| kap-jon | <i>obtain</i> |
| tud-jon | <i>know</i> |
| væzæf-ʃæn | <i>lead</i> |
| væs-sæn | <i>perish</i> |
| huuz-zon | <i>pull</i> |

The *j* becomes an *s* following *s*, an *ʃ* following *ʃ*, and a *z* following *z*. The generalization appears to be that *j* assimilates totally to a preceding coronal continuant. A complete assimilation of this sort is described formally by the use of the Root node which dominates all of the other features. (The rule below specifies that the first consonant must be a coronal continuant and that the second consonant must be a sonorant; these features may or may not be all that are necessary to correctly limit the rule.)



In many languages, including Madija, /w/ is pronounced as a voiced bilabial fricative, [β], before front vowels and [w] before back vowels. (In Madija, /w/ does not occur before /o/. The front vowel is essentially fronting the back velar approximant.

- (127)
- | | | | |
|----------------------|-------------------------|--------|---------------------|
| [w]ap ^h a | <i>monkey (species)</i> | ha[β]i | <i>trail</i> |
| a[w]a | <i>tree</i> | [β]eni | <i>river</i> |
| [w]api | <i>many</i> | [β]i | <i>dig</i> |
| ho[w]a | <i>shout</i> | o[β]i | <i>extinguished</i> |

Vowels may also assimilate to an adjacent consonant, as seen in chapter 18.

Key Concept

place assimilation

19.1 Try it for yourself with Xavante

What is the underlying form of the prefix for second person possessor?¹¹⁰ Give the phonological rule necessary to account for the allomorphy, using formal notation.¹¹¹

		<i>your</i>	
1.	du	ʔaddu	<i>stomach</i>
2.	ʔra	ʔajʔra	<i>child</i>
3.	hiʔrãti	ʔajhiʔrãti	<i>knee</i>
4.	tɔ	ʔattɔ	<i>eye(s)</i>
5.	ʔwa	ʔajʔwa	<i>tooth</i>
6.	ʃɛ:rɛ	ʔajʃɛ:rɛ	<i>hair</i>
7.	pɑ:ra	ʔajpɑ:ra	<i>foot</i>
8.	bã:bã	ʔajbã:bã	<i>father</i>

19.2 Try it for yourself with Cairo Arabic

What is the underlying form of the prefix which appears in the second column?¹¹² Give the rule necessary to account for the allomorphy.¹¹³

		<i>the...</i>	
1.	naas	innaas	<i>people</i>
2.	kursi	ilkursi	<i>chair</i>
3.	dars	iddars	<i>lesson</i>
4.	baab	ilbaab	<i>door</i>
5.	sitt	issitt	<i>woman</i>
6.	geeb	ilgeeb	<i>pocket</i>
7.	loon	illoon	<i>color</i>
8.	ʃaʔʔa	iʃʃaʔʔa	<i>apartment</i>
9.	nimra	innimra	<i>grade</i>
10.	satr	issatr	<i>line</i>
11.	ʃanta	iʃʃanta	<i>bag</i>
12.	mudarris	ilmudarris	<i>teacher</i>
13.	qism	ilqism	<i>section</i>
14.	waagib	ilwaagib	<i>assignment</i>

19.3 Try it for yourself with Selayarese

Assume that the word for *six* below ends in a nasal consonant underlyingly; it is irrelevant whether you know what nasal consonant that is. Give the rule(s) needed to account for the data. Provide a derivation for the phrases *six gardens* and *six bananas*.¹¹⁴

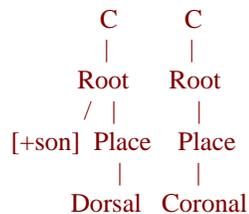
- | | | |
|----|-------------|--------------------|
| 1. | annam poke | <i>six spears</i> |
| 2. | annan tau | <i>six persons</i> |
| 3. | annan ɽupa | <i>six kinds</i> |
| 4. | annaŋ jaran | <i>six horses</i> |
| 5. | annaŋ koko | <i>six gardens</i> |
| 6. | annal loka | <i>six bananas</i> |

Feedback for Chapter 19

19.1 Xavante

¹¹⁰ The underlying form is {ʔaj}.

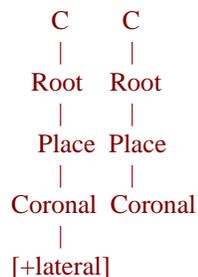
¹¹¹ The phonological rule is an assimilation rule: *j* assimilates totally to a following coronal consonant. The rule almost certainly needs to be restricted to apply only to *j*, hence the features [+son], Dorsal. *Note: a dotted line needs to be drawn between the top left “C” and the Root node on the right, to indicate the total assimilation in every feature.*



19.2 Cairo Arabic

¹¹² The underlying form is {il}.

¹¹³ The phonological rule is an assimilation rule: /l/ assimilates totally to a following coronal consonant. The following rule is formulated explicitly to only apply when the first consonant is /l/ may be adequate in terms of features, or it may need to delimit the first consonant in some way *Note: a dotted line needs to be drawn between the top left “C” and the Root node on the right, to indicate the assimilation.*



19.3 Selayarese

¹¹⁴ The phonological rule is an assimilation rule: a nasal assimilates to the place of a following consonant. If that consonant is a lateral, the nasal becomes a lateral. This should follow automatically if the feature [lateral] is dependent on the Coronal node, as mentioned in the text. This is a case where correct feature geometry should give the correct result, making it unnecessary to have a separate rule for assimilation to /l/ or additional features. We also assume that when the nasal becomes [+lateral], it must become [-nasal].

UF	annan koko	annan loka
Assim.	annaŋ koko	annal loka
SF	annaŋ koko	annal loka



Note: a dotted line needs to be drawn between the top left “C” and the Place node on the right, to indicate the assimilation.

CHAPTER 20 – DISSIMILATION AND THE OBLIGATORY CONTOUR PRINCIPLE

The phonological processes which we have considered in the past several chapters have all been assimilatory. Nevertheless, examples of dissimilation are also found in languages, although they are much less common than assimilatory ones. Dissimilation is the process by which two similar sounds become less like each other.

A possible example of dissimilation from Seri is the change from /ʎ/ to /ʃ/ when a suffix with /ʎ/ immediately follows.^a

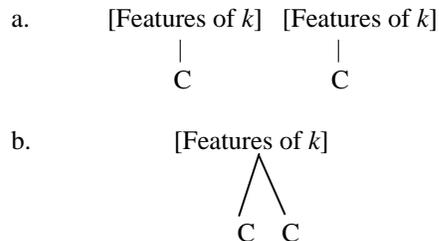
(128) $ka:p\text{ʎ} + i\text{ʎ} \rightarrow ka:p\text{ʃ} + i\text{ʎ}$ *suffocate*
 $knop\text{ʎ} + i\text{ʎ} \rightarrow knop\text{ʃ} + i\text{ʎ}$ *sink*

Kuman also has a rule of lateral dissimilation. When a suffix containing *l* is added to a stem that ends in *l*, the first *l* becomes [r]. Thus, the root {jal} changes to [jar] when it is followed by the suffix {al}.

In North Puebla Nahuatl, a *k* dissimilates to the velar fricative [x] when it precedes another *k*. Thus *okikakke* ‘they heard it’ comes out as [okikaxke]. Similarly, the affricate [tʃ] dissimilates to [ʃ] when it precedes tʃ. Thus the morpheme *ne:tʃ* becomes [ne:ʃ] before the root {tʃantia} ‘reside’.

Dissimilation has generally been formalized in recent years as the loss of a certain feature specification which is triggered by the presence of an identical feature in the environment. Here’s how the reasoning has gone. First, consider the matter of a long *k* sound. How would this be represented formally? Is it two consonant positions that each independently has the features of *k* (as in 129a), or is it two consonant positions that share the features of *k* (as in 129b)?

(129)



This may seem like just a little difference, but the issue is quite important. Does a language contain both kinds of structures? Do they contrast? If so, how does a speaker know the difference? After considerable debate during the past couple of decades, the general answer has been quite clearly that the structure in (129b) is the correct one, or at least the common one, morpheme-internally. The name of the universal principle is the **Obligatory Contour Principle**, or OCP, for short. This name came from the original context in which this was proposed, which had to do with tones.^b If a three syllable word had the tones High-Low-High pronounced on them, the tones would be just those: H-L-H. But if a three syllable word had high tone on each syllable, the OCP says that it is actually one high tone that is shared by the three syllables. The tone pattern has to have a “contour” — it can’t be H-H-H, that is, without a contour.

So what does this have to do with dissimilation? Consider again the Nahuatl facts mentioned above. The root is {kak} and a suffix is added that begins with /k/. So something that looks just like (129a) is created by the word formation rules of the language. Nevertheless, this is still a violation of the Obligatory Contour Principle. What do languages do? Actually, there are various kinds of ‘repair strategies’. One of

^a This rule is very “deep” in the phonology and is not immediately obvious.

^b John A. Goldsmith (1979) *Autosegmental phonology*. [1976 Ph.D. Dissertation, MIT.] New York: Garland Press. The OCP was stated as: “Adjacent identical elements are prohibited.”

these is simply to merge the features, and make them into (129b) formally. Another strategy is to eliminate one of the offending features. And this seems to be what is going on with cases of dissimilation: a feature is delinked because of pressure from the OCP.

The loss of a feature may then be compensated for by the insertion of some default feature. For example, in the North Puebla Nahuatl case the feature [–continuant] on the first *k* is dropped in the presence of the feature [–continuant] of an affix *k*. The assumption is then that some rule supplies the feature [+continuant] in this language in those cases where the consonant is not otherwise specified for this feature.

Key Concept

dissimilation

20.1 Try it for yourself with Tzeltal

The prefix in the data below indicates third person; the suffix, which has two allomorphs, indicates inanimate possessor (compare the first word with [spakʔ] *his cloth*). Describe what appears to be going on here.¹¹⁵ What feature is being delinked?

	Root	<i>its</i>	
1.	pakʔ	spakʔul	<i>cloth</i>
2.	wits	switsul	<i>hill</i>
3.	lew	slewul	<i>fat</i>
4.	lum	slumil	<i>ground</i>
5.	poʃ	spoʃil	<i>medicine</i>
6.	siʔ	siʔul	<i>firewood</i>

20.2 Try it for yourself with Lealao Chinantec

The words [ga] and [ka] indicate Recent Past. The word [g^wa] (mid tone) is a second person directional imperative. The words [g^wá] and [k^wá] (high tone) are used to indicate Optative mood. Choose an underlying form for each of these three morphemes and describe what is going on.¹¹⁶ What feature is being delinked?

1.	ga hme: ta	<i>he did work</i>
2.	ka daʔ hme: ta	<i>they did work</i>
3.	ka daʔ tã:j	<i>they fell</i>
4.	ga tã:j	<i>he fell</i>
5.	g ^w a hme: ta	<i>go do work!</i>
6.	g ^w a ba	<i>go strike it!</i>
7.	g ^w á hme: ta	<i>may he do work!</i>
8.	k ^w á daʔ hme: ta	<i>may they do work!</i>

Feedback for Chapter 20

20.1 Tzeltal¹¹⁵

The suffix is probably underlyingly {-ul}; this is the allomorph that occurs after front vowels and the low vowel /a/. It dissimilates to [-il] when it follows a round vowel. The feature [+round] is being delinked. We must also assume that the loss of [+round] also entails the loss of [+back], either by convention or stipulation. This is an interesting topic that we do not explore here.

20.2 Lealao Chinantec¹¹⁶

Underlying forms: Recent Past {kɑ}, Imperative {g^wɑ}, Optative {k^wɑ}

Notice that the Imperative morpheme does not vary in voicing (it always begins with [g^w]), but that the Optative morpheme varies between [k^w] and [g^w]. It seems reasonable to posit different underlying forms for them: the voiced one stays voiced, the voiceless one (like the Recent Past) varies in voicing.

Dissimilation: A voiceless consonant (these are all velars) becomes voiced if the next syllable begins with a voiceless consonant.

The feature in question is [-voice] (which seems odd, actually; usually it is the “marked” value of a feature that is delinked).

CHAPTER 21 - MISCELLANEOUS

Some phonological processes which are often found in languages are hard to classify by labels currently in use. The phonetic motivation for some of these rules is not easy to explain (even if we know what it is). Nevertheless, it is good to be aware of some phonological rules that are less well-understood, even though they are not all common. (The list below is growing informally with the drafts of this book, as time permits. Later chapters in this book deal with the common processes of insertion and deletion.)

“Aspiration” of *s*

In some dialects of Spanish, there is a tendency to pronounce syllable-final *s* as [h]. In Capanahua, any of the three sibilants of the language (alveolar, alveopalatal, and retroflexed alveopalatal) tends to be replaced by [h] or deleted in fast speech when it precedes the flap *r*.

(130)	baʔkiʃriʔbi	baʔkihriʔbi	baʔkiriʔbi	<i>tomorrow, too</i>
	hisisriʔbi	hisihriʔbi	hisiriʔbi	<i>ant also</i>
	marasriʔbi	marahriʔbi	marariʔbi	<i>poison also</i>

Alternation between *l* and *r*

Liquids (*l* and *r* sounds) alternate in some languages. In Korean, the liquid is realized as something more like an [l] when it is syllable-final; otherwise it is more like [r].

(131)	pa[l]	<i>foot</i>	u[r]i	<i>we</i>
	to[l]	<i>stone</i>	ma[r]u	<i>wooden floor</i>
	i[l]kop	<i>seven</i>		

In Madija these sounds are variants of a single phoneme. The liquid is realized as [l] when it is simultaneously preceded and followed by *i*; otherwise it is realized as [r].

(132)	po[r]e	<i>pierced</i>	hi[l]i	<i>sing</i>
	o[r]i	<i>paddle</i>	wi[l]idi	<i>grandfather</i>
	o[r]a	<i>tree (species)</i>		
	dze[r]o	<i>grass</i>		
	e[r]ibo	<i>our ears</i>		
	hi[r]ee	<i>be without</i>		

Labialization before unrounded vowels

In Capanahua, the labial consonants may be labialized when they precede a high back unrounded vowel.^a

(133)	kap ^[w] u	<i>alligator</i>	m ^[w] uʔi	<i>bark</i>
	p ^[w] uʔi	<i>leaf</i>	ʔam ^[w] uɪn	<i>capybara</i>

Variation in vowels

In many languages, vowels have a range of phonetic variation that is conditioned by many factors. Consider the following statements regarding the variation in the three vowels (*a*, *i*, *u*) of Inga (Levinsohn 1976, p. 26; the symbols in the quote have been adapted to IPA):

^a Loos 1967 specifies that the consonants which may be labialized are *p* and *m*; apparently *b* and *w* are not labialized by this rule. It is also said that the rule is a “regular feature with some speakers, but absent with others or used sporadically” (p. 183). The process is described using the acoustic feature [flat], and is given in a formulation that would suggest it is a kind of dissimilation. The consonant becomes [+flat] before a [-flat] vowel (with other features specified in the rule).

/ɑ/: has a variant [æ] which “varies freely with [ɑ] word-initial, and in syllables closed by a nasal.”

/i/: has a variant [e] which “varies freely with mid-low [ɛ] non-finally following /d, n, l, r, j/ and preceding /ɲ/. [e] varies with [i] non-finally following /s/. [e] occurs finally, except following non-contiguous [i].”

/u/: has various allophones, including [ʊ], [o], [ɔ], and [u]. The distributional statements are quite complex, and the rules accounting for them would also be complex.

SUMMARY AND REVIEW QUESTIONS FOR SECTION 2

An examination of morphemes often shows that a single morpheme has more than one shape (allomorph), and that these shapes are similar phonetically. The standard practice within generative phonology has been to posit a single underlying form for such morphemes and to account for the different shapes by general phonological rules. The most common phonological rules are assimilatory, in which a feature (or group of features) of one sound spreads to another sound. (Some other very common rules relate to syllable structure and are treated in a later chapter.)

Underlying forms are chosen and phonological rules are proposed in order to account for the facts in the most straightforward fashion using the smallest amount of language-specific complications. The guiding principle of generative phonology was “minimum storage, maximum computation.”

We have only minimally introduced the role of the Obligatory Contour Principle in phonological theory. Some of the references below contain a much more detailed explanation.

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Review Questions

The following questions are to help you review the material in the preceding section.¹¹⁷

1. Allomorphs which are similar phonologically are usually best described as being derived from a single underlying form and the application of a _____ rule.
2. Sounds often become like, or _____ to, neighboring sounds.
3. The change from *z* to *s* in the English plural is an example of _____ assimilation.
4. Sounds (such as *s*) which are produced with a significant obstruction in the mouth, causing an increase in air pressure, are called _____.

5. Sounds (such as *l*) which are produced with less obstruction in the mouth and more opportunity for resonance in the vocal tract are called _____.
6. Name the three major place features: _____, _____, _____.
7. Nasals often assimilate in _____ features to an adjacent consonant.
8. Combinations of distinctive (unpredictable) features in a language are commonly referred to as the _____ of the language; the inclusion of a non-contrastive feature produces an _____.
9. Assimilation may be best formalized as the _____ of one feature (or group of features) from one unit to another.
10. Some rules apply only in _____ environments, such as when two morphemes come together.
11. The change from **t** to **tʃ** before *i* is an example of _____.
12. The rounding of **t** in the word *tool* is an example of _____.
13. The feature which is spread to the vowel in the word *can* [k^hən] is the feature _____.
14. The assimilation of a vowel of one syllable to a vowel in another syllable is called vowel _____.
15. The change of one sound to become less like a neighboring sound is called _____.
16. What type of process is illustrated by the following data?
{*ni-tas*} → [nitʃas] _____
17. Allomorphs must be listed in the lexicon (a) always (b) when they cannot be predicted by phonological rules (c) when they are accounted for by phonological rules.
18. Circle the segments that are [+sonorant]. o k r z w n s l
19. (T or F) Feature spreading is a very common type of phonological rule.

20. The following data show the need for a rule that assimilates the vowel of one syllable to become identical to the vowel of the preceding syllable. What might be one reason for why this rule does not change the second vowel of *ritu* 'to be icy' to be *i* ?

Tarahumara

<i>ritu</i>	<i>to be icy</i>	<i>ritu-ku</i>	<i>ice</i>
<i>reme</i>	<i>to make tortillas</i>	<i>reme-ke</i>	<i>tortillas</i>
<i>patʃi</i>	<i>to grow ears of corn</i>	<i>patʃi-ki</i>	<i>ear of corn</i>
<i>opatʃa</i>	<i>to be dressed</i>	<i>opatʃa-ka</i>	<i>garment</i>

21. Give the values of the features [high] and [low] of mid vowels:

_____.

If you have mastered the material in this section, you should be able to examine data and

- distinguish suppletive allomorphy from non-suppletive allomorphy
- recognize phonological allomorphs which are related by phonological assimilatory processes
- describe examples of voice assimilation, place assimilation, manner assimilation, and nasalization in prose and with formal notation
- describe examples of palatalization, labialization, and vowel harmony in prose
- explain the importance writing general rules
- explain how the application of general rules may be restricted if the rule is structure-preserving or if it applies only in derived environments
- follow widely-accepted principles for choosing underlying forms

Feedback for Review Questions¹¹⁷

- phonological
- assimilate
- voicing
- obstruents
- sonorants
- labial, coronal, dorsal
- place
- phonemes, allophone
- spreading
- derived
- palatalization
- labialization
- [nasal]
- harmony
- dissimilation
- palatalization
- (b)
- o r w n l
- T
- It is a rule that applies only in a derived environment.
- [-high] [-low]

SECTION 3

PHONOLOGICAL RULES: SOME PRACTICAL PROCEDURES

This section has the subtitle "Some Practical Procedures" because it outlines some steps which are often taken in the initial stages of work on an unwritten language. We are presenting these steps now, after extensive discussion of assimilatory processes, since it is important to know what kinds of processes one should be looking for when one is doing such procedures.

The steps illustrated in this section are important for clarifying what features and combinations of features are distinctive in a language, and hence which features will be found in underlying forms of that language. These steps, commonly referred to as phonemic analysis, have been considered crucial for understanding enough of the phonology of a previously unwritten language to be able to develop a writing system for it.

CHAPTER 22 - CONTRASTIVE FEATURES

We have seen one way to find out whether a feature (or combination of features) needs to be present in underlying representations of a language. If we write a rule (to account for some allomorphy, for example) which can account for all of the occurrences of a feature/combination in the language, that feature/combination will not appear in the lexical representation of any morpheme. (The combination is therefore not a phoneme, although it is an allophone of a phoneme.)

A good example of this was seen in chapter 19 where we saw that [w̃] in Seri was an allomorph of the negative morpheme which is basically [m]. Once we wrote a rule accounting for this alternation, we would check around and see if that rule (along with another one, perhaps) would account for all of the occurrences of [w̃] in the language. And as a matter of fact, they do in Seri. There is no phoneme [w̃]. All occurrences of [w̃] follow a velar consonant; and there are no occurrences of [m] following a velar consonant.^a

Major Point: If a given feature may be accounted for entirely by a rule, it should not appear in any underlying form.

Not all allophones are discovered through the examination of allomorphic alternation, although such examination may be very important. Many allophones are found by looking at the **distribution** of sounds. This is usually a job for the analyst. Native speakers may be completely unaware of phonetic variation which to an outsider is quite obvious.

The most obvious evidence that a feature/combination must appear in a lexical representation of a morpheme is that you simply cannot explain it in any other way. For example, consider the sound *h* in English. It is a sound which does not occur just anywhere; in fact, it only occurs at the beginning of syllables: *hear, hold, reheat, behold*. One might wonder whether it must appear in the lexical representation of the morpheme HEAR. It must, since we must distinguish between *ear* and *hear*, and between *old* and *hold*, and there is no obvious other way to distinguish these words phonologically.^b Therefore, we say that /*h*/ is a phoneme of English. That is, the features or combination of features that are necessary to represent [h] (or distinguish it from other sounds) must be present underlyingly in English.

Words such as *old* and *hold* are called **minimal pairs**. The only difference between them can be narrowed down to the difference between the presence and absence of *h*; the difference is minimal but is significant. (We will assume that minimal pairs must be identical words except for the segments in question.)

If the simple replacement of phone *x* by phone *y* in a word results in a change of meaning, the two phones are said to **contrast in identical environments** (CIE).^c Consider the two phones [ɹ] and [l] of English. If we take the utterance [ɹɪp] and replace the [ɹ] with [l], the resulting utterance [lɪp] means something different. *Rip* and *lip* are a minimal pair. This is taken as initial evidence that the two phones [ɹ] and [l] are related to distinct elements in the lexical representations, probably the phonemes /ɹ/ and /l/. We use the following model to summarize these observations.

^a This is slightly simplified; the rule must actually specify that the velar consonant must be in the same syllable as the *m*, although the examples needed to show this are extremely rare. A couple of decades ago, there was some optionality to the rule in question, and so some words tended to fluctuate between having an [m] and having a [w̃].

^b The presence of a glottal stop before initial vowels in some dialects of English in certain contexts (especially utterance-initial position) clouds the issue a bit.

^c Procedures for discovering phonemes are elaborated in detail in textbooks such as Kenneth L. Pike (1947) *Phonemics: A Technique for Reducing Languages to Writing*, Ann Arbor, University of Michigan Press. Some assumptions made in work of that period are not made today. Our presentation below includes some warnings about possible errors that analysts sometimes make.

(134) [ɹ] and [l] contrast in identical environments

or

[ɹ] : [l] CIE (at least word-initially)

e.g. __ɹp [ɹɪp], [lɪp]
 __ɹk [ɹɪk], [lɪk]
 __ək [ɹæk], [læk]

Probable implication: [ɹ] and [l] belong to separate phonemes.

Lexical representations (assuming other sounds also to be phonemic): {ɹɪp}, {lɪp}, {ɹɪk}, {lɪk}, {ɹæk}, {læk}.

We take this evidence as being only initial evidence for contrast since the facts of the language as a whole must be taken into account. For example, there are words such as [pero] *but* (with a flap) and [pero] *dog* (with a trill) in Spanish which might be (and have been) taken as evidence for two phonemes in this language. Nevertheless, the contrast is found only intervocalically. An alternative analysis is that the trilled *r* is the phonetic realization of /rʀ/, since /r/ can occur at the end of a syllable and also at the beginning of a syllable in this language.^d The minimal pair shown above argues for a difference in the underlying forms of these words, but that difference may not be the difference which shows up phonetically.

22.1 Try it for yourself with Karuk

Using a format similar to that shown above, present the evidence that vowel length is contrastive in this language.¹¹⁸

- | | | | |
|---------|-----------------------|---------|------------------------|
| 1. tas | <i>to build fence</i> | 4. xas | <i>then, but</i> |
| 2. pi:p | <i>to say</i> | 5. ta:s | <i>plant (species)</i> |
| 3. xa:s | <i>almost</i> | 6. pip | <i>to sting</i> |

22.2 Now try it for yourself with Seri

Using a format similar to that shown above, present the evidence that the difference between [s] and [ʃ] is contrastive in Seri.¹¹⁹

- | | | | |
|----------|-----------------------|----------|-------------------------|
| 1. nas | <i>milkweed pod</i> | 4. ka:ʃx | <i>string up (nom.)</i> |
| 2. ka:sx | <i>unfold (nom.)</i> | 5. naʃ | <i>bush (species)</i> |
| 3. ʃi:m | <i>weed (species)</i> | 6. si:m | <i>will sleep</i> |

If two sounds do not contrast in identical environments, one must begin to look to see whether one of them occurs in an environment which might affect its pronunciation. That is the point of looking for minimal pairs, when possible—the environment is being controlled completely. If the environment is clearly not affecting the pronunciation, then we may say that the two sounds **contrast in noninfluencing environments** (CNE) although the environment is not identical.^e For example, the following evidence would be sufficient to establish that [m] and [n] belong to different phonemes in English, even though there are no minimal pairs in these data.

^d See James W. Harris (1983) *Syllable Structure and Stress in Spanish: A Nonlinear Analysis*, Cambridge, London, MIT Press.

^e Identical environments are of course simply one special kind of noninfluencing environment. (In other presentations of ‘phonemic analysis’, this kind of environment is referred to as analogous environment.)

(135)	[mæt]	<i>mat</i>	[muwn]	<i>moon</i>
	[næb]	<i>nab</i>	[nuwt]	<i>newt</i>

The evidence would be summarized as follows:

(136) [m] and [n] contrast in noninfluencing environments.

or

[m] : [n] CNE (at least word-initially)

e.g. before the vowel [æ]: [mæt] [næb]
before the vowel [u]: [muwn] [nuwt]

Probable implication: [m] and [n] belong to separate phonemes (/m/ and /n/ probably).

Lexical representations (assuming other sounds also to be phonemic): {mæt}, {næb}, {muwn}, {nuwt}.

If we were to discover minimal pairs later, such as *mat* and *gnat*, our conclusions would be confirmed. But such minimal pairs are not necessary or even always possible. (Rather, they are more like icing on the cake.)

Again, evidence from contrast in noninfluencing environments must be carefully considered from the perspective of the rest of the language. For example, in English one might take words such as [ˈmɪʃən] *mission* and [ˈvɪʒən] *vision* and claim that English has the phonemes /ʃ/ and /ʒ/. But this would be an unwarranted conclusion. There is no defect in the importance of the pair, however. What such a pair shows is that in English there is something different about the underlying form of *mission* from the underlying form of *vision* beyond the difference between *m* and *v*. But it does not tell us what this difference is. It might be that the difference is between /sj/ and /zj/, or between /ʃ/ and /zj/, or between /s/ and /z/, or something else. One must be careful about the conclusion one draws.

For another example, in Seri it was observed that many words apparently ending in /k^w/ could be pronounced with either [k^w] or something like a voiceless release [k^{wh}] in utterance-final position: [ʔok^w], [ʔok^{wh}] *wood*. Then one word was found which was always pronounced with [k^{wh}] (the voiceless release) and did not alternate with [k^w] (the voiced release): [ʔajaðk^{wh}] *anklebone*. Should this be taken as clear evidence that we have two phonemes, /k^w/ and /k^{wh}/? No, this would be a dramatic step based on such little evidence. The mystery was solved later: the word *anklebone* ends in a velar fricative /x/ which sounds just like labialized aspiration in this position.^f The two words are phonemically /ʔok^w/ and /ʔajak^wx/. The contrast between the two words exists, but the difference is not localized in the aspiration itself, but in the presence of another sound.

22.3 Try it for yourself with Kuskokwim Eskimo

Present the evidence that [k] and [q] contrast in this language.¹²⁰

1. nuliq	<i>wife</i>	4. nuʔuq	<i>buttocks</i>
2. kaʔuk	<i>thunder</i>	5. qiluk	<i>bark</i>
3. kaliqaq	<i>paper</i>	6. uʔu:ʔak	<i>cheek</i>

^f The presence of the /x/ might be suggested by indirect evidence having to do with certain allomorphy. Direct evidence was found when further probing produced the utterance [ʔaʔjak^waxaja] *anklebone, my eye!*, which includes a “suffix” [-aja] and an infix [a]. Note the [x] which appears before the suffix [-aja].

22.4 Try it for yourself with Venda

Present the evidence that alveolar [n] and dental [n̤] contrast in Venda.¹²¹

1. fiṇu	<i>at your place</i>	6. ene	<i>he</i>
2. liṇo	<i>tooth</i>	7. fiṇa	<i>childhood</i>
3. muṇe	<i>matter</i>	8. z ^w iṭanu	<i>five</i>
4. maṇa	<i>four</i>	9. z ^w ino	<i>now</i>
5. βonani	<i>see (pl.)!</i>	10. k ^h ouno	<i>there</i>
		11. ṇari	<i>buffalo</i>

Key Concepts

distributional evidence vs. allomorphic evidence

contrast in identical environments

contrast in noninfluencing environments

minimal pair

For each of the following exercises, give the results in a manner similar to that shown above.

22.5 Try it for yourself with Damana

Which fricatives are contrastive in Damana (just compare each fricative with each other fricative at this point)? Give the evidence, being sure to consider each possible pair (six).¹²²

1. sigi	<i>bother</i>	7. aʃega	<i>be seated</i>
2. asega	<i>cut off</i>	8. ʒa	<i>to eat</i>
3. ʃa	<i>hair</i>	9. ʃigi	<i>tomorrow</i>
4. ʒamaja	<i>to sing</i>	10. sina	<i>arrow</i>
5. ʒu	<i>narrow</i>	11. zu	<i>good</i>
6. zina	<i>paper</i>	12. ʃamaja	<i>widow</i>

22.6 Try it for yourself with Guanano

Which stops are contrastive in Guanano? (Just compare the stops at the same point of articulation with each other—nine pairs.) Give the evidence.¹²³

1. duaha	<i>I sell</i>	7. ba:ha	<i>I swim</i>
2. pa:ro	<i>toy</i>	8. tuaha	<i>I have strength</i>
3. pa:ha	<i>I play</i>	9. t ^h uaha	<i>I return home</i>
4. kaha	<i>I feel (pain)</i>	10. k ^h aʔaka	<i>near</i>
5. p ^h a:ro	<i>stomach</i>	11. k ^h aʔaga	<i>get drunk!</i>
6. k ^h aha	<i>I take a fish out of a trap</i>		

22.7 Try it for yourself with Sierra Miwok

Present the evidence that alveolar [t] contrasts with dental [t̪].¹²⁴

1. ʔa:tʃiʔ	<i>elder brother</i>	5. hiʃo:ʔaʔ	<i>eastern</i>
2. how:otuʔ	<i>beads</i>	6. tajiʃmuʔ	<i>jay</i>
3. ʔutu:	<i>Get out of the way!</i>	7. ʔena:t	<i>soon</i>
4. noʔu:wak	<i>on far side</i>	8. ʔotkimeʔ	<i>two days</i>

22.8 Try it for yourself with Agusan Manobo

Compare [p] with [b], [t] with [d], and [k] with [g]. Present evidence of contrast in word-initial position, intervocalic position, and word-final position.¹²⁵

1. pituʔ	<i>seven</i>	11. bagaʔ	<i>lung</i>
2. tabaʔ	<i>fat</i>	12. buʔuk	<i>piece</i>
3. bataʔ	<i>child</i>	13. bituʔ	<i>hole</i>
4. tapaʔ	<i>salted meat</i>	14. hipag	<i>other side</i>
5. bakaʔ	<i>jaw</i>	15. ʔaned	<i>float</i>
6. kandiŋ	<i>goat</i>	16. dagæha	<i>chest</i>
7. baga	<i>ember</i>	17. ʔusab	<i>again</i>
8. ʔusip	<i>to ask</i>	18. paliʔ	<i>wound</i>
9. bagnet	<i>weed</i>	19. buʔaŋ	<i>foolish</i>
10. badaʔ	<i>pass</i>	20. gamit	<i>use</i>

22.9 Try it for yourself with Eastern Quichua

Present evidence that there is contrast between the following pairs of sounds: [t] and [ts], [t] and [r], [ts] and [r], [k] and [g]; all of the nasals (all possible pairs).¹²⁶ If there is no evidence of contrast, say so.

1. karu	<i>far</i>	11. tsaka	<i>rough</i>
2. raku	<i>thick</i>	12. mati	<i>gourd bowl</i>
3. indi	<i>sun</i>	13. turi	<i>woman's brother</i>
4. maŋga	<i>pot</i>	14. pani	<i>man's sister</i>
5. kuri	<i>gold</i>	15. ɲapa	<i>woman's sister</i>
6. tikta	<i>trap</i>	16. rasu	<i>snow</i>
7. rumi	<i>stone</i>	17. kiŋgi	<i>twisted</i>
8. tasin	<i>nest</i>	18. tsinzu	<i>thin child</i>
9. naŋgi	<i>bird trap</i>	19. tamia	<i>rain</i>
10. ɲawi	<i>eye / face</i>	20. xuktu	<i>hole</i>

22.10 Try it for yourself with Tojolabal

Present evidence that there is contrast between the following pairs of sounds: [k] and [k']; [p] and [p'] (the latter is actually an implosive rather than an ejective); [t] and [t']; [t] and [tʃ]; [ts] and [tʃ].¹²⁷

1. ki'sim	<i>my beard</i>	10. tsa'mal	<i>pretty</i>
2. p'a'kal	<i>corn cob</i>	11. tʃa'k'a	<i>chop it down</i>
3. s'ak	<i>white</i>	12. ʔak'	<i>reed</i>
4. tʃi'tam	<i>pig</i>	13. tʃa'tat	<i>plant (species)</i>
5. tʃa'mal	<i>rotten</i>	14. k'a'nip	<i>squash flower</i>
6. po'tot'	<i>plant (species)</i>	15. na'hat	<i>long</i>
7. ti'nan	<i>upside down</i>	16. nu'pan	<i>married</i>
8. pa'kan	<i>setting</i>	17. ʔi'nat	<i>seed</i>
9. ʔi'poj	<i>armadillo</i>	18. ts'okop'	<i>thread</i>

Feedback for Chapter 22

22.1 Karuk¹¹⁸

[V] : [V:] CIE

e.g. t_s [tas] *to build fence*, [ta:s] *plant (species)*
 p__p [pip] *to sting*, [pi:p] *to say*

Probable implication: long vowels and short vowels are distinguished either by being separate phonemes or by being vowel clusters.

22.2 Seri¹¹⁸

[s] : [ʃ] CIE finally ([nas] *milkweed pod*, [naʃ] *bush (species)*)

[s] : [ʃ] CIE preconsonantly ([ka:sx] *unfold*, [ka:ʃx] *string up*)

[s] : [ʃ] CIE initially ([si:m] *will sleep*, [ʃi:m] *weed (species)*)

Probable implication: [s] and [ʃ] belong to separate phonemes.

22.3 Kuskokwim Eskimo¹²⁰

[k] : [q] CNE e.g. [kaʔuk] *thunder* vs. [nuʔuq] *buttocks*

Probable implication: [k] and [q] belong to separate phonemes.

22.4 Venda¹²¹

[n] : [ɲ] CNE ([ʃana] *childhood* and [maɲa] *four*)

Probable implication: [n] and [ɲ] belong to separate phonemes.

22.5 Damana¹²²

[s] : [ʃ]	CIE	e.g. [sɪgi] <i>bother</i> , [ʃɪgi] <i>tomorrow</i>
[z] : [ʒ]	CIE	e.g. [zu] <i>good</i> , [ʒu] <i>narrow</i>
[s] : [z]	CIE	e.g. [sɪna] <i>arrow</i> , [zɪna] <i>paper</i>
[ʃ] : [ʒ]	CIE	e.g. [ʃa] <i>hair</i> , [ʒa] <i>to eat</i>
[ʃ] : [z]	CNE	e.g. word-initially, before vowels [ʃa] <i>hair</i> , [zu] <i>good</i>
[s] : [ʒ]	CNE	e.g. word-initially, before vowels [sɪgi] <i>bother</i> , [ʒa] <i>to eat</i>

Probable implication: [s], [ʃ], [z] and [ʒ] belong to separate phonemes.

22.6 Guanano¹²³

[p] :	[p ^h]	CIE	e.g. [pa:ro] <i>toy</i> , [p ^h a:ro] <i>stomach</i>
[p] :	[b]	CIE	e.g. [pa:ha] <i>I play</i> , [ba:ha] <i>I swim</i>
[p ^h]:	[b]	CNE	e.g. [p ^h a:ro] <i>stomach</i> , [ba:ha] <i>I swim</i>
[t] :	[t ^h]	CIE	e.g. [tuaha] <i>I have strength</i> , [t ^h uaha] <i>I return home</i>
[t] :	[d]	CIE	e.g. [tuaha] <i>I have strength</i> , [duaha] <i>I sell</i>
[t ^h]:	[d]	CIE	e.g. [t ^h uaha] <i>I return home</i> , [duaha] <i>I sell</i>
[k] :	[k ^h]	CIE	e.g. [kaha] <i>I feel (pain)</i> , [k ^h aha] <i>I take fish out of a trap</i>
[k] :	[g]	CIE	e.g. [k ^h aʔaka] <i>near</i> , [k ^h aʔaga] <i>get drunk!</i>
[k ^h]:	[g]		No direct evidence in these limited data.

Probable implication: voiceless unaspirated, voiceless aspirated, and voiced stops belong to separate phonemes.

22.7 Sierra Miwok¹²⁴

[t] : [ʈ]	CNE	[ʈa:tʃiʔ] <i>elder brother</i> , [tajiʃmuʔ] <i>jay</i>
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Probable implication: [t] and [ʈ] belong to separate phonemes.

22.8 Agusan Manobo¹²⁵

[p] : [b]	CIE initially	(<i>seven, hole</i>)
[p] : [b]	CIE intervocalically	(<i>salted meat, fat</i>)
[p] : [b]	CNE finally	(<i>ask, again</i>)

[t] : [d]	C initially	(<i>fat, chest</i>)
[t] : [d]	CIE intervocalically	(<i>child, pass</i>)
[t] : [d]	CNE finally	(<i>weed, float</i>)

[k] : [g]	CNE initially	(<i>goat, use</i>)
[k] : [g]	CIE intervocalically	(<i>jaw, lung</i>)
[k] : [g]	CNE finally	(<i>piece, other side</i>)

Probable implication: [p], [b], [t], [d], [k], and [g] belong to separate phonemes.

22.9 Eastern Quichua¹²⁶

[t] : [ts] CNE [tasin] *nest*, [tsaka] *rough*

[t] : [r] CNE [tasin] *nest*, [raku] *thick*

[ts] : [r] CNE [tsaka] *rough*, [raku] *thick*

[k] : [g] no good evidence since [g] only occurs after [ŋ] (voiced context), whereas [k] does not

[m] : [n] CNE [tamia] *stone*, [pani] *man's sister*

[m] : [ɲ] CNE [manɲa] *pot*, [ɲawi] *eye / face*

[m] : [ŋ] no good evidence since [ŋ] only occurs before [g] (velar context) whereas [m] does not

[n] : [ɲ] CNE [nanɲi] *bird trap*, [ɲawi] *eye / face*

[n] : [ŋ] no good evidence since [ŋ] only occurs before [g] (velar context) whereas [n] does not

[ɲ] : [ŋ] no good evidence since [ŋ] only occurs before [g] (velar context) whereas [ɲ] does not

Probable implications: [t], [ts], and [r] belong to separate phonemes. There is evidence for three nasal phonemes: [m], [n], and [ɲ]. [ŋ] may well not be distinct from these since it does not appear to contrast with them. [k] and [g] are not shown to be in contrast by the data provided.

22.10 Tojolobal¹²⁷

[k] : [kʰ] CNE [sak] *my beard*, [ʔakʰ] *reed*

Probable implication: [k] and [kʰ] belong to separate phonemes.

[p] : [pʰ] CNE [paʰkan] *setting*, [pʰaʰkaɪ] *corn cob*
 [nuʰpan] *married*, [ʔiʰpʰoj] *armadillo*
 [kʰaʰnɪp] *squash flower*, [tsʰoʰkopʰ] *thread*

Probable implication: [p] and [pʰ] belong to separate phonemes. (Evidence in initial, medial, and final positions.)

[t] : [tʰ] CNE [poʰtotʰ] *plant (species)*, [naʰhat] *long*

Probable implication: [t] and [tʰ] belong to separate phonemes.

[t] : [tʃ] CNE [tiʰnan] *upside down*, [tʃiʰtam] *pig*

Probable implication: [t] and [tʃ] belong to separate phonemes.

[ts] : [tʃ] CIE [tsaʰmaɪ] *pretty*, [tʃaʰmaɪ] *rotten*

Probable implication: [ts] and [tʃ] belong to separate phonemes.

Note: The evidence has still not been presented that [t] and [ts] belong to distinct phonemes. Do you expect to find such evidence?

CHAPTER 23 - NONCONTRASTIVE FEATURES

If a certain sound x can never be found to occur in the same or a noninfluencing environment as sound y occurs in, then it may be that the two sounds are variant pronunciations (because of context)—allophones—of the same phoneme. For example, in Tswana one finds syllables of the following types:

(137)	r^V	l^V		
	ru	—	k ^h uru	<i>tortoise</i>
	ri	—	barisa	<i>herd</i>
	—	lo	loleme	<i>tongue</i>
	—	le	loleme	<i>tongue</i>
	—	la	xobala	<i>head</i>

The phone [l] occurs before [e, a, o], and the phone [r] never does. The phone [r] occurs before [u, i] and the phone [l] never does. The phones [r] and [l] are said to occur in complementary distribution, or in mutually exclusive environments. Where one occurs, the other does not occur.^a Since they never occur in the same environment, a statement of contrast in identical environment is not possible for these phones in Tswana. Rather, we can make the following statements:

(138) [r] does not contrast with [l]. They occur in different environments.

At this point we will simply assume that [r] is somehow more basic than [l] in Tswana and state the following:^b

(139) [r] : [l] CD

/r/ is pronounced as [l] when it immediately precedes nonhigh vowels

or

/r/ has the allophone [l] when it immediately precedes nonhigh vowels

or

$r \rightarrow l / ___ \text{nonhigh vowels}$

What is happening here is that the pronunciation of the sound /r/ is affected by its environment in Tswana.

A word such as [loleme] would be written phonemically as /roreme/.

A method which may help in finding out whether two sounds occur in complementary distribution or not is the use of y-diagrams, as shown below (where the square bracket symbol "[" means 'the edge of the word').^c

^a For another example, see the beginning of chapter 22.

^b The decision regarding which sound is more basic is not based on frequency but rather on restrictiveness of distribution and phonological simplicity (the least restricted sound or the more simple sound is considered more basic *usually*, it seems). That is, one doesn't count up the number of words that contain one allophone or another; one looks at where the sounds occur and considers how many kinds of environments the allophones occur in.

Even so, it is not always easy, and it may in some cases not even be possible or necessary to decide on a basic phone. Also, it should be noted that in traditional phonemic descriptions, a phoneme such as /r/ was said to have two allophones: [r] and also [l]. The important phonological fact seems to be that the sound is a non-nasal coronal sonorant, not whether it is a lateral or non-lateral, a flap or not a flap.

^c The symbol # is also commonly seen used for this purpose, especially in structuralist and earlier generative work.

(140)				

Sometimes it is necessary to place more of the environment on each side of the diagram; the influencing environment may not necessarily be immediately adjacent. One should check at least as far as the next syllable.

Now consider the situation where the substitution of one phone for another in some context is possible but the substitution results in no change of meaning. The following data from Spanish illustrate this situation. The phone [z] may be substituted for the phone [s] in certain environments, such as in faster speech styles:

(141)	[mismo]	<i>same</i>	[desde]	<i>since</i>
	[mizmo]	<i>same</i>	[dezde]	<i>since</i>
	[sapo]	<i>frog</i>	[kasa]	<i>house</i>
	[zapo]	(not possible)	[kaza]	(not possible)

The phones [s] and [z] do not contrast in identical environments since no change in meaning ever results from the substitution of one for the other in Spanish. Therefore, we have no basis for considering them to both be phonemes. Since the [z] occurs in a restricted environment, we can consider it to be a variant of /s/ which occurs under certain conditions. This is sometimes referred to as conditioned free variation (FV)—that is, two allophones alternate with each other in the same context under certain conditions.

(142) [s]:[z] FV before voiced consonants (fast speech phenomenon)

or

/s/ is pronounced as [z] when it precedes a voiced consonant in fast speech.

Sometimes the factors which affect the substitution of one phone for another are not well-known. It may have to do with how tired the speaker is, how fast s/he is speaking, etc. In such cases, the generalization for 'free variation' might be stated as in the following example:

(143) /e/ is optionally pronounced as [ɛ] (in any context).

This is sometimes referred to as 'unconditioned' free variation, although the terminology is not the best.

For example, in various dialects of Nahuatl (spoken in Mexico) certain short vowels are said to freely vary between tense and lax variants.^d A word such as /k^wowit/ *tree* is pronounced as either [k^wowit] or [k^wowit]. No description of Nahuatl (to our knowledge) has pinned down any environment for this variation.

Illustrative Sections

In the following sections, we show how examination of the distribution of sounds (as opposed to examination of allomorphic alternation) reveals that phonological processes such as palatalization, nasalization, etc. may be discovered in a language.

^d See, for example, Harold and Mary Key (1953) The Phonemes of Sierra Nahuatl, *International Journal of American Linguistics* 19:53-6.

Voicing Assimilation

See the discussion above regarding the voicing of *s* in Spanish.

23.1 Try it for yourself with North Puebla Nahuatl

Consider the phones [ʃ] and [ʒ]. Is there evidence for contrast? If not, state the distributional facts and make a hypothesis about these sounds by proposing a phonological rule.¹²⁸ A couple of words that do not contain either of these sounds are included to help you make your rule more accurate.

(144)	1. [aʃan]	<i>now</i>	4. [mitsmaka]	<i>he gives to you</i>
	2. [iʒwak]	<i>dry</i>	5. [iʒjajo]	<i>tear</i>
	3. [neʃtik]	<i>blue</i>	6. [onikmat]	<i>I knew it</i>

23.2 Try it for yourself with Walmatjari

Examine the Walmatjari data in Appendix F. In chapter 9 you proposed a rule of voicing assimilation (voicing consonants after nasals). This might lead you to question whether both voiced and voiceless consonants are needed underlyingly. Are they in fact in complementary distribution? If so, what other rule of voicing assimilation is required?¹²⁹

Place Assimilation

In North Puebla Nahuatl, a nasal is always velar preceding velar stops: [jaŋk^wik] *new*. This is a common type of assimilation. If a nasal is always velar in this position, and hence there is no contrast between [ŋ] and [n], and also no contrast between [ŋ] and [m], the question then arises as to what [ŋ] is phonemically. Is it phonemically /m/, or /n/? In some theories, this was a serious problem, and a decision had to be made. Usually the most similar sound (in this case /n/) was chosen as the phoneme, or the most common. Thus a word such as [jaŋk^wik] would be /jank^wik/ phonemically. But under other assumptions, made explicit in chapter 25, [ŋ] is simply a nasal consonant which is neither /n/ or /m/, but does not contrast with either.^e

English also has place assimilation of nasals. Thus the nasal in words such as *pump*, *finch*, *pant*, and *think* are homorganic with the following consonant. Consider how this fact may be relevant for the analysis of [ŋ]. This sound occurs in a word like *think*, of course. And one also finds pairs of words such as [θɪn] *thin*, and [θɪŋ] *thing*. Words such as these, which are minimal pairs, have been adduced as evidence of a phonemic contrast between [n] and [ŋ]. But this direct conclusion has been challenged. The minimal pairs show that something is different, but not exactly what. First of all, one should note that [ŋ] never occurs syllable-initially in English. There are no words like *[ŋɪp]. And yet syllable-initial position is the place where one expects to find most phonemic contrasts. Now consider the following data:

(145) Nasal plus voiceless consonant:

læmp *lamp* fɪntʃ *finch* pænt *pant* sɪŋk *sink*

Nasal plus voiced consonant:

—(none)— bɪndʒ *binge* sænd *sand* —(none)—

There are no words or syllables that end in a nasal-consonant cluster where the consonant is a voiced labial or velar. This fact has been used to argue that the phoneme [ŋ] does not exist in English, and that a word like [sɪŋ] *sing* is correctly analyzed as being {sɪŋ} phonologically. The nasal assimilates (as it must anyway), and the *g* deletes by a phonological rule.^f

^e In some cases, there may be alternation evidence that will provide evidence in favor of a particular analysis, but there are also cases where there is no alternation evidence.

^f See the chapter on deletion later in the book. The context for deletion of the *g* in English has to refer to the word

Consider the sounds [β] and [w] in the following data from Trio (Sipaliwini River dialect). These sounds show some fluctuation, with [β] or [w] occurring before front vowels, but only [w] (a back consonant) occurring before central and back vowels. Therefore, [w] and [β] are allophones of one phoneme. (This variation in the pronunciation of /w/ is actually quite common cross-linguistically.)

(146)	wae	<i>I am</i>	βei ~ wei	<i>sun</i>
	wui	<i>cassava</i>	βεβε ~ wewε	<i>wood</i>
	βiwanmæ ~ wiwanmæ	<i>I teach him</i>		
	βiβemε ~ wiwemε	<i>slippery</i>		

Palatalization and Labialization

In Brazilian Portuguese, a *t* becomes [tʃ] before *i*, and a *d* becomes [dʒ] in the same environment.

(147)	gatu	<i>cat</i>	mɔhtʃi	<i>death</i>
	gatʃipu	<i>small cat</i>	ondʒi	<i>where</i>
	tʃipu	<i>type</i>	dʒiferɛtʃi	<i>different</i>
	dedʒipu	<i>finger (dim.)</i>	dedu	<i>finger</i>

Therefore, a word such as [tʃipu] is phonemically transcribed /tipu/.

It is often claimed that English has a phoneme /ʒ/. This is heard at the end of the word *rouge* and *luge*. But curiously enough, the phoneme does not occur word-initially (although people may point to the name *Zsa Zsa Gabor*). Setting aside such words (*rouge* is a loanword from French, as are many words in English, of course), let us look at word-medial examples of [ʒ] and decide whether there is really good evidence that this is a phoneme of English.

The sound [ʒ] primarily occurs intervocalically in English: *occasion*, *pleasure*, *closure*, *treasure*, *seizure*, *division*, *incision*. Simply the fact that there are no good examples of contrast between [ʒ] and [z] should indicate to us that something is going on. We then may notice that several of these words have related words with [z] in them: *please*, *close*, *seize*, *divisibility*, *incisor*. And that other words in English have endings which begin with [j], a prime candidate for inducing palatalization: *rebellion*, *tenure*. With these facts in mind, we could reasonably propose that [ʒ] should be analyzed as /zj/. The word *incision* [ɪnsɪʒən] would be analyzed /ɪnsɪzjən/.^g

23.3 Try it for yourself with Chimalapa Zoque

Focus on the affricates [tʃ] and [tʃ̥], and the fricatives [s] and [ʃ]. Present the evidence to establish which are needed in underlying forms. Give the rule needed (informally) to derive the others.¹³⁰ Be sure to look beyond the immediately contiguous sounds.

boundary, and this is complicated by words such as *singer*. Note the difference between *finger* (with *g* pronounced) and *singer* (without *g*). There have been theories of phonology where such contrasts are taken as direct evidence that [ŋg] and [ŋ] contrast at some deeper level, despite the facts shown above and despite the relationship between words like *long* (without *g*) and *longer* (with *g*). It has also been pointed out that [ŋ] occurs morpheme-medially, perhaps uniquely, in the word *dinghy*.

^g This analysis does not carry over to the few words like *rouge* and *luge*. These remain exceptional.

1. metsaʔaŋ	<i>two</i>	7. ʃis	<i>meat</i>
2. metʃhiʔ	<i>the two of them</i>	8. ʔuʃpi	<i>alligator</i>
3. titspa	<i>it is drying</i>	9. ʔuʃiʔiŋ	<i>a little bit</i>
4. titʃi	<i>dry</i>	10. ʔiʃnitum	<i>straight</i>
5. tiʔtʃkin	<i>castor plant</i>	11. tʃin	<i>pine tree</i>
6. kospa	<i>he is scolding him</i>		

Nasalization

In Ñumí Mixtec, as well as some other Mixtec languages, a *t* has the pronunciation [tⁿ] (a *t* with a nasal release) when it precedes a nasalized vowel.

(148) [tⁿũʔũ] *word*

Since [tⁿ] occurs only in this environment, it does not appear in lexical representations of Mixtec words; it is an allophone of *t*. The lexical representation of the word *word* contains a simple *t*.^h Similarly, in Busa there is a nasal transition between certain consonants and nasalized vowels, as in /dãbo/ [dⁿã^mbo] *life*; and slight prenasalization precedes glides that begin syllables with nasalized vowels, as in /jĩ/ [ʰjĩ] *cold, wet*, and /wẽ/ [ʰwẽ] *year*.

In Seri, /m/ becomes a nasalized *w* after /k/, and the nasalization then spreads phonetically to the vowels which follow. A word such as /kmaai/ *don't make it!* is phonetically [kwããĩ].

Yoruba has oral vowels and nasalized vowels. Nasalization spreads from nasalized vowels to sonorant consonants which are in the same syllable.

(149)

ɾĩ	[ĩĩ]	<i>to walk</i>
jũ	[jũ]	<i>to dispense</i>
hũ	[hũ]	<i>to weave</i>
wĩ	[wĩ]	<i>to lend</i>

23.4 Try it for yourself with Busa

Consider the sonorant consonants in the following data. Consider what phonemes are needed. (Tone has been omitted.) The symbol [ɾ] represents a flap, but it usually may be replaced by a lateral flap. Similarly, the [n] in intervocalic position may be replaced by a nasal flap.¹³¹

^h Some languages have been described as having morphemes or words which are characterized as being either nasal or oral. The nasal feature affects a predictable range of consonants and vowels. For example, in Mixtec languages, it has been claimed that the feature [nasal] attaches to the right side of a word, linking up with as many sounds leftward as are compatible with it. The compatible sounds are sonorants: vowels, semivowels (like *j* and *w*) and nasal consonants. The sounds which are not compatible with the feature [nasal] are obstruents: stops and fricatives. When a vowel is linked with [nasal], it is pronounced nasalized; otherwise it is oral. When *j* is linked with [nasal], it typically is [j̃] (which sounds almost like [ɲ]); otherwise it typically sounds like [ʒ]. When *w* is linked with [nasal], it is pronounced [m̃]; when not linked with [nasal], it usually varies between [w] and [β]. Yet another consonant, usually thought of as *n*, is pronounced [n] when it is linked with [nasal] and pronounced as [n^d] when it is not. The feature [nasal] is distinctive (phonemic) in this language family; it works differently from other languages in that it is not a property of individual sounds. For more discussion, see Stephen A. Marlett (1992) *Nasalization in Mixtec Languages*, *International Journal of American Linguistics* 58:425-35.

(153)	Stop allophones		
	ba:	[ba:]	<i>dance a dirge</i>
	gab	[gab]	<i>be mean</i>
	pabi	[pabi]	<i>uncle</i>
	dag	[dag]	<i>get, meet, taste</i>
	jagi	[jagi]	<i>rat with bushy tail</i>
	Fricative allophones		
	habz	[haβz]	<i>perish quickly</i>
	kibl	[kiβl]	<i>roll on the ground</i>
	gubr	[guβr]	<i>pour out</i>
	dagd	[daɣd]	<i>already got</i>
	lɛgrjɔ	[lɛɣrjɔ]	<i>spider web</i>
	zagl	[zaɣl]	<i>kneel, crawl</i>
	rɔgz	[rɔɣz]	<i>just clucked, smoothed</i>

23.5 Try it for yourself with Oaxaca Chontal

Consider the labial sounds [p], [b], [f], and [β]; the coronal sounds [t], [d], and [ð]; and the velar sounds [k], [g], and [ɣ]. Which are phonemes? Give the evidence. Give the rules for the other sounds.¹³²

1. moɣi?	<i>tomorrow</i>	9. toɣuj	<i>I grow</i>
2. liβiða	<i>his grandmother</i>	10. fuŋguj	<i>she grows fat</i>
3. waðuj	<i>he carries</i>	12. ɛntɛða	<i>liver</i>
4. kanduj	<i>he leaves</i>	13. toɣa	<i>thick</i>
5. paɣuj	<i>she washes</i>	14. ɣo?	<i>heron</i>
6. apando?	<i>lame</i>	15. faðaj	<i>they saw</i>
7. paŋuj	<i>he lives</i>	16. bama?	<i>ten</i>
8. awa:ta	<i>girl</i>		

Vowel changes

Vowels may assimilate to the place of articulation of adjacent consonants. For example, in Corongo Quechua, which has only the vowels /i/, /u/, and /a/ in native words, the high vowels become mid when they follow a word-initial uvular consonant (which has the feature [-high] since the tongue is not raised), or when they precede a uvular consonant.

(154)	χeru	<i>wood</i>	puruŋ	<i>fallow</i>
	χɛfwa	<i>nest</i>	purin	<i>walks</i>
	χotʂa	<i>lake</i>	ura	<i>below</i>
	χoskiŋ	<i>he gives it all</i>	uma	<i>head</i>
	atoχ	<i>fox</i>		

The high vowels are also optionally lowered when they are otherwise simply adjacent to a uvular consonant.

(155)	isχuŋ ~ isχoŋ	<i>nine</i>
	janaχi ~ janaχe	<i>companion</i>
	roχuŋ ~ roχoŋ	<i>it cuts</i>

23.6 Try it for yourself with Tlahuitoltepec Mixe

Consider the vowels [o] and [ø] (its front counterpart), ignoring the length distinctions. They do not contrast with each other. Give the rule (informally).¹³³

1. mø:pj	<i>give</i>	8. ?oh	<i>cough</i>
2. køj	<i>rabbit</i>	9. koh	<i>weave</i>
3. pøkj	<i>sin</i>	10. mo:hkh	<i>corn</i>
4. køj	<i>wove</i>	11. ho:n	<i>bird</i>
5. møy:nj	<i>money</i>	12. po:p̄h	<i>white</i>
6. tøy:kj	<i>sold</i>	13. jo:ts	<i>cloud</i>
7. xo:kh	<i>dampen</i>	14. to:kh	<i>sell</i>

Miscellaneous

In Seri consonants are lengthened considerably if they follow a stressed vowel and precede a vowel. Thus a word such as /^hʔasatox/ [ʔas:a:tox] *stones* has a rather long *s*. Similarly, the vowel in the syllable with this lengthened consonant is also lengthened if it is followed by a consonant. So the second *a* in the word /^hʔasatox/ is also rather long. This predictable consonant length and vowel length is not analyzed as contrastive in Seri, despite the existence of contrastive vowel length in the stressed syllable.

23.7 Try it for yourself with Daga

Consider [t], [s], and [r] in the following data. Two of these sounds contrast with each other and two do not. Discuss the facts, present the evidence, and give the rule (informally—it won't be a rule with obvious motivation). Write the word whisper phonemically.¹³⁴

1. asi	<i>grunt</i>	10. anet	<i>we should go</i>
2. senao	<i>shout</i>	11. wagat	<i>holiday</i>
3. urase	<i>hole</i>	12. otu	<i>little</i>
4. sinao	<i>drum</i>	13. topen	<i>hit</i>
5. simura	<i>whisper</i>	14. taβe	<i>old</i>
6. use	<i>there</i>	15. tuian	<i>I kill</i>
7. siuran	<i>salt</i>	16. waria	<i>he takes</i>
8. warap	<i>I take</i>	17. watap	<i>I open</i>
9. nesip	<i>steps</i>	18. merip	<i>vomit</i>

23.8 Try it for yourself with Asheninca Campa

Consider the vowel pairs [i, ɪ], and [e, ɛ]. The feature distinguishing close from near-close vowels, and close-mid from open-mid vowels, is not distinctive. Give the rule informally.¹³⁵

1. etni	<i>armadillo</i>	7. ɪɲahi	<i>his bill</i>
2. ɪŋgani	<i>rain</i>	8. ʃiɛndi	<i>dragonfly</i>
3. nojea	<i>I eat</i>	9. oɑɾɪntsi	<i>roasted meat</i>
4. pitiro	<i>cockroach</i>	10. pokiɛ	<i>cook it!</i>
5. tapetsa	<i>vine</i>	11. nombakotɛmbi	<i>I'll show you</i>
6. nihanda	<i>far away</i>	12. iiri	<i>his nose</i>

Key Concepts

complementary distribution (mutually exclusive)

free variation (conditioned and 'unconditioned')

23.9 Try it for yourself with Sierra Nahuat

The sounds [w] and [w̥] (voiced and voiceless counterparts) do not contrast in this language, nor the sounds [j] and [j̥] contrast. What is the distribution of the voiced vs. voiceless sounds. Choose an underlying form and give a phonological rule.¹³⁶

1. kitʃi:wak	<i>he did it</i>	9. k ^w ʃwpatʃ	<i>moss</i>
2. k ^w ʃwʃi:ŋkeh	<i>sawyer</i>	10. wala:s	<i>he will come</i>
3. ja:s	<i>he will go</i>	11. jo:li:k	<i>slowly</i>
4. ʃiwit	<i>leaf</i>	12. k ^w e:ja ^l	<i>frog</i>
5. k ^w ow̥keke:ʃ	<i>woodpecker</i>	13. mok ^w ejtia	<i>one visits</i>
6. pepetsi:w̥tok	<i>fastened</i>	14. tehwa ^l n	<i>we</i>
7. k ^w owmeh	<i>trees</i>	15. noma:j	<i>my hand</i>
8. ne:tata:ta:w̥ti:li:s	<i>begging</i>		

23.10 Try it for yourself with Italian

The sounds [n] and [ŋ] do not contrast with each other. Which has the most restricted distribution? Give the rule (stated as generally as possible) to derive the most restricted one from the other.¹³⁷

1. nero	<i>black</i>	5. fango	<i>mud</i>
2. bjaŋko	<i>white</i>	6. liŋgwa	<i>tongue, language</i>
3. uŋgja	<i>(finger)nail</i>	7. fine	<i>end</i>
4. onda	<i>wave</i>	8. dantsa	<i>dance</i>

23.11 Try it for yourself with Damana

The sounds [ŋ], [n], and [ɲ] do not contrast with each other. Give the rule or rules needed to derive them from one underlying nasal /n/.¹³⁸

1. ɲi	<i>what?</i>	5. ʒəŋgə	<i>it is</i>
2. ɲik ^h uma	<i>egg</i>	6. naʒɛŋgə	<i>I will go</i>
3. ɲiŋg ^w a	<i>nothing</i>	7. k ^h ən	<i>wood</i>
4. nəŋk ^h ə	<i>s/he is</i>	8. suŋk ^h ina	<i>nose</i>

23.12 Try it for yourself with Tetelcingo Nahuatl

The phones [w], [f], [w̥], and [β] are in complementary distribution. (Check it out.) Assume that the phoneme is basically /w/, and account for the allophones by two prose rules, one for the fronting (making the w into a fricative, ignoring the fact that it is bilabial or labiodental) and one for the devoicing.¹³⁹

1. ɬfɪtɬ	<i>feast</i>	6. watsɪnko	<i>tomorrow</i>
2. iwa	<i>and</i>	7. βieβeɪtsi	<i>biggish</i>
3. βejak	<i>long</i>	8. teusɪβɪ	<i>hungry</i>
4. βehfeɪɪ	<i>big</i>	9. tehwɔ	<i>we</i>
5. ijoɬwɔ	<i>yesterday</i>	10. mɪtsfika	<i>he takes you</i>

23.13 Try it for yourself with Tairora

The sounds [b] and [β] do not contrast with each other; nor do the sounds [r] and [l]. Give the rules needed (informally).¹⁴⁰

1. burauka	<i>I went</i>	6. bulo	<i>I am going!</i>
2. bilo	<i>he goes</i>	7. biβa	<i>he went</i>
3. binaβu	<i>we went</i>	8. birera	<i>I will go</i>
4. iria	<i>listen!</i>	5. hura βuarera	<i>I might go tomorrow</i>

23.14 Try it for yourself with Cashinahua

Consider the following sets of sounds: [p, b, β]; [t, ts, tʃ, d, r]; [ts, s, ʃ, h]. Present the evidence of contrast. Give the rules needed to derive any allophones.¹⁴¹

1. paka	<i>bamboo</i>	17. mΛsu	<i>swollen hand</i>
2. taka	<i>liver</i>	18. mΛʃu	<i>dark, black</i>
3. kaka	<i>basket (type)</i>	19. bΛtu	<i>spotted face</i>
4. baka	<i>fish</i>	20. bΛtsu	<i>to be squeezed</i>
5. daka	<i>to rest</i>	21. bΛsu	<i>face</i>
6. tsaka	<i>to kill</i>	22. kutʃa	<i>arrow (type)</i>
7. tʃaka	<i>bad</i>	23. kuʃa	<i>to hit</i>
8. tapa	<i>floor</i>	24. naka	<i>to chew</i>
9. tama	<i>peanut</i>	25. taβa	<i>washboard</i>
10. bΛru	<i>eye</i>	26. isa	<i>bird</i>
11. isi	<i>unending</i>	27. isΛ	<i>head painting</i>
12. isu	<i>spider monkey</i>	28. bari	<i>sun</i>
13. ba	<i>friend</i>	29. naβu	<i>people</i>
14. daɾΛ	<i>plant (species)</i>	30. sΛpi	<i>weaving design</i>
15. ʃana	<i>fruit (species)</i>	31. dasi	<i>all</i>
16. hΛpΛ	<i>palm (species)</i>	32. maka	<i>rat</i>

Feedback for Chapter 23

23.1 North Puebla Nahuatl¹²⁸

There is no evidence of contrast. The sounds are in complementary distribution. The voiceless fricative occurs intervocalically and also before a voiceless consonant. The voiced fricative only occurs before voiced consonants.

The rule might be stated as generally as: Voicing spreads leftward to a fricative. Or it might be: Voicing spreads leftward from a glide. We see that oral stops and affricates do not become voiced before nasal consonants; therefore the rule cannot be generalized further (i.e., the rule cannot be: Voicing spreads leftward from a consonant).

23.2 Walmatjari¹²⁹

Voiced and voiceless consonants (the voiceless ones are all stops) are in complementary distribution. Another rule is needed: consonants are voiced when they occur between vowels.

23.3 Chimalapa Zoque¹³⁰

[ts] : [s] CNE [tʃtspa] *it is drying* vs. [kospa] *he is scolding him* (not the best evidence)

[tʃ] : [ʃ] CNE [tʃin] *pine tree* vs. [ʃis] *meat*

[ts] does not contrast with [tʃ], and [s] does not contrast with [ʃ].

Rule: Coronal fricatives and affricates become alveopalatal when followed in the same syllable or the next syllable by /i/.

23.4 Busa¹³¹

There are two contrastive sonorant consonants in these data. One is labial and one is coronal. The labial one, *m*, happens to only occur before nasalized vowels. The coronal sonorant has three forms: [l], [r], and [n]. Of these, only [l] occurs after a consonant. Otherwise, the phones [l] and [r] occur only before oral vowels, and [n] only before nasalized vowels. Otherwise, the phone [l] occurs only in word-initial onsets, and [r] in word-medial onsets. (These facts aren't very complicated, but they are not trivial either.) In the source, /n/ was chosen to represent the phoneme. However, [l] has a wider distribution. That fact, plus the fact that nasality is a contrastive feature on the vowel, suggests that perhaps [l] is more basic.

23.5 Oaxaca Chontal¹³²

The phonemes are: p, b, f; t, d; k, g.

- [p] : [b] CNE [paŋuj] *he lives* vs. [bamaʔ] *ten*
 [p] : [β] CNE [apandoʔ] *lame* vs. [liβiða] *his grandmother*
 [p] : [f] CNE [paŋuj] *he lives* vs. [faðaɟ] *they saw*
 [b] : [β] no good evidence
- [t] : [d] CNE [enteða] *liver* vs. [kanduj] *he leaves*
 [t] : [ð] CNE [awa:ta] *girl* vs. [faðaɟ] *they saw*
- [k] : [g] CNE [kanduj] *he leaves* vs. [goʔ] *heron*
 [k] : [ɣ] no good evidence

The feature [+continuant] spreads rightward to voiced obstruents. (Note that nasal stops are [-continuant] and that fricatives, vowels and glides are [+continuant].)

23.6 Tlahuitoltepec Mixe¹³³

/o/ is fronted to [ø] when it is followed somewhere in the same word (or syllable, actually) by the front glide /j/ (or palatalization).

23.7 Daga¹³⁴

[t] and [s] contrast with [r], as in [watap] *I talk* and [nesip] *steps* vs. [warap] *I open* and [merip] *vomit*; but [t] does not contrast with [s]. [t] never occurs preceding a front vowel, but [s] only occurs preceding front vowels. /t/ becomes [s] before front vowels. The word *whisper* is phonemically /timura/.

23.8 Campa¹³⁵

Close and close-mid vowels become near-close and open-mid, respectively, when they precede nasals.

23.9 Sierra Nahuat¹³⁶

The voiceless glides only occur before voiceless consonants. The voiced glides occur between vowels, after *h*, before voiced consonants, word-finally, word-initially, etc.

The rule is: Voicing spreads leftward to a glide.

23.10 Italian¹³⁷

The velar nasal has the most restricted distribution.

The rule: A nasal assimilates to the place of articulation of an immediately following consonant.

23.11 Damana¹³⁸

A coronal nasal becomes palatal before /i/. (This rule accounts for the occurrences of the sound [ɲ].)

A nasal assimilates to the place of articulation of an immediately following consonant. (This rule accounts for the occurrences of the sound [ŋ].)

23.12 Tetelcingo Nahuatl¹³⁹

/w/ becomes a bilabial fricative before front vowels.

A continuant consonant assimilates in voicing to an immediately preceding consonant. (Note that all of the forms of /w/ assimilate in voicing, but /k/ does not assimilate in voicing to a preceding nasal.)

23.13 Tairora¹⁴⁰

/b/ is a fricative when it occurs intervocalically.

/r/ is [l] when it precedes a round vowel.

23.14 Cashinahua¹⁴¹

[p] : [b] CIE [paka] *bamboo* vs. [baka] *fish*

[b] : [β] No contrast

[p] : [β] CIE [tapa] *floor* vs. [taβa] *washboard*

[t] : [d] CIE [taka] *liver* vs. [daka] *to rest*

[d] : [r] No contrast

[t] : [r] CIE [bʌtu] *spotted face* vs. [bʌru] *eye*

[t] : [ts] CIE [bʌtu] *spotted face* vs. [bʌtsu] *to be squeezed*

[t] : [tʃ] CIE [taka] *liver* vs. [tʃaka] *bad*

[ts] : [tʃ] CIE [tsaka] *to kill* vs. [tʃaka] *bad*

[ts] : [s] CIE [bʌtsu] *to be squeezed* vs. [bʌsu] *face*

[ts] : [ʃ] CNE [tsaka] *to kill* vs. [ʃana] *fruit (species)*

[ts] : [h] CNE [tsaka] *to kill* vs. [hʌpʌ] *palm (species)*

[s] : [ʃ] CIE [mʌsu] *swollen hand* vs. [mʌʃu] *dark, black*

[h] : [s] CNE [hʌpʌ] *palm (species)* vs. [sʌpi] *weaving design*

[h] : [ʃ] CNE [hʌpʌ] *palm (species)* vs. [ʃana] *fruit (species)*

The feature [+continuant] spreads rightward to voiced obstruents. (In this language, the [+continuant] version of /d/ is [r].)

CHAPTER 24 - SUSPICIOUS PAIRS

Not every pair of sounds in a language must be investigated in the manner described in the preceding chapters. Certainly in no language is the phoneme /b/ sometimes pronounced [s]. Therefore we would not even bother worrying about whether the sounds [b] and [s] in a language are phonemically distinct. We simply assume that they are. The reason for this is that the environment that a phoneme occurs in can affect it only slightly (although probably more than you might have guessed). Therefore the analyst restricts attention to phonetically similar sounds, which are called the **suspicious pairs**.

It does not take too much experience to be able to guess what sounds must be investigated. These sounds usually only differ in one, two, or three features. The degree to which sounds might be considered suspicious pairs can be shown by comparing the following sounds. Below each sound we list certain features, the features that distinguish one or more of the sounds from the other sounds. For example, since the sounds listed here all have a common place of articulation (they are bilabials), we do not list any place features.

(156)		p	b	β	w	m
	sonorant	-	-	-	+	+
	continuant	-	-	+	+	-
	voice	-	+	+	+	+
	nasal	-	-	-	-	+

We now take each pair of sounds and note how many features separate them.

(157)	One feature	Two features	Three or more
	p, b	p, β	p, w
	b, β	b, m	p, m
	β, w	b, w	β, m
		w, m	

The pairs in the first column are those which we want to check out first; we might call them the primary suspicious pairs. The sounds in the second column are also worth checking out, although it is a little less likely that they are allophones. We might call them the secondary suspicious pairs. The sounds in the third column are not out of the question as suspicious pairs. In any case, if the analyst has difficulty in finding contrast between two sounds which share some features, s/he should be aware that they may be allophones of the same phoneme.^a

Rules of thumb: Having different articulators is a very significant fact for obstruents. Therefore, although [p] and [t] are distinguished only by their point of articulation, this difference virtually guarantees that they are not allophones of the same phoneme. Having different articulators is not a very significant fact for nasals. A nasal often takes on the place of articulation of an adjacent consonant, especially one that follows it.

Laryngeal consonants (such as [h] and glottal stop) also merit special consideration, and comparison with consonants such as [s] and [t], respectively, is appropriate.

Key Concept

suspicious pairs

24.1 Try it for yourself with Suspicious Pairs

For the groups of sounds listed below, decide which are primary suspicious pairs using the features provided.¹⁴²

Group A: _____ s z t d b m _____

continuant

voice

Coronal

Labial

nasal

Group B: _____ s f v b m _____

voice

Labial

Coronal

continuant

nasal

Feedback for Chapter 24

24.1 Suspicious Pairs¹⁴²

Group A: s,z s,t t,d z,d b,m

Group B: f,v v,b b,m

^a This method of determining suspicious pairs depends, of course, on which features you choose to utilize. Nevertheless, we feel it is more important to know why two sounds should be compared than to rely mechanically on a chart of suspicious pairs.

SUMMARY AND REVIEW QUESTIONS FOR SECTION 3

Just as an examination of allomorphy reveals that processes of assimilation are operative in a language, so an examination of the distribution of sounds reveals the same.

The analyst provides evidence that two sounds are not related by a rule of assimilation by showing that the sounds contrast in non-influencing environments. If two phonologically similar sounds (suspicious pairs) cannot be found to contrast in this way, we assume that they are allophones and look for environments which may account for their distribution.

If you have mastered the material in this section, you should be able to examine data and

- (a) recognize the operation of phonological rules based on distributional facts
- (b) provide evidence that certain sounds contrast with each other
- (c) provide evidence that certain sounds do not contrast with each other
- (d) propose phonological rules to describe allophonic variation
- (e) recognize sounds which are likely to be analyzed as allophones of a single phoneme
- (f) explain the role that contrastive features have in the sound system of a language
- (g) explain the role that non-contrastive features have in the sound system of a language

For Further Reading:

Anderson, Stephen R. 1974. *The organization of phonology*. New York, London, Academic Press.

Hyman, Larry M. 1975. *Phonology: theory and analysis*. New York, London, Sydney: Holt, Rinehart and Winston.

Kenstowicz, Michael and Charles Kisseberth. 1979. *Generative phonology: description and theory*. New York, London, Academic Press.

Pike, Kenneth L. 1947. *Phonemics: A technique for reducing language to writing*. Ann Arbor, University of Michigan Press.

Review Questions

The following questions are to help you review the material in the preceding section. ¹⁴³

1. (T or F) Allophones sometimes appear in the underlying form of a morpheme.
2. (T or F) One cannot assume that two similar sounds contrast in a language until one finds them in a minimal pair.
3. (T or F) A minimal pair such as [naka] *dog* and [naga] *table* proves that /k/ and /g/ are phonemes.
4. (T or F) When there is free variation between two segments, an optional rule can be written.
5. (T or F) Contrast in non-influencing environment is helpful for demonstrating that two sounds are distinct phonemes.
6. (T or F) When two similar sounds are in complementary distribution, one expects to write a rule to account for the facts.
7. (T or F) Phonetic differences that make a difference in meaning are accounted for by phonological rules.
8. (T or F) The demonstration of contrast between two sounds establishes them as separate allophones of a single phoneme.

9. (T or F) In the case of complementary distribution, two or more sounds occur in mutually exclusive environments.
10. (T or F) If you cannot prove that the members of a suspicious pair contrast, you should look for complementary distribution.
11. Two sounds are _____ of one _____ if they occur in complementary distribution.
12. If two phonetically similar sounds occur in mutually exclusive environments, they are _____.
13. A(n) _____ has the potential to create a difference in meaning.
14. [p] and [p^h] are _____ in English.

Feedback for Review Questions ¹⁴³

1. F 2. F
3. F (This is evidence that there is something different between the two words underlyingly, but it doesn't necessarily mean that the difference is located in a voicing contrast between *k* and *g*.)
4. T 5. T 6. T
7. F 8. F 9. T 10. T
11. allophones, phoneme 12. allophones 13. phoneme
14. allophones

SECTION 4

PHONOLOGICAL RULES: STRUCTURAL ISSUES

In this section we look at a variety of issues, many of which relate to features in a larger structure, such as a syllable, a word, or an utterance.

Sounds are organized into groups when words are formed. The syllable patterns of a language tend to be preserved when affixes are added to words. Thus there are phonological rules that insert or delete material in order to keep these patterns intact. These phonological rules 'mop up' after morphological rules have done their thing.

In this section we also look a bit more closely at how phonological rules interact. What happens when two or more rules might apply to the same underlying form? Do they apply in order or all at once? Questions such as these constitute an important part of linguistic research over the past thirty years.

We also look at some issues that relate to the nature of underlying forms.

CHAPTER 25 - UNDERSPECIFICATION

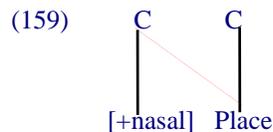
Up to this point we have presented underlying forms of morphemes as strings of phonemes. For example, we have given the underlying form of the most common plural suffix in English as {z}. We have also clarified that symbols such as *z* are abbreviations for combinations of features. Therefore, we might more correctly give the underlying form of this morpheme as the combination of the features [-sonorant], [+voice], [Coronal], [+continuant].

But this view still may be unnecessarily complicated. It has been suggested that in some cases certain features may be absent in underlying forms. That is, certain characteristics of the morpheme may be **underspecified**. As an example, consider the following data from Seri.^a

- (158) [m]-potis *if you point at it*
 [n]-ttis *did you point at it?*
 [n]-jotis *you pointed at it*
 [ɲ]-χotis *you pointed at it!*

The subject prefix for second person singular is a nasal, it always happens to occur in front of a consonant, and it always has the same point of articulation as that consonant. So there is no obvious way to choose one of these forms as underlying. It would be arbitrary (from these data alone) to choose *m* as basic, arbitrary to choose *n* as basic, and so forth.

An alternative to an arbitrary choice is to claim that the morpheme is simply a nasal consonant which is not specified for place of articulation. The nasal will then assimilate to the following consonant.



In Salasaca Quichua, syllable-final consonants are extremely restricted. If it is a nasal, its place of articulation is either (a) that of the following obstruent, or (b) velar.

- | | | | |
|-------|-----------------------|-------------------------|----------------------------|
| (160) | munduŋgu | <i>head</i> | (nasal precedes velar) |
| | tsaŋkana | <i>to grind by hand</i> | (nasal precedes velar) |
| | janta | <i>wood</i> | (nasal precedes alveolar) |
| | t ^h imbuna | <i>to boil</i> | (nasal precedes labial) |
| | guluŋ | <i>thunder</i> | (nasal is utterance-final) |

If the syllable-final consonant is a non-strident obstruent (i.e. not *s*, *ʃ*, *z*, *tʃ*, etc.), its point of articulation is always velar, the exact pronunciation of which varies by context: [x] word finally, [ɣ] before voiced fricatives, [k] before voiceless stops, etc.

- | | | | |
|-------|--------|-----------------------|------------------------------|
| (161) | kulux | <i>storage bench</i> | (word-final position) |
| | tuɣʒa | <i>slipknot</i> | (preceding voiced fricative) |
| | waksux | <i>bird (species)</i> | (preceding voiceless stop) |

Therefore, it appears that Place features at the end of syllables in this language are not present if the consonant is a nasal or a nonstrident obstruent. If the nasal does not obtain Place features from the following consonant, it is assigned the features of a velar. And a nonstrident obstruent in syllable-final position not only has no Place features, it also has no Manner features. It is assigned the Place features of a velar. It receives the features [voice] and [continuant] from the context, when possible, and is otherwise assigned the features [-voice] and [+continuant]. The underlying form of the word for *storage bench* is

^a These forms are those which follow vowel-final words. If a consonant-final word preceded them, they would begin with an *i*.

therefore something like {kuluC}; the pronunciation of the final consonant is derived from general phonological patterns of the language.

It is possible for other features to be absent in underlying forms. Whenever there is a lack of contrast between sounds, one should consider the idea that a feature or set of features is not specified rather than make an arbitrary choice.

There is another way in which underspecification is used in phonology. Suppose, for example, that you had a common five vowel system, as shown below.

(162)		a	e	i	o	u
	high	-	-	+	-	+
	low	+	-	-	-	-
	back	+	-	-	+	+
	round	-	-	-	+	+

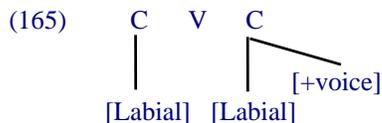
Note that if a vowel is [+high], it is [-low]. And if a vowel is [+low], it is [-high]. In addition, the values of the feature [round] are predictable from other features. If a vowel is [+back] and [-low], it is [+round] in this language. In fact, if as much redundant information as possible is omitted from the specifications of the vowels, we can end up with the representations shown below. And each vowel is still representationally distinct.

(163)		a	e	i	o	u
	high			+		+
	low	+				
	back	+			+	+
	round					

Unless otherwise specified, a vowel is [-high]. Unless otherwise specified, a vowel is [-low]. Unless otherwise specified, a vowel is [-back]. The rules might be expressed as:^b

(164)	[] → [-high]	[] → [-low]	[] → [-back]
	[+back] → [+round]		[] → [-round]
	[-low]		

This approach allows a considerable simplification of underlying forms in a language. For example, a morpheme such as *peb* might have the following shape (simplifying the formalism somewhat):^c



We know that the first consonant is a *p* (or *f*)^d because the feature [voice] is not specified and the place feature [+labial] is specified. On the other hand, we know that the second consonant is *b* (or *v*) because the features [+voice] and [+labial] are both specified. The vowel will surface as /e/ because of the rules given above.^e

It is possible (but probably not common) that an underspecified consonant or vowel contrasts with all of the other phonemes of the language. For example, it has been claimed that Seri has a number of roots

^b In order to make these redundancy rules give the correct results, certain ones must be applied before certain others.

^c We are assuming a redundancy rule [] → [-voice] for obstruents.

^d If the language had *f* as well as *p*, an extra feature would be necessary for one or the other of these sounds.

^e See Diana Archangeli (1984) *Underspecification in Yawelmani phonology and morphology*, Ph.D. Dissertation, MIT; Diana Archangeli (1988) Aspects of underspecification theory, *Phonology* 5; Douglas Pulleyblank (1988) Vocalic underspecification in Yoruba, *Linguistic Inquiry* 19:233-270; and Poovi Abaglo and Diana Archangeli (1989) Language-particular underspecification: Gengbe /e/ and Yoruba /i/, *Linguistic Inquiry* 20:457-80.

which begin with a consonant which has no features of its own, but which is distinct from all other consonants in the language. When this consonant follows a consonant prefix, it assimilates entirely to the preceding consonant.

- (166) t-taχ *is it hard?*
 k-kαχ *that which is hard*
 s-sαχ *it will be hard*
 im-mαχ *it is hard*

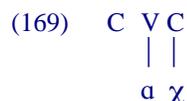
As discussed in chapter 19, this is described formally by a spreading of the Root node, which dominates all of the features of a sound.



When it follows a vowel, it cannot assimilate and is not pronounced.^f

- (168) po-aχ *if it is hard*
 yo-aχ *it was hard*

The underlying form of the root for *be hard* is therefore the following (where letters are still used as abbreviations for feature combinations):



We have seen in this chapter that if we allow underlying forms to be underspecified for some features, then we are able to avoid making arbitrary choices in many cases. In this last example from Seri, we don't have much of an option at all.

Key Concepts

underspecification of features in underlying forms

25.1 Try it for yourself with Hausa

Propose underlying forms for the roots and suffixes, and phonological rules. Be sure not to propose explicit underlying forms where underspecified forms are appropriate.¹⁴⁴

	<i>father</i>	<i>mother</i>	
1.	ʔubaŋka	ʔuwakka	<i>your...</i>
2.	ʔubaŋfi	ʔuwaʃfi	<i>his...</i>
3.	ʔubanta	ʔuwatta	<i>her...</i>
4.	ʔubammu	ʔuwammu	<i>our...</i>
5.	ʔubaŋku	ʔuwakku	<i>your (pl.) ...</i>
6.	ʔubansu	ʔuwassu	<i>their...</i>

^f Stephen A. Marlett and Joseph P. Stemberger (1983) Empty consonants in Seri, *Linguistic Inquiry* 14:617-39.

25.2 Try it for yourself with Tarahumara

Propose an underlying form for the nominalizing suffix in the following data, and a phonological rule.¹⁴⁵

- | | | | |
|--------------|--------------------------|--------------|-----------------------------|
| 1. mitʃiru | <i>to make shavings</i> | 6. remeke | <i>tortillas</i> |
| 2. mitʃiruku | <i>shavings</i> | 7. patʃi | <i>to grow ears of corn</i> |
| 3. ritu | <i>to be icy</i> | 8. patʃiki | <i>an ear of corn</i> |
| 4. rituku | <i>ice</i> | 9. opatʃa | <i>to be dressed</i> |
| 5. reme | <i>to make tortillas</i> | 10. opatʃaka | <i>garment</i> |

25.3 Try it for yourself with Walmartjari

The following data apparently show the full range of allomorphy for the Irrealis suffix and the full range of facts for verb stem-final consonants in this language. Discuss the facts and propose an analysis. (The diacritic ̣ indicates a lamino-alveolar consonant. The diacritic ̤ indicates an apical post-alveolar consonant.) For the purposes of this exercise, you may omit consideration of the allomorph which occurs with the verb *chop*. Also, recall that voicing of the stop is determined by the context in which it occurs; it is not distinctive.¹⁴⁶

	<i>Stem</i>	<i>Irrealis</i>	
1.	waŋ̣ɖa	waŋ̣ɖa	<i>get</i>
2.	kari	kari	<i>stand</i>
3.	paɖar	paɖara	<i>chop</i>
4.	maŋ̣	maŋ̣ɖa	<i>speak</i>
5.	kaŋ	kaŋga	<i>carry</i>
6.	ʦan	ʦanda	<i>go</i>
7.	paɖaran	paɖaranda	<i>continue to chop</i>
8.	kaŋan	kaŋanda	<i>continue to carry</i>

25.4 Try it for yourself with Agutaynen

Propose an underlying form and a rule or rules to account for the allomorphy of the second person pronoun which follows the verb.¹⁴⁷

1. mijip pa *you will blow*
2. manlit ta *you will borrow*
3. timilik ka *you will look*
4. tumaʔlib ba *you will pass by*
5. tinlid da *you will enter*
6. maboʔlog ga *you will fall*
7. malitim ma *you will grow hungry*
8. mailin na *you will become full*
9. maglibiŋ ŋa *you will attend the funeral*
10. mangilil la *you will tremble*
11. magpadir ra *you will make a fence*
12. magbosis sa *you will use your voice*
13. magbalaj ja *you will make a house*
14. magpaoraw wa *you will get in the shade*
15. magsisi a *you will scale (fish)*
16. magpalipi a *you will humble yourself*
17. magpatako a *you will inform*
18. magbalita a *you will tell the news*

Feedback for Chapter 25

25.1 Hausa

¹⁴⁴ *your* {-kɑ}, *his* {-fi}, *her* {-tɑ}, *our* {-mu}, *your (pl.)* {-ku}, *their* {-su}.

father {ʔubaN} (where N indicates an underspecified nasal consonant)

mother {ʔuwaC} (where C indicates a fully underspecified consonant)

Rule: The underspecified nasal consonant assimilates in Place to an immediately following consonant.

Rule: The underspecified consonant assimilates in all features to an immediately following consonant.

25.2 Tarahumara

¹⁴⁵ The suffix is {-kV} (where V indicates a fully underspecified vowel). The underspecified vowel assimilates in all features to the vowel of the preceding syllable.

25.3 Walmatjari

¹⁴⁶ First of all, there are probably two suppletive allomorphs: null (after vowels), and something else after consonants. The underlying form of the overt allomorph is indeterminate since it always agrees in place of articulation with the preceding consonant. (It is deleted after a liquid.) Unless there is other evidence of an underlying Place feature for this suffix, it would seem best to simply posit an underlying form of {-Cɑ}—but the C would have the feature [-sonorant] at least, but no Place node. A rule spreads Place to the right to give this consonant a Place feature in surface representation. Voicing would spread to the right (by the rule already seen).

25.4 Agutaynen

¹⁴⁷ The pronoun is {Cɑ}. The consonant has no features at all. The Root node of the preceding consonant spreads to it. If there is no consonant immediately preceding it (such as when the verb ends in a vowel), no features can spread and the ‘empty’ consonant is not realized phonetically at all. This example parallels the Seri case discussed in the text exactly.

CHAPTER 26 - EDGE PHENOMENA

There are a number of phenomena that can be observed happening at the edge of some unit of structure such as the word, or syllable, or utterance. Before considering these phenomena, we need to clarify what we mean by these labels.

For some rules of a language, the word unit which is relevant is the word produced by the word structure rules. For others, the word unit may include a word produced by the word structure rules *plus* some smaller words which occur next to it. The latter has sometimes been referred to as the phonological word. We do not distinguish between these here, but use the symbols]_w (end of word) and _w[(beginning of word) to refer to either.^a

For our purposes, an utterance is any string of words which occurs between two pauses (however short). A simple sentence might be said so slowly that it is actually composed of many utterances by this definition. We use the symbols]_ϕ (Greek upper case *phi* following square bracket) to refer to end of utterance.

A syllable is a small unit of structure which we discuss in more detail in the following chapter, as we assume that you have some idea of what a syllable is. We use the convention _σ[(Greek lower case *sigma* preceding square bracket) to refer to the beginning of a syllable.^b

We now consider various rules below which refer to the end or the beginning of one of these units.

Final Position

In various languages it has been observed that consonants tend to become voiceless at the end of a unit, especially the syllable or utterance.^c Although this devoicing is common and natural, it is *not* due to the spreading of some feature from another sound.

It is common in Spanish, for example, for the r-sound to be voiceless (and trilled) utterance-finally.

(170) *flo*[r] ~ *flo*[r̥] flower

It can be shown that the relevant unit is the utterance and not the word (or syllable) by noting that the devoicing never happens when the word *flor* is used in the middle of a sentence. The rule is therefore:

(171) r]_ϕ
 ↓
 [-voice]

In German, obstruents are devoiced in syllable-final position. Thus the underlying *g*'s and *d*'s in the following words become *k*'s and *t*'s in many instances.

(172)	tagə	days	jagən	to hunt
	tak	day	jakdən	hunting (pl.)
	kɪndɪʃ	childish	jakt	hunting
	kɪnt	child		

^a The symbol # (or a pair, ##) were commonplace in earlier generative phonological work to symbolize word boundary.

^b The symbols \$ and . (period) are sometimes seen in the literature to symbolize syllable boundary.

^c In earlier generative phonological work, explicit reference to the syllable was avoided on principled grounds. Therefore, rather than indicate that something happened at the end of a syllable, the rule was formulated such that it applied before a consonant *or* at the end of a word. This kind of complicated environment was expressed with the brace ({}) notation, which was used elsewhere in the theory to combine two *unrelated* environments. Direct reference to the edge of the syllable is now no longer avoided.

In Sierra Nahuat, *w* and *j* are voiceless in this position. Therefore a word such as /*ipatiw*/ *its price* has a voiceless *w* when it occurs before pause. It is also not uncommon for vowels to become voiceless, or have a voiceless release, in utterance-final position.

Also in Spanish, in highly emphatic speech, an “*r*” is trilled if it occurs at the end of the syllable.^d (Otherwise it is a flap in that position.)

(173) *ma[r]tes ~ ma[r̄]tes Tuesday*

In Seri a *p*, *t*, or *k* is optionally pronounced three different ways at the end of an utterance: either unreleased, or with a voiceless nasal release, or aspirated. Following a consonant and utterance-final, a *k* may be glottalized instead.

In Chimalapa Zoque, a vowel is lengthened if it occurs at the end of a stressed syllable before another syllable.

(174) *'kitpa bends, 'ki:ti? bend (root: kit)*

A consonant may be stripped of certain features in syllable-final or word-final position. For example, a stop such as *t* may lose its coronal place features and be pronounced as glottal stop, as in certain dialects and speech styles of English where *hit* is pronounced [hɪʔ]. In some dialects of Nahuatl, a syllable-final glide (*j* or *w*), which is [+continuant], shows up as *h*, having lost distinctive place features. In Spanish, in certain dialects, an *s* is changed to *h* in syllable-final position.

(175) *de[s]pue[s] → de[h]pue[h] ‘after’*

In many languages, a (phonetic) glottal stop is inserted between a vowel and pause. In Sierra Nahuat, this happens only *after* a vowel. Thus a word such as *look!* has two pronunciations: [ʃkitaʔ] at the end of an utterance, and [ʃkita] if another word follows.

Initial Position

In English the voiceless stops are aspirated at the beginning of a word and also at the beginning of stressed syllables.

(176) [p^h]each
[p^h]ollute
ca[p^h]itulate

The “*r*” of Spanish is trilled if it occurs at the beginning of a word, whether or not the word is inside a larger utterance or not.

(177) [r̄]eto *challenge*

In Sierra Nahuat, a *w* optionally has a velar onglide in word-initial position (making it sound like [g^w]), especially before back vowels.

Key Concepts

processes which apply at edges of units
utterance

syllable

word

^d We return to these facts below. The rule is more general than this.

26.1 Try it for yourself with Korean

Complete the following rule to accounting for the distribution of [r] and [l]. Write the words for *road* and *water* phonemically, making some choice about the representation of the phoneme.¹⁴⁸

The liquid is [l] at the end of a _____ and [r] at the beginning of a _____.

- | | | | | | |
|----|-------|---------------|-----|--------|-----------------|
| 1. | rubi | <i>ruby</i> | 6. | mul | <i>water</i> |
| 2. | kiri | <i>road</i> | 7. | pal | <i>big</i> |
| 3. | saram | <i>person</i> | 8. | səul | <i>Seoul</i> |
| 4. | irumi | <i>name</i> | 9. | ilkop | <i>seven</i> |
| 5. | radio | <i>radio</i> | 10. | əlmana | <i>how much</i> |
| | | | 11. | ibalza | <i>barber</i> |

26.2 Try it for yourself with Totonac

Consider the voiceless vowels in the following words which are presented as they would be pronounced in a list. Is the lack of voicing in vowels predictable? Give a rule and discuss what other kind of data you would like to see.¹⁴⁹

- | | | | | | |
|----|------------|--------------|----|--------|-----------------------|
| 1. | kuk̥u | <i>uncle</i> | 4. | ʃump̥i | <i>porcupine</i> |
| 2. | mik̥i | <i>snow</i> | 5. | stap̥u | <i>beans</i> |
| 3. | sn̥ap̥ap̥ə | <i>white</i> | 6. | tsap̥ə | <i>he piles it up</i> |

26.3 Try it for yourself with Seri

Does [ŋ] contrast with [m]? Does it contrast with [n]? Write the word for *did they arrive?* phonemically.¹⁵⁰ Give an explicit prose rule accounting for the distribution of [ŋ]. (The location of stress is relevant; the plurality of the subject of the verb is not. The words are given as they occur utterance-finally.)

- | | | | | | |
|----|-------------|--------------------------|-----|--------------|-------------------------------|
| 1. | 'taʃkaŋ | <i>did they arrive?</i> | 8. | 'kmamiʔa | <i>it is cooked</i> |
| 2. | 'kaʃkamiʔa | <i>they are arriving</i> | 9. | i'to:n | <i>is s/he carrying them?</i> |
| 3. | 'taiskan | <i>was it hard?</i> | 10. | 'ko:niʔa | <i>s/he is carrying them</i> |
| 4. | 'kaiskaniʔa | <i>it is hard</i> | 11. | 'ti:m | <i>is s/he sleeping?</i> |
| 5. | 'toitoŋ | <i>are there five?</i> | 12. | 'ki:miʔa | <i>s/he is sleeping</i> |
| 6. | 'koitomiʔa | <i>there are five</i> | 13. | ta'tikpan | <i>is s/he working?</i> |
| 7. | 'tmam | <i>is it cooked?</i> | 14. | ka'tikpaniʔa | <i>s/he is working</i> |

26.4 Try it for yourself with North Puebla Nahuatl

Words ending in sonorant consonants in North Puebla Nahuatl have a variant pronunciation when they are in utterance-final position. Give the rule. Similarly, words ending in stops have a variant pronunciation in this position. Give that rule also.^{e 151}

	Medial Position	Final Position	
1.	ke:man	ke:man ~ ke:maŋ	<i>when</i>
2.	onikmat	onikmat ~ onikmat ^h	<i>I knew it</i>
3.	omok ^w ep	omok ^w ep ~ omok ^w ep ^h	<i>he returned</i>
4.	tʃipawak	tʃipawak ~ tʃipawak ^h	<i>clean</i>
5.	nokal	nokal ~ nokaɭ	<i>my house</i>
6.	nika:n	nika:n ~ nika:n̄	<i>here</i>

26.5 Try it for yourself with North Puebla Nahuatl

Consider the phones [l], [l̥] (voiced lateral with a voiceless release), [ɬ] (voiceless lateral), [w] and [w̥]. What are the phonemes and what are the rules?¹⁵²

1. paɬtik ~ palɬtik	<i>wet</i>	8. to:na:li	<i>day</i>
2. tsa:joli	<i>housefly</i>	9. we:ji	<i>big</i>
3. wa:tsap	<i>blackberry</i>	10. ka:li	<i>house</i>
4. neɬwajo ~ nelɬwajo	<i>root</i>	11. izwak	<i>dry</i>
5. nokaɬ ~ nokaɬɬ	<i>my house</i>	12. o:wpa	<i>twice</i>
6. mo:ɬwi ~ mo:lɬwi	<i>very</i>	13. tʃipawak	<i>clean</i>
7. onikiɬkaw ~ onikiɬkaw	<i>I forgot</i>		

26.6 Try it for yourself with Sierra Popoluca

Consider the nasals with voiceless off-glides. Is the off-glide predictable? Give a rule and discuss what kind of data is lacking to make the rule precise.¹⁵³

1. jo:mo	<i>woman</i>	5. mok	<i>corn</i>
2. tsa:mm̥	<i>very</i>	6. tsa:n̥	<i>snake</i>
3. ɲi:wi	<i>chili</i>	7. wo:ɲi	<i>little girl</i>
4. hon̥	<i>bird</i>	8. nits	<i>armadillo</i>

^e Affricates and k^w apparently do not undergo the second rule. Ignore this fact.

26.7 Try it for yourself with Pennsylvania German

Focus on the sounds [ɣ] (representing a voiced uvular fricative and [r]). They do not contrast with each other, so both are not needed in underlying forms. [r] occurs in syllable onsets. Where does [ɣ] occur?¹⁵⁴

1. rot	<i>red</i>	7. ʃtros	<i>street</i>
2. ʃrajβə	<i>write</i>	8. marik	<i>market</i>
3. βaɣʃt	<i>sausage</i>	9. reɣərə	<i>rain</i>
4. maɣ	<i>mare</i>	10. nəxpərə	<i>neighbor</i>
5. tiɣ	<i>door</i>	11. krumpiɣ	<i>potato</i>
6. tiɣə	<i>doors</i>	12. paɣraj	<i>farm</i>

Feedback for Chapter 26

26.1 Korean

¹⁴⁸ Syllable; syllable. /kiri/ and /mur/; or /kili/ and /mul/.

26.2 Totonac

¹⁴⁹ Vowels are devoiced in final position.

What is unclear is whether it is the end of the utterance or the end of the word which is relevant. We would need to see these words inside of a phrase to adequately formulate the rule. (In actuality, as in so many cases, the environment is “utterance final”.)

26.3 Seri

¹⁵⁰ [ŋ] contrasts with [n], but not with [m]. Morphemes with [ŋ] have allomorphs with [m]. The phonemic form of *did they arrive?* is /tɑʃkɑm/.

Rule: /m/ becomes velar when it occurs at the end of an unstressed utterance-final syllable (or word-final syllable—one can’t tell from these data, but the former is correct).

26.4 North Puebla Nahuatl

¹⁵¹ A stop is optionally aspirated utterance-finally.

A sonorant consonant is optionally devoiced utterance-finally.

26.5 North Puebla Nahuatl

¹⁵² There are two phonemes: /l/ and /w/.

/l/ is either wholly or partially devoiced in syllable-final position.

/w/ is voiceless in syllable-final position; it is also voiceless following a voiceless consonant.

26.6 Sierra Popoluca

¹⁵³ Nasals have voiceless off-glides in final position.

What is unclear from these data is whether it is the end of the utterance or the end of the word which is relevant. We would need to see these words inside of a phrase. (According to the source of the data, the correct environment is utterance-final.)

26.7 Pennsylvania German

¹⁵⁴ /r/ is [ʁ] when it occurs in the coda (or, alternatively, in the rhyme) of a syllable.

CHAPTER 27 - SYLLABLE STRUCTURE

In the previous chapter we looked at some phenomena which make reference to the end or beginning of a syllable. Most linguists consider that a word must be ‘parsable’ into syllables, and languages impose restrictions which have to do with possible syllables. One way in which this has been conceptualized recently is in terms of a maximal syllable template, where the template specifies the largest syllable allowed.^a For example, Madija has the following maximal syllable template:

(178) [C V]

The largest syllable in this language consists of a consonant and a vowel, although of course smaller syllables also occur (consisting of a vowel).^b We can parse the following words of Madija using this template:

(179)

σ	σ	σ	σ		σ	σ	σ
()	()	()	()			()	
C	V	C	V		V	C	V
n	a	p	i	p	i	n	i
<i>her stomach</i>							
				<i>sadness</i>			

There are no maximal syllable templates smaller than (178) in any language. In other words, every language has CV syllables in its inventory. But there are some syllable templates which are larger, of course. In Corongo Quechua, the maximal syllable template is:

(180) [C V C]

We can parse the following words using this template:

(181)

σ	σ	σ		σ	σ
()	()	()		()	()
C	V	C	C	V	C
m	a	n	t	a	k
<i>it is suspended</i>					
			<i>potato</i>		

Note that this template is able to parse syllable types CV and VC as well as CVC. An English word such as *inspect* could not be a word of Quechua since it cannot be parsed by the template given above.^c

The following maximal syllable template is proposed for Isthmus Zapotec:

(182) [C C V V]

We can parse the following words using this template:

(183)

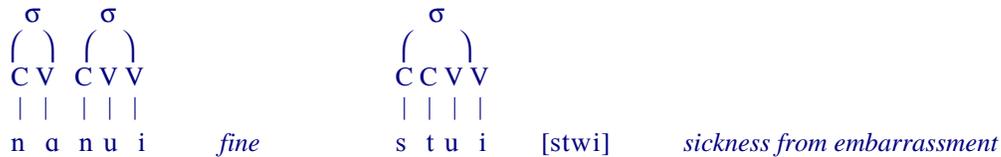
σ	σ		σ
()	()		()
C	C	V	V
ʃ	n	e	z
<i>correct</i>			
		σ	
		()	
		C	V
		g	i eʔ
		[gjeʔ] ^d	<i>flower</i>

^a For example, see Junko Itô (1986) *Syllable theory in prosodic phonology*, Dissertation, University of Massachusetts, Amherst.

^b In some languages (e.g. Japanese), loanwords from other languages are restructured according to the native syllable template. In others, loanwords are incorporated into the language with a syllable structure very much like the language from which they were taken. For example, Madija speakers use certain words from Spanish which would not be possible words in their language since they violate the syllable template.

^c Loanwords in Quechua do violate native syllable structure constraints, however.

^d See Marlett and Pickett (1987) The syllable structure and aspect morphology of Isthmus Zapotec, *International Journal of American Linguistics* 53:398-422, for arguments that the [j] of words such as [gjeʔ] is to be analyzed as shown here. The vowel of this word is ‘checked’ by a glottal stop; the glottal feature is not a consonant in the language, but a vowel feature.



And in Seri, the maximal syllable template (excluding certain special cases) is apparently the following:^e

(184) [CCCCVVVCCC]

(185) Examples:

ka:txk *grasshoppers*
 tmoi:x *is it circular?*
 kʃχok *who chops it off*

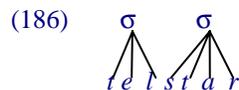
Of course, we are not giving a complete inventory of possible maximal syllable templates, but simply giving some examples of what they look like.

Syllabification

We have used the term *parse* above, and it needs some explanation. By some algorithm, a string of sounds is scanned using a syllable template, and the string is organized into syllables. There is a considerable amount of discussion in the literature as to when this is done, and how it is done. We ignore these issues here, except for one. We assume, with others, that languages always organize the string CV into a syllable. A sequence such as CVCV is claimed to be universally syllabified as [CV] [CV], never as [CVC] [V].^f

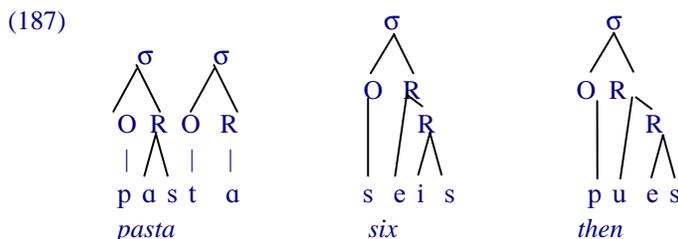
Internal Structure of Syllables

Some linguists have viewed the syllable as a flat structure, as illustrated below:



That is, the consonants and vowels which occur in a syllable are simply linked directly to the syllable node.^g

A more common view is that the syllable has some kind of internal structure, although there are differences of viewpoint in this matter. Some linguists view the syllable as having two major parts: **onset** (O) and **rhyme** (R), as shown below for three words from Spanish.^h



^e For extensive discussion, see Stephen A. Marlett (1988) The syllable structure of Seri, *International Journal of American Linguistics* 54:245-78.

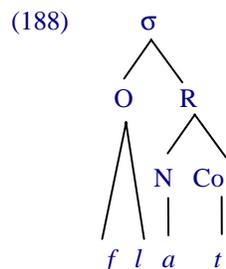
^f Junko Itô (1986) *Syllable theory in prosodic phonology*, proposes the following Universal Core Syllable Condition: if a consonant precedes a vowel, it is in the same syllable as that vowel.

^g George N. Clements and Samuel Jay Keyser (1983) *CV phonology: a generative theory of the syllable*, London, Cambridge, Mass., MIT Press.

^h James Harris (1983) *Syllable structure and stress assignment in Spanish: a nonlinear analysis*, Cambridge, London, MIT Press.

Phonological rules may make reference to the unit rhyme. For example, the rule in Spanish trilling *r* mentioned in chapter 26 actually applies to any *r* in a rhyme, not just to *r*'s which occur at the end of the syllable.ⁱ

Another view of the internal structure of the syllable which is now quite commonly adopted, is that there are three major constituents: Onset, Nucleus, and Coda, with the latter two units usually grouped under a common node (Rhyme).^j The nucleus is always the part which is perceived as the syllable peak.



Since there is still considerable debate about these different views, we do not develop this topic more here.

Distribution of syllables

In some languages a syllable is never without an onset, so a condition such as the following is necessary:

(189) Restriction: Onset obligatory.

All languages, however, appear to have onsets in most syllables, although they may never have complex onsets. (All languages have nuclei, of course.)

In some languages, stressed syllables are specially licensed to contain more consonants (or vowels) than other syllables.^k

Special Syllables

In some languages syllables which appear at the edge of a word are special in one of two ways. First, they may be without onsets, in spite of a general restriction requiring onsets in the language. This seems to be handled typically by stipulating the restriction, as in (189) above.

Second, they may include sounds in the onset (if word-initial) or coda (if word-final) which are not generally allowed there otherwise, or they allow for more sounds than are generally allowed.^l English has some special syllables. For example, there are syllables of the type illustrated by the word *asked*, which have a syllable coda [skt] that does not occur word-medially nor in words consisting of only one morpheme (note that the past tense suffix occurs in *asked*). (There are no nouns like *raskt* in English, nor are they possible.) These special syllables always end in a coronal consonant in English.^m Given this fact, it is not

ⁱ An example would be the *r* in *perspicaz*; the first syllable is *pers*. See Harris (1983) *Syllable structure and stress assignment in Spanish* for a careful treatment of syllables in Spanish. The results he obtains are not those traditionally held for Spanish. The argumentation is clear and careful and worth reading. A major point to remember is that the decisions about the internal structure of the syllable cannot be made without careful examination of facts other than just the strings of consonants and vowels.

^j Kenneth L. Pike and Eunice V. Pike (1947) Immediate constituents of Mazateco syllables, *International Journal of American Linguistics* 13:78-91, proposed a view of the syllable along these lines.

^k For example, this is true of Seri. See Stephen A. Marlett (1989) *The syllable structure of Seri*.

^l These consonants are commonly called *extrametrical*. The theoretical point is that words are sometimes composed of more than simply well-formed syllables. The practical point is that the characterization of the maximal syllable template is thrown off by looking at word edges.

^m See Elizabeth Selkirk (1984) On the major class features and syllable theory, in Mark Aronoff and Richard T. Oehrle, eds. *Language sound structure*, MIT Press, Cambridge, Mass.; and John A. Goldsmith (1990) *Autosegmental and metrical phonology*, Basil Blackwell, Oxford, Cambridge, Mass.

In more current terms, the edge sounds may be extrametrical, and may be exempt from the conditions imposed by the

possible or appropriate to simply look at a list of monosyllabic words in order to determine what the maximal syllable template is. Consider the following set of ‘words’:

- (190) pag
 spak
 paktap
 (no word like *pakspat)

We can parse all of these words with the template [CVC] if we analyze the word *spak* as consisting of the syllable *pak* plus the extra sound *s* which this ‘language’ allows at the beginning of words. If the template is [CVC], we can explain why words such as *pakspat* do not occur. On the other hand, if the template were expanded to [CCVC] just to account for the word *spak*, then we would have no account for the fact that this kind of syllable cannot occur word-internally but may only occur at the beginning of a word.

Key Concepts

(maximal) syllable template	parsability of a string	special syllables
internal constituents of syllable (onset, rhyme, nucleus, coda)		

27.1 Try it for yourself with North Puebla Nahuatl

What is the maximal syllable template for the following data? Show how each word may be parsed with it by grouping the sounds into syllables.¹⁵⁵

- | | | | | | |
|----|----------|----------------------|----|--------|-------------|
| 1. | paltik | <i>wet</i> | 4. | aʃan | <i>now</i> |
| 2. | onikmat | <i>I knew it</i> | 5. | iʃwak | <i>dry</i> |
| 3. | okikakke | <i>they heard it</i> | 6. | neʃtik | <i>blue</i> |

27.2 Try it for yourself with Marinhua

This language has many obvious CV syllables and V syllables:

- | | | | | | |
|----|------|-----------------|----|------|---------------|
| 1. | tonã | <i>blue</i> | 5. | õĩ | <i>to see</i> |
| 2. | ʃimã | <i>fish</i> | 6. | jawa | <i>pig</i> |
| 3. | fĩ | <i>mosquito</i> | 7. | saja | <i>dress</i> |
| 4. | fĩĩ | <i>rubber</i> | 8. | nõnũ | <i>duck</i> |

27.2.A. There are no words like [skata], [katas], or [kas]. Explain how a [CV] maximal syllable template accounts for all of these facts, both attested syllables and unattested syllables, with the assumption that there are no special syllables.¹⁵⁶

27.2.B. But there are, in fact, words like [tuʃpu] *waterfall*, [tuʃpi] *throat*, and [niskãĩ] *sweat*. First, show that these cannot be handled by a [CV] template, with or without special syllables (in the restricted sense discussed in the chapter). Next, discuss the problems that arise if the maximal template is simply extended to be either [CVC] or [CCV]. What facts are unaccounted for?¹⁵⁷

27.3 Try it for yourself with these claims

The following data are based on a preliminary, descriptive write-up of a language in Ethiopia. Evaluate the claims and provide an alternative account using the notions of maximal syllable and special syllables.¹⁵⁸

The language has seven kinds of syllables (proposed syllable breaks shown by dots):

CV	do.ro <i>chicken</i>	CVC	lam <i>cow</i> , dɛs.ta <i>happiness</i>
V	a.sa <i>fish</i>	CVCC	mɛls <i>answer</i>
VC	af <i>mouth</i> , an.be.sa <i>lion</i>	VCC	ird <i>turmeric</i>
CCVCC	k ^h rɛmt ^h <i>winter</i>		

The patterns VC and VCC only occur as single words or word-initially.

(Not stated explicitly, but apparently true: CC sequences in coda only occur word-finally.)

Feedback for Chapter 27

27.1 North Puebla Nahuatl

¹⁵⁵ Maximal syllable template: [CVC]

[paɪ] [tik], [o] [nik] [mat], [o] [ki] [kak] [ke], [a] [ʃan], [iʃ] [wak], [neʃ] [tik].

27.2.A Marinahua

¹⁵⁶ A maximal template of [CV] can account for the [V] syllables and for those that are [CV]. A word such as fiĩ can be analyzed as being [CV] plus a [V] syllable. If there are no special syllables allowed word-initially or finally, then syllables such as [ska] and [kas] cannot be generated, and their absence is explained.

27.2.B Marinahua

¹⁵⁷ These words cannot be described by the [CV] template because niskāĩ, for example, has two consonants intervocalically.

With respect to a [CCV] template, the absence of words like [skata] must be accounted for. If the template were [CCV], we would expect such words to occur. Pike and Scott simply observe that “the syllable type CCV never occurs phonological-word initial” (p. 197).

With respect to a [CVC] template, the absence of words like [katas] and [kas] must be accounted for since such a template would lead one to expect them. One might propose that a coda is possible *only* in syllables which are in a “strong” position. (Elsewhere, Pike and Scott claim that the first syllable of the phonological word is the “nuclear” syllable, so this is plausible.) The analysis must be formalized to disallow a closed syllable in monosyllabic words.

27.3 Data from Ethiopia

¹⁵⁸ A template [CVC] accounts for all of the data, with the following extra statements:

1. Onset is obligatory except word-initially.
2. Special syllables occur at word edges. Specifically, an extra consonant may occur at either edge of the word, giving CC onset and CC codas at word edges.

CHAPTER 28 - SYLLABLE STRUCTURE CONSTRAINTS

In many languages there are constraints on the types of consonants that may occur in the coda of the syllable, or that may cooccur in the onset or coda. For example, English syllables may begin with *fl* but not with *fn*. And *h* can occur in the onset of a syllable in English, but not in the coda. Furthermore it cannot co-occur with any other consonant in an onset since there are not words like [phɪn]. Such facts may be described by constraints such as the following:^a

- (191) Constraint: Onsets must be parsable by the following maximal onset template:

[C C C]_{onset}
[+cont] [+son]
[Coronal]

- (192) Constraint: *h* cannot occur in a coda.
(193) Constraint: *h* does not co-occur with any other consonant in an onset.

Features are useful in such constraints. The feature [sonorant] properly defines the natural class of consonants in the last position of (191). This condition allows the first group of examples below, but disallows the second group.

- | | | | | |
|-------|--------|--------|-------|-------|
| (194) | sprint | twɪtʃ | kjut | flut |
| | *ptɪnt | *psɪtʃ | *gzut | *fʃut |

In this way English reflects a common, but not universal, trait of languages to require sounds which are higher in **sonority** (they are more resonant) to be closer to the syllable nucleus than sounds which are lower in sonority. (A general sonority scale is: stops < fricatives < liquids < nasals < glides < vowels.)^b

In most cases, only vowel-like sounds may occur in the Nucleus position of a syllable. But English does allow nasals to be in this position, as in words such as *didn't*. Sounds which commonly occur in Onset or Coda positions in languages are the stops, fricatives, nasals, etc.. It is also not uncommon to find the high vowel-like sounds, such as [i] and [u], in Onset or Coda positions.^c In such cases, they are usually transcribed as *j* and *w*, respectively; but note that the difference is not one of features really, but of position in the syllable.^d

Nucleus, onset, or coda?

The matter of whether a sound is to be taken as being in the syllable nucleus or the syllable onset or coda is not decidable purely on phonetic grounds. There are too many factors that interfere with our perceptions of syllables, including knowledge of other languages and deep-rooted prejudices. The decision about how to analyze a syllable is more difficult, however, when one of the vowel-like sounds is one that could be taken as a glide, since we know that there are languages in which glides do function as onset (as in English *yet*) or coda (no good examples in English).^e

^a For one of many treatments of such facts, see Michael Hammond (1999) *The phonology of English: a prosodic optimality-theoretic approach*, Oxford and New York, Oxford University Press.

^b See Elizabeth Selkirk (1984) *On the major class features and syllable theory* for one attempt to make sonority scales more precise.

^c In the work of Kenneth L. Pike (1947) *Phonemics*, the issue of whether a high vowel could function in a non-nuclear position was discussed under the rubric of *interpretation*. Sound which can occur in either nuclear or nonnuclear positions are called *ambivalent* sounds.

^d In earlier generative work, they were distinguished by the feature *syllabic*. In recent years, given the rise of syllable theory, this feature is generally avoided.

^e The analysis of words such as *toy* usually posit a diphthong which occurs in the syllable nucleus. Similar analyses are given for words such as *die* [daj] and *hay* [hej]. These are not analyzed as instances of a glide in the coda.

Arguments from phonological rules

Consider the following words from Spanish and Seri, which sound virtually the same except for the onsets (they both rhyme with English *sigh*).

- (195) Spanish: [aj] *there is*
Seri: [ksaj] *brush*

Whereas one might think that the [j] in the Seri example should be analyzed as a syllable coda (since Seri does allow closed syllables), this analysis would present problems. Evidence from the phonology clearly points to this [j] as being a vowel in the syllable nucleus. For example, there are two allomorphs of the declarative morpheme: [ʔa] occurs after vowels, and [iʔa] occurs after consonants.

- (196) [ʔo:ʔa] *it is a wild pig* cf. po:
[χaʔpo:ʔa] *it is a sea lion* cf. χaʔpo:
[ʔktamiʔa] *it is a man* cf. ktam

The fact that the allomorph [ʔa] rather than [iʔa] occurs after [ksaj] *brush* shows that the [j] sound is really functioning as a vowel.

- (197) [ʔksajʔa] (the word is not *[ʔksajiʔa])

If this word actually ended in a consonant, we would not be able to easily handle these facts. Informed by these facts, the phonological representation of this word is therefore /ksai/, a CCVV monosyllabic word. (The word is written *csai* in the practical spelling system.) This kind of evidence is supported by other facts in the language, and we can actually propose the following constraint:^f

- (198) Constraint: [j] cannot occur in a coda.

On the other hand, [j] does occur at the beginning of a root in Seri, and it is (almost) always to be taken as a syllable onset, not part of the syllable nucleus. For example, the root {ja:} *have, own* might be analyzed (a priori) as either being {ia:} or {ja:}. Phonological evidence can be brought to bear on this issue. Prefixes such as the dependent irrealis in Seri have the shape [po-] before consonants (compare [ʔtpanʃχ] *when s/he ran* and [poʔpanʃχ] *if s/he runs*, and [p-] before vowels (compare [ʔti:m] *when s/he slept* and [ʔpi:m] *if s/he sleeps*). The allomorph [po] occurs before the root in question: [ipoʔja:] *if s/he owns it*, establishing that this is a consonant-initial root.

Another fact comes from the familiar rule of nasal place assimilation. The negative prefix {m} always assimilates to the point of articulation of a following consonant in Seri, (when not preceded by a stressed vowel) and it does not change before a vowel. Since it changes to [ɲ] in word like [itkoɲʔja:] *doesn't he have it?*, we have additional evidence that the [j] is a consonant in this word. In fact, the following constraint general holds in the language:^g

- (199) Constraint: [i] cannot precede another vowel (in the same syllable).

This constraint correctly rules out morphemes like {iat}, but allows ones like {aai}. The constraint on [j] correctly disallows morphemes like {paj}, but allows ones like {ja}.

Arguments from special rules

The evidence that we have looked at so far has been fairly straightforward phonological evidence, and we have looked at cases where the [j] occurs at the edge of a morpheme. But what kind of direct evidence

^f To my knowledge, there is only one exception to this constraint in Seri: the loanword [kaaj] *horse*, which is identical phonetically but not phonologically to the word [kaai] *one who makes (it)*. The phonetic transcriptions given are informed by our understanding of the phonology.

^g I know of only a couple verbs that may be exceptions.

might we find for the analysis of a word such as [^hʔait] *blood*. The constraint on [j] that we have posited above ought to rule out the analysis CVCC, so the word is not [^hʔajt], although it sounds just like that. Direct evidence in support of this comes from an interesting “rule” of the language which breaks up consonant clusters after a stressed vowel under special conditions. One of these conditions is to say something like “*Stone, my eye!*”. The word *stone*, which is [^hʔast] comes out as [^hʔasat aja]. If there is no consonant cluster, no *a* is inserted: [^hktam] *man*, [^hktam aja] *Man, my eye!* If *blood* is CVCC, clearly we expect *a* to be inserted; if it is CVVC, then we do not. The facts support the latter analysis, just as our constraint on [j] predicted: [^hʔait aja] *Blood, my eye!*

Arguments from suppletive allomorphy

More evidence that supports our constraint prohibiting clusters of *i* followed by another vowel is based on the suppletive allomorphy of the passive morpheme. As shown in chapter 3, the passive morpheme has two suppletive forms: {p} before vowels and {aʔ} before consonants. Since the passive form of the verb *own* contains the second allomorph, as in [taʔ^hja:] *is it owned?*, we have clear evidence that the verb *own* is {ja:}; it is a CVV root.

Finally, the stress facts of the language support the analysis that this root begins with a consonant [j] and not a vowel [i]. Stress regularly falls on the first vowel of the root. If the word were *kiaa*, other things being equal we would expect it to be pronounced with stress on the [i]. But the vowel [a] is clearly more prominent perceptually and is the locus of the phonetic correlates of stress in the language.^h

Phonological and morphological evidence of the sort shown above is very important for making decisions about whether a sound is to be syllabified as a consonant or a vowel. It should be considered more relevant than evidence from possible types of syllables.

Key Concepts

conditions on syllables

function of high vowels

28.1 Try it for yourself with Marinhua

We will assume the [CVC] template proposed in chapter 34. The following kinds of closed syllables are the only ones found in this language: [nis], [tsis] [iʃ], [uʃ]. The coda may not be [t], [ts], [k], [h], or [r], for example. Propose a constraint, using features, to deal with this.¹⁵⁹

28.2 Try it for yourself with these data

The language from Ethiopia referred to in the exercise at the end of the preceding chapter has onset clusters which are limited to the following: *br*, *gr*, *kr*, and *bl*. Discuss these in terms of the sonority scale and propose a formal constraint.¹⁶⁰

The same language has codas which include the following:

bs fs st nt nd nz lk ld ls lʃ lm
rk rd rʃ

Discuss these in terms of sonority.¹⁶¹

^h The facts are the same for verbs which don't have long vowels, such as {-jakx} *have sibling*.

Feedback for chapter 28

28.1 Marinahua

¹⁵⁹ If $C]_{\sigma}$
 |
 then [+cont]
 [Coronal]

28.2 Data from Ethiopia

¹⁶⁰ These sequences follow the sonority scale, but they are very restrictive. The following constraint could be proposed (written somewhat informally):

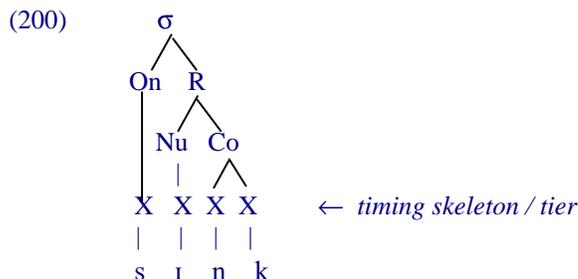
If $\sigma[C C$
 | |
 Then Stop Liquid

¹⁶¹ The coda sequences are much more liberal than the onsets, some of them violating the sonority scale in that the syllable is *not* becoming less sonorant at the edge. In one case, the sonority does not change (fricative-fricative), and in one case it becomes more sonorant (for example, stop-fricative).

bs	stop - fricative	(violation)
fs	fricative - fricative	(violation)
st	fricative - stop	
nt nd	nasal - stop	
nz	nasal - fricative	
lk ld	liquid - stop	
ls lf	liquid - fricative	
lm	liquid - nasal	
rk rd	liquid - stop	
rf	liquid - fricative	

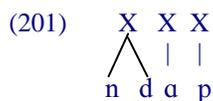
CHAPTER 29 - LINKING FEATURES TO THE SYLLABLE

Up until now we have ignored complications with respect to how features may link up to the syllable structure. For our discussion we will assume that there is a level of structure which intervenes between the syllable and the bundles of features (still informally represented by letters), often called the **timing skeleton** or the **timing tier**.^a

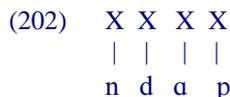


This level of structure has been claimed to be relevant for various reasons, but we examine only one here. There are pairs of sounds which occur together in a language and which function together as a unit in certain ways. We refer to these as **contour segments**.

Given the concept of the skeletal tier, phonetic sequences such as [nd] might be analyzed as prenasalized stops (single consonants with two parts). If [nd] is analyzed as a prenasalized stop, a word such as [ndap] might be represented as:^b



But the phonetic sequence [nd] might very well be linked to two X slots in the skeletal tier of a given language (if the language has a syllable template which allows for it), in which case a word like [ndap] would be represented as follows:



Various facts may be brought to bear on the decision as to how a given phonetic sequence such as [nd] or [tʃ] should be analyzed. Some of the possible arguments that have been or could be used are presented below.

Argument based on the syllable template

One argument is based on whether the language has clear cases of consonant clusters in a single syllable. If it does not, then one presumes that the phonetic sequence is linked to a single X slot (why not?); if the language does have clear cases of consonant clusters, then perhaps the sequence [nd] is linked to two X slots.

Seri has a word [tʃiʔ] (the name of a fish). The sequence [tʃ] might be analyzed as a consonant cluster (as shown), or as a single contour segment (an affricate). As a matter of fact, Seri does have consonant

^a For extensive discussion of the skeletal tier, see Goldsmith (1990) *Autosegmental & Metrical Phonology*.

^b This has been proposed by Clements and Keyser (1983) *CV phonology*, among others, and we adopt it here for the sake of explication. But Goldsmith (1990) *Autosegmental and metrical phonology* gives some arguments why affricates should not be analyzed this way. Similarly, Lombardi (1990) *The nonlinear organization of affricates, Natural Language and Linguistic Theory* 8:375-425 1990, considers affricates to have a single set of features and not contour segments. Affricates are distinguished from stops as [+delayed release] in Chomsky and Halle (1968) *The sound pattern of English*.

clusters inside of single syllables, as illustrated by the word [psa:k] *hunger*. There is no argument from the syllable structure to analyze [tʃ] as an affricate in Seri (and other reasons for *not* analyzing it so.)

Quiégolani Zapotec has a word [gitʃ] *grinding stone*. Again, the sequence [tʃ] might be analyzed as a consonant cluster, or as a single contour segment. In syllable-final position, Quiégolani Zapotec only has a few clear cases of consonant clusters, and these are clusters like [lt] (beginning with a sonorant). This fact provides an argument for treating the sequence [tʃ] in this language as an affricate.^c

Argument based on syllable structure constraints

English has the word [hætʃ], and one might wonder with the [tʃ] is a consonant cluster analogous to the cluster [ts] that we observe in *hats* (compare *hat*), or whether it is a contour segment which occupies only a single consonant position in the syllable. One argument against the cluster analysis for [tʃ] in English is the fact that Stop-Fricative clusters in syllable codas in English are always and only Stop-*s*, as in *lapse* [læps] and *tax* [tæks]. There are no syllables in English like [læpʃ] and [tækf], and therefore no independent evidence for a cluster [tʃ] in a syllable coda.

Argument based on lack of independent existence of both “parts”

A second argument for making a decision of this sort might be based on the observation that if a sequence such as [nd] is analyzed as a consonant cluster, then one should expect that the sound [d] (or [t], as they might be allophones) occurs independently. For example, the word [tʃato] *flat* in Spanish should be analyzed as containing an affricate, not a consonant cluster. There is no phoneme /ʃ/ in Spanish (nor is [ʃ] an allophone of any other phoneme in this position in Spanish).^d It is not possible for [tʃ] to be a cluster unless it corresponds to two independently-attested phonemes.^e

This argument does not provide any help for the Seri, Quiégolani Zapotec, and English facts discussed above, however, since [t] and [ʃ] both occur independently as well in these languages.

Argument based on interaction with rules

An argument may be based on how the sounds in question interact with phonological rules. Do they act as a single consonant or as a cluster? For example, a casual speech rule in Chimalapa Zoque voices stops when they precede a voiced consonant: *haʔtmuspa* *he can make twine* is pronounced *haʔdmuspa* in casual speech. Fricatives do not undergo this rule: *?isjonpa* *he is watching it fall* is not pronounced with a [z] in casual speech. The fact that the word *tsetsmuspa* *he knows how to carve* is pronounced *tsedzmuspa* in casual speech is entirely expected if [ts] is an affricate in this language, but not if it is a stop+fricative cluster.

^c Affricates are represented with single symbols in some traditions; for example, c-wedge (č) is used for [tʃ].

^d The sound [ʃ] occurs phonetically in some dialects of Spanish; for these dialects, this argument would have to be very carefully presented.

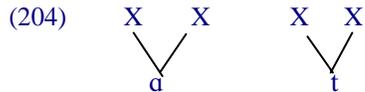
^e Those two phonemes might be /t/ and /s/ rather than /t/ and /ʃ/, but one would have to have an explanation for the phonetic representation [ʃ] regardless.

Alternative analyses reviewed

Phonetic sequences which might be taken as occupying either one X slot or two include the following (where *t* represents any consonant by example, although in some cases the two parts must be homorganic):

(203) <i>phonetic transcription</i>	X	XX
<i>tj or t̟ or tʲ</i>	<i>tʲ</i>	<i>tj or ti^a</i>
<i>tw or tʷ or t^w</i>	<i>t^w</i>	<i>tw or tu</i>
<i>th or t^h</i>	<i>t^h</i>	<i>th</i>
<i>tʔ or tʻ</i>	<i>tʻ</i>	<i>tʔ</i>
<i>ts</i>	<i>t̟s</i>	<i>ts</i>
<i>tʃ</i>	<i>t̟ʃ</i>	<i>tʃ</i>
<i>tʃ</i>	<i>t̟ʃ</i>	<i>tʃ</i>
<i>nd or ⁿd</i>	<i>ⁿd or n^d</i>	<i>nd</i>

We should mention here that long vowels and consonants have been analyzed in recent work as single segments (actually feature complexes, of course) linked to two X slots.^f



These decisions about how the features link up to the timing tier are only indirectly related to claims about the phonemic status of the sounds. If [dʒ] is taken as an affricate, then it still must be decided if [dʒ] is a phoneme distinct from [tʃ] or [d], for example. And if [dʒ] is taken as a cluster [dʒ], then it still must be decided if [ʒ] is a phoneme distinct from [ʃ] or [z] or [j], for example.

29.1 Try it for yourself with North Puebla Nahuatl

From a previous exercise you have found evidence for a maximal syllable template [CVC] for this language. Do the following data provide evidence for expanding that template to something larger?¹⁶² Consider the affricates (or sequences) and aspirated consonants (or sequences) separately from the long vowels.

- | | | | |
|--------------|-----------------------|------------|-------------|
| 1. omokweph | <i>he returned it</i> | 4. tʃakatʃ | <i>man</i> |
| 2. ka:li | <i>house</i> | 5. mo:tʃwi | <i>very</i> |
| 3. tʃipawakh | <i>clean</i> | | |

29.2 Try it for yourself with Corongo Quechua

In chapter 27 you were told that Corongo Quechua had a maximal syllable template [CVC]. Do words such as the following require a change in that template?¹⁶³

- | | | |
|---------------------------|--------------------------|---------------------------|
| 1. i:ʃaŋ <i>his sheep</i> | 2. na:ne: <i>my road</i> | 3. pu:kaŋ <i>he blows</i> |
|---------------------------|--------------------------|---------------------------|

Observation: there are no syllables such as [na:ŋ] in this language.

Practical Procedures

We outline here some basic steps for figuring out the syllable structure of a language. First, since all languages have CV syllables, we attempt to parse all words with a CV template. Consider the following data from Tlapanec:

^f Early generative phonology work used the feature long; but given the skeletal tier, this feature has been avoided.

- (205) *gagi* *happy* *ama* *net*
 gido *sown* *iji* *corn*

All of these words are easily parsed as having two CV syllables. We would understand from these facts that Tlapanec has syllables which do not have onsets, *at least word-initially*. If the maximal syllable is CV, this is quite normal.

- (206) Tentative maximal syllable template: [CV]

We might then look further to see if there is anything special to be said about the distribution of these syllable types. An obvious place to start would be to check whether the V syllable can occur somewhere other than word initially. If it cannot (as appears to be the case in Tlapanec), then we state a restriction such as follows:

- (207) Restriction: Onset obligatory except word-initially.

Now consider the following additional words from Tlapanec:

- (208) *agu?* *my fire* *ma?si* *watery* *e?de* *blood*

What do we do with the glottal stop? Perhaps we now have examples of syllables with codas in Tlapanec, where the final consonant can only be the glottal stop. Another possibility is that the vowels in this language come either plain or with laryngeal modification (perceived as a glottal stop). In the latter case, there would be no CVC syllable. At this point, we do not have evidence to decide between these analyses.

The following words have nonsyllabic high vowels (transcribed as glides, as we hear them):

- (209) *waba* *soft* *ija* *water* *ka?wi* *it is clean*

Do we consider these words to have word-medial syllables without onsets? If so, they would be (partially) analyzed as:

- (210) *uaba* (u - a - ba) *ija* (i - i - a) *ka?wi* (ka? - u - i)

If we did this, however, we would run afoul of our proposed restriction on such syllables (namely, that syllables without onsets occur only word-initially). The facts do not seem to warrant abandoning this constraint since another possibility is open to us. We could consider the nonsyllabic high vowels as linked to an onset position in the syllable, in which case they could be (partially) analyzed as:

- (211) *waba* *ija* *ka?wi*

We are able to maintain our simple syllable structure and proposed generalization.

The following words contain some possible consonant clusters:

- (212) *ʃtatsō* *blanket* *mi?tsi* *fat*
 kutʃi *thick* *nethō* *broken*
 akwā *ant* *mbadʒi?* *my (female) turkey*

The sequence [ʃt] is not a problem. There is nothing we can do with the cluster except admit a new syllable type, CCV, although we do not know whether the syllable is a basic syllable or a special syllable. (Does it occur only word-initially? If so, it may be a special syllable.)

More difficult are the other consonant sequences in these data. Perhaps the [tsō] syllable is another instance of the CCV pattern, or perhaps we really have the affricate [tʃ], and therefore it is the syllable type CV. We do not have good evidence to decide between these alternatives yet; we will assume the CV analysis.

- (213)
- | | |
|--------|--------|
| σ | σ |
| () | () |
| C C V | C V |
| | |
| ʃ t a | t s ð |

Similarly, the sequence [th] could be two consonants (*t* plus *h*) or a single consonant (aspirated *t*), and the sequence [kw] could be two consonants (*k* plus *w*) or one (*k^w*). (Note that we do not consider the possibility the sequence [kwã] is two syllables ([ku] plus [ã]) since we have already proposed without problems that non-initial syllables cannot be of the V type.) The sequence [mb] could be two consonants or a prenasalized stop. We do not have good evidence to decide between these alternatives yet, and so will assume the CV analysis.

(214) CV CV CV CV V CV
 m iʔ t^s i n e t^h ð a k^w a

Finally, look at the sequences [tʃ] and [dʒ]. As with the previous cases, these might be analyzed as two consonants or as single consonants (affricates). For these cases, however, we have some reason to decide in favor of the affricate analysis. If we were to analyze [dʒ] as a cluster, we would be claiming that Tlapanec probably has a phoneme /ʒ/. Since [ʒ] does not occur anywhere in the language other than following [d], this would be a strange claim to make. Therefore, we should analyze [dʒ] as an affricate. If we have a voiced affricate, we would expect that we would also have a voiceless one, and therefore we might then analyze [tʃ] as [tʃ̥] (despite the fact that [ʃ] occurs independently in the language, unlike [ʒ]).

After tentative analyses are made with respect to such facts, the decisions and evidence supporting them should be written down. Evidence based on other aspects of the phonology of the language may become available as further study continues. Such evidence may force you to reevaluate previously made analytical decisions.

Key Concepts

timing skeleton / tier

features linked in more complex ways to skeletal tier

contour segments

29.3 Try it for yourself with Seri

What is the maximal syllable template needed for the following data? Is there evidence for treating either [ts] or [tʃ] as an affricate? Show how the first five words (in the first column) should be parsed by this template.¹⁶⁴

- | | | | |
|-----------|-----------------------|-------------|----------------------------|
| 1. tosni | <i>pelican</i> | 7. tʃopt | <i>is it extinguished?</i> |
| 2. ʔapats | <i>Papago</i> | 8. ʃatʃ | <i>tiny thorns</i> |
| 3. tʃiʔ | <i>fish (species)</i> | 9. ʔasax | <i>basket</i> |
| 4. nop | <i>mountain lion</i> | 10. ʃæmæ | <i>sunset</i> |
| 5. kops | <i>glowworm</i> | 11. stak | <i>pumice</i> |
| 6. ʃtɔtɔ | <i>fish (species)</i> | 12. txamoxa | <i>fish (species)</i> |

29.4 Try it for yourself with Tetelcingo Nahuatl

What is the maximal syllable template needed for the following data? Show how the first five words (in the first column) should be parsed by this template.¹⁶⁵

1.	tɪmitskwəs	<i>I'll eat you</i>	10.	kɪtʃiwa	<i>he makes</i>
2.	vɪtstɬɪ	<i>thorn</i>	11.	tunaɬ	<i>shadow</i>
3.	itstɪk	<i>cold</i>	12.	ok	<i>another</i>
4.	aloʃoʃtɬa	<i>orange grove</i>	13.	tɬaketsoma	<i>it bites</i>
5.	ajoktsɪ	<i>he is not here</i>	14.	itʃkatɬ	<i>cotton</i>
6.	kɪpɪtskwa	<i>he pinches him</i>	15.	iwa	<i>and</i>
7.	kotʃteka	<i>he's sleeping</i>	16.	umɪ	<i>two</i>
8.	sa	<i>only</i>	17.	puktɬɪ	<i>smoke</i>
9.	tʃuka	<i>he cries</i>	18.	ma	<i>let</i>
10.	kɪtʃiwa	<i>he makes it</i>	19.	tɬɪsɪntɬɪ	<i>fire</i>
11.	itɬapetʃ	<i>his bed</i>			

29.5 Try it for yourself with other data

On page 155 you saw data from Ethiopia that motivated a [CVC] template with the possibility of special syllables (extra C) at word edges. Now consider the following additional data:

1.	tʃɛr	<i>kind</i>	6.	tatʃ	<i>under</i>
2.	metʃal	<i>to be able</i>	7.	dʒoro	<i>ear</i>
3.	hidʒi	<i>he goes</i>	8.	lidʒ	<i>child</i>
4.	kitʃbɪlaɛtʃ	<i>she is sitting</i>	9.	fɪntʃ	<i>clue</i>
5.	tɛramdʒi	<i>she walks</i>	10.	k'ɪntʃɛ	<i>ground wheat</i>

Evaluate the following proposals for the analysis of the phonetics sequences [tʃ] and [dʒ]. Note: the sound [ʃ] occurs with [t] before it, but [ʒ] never occurs without [d] before it.

- [tʃ] should be analyzed as a sequence of consonants because [t] and [ʃ] both exist in the language and there is no reason to posit an affricate as a phoneme. A word such as [metʃal] is CVC.CVC and words such as [tatʃ] and [tʃɛr] show CVC plus special cases of C at the edge of the word. An utterance such as [kitʃbɪlaɛtʃ] *she is sitting* can't be analyzed properly until we know where the word breaks are.¹⁶⁶
- [dʒ] should be analyzed as an affricate. This phonetic sequence may be properly syllabified as a single consonant.¹⁶⁷

29.6 Try it for yourself with Quiquitani Zapotec

What is the maximal syllable template needed for the following data? What are the constraints on coda clusters? Show how the first five words (in the first column) should be parsed by this template.¹⁶⁸

1.	milɛŋʃ	<i>mosquito</i>	13.	lon	<i>bed</i>
2.	winj	<i>small</i>	14.	kpaj	<i>broom</i>
3.	ktanʃ	<i>Quiquitani</i>	15.	nis	<i>water</i>
4.	kwesj	<i>cheek</i>	16.	mtoʔ	<i>dove</i>
5.	tʃeʔ	<i>pitcher</i>	17.	mban	<i>sad</i>
6.	tsit	<i>egg</i>	18.	kits	<i>hair</i>
7.	ʃug	<i>nail</i>	19.	mbidz	<i>sun</i>
8.	ʃutʃ	<i>onion</i>	20.	pe	<i>what</i>
9.	nlenʃkw	<i>crooked</i>	21.	tu	<i>one</i>
10.	tsiŋk	<i>hummingbird</i>	22.	job	<i>brain</i>
11.	ʃpid	<i>snout</i>	23.	plag	<i>leaf</i>
12.	toŋk	<i>corn smut</i>	24.	skan	<i>bench</i>

Feedback for Chapter 29

29.1 North Puebla Nahuatl

¹⁶² With respect to the consonants, these words can all be parsed with the [CVC] template if certain sequences are taken as aspirated consonants and affricates. The aspirated consonants have already been seen to be allophones of the stop phonemes, so this is appropriate. The long vowels do present a problem for this template. Long vowels occur in closed syllables, so the long vowel cannot be simply occupying both positions in the rhyme of the syllable.

29.2 Corongo Quechua

¹⁶³ These words can still be parsed with the [CVC] template if long vowels are analyzed as occupying both positions in the rhyme of the syllable. This would account for why long vowels cannot occur in syllables with a final consonant.

29.3 Seri

¹⁶⁴ Maximal syllable template: [CCVCC]

tos – ni ʔa – pats tʃiʔ nop kops

There is no evidence for treating [ts] or [tʃ] as an affricate since consonant clusters are perfectly fine in this language.

29.4 Tetelcingo Nahuatl

¹⁶⁵ Maximal syllable template: [CVC]

ti – miɾˢ – kˡɔs viɾˢ – tˠɪ itˢ – tiɰ a – lo – ʃoʃ – tˠa a – jok – tˢɪ

29.5 Other data from Ethiopia

¹⁶⁶ This is all true. However, two words are still problematic. One is [k'intʃɛ]. It has three consonants word-medially, and one of them cannot be properly analyzed. It might be a compound word, or an expression [k'inɪtʃɛ], which would therefore be two words and not problematic. But a word such as [fintʃ] *clue* is very problematic for the sequence analysis, which would have to claim it is CVCCC. One is only allowed to have *one* extra consonant at a word edge.

It also seems to be the case that [tʃ] occur together very often. This also suggests that we really have an affricate here.

¹⁶⁷ While it is true that [dʒ] may be syllabified as an affricate (single C), none of the examples shows conclusively that this *must* be the case. A word such as [hidʒi] could be analyzed as CVC.CV. Most of the other instances could be analyzed as C of the syllable template plus an extra segment at the edge of the word.

The one problem is the word [tɛramdʒi] *she walks*, which shows a problematic word-internal CCC unless we adopt the affricate analysis. We would have to be convinced that this is a single word, however, and there is no evidence of this yet. What if it is [tɛram dʒi]?

The most important evidence so far that is very important for the analysis of [dʒ] is the fact that there is no [ʒ] without [d]. This would argue forcefully that we have an affricate and not a sequence of consonants.

29.6 Quijoquitani Zapotec

¹⁶⁸ Maximal syllable template: [CCVCC]

Constraint: Coda clusters must begin with a nasal.

(If [sj] is analyzed as a cluster, then this constraint is not valid. The evidence presented here is not overwhelming.)

mi – lent^ʃ win^j ktan^j k^wes^j t^ʃeʔ

CHAPTER 30 - STRESS-CONDITIONED PROCESSES

There are many processes in language that are affected by the presence or absence of stress. (Stress is discussed in more detail in chapter 35.) In some cases, a rule applies only if stress is present; in other cases, a rule applies only if stress is absent.

In English, for example, *t* and *d* become a flap intervocalically, as in *latter* and *ladder*, but not if the second vowel is stressed (where it is aspirated), as in *fraternal*.

In many languages, including English, the vowels that are found in unstressed syllables have a less distinctive character and are often transcribed as schwa.

(215) ¹tot[ə]l to¹t[æ]lity
 ¹hum[ə]n hu¹m[æ]nity

On the other hand, stressed vowels are often longer than unstressed vowels. For example, in Tagalog the vowel of a non-final stressed syllable is lengthened, but vowel length is not contrastive in the language.

(216) ¹bahaj [¹ba:haj] house
 mag¹lalaba [mag¹la:laba] will wash (clothes)
 pam¹butas [pam¹bu:tas] instrument for making holes

In Seri, nasal assimilation only applies in unstressed syllables (the verbs below both end in *m* underlyingly).

(217) ¹si:ʃka[n] kaʔa they will arrive (unstressed syllable)
 ¹sma[m] kaʔa it will be cooked (stressed syllable)

In Spanish, certain vowels alternate with diphthongs when stressed.

(218) [xu¹ʎar] to play [u]
 [¹xweyo] I play [we]
 [pen¹sar] to think [e]
 [¹pjenso] I think [je]

Key Concepts

effect of stress on phonological rules

30.1 Try it for yourself with Karuk

Consider the vowels [a:], [a], and [ə]. Assume that stress is part of the underlying form of each of these words and that it is relevant to the distribution of these sounds. What sounds are contrastive and which one is an allophone of one of the others?¹⁶⁹ Give the phonological rule (in prose).¹⁷⁰ Write the word for *bread* phonemically.¹⁷¹

- | | | | |
|--------------------------|----------|------------------------------|---------|
| 1. ¹ ʔatra:x | arm | 6. ʔətʃ ¹ na:t | rat |
| 2. ¹ tatətʃ | mama | 7. ¹ ʔaxək | two |
| 3. ¹ sarə | bread | 8. ¹ ʔasər | wet |
| 4. tʃə ¹ na:k | mosquito | 9. tənuk ¹ ja:nər | shovel |
| 5. ¹ na:pif | beetle | 10. ¹ βa:sə | blanket |

30.2 Try it for yourself with Seri

Examine long consonants and long vowels in the data below and propose an analysis of the facts shown. (Some Seri data presented elsewhere does not contain this level of detail and so should not be used in conjunction with this exercise.) You may assume that vowel length in stressed syllables is distinctive (since it is). But do not assume that just because you can't predict everything you cannot predict anything. Make morpheme cuts when this is called for.¹⁷² Provide transcriptions of all of the following data which (a) eliminate predictable length, and (b) show clearly what your understanding of the phonological structure of these words is.¹⁷³

1. 'in:o:ɬ	<i>his/her finger</i>	7. i'ta:m	<i>did s/he harvest it?</i>
2. 'inɬ	<i>his/her fingers</i>	8. 'kta:m	<i>who harvests it</i>
3. 'ʔop:a:tx	<i>ocean wave</i>	9. 'kak:a:t	<i>what is bitter</i>
4. 'k:am	<i>what is alive</i>	10. 'tak:a:t	<i>is it bitter?</i>
5. 'tkam	<i>is it alive?</i>	11. 'ko:p:o:ɬ	<i>black widow spider</i>
6. 'montax	<i>ghost shrimp</i>	12. 'saptim	<i>enormous basket</i>

Feedback for Chapter 30

30.1 Karuk

¹⁶⁹ [a:] and [ə] both occur in unstressed syllables, and therefore contrast. [a] occurs only in stressed syllables, and [ə] occurs only in unstressed syllables; they are likely to be allophones.

¹⁷⁰ The vowel /a/ becomes [ə] when it is unstressed.

¹⁷¹ *Bread* is (probably) /^hsara/.

30.2 Seri

¹⁷² Long consonants are explained in the following two ways. First, in some cases they are simply the result of two identical consonants (one a prefix and one a root-initial consonant) occurring next to each other because of a word-formation rule putting them together. Second, in the remaining cases they occur when a simple onset follows a stressed open syllable. Thus 'CVCV becomes 'CVC:V. Long vowels in unstressed syllables occur as the result of this same lengthening process: the vowel following such a lengthened consonant is also lengthened. (There are, in fact, some additional restrictions on the lengthening rule, but this is essentially correct.)

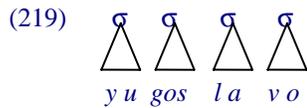
¹⁷³ The words can be transcribed as shown below. Note that predictable consonant and vowel length is omitted and that long consonants resulting from morphological juxtaposition are written as geminate consonants. Distinctive vowel length (in the stressed syllable) is still written as such.

1. 'inoɬ	<i>his/her finger</i>	7. i'tta:m	<i>did s/he harvest it?</i>
2. 'inɬ	<i>his/her fingers</i>	8. 'kta:m	<i>who harvests it</i>
3. 'ʔopatx	<i>ocean wave</i>	9. 'kakat	<i>what is bitter</i>
4. 'kkam	<i>what is alive</i>	10. 'takat	<i>is it bitter?</i>
5. 'tkam	<i>is it alive?</i>	11. 'ko:poɬ	<i>black widow spider</i>
6. 'montax	<i>ghost shrimp</i>	12. 'saptim	<i>enormous basket</i>

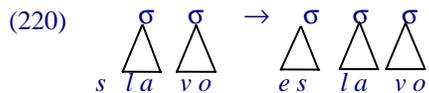
CHAPTER 31 - EPENTHESIS

In this chapter we look at situations in which a phonological rule inserts a sound. These rules of insertion are called **epenthesis**. In some cases, the rules are motivated by syllable-structure considerations.

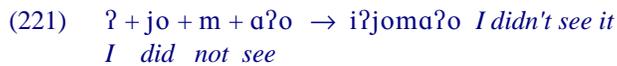
A syllable in Spanish cannot begin with an *s* followed by a consonant. In the Spanish word *yugoslavo* ‘Yugoslavian’ the *s* is part of the second syllable, as shown below.



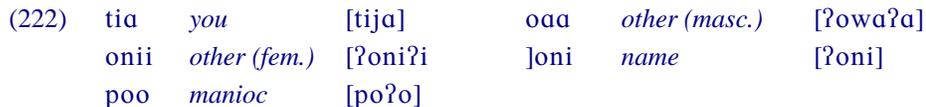
If the prefix *yugo-* does not occur, the *s* of the root *slavo* ‘Slav’ cannot be properly incorporated into a syllable. In such a case, an *e* is inserted to allow the construction of a proper syllable for the *s* to attach to.



In Seri a syllable cannot begin with a consonant cluster whose first member is a sonorant (which includes glottal stop in this language). When such a cluster arises through word-formation processes, an *i* is inserted.

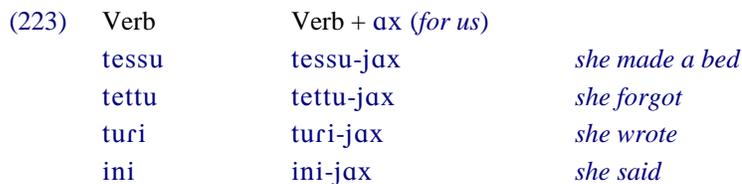


In Madija, a *j* is inserted when an *i* precedes a distinct vowel, a *w* is inserted when an *o* precedes a distinct vowel, and otherwise a glottal stop is inserted if a syllable would have no onset.^a



Since glottal stop and *j* do not occur otherwise in this language, they do not appear in underlying forms and are not phonemes of the language.

In Berber, a *j* is inserted between vowels as one way of ensuring that every word-internal syllable starts with a consonant.



^a There are some vowel combinations which do not have glottal insertion between them, at least in some words. An example is /kaikai/ [kaikai] *parrot*.

31.1 Try it for yourself with Isthmus Zapotec

All word-internal syllables begin with a consonant in Isthmus Zapotec. Assume that the Progressive prefix is underlyingly {kɑ-} and stems such as *dress oneself* begin with a vowel. Account for the facts in the third column of facts.¹⁷⁴

Syllables in Isthmus Zapotec may not begin with two consonants except when the second consonant is a glide (and some other special cases, not shown here). Assume that the Habitual prefix is underlyingly {r-} and that the Potential prefix is underlyingly {g-}. Note the allomorphy; account for the facts.¹⁷⁵

	<i>Habitual</i>	<i>Potential</i>	<i>Progressive</i>	
1.	raku	gaku	kajaku	<i>dress oneself</i>
2.	raʔde	gaʔde	kajaʔde	<i>receive gift</i>
3.	reʔ	geʔ	kajeʔ	<i>drink</i>
4.	rɛda	gɛda	kajɛda	<i>come</i>
5.	riniti	giniti	kaniti	<i>lost</i>
6.	riɾɛ	giɾɛ	kaɾɛ	<i>leave</i>
7.	ridubi	gidubi	kadubi	<i>worn out</i>
8.	rila	gila	kala	<i>push</i>
9.	rjaka	gjaka	kajaka	<i>enjoy</i>

Transitional sounds

Not all cases of epenthesis are motivated by syllable structure, however. Some are due to the transition from one point of articulation to another. English words like *tense* and *fence* may have the sequence /ns/ underlyingly, and phonetically the sequence [nts] in some dialects, but in other dialects they are pronounced with an ‘intrusive’ transitional *t* (as part of the transition from a voiced nasal stop to a voiceless fricative) and therefore are phonetically very close to or even indistinguishable from [nts].

In Seri a transitional vowel is inserted between nonround vowels and round consonants that immediately follow. This insertion is due to an anticipation of the round consonant.

(224) kik^w [kiŭk^w] *who kills it* itak^w [itaŏk^w] *did s/he kill it*

Formalization

One way to formalize epenthesis rules is to use an explicit rule that says replace null with something in a certain environment.

(225) $\emptyset \rightarrow X / Y _ Z$

For example, the rule inserting the *e* in Spanish might be formalized as:

(226) $\emptyset \rightarrow e / _ s C$

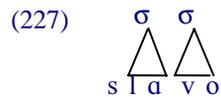
But as Harris has observed,^b this formalization ignores the fact that the statement of the environment duplicates what one has to say anyway about the syllable structure and constraints on the distribution of sounds within syllables.

Alternative accounts have been proposed. Following Itô,^c we might claim that strings of sounds are syllabified according to the template of Spanish syllables. Since Spanish contains a constraint blocking

^b Harris (1983) *Syllable structure and stress assignment in Spanish*.

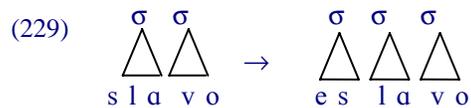
^c Itô (1986) *Syllable theory in prosodic phonology*.

syllables from beginning with sC, the morpheme *slavo* is parsed as (with the *s* unincorporated into any syllable at this stage):



Consonants which have not been syllabified are **stray consonants**. Some stray consonants in Spanish are handled by the following rule:

(228) Insert *e* to the left of a stray *s*.^d



Key Concepts

epenthesis

stray consonants

Rule of Thumb: The possibility of epenthetic vowels and consonants makes morpheme cutting more difficult many times. When looking at data, you might do well to circle segments which might be analyzed as being epenthetic in order to keep track of them. You are more likely to find epenthetic vowels when a morpheme-final consonant precedes a morpheme-initial consonant. Therefore, it is helpful to make early hypotheses about the underlying shapes of morphemes. Then, ask yourself if you can see any motivation for the putative insertion based on the syllable structure of the language. In the next chapter, we see that there are other ways that the language may use to bring things into line.

^d This rule could be simplified in various ways, although we do not go into this matter here.

31.2 Try it for yourself with Latin

Assume that the maximal syllable template for Latin is [CCVX] (where X means C or V) and that long vowels occupy the last two positions in the syllable.

The following nouns are some of those in Latin which have stems ending in *r*. (You wouldn't know that if we didn't tell you.) Give the underlying forms for all the morphemes, including the suffixes marking nominative and genitive, and the rule(s) needed to account for the surface forms.¹⁷⁶

	Nominative	Genitive	
1.	li : ber	li : beri :	<i>free</i>
2.	miser	miseri :	<i>wretched</i>
3.	ager	agri :	<i>field</i>
4.	sinister	sinistri :	<i>left</i>
5.	liber	libri :	<i>book</i>

31.3 Try it for yourself with Serbo-Croatian

Account for the allomorphs in the data below. Assume that the maximal syllable template for this language is [CCVCC] and that the final consonant of a maximal syllable cannot be a sonorant. Give derivations for the forms of the word for *good*.¹⁷⁷

	<i>Masculine</i>	<i>Feminine</i>	<i>Neuter</i>	<i>Plural</i>	
1.	mlad	mlada	mlado	mladi	<i>young</i>
2.	pust	pusta	pusto	pusti	<i>empty</i>
3.	zelen	zelena	zeleno	zeleni	<i>green</i>
4.	tʃest	tʃesta	tʃesto	tʃesti	<i>frequent</i>
5.	bogat	bogata	bogato	bogati	<i>rich</i>
6.	suntʃan	suntʃana	suntʃano	suntʃani	<i>sunny</i>
7.	rapav	rapava	rapavo	rapavi	<i>rough</i>
8.	dobar	dobra	dobro	dobri	<i>good</i>
9.	jasan	jasna	jasno	jasni	<i>clear</i>
10.	ledan	ledna	ledno	ledni	<i>frozen</i>
11.	sitan	sitna	sitno	sitni	<i>tiny</i>
12.	oʃtar	oʃtra	oʃtro	oʃtri	<i>sharp</i>
13.	mokar	mokra	mokro	mokri	<i>wet</i>

31.4 Try it for yourself with Southeastern Puebla Nahuatl

The following words are cited in the ‘absolute’ form. Account for the allomorphy of the absolute suffix. Assume that the maximal syllable in this language is [CVC].¹⁷⁸

1.	'popotɬ	<i>drinking straw</i>	6.	'itʃpotʃtɬi	<i>girl</i>
2.	'tɬakatɬ	<i>man</i>	7.	'estɬi	<i>blood</i>
3.	'koyotɬ	<i>coyote</i>	8.	'tenkotɬ	<i>goat</i>
4.	'siwatɬ	<i>woman</i>	9.	'poktɬi	<i>smoke</i>
5.	'teksistɬi	<i>egg</i>			

31.5 Try it for yourself with American English

Give the alternations that are exhibited; the underlying forms for *four*, *seven*, *twelve*, *warm*, and the suffix marking ordinals; and the informal rule(s) needed to account for the surface forms.¹⁷⁹

	<i>Cardinal</i>	<i>Ordinal</i>	
1.	foʊ	foʊθ	<i>four</i>
2.	sɪks	sɪksθ	<i>six</i>
3.	sɛvən	sɛvəntθ	<i>seven</i>
4.	tɛn	tɛntθ	<i>ten</i>
5.	twɛlv	twɛlfθ	<i>twelve</i>
	<i>Adjective</i>	<i>Noun</i>	
6.	wɔ:ɹm	wɔ:ɹmpθ	<i>warm</i>

31.6 Try it for yourself with Czech

Give the necessary rules and show how they account for the data. How do they force you to consider the sequences [tʃ] and [ts]? The Dative suffix is sometimes *u* and sometimes *i*; do not try to predict this alternation. Assume that the underlying form of the word for brain contains a *z*.¹⁸⁰

	<i>Accusative</i>	<i>Dative</i>	<i>Instrumental</i>	
1.	den	dni	dnem	<i>day</i>
2.	kmen	kmeji	kmenem	<i>stem</i>
3.	bit	bitu	bitem	<i>apartment</i>
4.	kli:tʃ	kli:tʃi	kli:tʃem	<i>key</i>
5.	dvor	dvoru	dvorem	<i>courtyard</i>
6.	potok	potoku	potokem	<i>stream</i>
7.	koʃ	koʃi	koʃem	<i>basket</i>
8.	mozek	mosku	moskem	<i>brain</i>
9.	hrnets	hrntsi	hrntsem	<i>pot</i>
10.	rok	roku	rokem	<i>year</i>

Feedback for Chapter 31

31.1 Isthmus Zapotec

¹⁷⁴ A *j* is inserted between when a word-internal syllable is lacking an onset.

¹⁷⁵ An *i* is inserted to help syllabify a stray consonant.

31.2 Latin

¹⁷⁶ Underlying forms: {li:ber} *free*, {miser} *wretched*, {agr} *field*, {sinistr} *left*, {libr} *book*.

Suffixes: Nominative (no suffix), Genitive: {-i:}

Stray Epenthesis (inserting an *e* to the left of a stray consonant) is motivated by syllable structure considerations. The syllable template does not permit final clusters. In the case of {sinistr}, we might propose (as others have) that we proceed directionally (from right to left in Latin) and insert vowels as needed. Therefore, an *e* is inserted to the left of *r*, but its insertion enables the *t* to not be a stray consonant, blocking further epenthesis.

31.3 Serbo-Croatian

¹⁷⁷ Stray Epenthesis (inserting an *a* to the left of a stray consonant) is motivated by syllable structure considerations since the coda Consonant-Sonorant is not permitted.

Derivations:

Underlying	dobr	dobr-a	dobr-o	dobr-i
(syllabification)	(dob) r	(dob) (ra)	(dob) (ro)	(dob) (ri)
Stray Epenthesis	dobar	_____	_____	_____
Surface	dobar	dobra	dobro	dobri

31.4 Southeastern Puebla Nahuatl

¹⁷⁸ Stray Epenthesis, inserting an *i* to the right of a stray consonant, is motivated by syllable-structure considerations. Syllable-final consonant clusters are not permitted.

31.5 English

¹⁷⁹ A rule devoices a consonant before voiceless consonants, as seen in the form *twelf-θ*.

A rule inserts a stop between a nasal and a fricative. The epenthetic stop agrees in place of articulation with the nasal.

31.6 Czech

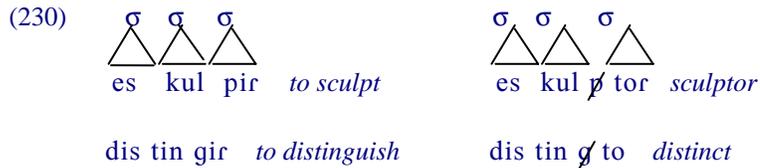
¹⁸⁰ Stray Epenthesis applies, inserting *e* to the left of a stray consonant. There are no syllable-final clusters. The sequences [tʃ] and [ts] must be analyzed as affricates.

The underlying form of *brain* must be {mozk}, with devoicing of the *z*, either syllable-finally, or before a voiceless consonant.

The consonant *n* becomes palatalized before *i*.

CHAPTER 32 - DELETION

A consonant or a vowel can be completely lost under certain conditions. For example, in Spanish, a consonant of the root is lost in the word preceding a consonant-initial suffix since it cannot be incorporated into any syllable. Consider the roots {eskulp} *sculpt*, and {disting} *distinguish* when they are combined with the suffixes {-i-r}, {-tor} (agentive nominalizer), and {-to} (adjectivalizer).



The “theme vowel” which occurs in each of the three conjugation classes of Spanish verbs is deleted when it occurs before a vowel-initial suffix, such as the suffix {-o} for first person singular in present tense.^a

(231) <i>we ...</i> root + theme + suffix abl + a + mos kom + e + mos bib + i + mos	<i>I ...</i> root + theme + suffix abl + a + o <i>speak</i> kom + e + o <i>eat</i> bib + i + o <i>live</i>
---	---

Formalization

A common way to formalize deletion rules is with the use of the null symbol, replacing a certain sound with null in a certain context.

$$(232) \quad X \rightarrow \emptyset / Y _ Z$$

The rule deleting vowels in Spanish could be formalized as:^b

$$(233) \quad V \rightarrow \emptyset / _ V$$

It has been suggested by Harris that an explicit rule deleting consonants in Spanish is not necessary, however.^c The assumption is that if a sound is not incorporated into any syllable, it is deleted by convention.^d

Deletion rules often serve the function of enforcing common syllable structure patterns, although this is not always the case.

Coalescence

There are cases in which two sounds merge into one, resulting in one sound that has some features of both of the original sounds.

In Copainala Zoque a coronal consonant and a *j* coalesce to form a palatal or palatalized consonant.

^a Vowel deletion is blocked when the vowel in question carries stress, as in the *vosotros* form (*abláis*, for example).

^b This formalization does not mention the morpheme boundary on the assumption that this is a rule which can only apply in a derived environment.

^c Harris (1983) *Syllable structure and stress assignment in Spanish*.

^d This has been called the *Stray Erasure Convention*. The proposal is that some deletions should be built into the theory rather than be done by language-specific rules. This results in simple language-specific phonological statements (but more complicated and interesting theories).

(234)	Root + Plural			
	wiht + jah	→	wiht ^h ah	walk
	meʔts + jah	→	meʔtʃah	look for
	sohs + jah	→	sohʃah	cook

In Isthmus Zapotec an /ʃ/ and a following sonorant consonant coalesce to become a voiceless version of the sonorant: therefore /ʃl/ becomes voiceless *l*, /ʃn/ becomes voiceless *n*, etc.

In Corongo Quechua, certain sequences of vowel and glide merge to become long vowels: /aj/ becomes [e:] and /aw/ becomes [o:].

(235)	{ajwa-jka:n}	→	[e:we:kaŋ]	he is going
	{awmi}	→	[o:mi]	yes

In some cases of coalescence it might be possible to think of coalescence as assimilation of one segment to another followed by deletion of one segment. For example, if a vowel plus nasal sequence is replaced by a nasalized vowel phonetically, one might argue that there are two rules (vowel assimilates in nasality, nasal consonant deletes) rather than one rule (vowel-nasal coalescence). Various facts must be brought into the discussion of this issue which we cannot go into here.

Key Concepts

deletion

coalescence

32.1 Try it for yourself with Maori

Give the necessary rules and show how they account for the data. What is the suffix for Passive? (Propose a single underlying form.) Show how your analysis accounts for examples 1 and 8.¹⁸¹

	Active	Passive	
1.	awhi	awhitia	<i>embrace</i>
2.	hopu	hopukia	<i>catch</i>
3.	aru	arumia	<i>follow</i>
4.	tohu	tohuŋia	<i>point out</i>
5.	mau	mauria	<i>carry</i>
6.	wero	werohia	<i>stab</i>
7.	patu	patua	<i>strike, kill</i>
8.	kite	kitea	<i>see, find</i>

32.2 Try it for yourself with Walmatjari

Examine the Walmatjari data in Appendix F. Propose a simple rule to account for the loss of consonant in the forms 4-7.¹⁸²

32.3 Try it for yourself with French

Account for the allomorphy in the adjectives.¹⁸³

		... <i>friend</i>	... <i>horse</i>	
1.	səl	səlami	səlʃəval	<i>only</i>
2.	pəti	pətitami	pətifəval	<i>small</i>
3.	gɛo	gɛozami	gɛoʃəval	<i>heavy</i>

32.4 Try it for yourself with Sre

Give the underlying form for each morpheme, and the phonological rule(s) needed. (V: indicates a long vowel with falling pitch.)¹⁸⁴

	Stem	Causative	
1.	du:h	təndu:h	<i>fall</i>
2.	lik	təlɪk	<i>come out</i>
3.	pɔ	tənpɔ	<i>nurse</i>
4.	mu:ʔ	təmu:ʔ	<i>descend</i>
5.	tʃhet	təntʃhet	<i>die</i>
6.	duh	tənduh	<i>be hot</i>
7.	ŋətʃ	təŋətʃ	<i>goodbye (greeting)</i>
8.	guh	tənguh	<i>wake up</i>
9.	hɔ:r	tənhɔ:r	<i>flow</i>
10.	kəh	tənkəh	<i>remember</i>

32.5 Try it for yourself with Koine Greek

Give the underlying form for each morpheme, and the phonological rule(s) needed.¹⁸⁵

	Nom. Sg.	Gen. Sg.	Dat. Pl.	Acc. Pl.	
1.	lailaps	lailapos	lailapsi	lailapas	<i>storm</i>
2.	sarks	sarkos	sarksi	sarkas	<i>flesh</i>
3.	elpis	elpidos	elpisi	elpidas	<i>hope</i>
4.	ornis	ornit ^h os	ornisi	ornit ^h as	<i>bird</i>
5.	araps	arabos	arapsi	arabas	<i>Arab</i>
6.	floks	flogos	floksi	flogas	<i>flame</i>
7.	orniks	ornik ^h os	orniksi	ornik ^h as	<i>hen</i>
8.	k ^h aris	k ^h aritos	k ^h arisi	k ^h aritas	<i>grace</i>
9.	—	aeros	aersi	aeras	<i>air</i>
10.	—	arsenos	arsesi	arsenas	<i>male</i>
11.	nyks	nyktos	nyksi	nyktas	<i>night</i>

32.6 Try it for yourself with Asheninca Campa

Give the underlying form for each morpheme, and the phonological rule(s) needed.¹⁸⁶

	Noun	<i>my ...</i>	<i>your ...</i>	
1.	mapi	nomapini	pimapini	<i>rock</i>
2.	saŋko	nosanƙoni	pisanƙoni	<i>sugar cane</i>
3.	t ^h oŋki	not ^h oŋkini	pit ^h oŋkini	<i>ant (species)</i>
4.	iŋki	niŋkini	piŋkini	<i>peanut</i>
5.	ana	nanani	panani	<i>black dye</i>
6.	oŋko	noŋkoni	poŋkoni	<i>root (species)</i>

Feedback for Chapter 32

32.1 Maori

¹⁸¹ Consonant Deletion: A word-final consonant is deleted. Or, alternatively (from the data shown), obstruents are not possible in the coda of the syllable, and stray consonants are deleted.

Vowel Deletion: A vowel deletes after a vowel (in derived environments only).

	Active	Passive
Underlying	a whit	a whit-ia
C-Deletion	a whi	_____
V-Deletion	_____	_____
Surface	a whi	a whitia
	Active	Passive
Underlying	k ite	k ite-ia
C-Deletion	_____	_____
V-Deletion	_____	k itea
Surface	k ite	k itea

The proper understanding of these facts has been discussed in the literature. These data are taken from a paper which argues that the consonant deletion analysis outlined above is not the correct analysis synchronically. It also proposed that the allomorphs [-ia] and [-a] of the Passive suffix are suppletive, but it does not argue for this analysis over the vowel deletion analysis proposed above.

32.2 Walmatjari

¹⁸² A coronal consonant is deleted after a coronal liquid. Dorsal consonants (e.g. *k*) are not deleted – see the Dative suffix. Deletion does not take place after obstruents or nasals. We don't know what would happen after glides since these do not occur in this position in the language. The features necessary to specify “liquid” are [+son], [-nas]; if glides were to be excluded, we could add the feature [+cons].

32.3 French

¹⁸³ From these data it appears that obstruents cannot appear in syllable-final position. Stray Deletion applies.

32.4 Sre

¹⁸⁴ The unpredictable allomorph of the causative prefix is {tən-}. The nasal deletes before a sonorant consonant. It may be necessary to restrict the deletion of the consonant to apply only to sonorants, or nasals only. The data given do not warrant this restriction, however.

Consonant Deletion: C C
 ↓ [+son]
 ∅

32.5 Koine Greek

¹⁸⁵ The voicing of a consonant and aspiration of a consonant is not predictable before a vowel and must be included in the underlying form. Consonants are deaspirated and devoiced before a consonant. If this rule is specified as a structure preserving rule, the following is sufficient; if not, we must specify that both consonants must be obstruents, or must be in different morphemes.

Rule: Laryngeal Assimilation: The laryngeal features of a consonant spread to a preceding consonant.

Coronal stops (oral and nasal) are deleted before a consonant.

Rule: Coronal Stop Deletion: A coronal stop deletes before another consonant.

32.6 Asheninca Campa

¹⁸⁶ The underlying forms of the noun stems would be the forms which appear in the first column. The affixes are: {no-} (first person singular possessor), {pi-} (second person singular possessor), and {-ni} (perhaps a suffix that changes an alienable noun into one that can be possessed).

The rule needed is:

$$\begin{array}{c} V \ V \\ \downarrow \\ \emptyset \end{array}$$

Both of the prefixes lose their vowel when they precede a vowel-initial root.

CHAPTER 33 - UNDERLYING FORMS

The basic criterion for positing underlying forms is simplicity. We posit as the underlying form that form from which the various allomorphs can most easily and naturally be derived by phonological rules such as assimilation, deletion, etc. There is no principle which says that the underlying form must be one of the surface allomorphs, although it often is. It is a good idea to consider a range of possibilities first. For the past tense suffix of English, these possibilities include the following:

- (236) -d (as in *believed*)
-t (as in *walked*)
-id (as in *heated*)
-it (a composite of the previous, not attested in any surface form)

We also consider how a description positing each of these might go.

If the underlying form is {-d}, then we must account for the fact that an *i* is inserted in words such as [patid]^a *potted* and that the *d* is devoiced in words such as [fejkt] *faked*.

If the underlying form is {-t}, then we must account for the fact that the *t* becomes voiced in words such as [sabd] *sobbed*, and that the *t* is voiced and an *i* inserted in forms such as [natid] *knotted*.

If the underlying form is {-id}, then we must account for the fact that the *i* is lost in words such as [sabd] *sobbed*, and that the *i* is lost and the *d* devoiced in words such as [dɪpt] *dipped*.

If the underlying form is {-it}, then we must account for the fact that the [*i*] is lost in words such as [dɪpt] *dipped*, the *i* lost and the *t* voiced in words such as [sabd] *sobbed*, and the *t* voiced in words such as [nadid] *nodded* and [natid] *knotted*.

We will begin by showing how each of these possibilities might be investigated, beginning with the last one and working backwards. The clearest way to do this is to put down clearly what the proposed underlying form is for a particular surface form, and then see what rules are needed to get from one to the other. Each solution posits underlying forms and phonological rules which apply to these forms, with the intermediate representations (the output of each rule) shown. *Every rule must be attempted for every form.* One cannot simply not apply a rule because one does not want to. The rule must be formulated with precision so that it applies in just the right contexts and not in the wrong contexts.

Before beginning this demonstration, we also point out that we will be proposing two phonological rules: one dealing with the alternation in voicing that we see, and one dealing with the presence (or absence) of the vowel *i*. Since these are related to separate phonological processes, two rules are needed. We do *not* write rules such as the following:

- (237) $t \rightarrow id / \dots$

The rule is formally too complex: it adds a segment and it changes the features of another segment at the same time. Furthermore, it conflates two processes which can be shown to be independently operating processes in the language.

We will now proceed with the comparison of the different possible solutions, starting with one that may appear to be the least likely. (We ignore here the fact that in these solutions, the rules must apply in a certain order; this topic is taken up in chapter 34.)

Solution 1: Underlying {-it}

- (238) Deletion: *i* is deleted if it does not follow a coronal stop.

^a This form actually has a flap instead of [t] in American English. This fact is ignored here. The same is true of the word *knotted* mentioned below.

- (239) Voicing Assimilation: A consonant assimilates in voicing to an immediately preceding sound.

	<i>knotted</i>	<i>sobbed</i>	<i>dipped</i>	<i>laced</i>	<i>rowed</i>
Underlying	nat - it	sab - it	dɪp - it	lejs - it	ɹow - it
Deletion	—	sabt	dɪpt	lejst	ɹowt
Voicing	nadɪd	sabd	dɪbd	lejzd	ɹowd
Surface	*nadɪd	sabd	*dɪbd	*lejzd	ɹowd

The Deletion rule in this solution is complicated; notice that it has to include a negative environment (not X). It applies in an environment which does not consist of a natural class.^b

The Voicing rule in this solution causes problems in that it applies incorrectly in a number of places (even though sometimes it may be debated how it is actually to be applied). This solution must be rejected for this reason.

Solution 2: Underlying {-id}

- (240) Deletion (same as above).
 (241) Voicing Assimilation (same as above except that we stipulate that it applies only in derived environments, see chapter 14)

Underlying	nat - id	sab - id	dɪp - id	lejs -id	ɹow - id
Deletion	—	sabd	dɪpd	lejzd	ɹowd
V. Assim.	natid	sabd	dɪpt	lejst	ɹowd
Surface	natid	sabd	dɪpt	lejst	ɹowd

This solution has the same problem as the previous one with respect to the complexity of the deletion rule. It would also have the same problem with respect to voicing were it not for the possibility of stipulating that it applies only in derived environments (a move that would not have saved the previous solution). This stipulation keeps it from applying morpheme-internally to words such as dɪpt *dipped* (otherwise we would have derived either dɪbt or dɪbd, depending on how the rule was applied).

Solution 3: Underlying {-t}

- (242) Insertion: ɪ is inserted between two coronal stops.
 (243) Voicing Assimilation (same as in Solution 2 above)

Underlying	nat - t	sab - t	dɪp - t	lejs - t	ɹow - t
Insertion	natɪt	—	—	—	—
Voicing	natid	sabd	dɪpt	lejst	ɹowd
Surface	natid	sabd	dɪpt	lejst	ɹowd

The insertion rule in this solution is an improvement over the deletion rule in the previous solutions; the environment is simple. The rule of Voicing Assimilation applies without any problem also if we stipulate that it applies only in derived environments.

Solution 4: Underlying {-d}

- (244) Insertion: (same as above).
 (245) Voicing Assimilation: (same as in Solution 2 above).

^b When rules are looked at from a historical perspective, negative environments are evaluated differently.

Underlying	nat - d	sab - d	dɪp - d	lejs - d	ɔw - d
Insertion	natid	—	—	—	—
Voicing	natid	sabd	dɪpt	lejst	ɔwd
Surface	natid	sabd	dɪpt	lejst	ɔwd

This solution also works fine. Which leads us to the problem of deciding between Solution 3 and Solution 4. The rules are the same; the underlying forms are different; both solutions work. Maybe the voicing of the suffix is irrelevant; it would be underlying unspecified for voicing. People have also pointed out that we must be able to distinguish between the words *burnt* and *burned*. While there are perhaps other ways to skin this cat, the most usual solution has been to claim that the word *burnt* has the irregular past tense suffix {-t} and that the word *burned* has the regular past tense suffix {-d}. One must still claim that the form *burnt* does not undergo the same rule of Voicing Assimilation that regular past tense forms do.

Phonological rules such as Insertion and Voicing Assimilation are written to account for morpheme alternations. But they are meant to be general rules; therefore the analyst must investigate and explain any data which appear to contradict them. The analyst will also attempt to make them as simple and general as possible. For example, the third person present suffix shows alternations which are similar to those of the third person past: [-s], [-z], [-iz]. We can immediately see that our rule of Voicing Assimilation will account for the voicelessness of the plural suffix in words such as /nɪks/ *nicks*.

(246)	Underlying	nɪk - z
	Devoicing	nɪks
	Surface	nɪks

Likewise our rule of Insertion (with minor adjustments—the environment is two coronal consonants that have the same value of certain features) will account for the insertion of the *i* in words like *rices* [ɹejsɪz].^c

Key Concepts

underlying forms to account for the facts
simple environments

phonological rules which apply generally

33.1 Try it for yourself with Basque

List all allomorphs. Give the underlying forms for the noun stems and the suffixes. Give the rules necessary to account for the allomorphs. (Hint: There are three rules, one of which changes *e* to *i* when it precedes a vowel.)¹⁸⁷

	Absolutive Singular	Absolutive Plural Proximate	Ergative Indefinite	Genitive Plural	
1.	gisona	gisonok	gisonek	gisonen	<i>man</i>
2.	tʃakura	tʃakurok	tʃakurek	tʃakuren	<i>dog</i>
3.	alaβa	alaβok	alaβak	alaβen	<i>daughter</i>
4.	paatia	paatiok	paatek	paatien	<i>wall</i>

^c See Moira Yip (1988) The Obligatory Contour Principle and phonological rules: a loss of identity *Linguistic Inquiry* 19:65-100 for more discussion.

33.2 Try it for yourself with Seri

The second and third columns are verbs inflected for third person subject and third person object (when the verb is transitive). The transitive verbs have an extra morpheme (a prefix *i*) in these columns. However, not all cases of *i* in this position are this morpheme. Note that the third column has more instances of *i* than the second column.

Identify all morphemes. Give underlying forms and the rules necessary. Several rules are needed. Give derivations for the various forms of the verbs *be painful*, *be cold*, and *look for*. Prose rules are OK.¹⁸⁸

Hint: Onset restriction in Seri: $* \sigma [\text{C} \quad \text{C}]$
[+son]

(That is, no syllable onset cluster in Seri begins with a sonorant consonant.)

	Nominalized	Unrealized	Proximal	
1.	'kṽækæ	po'mækæ	i'm:ækæ	<i>be lukewarm</i>
2.	'kṽis	ipo'mis	i'm:is	<i>resemble</i>
3.	'kis	'pis	'mis	<i>be raw</i>
4.	'ka:pɫ	'pa:pɫ	'ma:pɫ	<i>be cold</i>
5.	'ko:kta	i'po:kta	i'mo:kta	<i>look at</i>
6.	'ktis	ipo'tis	in'tis	<i>point at</i>
7.	'kpi:	ipo'pi:	im'pi:	<i>taste</i>
8.	'ka:i	i'pa:i	i'ma:i	<i>make</i>
9.	'ko:n	i'po:n	i'mo:n	<i>carry (pl.items)</i>
10.	'kka:	ipo'ka:	iŋ'ka:	<i>look for</i>
11.	'ki:	i'pi:	i'mi:	<i>hear</i>
12.	'kpaxim	po'paxim	im'paxim	<i>be overcooked</i>
13.	'kxiŋi	po'xiŋi	iŋ'xiŋi	<i>be painful</i>

Feedback for Chapter 33

33.1 Basque

¹⁸⁷ Two roots have no allomorphs: *gison* *man* and *tʃakur* *dog*.

Two roots have allomorphs: *alaβ*, *alaβa* *daughter*; *paati*, *paate* *wall*. (Choose *alaβa* as UF to distinguish it from consonant-final roots like *gison*. Choose {*paate*} as UF, as per hint.)

Three suffixes have no allomorphs: *-a* Abs. Sg., *-ok* Abs. Pl. Prox., *-en* Gen. Pl. Choose these as UFs.

One suffix has allomorphs: *-k*, *-ek* Erg. Indef. Choose *-k* as UF to distinguish it from vowel-initial suffixes like *-ok*.

Deletion: *a* deletes before another vowel. (Other vowels do not delete. Also, the rule may apply only in a derived environment, or the double vowel symbols indicate long vowels.)

$$\begin{array}{l} \text{ala}\beta\text{a} + \text{en} \rightarrow \text{ala}\beta\text{en} \quad \text{ala}\beta\text{a} + \text{a} \rightarrow \text{ala}\beta\text{a} \quad \begin{array}{l} \text{a V} \\ \downarrow \\ \emptyset \end{array} \end{array}$$

Insertion: An *e* is inserted before a stray consonant. (Or, more descriptively, an *e* is inserted between two consonants, assuming that [tʃ] is an affricate.)

$$\text{gison} + \text{k} \rightarrow \text{gisonek}$$

Raising: An *e* is raised to *i* before a vowel.

33.2 Seri

¹⁸⁸ Nominalizer: *k-*

Unreal: *po-*

Proximal: *m-* (from these data; other data suggest there is more to the story)

Transitive: *i-*

Stems: as in first column without the initial *k*, but with *m* instead of nasalized *w*.

Nasal Velarization: *m* becomes [+back] and [+cont] after a [+back] consonant.

Nasal Place Assimilation: Nasals assimilate in place to an immediately following consonant. (Actually, the rule is not quite this general; it only applies to *m* in Seri, surprisingly, and only in unstressed syllables.)

Deletion: V V (applies only in derived environments)

$$\begin{array}{l} \downarrow \\ \emptyset \end{array}$$

Epenthesis: An *i* is inserted before a stray consonant.

 Crucial Derivations:

Underlying	po-a:pʔ	m-xifi	i-m-ka:	k-mækæ
Nasal Assimilation	_____	ŋxifi	iŋka:	_____
Nasal Velarization	_____	_____	_____	kw̃ækæ
Deletion	pa:pʔ	_____	_____	_____
Epenthesis	_____	iŋxifi	_____	_____
Surface	pa:pʔ	iŋxifi	iŋka:	kw̃ækæ

CHAPTER 34 - RULE ORDERING

In the previous chapter we saw that two phonological rules were needed to account for the allomorphy of the past tense suffix in English. Whenever two or more rules are involved, we need to consider, and perhaps stipulate, how the rules should apply. Ideally, a theory of phonology would tell us exactly how the rules should apply in most cases, thereby simplifying the phonological description of a language. Considerable effort has been made to develop such a theory of language, but to date the mystery of rule application remains largely unsolved. Nevertheless, considerable progress has been made in finding out what theories of language are not adequate.

Consider first of all the rules of Insertion and Devoicing from the previous chapter.^a

(247) Insertion: *i* is inserted between two coronal stops.

(248) Voicing Assimilation: A consonant assimilates in voicing to an immediately preceding sound.

One might suppose that phonological rules such as these apply simultaneously to any underlying forms that meet their structural description. Let us see how this hypothesis might fare with the English facts.

(249)	Underlying form for <i>knotted</i>	nat - d
	Would Insertion apply?	(yes)
	Would Voicing Assimilation apply?	(yes)
	Apply both rules at once:	* natit (incorrect)

Since the simultaneous application hypothesis produces incorrect results, and since it is not obvious how it might be fixed up to produce the correct results, we will not consider it further.^b

Rather than take the reader through other hypotheses of rule application that have been proposed, we will explain the hypothesis for rule application which has (with some variations) been widely used within generative phonology for over twenty-five years.

It is widely assumed that most phonological rules appear in an ordered list and apply once in the derivation of a word.^c All rules generally apply to all morphemes that meet their structural description. The linguist must determine and specify the order in which they apply; there is no completely reliable method for predicting ahead of time the order in which two rules will apply.

If we assume that Insertion appears before Devoicing in the ordered list of rules of English, then we can derive the correct results in every case. The first rule applies to the underlying form and gives the intermediate output shown beside its name. The next rule applies to the output of the first rule and gives the output shown beside its name. The next rule applies similarly, and so on until all of the rules of the phonology have been applied. If a rule does not find anything to which it can apply in the string, this lack of application is shown by a line, as we showed in the last chapter. (The next rule in the derivation applies to the last output shown).

(250)	Underlying	nat - d	dtp - d
	Insertion	natid	_____
	Voicing Assimilation	_____	dtp
	Surface	natid	dtp

If we were to assume the opposite order, incorrect results (marked with an asterisk) are sometimes derived.

^a The discussion in this chapter still ignores the fact that the intervocalic *t* in words like *potted* is flapped in American English. The introduction of a third rule (Flapping) to the discussion would make it more interesting, but also more complicated.

^b Such a hypothesis is not to be lightly dismissed, however.

^c Cyclic rules apply more than once, once on each cycle. This topic cannot be covered in this course.

(251)	Underlying	nat - d	dɪp - d
	Voicing Assimilation	natt	dɪpt
	Insertion	natit	—
	Surface	* natit	dɪpt

The order in which Insertion and Voicing Assimilation apply is important. Crucial orderings such as this are usually indicated in the list of rules by means of a curved line connecting the two rules. This is shown in the following figure where rule W is crucially ordered before rule X, and rule X is crucially ordered before Insertion. Insertion and Rule Y are both crucially ordered before Voicing Assimilation, but they are not crucially ordered with respect to each other. Finally, Voicing Assimilation is crucially ordered before rule Z.



When one rule creates input for another rule, it is said that the first rule **feeds** the second rule. When one rule robs another rule of input, it is said that the first rule **bleeds** the second rule.

When we claim that two rules must apply in a particular order, we need to show that this is so. To do this, one constructs a derivation which shows, as it did above, that one order gives the correct results and the opposite order does not. This is done for each pair of rules. The best way to do this is to find a form in which only a given pair of rules will both apply and see if they must be ordered.

When we think about a solution for a set of data, we must constantly think about three parts to the solution:

- (1) the underlying forms,
- (2) the phonological rules, and
- (3) the way in which the rules apply.^d

Each of these represents a distinct hypothesis. We might have the right underlying forms and the right rules, but the wrong order of application. Or we might have the right rules, and the right ordering, but the wrong underlying forms. Or everything might be right except that one phonological rule is overly general or overly restricted. Phonological analysis requires the constant juggling of these factors to come up with the best solution. In general, however, rule ordering is preferred to complication of rules.

Try it for yourself with Totonac

Consider the following two rules. Examine the data and determine the order in which they must apply. Give derivations to show the correct order and to demonstrate that the opposite order is not correct.¹⁸⁹

Devoicing: Short non-laryngealized vowels are devoiced utterance-finally.

Data: /kuku/ *uncle*, pronounced as [kuku] utterance-finally and [kuku] utterance-medially;

h-Deletion: h is deleted utterance-finally.

Data: /kukuh/ *sand*, pronounced as [kuku] utterance-finally and [kukuh] utterance-medially,
as in [kukuh ku?] *it is still sand*.

^d One must also consider the possible constraints discussed in chapter 14.

Effects of rule interaction

When two or more rules apply in a derivation, the effect of their interaction sometimes produces surface forms that look like exceptions to one rule or the other. Because of the way in which the rules apply, the true facts of the language may be more difficult to discover. For example, after looking at many words in Hueyapan Nahuatl, one would easily conclude that [k] and [ɣ] are in complementary distribution. The following rule of Spirantization (fricative-formation) would be formulated:

(253) Spirantization: A velar stop becomes a fricative intervocalically.^e

But now we come across the following data:

(254) [nikoa] *I buy it* [niɣoa] *I shell it*

It looks like [k] and [ɣ] are contrasting in identical environments here, and that we have a minimal pair. It looks like we have an exception to our rule of Spirantization. But actually it would be wrong to conclude from these data that we have two phonemes. A closer inspection reveals that more is going on. First of all, note that the words are morphologically complex; they have more than one morpheme. In fact, a quick comparison with other words shows that the morphemes are the following:^f

(255) FIRST PERSON SUBJECT ni-
THIRD PERSON OBJECT k-
buy koa
shell oa

The underlying forms of the two words then must be {ni-k-koa} *I buy it* and {ni-k-oa} *I shell it*. In the first word the underlying cluster is reduced to a single *k* in the surface by the following degemination rule (given informally) which reduces a cluster of geminate consonants to a single consonant:

(256) Degemination: k k
 ↓
 ∅

In the second word the prevocalic *k* changes to [ɣ]. The correct derivations for these words must have the rules apply in a certain order.

(257)		<i>I buy it</i>	<i>I shell it</i>
	Underlying	ni - k - koa	ni - k - oa
	Spirantization	—————	niɣoa
	Degemination	nikoa	—————
	Surface	nikoa	niɣoa

If these rules apply in the opposite order, where Degemination would feed Spirantization, the correct forms are not derived.

(258)		<i>I buy it</i>	<i>I shell it</i>
	Underlying	ni - k - koa	ni - k - oa
	Degemination	nikoa	—————
	Spirantization	niɣoa	niɣoa
	Surface	* niɣoa	niɣoa

This example shows very clearly the importance of our point above that exceptions to rules may only be apparent and not real. Rule interaction often accounts for what appear to be exceptions.

^e The fricative is voiced as well, so it could be that the feature [voice] is what is spreading. Once we have one feature spread, the other one can be gotten for free later on in this language.

^f The *i* of the prefix *ni-* is actually epenthetic.

Key Concepts

rule ordering

feeding order

bleeding order

Tips about Rule Application in Traditional Generative Phonology

1. Rules apply in a **fixed order** (to be discovered for each language).
2. All rules are put in a **list of rules**, with crucial orderings indicated. (Rules which are unordered in relation to other rules are often put last in the list.)
3. A derivation shows how **all** of the rules apply (or fail to apply) to a given word.
4. The first rule of the list applies directly to the underlying form; each subsequent rule applies to the output of the last rule which applied.
5. **Every** rule must be attempted on every word. All rules must be shown in each derivation, whether they actually apply or not.
6. If a rule does not apply to a word, this is indicated by a line in the derivation.
7. **Crucial rule orderings** must be demonstrated by one correct and one false derivation for the same word (most easily done when only two rules actually apply in the derivation).
8. An incorrect output is indicated by an **asterisk**.
9. **All** morphemes are included in the underlying form (at the top of the derivation).^g

^g In some versions of Lexical Phonology, morphemes are added in *cycles*. We ignore this possibility here.

34.1 Try it for yourself with Serbo-Croatian

The first thirteen forms below were included in an exercise in chapter 31. You should review the data and the solution for that part. Then propose an account for the data in examples 14-22. Discuss the order of the rules and show derivations to support what you say.¹⁹⁰

	Masculine	Feminine	Neuter	Plural	
1.	mlad	mlada	mlado	mladi	<i>young</i>
2.	pust	pusta	pusto	pusti	<i>empty</i>
3.	zelen	zelena	zeleno	zeleni	<i>green</i>
4.	tjest	tjesta	tjesto	tjesti	<i>frequent</i>
5.	bogat	bogata	bogato	bogati	<i>rich</i>
6.	suntjan	suntjana	suntjano	suntjani	<i>sunny</i>
7.	rapav	rapava	rapavo	rapavi	<i>rough</i>
8.	dobar	dobra	dobro	dobri	<i>good</i>
9.	jasan	jasna	jasno	jasni	<i>clear</i>
10.	ledan	ledna	ledno	ledni	<i>frozen</i>
11.	sitan	sitna	sitno	sitni	<i>tiny</i>
12.	oštari	oštra	oštro	oštri	<i>sharp</i>
13.	mokar	mokra	mokro	mokri	<i>wet</i>
14.	debeo	debela	debelo	debeli	<i>fat</i>
15.	posustao	posustala	posustalo	posustali	<i>tired</i>
16.	beo	bela	belo	beli	<i>white</i>
17.	mio	mila	milo	mili	<i>dear</i>
18.	tseo	tsela	tselo	tseli	<i>whole</i>
19.	okrugao	okrugla	okruglo	okrugli	<i>round</i>
20.	obao	obla	oblo	obli	<i>plump</i>
21.	nagao	nagla	naglo	nagli	<i>abrupt</i>
22.	podao	podla	podlo	podli	<i>base</i>

34.2 Try it for yourself with Lamba

Two rules are needed for the following data. One of them is the following:

Vowel Harmony: [+high] vowels become [-high] when the preceding syllable has a [-high, -low] vowel.

This Harmony rule takes underlying {-ila} and gives the allomorph [-ela]. (Notice that the allomorph [-ila] has a wider distribution since it occurs after more kinds of vowels.) What is the other rule?¹⁹¹

Show that the two rules may apply in either order or that they must apply in only one of the two possible orders.¹⁹²

Discuss the interaction of these rules using the terms ‘feeding’ and/or ‘bleeding’.¹⁹³

	<i>Past</i>	<i>Passive</i>	<i>Applied</i>	<i>Reciprocal</i>	
1.	tʃita	tʃitwa	tʃitila	tʃitana	<i>do</i>
2.	tula	tulwa	tulila	tulana	<i>dig</i>
3.	tʃeta	tʃetwa	tʃetela	tʃetana	<i>spy</i>
4.	soŋka	soŋkwa	soŋkela	soŋkana	<i>pay tax</i>
5.	pata	patwa	patila	patana	<i>scold</i>
6.	fisa	fiswa	fiʃila	fisana	<i>hide</i>
7.	tʃesa	tʃeswa	tʃesela	tʃesana	<i>cut</i>
8.	kosa	koswa	kosela	kosana	<i>be strong</i>
9.	lasa	laswa	laʃila	lasana	<i>wound</i>
10.	masa	maswa	maʃila	masana	<i>plaster</i>

34.3 Try it for yourself with Ocotepec Mixtec

Only one example of each type of root is given below. Several rules are needed. They are:

Nasal Place Assimilation: A nasal assimilates in place to an immediately following consonant.
(n-koko → ŋgoko)

Degemination: Identical consonants which are adjacent degeminate.
({n-nenda} → [nenda])

Voicing: A consonant assimilates in voicing to an immediately preceding consonant.
({n-saʔa} → [nzaʔa])

Affrication: A voiced palatal fricative assimilates in manner features to a preceding stop (becoming an affricate). (The exact formulation of this rule depends on the features one uses for affricates, stops and fricatives.) (n-ʒaʔa → ndʒaʔa)

Nasal Deletion: A nasal deletes before an alveopalatal fricative. (n-ʃiko → ʒiko)

What are the crucial orderings? Illustrate them with derivations (showing correct and incorrect results resulting from alternate orderings).¹⁹⁴

	<i>Continuative</i>	<i>Completive</i>	
1.	koko	ŋgoko	<i>swallow</i>
2.	saʔa	nzaʔa	<i>do, make</i>
3.	tiβi	ndiβi	<i>become inoperative</i>
4.	nenda	nenda	<i>come back</i>
5.	tʃũʔũ	ndʒũʔũ	<i>put into</i>
6.	ʃiko	ʒiko	<i>see</i>
7.	ʒaʔa	ndʒaʔa	<i>pass</i>

Feedback for Chapter 34

¹⁸⁹ Totonac

Devoicing must precede h-Deletion.

Correct order:

	<i>uncle</i>	<i>sand</i>
Underlying	kuku	kukuh
Devoicing	kuku̥	————
h-Deletion	————	kuku
Surface	kuku̥	kuku

Incorrect order (note wrong result):

	<i>uncle</i>	<i>sand</i>
Underlying	kuku	kukuh
h-Deletion	————	kuku
Devoicing	kuku̥	kuku̥
Surface	kuku̥	* kuku̥

34.1 Serbo-Croatian

¹⁹⁰For the data in the first part: a-Epenthesis, motivated by the need to incorporate a stray sonorant.

For the data in the second part: l-Vocalization. The consonant *l* becomes *o* when it occurs syllable-final. (The reverse is formally possible, given these data, but less plausible phonologically.)

Ordering: a-Epenthesis must precede l-Vocalization. The opposite order gives incorrect results.

	<i>plump (masc.)</i>		<i>plump (masc.)</i>
Underlying	obl	Underlying	obl
(syllabification)	(ob)l	(syllabification)	(ob)l
a-Epenthesis	obaɪ	l-Vocalization	obo
l-Vocalization	obao	a-Epenthesis	-----
Surface	obao	Surface	* obo

In the “incorrect” order derivation, the l-Vocalization rule would have to be formulated somewhat differently since the *l* is not part of any syllable at this point. An alternative (which would not rescue the solution, of course) would be that *l* becomes *o* in word-final position. For more discussion, see Kenstowicz 1994:90ff.

34.2 Lamba

¹⁹¹Palatalization: *s* is palatalized (to *ʃ*) before *i*.

¹⁹²Ordering: Vowel Harmony must precede Palatalization. Demonstration:

Underlying	kos - ila	
Harmony	kosela	Correct results with this order.
Palatalization	————	
Surface	kosela	

Underlying	kos - ila	
Palatalization	koʃila	
Harmony	koʃela	Incorrect forms with this order.
Surface	* koʃela	

¹⁹³ The rule of Harmony bleeds the rule Palatalization.

34.3 Ocotepéc Mixtec

¹⁹⁴Crucial Orderings:

Affrication must precede Voicing (to keep ʃ and ʒ from acting identically).

Underlying	n - ʃiko	n - ʒaʔa	<u>Incorrect:</u>	n - ʃiko
Affrication	————	ndʒaʔa	Voicing	nʒiko
Voicing	nʒiko	————	Affrication	ndʒiko
Nasal Deletion	ʒiko	————	Nasal Del.	————
Nasal Place Assimilation	————	ndʒaʔa	Nasal Place Assim.	ndʒaʔa
Degemination	————	————	Degem.	————
Surface	ʒiko	ndʒaʔa	Surface	* ndʒiko

Affrication must precede Nasal Deletion (for the same reason).

Underlying	n - ʃiko	<u>Incorrect:</u>	n - ʃiko
Affrication	————	Nasal Del.	ʃiko
Voicing	nʒiko	Affrication	————
Nasal Deletion	ʒiko	Voicing	————
Nasal Place Assimilation	————	Nasal Place Assim.	————
Degemination	————	Degem.	————
Surface	ʒiko	Surface	* ʃiko

Voicing must precede Nasal Deletion to change ʃ to ʒ before the nasal deletes.

Underlying	n - ʃiko	<u>Incorrect:</u>	n - ʃiko
Affrication	————	Affrication	————
Voicing	nʒiko	Nasal Deletion	ʃiko
Nasal Deletion	ʒiko	Voicing	————
Nasal Place Assimilation	————	Nasal Place Assimilation	————
Degemination	————	Degem.	————
Surface	ʒiko	Surface	* ʃiko

SUMMARY AND REVIEW QUESTIONS FOR SECTION 4

In this section we have discussed a variety of important issues.

In order to capture important generalizations and at the same time simplify phonological representations, it has been proposed that phonological representations are not fully specified as far as features go. Predictable features (either from context or from other features) are omitted.

In order to capture other important generalizations, it has also been proposed that phonological representations must be enriched with information that is different from features: namely, prosodic structure in the form of organization into syllables, etc. This information is often directly relevant to processes which delete or insert sounds.

Finally, we have seen that phonological rules may interact in interesting ways. In order to keep rules simple, it may be necessary to have them apply in a crucial order.

If you have mastered the material in this section, you should be able to

- (a) explain why some underlying forms may not contain all of the features that occur in surface forms
- (b) recognize when phonological processes are sensitive to the location of a syllable, word, or utterance boundary
- (c) describe the major internal parts of a syllable
- (d) parse strings of sounds according to proposed maximal syllable templates
- (e) examine a set of data and propose an adequate maximal syllable template
- (f) provide accounts of data which may be analyzed in more than one way, depending on how the features are linked to the syllable structure (affricates, glides, etc.)
- (g) recognize that phonological processes may be sensitive to the presence or absence of stress
- (h) account for allomorphy by proposing epenthesis and deletion rules
- (i) explain the relationship of many instances of epenthesis and deletion to the syllable structure of the language
- (j) explain and argue for rule ordering relationships

For Further Reading:

Goldsmith, John A. 1990. *Autosegmental & metrical phonology*, Oxford, Cambridge, Mass.; Basil Blackwell.

Goldsmith, John A., ed. 1995. *Phonological theory*, Cambridge, Mass., Oxford: Basil Blackwell.

Harris, James W. 1983. *Syllable structure and stress in Spanish: a nonlinear analysis*, Cambridge, London; MIT Press.

Itô, Junko. 1986. *Syllable theory in prosodic phonology*, Ph.D. Dissertation, University of Massachusetts, Amherst.

van der Hulst, Harry and Norval Smith. 1982. *The structure of phonological representations I, II*, Dordrecht; Foris.

Yip, Moira. 1987. English vowel epenthesis. *Natural Language and Linguistic Theory* 5:463-84.

Review Questions

The following questions are to help you review the material in the preceding section.¹⁹⁵

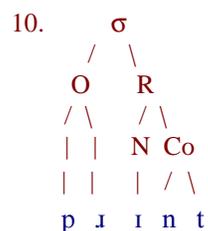
1. (T or F) The interaction of phonological rules sometimes results in there being a surface form that appears to be a counterexample to one of the rules.
2. (T or F) The most common syllable type among the languages of the world is CV.
3. (T or F) In some languages the syllable nucleus is optional.
4. What process is illustrated by the following data: {abam} → [abã]
5. (T or F) The underlying form of a morpheme must be the allomorph that occurs when there are no affixes.
6. Name the two major parts of a syllable: _____, _____.
7. Name the two major parts of the second part of a syllable: _____, _____.
8. Circle the sequences which might be analyzed in some language as a single consonant phonologically: ft nd dʒ st pt ts tr mg kj kh
9. Circle the words which may be parsed by the following syllable template and restriction: [CCVC], Onset obligatory.
 ʃalt ant spæt trɪmps
 mileŋk poai θɪn tʃuz stʃɑ
10. Draw a syllable tree structure for the word [pɪɪnt].

Feedback for Review Questions

¹⁹⁵ 1. T 2. T 3. F 4. coalescence 5. F 6. Onset & Rhyme

7. Nucleus & Coda 8. nd, dʒ, ts, kj, kh

9. spæt, θɪn, tʃuz, stʃɑ (tʃ could be an affricate)



SECTION 5

PHONOLOGICAL RULES: SUPRASEGMENTAL PROPERTIES

In this section we examine certain features of language that are typically not linked to a particular consonant or vowel but to the syllable or word or a larger unit. While this may also be true of features like [nasal] or [voice] as well as stress and pitch, the former are more commonly closely associated with particular consonants or vowels in underlying forms, unlike the latter.

CHAPTER 35 - STRESS

Stress refers to the relative degree of prominence placed on syllables within an utterance. This is sometimes manifested by loudness (greater amplitude of the acoustic signal), but many languages manifest stress by lengthening the stressed syllable and/or by raising the pitch of the voice on the stressed syllable. (People who claim they are tone deaf should not be unable to distinguish the noun *permit* from the verb *permit*. If they can distinguish them as speakers typically do, based on the pitch, they are not tone deaf.) Stress may also be manifested in increased muscular activity involved in articulatory movements.^a English uses a combination of these features to signal stress: a stressed syllable is often pronounced louder and with a higher pitch; the vowel of the syllable is usually longer, too. Stress is also realized in features such as the aspiration of voiceless stops at the beginning of stressed syllables.

Although stress is actually realized on the syllable as a whole, it is most evident in the vowel, which has greater intrinsic prominence anyway, because of its resonance. For this reason, linguists have often assigned the feature [stress] to the vowel of the syllable in particular, using a rule that begins as follows:

(259) V → [+stress] ...

Elaborate means have also been devised to generate the various levels of stress that descriptive works on English have differentiated. For example, the following representation is based on the work like that of Kenyon and Knott:^b

(260) 3 4 1 0
relaxation

Current theoretical representations of stress have been quite varied. Some approaches label syllables as strong (S) or weak (W),^c or use other devices which do not make use of the feature [stress]. In the notation with asterisks,^d the greater number indicates a higher degree of stress.

(261)

S				
W	S			
S	W	S	W	W
me	tri	ca	li	ty

*				
*		*		
*	*	*	*	*
me	tri	ca	li	ty

Both of the notations shown above indicate that some of the syllables are more prominent than others, and they indicate their relative prominence.

Much of the work within metrical phonology attempts to find the factors that are relevant to the rules of stress placement in a language, on the assumption that speakers use rules to assign stress to words rather than memorize where stress is assigned to the words (apart from some or many irregular words). Some of the factors are reviewed below.

Boundary information

Some stress rules make reference to root boundaries and some make reference to word boundaries. The first kind places stress on a certain syllable of the root and the stress stays on that syllable throughout the entire paradigm, regardless of how many affixes are added. Stress rules in many languages work this way.

(262) Seri: Stress the first syllable of the root.

^a Peter Ladefoged (1982) *A course in phonetics*, New York: Harcourt Brace Jovanovich, p. 225.

^b J. Kenyon and T.A. Knott (1944) *A pronouncing dictionary of American English*, Springfield, Mass.: G.C. Merriam Co. This work is cited in Chomsky and Halle (1968) *The sound pattern of English*, New York, Harper and Row, for example.

^c For example, Bruce Hayes (1980) *A metrical theory of stress rules*, Doctoral dissertation, MIT, Cambridge.

^d For example, see Morris Halle and Jean-Roger Vergnaud (1987) *An essay on stress*, Cambridge, Mass., MIT Press.

The following data show this for Seri (with the roots underlined).^e Regardless of whether a syllable is added at the beginning or at the end of the word, the stress always remains in the same place, on the first syllable of the root.

(263)	<i>táanpx</i>	Did he go home?
	<i>ihpyáanpx</i>	I went home.
	<i>ihpyomáanpx</i>	I didn't go home.
	<i>táanipxat</i>	Did they go home?
	<i>matáanipxat</i>	Did you (plural) go home?
	<i>cáanpxiha</i>	S/he is going home.

In other languages, the stress rule refers to the edge of the word (either the beginning or the end). Therefore stress does not always appear on the same syllable of the root. In fact, it may not appear on the root at all. Note how stress moves around in English: *défect*, *deféctive*; *propóse*, *proposition*; *nónsense*, *nonsénsical*. Some stress rules refer to initial syllables, others to final, others to penultimate (next to last), among other positions. (One of the goals of metrical phonology is to account for all of these cases and to exclude what are believed to be impossible cases.) The following rules illustrate two simple cases:

- (264) Chimalapa Zoque: Stress the penultimate syllable of the word (or only syllable).
Finnish: Stress the first syllable of the word.^f

Syllable weight

Stress placement also often depends on syllable structure or syllable weight (perhaps irrespective of position in the word, perhaps in addition to this information). A classic example is Latin where stress was assigned to the antepenultimate (third from end) syllable unless the penultimate syllable was a heavy syllable (one whose rhyme was not a simple V—either VV or VC); if the penultimate syllable was heavy, it was stressed.

(265)	Light penultimate syllable:	<i>réfícit</i>	
	Heavy penultimate syllable:	<i>refé:cit</i>	(long vowel)
		<i>reféctus</i>	(closed syllable)

This stress assignment rule is still reflected to some degree in Romance languages and English. Compare, for example, *alúminum* (antepenultimate stress because of light penultimate syllable), *conúndrum* (heavy penultimate syllable because it is closed) and *cerébrum* (heavy penultimate attracts stress because it has the 'long' vowel [ij] and not a 'short' vowel such as [ɪ]).

Other types of grammatical information may also be necessary. In English, stress sometimes depends on whether the morpheme is a noun, adjective, or verb.

(266)	<i>pérfect</i> (Adjective)	-	<i>perféct</i> (Verb)
	<i>cónvert</i> (Noun)	-	<i>convért</i> (Verb)

In Spanish, the stress pattern for nouns and adjectives is quite different from the one for verbs.^g

Of course, most languages have exceptions to any general rule of stress placement. One way to handle these is by including the stress of these exceptional words in the underlying representation. Current theories of stress have proposed other means of accounting for irregular stress which are more constrained than direct marking, but we cannot go into these here. While such examples are often cited in earlier literature to illustrate that stress is 'phonemic' (i.e. not completely predictable), they should not deter the analyst from looking for the regular stress patterns in the language.

^e In this chapter, as occasionally elsewhere, we use acute accents to indicate primary stress on a word, rather than the IPA symbol of a raised vertical stroke preceding the stress syllable.

^f John A. Goldsmith (1990) *Autosegmental and metrical phonology*, Cambridge, Mass., Basil Blackwell, p. 114.

^g James W. Harris (1983) *Syllable structure and stress in Spanish: a nonlinear analysis*, Cambridge, London, MIT Press.

Key Concepts

general stress patterns

stress placement sensitive to root or word boundaries

stress placement sensitive to syllable weight

Postscript for Teachers

This chapter barely introduces the topic of stress. Stress rules that do not refer to the edge of words (but rather to roots) do not get much attention in the current literature, which is substantial. One point that needs to be emphasized is the distinction between the approach presented here and that commonly used in the structuralist tradition. In that tradition, if stress was not everywhere predictable from the edge of the word, then it was considered phonemic and therefore stress was assumed to be necessary in the phonemic representation of every word. Under this view, there is nothing to say about stress in a language like Seri (other than it is phonemic)—or even most languages, which is a serious mistake. The existence of exceptions thus was often allowed to override the postulation of a general stress rule within the structuralist tradition.

35.1 Try it for yourself with Dakota Sioux

Give a stress rule to account for the placement of stress in the words below.¹⁹⁶

- | | | | |
|------------------------|--|-----------------------------|----------------------|
| 1. t ^h ā'ni | <i>to be old</i> | 6. a'mani | <i>to walk on</i> |
| 2. kak'sa | <i>to separate by striking</i> | 7. ptus'ja | <i>bent over</i> |
| 3. mnis'kuja | <i>salt</i> | 8. t ^h ik'te | <i>I kill you</i> |
| 4. ma'jakte | <i>you kill me</i> | 9. wi't ^h ajakte | <i>you kill them</i> |
| 5. a'manisūk'ole | <i>walking about, he looked for horses</i> | | |

35.2 Try it for yourself with Isthmus Zapotec

Give a stress rule to account for the placement of stress in the words below.¹⁹⁷

- | | | | |
|--------------|------------------|-------------|------------------------|
| 1. ba'ndaga | <i>leaf</i> | 6. ri'bi | <i>sits</i> |
| 2. 'benda | <i>fish</i> | 7. za'bi | <i>will sit</i> |
| 3. 'geta | <i>tortilla</i> | 8. ri'zana | <i>gives birth</i> |
| 4. gudu'biza | <i>last year</i> | 9. za'zana | <i>will give birth</i> |
| 5. 'gi | <i>fire</i> | 10. gu'zana | <i>gave birth</i> |

Feedback for Chapter 35

35.1 Dakota

¹⁹⁶ Stress occurs on the second syllable of the word.

35.2 Isthmus Zapotec

¹⁹⁷ Stress falls on the penultimate (or only) syllable of the root.

CHAPTER 36 - INTRODUCTION TO PITCH

Since speakers of a language do not speak in a complete monotone, there are always variations in the fundamental frequency of the sounds they make. Changes in fundamental frequency are perceived as changes in pitch, which is often used for linguistic purposes. That is, it is not always irrelevant to the hearer. And since we observe that different people speak at different pitch levels (compare adults with children, for example), we know that it is not *absolute* pitch that is significant, but the *relative* pitch of one syllable compared with the syllables around it.

Tone

Pitch variations that can affect the lexical meaning of a word are called tones. A language that uses pitch for lexical distinctions is called a tone language. The majority of the world's languages fall into this category. Nupe is a tone language, as can be seen from the following words with High (H), Mid (M), and Low (L) tones.

(267)	bá	high tone (H)	<i>to be sour</i>
	bā	mid tone (M)	<i>to cut</i>
	bà	low tone (L)	<i>to count</i>

Pitch is being used here for a lexical purpose, to contrast the meanings of different words. The three separate levels of pitch are significant and must be included in the lexical representation of the word.

Intonation

Pitch differences are also used in language to mark off larger phonological and grammatical units than the word, such as phrases and clauses, and to distinguish between different types of such units. Here the variations in pitch do not affect the *lexical* meaning of utterances, but convey other types of information such as questioning, anger, affection, politeness, etc. This phenomenon is called **intonation**.

English uses a falling pitch (High to Low) sequence at the end of neutral declarative phrases:

(268)		H	L
		<i>John is from Los Angeles.</i>	

A rising pitch (Low to High) sequence often indicates a yes-no question.

(269)		L	H
		<i>Is John from Los Angeles?</i>	

If the final syllable is stressed, the entire rising pitch sequence is mapped onto that syllable, resulting in a gliding pitch sequence.

(270)		LH
		<i>Is he here?</i>

While we have discussed intonation data from non-tonal language (English) here, tonal languages also may display intonation, as we show in the following chapter.

Key Concepts

relative pitch

tone

intonation

36.1 Try it for yourself with Isthmus Zapotec

What conclusions do you draw from the following data regarding the role of pitch in this language?¹⁹⁸

- | | | |
|--|--------------------------|-------------------------------|
| 1.  | <i>hot</i> | (low pitch, high pitch) |
| 2.  | <i>bitter</i> | (low pitch, rising pitch) |
| 3.  | <i>cheek</i> | (low pitch on both syllables) |
| 4.  | <i>chachalaca (bird)</i> | (low pitch, rising pitch) |

36.2 Try it for yourself with Mende

What conclusions do you draw from the following data regarding the role of pitch?¹⁹⁹

- | | | |
|---------|-----------------|--------------------------------|
| 1. mbû | <i>owl</i> | (high falling pitch) |
| 2. mbǎ | <i>rice</i> | (low rising pitch) |
| 3. pélé | <i>house</i> | (high pitch on both syllables) |
| 4. bèlè | <i>trousers</i> | (low pitch on both syllables) |

36.3 Try it for yourself with English

Consider various ways in which you might change the intonation on a phrase such as *Good night!*. What does each intonation pattern indicate? How would you teach this to a non-native speaker?

Feedback for Chapter 36

36.1 Isthmus Zapotec

¹⁹⁸ This is a tonal language. Pitch is being used for lexical purposes. The words (or at least the roots) must include tonal information in their underlying forms.

36.1 Mende

¹⁹⁹ This is a tonal language. Pitch is being used for lexical purposes. The words must include tonal information in their underlying forms.

CHAPTER 37 - INTONATION

Intonation is like spice in food, adding incredible (and incredibly important) variety to the way words are used. Consider the following different ways in which the word *tamales* can be said (S = super high):

(271)	M H L tamales	Simple statement
	L H H tamales	Question
	L S L tamales	Surprise
	L L L tamales	Dislike
	L S M tamales	Surprise plus disbelief (horror?)

Maybe you don't agree with these representations exactly. Sometimes a major difference between dialects is as much intonation as it is slight differences in the pronunciations of the vowels and consonants. Regardless, some of these intonation patterns are very subtle and difficult to represent. Punctuation devices, such as commas, question marks, exclamation marks, underlining, and italicization, are only imprecise indications of some of the major intonation patterns in languages.

An important feature of intonation, as opposed to lexical tone, is the fact that it is distributed over an entire phrase, even though one may still talk about the different 'tones'. A good illustration of this is provided by the following set of examples,^a which start from monosyllables and end with polysyllabic phrases, using the same pair of intonation tones:

(272)	<i>Exclamation—falling tone</i>	<i>Surprise—falling-rising tone</i>
	<i>Tom!</i>	<i>Tom!?</i>
	<i>Tommy!</i>	<i>Tommy!?</i>
	<i>telephone number!</i>	<i>telephone number!?</i>

Studies of intonation very often refer to various parts of the domain of a particular tone, of which the most important is the **nucleus**. For example, in a simple reading of the following sentence, the word *tamales* is the nucleus and carries the falling tone.

(273) *We're going to eat tamales tonight.*

One study of certain dialects of English in the United Kingdom found that differences included the following: (a) where stressed syllables occur in relationship to the base-line pitch (higher or lower), (b) the inclination of the base line (flat or gradually dropping), and (c) the amount of pitch movement that occurs on stressed syllables.^b

All languages have intonation, even tone languages,^c although they use it in different ways and some reportedly tend to have simpler intonation systems.^d The use of intonation is an important part of what native speakers have learned about the language they speak, because within a language community, the uses

^a Kenneth L. Pike (1945) *The intonation of American English*, Ann Arbor, University of Michigan Press, p. 26.

^b Gillian Brown, Karen L. Currie and Joanne Kenworthy (1980) *Questions of intonation*, London: Croon Helm, pp. 19-20.

^c Peter Hawkins (1984) *Introducing phonology*, London; Hutchinson, p. 193. But this does not mean that they all use intonation in the same way.

^d Paul Tench (1996) *The intonation systems of English*, London, New York, Cassell, p. 6.

of intonation are shared. And correct intonation is one of the aspects of language that non-native speakers often fail to acquire for lack of attention.

One kind of change in pitch which might be mentioned here under intonation has been called **declination**.^e This is the gradual fall in pitch that occurs from the beginning of an utterance over some span of words. “In many tone languages this results in successive tones becoming phonetically lower and lower in pitch until, at the end of the phrase, the high tones could be phonetically as low or even lower than the low tones at the beginning of the phrase.”^f This pitch decrement “serves a useful linguistic purpose in signaling clause and sentence boundaries,”^g which seems to be one function of intonation generally in nontonal languages, of course.

Transcription

Many ways of transcribing intonation have been used, but apparently there is still little or no agreement on the best method even for English, much less for broad cross-linguistic use. Some systems are analogous to a phonetic transcription, and others are obviously ‘phonemic’ in that they require more information to actually pronounce them accurately, or require a use of capitalization that cannot be used for standard phonetic transcriptions. Some samples are given below:^h

Lines: ⁱ	<u>he's gone to the</u> of- <u>ffice</u>
Numbers: ^j	² he's gone to the ³ o ¹ ffice
	M H L
Letters: ^k	he's gone to the office
Contours: ^l	he's gone to the office (<i>not illustrated</i>)
Diacritics: ^m	he's gone to the \ <u>office</u> vs. he's gone to the / <u>office</u> ? he's gone to the ` <i>office</i> vs. he's gone to the ´ <i>office</i> ?

In all languages, intonation has a function, or a variety of functions. Ladefoged states that “all languages use pitch differences to mark the boundaries of syntactic units. In nearly all languages the completion of a grammatical unit such as a normal sentence is signaled by a falling pitch.”ⁿ

We will look at some common uses of intonation and contrast English intonation with that of other languages so that the importance of intonation contours may be appreciated.

^e It has also been called “downdrift”, although this term also is used to refer to something slightly more specific, discussed in a later chapter.

^f John J. Ohala (1978) The production of tone, *Tone: a linguistic survey*, ed. Victoria A. Fromkin, New York, San Francisco, London: Academic Press, p. 31.)

^g Ohala (1978), p. 32.

^h Hawkins (1984), pp. 195f.

ⁱ C. C. Fries (1940) *American English grammar*, New York, Appleton Century; Pike (1945).

^j Pike (1945); G. L. Trager and H. L. Smith (1951) An outline of English structure, *Studies in linguistics, Occasional Paper 3*, Norman, Oklahoma; María Beatriz Fontanella de Weinberg (1980) Three intonational systems of Argentinian Spanish, in Linda R. Waugh and C. H. van Schooneveld, eds., (1980) *The melody of language*, University Park Press, Baltimore, pp. 115-126.

^k Mark Liberman and Alan Prince (1977) Prosodic form and discourse function, *Linguistic Inquiry* 8:249-336.

^l Lilia E. Armstrong and Ida C. Ward (1931) *A handbook of English intonation*, Cambridge: W. Heffer & Sons. This graphical presentation of intonation is used in many works as part of the phonetic representation.

^m Tench (1996), using diagonals; Hawkins (1984), using accents. Other systems of diacritics may be found in W. R. Lee (1960) *An intonation reader*, London, Macmillan. The underlined word indicates the place where the intonational contour is realized.

ⁿ Peter Ladefoged (1982) *A course in phonetics*, New York, Harcourt Brace Jovanovich, p. 227.

Content Question

Simple questions which expect an answer other than ‘yes’ or ‘no’ have a couple of common intonation patterns in English: *Where did she* ↘ *go?* (falling) and *Where did she* ↘ ↗ *go?* (falling-rising). In fact, cross linguistically, both patterns are commonly found.[†]

In Seri, such content questions have a falling intonation pattern which appears on the question word, the rest of the clause being rather flat

- (276) H L
Quihya cöitáasitim? Who fooled him/her?
 who s/he.fooled.him/her

Focus of information

In English we can use variations on the intonation pattern to draw attention to a particular element of an utterance. A sentence like the following can be uttered without emphasis on a particular word. The intonation will be that of a simple declarative.

- (277) Maybe on Sunday we should eat fish and chips somewhere.

But numerous variations on this sentence would be appropriate in different contexts, as you can verify by pronouncing it with a falling intonation on the underlined words.

- (278) a. Maybe on Sunday we should eat fish and chips somewhere.
 b. Maybe on Sunday we should eat fish and chips somewhere.
 c. Maybe on Sunday we should eat fish and chips somewhere.
 d. Maybe on Sunday we should eat fish and chips somewhere.
 d. Maybe on Sunday we should eat fish and chips somewhere.
 e. Maybe on Sunday we should eat fish and chips somewhere.
 f. Maybe on Sunday we should eat fish and chips somewhere.

In other languages, this use of intonation may or may not be possible. I don’t believe that such a simple use of intonation is possible in Seri.[§] In that language, focused elements are moved to a special place in the sentence and there marked with a special morpheme and intonation. The construction in Seri is somewhat more like the (awkward) English *It is fish and chips that maybe on Sunday we should eat somewhere*.

Other

In addition to the lexical tone found in Vietnamese, Thompson states that the final syllables of the utterances carry the most intonation information. If the tones of the final syllables begin and end at a lower than normal pitch, this indicates certainty. If the tones of the final syllables begin and end at a higher than normal pitch, this indicates uncertainty.[‡]

Intonation figures into English in fascinating ways that we have not discussed, as the examples at the beginning of this chapter partially show. There is much more to describe here.[§] Tensch 1996 lists six major functions of intonation:

[†] Cruttendon (1986), p. 165, citing finding presented in R. Ulta (1978) Some general characteristics of interrogative systems, in J. P. Greenberg, C.A. Ferguson and E. A. Moravcsik (eds.), *Universals of human language*, Vol. 4: *Syntax*, Stanford, Stanford University Press.

[§] According to Tensch (1996:10), Hausa also does not have the option of emphasizing particular elements by intonation, and Cruttenden (1986:149) claims that French and Portuguese also do not.

[‡] Laurence Thompson (1965) *A Vietnamese grammar*, Seattle: University of Washington.

[§] The various analyses of English intonation testify to its complexity. For example, see Hawkins (1984), chapter 7 (a succinct presentation); M. A. K. Halliday (1967) *Intonation and grammar in British English*, Mouton, The Hague, Paris; and Elizabeth Couper-Kuhlen (1986) *An introduction to English prosody*, Edward Arnold, Baltimore, London; Pike (1945); Tensch (1996).

- (1) the organization of information—the grouping of thoughts, indication of new information vs. given information;
- (2) the realization of communicative functions—command, statement, question, persuade, request, etc., plus indications of deference and authority;
- (3) the expression of attitude, which is an extremely important but very under-described aspect of language; how does one show politeness or anger in language X?;
- (4) syntactic structure—for example, the difference between *She washed and brushed her hair* (where the intonation makes it clear that she washed her hair), and *She washed, and brushed her hair* (where the intonation suggests that she washed up (hands, faced, whatever) and also brushed her hair);
- (5) textual structure—the way in which larger units such as paragraphs are indicated phonologically;
- (6) the identification of speech styles—distinguishing kinds of language events, such as conversation, prayer, formal reading, etc.

It is also probably true that these different patterns are some of the most difficult things about a language for a person to use correctly when speaking another language. Except in rare cases, they are hardly ever taught, despite their great importance. This is a matter for language learners to be well aware of.

37.1 Try it for yourself on your language

Take five simple sentences in your language and transcribe alternative intonation patterns that may occur with them. Practice reading your transcriptions back to yourself. Then ask a classmate to read them. Experiment with ways to present this transcription using symbols that are commonly available.

37.2 An exercise in transcription²⁰⁰

Use one of the methods for transcribing intonation to correctly distinguish the following utterances. (Some methods have been incompletely represented, so you may have to improvise.)

I've already paid Mary. (neutral)

I've already paid, Mary. (direct address)

I've already paid Mary. (emphasis)

I've already paid Mary? (question)

I've already paid Mary, ... (beginning of list)

Have another student read your transcriptions and see that he or she can accurately reproduce the sentence.

37.3 Look at contrasting patterns²⁰¹

Examine the following utterances and explain what "tones" are necessary to represent the intonation patterns. Discuss the way in which these interact with stress of the nucleus. (3 = High)

Pattern 1

²Good ³¹dáy.

²Good ³mór-¹ning.

²Good ²af-²ter-³¹nóon.

²Hap-²py ³hó-¹li-¹days.

Pattern 2

²Good ¹³dáy.

²Good ¹mór-³ning.

²Good ²af-²ter-¹³nóon.

²Hap-²py ¹hó-³li-³days.

Key Concepts

intonation patterns

nucleus

declination

Feedback for Chapter 37**37.2 An exercise in transcription**

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1. I've already paid ` Mary. (neutral)
2. I've already ` paid, ˇ Mary. (direct address)
3. I've already paid ↑ ` Mary. (emphasis)
4. I've already paid ˇ Mary, ... (beginning of list)

37.3 A look at contrasting patterns

²⁰¹ One pattern has falling intonation and one has rising. The tone begins on the stressed syllable of the nucleus. If the nucleus has only one syllable, that syllable carries the entire tone; this is also true if the nucleus does not have any unstressed syllables after the stressed syllable (*afternoon*). Otherwise, the tone is distributed over the nucleus, with the first two syllables carrying the change in pitch.

CHAPTER 38 - TONE

In chapter 36 we saw data from Nupe which showed that the pitch was relevant to the lexical meaning, just like segmental information. This is the defining situation for a tone language.

Grammatical uses of tone

Many tone languages also use tone to make changes in *grammatical* meaning. That is, a morpheme may consist solely of a tone (underlyingly—since superficially the tone will be pronounced with some segment, of course). The following data from Atlatlahuca Mixtec illustrate this, showing that Present tense is consistently a High tone on the first syllable.

(279)	Future	Present	
	ndùkú	ndúkú	<i>look for</i>
	kùnù	kúnù	<i>weave</i>
	kīβī	kíβī	<i>enter</i>

Glides

Many tone languages are best analyzed as having simple tones underlyingly even though glides may sometimes occur phonetically. For example, a High tone in some language might really be in many cases a phonetically rising tone. The claim is that the phonetic changes in the tone have no phonological role, and are best analyzed simply as phonetic correlates of the tone and not as distinctive features.

In Chiquihuitlán Mazatec there is contrast between four tones.

(280)	tʃha	(High)	<i>I talk</i>
	tʃha	(Higher Mid)	<i>difficult</i>
	tʃha	(Lower Mid)	<i>his hand</i>
	tʃha	(Low)	<i>he talks</i>

Low tone is phonetically a low falling tone when it is the only tone on an utterance-final syllable. Therefore, the tone on the word for *he talks* is actually a glide (Low to extra Low) when the word is spoken in a list, for example.

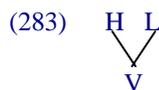
Other apparent glides in some tone languages are due to adjacent tone-bearing units with different level tones. For example, in Ocoatepec Mixtec a Mid-Low glide occurs when two vowels occur next to each other, the first having a Mid tone, the second having a Low tone.

(281)	ML	ML	compare:	ML	ML
	[sa:]	<i>bird</i>	/saa/	[βiko]	<i>cloud</i> /wiko/

It is not necessary that the vowel be long in order for there to be more than one tone associated with it. The following data are also from Ocoatepec Mixtec. The Continuative morphemes can be analyzed as a prefix consisting solely of a High tone that must subsequently be associated with the verb stem. This association results in a glide when the following tone is a Low tone.

(282)	Continuative + Stem		
	H	L M	H L M
	kaku	→	kaku <i>escape</i>
	H	L H	H L H
	tiwi	→	tiwi <i>become inoperative</i>

Some languages allow more than one tone to be linked to a single tone-bearing unit in underlying form. For example, a (high) Falling tone might be analyzed (somewhat informally) as follows.^a



Such tones are referred to as **contour tones**. Chinese is a language that has contour tones.

(284)	\overline{ma}	high	<i>mother</i>
	ma	rising	<i>hemp</i>
	ma	falling	<i>scold</i>
	ma	falling-rising	<i>horse</i>

Restricted on the distribution of tones

While in some tone languages the tones are assigned to each syllable on a relatively free basis, in other languages severe restrictions are found.

In a few languages, tone patterns are assigned to morphemes or words as a whole, rather than to individual syllables. For example, a word might have the pattern HL realized on one syllable as a HL glide, on two syllables as H-L, on three syllables as H-L-L, on four syllables as H-L-L-L, etc.^b

Other tone languages limit the number and position of tones within a word or morpheme. These have sometimes been called **pitch-accent languages**. Pitch-accent languages are like the tone languages discussed above in that tone may be contrastive. At the same time they are like stress languages. One syllable per word is marked as prominent and a tone is linked to it first (it is *accented*). The pitch on the remaining syllables is then predictable from this *accent*.

Japanese is an example of a pitch-accent language. At first, it may look like a simple tonal language, since it has words such as *hi* ‘fire’ (with high pitch), and *hi* ‘day’ (with low pitch). These facts have not been analyzed as true tone since the system is so restricted.

Japanese is analyzed as having an accent: a word may have one accent or none at all. On one syllable words, therefore, there are two patterns (accented or not accented). On two syllable words there are three patterns: neither syllable accented, first syllable accented, or second syllable accented. On three syllable words, there are four patterns: first, second, third, or no syllable accented. The accented syllable must be indicated as being such in underlying form since where it goes is not predictable.

The syllables are spoken at high pitch until an accented syllable is reached, which is also pronounced at high pitch; and then the pitch drops. One extra fact: in Tokyo Japanese (shown below) the first syllable of a word is pronounced at a lower pitch if it is not accented. Note the following patterns (the accented syllables is indicated with an acute accent):

(285)	<i>kábuto</i>	‘helmet’	HLL
	<i>kokóro</i>	‘heart’	LHL
	<i>otokó</i>	‘man’	LHH (next syllable is Low)
	<i>katati</i>	‘form’	LHH (next syllable is High)

Key Concepts

tone languages
pitch accent

tone for grammatical meaning

contour tones

^a The formal analysis of contour tones has been controversial for a long time. Are contour tones unanalyzable (e.g., Rising), or are they a sequential ordered sequence of special tone combinations (e.g. Low-High), and best analyzed as affricates?

^b See William R. Leben (1973) *Suprasegmental phonology*, Ph.D. Dissertation, MIT; William R. Leben (1978) The representation of tone, *Tone: a linguistic survey*, ed. Victoria A. Fromkin, New York, London: Academic Press; and Larry M. Hyman (1987) Prosodic domains in Kikuyu, *Natural Language and Linguistic Theory* 5:311-33.

CHAPTER 39 - TONE RULES

Tones undergo processes similar to those seen in earlier chapters for segments. They assimilate to neighboring tones (tone features spread), they dissimilate, and they undergo changes at the edges of domains (especially at the end of an utterance).

Tones are not simply features of the vowels. They are now well established as independent entities—autosegments—that are associated with vowels or syllables. (Some other properties of speech, perhaps many, have this characteristic, but tones are the most famous autosegments.)

In perhaps the simplest of all situations, tones and the units which bear them—TBU's, tone-bearing units—line up one-to-one. A two syllable word would have two tones, a three syllable word would have three tones, etc., and the tones and TBU's would match up. The surface forms of some words in a language like this would be:



The underlying form of these morphemes would not need to tell which tone went where. The information {pata, HL} would be sufficient, and by convention the tones would associate with the correct syllable.

In other situations, and very commonly, the tones and TBU's do *not* line up one-to-one. The number of tones may be less than the number of TBU's; so something has to happen. Quite commonly, the nearest tone spreads to the TBU that lacks a tone. This is shown by the dotted line below.



This might be especially obvious if an affix is underlyingly toneless and always receives its tone from the morpheme adjacent to it.

If the number of tones is greater than the number of TBU's, something also has to happen. Quite commonly, the extra tone links with the nearest TBU.



In both of the preceding examples, the results shown are obtained only if the convention for associating tones begins the linking from the left side. This is the most common (but not universal) situation. Otherwise the following results would have been obtained.



But two other possibilities exist when the number of tones does not match the number of TBU's. If there is an extra TBU, a tone could be inserted, say the default tone for the language. If there is an extra tone, it might be deleted.

It is also possible that a particular lexical item has the tones or one of the tones pre-linked in the lexicon. For example, a morpheme might have the tone pattern HL, have three TBU's, but have the L pre-linked to the last TBU.



This kind of pre-linking circumvents the most general application of the association convention. And as a result, the first two syllables in the preceding example would end up with high tone.

Contour Tones

Many proposals have been made in order to account for contour tones. Yip proposes the following for Cantonese, using her features of Register and Pitch.^a

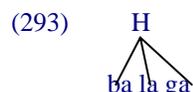
(291)				Register	Pitch
	55	si	<i>poem</i>	H	h
	33	si	<i>try</i>	H	l
	53	si	<i>silk</i>	H	hl
	35	si	<i>cause</i>	H	lh
	22	si	<i>affair</i>	L	h
	(unattested)	—		L	l
	21	si	<i>time</i>	L	hl
	24	si	<i>city</i>	L	lh

Edge Phenomena

Kukuya has been analyzed as having two tones: High and Low. Nevertheless, when a High tone occurs at the end of an utterance, it is lowered slightly, to Mid. Therefore, a word such as *mùsá* is pronounced with the tone pattern Low-High usually, but with the tone pattern Low-Mid before pause. Therefore, we have the following rule:

$$(292) \quad H \rightarrow M / ___]_{\phi}$$

The stem *bálágá* ‘fence’ is pronounced with High tone, except before pause where it is pronounced with Mid tone. The analysis given for this proposes, typical of many current tone analyses, that syllables with similar pitch share the same tone.^b If the word *bálágá* is represented as



then the rule lowering High to Mid before pause will give the correct result, as shown below.



Assimilation (Spreading)

Tones also assimilate to neighboring tones. In Peñoles Mixtec, the following tone patterns occur on common native two syllable words:^c

$$(295) \quad H H \quad H L \quad M M \quad L L$$

This might look like clear evidence for three tones. But if there are three tones in this language, then one should have found more possible combinations of tones on two syllable words, unless there are some very bizarre restrictions. As there is not good evidence for contrast between three tones, we might attempt to analyze these data with only High and Low. One might take the M M pattern as the phonetic realization of the tone sequence L H. If this is the case, a High is somewhat lower after a Low, and a Low is somewhat higher before a Low—simple cases of assimilation.

In Gwari a Low spreads to a following High, creating a contour tone phonetically.

^a Moira Yip (1995) Tone in East Asian languages. In John A. Goldsmith, ed. *Phonological Theory*, Cambridge, Mass., Oxford: Basil Blackwell, pp. 476-494.

^b Larry Hyman (1975) *Phonology: theory and analysis*, New York, Holt, Rinehart and Winston.

^c Some words are pronounced somewhat differently in utterance-final position (see chapter 26).

The problem is the last pattern. If there are two tones and two syllables, we should have four possible patterns, not five. And the fact that we have H M but not M H is also puzzling. This fact, together with the fact that we also do *not* have a contrast between M and H after L, suggests that we should *not* propose three tones for this situation. So what to do?

The proposal that has been adopted by numerous analysts is that the H M is actually a special kind of downdrift where the syllable which contained the triggering low tone has been lost, but the downdrift effect caused by the low tone has been retained. So the H M is analyzed as H LH, and usually written H !H (high downstepped-high).

Sometimes there is evidence that the word has a low tone underlyingly in that position. But sometimes there is not, in which case “downstepped high” is in essence a kind of third tone, but one which is predictably restricted in its distribution and which does not contrast with a following high.^e That is, once the High pitch has been re-set to a lower level by downstep, High pitch is now phonetically lower for that utterance.

Tone Features

Our discussion of tone so far has been quite informal, referring to units such as H (high), L (low), and M (mid). This is much like referring to the consonants *p* and *k* in segmental phonology and never getting around to thinking of these sounds in terms of their composite features (a serious mistake). There have been numerous attempts at characterizing tones with features, although we do not discuss these here.

Key Concepts

tone changes at edge of domains
downdrift

tone assimilation
downstep

tone features

39.1 Try it for yourself with Mende (I)

According to the source of these data (Leben 1978:186), “the majority of Mende monomorphemic words have the tone patterns H, L, HL, LH, and LHL ...”.

Draw association lines to link tones and vowels in the following examples in order to obtain the correct results. (The consonant and vowels symbols are not phonetic.)²⁰²

HL

1. mbu mbû *owl* (Falling)

H

2. hawama háwámá *waistline*

LHL

3. mba mbâ *companion* (Rising-Falling)

LH

4. ndavula ndàvúlá *sling*

^e For more discussion, see Hyman (1975), pp. 226ff; and Stephen R. Anderson (1978) Tone features, in Victoria R. Fromkin, *Tone: a linguistic survey*, New York, etc.: Academic Press, pp. 141ff.

Answer the following typological questions based on what you have just learned about Mende tone:²⁰³

- The number of tones (may)(may not) exceed the number of TBU's in a word.
- The number of TBU's (may)(may not) exceed the number of tones in a word.
- Tone association begins on the (left)(right).

39.2 Try it for yourself with Mende (II)

Propose an analysis that uses the facts from the preceding exercise to account for the facts below. What do you propose for the underlying tone of the morpheme -hu? Explain why.²⁰⁴

in ...

1.	kó	kóhú	<i>war</i>
2.	mbû	mbúhù	<i>owl</i>
3.	mbǎ	mbàhú	<i>rice</i>
4.	pélé	péléhú	<i>house</i>
5.	bèlè	bèlèhù	<i>trousers</i>
6.	ngílà	ngílàhù	<i>dog</i>
7.	njàhâ	njàháhù	<i>woman</i>

39.3 Try it for yourself with Mende (III)

Propose an analysis of these facts.²⁰⁵

_____ *business* (compound)

1.	kó	kóhíndà	<i>war</i>
2.	mbû	mbúhíndà	<i>owl</i>
3.	mbǎ	mbàhíndà	<i>rice</i>
4.	pélé	péléhíndà	<i>house</i>
5.	bèlè	bèlèhíndà	<i>trousers</i>
6.	ngílà	ngílàhíndà	<i>dog</i>
7.	njàhâ	njàháhíndà	<i>woman</i>

39.4 Try it for yourself with Mende (IV)

Assume that the following rule applies: A final High tone of the verb stem is dropped when the verb is conjugated in the Past Negative. Show how you would account for each form in the second column, remembering the way tones work in this language, as shown by the previous exercises. You may need to make one new proposal, but maybe not. More than one analysis is possible.²⁰⁶

		Past Negative	
1.	gòndò	gòndòní	<i>starve</i>
2.	njàmú	njàmùní	<i>become bad, ugly</i>
3.	mèlí	mèlíní	<i>graze</i>
4.	gbáwò	gbáwòní	<i>howl</i>
5.	hìtê	hìténí	<i>come down</i>

39.5 Try it for yourself with Ewe

If Ewe has only three tones (H, M, L), how might you account for the facts below? What are the underling tones of each morpheme?²⁰⁷

- | | | |
|----|--------|---|
| 1. | ètó mè | <i>in a mountain</i> (mountain in) (Low-High Low) |
| 2. | ètò mè | <i>in a buffalo</i> (buffalo in) (Low-Low Low) |
| 3. | ētō mē | <i>in a mortar</i> (mortar in) (Mid-Mid Falling) |

39.6 Try it for yourself with Marinahua

These data have been transcribed using the tradition of using high numbers for high tones; therefore 5 = highest, 1 = lowest. They are a close interpretation of the facts as originally presented.

A. Determine the number of tones needed to account for the following data. First do an analysis which simply assumes this is a tonal language. (At that point, you may want to check your answer before proceeding.) Be sure to give an analysis of the first word (which has a phonetically long vowel and a falling tone).

Procedural hint: Always start with the idea that tone is not contrastive at all. Will that work for one-syllable words? Two syllable words? Three syllable words? Then go with the idea that two tones will suffice. Will that work? If not, then try three contrastive tones, etc.

Write up this analysis informally, showing how the tones that you posit account for the phonetic facts.²⁰⁸

B. Then propose a pitch-accent analysis. What facts are better handled under one analysis or the other? There are no simple words with the tone patterns $ta^{21}ta^3$, $ta^{21}ta^3ta^3$, and $ta^{21}ta^2ta^3$. How does your analysis account for these gaps? Hint: your pitch accent analysis should appear quite different from your tone analysis.²⁰⁹

- | | | | |
|---|------------------------|--|---------------------------------|
| 1. na ⁵¹ | <i>dead</i> | 13. fa ³ i ³ | <i>path</i> |
| 2. i ² mi ¹ | <i>blood</i> | 14. fa ⁵ i ¹ | <i>rise in a river</i> |
| 3. o ² no ¹ | <i>over there</i> | 15. fa ² i ¹ | <i>cornfield</i> |
| 4. tsi ² spa ¹ | <i>back of a canoe</i> | 16. ma ³ sta ³ ti ³ | <i>hammer</i> |
| 5. i ⁵ ʃmi ¹ | <i>buzzard</i> | 17. ta ² ka ¹ ra ¹ | <i>chicken</i> |
| 6. ko ³ ʃa ³ | <i>to hit</i> | 18. sa ⁵ ra ² pi ¹ | <i>paddle</i> |
| 7. wa ⁵¹ | <i>to place</i> | 19. pa ² pi ⁴ o ¹ | <i>paper</i> |
| 8. ma ³ po ³ | <i>head</i> | | (uncommon tone pattern on three |
| 9. ta ⁵ po ¹ | <i>root</i> | | syllable words; perhaps only on |
| 10. tʃi ³ | <i>fire</i> | | loanwords) |
| 11. ka ⁵ fi ² ti ¹ | <i>arrow</i> | 20. po ³ ta ⁴ o ¹ | <i>threw out</i> |
| 12. tso ² | <i>chigger</i> | | (uncommon tone pattern on three |
| | | | syllable words) |

It may or may not be relevant, but apparently words with (contrastively) long vowels and no contour tone, such as ta^{33} , do not exist.

Phonetic note: “Each phonological word is a rhythm unit with a nuclear syllable which is longer than other syllables of that word.” (Pike and Scott 1975, p. 197)

Feedback for Chapter 39

39.1 Mende I

²⁰² In 1, HL both attach to the only syllable. In 2, H attaches to all three syllables. In 3, LHL all attach to the one syllable. In 4, L attaches to the first syllable, and H attaches to the second and third.

- ²⁰³
- The number of tones may exceed the number of TBU's in a word.
 - The number of TBU's may exceed the number of tones in a word.
 - Tone association begins on the left. [This is shown by example 4. Low is linked to the first syllable, High to the second, and then High is linked to the remaining syllable in the word.]

39.2 Mende II

²⁰⁴ It should be analyzed as being toneless underlyingly. It is attached to the root, and the tone melody of the root provides the tone. Where a HL melody (as in 2) appears on one syllable in the first column, the same melody is distributed to two syllables in the suffixed word in the second column.

39.3 Mende III

²⁰⁵ The morpheme for *business* has a low tone that is linked only to the second syllable. The first syllable of this morpheme receives its tone from the tone melody of the other root.

39.4 Mende IV

²⁰⁶ First solution: the suffix -ni has underlying low tone. In 1, L (root melody)+L (suffix tone) accounts for the low tones in the word. In 2, the dropping of the final high tone of the root removes all tones from the root melody and leaves simply L (from the suffix). In 3, the dropping of the final high tone of the root leaves a tone melody of simply L, and the correct results are obtained. In 4, the underlying tones HL+L link in straightforwardly (left to right). In 5, the tones LHL+L link left to right. Presumably the extra L tone is deleted; there are only three tone bearing units in the past negative of *come down*.

Second solution: the suffix -ni has no underlying tone. We would posit a default low tone that is inserted in the absence of any other tone. In 1, with a L melody, L spreads to all syllables. In 2, with a H melody, the H is dropped in the negative, and default L is inserted and spreads to all syllables. In 3, with a LH melody, the H is dropped in the negative, and L spreads to all syllables. In 4, with a HL melody, the L spreads to the third syllable. In 5, with a LHL melody, the melody is linked to the three syllables as usual.

39.5 Ewe

²⁰⁷ One might posit that *mortar* has a (floating) High tone in its underlying form. *Mountain* is LH, *buffalo* is LL (or simply L), and *mortar* is MMH (or simply MH, perhaps, depending on how things work), with High tone marked as being unattached or unattachable (floating) with respect to the root. It attaches to the next available tone bearing unit.

39.6 Marinhua

²⁰⁸ Two tones are sufficient to account for the data. There are only two patterns on one-syllable words, only three patterns on two-syllable words (two tones would give four possible patterns), and only five patterns on three-syllable words. High tone has the following variants: 5 on first syllable when before Low, 4 elsewhere when before Low, 3 otherwise. Low tone is 1 following a L, 1 word-finally (actually, phrase-

finally) following another tone, and 2 elsewhere (i.e., following H and word-medially and when the only tone). (Actually, it is not word-final, but phrase-final. All of the phonetics facts are not shown here.) Some sample words: [nɑ̃⁵¹] *dead*

/náù/ (HL), [i²¹mi¹] *blood* /ìmi/ (LL).

Setting aside the rare words, one might even propose that there are only three melodies possible in Marinahua: H, L, and HL, with left-to-right linking of tones.

Neither proposal so far accounts for the lack of simple tones on “long” vowels. One might suggest that words such as *dead* are phonologically /nɑ/ (HL) and that the length is entirely the result of the linking of two tones to a monosyllabic word.

²⁰⁹ *Pitch Accent Analysis:* A pitch accent analysis appears to be possible. One might propose that there is one or no accented syllable per word and that pitch is high until the accented syllable, and then low after that; pitch is low if there is no accent on the word.

Under this analysis, the following facts are accounted for:

One syllable:

L No accent.

H Accent.

Two syllables:

LL No accent on either syllable.

HL Accent on the first syllable.

HH Accent on the second syllable.

*LH Not a possible pattern since there is no other logical possibility.

Three syllables:

LLL No accent on any syllable.

HLL Accent on the first syllable.

HHL Accent on the second syllable. (For some reason, not common; see ex. 20)

HHH Accent on the last syllable.

*LHH, *LLH Not possible patterns since there is no other logical possibility.

However, LHL should also not be possible, but it does occur rarely, perhaps only in loanwords; see ex. 19. Loanwords may or may not fit it in with native accentual patterns.

This analysis does not account for the apparent lack of long vowels with a simple tone.

REVIEW QUESTIONS FOR SECTION 5

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Review Questions

The following questions are to help you review the material in the preceding section.²¹⁰

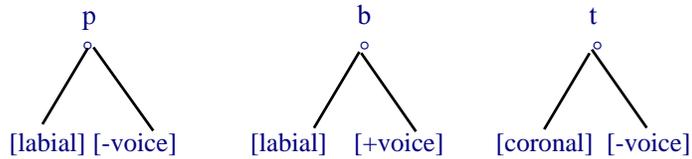
- (1) (T or F) Stress is the technical name for the relative degree of loudness of a syllable.
- (2) The two boundaries to which stress is most commonly sensitive cross-linguistically are root and _____.
- (3) A heavy syllable is one which has extra weight in the (a) onset (b) rhyme.
- (4) (T or F) If a language has two words such as *badág* and *bádag*, stress is not predictable and must be included in the underlying representation of all words.
- (5) The linguistic use of pitch to distinguish lexical items is known as _____.
- (6) The linguistic use of pitch to show doubt, questions, politeness, etc. is known as _____.
- (7) (T or F) The tones of a word and the number of vowels or syllables in the word always match up one-to-one.

²¹⁰ Feedback for Review Questions

1. False (Stress is more than amplitude.) 2. word 3. rhyme
4. False (Stress might be irregular on only one of those words and generally predictable in most cases.)
5. tone 6. intonation 7. False

APPENDIX A - FEATURES

Sounds are composed of features, as shown below (in an abbreviated fashion).



Features have six important uses. First, they distinguish between sounds that occur in underlying representations or in lexical representations—the phonemes. Traditionally this has been called their classificatory function. The phonemes of a language must differ in at least one feature. For example, /p/ and /b/ are two phonemes of English and are distinguished by the feature [voice]. When the term “feature” is used in this way, it is typically modified by the word “distinctive”, so we speak of the **distinctive features** of a language.

Second, features are used to describe the phonetic sounds of a language. In some dialects of Spanish there are two ways to pronounce the phoneme /s/, depending on the context: [s], as in *pi[s]ta* and [z], as in *de[z]de*. These two pronunciations are characterized by a difference in the value for the feature [voice]. We also need features to describe the phonetic difference between the *t* of Spanish and the *t* of English, since they are not the same phonetically. This use of features complicates the selection of the features that we want to include in the universal set. The result is that there is still some disagreement among linguists with respect to features. Feature theory is still grappling with these and other issues. In fact, anything we say here is outdated already.

Third, features are used to define natural classes of sounds. Many times a group of sounds is found in a specific context or undergoes a common change or is related to a certain phonological process. For example, the three stops /p/, /t/, and /k/ of English have aspirated variants in certain contexts. With very few features we can isolate these stops from the rest of the consonants of English in order to indicate which are the consonants that participate in this phonological process. We return to the topic of natural classes below.

Fourth, features are used to describe phonological processes. The fact that in a given language a vowel is nasalized before a nasal consonant must be captured formally in an adequate way.

Fifth, (distinctive) features have been used to attempt to explain why certain sounds exist and others do not.

Sixth, features have been used as part of a simplicity metric; that is, they have been used to formally measure the simplicity of a phonological rule. A natural process (one that is commonly found in languages) should be storable with fewer features than a process which is unnatural.^a Although earlier versions of generative phonology had difficulty in making the evaluation metric work well, good progress in this area has been made with the use of feature geometry (discussed below).

The choice of features is difficult because one must choose the features that serve the best for all of the uses mentioned above. For this reason there is also considerable disagreement among linguists with respect to this matter.

The distinctive features in their classificatory function are used only with two specified values: plus (+) and minus (-), or in a “privative” way (the feature is either present or it is not present). The use of binary values has its basis in various observations. For example, many languages have oral vowels but no nasalized vowels. Other languages have oral vowels and nasalized vowels. But there is no language, to our knowledge, that has oral vowels, nasalized vowels, and semi-nasalized vowels as phonemes.^b If the

^a For early arguments along these lines, see Morris Halle (1962) *Phonology in generative grammar*, *Word* 18:54-72.

^b The one example that has been brought forward is from Palantla Chinantec, discussed in Ladefoged and Maddieson (1996, pp. 299-300) where it is shown that an adequate analysis can be given that does not require a trinary distinction in nasality.

distinctive features in their classificatory function can have only two values, this fact is explained. In other cases, such as with vowel height, the binary nature of the features predicts that some vowel systems are more common and natural than others. (In some current work on features, some features have only one value, but the feature may be absent altogether. The feature is called a *privative* feature. If the feature may be plus or minus, it is called *equipollent*.)

In their function of describing the phonetic reality, the features can have scalar values, although this system has not been proposed in any detail. For example, the first *s* in *asbestos* can be pronounced with varying degrees of voicing, depending on style, speed, dialect, etc. It is not sufficient to describe with only [+voice] or [-voice]. If we use a scale from 0 to 1 for voicing at the phonetic level, then we can give a more precise description of these facts. The *s* can be [.1 voice] (with little voicing), [.6 voice] (with more voicing), or perhaps [.9 voice] (with significant voicing). At the phonetic level one must also indicate various grades of nasalization in vowels.

After the first set of universal distinctive features was proposed, several other sets have been suggested. Some have been acoustically based,^c and others articulatorily based, which we generally follow here.^d

Although there is still some disagreement over the set of universal features and in the definition of these features, we present below the features that are among the currently most used and needed.

Major Class Feature

The feature [sonorant] is of primary importance because it divides sounds into two major classes which are referred to repeatedly: the class of sonorants and the class of obstruents.^e

sonorant [son] **Sonorants** are the sounds that are produced in such a way that there is resonance in the oral cavity. The sounds which are not sonorants are called **obstruents**.

The sonorants include the vowels, semivowels, liquids, and nasals.^f Oral stops, fricatives, and affricates are obstruents.

Manner Features

With the following manner features we can define other important classes of sounds.

consonantal [cons] Consonantal sounds are produced with at least moderate constriction of the supralaryngeal vocal tract (i.e., that portion of the vocal tract that is above the larynx). The only nonconsonantal sounds are the vowels, the glides (such as [j]), [h], and glottal stop [ʔ].

^c See Roman Jakobson, Gunnar Fant and Morris Halle (1952) *Preliminaries to speech analysis*, Cambridge, Mass., MIT Press.

^d Noam Chomsky and Morris Halle (1968) *The sound pattern of English*, New York, Harper & Row.

^e The feature [syllabic] has been used in the past as a major class feature to distinguish between syllabic and nonsyllabic sounds, [i] and [j], for example. This feature refers to the prominence of a sound in the syllable. There are cases in which a consonant can be [+syllabic] phonetically (e.g. the /m/ in prism). This feature has been dispensed with in the version of phonological theory that we are adopting here by enriching the representation of words with syllable structure, CV skeleta, etc.

^f In some languages the laryngeals seem to group with these sounds, and for that reason are considered sonorants by some linguists.

continuant [cont] A sound is [+continuant] if there is not complete blockage of the air stream at the primary constriction in the vocal tract. Fricatives, semivowels (glides), and vowels are [+continuant], whereas stops (oral or nasal) and affricates are [–continuant]. Liquids are not a homogeneous class with respect to this feature. It has been claimed that vibrants (flaps, taps, and trills) are continuants, while [l] is not, and evidence from various languages seems to support this.^g One piece of evidence comes from Spanish: after nasals and [l], the voiced coronal obstruent is a stop (examples: *don*[d]*e*, *bal*[d]*e*), whereas following vowels, fricatives, and flap *r*, they are fricatives (examples: *lo*[ð]*o*, *des*[ð]*e*, *bar*[ð]*a*). If we assume that the feature [+continuant] is spreading, the flap *r* is [+continuant], but *l* is not. Another piece of evidence comes from English. Consider the word *attitude*, where the first *t* is a flap in American English. The *t* in *particle* is also flapped, but the *t* in *altitude* is not. The *r* is [+continuant] like the vowel and provides the context for flapping, but the *l* does not.

nasal [nas] If air leaves through the nasal cavity, the sound is classified as [+nasal]. Nasal sonorant consonants and nasalized vowels are [+nasal].

voice [voi] The feature [voice] is used to indicate the presence or absence of vibration of the vocal cords.^h

^g Chomsky and Halle (1968) *The sound pattern of English*.

^h There are other features used to describe less common sounds. We do not go into these details here.

Other laryngeal features besides [voice] are also used to describe phonologically significant modifications (see Stephen Anderson [1975] *The organization of phonology*, New York, Academic Press, p. 301 and Noam Chomsky and Morris Halle [1968] *The sound pattern of language*, New York, Harper and Row, p. 321): [spread glottis] (the glottis is open, permitting the air to escape but inhibiting the vibration of the vocal cords), [constricted glottis] (the arytenoid cartilages are kept tense so that the vocal cords can vibrate only at one end), and [heightened subglottal pressure]. These features can be used as follows:

	[spread glottis]	[constricted glottis]	[voice]	[heightened subglottal pressure]
voiced sound	–	–	+	–
voiceless obstruent	+	–	–	–
voiceless vowels	+	–	–	–
h	+	–	–	+
aspirated consonant	+	–	–	+
glottal stop	–	+	–	–
breathy voiced vowels	+	–	+	–
murmured consonant	+	–	+	–
glottalized consonant	–	+	–	+
laryngealized (creaky) sound	–	+	+	–
implosive consonant	–	+	+/–	–

The clicks, which are produced with ingressive velar air, are classified as [+velar suction] by Stephen Anderson (1975) *The organization of phonology*. The feature [glottal suction] has also been proposed to distinguish between the glottalized consonants and the implosive consonants.

Place of Articulation for Consonants

Major Place Features

In current feature theory, three place feature nodes (as opposed to terminal features) are posited to account for the major points of articulation of consonants: labial, coronal, and dorsal.

Labial The sounds which are produced using the lower lip have a labial feature node in their feature composition. This includes bilabials, labiodentals, and rounded consonants.

Coronal The sounds which are produced using the front (or crown) of the tongue have a coronal feature node. Such sounds include interdental, dental, alveolar, and alveopalatal consonants.

Dorsal The consonants which are produced by activating the body (dorsum) of the tongue have a dorsal feature node. They include palatal, velar and uvular consonants.

These three feature nodes are sufficient to differentiate between the most common points of articulation:

<u>[Labial]</u>	<u>[Coronal]</u>	<u>[Dorsal]</u>
bilabial,	interdental,	palatal,
labiodental	dental,	velar,
	alveolar, alveopalatal	uvular

These major place feature nodes make certain predictions. First, it is common for a language to have either a bilabial fricative or a labiodental fricative, but much less common to have both. It is common for a language to have a dental stop or an alveolar stop, but less common for one to have both. In other words, the features are designed to reflect general tendencies in language.

Features Dependent on Place Features

When the major place feature nodes cannot adequately distinguish between the places of articulation that a language utilizes, other features must be invoked. For example, the feature [strident] could be used to distinguish between interdental fricatives and dental or alveolar fricatives (see below). Other features which are used to fine tune the point of articulation are given below. Some (or all) of these features are dependent on one of the major place feature nodes. That is, only [labial] sounds can be [round], only [coronal] sounds can be [anterior], etc.

Features Dependent On Labial

round [rnd] When the lips are rounded in the articulation (either as the primary articulation (e.g. *o*) or as a secondary articulation (e.g. *k^w*), the feature [round] is present.

Features Dependent on Coronal

distributed [dist] If the tongue tip is used, the sound is [-distributed] (apical articulation); if the tongue blade is used, it is [+distributed] since more of the surface is used in the articulation (laminal articulation).

anterior [ant] The feature [anterior], as currently used, distinguishes between dentals and alveolars ([+anterior]) and alveopalatals and retroflex consonants ([-anterior]).

lateral [lat] If one or both sides of the midsection of the tongue are lowered, permitting the air to escape in that fashion, the sound is [+lateral].ⁱ

These features were designed to account for phonological oppositions, not necessarily all phonetic differences. In these matters, it is important to keep abreast of the latest research; this textbook is not attempting to do this.

ⁱ Patricia Shaw has argued (colloquium, University of Arizona, December 1988) that the interdependency between lateral and the coronal node may be formalized in a different way, yielding desirable results in the description of certain languages. See also Juliette Blevins (1994) A place for lateral in the feature geometry, *Journal of Linguistics* 30:301-48.

strident [strd] The strident sounds are fricatives or affricates which are characterized by more noise than other fricatives or affricates.^j

	[strd]	
interdental	–	θ
dental/alveolar	+	s ts
alveopalatal	+	ʃ tʃ

Features Dependent on Dorsal

high [hi] If the tongue body is raised in the production of a sound, the sound is [+high]. The [+high] consonants are the palatals and the velars,^k while the uvulars are [-high].

back [bac] If the tongue body is retracted, the sound is [+back]. Velars and uvulars are [+back], while palatals are [-back]. Palatalized sounds have a dorsal node which is specified as [-back].

These features group the consonants in the following way:

<u>Labial Sounds:</u>	[round]		
bilabial	–	p	
rounded bilabial	+	p ^w	
labiodental	–	f	
<u>Coronal Sounds:</u>	[anterior]		
interdental	+	θ	
dental	+	ʒ	
alveolar	+	s	
alveopalatal	–	ʃ	
<u>Dorsal Sounds:</u>	[high]	[back]	
palatal	+	–	ɲ
velar	+	+	k
uvular	–	+	q

Place of Articulation for Vowels

The following features are used to distinguish basic vowel qualities:

back The central and back vowels are [+back], while the front vowels are [-back].

	Front	Central	Back
[bac]	–	+	+

The reason for making the split this way is that it is not important phonologically whether a vowel is central or back phonetically since other features (such as [round]) can always be used to distinguish between central and back vowels.

high and low The tongue body is lowered in the production of a [+low] sound. The features [high] and [low] are used in combination to define three vowel heights.

^j In previous work, the feature [strident] was used to distinguish bilabial and labiodental articulations. The feature [distributed] has also been proposed to make such distinctions. If the constriction involves more area, as in the bilabial articulations, the sound is [-distributed]. Dental and alveolar consonants, which are not commonly found in contrast in a single language, usually can be distinguished with the feature [distributed] if there is a distinction between apical (use of tongue tip) ([-distributed]) and laminal (use of tongue blade) ([+distributed]) articulation. Otherwise, the appropriate feature characterization is unclear. The retroflex articulations are characterized as [-distributed]. For further general discussion of features such as [distributed], see Jacques Durand (1990) *Generative and non-linear phonology*, London, Longman.

^k This use of [high] only for dorsal consonants is different from that in earlier generative theory.

	[high]	[low]	
Close and near-close	+	-	i u
Close-mid, mid, and open-mid	-	-	e o
Near-open, open	-	+	æ ɑ a

Round vowels are characterized as [+round]. It is much more common for a close back vowel to be rounded than unrounded. In some languages, however, close back unrounded vowels are also found.

The nasalized vowels are described with the feature [nasal] that has already been mentioned.

Other vowel modifications

ATR The feature [advanced tongue root] has been proposed for distinguishing between close ([+ATR]) and near-close vowels ([-ATR]), and between close-mid ([+ATR]) and open-mid ([-ATR]) vowels. This feature replaces the feature [tense] that has been used in some works to make this distinction. In the view of some phonologists, this use of the feature [ATR] is not always justifiable.

Natural Classes

One can speak of natural classes in two ways: formally and functionally. Formally, the number of features that are needed to define a natural class is always less than the number of features that are needed to describe any of its members. And the fewer the features, the larger the class. The most interesting natural classes are those which function as such in the phonology of a language. That is, as will be seen repeatedly, a certain group of sounds is singled out by some phonological rule.

<i>Class</i>	<i>Features and/or Nodes</i>
p t k b d g m n	[-continuant]
b d g m n	[-continuant], [+voice]
b d g	[-sonorant], [-continuant], [+voice]
p t k	[-continuant], [-voice]
s z ʃ ʒ tʃ dʒ	[Coronal], [+strident]

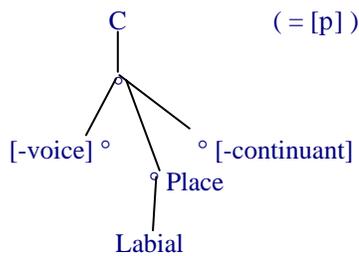
Feature Organization

Recent work has argued that features are organized hierarchically.¹ That is, rather than a representation such as shown below for a sound like [p], as was typical of earlier generative theory,

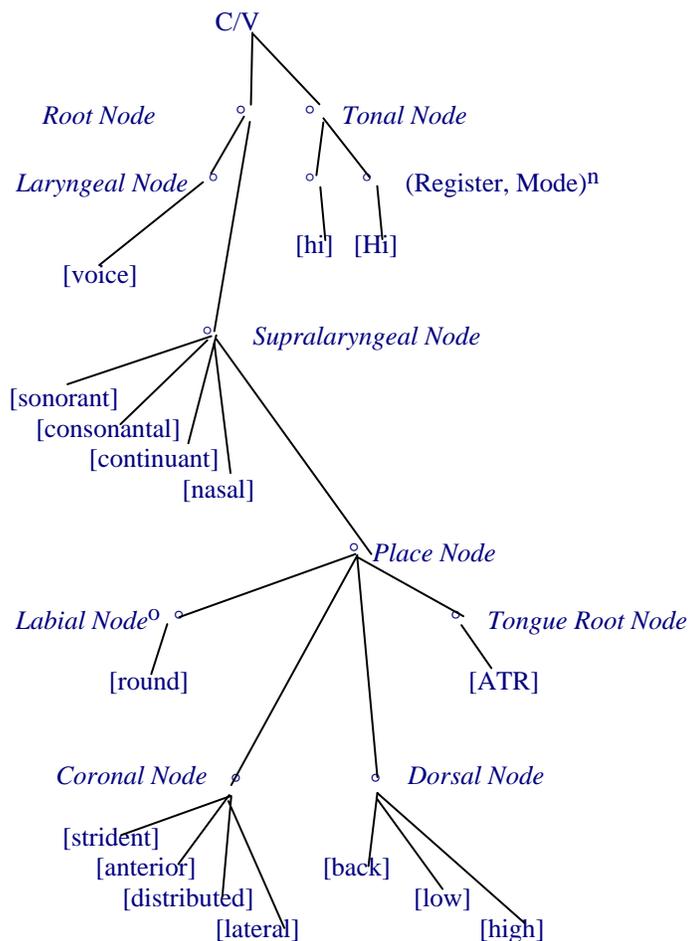
+cons
-son
-cont
-nas
-lat
-strd
-cor
etc.

¹ George N. Clements (1985) The geometry of phonological features, *Phonology Yearbook* 2:223-250; Elizabeth Sagey (1986) *The representation of features and relations in nonlinear phonology*, Ph.D. Dissertation, MIT; John McCarthy (to appear) *Feature geometry and dependency, articulatory organization—from phonology to speech signals*, O. Fujimura, ed., Basel, S. Karger. Also see G. N. Clements and Elizabeth V. Hume (1995) The internal organization of speech sounds, in John A. Goldsmith, ed., *The handbook of phonological theory*, Blackwell, Cambridge, Mass. and Oxford, pp. 245-306. The important innovations of the latter have not been incorporated into this text yet.

the representation should be something along the following lines, with some features grouped together under certain ‘nodes’:



This organization of features, known as **feature geometry**, is based on a hierarchical view of feature organization which is more fully illustrated below.^m



The essential claim is that certain features may work together in bundles, not always individually. See, for example, the discussion of place assimilation in chapter 11.

^m The organization shown here is an adaptation of various proposals. Where each feature appears is a theoretical issue. It is more important to know why a feature might appear in a certain place than where a given feature appears.

ⁿ This is one view of tone features, based on Keith Snider (1990) Tonal upstep in Krachi: evidence for a register tier, *Language* 66:453-474.

^o If the distinction between labial and labiodental articulations is to be made using the feature [strident] or the feature [distributed], this hierarchy must be revised.

APPENDIX B - ORTHOGRAPHY DESIGN

One of the reasons for which phonological analysis is done is to prepare to develop a practical writing system (orthography) that will be used by native speakers of a particular language. Many factors enter into the creation of an orthographic system—some of which are directly related to the phonological analysis and many of which are not. In the following sections some of these factors are discussed.

For those of us who have had experience with only the Roman alphabet, it is important to realize that an adequate writing system does not have to use this alphabet. If an orthography were being developed for a new language found in Greece, it would be reasonable to expect that an orthography based on the Greek alphabet would be used. But we must think even further than this. Some languages use a syllabary, where each symbol represents a syllable rather than a single phoneme. Some orthographies, such as that of Chinese, are really not based on the sound system at all. (This is not so strange, really; it is also true of numbers like “8” and symbols such as “&” and “\$”.) We cannot take the time here to discuss advantages or disadvantages which are found in each of these systems (including the alphabetic approach), but point out that flexibility must be exercised in this area. The discussion that follows centers around an alphabetic approach, however.

Linguistic factors

There are two basic views with respect to the visual representation of utterances. One, which we will call the phoneme-based view, emphasizes the importance of a fairly straightforward bidirectional sound-to-letter correspondence.

By bidirectional, we mean that the relationship is $X \leftrightarrow Y$. For example, the letter *k* would be used to represent the voiceless velar stop phoneme and nothing else, and the voiceless velar stop phoneme would be always be written *k*. English does not have an orthography with this bidirectional correspondence, as is well known. The sound [k] is sometimes written *c*, (as in *cool*), sometimes as *cc* (as in *hiccough*), sometimes as *k* (as in *keep*), sometimes as *ck* (as in *pick*), sometimes as *ch* (as in *school*), and who knows what else.^a And these symbols sometimes are used for other sounds. The letter *c* is sometimes pronounced [s], as in *ice*. This lack of one-to-one bidirectional correspondence is arguably part of the problem of literacy in English since children cannot automatically pronounce [k] and know that they should write *c*, nor can they see *c* and automatically know that they should pronounce it as [k].

Phoneme-based orthography

The following examples from Seri show that the orthography for that language is (by and large) a phoneme-based orthography, although the practical orthography uses symbols which are not those of the International Phonetic Association, of course.

	Phonemic representation	Orthography
‘stone’	ʔast	<i>hast</i>
‘woman’	kmaam	<i>cmaam</i>
‘roadrunner’	ʃaap	<i>zaap</i>
‘your hair’	miʔit	<i>milit</i>
‘ironwood’	ʔæsæn	<i>hesen</i>

Orthographies of many major languages violate the phoneme-based view since they have long histories and often there are no mechanisms in place for regular updating of spelling conventions. Examine the following data from Spanish (general Western Hemisphere dialect, specifically Mexican) and determine whether the spelling is strictly “phonemic”.

^a Names, such as *Iraq*, add further symbols. Labialized *k* (or /kw/, depending on the analysis) is written *qu*.

	Phonemic Representation	Orthography
<i>floor</i>	pi s o	<i>piso</i>
‘zone’	so n a	<i>zona</i>
‘sky’	sj e lo	<i>cielo</i>
‘ice’	je l o	<i>hielo</i>
‘plaster’	je s o	<i>yeso</i>
‘hand’	ma n o	<i>mano</i>
‘brother’	er m ano	<i>hermano</i>
‘cheese’	ke s o	<i>queso</i>
‘cow’	ba k a	<i>vaca</i>
‘drinks’	be b e	<i>bebe</i>
‘lives’	bi b e	<i>vive</i>

Although Spanish is often mentioned as a language which has a reasonable orthography, even a phoneme-based one, it is clear upon examination that it does not follow this principle with any strictness (especially as it is spoken by the majority). As the preceding examples show, /b/ is sometimes represented as *b* and sometimes as *v*; /j/ is represented by both *i* and *y*.^b *H* is used at times although it is not pronounced at all. /s/ is sometimes written as *c*, sometimes as *s*, and sometimes as *z*. /k/ is both *c* and *qu* (not to mention *k* in a few words like *kilograma*).

A phoneme-based orthography seems relatively straightforward, and in many (if not most) cases, newly orthographies have been successfully developed based on this principle. Unfortunately, there are some problems. A phoneme-based orthography requires a phonemic analysis, and hence some clear idea of what a phoneme is. This book has attempted to show some of the complexity of phonological analysis, and it should be evident that the notion of “phoneme” is not entirely straightforward.

Consider two examples from Seri. First, the phoneme /m/ assimilates to the point of articulation of a following consonant when it occurs in the coda of an unstressed syllable. So [ŋ] is an allophone of /m/ (not of /n/ ever, as a matter of fact), and presumably all words that are pronounced with [ŋ] should be written with *m*. That works for 99% of the cases, but there are some special words. First, there is a word like [ˈktoŋk], which means some kind of duck, which inexplicably has a velar nasal even in a stressed syllable. This word, presumably onomatopoeic, cannot be spelled phonemically. Second, there are a number of demonstratives that have the underling forms {ʔim-kop}, {ʔim-kix}, {ʔim-kom} and {ʔim-koi}, which have velar nasals phonetically even though the first syllable is stressed (compare {ʔim-intika} which has [m]). These words also cannot be written phonemically.

Another example from Seri is also illustrative of a problem. Vowel length is contrastive in the language, but only in stressed syllables. In other syllables, one can hear short and (very) long vowels, but this length is not contrastive. Thus a word such as {ʔæpæm} *white-tailed deer* is phonetically [ˈʔæpæ:m]. We analyze this word as being /ʔæpæm/ phonemically.^c The complication arises in a small detail about the lengthening rule. Suffix vowels are never lengthened. Since phonemic representations and practical orthographies typically do not include morphological information in them, there are a very few situations in which the phonemically-written word does not give enough information about how to pronounce it. If you

^b If one wanted to say that the phonemic representation of [j] should be /i/, the point is still true.

^c An alternative phonemic analysis would claim that the lengthened vowel in the second syllable is also a long vowel, given that long vowels are phonemic. This would mean that hundreds or thousands of words have predictably long vowels.

were to see a Seri word written as *patoc*, you wouldn't know if it were a single morpheme and pronounced [pat:ok], or a root plus suffix, *pat-oc* and pronounced [pat:ok] (with short *o*). Despite this problem, the current orthography does not show vowel length in the second syllable of such words.

Morpheme-based orthography

The second approach to orthography, which we will label the morpheme-based view, emphasizes the importance of a fairly uniform representation of each morpheme, regardless of the phonologically-conditioned allomorphs it may actually have. A very simple example: the first morpheme of the words *grandson* and *granddaughter* is spelled the same even though in the second word there probably are not two distinct *d*'s in that word. But no language that we know of follows this view entirely, although some do it partially. The following examples from English show that its orthography is morpheme-based to some extent. (The morphemes in question are underlined.)

English

<u>sejn</u>	<u>sane</u> ^d
<u>sænti</u>	<u>sanity</u>
<u>sajŋ</u>	<u>sign</u>
<u>signəl</u>	<u>signal</u>
<u>luz</u>	<u>lose</u>
<u>lost</u>	<u>lost</u>

The differences between a phoneme- and a morpheme-based orthography show up when a morpheme has two or more allomorphs. Allomorphy (above the phonetic level) invariably means different spellings in a phoneme-based orthography, but not in a morpheme-based orthography.

Certain factors affect the appropriateness of a morpheme-based approach in a given case. Phonological changes that are not regular would have to be indicated somehow. It would be inappropriate, for example, to spell the plural of *leaf* as *leafs* just to maintain morpheme invariance. The voicing of the /f/ in the plural is not part of the regular sound pattern of English, as we noted in chapter 5. The use of a morpheme-based approach to orthography usually requires more instruction. We return to this issue below.

These two basic approaches to orthographic representations will be compared below with respect to three features of an optimal orthography proposed by Edward Klima: low degree of arbitrariness, expressiveness, and economy.^e

Low degree of arbitrariness

Since the correlation of meaning to sound is already arbitrary, there is no reason to introduce an additional aspect of arbitrariness. That is, it seems reasonable for an orthography to reflect the phonological structure of morphemes. Thus the morpheme for a canine animal should be represented by some symbols, such as *d-o-g* since speakers already know how the word is pronounced. A close correlation between sounds (at the underlying, lexical, or surface level) and spelling therefore results in a *low degree of arbitrariness*. One might argue that anytime there is not a bidirectional correlation between phonological representation and orthographic representation, the language is displaying some degree of arbitrariness.

Arbitrariness in English orthography is illustrated by the use of the letter *a* in some monosyllabic words to represent the phoneme /æ/, as in *bad*, *wag*, *cat*, but to represent the phoneme /ɑ/ in other monosyllabic words, as in *wad*, *what*, and *watt*.

<i>a</i>	
/æ/	/ɑ/

^d The final *e* of this spelling is actually inconsistent with the morpheme-based approach.

^e Edward Klima (1972) How alphabets might reflect language, in *Language by ear and by eye: the relationship between speech and reading*, J. F. Kavanagh and I.G. Mattingly (eds.), Cambridge, Mass.: MIT Press, pp. 57-80.

Arbitrariness in Spanish orthography is illustrated by the use of the letter *h* (which has no pronunciation), and the representation of /b/ by the letter *v* in some words and the letter *b* in others.

Arbitrariness is also reflected by the use of more than one orthographic representation per phoneme, as in the use of *oa* and *o...e* to represent the same sounds, as in *boat* and *hope*.

<i>oa</i>	<i>o...e</i>
/o/	

This principle does not imply that orthographies should adhere to the symbols that are used by linguists for phonetic transcriptions. For example, if long vowels are distinctive, that length could be indicated well by a number of conventions. Some common ones are: doubling (*aa*), diacritic letter (*ah*, *a...e*), and diacritic (*ā*). We return to this topic below.

Expressiveness

Another characteristic of an optimal orthography is expressiveness. When two words such as the verbs *lead* [lijd] and *lead* [led] have the same orthographic representation, the orthography is not as expressive as the sound system. Homophones which are spelled differently, such as *meat*, *mete*, and *meet* illustrate the fact that English orthography is more expressive than the (present-day) sound system—which might be considered a positive feature in that semantic differences are thereby reflected in the orthography. This is achieved only at an increase in the degree of arbitrariness, however. (The English orthography is also expressive in that it preserves written contrasts which are maintained in only some dialects—e.g. *Mary*, *merry*, *marry*.) A language may systematize a way to increase expressiveness, as in the use of capital letters (e.g., *Bill* vs. *bill*) or accents (e.g., Spanish *más* ‘more’ vs. *mas* ‘but’). French orthography is expressive in that it indicates plurals with *x* or *s* even in contexts where it is not pronounced, following a morpheme-based principle. Thus, *les belles femmes* ‘the beautiful women’ has three occurrences of *s*, none of which is pronounced in this particular utterance.

Economy

A third feature of an optimal orthography is **economy**. The economy principle is that the orthography should not duplicate the predictable variation that the sound system has. Phoneme-based and morpheme-based orthographies both hold to the economy principle, but they differ with respect to the *degree* to which they hold to it. A phoneme-based orthography would agree to economize in the orthography by not representing variations in a sound which is *everywhere* determined by its environment. Thus all of the allophones of /t/ in English— aspirated, unreleased, unaspirated, glottalized, and flapped—are represented by only one symbol, *t*.

A morpheme-based orthography would want to economize in the orthography by not representing in the orthography any change that is anywhere predicted by a regular phonological rule. Thus such spellings as *rotate* [t] : *rotation* [ʃ], *paradigm* [Ø] : *paradigmatic* [g], *column* [Ø] : *columnar* [n] are viewed as the proper application of the economy principle, despite the differences in pronunciation. The reader learns to associate only one visual sequence with each morpheme; the reading process thereby avoids a trip through the phonology. The maximizing of the economy principle comes at the expense of expressiveness in some cases, however. For example, the spelling for [ɹejʃjo] could be motivated to be *ratio* by deriving it from *rate* plus the suffix *-io*. The spelling of the words *ratio* and *patio* now conceal their different pronunciations since English orthography, like most orthographies, does not include symbols for morpheme boundaries.

One situation in the Seri orthography where the economy principle seems to be appropriately applied is with certain allomorphy of the future prefix *si-*. The *i* often deletes, even before consonants, so many future verb forms begin with *s* followed by consonant. When *s* precedes the alveopalatal fricative *z*, however, it assimilates to it. This assimilation is apparently automatic and exceptionless, although there are no other places in the language where the situation arises. The future of the verb *-zip* is pronounced [ʃʃip]. The most obvious choices for writing this are *zzip* (writing each phoneme separately), and *szip* (preserving the visual cue of *s* for future tense).^f

^f It will be interesting to see what Seri writers do. If they “sound out” the word, presumably they will write *zzip*. If they

The economy principle, regardless of how it is applied, suggests that an optimal orthography is not characterized by unnecessary variation in the shapes of the morphemes. Therefore it is considered advantageous if a morpheme has the same shape everywhere. There are ways that this positive feature can be maintained without using the same symbol for two different sounds (as *t* for /t/ and /ʃ/, in *rate* : *ratio* above). The use of diacritic symbols (like the silent *e* of English) and (true) diacritics are two such ways. Consider the following infamous pairs of words:

<i>divine</i>	[dɪvɑjɪn]	<i>divinity</i>	[dɪvɪnɪti:]
<i>serene</i>	[səriɪn]	<i>serenity</i>	[səriɛnɪti:]
<i>profane</i>	[pɹɔfeɪn]	<i>profanity</i>	[pɹɔfæni:]
<i>cone</i>	[kɔwn]	<i>conical</i>	[kɔnikəl]

The ‘long’ *i*, *e*, and *a*, which are phonetically the diphthongs [ɑj], [ij], and [ej] of the unsuffixed form, are indicated in the English orthography by the silent *e* that occurs at the end of the word (functioning as a diacritic symbol).^g These vowels occur ‘short’ (phonetically lax) in other forms, such as when suffixes are added, but orthographically the roots have nearly the same shape as in the isolated forms. In this way English follows the economy principle quite well. Compare this approach with one which would represent the morphemes very differently. If each phoneme had a separate representation in English orthography, the words might be written like *divayn*, *divinitty*, *seriyn*, *serenitty*, *profeyn*, *profanitty*. (Actually, who knows how the schwa would be written!)

English also writes certain very common morphemes with a morpheme-based approach. The past tense suffix is *-ed* whether it is pronounced [ɪd] or [t] or [d] (*heated*, *passed*, *rolled*).

Isthmus Zapotec has a successful practical orthography that is phoneme-based except in a few situations. One of these is how it writes the possessive prefix [ʃ-]. Whereas the phoneme /ʃ/ is usually written *xh*, and the phoneme /z/ is written *x* in this language, the possessive prefix is written simply *x* when it precedes a consonant (in which position there is no contrast possible). The reason seems to be simply that *xt* adequately signals the phonetic value of [ʃt] and that the *h* in *xht* would be superfluous.^h

It is not hard to find examples of how a language does not follow the various principles discussed above. English and French are often cited as having terrible spelling systems, and yet in some ways they are very good. The Greek orthography was not an optimal one in various respects. Certain consonant clusters, which cannot be analyzed as single consonants, were written with special symbols: /ps/ as ψ and /ks/ as ξ. Because of this, many morphemes had alternating shapes unnecessarily. For example, if the future suffix {-s} was added to the root {pemp-} *send*, the result was written as πεμψ rather than as πεμπσ. This violates the economy principle since a morpheme is written with more than one shape unnecessarily. The phoneme /h/ (if it is correctly analyzed as such) occurred only word-initially and was represented by a special mark above the first vowel. While this is a good idea, since these words pattern in certain ways like vowel-initial words, the orthography also indicated (by means of another special mark) when the word did *not* begin with an /h/. Finally, Greek also violated the economy principle by having two shapes for lower case /s/: one shape (σ) was used word-internally, and the other (ς) was used word-finally.

Comparison

You have likely already come to the conclusion that an orthography which is strictly phoneme-based or strictly morpheme-based is less than ideal. Clearly there is reason to question either of these extreme positions. It is generally agreed that at the initial stages of reading and writing, less effort is required to learn an orthography that is phoneme-based. (This is an important point to remember if schooling to teach

think “future”, presumably they will write *szip*.

^g Alternative spellings using diacritic letters or symbols would be *divihn*, *diviniti* and *divīn*, *diviniti*.

^h This may suggest that the wrong decision was made forty some years ago when the current orthography was adopted. It might have been better to have *x* represent /ʃ/ and *xh* represent /z/. However, right or wrong, the current orthography is well used and there is very little likelihood that it would be changed at this point.

reading and writing is scarce or not available.) Nevertheless, it is also claimed that a morpheme-based orthography allows for a greater facility in reading at later stages. After the initial stages the reader ceases to ‘sound out’ words and instead makes a form-to-meaning connection. Compare the following representations of *telegraph* / *telegraphy*.

Phoneme-based	Morpheme-based
telugraf	telegraf
tulegrufiy	telegrafi

Whereas the phoneme-based representation may be easier for new readers, it presents some disadvantages for more skilled readers since it forces them to recognize every significant phonological alternation, no matter how regular.ⁱ

We should also point out that a phoneme-based orthography for English would be difficult to implement in view of the radically differing dialects of English. The currently used orthography does not distinguish between dialects, whereas a phoneme-based one would of necessity have to reflect one certain dialect in the spelling of each word.

Other phonological factors

The sound system itself may be important to consider if certain sounds pair up in key phonological processes. Suppose there were five vowels, both long and short. It would be reasonable to choose symbols for the long vowels which are based on the short vowels, regardless of the actual phonetics. Likewise, an aspirated series of stops is reasonably represented as a modification of the simple series, either by digraph or diacritic; a novel character is not required for each distinct phoneme.

Syllable structure may be very relevant. For example, the digraph *th* for the phoneme /θ/ will not be appropriate in a language that regularly has consonant clusters that may include the cluster /th/, of course. If the phoneme /ŋ/ and the cluster /ŋg/ both occur, then one will not automatically propose using *ng* to represent the former without at the same time considering how the latter will be represented.

One may also take into consideration the frequency with which a phoneme occurs. For example, Seri has two kinds of laterals: /ʎ/ (voiceless fricative) and /l/. The voiced version is extremely rare, but the voiceless one is not uncommon. The decision was made to use plain *l* to represent the voiceless fricative, and an underscored *l̲* for the rare one, and this has seemed to work well.

Morpheme alternations also motivated the choice of *cö* for /k^w/. There is an intimate connection in the language between the phoneme /k^w/ and the sequence /ko/, as the former is often derived from the latter by (non-automatic) rules. So the words /ʎaako/ ‘house’ and /ʎaak^wt/ ‘houses’ are written *haaco* and *haacöt*, respectively. The o-dieresis preserves visual similarity between the full *o* and the labialization.

All languages presumably show some phonological effects of fast speech or casual speech, as opposed to careful speech. In English, casual speech must be distinguished from informal speech as well. The contraction of *is not* to *isn’t* is a characteristic of informal speech, but informal speech may be carefully or slowly articulated. And so English orthography represents the distinction between *is not* and *isn’t*. On the other hand, the palatalization which takes place in sequences such as *did you*, where it comes out [ˈdɪdʒjə], is characteristic of casual speech and even of some levels of careful speech. This palatalization is *not* represented in English orthography, even though the change from [d] to [dʒ] is from one phoneme to another.

Psycholinguistic factors

The previous section outlined some facts that need to be considered when developing an orthography. Those facts were primarily based on the linguistic description of the language. It was shown that some analysis of morpheme alternations is a prerequisite since creating an orthography involves more than the

ⁱ There are two phonological rules suppressed in the morpheme-based representation above. One is the rule which tenses final vowels. The other is the rule which reduces unstressed vowels in certain positions, often to schwa, which we represent here as being an allophone of the same vowel as in the word *but*.

choice of symbols for the contrasting sounds. For this reason, the matter of creating an orthography is something which cannot simply be tossed into the hands of a novice, whether a native speaker of the language or not. In this section we will briefly consider some psycholinguistic factors that are involved in creating an orthography.

One important consideration is the attitude of native speakers to the written form of their language, especially if there exists any indeterminacy in the linguistic analysis. Speakers' knowledge of their language may provide valuable input to the orthography creation process by helping to answer certain questions, whether directly or indirectly. Should a word break be put here? How should this be written? Therefore, while there is no substitute for a careful phonological analysis of the language, speaker reaction to proposed spellings needs to be carefully considered. (Nevertheless, great caution must be exercised in this area since many extraneous factors could be affecting the speaker's answer, such as a desire not to make the language look at all different from the national language.)

Another factor to consider is the importance of a particular phonological feature in the language. This is especially relevant where stress or tone has only a marginal contrastive function. Consider English, for example, where stress placement contrasts such noun/verb pairs as *cóntrast* / *contrást* and *pérmit* / *per mít*. Despite this contrastive function of stress in English, stress is not represented in the orthography. Likewise in Seri, although stress is not completely predictable, it is not represented in the orthography. (An alternative would be to represent stress only where it is not predicted by some simple rule, as in Spanish.)

Sometimes the phonemic principle has been set aside at times for orthographies of minority languages where the phonetic forms correspond to phonemic forms in the national language. For example, in some varieties of Mixtec, the phoneme /t/ is pronounced with a nasal release, [tⁿ], when it precedes a nasalized vowel. The nasal release is not phonemic, but the salience of this feature and the perception of it as a real *n*, has led native writers to prefer writing it as *tn*. Similarly, in languages where voiced consonants are allophones of the voiceless ones, there may be pressure to write both variants differently if the national language writes them differently. And finally, when a great deal of borrowing takes place into a language, a non-phonemic distinction in native words may have to be written because of the influence of the phonemic distinctions in the borrowed words.

The decision to use a particular orthographic symbol rather than another also involves consideration of various facts, including distinguishability. The phoneme /θ/ in English is represented by the sequence *th* rather than an entirely different symbol. (This is only possible because the phonemes /t/ and /h/ rarely occur together, and then only in compounds, e.g. *outhouse*.) An alternative representation such as a *d* with a bar through it would probably be judged less acceptable since it is visually so much like the standard *d*, and the representation *ð* might be rejected because it is too bizarre. For similar reasons, the phoneme /u/ in a language might be represented as *ü* (umlaut u) rather than *ĩ* (umlaut i), since the latter is distinguished from simple *i* only by a single dot.

One should not assume that an alphabetic symbol must be based on some phonetic chart, such as the IPA. IPA symbols mean nothing more to a new reader and writer than any other symbol. Consider the following ways in which the phonemes /ʃ/ and /ɲ/ are represented in the following languages:

	/ʃ/		/ɲ/
English	<i>sh</i>	Portuguese	<i>nh</i>
French	<i>ch</i>	Italian	<i>gn</i>
Seri	<i>z</i>	Spanish	<i>ñ</i>
Mixtec	<i>x</i>		
Isthmus Zapotec	<i>xh</i>		
German	<i>sch</i>		

Sociolinguistic factors

Orthographies are not designed for linguists but for the speakers of the language, speakers who live in social groups and who invariably have differences in speech habits. An orthography that is designed to be acceptable over a wide dialectal area will be different from one that is designed for a narrow linguistic group. The broader the linguistic group, the less likely it is that a phoneme-based orthography will be utilizable. The advantages of an orthography that is more morpheme-based (such as permitting greater

cross-communication) must be weighed, however, against the disadvantage that much more instruction in the orthographic system will probably be required. If a linguistically diverse speech community is not able or willing to make serious compromises in the orthographic representation of their speech, there will not be success in these attempts to bridge dialects.

It is likely that speakers of a minority language will also read and write a majority or national language. It has often been considered advantageous if the symbol-phoneme correspondences in the two languages are as much in agreement as possible. This will help a person who is literate in one language to more easily become literate in the other. Close conformity may actually be required by the government of the country. In Mexico at one time, the use of *c* and *qu* to represent /k/ was in fact required. Such conformity is not without disadvantages, however. As the result of orthographic conventions in Spanish, the Seri prefix {k-} is spelled *c-* before back vowels and *qu-* before front vowels. This is a complication for Seri readers, of course, but by learning it for Seri, they also learn it for Spanish, and vice versa.^j

The way that words look in a dominant language may affect the conventions that speakers of a minority language will accept. For example, in countries where the major language is not tonal or does not write tone, it is going to be more difficult to convince speakers of a minority tone language that tone needs to be written in their language. (And indeed it is not always the case that it must be. Linguists may object to having tone omitted from a practical orthography, but speakers will argue that they know what the tones are and so they don't want to bother with them. (The same kind of argument is made for stress, vowel length, and other contrasts. And the argument cannot be dismissed easily; in fact, it is very sensible in some cases.)

While often the speakers the minority group want their written language to look like other languages held in esteem (which may mean the use of certain symbols, the avoidance of others, or the preference to have short words), it is also true that sometimes the minority group want their language to look *different* from the national language and will choose certain symbols as a sign of the difference. Some groups inside the U.S. have deliberately chosen to adopt orthographies that are unlike English (and more like Spanish) in order to distance themselves culturally in this symbolic way. Government policy may actually insist on at least certain differences between the national language and minority languages. In Mexico today, for example, the pressure is just the opposite from previous periods; *k* is a symbol that Indian languages are expected to have to show that they are different from Spanish.

Of course, if the symbols of the local language and the national language are at odds, there may be problems, especially if there is going to be massive borrowing or code-switching take place in the written language. Seri does use a few symbols which have different values from Spanish, as shown below, but these have not been a problem. Any of us who have learned to read and write more than one language have learned to handle different systems.

Symbol	Seri value	Spanish value in Mexico
<i>z</i>	ʃ ^k	s
<i>h</i>	ʔ	(null)
<i>x</i>	χ	ks, s, x, ʃ ^l
<i>f</i>	ϕ	f
<i>e</i>	æ	e

Practical factors

Some factors bearing on the creation of an orthography are related to such matters as what is available on printing presses and typewriters in the country. Computer solve this problem only for the rich and

^j The “*c/qu*” issue is quite different from the “*v/b*” one of Spanish, since all readers and writers of Spanish learn how to use *c* and *qu* correctly. The distribution is completely rule-governed. However, the distribution of *v* and *b* is arbitrary, and new writers of Spanish frequently make mistakes with these letters.

^k Actually, it is often retroflex, so the symbol perhaps should be ʂ.

^l *Taxi, Taxco, México, Xochimilco* (some pronunciations), respectively.

computer-literate. There is no reason to introduce a phonetic symbol into the orthography—the phonemes /æ/, /ʃ/, and /χ/ are represented as *e*, *z*, and *x* in Seri, for example, because the latter symbols are easier to teach and reproduce than the former.

Other Matters

Orthography design is more than just a matter of choosing symbols. A rather knotty problem in many cases is where to make word breaks. Some morphemes, such as prepositions or postpositions, may be unstressed because they are not nouns or verbs, and therefore do not appear in isolation (see chapter 8). In some languages, these are written as separate words, and in others they are written as if they were prefixes or suffixes. While some people (linguists and native readers) prefer to follow the principle ‘when in doubt, string it out’ (write morphemes as separate words), this apparently does not always work. In other cases, there appears to be a tendency to write all unstressed morphemes (whether truly affixes or not) attached to some other word.

Compounds present another kind of complication, even in English where there are no good rules for deciding when to write something as one long word, one hyphenated word, or two words. All three options are used. Other languages have compounds and similar issues will arise. It is actually a bit worse in Seri, where contrastive vowel length is lost when the syllable is unstressed. In Seri compounds, it is the second part that retains its length. So when the word *ctooml* occurs as the first part of a compound, it will be pronounced with a short vowel. But how should it be written?

Another problem that cannot be ignored has to do with small (or great) dialect differences. How should words be spelled when people say them differently? English orthography is vague enough that differences between the pronunciation of *roof*, *route*, and *creek*, for example, are simply ignored. Sometimes, a spelling system fares better if it is slightly more abstract, if it ‘peels off’ certain phonological rules. For example, Seri has a rule that changes a /p/ to /k^w/ (the latter is written *cö* in Seri) when it immediately follows a k^w. So when the prefix /k^w-/ is added to a word such as *poofp* ‘if s/he arrives’, the result is [k^wk^wooφp] (that is, [k^w:o:φp]), for most speakers. Nevertheless, some speakers actually pronounce the word as [k^wpoofp]. In other words, some speakers assimilate the /p/ to the /k^w/ of the prefix, and some do not. The orthography of Seri has ignored this rule and lets people pronounce the sequence as they wish. The word ‘if s/he arrives to him/her/it’ is spelled *cöpoofp* and adequately serves both sub-dialects. Such solutions do not always work, but they are worth considering.

Loanwords will always be a difficulty because they regularly introduce new sounds and new patterns that may be incorporated with difficulty into the writing system. It seems appropriate to anticipate these problems, but how? For example, in Seri there are phonemes /t/ and /ʃ/, and these may occur in the cluster /tʃ/ at times (not very commonly). The national language of Mexico, Spanish, has an affricate /tʃ/ which is written as *ch*. Since Seri does not have this affricate, but it has the phonetically similar sequence /tʃ/, one can always write a name such as *Chela*, but not with the same symbols as Spanish (it would be *Tzela* in Seri (with an underlined *l* to show the voicing which is not common in Seri laterals). The Seri orthography is adequately expressive, but the problem is that such a simple thing as the writing of names will be different in the Seri orthography from Spanish orthography. At this point it seems unavoidable since otherwise one would have to allow the phonology and the orthography of the national language to dictate how the minority language will be written.

Political factors

Of course one wants to think about all of the issues laid out above, and yet in the end the language community itself has to make the decision. It will do this in one or more ways.

First, the community may have already decided that certain symbols or conventions will be followed, especially if there is an “academy” of some sort for the language or language family. This academy may or may not have made what one may consider to be the best choice, but the decisions are a reality not to be ignored nor disparaged. These may be influenced by a long history of government policy, of attitudes, of input by other linguists, etc. They may not be immutable, but they are real. Even if those decisions lead to very unsatisfactory results, they still cannot be ignored. (For example, the decision may have been made to represent two common phonemes with the same symbol.)

Second, the community may not have made a decision, but it will consider its options. It may consider that the decisions by outsiders (including those of related languages, those of government-sponsored committees, and those of linguists) are irrelevant. The political landmines are real as one interacts with people who are making decisions and with those who are going to be actually affected by them. In these cases, it is important to understand how communities make decisions in that culture.

Third, the community may nominally accept the conventions that are proposed by outsiders or insiders (whether well-reasoned or not), but demonstrate that they are not adequate by either not learning them, by not using them, or by changing them over time. What is relevant in the long run is what the writers in the community use in future generations and not what is proposed by linguists or committees.

Try it for yourself

Consider the following phoneme list (based on Zapotec language of Mexico) and make proposals for an orthography of this language based on three different scenarios. These are proposals that you are making to speakers of the language for their consideration, so you will need to have reasons for your suggestions.

The syllable onset may have two consonants and the nucleus may have two segments (if two, one of them is a glide). (See sample words below.) The kinds of complex which occur are /sC/, /ʃC/, or /NC/ (where N = nasal, C = consonant).

First, propose an orthography that might be appropriate for this language if English were the language of education and communication for the country in which it is found. Second, propose an orthography that might be appropriate if French were the language of education. (If you don't know French, choose another major language that you do know something about, perhaps Spanish.) Third, propose an orthography that does not take the national language into consideration, but which is constrained by the "non-negotiable" symbols that a government committee has imposed (as shown). Discuss your proposals. For example, if you propose that *ch* should represent /tʃ/ in the English-influenced orthography, tell why.²¹¹

For each orthography, show how the following words would be written:

1. sq ‘music’ (vowel with creaky voice)
2. waga ‘rat’
3. gi ‘fire’
4. bjw ‘flea’
5. gjeʔ ‘tortilla’ (vowel with glottalized articulation)
6. ʃpjaʔ ‘custom of’
7. mbjoʔʃo ‘clown’
8. sej ‘computer’
9. rusidubi ‘wears out’
10. ndzæ ‘hard drive crash’

Phoneme	English	French	committee
p			p
b			b
t			t
d			d
tʃ			
dʒ			
k			k
g			g
s			s
z			z
ʃ			x
ʒ			xh
m			m
n			n
ɲ			ñ
l			l
r			r
j			y
w			w
ɑ			a
e			e
i			i
o			o
u			u
æ			
creaky voice on vowels			
glottalization on vowels (phonetically often like a vowel followed by glottal stop)			a'

211 Orthography design exercise

English-oriented orthography (one proposal, taking English orthography seriously, but recognizing that the results may look odd at first):

Unless there is a reason not to, presumably the following phonemes would be written as shown because of the direct correspondence to the most common English spelling for these phonemes.

Phoneme	p	b	t	d	tʃ	dʒ	k	g	s	z	ʃ	m	n	l	j	w
Orthography	<i>p</i>	<i>b</i>	<i>t</i>	<i>d</i>	<i>ch</i>	<i>j</i>	<i>k</i>	<i>g</i>	<i>s</i>	<i>z</i>	<i>sh</i>	<i>m</i>	<i>n</i>	<i>l</i>	<i>y</i>	<i>w</i>

More difficult cases: Since English does not have a simple way to represent the sound /ɜ/ since this sound is not a phoneme of English, one might propose something analogous to the digraph used for /ʃ/, namely *zh*. Similarly, English does not have the palatal nasal as a phoneme. Perhaps *ny* would be good to use. The flap is a problem because in English this is an allophone of /t/, and the *r* of English is quite different. Nevertheless, I would propose using *r* for the flap.

The vowels are difficult. Since the syllables of this language are all open, it would be good to look at similar syllables in English. The correspondences are often digraphs in English, however.

/i/	<i>ee, ea</i>	<i>see, pea</i>
/e/	<i>ay, ey</i>	<i>day, hey</i> (besides <i>igh</i> in <i>neigh</i>)
/o/	<i>o, oe</i>	<i>go, hoe</i> (beside <i>ow</i> in <i>low</i>)
/u/	<i>oo, ue</i>	<i>too, due</i> (besides <i>o</i> in <i>do</i> and <i>oe</i> in <i>shoe</i>)
/a/	(doesn't occur in open syllables in monosyllabic words except for interjections, as in <i>ha!</i> and <i>bah!</i> , and a few words like <i>ma</i>)	
/æ/	(doesn't occur in open syllables in monosyllabic words, but otherwise it is written as <i>a</i> , as in <i>happy</i>)	

Those facts don't make the decisions very easy. The /e/ is especially difficult because the sequence /ej/ is also possible in the language, and so /e/ cannot (?) be written *ay* since /ej/ would come out as *ayy*. It might be nice just to propose the regular five vowels plus *ä* for the sixth vowel. But that would be a cop-out for this exercise that is supposed to make us really think about alternatives based on English spelling, so I would propose:

Phoneme	i	e	o	u	ɑ	æ
Orthography	<i>ee</i>	<i>e</i>	<i>o</i>	<i>oo</i>	<i>ah</i>	<i>a</i>

A creaky vowel could be represented by V'V, and a glottalized vowel by V'.

1.	sq	‘music’	<i>sah’ah</i>
2.	waga	‘rat’	<i>wahgah</i>
3.	gi	‘fire’	<i>gee</i>
4.	bjw	‘flea’	<i>bee’eeew</i>
5.	gjeʔ	‘tortilla’	<i>gye’</i>
6.	ʃpjaʔ	‘custom of’	<i>shpyah’</i>
7.	mbjoʔʃo	‘clown’	<i>mbyo’sho</i>
8.	sej	‘computer’	<i>sey</i>
9.	rusidubi	‘wears out’	<i>rooseedoobee</i>
10.	ndzæ	‘hard drive crash’	<i>nja</i>

French-oriented orthography (one proposal)

Unless there is a reason not to, presumably the following phonemes would be written as shown because of the direct correspondence to the most common French spelling for these phonemes.

Phoneme	p	b	t	d	k	g	s	ʒ	ʃ	m	n	ɲ	l
Orthography	<i>p</i>	<i>b</i>	<i>t</i>	<i>d</i>	<i>c, qu</i>	<i>g, gu</i>	<i>s</i>	<i>j</i>	<i>ch</i>	<i>m</i>	<i>n</i>	<i>gn</i>	<i>l</i>

Of the above cases, the use of *c, qu* for /k/ and *g, gu* for /g/ are potential problems (politically, but not linguistically) since they do carry over some complication from French orthography (*c* before back vowels, *qu* before front vowels).

French spells /w/ as *hu* and /j/ as *hi*, but these spellings would be problematic in Zapotec because the glides may occur after consonants and also at the end of syllables. There would be no automatic problem in spelling these phonemes simply as *u* and *i*, however.

Since /s/ and /z/ are represented by complicated conventions in French (sometimes *s*, sometimes *ss*, etc.), we will propose that *z* be used to represent [z] in Zapotec, and that simple *s* be used to present /s/.

More difficult cases: Since French does not have the phonemes /tʃ/ and /dʒ/, one might propose the digraphs *tch* and *dj*, respectively, based on the representations of the fricatives.

The flap could be represented as *r*, although it will have a rather different phonetic value from French.

For the vowels, one might propose the following, based on the most common French equivalents.

/i/	<i>i</i>
/e/	<i>ai</i> (or perhaps simple <i>e</i> , despite the different phonetic value)
/o/	<i>au</i> (or perhaps <i>o</i> , despite the different phonetic value)
/u/	<i>ou</i>
/a/	<i>a</i>
/æ/	<i>ae</i> (a difficult decision because this sound does not occur in open syllables in French)

A creaky vowel could be represented by V’V, and a glottalized vowel by V’.

1.	sq	‘music’	<i>sa’a</i>
2.	waga	‘rat’	<i>uaga</i>
3.	gi	‘fire’	<i>gui</i>
4.	bjw	‘flea’	<i>bi’iu</i>

5.	gjeʔ	‘tortilla’	<i>guie’</i>
6.	ʃpjaʔ	‘custom of’	<i>chpia’</i>
7.	mbjoʔʃo	‘clown’	<i>mbio’cho</i>
8.	sej	‘computer’	<i>sei</i>
9.	rusidubi	‘wears out’	<i>rousidoubi</i>
10.	ndzæ	‘hard drive crash’	<i>ndjae</i>

Spanish-oriented orthography (one proposal)

Unless there is a reason not to, presumably the following phonemes would be written as shown because of the direct correspondence to the most common Spanish spelling for these phonemes.

Phoneme	p	b	t	d	k	g	tʃ	s	m	n	ɲ	l	r
Orthography	<i>p</i>	<i>b</i>	<i>t</i>	<i>d</i>	<i>c, qu</i>	<i>g, gu</i>	<i>ch</i>	<i>s</i>	<i>m</i>	<i>n</i>	<i>ñ</i>	<i>l</i>	<i>r</i>

Of the above cases, the use of *c, qu* for /k/ and *g, gu* for /g/ are potential problems (politically, but not linguistically) since they do carry over some complication from Spanish orthography (*c* before back vowels, *qu* before front vowels).

Spanish spells /w/ as *hu* but this spelling would be problematic in Zapotec because the glides may occur after consonants and also at the end of syllables. There would be no automatic problem in spelling /w/ simply as *u*, however. In fact, an analogous decision could be made for /j/ even though one could use *y*.

Since Spanish does not have /z/, some proposal needs to be made. The symbol *z* in Spanish orthography represents only [s] in the Americas. Despite this problem and potential complication, we will propose that *z* be used to represent [z] in Zapotec.

More difficult cases: Since Spanish does not have the phonemes /ʃ/, /ʒ/ and /dʒ/, one might propose *sh, zh* and *dzh* (novel uses of these combinations), or *xh, x,* and *dx* (variations on one phonetic value of *x* in Mexican Spanish influenced by indigenous place names), or *x, ll,* and *dx* (differing primarily in the use of *ll* which has the pronunciation [ʎ] in regional Spanish). Each of these options has been adopted and preferred by different Zapotec language groups. For the sake of this exercise, we will adopt *ll*.

For the vowels, one might propose the following, based on the most common French equivalents.

/i/	<i>i</i>
/e/	<i>e</i>
/o/	<i>o</i>
/u/	<i>u</i>
/a/	<i>a</i>
/æ/	<i>ä</i> (utilizing the dieresis which is used elsewhere in Spanish)

A creaky vowel could be represented by VˀV, and a glottalized vowel by Vʔ.

1.	sq	‘music’	<i>sa’a</i>
2.	waga	‘rat’	<i>uaga</i>
3.	gi	‘fire’	<i>gui</i>
4.	bjw	‘flea’	<i>bi’iu</i>
5.	gjeʔ	‘tortilla’	<i>guie’</i>

(Problem: how would [guj] be distinguished from [gi]? Under the proposals here, these would both be spelled *gui*, wouldn’t they? This problem would suggest that something has to be changed.)

6.	ʃpjaʔ	‘custom of’	<i>xpia’</i>
7.	mbjoʔʃo	‘clown’	<i>mbio’xo</i>
8.	sej	‘computer’	<i>sei</i>
9.	rusidubi	‘wears out’	<i>rusidubi</i>
10.	ndzæ	‘hard drive crash’	<i>nllä</i>

Committee-influenced orthography

The following consonant-letter correspondences are given by the committee’s proposal, and they will be followed.

Phoneme	p	b	t	d	k	g	s	z	ʃ	ʒ	m	n	ɲ	l	r	j	w
Orthography	<i>p</i>	<i>b</i>	<i>t</i>	<i>d</i>	<i>k</i>	<i>g</i>	<i>s</i>	<i>z</i>	<i>x</i>	<i>xh</i>	<i>m</i>	<i>n</i>	<i>ñ</i>	<i>l</i>	<i>r</i>	<i>y</i>	<i>w</i>

The committee has not been a proposal for the affricates /tʃ/ and /dʒ/. The proposal might be made to use a digraph and trigraph based on the corresponding stops and fricatives: *tx* and *dxh*. The trigraph might be simplified by omitting the redundant *h*, leaving *dx*. These would need to be tested, of course.

The vowel symbols are all provided except for /æ/. There are a number of proposals that might be made, including *ä* and *ae*. We will suggest the latter (to avoid the diacritic).

For creaky voice, we might propose using V’V or VV. If we had /æ/ with creaky voice, the latter would result in *aeae*, which might be deemed less aesthetically pleasing than *ae’ae*. Nevertheless, in the absence of good reasons not to, we will propose VV.

1.	sq	‘music’	<i>saa</i>
2.	waga	‘rat’	<i>waga</i>
3.	gi	‘fire’	<i>gi</i>
4.	bjw	‘flea’	<i>biiw</i>
5.	gjeʔ	‘tortilla’	<i>gye’</i>
6.	ʃpjaʔ	‘custom of’	<i>xpia’</i>
7.	mbjoʔʃo	‘clown’	<i>mbyo’xo</i>
8.	sej	‘computer’	<i>sey</i>
9.	rusidubi	‘wears out’	<i>rusidubi</i>
10.	ndzæ	‘hard drive crash’	<i>ndxæ</i>

APPENDIX C - PHONOLOGY WRITE-UPS

The results of linguistic research should be published in an appropriate place, such as a professional journal. In many cases, straight descriptions of the phonology of a language are not appropriate for such journals, however. Many readers of journals are more interested in theoretical issues and data that bear on them. Nevertheless, there is a place for good descriptive work if its presentation is adapted to the audience and, when appropriate, some attention is paid to issues of current concern. In this appendix we present an outline of topics which are basic to any phonological description. The outline is not necessarily appropriate for a published article, but the information it covers should be included somewhere. It is also certainly possible that other topics must be included.

In order to make the description useful to a wide audience, theory-particular formalism should be downplayed, or at least accompanied by a careful prose description. In addition, each claim should be backed by a carefully presented array of data. Three things are essential: good writing, good data, and good argumentation.

The following examples are somewhat more segment-oriented than feature-oriented, since at this level of description we are aiming at a more general audience. In some cases, this may lead to less than desirable results, in which case some additional discussion is necessary.

Inventory of Phonemes

Include a list of the phonemes of the language, perhaps in chart form. Use standard linguistic symbols in this list rather than those which are used by literature for native speakers (tʃ rather than *ch*, for example). Regardless of what you say, people pay attention to how words are spelled. You don't want to miscommunicate.

If a proposed phoneme occurs only in loanwords, or less than a dozen morphemes, or ideophones, list it separately or mark it clearly.^a

Sample Consonant Chart

<i>Consonants</i>					
p	t		k	ʔ	(Oral Stops)
f	s	ʃ	x		(Fricatives)
m	n				(Nasal Stops)
	l				(Liquid)

r occurs in loanwords from Spanish.

Sample Vowel Chart

<i>Vowels</i>	
i	(Close Front Unrounded)
o	(Mid Back Rounded; functions phonologically as high)
æ	(Open Front Unrounded)
ɑ	(Open Central Unrounded; functions phonologically as back)

Vowels occur both 'short' and 'long'; see discussion.

<i>Tones: High, Low</i>

^a Most languages have borrowed words from other languages, and some more than others. Nevertheless, a skewed picture of the core phonology can be given if loanwords are not considered separately.

Evidence for Phonemic Contrasts

Present data which establishes the existence of the phonemes or distinctive features claimed. We suggest that data be given in *phonemic* rather than phonetic transcription at this point, and organized by class of sounds. For example, data regarding p and b need to be carefully presented, but one does not worry whether *p* and *t* are distinct phonemes. Therefore *labials* need to be contrasted, not voiceless stops. Other classes include coronals, velars, nasals, liquids, etc. Of course, one should adapt the presentation to the facts of the language. It is not possible to propose a canned style for presenting data from all languages.

Present the data with glosses. Give examples with the sounds in various positions in the word if possible, although the focus of concern here is not the distribution of the phonemes, but the existence of contrast.

If a certain contrast is hard to establish, make this fact very clear. (Any time a contrast is established by only a few examples, one should be suspicious.) Avoid presenting a misleading picture that will make it difficult for the reader to think about alternatives.

If there are unresolved issues (and there always are!), don't sweep them under the rug. Be up front about them, although of course they don't need to occupy an inordinate amount of space or attention.

Syllable Structure

In this section of a write-up, discuss kinds of syllables that occur in the language. In line with the view of syllables presented in this book, one might start by presenting the maximal syllable template and illustrative examples of syllable types that it covers. (Again, be careful to distinguish syllables which appear only in loanwords.)

Sample Syllable Structure Overview

Maximal Syllable Template:	[CVVC]
CVVC	<i>examples</i>
CVC	<i>examples</i>
CVV	<i>examples</i>
CV	<i>examples</i>
V	<i>examples</i>
VC	<i>examples</i>
VVC	<i>examples</i>

If any of these syllable types is restricted to some position in the word, note this. For example,

(302) Syllables without onsets occur only word-initially.

(303) Syllables with codas occur only if stressed.

If 'special' syllables occur at the edge of words, include discussion of these syllables. For example, syllables ending in [gz] occur only at the end of polymorphemic words in English, the *z* being either the plural suffix (as in *frogs*), the third singular suffix (*lags*) or the possessive morpheme (*pig's*).

Under this section also discuss complex segments, such as affricates, and the glide/vowel issue, as necessary.

Sample Discussion of Complex Segments, Glides, etc.

[tʃ] is analyzed as an affricate (rather than a cluster) since there are no unambiguous examples of CVCC syllables. (*Provide examples here.*)

Nonsyllabic *i* is analyzed as [j] at the beginning of roots since prefix allomorphy shows that such roots pattern with consonant-initial roots. (*Provide data here.*)

Distribution of Phonemes

Some phonemes may have strict distributional constraints. Present such constraints.

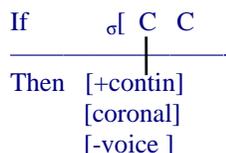
Examples of distributional constraints

/h/ occurs only syllable-initially.

A nasal is always homorganic with the following consonant.

The following vowel/glides sequences do not occur: *ij, ji, uw, wu, ow, wo*.

If a syllable begins with two consonants, the first consonant must be *s*.



Voiced consonants do not occur syllable-finally.

Phonetic Detail

Describe the phonetic nature of the segments and tones. This can be done by class of segments when appropriate.

Sample Discussion of Phonetic Detail

The phonemes *p, t, and k* are basically voiceless unaspirated stops (bilabial, alveolar, and velar).

When a phoneme has more than one allophone, describe the allophones and justify the rules with adequate data. For example:

Sample Discussion of Allophones

The voiceless stops have an optional voiceless nasal release in utterance-final position. This nasal release is homorganic with the stop.

m is phonetically a nasalized labiovelar approximant when it follows a tautosyllabic velar stop. /kmaam/ [kṵããm] *woman* (tautosyllabic), /ikmana/ [ikmana] *sandpiper* (not tautosyllabic). It is a velar nasal when it occurs in an unstressed syllable and immediately precedes a back consonant (*k, x, or χ*). Otherwise it is a labial nasal.

It is quite disturbing to read a phonological description which makes a certain claim for which inadequate data is presented. If you make a claim, be sure to provide systematic illustrative data to back up the claim and to show that an alternative analysis is not adequate.

Morphological Structure

In preparation for discussion of phonological rules applying within words, present the morphological structure of words in the language. This discussion should include word structure rules which specify the order of morphemes within verbs, nouns, etc. Of course, for some languages much more must be included here than for others. A phonological description which is complete in this area may be quite long.

Sample Word Structure Rule

Verb Structure:

V → Subject Agreement - Tense - Stem - Plural

Phonological Rules

Apart from those already discussed in the section on phonetic detail above, some phonological rules may apply when words are juxtaposed. (This is especially true of tone sandhi.) Most of the phonological rules relevant here, however, are those which apply inside of words when morphemes are combined. The rules

should be given, with evidence for each part of the rule, and an adequate number of examples to justify them. This part of a phonological description may also be quite long; in addition to simply presenting the rules and supporting evidence, justify the underlying forms, the direction and generality of the rules, discuss and justify rule ordering, and discuss rule interaction.

Stress and Intonation

Give an account of the general stress pattern of the language, or at least present the basic facts. Similarly, describe major intonation patterns.

Sample Informal Discussion of Stress

Stress generally occurs on the first syllable of the root, although there are numerous exceptions. In compounds, the second part receives primary stress. No clear secondary stress is perceived.

Sample Informal Discussion of Intonation

Declarative sentences are usually characterized by a gradually rising pitch contour which reaches a High level on the last stressed syllable and then drops to Low on succeeding syllables. (*Give examples.*)

Interrogative yes-no questions are characterized by a gradually rising pitch contour which reaches an extra High level on the last stressed syllable and then drops to Low on succeeding syllables. (*Give examples.*)

Interrogative content questions are characterized by a pitch contour that starts at a High level and falls gradually to Low on succeeding syllables. (*Give examples.*)

APPENDIX D - SYMBOLS TABLES

Table 1: Common Consonants (plus a few more)

	Bilabial	Labio-dental	Inter-dental	Dental or Alveolar	Palato-alveolar	Palatal	Velar	Uvular	Pharyngeal	Glottal
Stops										
	p			t		c	k	q		ʔ
	b			d		ɟ	g	ɢ		
Affricates										
				\overline{ts}	$\overline{tʃ}$					
				$\overline{dʒ}$	$\overline{dʒ}$					
	(<i>lateral</i>)			$\overline{tʃ}$						
Fricatives										
	ɸ	f	θ	s	ʃ	ç	x	χ	ħ	h
	β	v	ð	z	ʒ	ʝ	ɣ	ʁ	ʕ	
	(<i>lateral</i>)			ɬ						
Nasals										
	m			n	ɲ		ŋ	ɴ		
Liquids										
	(<i>lateral</i>)			l						
	(<i>tap, flap</i>)			ɾ						
	(<i>trill</i>)			r						
Glides										
				ɹ	j		w			

Double Articulation: w kp gb k^w g^w (*labiovelar*)

Modifications:

Aspirated: t^h

Glottalized: tʔ

Laryngealized: t̠

Palatalized: tʲ

Prenasalized: ⁿd

Implosive: ɓ ɗ ɠ

Voiceless Sonorant: m̥

Labialized: t^w

Table 2: Common Vowels (plus a few more)^a

	Front		Central		Back	
	unround	round	unround	round	unround	round
close	i	y	ɨ	ɤ	ɯ	u
near close	ɪ	ʏ				ʊ
close-mid	e	ø			ɤ	o
mid			ə			
open-mid	ɛ	œ			ʌ	ɔ
near open	æ		ɐ			
open	a				ɑ	ɒ

Modifications:

Voiceless: ɸ

Laryngealized (glottalized, creaky voiced): ɸ̰

Nasalized: ɸ̃

Long: Vː or Vˑ or VV

^a For a comprehensive treatment of symbols, see Geoffery K. Pullum and William A. Ladusow (1986) *Phonetic symbol guide*, Chicago, University of Chicago Press.

APPENDIX E - LANGUAGE INDEX AND SOURCE INFORMATION^a

Agutaynen (Philippines) Source: Stephen Quakenbush, p.c. [Exercise on page 143.]

Arabic

Cairo Arabic (Egypt) Source: Most of the data come from Robert T. Harms (1968) *Introduction to phonological theory*, Englewood Cliffs, New Jersey, Prentice-Hall. The original source of the data there were Walter Lehn and Peter Abboud (1965) *Beginning Cairo Arabic*, Austin, Texas, Multilithed. The source of the other data is unknown. [Exercise on page 101.]

Bakwiri (Bantu, Cameroon) Source: Jacques Durand (1990) *Generative and non-linear phonology*, London, New York: Longman. The original source was J.-M. Hombert (1973) Speaking backwards in Bakwiri, *Studies in African Linguistics* 4:227-35. [Data cited on pages 216.]

Basque (Spain) Source: José Ignacio Hualde (1991) Unspecified and unmarked vowels, *Linguistic Inquiry* 22:205-9. [Exercise on page 184.]

Berber (Morocco) Source: Mohamed Guerssel (1986) Glides in Berber and syllabicity, *Linguistic Inquiry* 17:1-12. [Data cited on page 170.]

Busa (Niger-Congo; Nigeria) Source: Klaus Wedekind (1972) *An outline of the grammar of Busa (Nigeria)*. Dissertation, Kiel. [Exercise on page 125. Data cited on page 125.]

Campa

Asheninca Campa (Peru). Source: Donald A. Burquest and David L. Payne (1993) *Phonological Analysis: A Functional Approach*. Dallas: SIL and University of Texas at Arlington. [Exercises on pages 129 and 179.]

Capanahua (Panoan, Peru) Source: Eugene Loos (1967) *The phonology of Capanahua and its grammatical basis*, Ph.D. dissertation, University of Texas, Austin. [Data cited on pages 107 and 107.]

Cashinahua (Peru) Source: Kenneth M. Kensinger (1963) The phonological hierarchy of Cashinahua, *Studies in Peruvian Indian languages: I*, Mexico City, Summer Institute of Linguistics, pp. 207-217. [Exercise on page 131.]

Chatino (Zapotecan, Otomanguean, Mexico) Source: Leslie and Kitty Pride, p.c. [Data cited on pages 57 and 83.]

Chinantec

Lalana Chinantec (Chinantecan, Otomanguean, Mexico) Source: Merrifield (1987). [Exercise on page 89.]

Lealao Chinantec (Chinantecan, Otomanguean, Mexico) Source: Jim Rupp, p.c. [Exercise on page 105.]

Chinese. Source: Larry Hyman (1975) *Phonology: theory and analysis*, New York, Holt, Rinehart and Winston. [Exercise on page 66. Data cited on page 213.]

Min Nan Chinese (Taiwan). Source: Merrifield (1987). They were originally provided by D. Chuang and C. Rensch. [Exercise on page 66.]

Ch'ol (Mayan, Mexico). Source: Viola Warkentin and Ruby Scott (1980) *Gramática ch'ol*, Mexico City: Summer Institute of Linguistics. [Exercise on page 24.]

^a Merrifield (1987) is William R. Merrifield et al., eds. (1987) *Laboratory manual for morphology and syntax*, Dallas, SIL.

Chontal

Oaxaca Chontal (Tequistlatecan, Hokan, Mexico) Source: Kenneth L. Pike (1947) *Phonemics: A technique for reducing language to writing*. Ann Arbor, University of Michigan Press; data originally provided by Viola Waterhouse and May Morrison. [Exercise on page 127.]

Czech. Source: unknown. [Exercise on page 174.]

Daga (Papua New Guinea) Sources: John and Elizabeth Murane (1972) Vocalic syllabicity in Daga, *Phonetica* 25: 19-26, Elizabeth Murane (1974) *Daga grammar: from morpheme to discourse*, University of Oklahoma, Norman, SIL. [Exercise on page 128.]

Damana (Chibchan, Colombia) Source: Cindy S. Williams (1993) *A grammar sketch of Dāmāna*, M.A. Thesis, University of North Dakota. [Exercises on pages 48, 116, and 130.]

Doyayo (Cameroon) Source: Marinus Wiering and Elisabeth Wiering (1994) Phonological description of Doyayo (Poli dialect), *The Doyayo language: selected studies*, Arlington, Texas: Summer Institute of Linguistics and The University of Texas at Arlington. [Data cited on page 126.]

Ejagham (Bantu, Nigeria & Cameroon) Source: Donald A. Burquest and David L. Payne (1993) *Phonological analysis: a functional approach*. Dallas: SIL and University of Texas at Arlington; data originally provided by K. Watters. [Exercise on page 91.]

English [Exercises on pages 66 and 205.]

American English [Exercises on pages 80, 81, and 174.]

Southern British English [Exercises on pages 263 and 264.]

Eskimo

Kuskokwim Eskimo (Alaska, U.S.) Source: unknown. (Some phonetical detail has been omitted.) [Exercise on page 115.]

Ewe (Kwa, Togo) Source: George N. Clements (1978) Tone and syntax in Ewe, *Elements of tone, stress, and intonation*, ed. Donna Jo Napoli, Washington, D.C., Georgetown University Press. [Exercise on page 219.]

Flemish (Teralfene dialect). Source: Juliette Blevins (1994) A place for lateral in the feature geometry. *Journal of Linguistics* 30:301-48. The sources of the data were cited as Willem J. de Reuse (1984) Cluster palatalization and vowel fronting in the Flemish dialect of Teralfene, manuscript, The University of Texas at Austin, and C. McClemore (1987) Palatalization and lateral spread in Teralfene Dutch, manuscript, The University of Texas at Austin. [Data cited on page 99.]

German. Source: Jerzy Rubach (1990) Final devoicing and cyclic syllabification in German, *Linguistic Inquiry* 21:79-94. [Data cited on page 145.]

Pennsylvania German (U.S.) Source: Unknown. [Exercise on page 149.]

Greek (Modern) Source: Andreas Koutsoudas (1962) *Verb morphology of Modern Greek: a descriptive analysis*. *International Journal of American Linguistics* 28.4. Publication 24 of the Indiana University Research Center in Anthropology, Folklore, and Linguistics. [Exercise on page 86.]

Guanano (Colombia & Brazil) Source: Nathan and Carolyn Waltz (1967) Guanano phonemes, *Phonemic systems of Colombian languages*, Mexico City, Summer Institute of Linguistics. [Exercise on page 116.]

Gwari (Kwa, Nigeria) Source: Larry Hyman (1975) *Phonology: theory and analysis*, New York, Holt, Rinehart and Winston. The original source was Larry Hyman (1972) Nasals and nasalization in Kwa, *Studies in African Linguistics* 3:167-205. [Data cited on page 215.]

- Hausa** (Sudan) Source: Eugene Nida (1949) *Morphology: the descriptive analysis of words*, Ann Arbor, University of Michigan Press. The original source was Carleton T. Hodge (1947) *An outline of Hausa grammar*, Language Dissertation 4, Baltimore: Linguistic Society of America. [Exercise on page 141. Data cited on page 208.]
- Houailou** (Oceanic, New Caledonia) Source: Frantisek Lichtenberk (1978) A sketch of Houailou grammar, *Working Papers in Linguistics*, University of Hawaii Vol. 10, 2:73-116. This work is based on Jacqueline de La Fontinelle (1976) *La langue de Houailou (Nouvelle-Calédonie)*. Paris: Société d'études linguistiques et anthropologiques de France. *Langues et civilisations à tradition orale*, 17. [Exercise on page 47.]
- Hungarian**. Source: Merrifield (1987). The data were checked and the transcription adjusted with the help of Emese Láng. [Data cited on pages 93ff and 99.]
- Inga** (Quechuan, Colombia) Source: Stephen H. Levinsohn (1976) *The Inga language*, The Hague and Paris, Mouton. [Data cited on page 107.]
- Italian**. Source: dictionary and miscellaneous other sources. [Exercise on page 129.]
- Japanese**. Sources: James D. McCawley (1978) What is a tone language?, in Victoria A. Fromkin, *Tone: a linguistic survey*, New York, London; Academic Press; Junko Ito and Ralf Armin Mester (1986) The phonology of voicing in Japanese: theoretical consequences for morphological accessibility, *Linguistic Inquiry* 17:49-73; and Larry Hyman (1975) *Phonology: theory and analysis*, New York, Holt, Rinehart and Winston. [Data cited on pages 56 and 213.]
- Javanese** (Java) Source: unknown. [Exercises on pages 67 and 72.]
- Karuk** (Hokan, northern California; also known as Karok) Sources: William Bright (1957) *The Karok language*, University of California Publications in Linguistics 13, Berkeley and Los Angeles: University of California Press. [Exercises on pages 83, 114, and 168.]
- Kikongo** (Bantu, Zaire). Source: Benjamin Ao (1991) Kikongo nasal harmony and context-sensitive underspecification, *Linguistic Inquiry* 22:193-6. [Data cited on page 88.]
- Kikuyu** (Bantu, Tanganyika) Source: Merrifield (1987); original source was B. Hooley, p.c.; and Larry Hyman (1975) *Phonology: theory and analysis*, New York, Holt, Rinehart and Winston. The original source was Mary Pratt (1972) Tone in some Kikuyu verb forms, *Studies in African Linguistics* 3:325-378. [Data cited on pages 14ff and 216.]
- Korean**. (Korea) Sources: Victoria Fromkin and Robert Rodman (1983) *An introduction to language*, New York, London, Sydney: Holt, Rinehart and Winston; and Chang-Hai Park (1961) *An intensive course in Korean*, Yonsei University, Seoul. [Exercise on page 147. Data cited on pages 16 and 107.]
- Kukuya** (Bantu, Congo) Source: Larry M. Hyman (1987) Prosodic domains in Kukuya, *Natural Language and Linguistic Theory* 5:311-33. The analysis was originally due to Christiane Paulian (1974) *Le Kukuya: langue Teke du Congo*. [Data cited on page 215.]
- Kuman** (Chimbu, Papua New Guinea) Source: Juliette Blevins (1994) A place for lateral in the feature geometry. *Journal of Linguistics* 30:301-48. The source of the data was cited as J. Lynch (1983) On the Kuman 'liquids', *Languages and Linguistics in Melanesia* 14:98-112. [Data cited on page 104.]
- Lamba** (Zambia & Zaire) Source: Michael Kenstowicz and Charles Kisseberth (1979) *Generative phonology: description and theory*, New York, London, Academic Press. The data are originally from C. Doke (1938) *Textbook of Lamba grammar*, Johannesburg, Witwaterstrand Press. [Exercises on pages 96 and 193.]
- Latin** Source: dictionary. [Exercise on page 173. Data cited on page 201.]
- Lithuanian**. Source: unknown. [Exercises on pages 57 and 72.]

Madija (Arauan, Peru & Brazil) Source: Patsy Liclán and Stephen A. Marlett (1990) Madija noun morphology, *International Journal of American Linguistics* 56:102-120; Patsy Adams (Liclán) (1987) Gender agreement in Madija, *Native American languages and grammatical typology, papers from a conference at the University of Chicago, University of Chicago, April 22, 1987*, eds. Paul D. Kroeber and Robert E. Moore, 1-18, Indiana University Linguistics Club; and Patsy Liclán, p.c. [Exercises on pages 21 and 25. Data cited on pages 30, 44, 46, 46, 100, 107, 151, and 170.]

Manam (Austronesian, Manam and Boesa Islands, off the coast of Papua New Guinea) Source: Frantisek Lichtenberk (1983) *A grammar of Manam*, University of Hawaii Press. [Exercises on pages 10 and 10. Data cited on page 29.]

Manobo

Agusan Manobo (Philippines) Source: Daniel and Marilou Weaver (1963) The phonology of Agusan Manobo (with special reference to æ), *Papers on Philippine Languages No. 1*, Institute for Language Teaching, University of the Philippines and Summer Institute of Linguistics, Manila, pp. 1-6. [Exercise on page 117.]

Maori (New Zealand) Source: Kenneth Hale (1973) Deep-surface canonical disparities in relation to analysis and change: an Australian example, *Current trends in linguistics 11, Diachronic, areal, and typological linguistics*, The Hague and Paris, Mouton, pp. 400-458. [Exercise on page 177.]

Margi (Nigeria) Source: Jacques Durand (1990) *Generative and non-linear phonology*, London, New York: Longman. The original source was C. Holffmann (1963) *A grammar of the Margi language*, London: Oxford University Press. [Exercise on page 216.]

Marinahua (Peru) Source: Eunice Pike and Eugene Scott (1975) The phonological hierarchy of Marinahua, in Ruth M. Brend, ed., *Studies in tone and intonation*, S. Karger: Basel, London, New York, etc., pp. 196-211. Reprinted from *Phonetica* 8:1-8 (1962). [Exercises on pages 154, 158, and 219.]

Mazatec

Chiquihuitlán Mazatec (Popolocan, Otomanguean, Mexico) Source: Allan Jamieson (1977) Chiquihuitlan Mazatec tone, *Studies in Otomanguean phonology*, ed. William R. Merrifield, Dallas, SIL and University of Texas at Arlington. [Data cited on page 212.]

Mende (Bantu, Sierra Leone). Source: William R. Leben (1978) The representation of tone, in Victoria A. Fromkin, *Tone: a linguistic survey*, New York, Academic Press, pp. 177-219. [Exercises on pages 205, 217, 218, 218, and 218.]

Mengen (Papua New Guinea). Source: Daniel D. Rath (1993), *Phonologies of Austronesian languages No. 2*, ed. John M. Clifton, Ukarumpa, SIL. [Exercise on page 24.]

Miwok

Sierra Miwok (California) Source: L. S. Freeland (1951) *Language of the Sierra Miwok*, Indiana University Publications in Anthropology and Linguistics. [Exercise on page 117.]

Mixtec

Atlatlahuca Mixtec (Mixtecan, Otomanguean, Mexico). Source: Ruth María Alexander (1980) *Gramática mixteca: mixteco de Atlatlahuca*, Mexico City, Instituto Lingüístico de Verano. [Data cited on page 212.]

Huajuapán Mixtec (Mixtecan, Otomanguean, Mexico) Source: John H. Cowan and Eunice V. Pike (1967) Huajuapán Mixtec phonology and morphophonemics, *Anthropological Linguistics* 1-15. [Exercises on pages 20 and 263.]

Nuyoo Mixtec (Mixtecan, Otomanguean, Mexico) Source: Larry Harris, p.c. [Exercises on pages 68, 72, 76, and 82.]

Ñumí Mixtec (Mixtecan, Otomanguean, Mexico) Source: Laura Gittlen and Stephen A. Marlett (1985) Ñumí Mixtec syllable structure and morphology. *Work Papers of the Summer Institute of Linguistics, University of North Dakota*, 29:175-94. [Data cited on page 125.]

Ocotepec Mixtec (Mixtecan, Otomanguean, Mexico) Source: Ruth Mary Alexander, p.c. [Exercise on page 194. Data cited on pages 212 and 216.]

Peñoles Mixtec (Mixtecan, Otomanguean, Mexico) Source: John Daly, p.c. See also John P. Daly (1977) A problem in tone analysis, *Studies in Otomanguean phonology*, ed. William R. Merrifield, Dallas: SIL and University of Texas at Arlington. [Exercise on page 215.]

Mokilese (Mokil Atoll and the island of Ponape, near the Marshallese Islands) Source: Sheldon P. Harrison with the assistance of Salich Y. Albert (1976) *Mokilese reference grammar*, Honolulu, University of Hawaii Press. [Data cited on page 66.]

Nabak (Papua New Guinea) Source: Edmund and Grace Fabian, p.c. [Exercises on pages 67 and 76. Data cited on page 71.]

Ngemba (Bantoid, Cameroon) Source: Charles L. Eastlack (1968) The noun classes of Ngemba, *Journal of African Languages* 7:33-40. [Exercise on page 23.]

Nahuatl

Sierra Nahuatl (Nahuatl, Uto-Aztecan, Mexico) Source: Harold and Mary Key (1953) The phonemes of Sierra Nahuatl, *International Journal of American Linguistics* 19:53-6. [Exercise on page 129. Data cited on pages 146, 146, and 146.]

Nahuatl

Hueyapan Nahuatl (Nahuatl, Uto-Aztecan, Mexico) Source: R. Joe Campbell (1976) Underlying /ŋ^w/ in Hueyapan Nahuatl, *International Journal of American Linguistics* 42:46-50. [Data cited on page 190.]

North Puebla Nahuatl (Nahuatl, Uto-Aztecan, Mexico) Source: Earl Brockway (1963) The phonemes of North Puebla Nahuatl, *Anthropological Linguistics* 5:14-17. See revised analysis in Earl Brockway (1979) North Puebla Nahuatl, in Ronald W. Langacker, ed., *Studies in Uto-Aztecan grammar* 2, 141-98, Dallas: SIL and University of Texas at Arlington. [Exercises on pages 69, 72, 123, 148, 148, and 154. Data cited on pages 104 and 123.]

Southeastern Puebla Nahuatl (Nahuatl, Uto-Aztecan, Mexico) Source: Ralph Reed, p.c. [Exercise on page 174.]

Tetelcingo Nahuatl (Nahuatl, Uto-Aztecan, Mexico) Sources: Kenneth L. Pike (1947) *Phonemics: A technique for reducing language to writing*. Ann Arbor, University of Michigan Press (data originally provided by Richard S. Pittman); Richard S. Pittman (1961) The phonemes of Tetelcingo Nahuatl (Morelos) Nahuatl, *A William Cameron Townsend en el vigésimoquinto aniversario del Instituto Lingüístico de Verano*, Mexico City: ILV, pp. 643-651; and David Tuggy, p.c. [Exercises on pages 130 and 165.]

Nupe (Nigeria) Source: Larry Hyman (1975) *Phonology: theory and analysis*, New York, Holt, Rinehart and Winston. The original source was Isaac George (1970) Nupe Tonology, *Studies in African Linguistics* 1:100-22. [Exercise on page 204.]

O'odham

Tohono O'odham (Tepiman, Uto-Aztecan, Arizona) Source: Jane Hill and Ofelia Zepeda, Tohono O'odham plurals, Paper presented at the Universidad de Sonora, Hermosillo, Sonora, Mexico. October 1990. [Exercise on page 45.]

Paresí (Arawakan, Brazil) Source: Orland Rowan (1967) Phonology of Paresí (Arawakan) *Acta Linguistica Hafriensia: International Journal of Structural Linguistics* 10:2, 201-210. [Exercise on page 84.]

Pengo (India) Source: Michael Kenstowicz and Charles Kisseberth (1979) *Generative phonology: description and theory*, New York, San Francisco, and London, Academic Press. [Exercises on pages 62 and 76.]

Popoluca

Sierra Popoluca (Mixe-Zoquean, Mexico) Source: Merrifield (1987); and Benjamin Elson (1947) Sierra Popoluca syllable structure, *International Journal of American Linguistics* 13:13-17. [Exercises on pages 67 and 148.]

Portuguese

Brazilian Portuguese (Brazil) Source: unknown. [Exercise on page 124.]

Quechua

Corongo Quechua (Quechuan, Peru) Source: Daniel Hintz (1990) *Distinctives of Corongo Quechua: historical and synchronic perspectives*, M.A. Thesis, Grand Forks, University of North Dakota. [Exercises on pages 49 and 162. Data cited on pages 127, 151, and 177.]

Pastaza Quechua (Quechuan, Peru) Source: Charlotte Zahn (1978) *Materiales para estudios fonológicos* (vol. 1), ed. Eugene Loos, Yarinacocha, Peru, SIL. [Exercises on pages 68, 72, and 77.]

Quichua

Eastern Quichua (Quechuan, Ecuador) Carolyn Orr and Betsy Wrisley (1965) *Vocabulario quichua del oriente del Ecuador*, Quito, Instituto Lingüístico de Verano. [Exercise on page 117.]

Salasaca Quichua (Quechuan, Ecuador) Source: Sheldon Waskosky (1990) *The phonology of Salasaca Quichua*, M.A. Thesis, University of North Dakota. [Data cited on pages 90 and 139.]

Selepet (Papua New Guinea) Source: K. A. McElhanon (1972) *Selepet grammar, Part I: from root to phrase*, Pacific Linguistics, Series B, 21, The Australian National University. [Exercise on page 10.]

Serbo-Croatian Source: Michael Kenstowicz (1993) *Phonology in generative grammar*, Cambridge, Mass., Blackwell. The original source of the data is not known. [Exercise on page 173.]

Seri (Serian, Hokan, Mexico) Source: Edward W. Moser and Mary B. Moser (1965) Consonant vowel balance in Seri (Hokan) syllables, *Linguistics* 16:50-67; and Stephen A. Marlett (1981/1995) *The structure of Seri*, Ph.D. Dissertation, University of California, San Diego. [Exercises on pages 4, 20, 21, 22, 38, 37, 114, 147, 164, 169, and 270. Data cited on pages 7, 12ff, 15, 16ff, 18, 29, 29, 36, 37, 64, 71, 93, 99, 104, 113, 115, 125, 128, 139, 140, 146, 152, 157ff, 160, 168, 170ff, 185ff, 200ff, 208ff, 237, 239 and 231ff.]

Sioux

Dakota Sioux (Siouan, North and South Dakota) Source: Patricia Shaw (1989) The complex status of complex segments in Dakota, *Theoretical perspectives on Native American languages*, eds. Donna B. Gerdts and Karin Michelson, Albany, SUNY Press. [Exercise on page 202. Data cited on page 83.]

Spanish. Source: James W. Harris (1983) *Syllable structure and stress in Spanish: a nonlinear analysis*, Cambridge, London, MIT Press; and other common sources. [Data cited on pages 12, 17, 29, 90, 107, 114, 122, 126, 145ff, 161, 168, 170, 171, 176, and 231ff.]

Sre (Viet Nam) Source: unknown. [Exercise on page 178.]

Swahili (Bantu, Zaire) Source: Jim Meyer, p.c. [Exercises on pages 31ff.]

- Tabaru** (Indonesia) Source: Edward A. Kotynski (1987) *Tabaru phonology and morphology*, M.A. thesis, University of North Dakota; Edward A. Kotynski (1995) Glottal stop and the nasal prefix in Tabaru and other North Halmaheran languages, in Wyn D. Laidig, ed., *Descriptive studies in languages of Maluku*, part II, 1-17, NUSA 38:Jakarta; Edward A. Kotynski (1998, ms.) *Tabaru-Indonesian-English dictionary*. The thesis also appeared complete in *Workpapers of the Summer Institute of Linguistics: University of North Dakota Session* (1988) vol. 32, pp. 143-216. [Exercise on page 269.]
- Tagalog** (Philippines) Source: Teresita V. Ramos (1971) *Tagalog structures*, Honolulu: University of Hawaii Press. [Data cited on page 168.]
- Tairora** (Papua New Guinea) Source: Alex and Lois Vincent (1962) Introductory notes on Tairora verb morphology and syntax, *Studies in New Guinea linguistics*, pp. 4-27, Oceanic Linguistic Monograph 6, University of Sydney, Australia. [Exercise on page 263.]
- Tarahumara** (Tarachitan, Uto-Aztecan, Mexico) Source: Eugene Nida (1949) *Morphology: the descriptive analysis of words*, Ann Arbor, University of Michigan Press. [Exercises on pages 111 and 142.]
- Tlapanec** (Tlapanecan, Otomanguan, Mexico) Source: Mark Weathers, p.c. [Data cited on pages 162ff.]
- Tojolabal** (Mayan, Mexico) Source: Julia Supple and Celia M. Douglass (1949) Tojolabal (Mayan): phonemes and verb morphology, *International Journal of American Linguistics* 15:168-174. [Exercise on page 118.]
- Totonac** (Totonacan, Mexico) Source: Herman P. Aschmann (1946) Totonaco phonemes, *International Journal of American Linguistics* 12:34-43. [Exercises on pages 147 and 189.]
- Misantla Totonac** Source: Juliette Blevins (1994) A place for lateral in the feature geometry. *Journal of Linguistics* 30:301-48. The source of the data was cited as C. J. MacKay (1991) *A grammar of Misantla Totonac*, Ph.D. dissertation, The University of Texas at Austin. [Exercise on page 43.]
- Trio** (Surinam) Source: Morgan W. Jones (1972) *Languages of the Guianas*, ed. Joseph E. Grimes, Mexico City, Summer Institute of Linguistics, pp. 42-46. [Exercise on page 124.]
- Tswana** (Bantu, southern Africa) Source: unknown, but the phonetics facts are based on C. M. Doke (1954) *The southern Bantu languages*, London, New York, Cape Town, Oxford University Press for the International African Institute. [Data cited on page 121.]
- Turkish** Some of the data are from the following sources: Michael Kenstowicz (1993) *Phonology in generative grammar*, Cambridge, Mass., Blackwell; and George N. Clements and Engin Sezer (1982) Vowel and consonant disharmony in Turkish. In Harry van der Hulst and Norval Smith, eds., *The structure of phonological representations*, Part 2, pp. 213-255. [Exercise on page 97.]
- Tzeltal** (Mayan, Mexico) Source: Marianna C. Slocum (1948) Tzeltal (Mayan) noun and verb morphology, *International Journal of American Linguistics* 14:77-86. Also see Marianna C. Slocum, Florencia L. Gerdel, and Manuel Cruz Aguilar (1999) *Diccionario del tzeltal de Bachajón (Chiapas)*. [Exercise on page 105.]
- Tzotzil** (Mayan, Mexico) Source: Judith L. Aissen (1987) *Tzotzil clause structure*, Dordrecht and Boston, Reidel. [Exercise on page 22.]
- Ukrainian**. Source: Michael Kenstowicz and Charles Kisseberth (1979) *Generative phonology: description and theory*, New York, San Francisco, and London, Academic Press. [Exercise on page 84.]
- Venda** (South Africa). Source: C. M. Doke (1954) *The southern Bantu languages*, London, New York, Cape Town, Oxford University Press for the International African Institute. [Exercise on page 116.]
- Vietnamese**. Source: Laurence Thompson (1965) *A Vietnamese grammar*, Seattle, University of Washington. [Data cited on page 209.]

Walmatjari (Pama-Nyungan, Australia). Source: Joyce Hudson (1978) *The core of Walmatjari grammar*, Canberra, Australian Institute of Aboriginal Studies; and New Jersey, Humanities Press. [Exercise on page 262.]

Wantoat (Papua New Guinea). Source: Merrifield (1987); originally provided by D. Davis and E. Deibler. [Exercise on page 65.]

Waorani (Ecuador) Source: Merrifield (1987). [Data cited on page 88.]

Xavante (Brazil) Source: Merrifield (1987); originally provided by E. Burgess and J. Hall. [Exercise on page 101.]

Yaqui (Taracahitan, Uto-Aztec, Mexico) Source: Constantino Martínez Fabián (1990) La reduplicación en las categorías mayores del yaqui, Paper presented at the Universidad de Sonora, Hermosillo, Sonora, Mexico. [Exercise on page 83.]

Yoruba (Niger-Congo, Nigeria) Source: Diana Archangeli and Douglas Pulleyblank (1989) Yoruba vowel harmony, *Linguistic Inquiry* 20:173-217; and Douglas Pulleyblank (1988) Vocalic underspecification in Yoruba, *Linguistic Inquiry* 19:233-70. [Data cited on pages 95 and 125.]

Zapotec

Coatecas Altas Zapotec (Zapotecan, Otomanguean, Mexico) Source: Joseph Benton, p.c. [Exercise on page 23.]

Isthmus Zapotec (Zapotecan, Otomanguean, Mexico) Source: Merrifield (1987) (originally provided by John and Jean Alsop and Velma Pickett) and Stephen A. Marlett and Velma Pickett (1987) The syllable structure and aspect morphology of Isthmus Zapotec, *International Journal of American Linguistics* 53:398-422. [Exercises on pages 47, 171, 202, and 205. Data cited on pages 151, 177, and 235.]

Quiegolani Zapotec (Zapotecan, Otomanguean, Mexico) Source: Sue Regnier (1993) Quiegolani Zapotec phonology, *1993 Work Papers of the Summer Institute of Linguistics, University of North Dakota Session 37*. [Data cited on page 161.]

Quioquitani Zapotec (Zapotecan, Otomanguean, Mexico) Source: Michael Ward, p.c. [Exercise on page 166.]

Yatzachi el Bajo Zapotec (Zapotecan, Otomanguean, Mexico) Source: Inez M. Butler H. (1980) *Gramática zapoteca: zapoteco de Yatzachi el Bajo*, Mexico City, Instituto Lingüístico de Verano. [Exercise on page 58.]

Zoque

Chimalapa Zoque (Mixe-Zoquean, Mexico) Source: Lyle Knudson (1975) *A natural phonology and morphophonemics of Chimalapa Zoque*, M.A.Thesis, Grand Forks, University of North Dakota. See also the discussion in John A. Goldsmith (1990) *Autosegmental & metrical phonology*, Oxford, Cambridge, Mass., Basil Blackwell. [Exercise on page 124. Data cited on pages 146 and 201.]

Copainalá Zoque (Mixe-Zoquean, Mexico). Source: Roy and Margaret Harrison and Cástulo Garcías H. (1981) *Diccionario zoque de Copainalá*, Mexico City: Instituto Lingüístico de Verano; William L. Wonderly (1951) Zoque II: Phonemes and morphophonemes, *International Journal of American Linguistics* 17:105-23. [Exercises on pages 59, 68, 82. Data cited on pages 88 and 176.]

APPENDIX F: OPEN-ENDED EXERCISES

This appendix presents data sets which will be useful for discussing important issues that face phonologists. They do not necessarily have pat answers and model solutions. If you are interested in discussing the problems or the solutions, write to me at steve_marlett@sil.org.

Other exercises of this nature may be found on-line soon at the SIL North Dakota website: www.nd.sil.org.

Walmatjari (Pama-Nyungan; Australia)

The published data have been transcribed here phonetically according to IPA conventions. The language does not have any fricatives. Some sounds, including the “semi-consonants” *w*, *j*, and *ɹ* (distinct from the flap/trill which occurs in the data below) do not occur word finally. [n] is an apico-alveolar, [ɲ] is an apical post-alveolar, and [ɳ] is a lamino-alveolar. Similar conventions are used for the other coronal consonants. [r] is an apico-alveolar vibrant / flap (depending on context – this phonetic detail has not been included). Issues to look at: voicing, place assimilation (is our feature system adequate?), alternations that do not seem to be phonologically motivated, morphemes that don’t alternate, suppletive vs. non-suppletive analyses.

	Locative	Ergative	Nominative	Dative	
1.	tirpta	tirptu	tirp	tirpku	<i>mark on message stick</i>
2.	maŋinda	maŋindu	maŋin	maŋingu	<i>woman</i>
3.	lambaŋɟa	lambaŋɟu	lambaŋ	lambaŋgu	<i>small one</i>
4.	miɟiɻa	miɟiɻu	miɟiɻ	miɟiɻku	<i>newborn babe</i>
5.	puɟuɻa	puɟuɻu	puɟuɻ	puɟuɻku	<i>frog (species)</i>
6.	kuŋɟala	kuŋɟalu	kuŋɟal	kuŋɟalku	<i>daughter</i>
7.	kuŋara	kuŋaru	kuŋar	kuŋarku	<i>dog</i>
8.	piɽpittɻa	piɽpittɻu	piɽpiɽ	piɽpitku	<i>lightning</i>
9.	walakɽa	walakɽu	walak	walakku	<i>frog (species)</i>
10.	panaŋɟa	panaŋɟu	panaŋ	panaŋgu	<i>old woman</i>
11.	maŋaŋa	maŋaŋu	maŋa	maŋawu	<i>girl</i>
12.	ŋaɽpuŋa	ŋaɽpuŋu	ŋaɽpu	ŋaɽpuwu	<i>father</i>

After words of three or more syllables, the following patterns of suffixes occur (*the allomorphy of the Dative suffix is not affected by polysyllabicity, however):

13.	ŋabuɻuɻa	ŋabuɻuɻu	ŋabuɻu	ŋabuɻuwu*	<i>sister</i>
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Other data of importance:

pari *boy*

pariwaŋɟi *boys*

kanaɻaŋwaŋɟi *others*

piɻaŋgirwaŋɟi *blankets*

ŋura *camp*

ŋuragaɟi *camp (Allative)*

Southern British English^a

1.	'stəʊn	<i>stone</i>	'stəʊni	<i>stony</i>
2.	'rɒk ^h	<i>rock</i>	'rɒk ^h i	<i>rocky</i>
3.	'wɪləʊ	<i>willow</i>	'wɪləʊi	<i>willowy</i>
4.	'grɑ:s	<i>grass</i>	'grɑ:si	<i>grassy</i>
5.	'sɒlt ^h	<i>salt</i>	'sɒlt ^h i	<i>salty</i>
6.	'biɹ	<i>beer</i>	'biɹ.i	<i>beery</i>
7.	'stɑ:	<i>star</i>	'stɑ:i	<i>starry</i>
8.	'wɔ:t ^h ə	<i>water</i>	'wɔ:t ^h ɪ ~ 'wɔ:t ^h ə.i	<i>watery</i>
9.	'fɜ:	<i>fur</i>	'fɜ:i	<i>furry</i>
10.	'tɛə	<i>tear (v.)</i>	'tɛə.ɪŋ	<i>tearing</i>

^a The transcription is based on the *Collins Cobuild English Language Dictionary* (1987) London and Glasgow: Collins. Some adaptations to the standard IPA have been made.

Southern British English (monosyllables)^b

gɹɑ:s, pɑ:s <i>grass, pass</i>	bɑ:n, kɑ:m <i>barn, calm</i>	hɑ:t <i>heart</i>	ɑ:nt, plɑ:nt <i>aunt, plant</i>	stɑ: <i>star</i>	-----
lɛs <i>less</i>	ɹɛn <i>wren</i>	lɛt <i>let</i>	ɹɛnt <i>rent</i>	-----	ɹɛə̯ <i>rare</i>
gæs, mæs <i>gas, mass</i>	ɹæn <i>ran</i>	ɹæt <i>rat</i>	ɹænt, pænt <i>rant, pant</i>	-----	-----
li:s <i>lease</i>	li:n <i>lean</i>	bi:t <i>beet</i>	-----	bi: <i>bee</i>	-----
kɪs <i>kiss</i>	kɪn <i>kin</i>	kɪt <i>kit</i>	lɪnt <i>lint</i>	-----	fɪə̯ <i>fear</i>
laɪs <i>lice</i>	laɪn <i>line</i>	laɪt <i>light</i>	pɑɪnt <i>pint</i>	pɑɪ <i>pie</i>	fɑɪə̯, pɑɪə̯ <i>fire, pyre</i>
lu:s <i>loose</i>	spu:n <i>spoon</i>	lu:t <i>loot</i>	-----	lu: <i>loo</i>	-----
pju:s <i>puce</i>	tju:n <i>tune</i>	kju:t <i>cute</i>	-----	kju: <i>cue</i>	-----
bʊʃ <i>bush</i>	-----	fʊt <i>foot</i>	-----	-----	lʊə̯, kjuə̯ <i>lure, cure</i>
feɪs <i>face</i>	leɪn <i>lane</i>	feɪt <i>fate</i>	feɪnt, peɪnt <i>faint, paint</i>	ɹeɪ <i>ray</i>	-----
dəʊs <i>dose</i>	təʊn <i>tone</i>	təʊt <i>tote</i>	wəʊnt ^c <i>wont</i>	təʊ <i>toe</i>	-----
lɒs <i>loss</i>	dɒn <i>don</i>	lɒt, wɒt <i>lot, what</i>	fɒnt <i>font</i>	-----	-----
bʌs <i>bus</i>	ɹʌn <i>run</i>	ɹʌst <i>rust</i>	ɹʌnt <i>runt</i>	-----	-----
nɜ:s <i>nurse</i>	lɜ:n <i>learn</i>	hɜ:t <i>hurt</i>	lɜ:nt, bɜ:nt ^d <i>learnt, burnt</i>	fɜ: <i>fur</i>	-----
gɔ:z <i>gauze</i>	lɔ:n <i>lawn</i>	nɔ:t <i>nought</i>	hɔ:nt <i>haunt</i>	lɔ:, dɔ: <i>law, door</i>	-----
laʊs <i>louse</i>	gaʊn <i>gown</i>	gaʊt <i>gout</i>	kaʊnt <i>count</i>	kaʊ <i>cow</i>	aʊə̯ <i>hour</i>
vɔɪs <i>voice</i>	dʒɔɪn <i>join</i>	kɔɪt ^e <i>quoit</i>	dʒɔɪnt <i>joint</i>	dʒɔɪ <i>joy</i>	-----

^bThe transcription is based on the *Collins Cobuild English Language Dictionary* (1987) London and Glasgow: Collins. Some adaptations to the standard IPA have been made.

^c Most examples in this cell would be polymorphemic or special in some way. For example, *wont* is an archaic word. Other words include: *won't* and *don't*.

^d Both of these examples are polymorphemic. No monomorphemic examples were found.

^e This may be a unique word of this pattern.

Huajuapan Mixtec (Otomanguan, Mexico)

The following data are given in a broad phonetic transcription. Each bisyllabic word has stress on the first syllable. Geminate vowels could be analyzed in different ways, of course, as could elements such as [nd], [kw] and [kj]. In most, if not all, Mixtec languages, what is transcribed as [ɲ] is actually a nasalized palatal glide. Also, in most Mixtec languages, the degree of nasalization which is heard adjacent to nasal consonants is much less than what is heard elsewhere. Make some careful hypotheses about the phonemes of this language. Consider carefully the distribution of the consonants and vowels. And pay close attention to nasalization. If you need some prompting about what to see in these data, look at the questions which follow the data.

- | | | | | | | | |
|-----|-------|----|--------------------|-----|-------|----|----------------------|
| 1. | βaʔa | LM | <i>good</i> | 20. | ðĩʔã | HH | <i>buzzard</i> |
| 2. | βeʔe | MM | <i>house</i> | 21. | ðĩnĩ | LL | <i>head</i> |
| 3. | βitʃi | MM | <i>now</i> | 22. | ðita | LL | <i>tortilla</i> |
| 4. | βifi | LL | <i>sweet</i> | 23. | ðito | ML | <i>uncle</i> |
| 5. | βiko | LL | <i>cloud</i> | 24. | ðĩʔĩ | LM | <i>leg</i> |
| 6. | tʃelo | HL | <i>calf</i> | 25. | ðoʔo | LM | <i>ear</i> |
| 7. | tʃĩĩ | HL | <i>finger nail</i> | 26. | ðõʔnõ | LL | <i>shirt</i> |
| 8. | tʃika | ML | <i>banana</i> | 27. | ðykjy | LL | <i>niece</i> |
| 9. | tʃõõ | MM | <i>work</i> | 28. | kaβa | MM | <i>will lie down</i> |
| 10. | tʃõõ | LL | <i>hen</i> | 29. | kãʔã | HH | <i>wants</i> |
| 11. | ðãʔmã | ML | <i>clothing</i> | 30. | kãʔã | LL | <i>will talk</i> |
| 12. | ðãmã | MM | <i>will change</i> | 31. | katʃi | MM | <i>cotton</i> |
| 13. | ðaʃi | LL | <i>nephew</i> | 32. | kaʃa | HH | <i>hard thing</i> |
| 14. | ðeʔe | LM | <i>son</i> | 33. | kjeðõ | MM | <i>will sneeze</i> |
| 15. | ðẽʔẽ | LL | <i>lard</i> | 34. | kjĩnĩ | MM | <i>poor quality</i> |
| 16. | ðitʃi | LL | <i>nose</i> | 35. | kjyʃi | HH | <i>white</i> |
| 17. | ðiko | LL | <i>will sell</i> | 36. | koko | MM | <i>will swallow</i> |
| 18. | ðiko | HH | <i>is selling</i> | 37. | kõɲõ | LM | <i>meat</i> |
| 19. | ðikõ | LL | <i>neck</i> | 38. | koo | LL | <i>snake</i> |

39.	koʔo	LL	plate	62.	ndoko	ML	zapote (fruit)
40.	kõmĩ	LH	four	63.	ndata	MM	split wood
41.	kõnĩ	MM	yesterday	64.	ndytʃi	ML	bean
42.	kwali	HL	horse	65.	ɲãmã	LL	corn husk
43.	kwãʔã	LH	yellow	66.	ɲãní	ML	brother
44.	kwaʔa	LH	red	67.	ɲẽʔẽ	HM	is scratching
45.	kwee	HH	slow	68.	ɲõõ	ML	town
46.	kjete	MM	will dig	69.	nĩnõ	LM	above
47.	kjiti	ML	animal	70.	nõʔõ	LM	tooth
48.	kjya	LL	year	71.	nõʔõ	ML	fire
49.	kjyka	LL	comb	72.	nãmã	LL	soap
50.	kjykjy	HM	is sewing	73.	saði	HH	is closing
51.	kjykjy	LM	will sew	74.	saa	LL	new
52.	lasa	HL	bone	75.	saʔa	LL	foot
53.	lende	ML	navel	76.	sõʔnĩ	HH	is tying
54.	lekwã	LL	eyebrow	77.	sõnã	HH	is opening
55.	ndaʔa	ML	hand	78.	ʃẽẽ	HM	is buying
56.	ndee	HH	is caring for	79.	ʃito	LM	bed
57.	ndeʔe	HH	is watching	80.	ʃitõ	LL	oven
58.	ndeʔi	LL	mud	81.	ʃii	LL	grandfather
59.	ndiði	MM	pulque	82.	ʃĩʔĩ	LL	mushroom
60.	ndisa	LL	sandal	83.	ʃoo	MM	griddle
61.	ndoo	LL	sugarcane	84.	tata	LL	medicine

85.	teʔnde	HL	<i>is cutting</i>	101.	ʒoo	ML	<i>water jug</i>
86.	teʔnde	LL	<i>will cut</i>	102.	ʒoðo	LL	<i>grinding stone</i>
87.	tei	ML	<i>chair</i>	103.	ʒoʔo	ML	<i>rope</i>
88.	titʃi	LL	<i>avocado</i>	104.	ʒyʔa	LL	<i>thread</i>
89.	tila	LM	<i>bird</i>	105.	ʒyʔy	ML	<i>mouth</i>
90.	tĩnã	LM	<i>dog</i>	106.	ʒyy	LL	<i>rock</i>
91.	tijɪ	LM	<i>stomach</i>	107.	ʔia	MM	<i>sour</i>
92.	ti ʒaka	LMM	<i>fish</i>	108.	ʔiʔi	HH	<i>raw</i>
93.	tõmĩ	HM	<i>feather</i>	109.	ʔĩĩ	LL	<i>salt</i>
94.	tyty	ML	<i>paper</i>	110.	ʔĩĩ	LL	<i>nine</i>
95.	ʒaa	HL	<i>tongue</i>	111.	ʔĩĩ	MM	<i>one</i>
96.	ʒakwa	MM	<i>crooked</i>	112.	ʔĩõ	ML	<i>thorn</i>
97.	ʒeʔe	HH	<i>door</i>	113.	ʔĩnĩ	MM	<i>warm</i>
98.	ʒikõ	ML	<i>furrow</i>	114.	ʔĩnõ	LL	<i>six</i>
99.	ʒitõ	ML	<i>tree</i>	115.	ʔoa	LL	<i>bitter</i>
100.	ʒoko	LL	<i>steam</i>	116.	ʔysa	LL	<i>seven</i>

Questions relating to the Huajuapán Mixtec data.

1. Is nasalization contrastive?
2. Consider the distribution of all consonants with respect to nasalized vowels? Which ones are defective in their distribution?
3. Consider the distribution of nasalized vowels. Is there anything to comment on?
4. Consider how glottal stop should be analyzed.
5. How will you analyze [kj], [kw], and [tʃ]?

Tairora (Papua New Guinea)

All verbs in Tairora conjugate like one of the following verbs. (For the purposes of this problem, analyze the suffixes as monomorphemic chunks.)

	<i>speak</i>	<i>go</i>	<i>eat</i>
Past 3s	tiba	biba	naiba
Dubitative 2	tireera	bireera	naireera
Perfective 3s	tira	bira	naira
Imperative Sg	tiena	buana	naana
Imperative Pl	tieta	buata	naata
Avolitional 1	tieroora	buaroora	naaroora
Abilitative 3s	tiendaroo	buandaroo	naandaroo
Past 1s	turauka	burauka	naurauka
Perfect 1	tunara	bunara	naunara
Far Past 3s	tura	bura	noora
Far Past 2s	tunara	bunara	noonara
Avolitional 2	tiroora	biroora	neeroora
Avolitional 3p	tiboora	biboora	neeboora
Neutral	ti	bi	nee
Customary 3p	tika	bika	neeka

Tabaru (Indonesia)

Monomorphemic words fall into two major patterns if they consist of more than one syllable. Examine all of the data below and propose a single, simple stress rule. This rule interacts with other phonological rules which you may wish to propose. Hint: the data at the bottom of the page are as important as those at the top.

Words with penultimate stress

'goa	<i>buttocks</i>	pa'jake	<i>illness</i>
'mao	<i>feel</i>	be'leka	<i>shoulder</i>
'ʔawe	<i>thread</i>	sa'maka	<i>watermelon</i>
'ʔuru	<i>mouth</i>	ka'kawo	<i>ash</i>
'sira	<i>first</i>	mo'didi	<i>two</i>
'rio	<i>footprint</i>	tʃa'ana	<i>pants</i>
'bira	<i>rice</i>	mo'doka	<i>marry</i>
'geri	<i>brother-in-law</i>	do'woŋi	<i>sand</i>

Words with antepenultimate stress (always with identical vowels in last two syllables)

'odomo	<i>eat</i>	'sowoko	<i>fruit</i>
'ʔakere	<i>water</i>	'wekata	<i>wife</i>
'gogere	<i>sit</i>	'sauku	<i>hot</i>
'naoko	<i>fish</i>	'obiri	<i>night</i>
'koana	<i>sultan</i>	'osisi	<i>urinate</i>
go'somaŋa	<i>crocodile</i>	tumu'diiŋi	<i>seven</i>
gu'mutuku	<i>rope</i>	bo'ʔosuku	<i>grave</i>

If a word has a suffix, stress always falls on the penultimate syllable.

'kula	<i>give</i>	ku'lasi	<i>still give</i>
'tike	<i>look for</i>	ti'kesi	<i>still look for</i>
'ʔokere	<i>drink</i>	ʔoke'rosi	<i>still drink</i>
'make	<i>see</i>	ma'kewa	<i>not see</i>
tu'ʔuru	<i>follow</i>	tuʔu'ruwa	<i>not follow</i>
bo'dito	<i>have misfortune</i>	bodi'towa	<i>not have misfortune</i>
'pidili	<i>release</i>	pidi'luwa	<i>not release</i>
'odomo	<i>eat</i>	odo'muwa	<i>not eat</i>
pa'ʔasana	<i>beat</i>	paʔasa'nuwa	<i>not beat</i>
'punusu	<i>be full</i>	punu'suwa	<i>not be full</i>

Seri (Mexico)

<i>if I ...</i>	<i>if you ...</i>	<i>if s/he ...</i>	<i>did I ...</i>	<i>did you ...</i>	<i>did s/he ...</i>	
iʔ'pooʔo	im'pooʔo	i'pooʔo	iʔ'taʔo	in'taʔo	i'taʔo	<i>see it/him/her</i>
iʔ'pooʃt	im'pooʃt	i'pooʃt	iʔ'taʃt	in'taʃt	i'taʃt	<i>tattoo him/her</i>
iʔ'poom	im'poom	i'poom	iʔ'tam	in'tam	i'tam	<i>swallow it</i>
iʔ'pam	im'pam	'pam	iʔp'toom	in'toom	'toom	<i>swallow (unspec.)</i>
iʔ'poitom	im'poitom	'poitom	iʔp'taitom	in'taitom	'taitom	<i>talk</i>
iʔ'pooʆp	im'pooʆp	'pooʆp	iʔp'taʆp	in'taʆp	'taʆp	<i>arrive</i>
iʔ'poosim	im'poosim	'poosim	iʔp'tasim	in'tasim	'tasim	<i>laugh</i>
iʔ'pootæxa	im'pootæxa	'pootæxa	iʔp'tætæxa	in'tætæxa	'tætæxa	<i>stagger</i>
iʔ'pookta	im'pookta	i'pookta	iʔ'tookta	in'tookta	i'tookta	<i>look at it/him/her</i>
iʔ'pooŋt	im'pooŋt	i'pooŋt	iʔ'tooŋt	in'tooŋt	i'tooŋt	<i>stir it</i>
iʔ'patx	im'patx	'patx	iʔp'totx	in'totx	'totx	<i>arise</i>
iʔ'pii	im'pii	i'pii	iʔ'tii	in'tii	i'tii	<i>hear it/him/her</i>
iʔ'piim	im'piim	'piim	iʔp'tiim	in'tiim	'tiim	<i>sleep</i>
iʔ'paai	im'paai	i'paai	iʔ'taai	in'taai	i'taai	<i>do it</i>
iʔ'paaʆʃx	im'paaʆʃx	'paaʆʃx	iʔp'taaʆʃx	in'taaʆʃx	'taaʆʃx	<i>be fast</i>
iʔpo'pii	impo'pii	ipo'pii	iʔ'tpii	in'tpii	i'tpii	<i>taste it</i>
iʔpo'panʃx	impo'panʃx	po'panʃx	iʔp'tpanʃx	in'tpanʃx	'tpanʃx	<i>run</i>
iʔpo'ʃxok	impo'ʃxok	ipo'ʃxok	iʔ'tʃxok	in'tʃxok	i'tʃxok	<i>hack it off</i>
		po'masoʃt			'tmasoʃt	<i>be yellow</i>
iʔpo'sanx	impo'sanx	ipo'sanx	iʔ'tsanx	in'tsanx	i'tsanx	<i>carry him/her on back</i>
iʔpa'sanx	impa'sanx	pa'sanx	iʔpto'sanx	into'sanx	to'sanx	<i>carry on back (unspecified)</i>
iʔ'piip	im'piip	i'piip	iʔ'tiip	in'tiip	i'tiip	<i>carry it on head</i>
iʔ'pæp	im'pæp	'pæp	iʔp'tæp	in'tæp	'tæp	<i>carry on head (unspecified)</i>
iʔpo'ifx	impo'ifx	ipo'ifx	iʔ'ttifx	in'ttifx	i'ttifx	<i>grind it</i>
iʔpa'ifx	impa'ifx	pa'ifx	iʔpto'ifx	into'ifx	to'ifx	<i>grind (unspecified)</i>

Seri (negative of previous page):

iʔpo'maʔo	impo'maʔo	ipo'maʔo	iʔ'tkṵāʔo	in'tkṵāʔo	i'tkṵāʔo	<i>see it/him/her</i>
iʔpo'maʃt	impo'maʃt	ipo'maʃt	iʔ'tkṵāʃt	in'tkṵāʃt	i'tkṵāʃt	<i>tattoo him/her</i>
iʔpo'mam	impo'mam	ipo'mam	iʔ'tkṵām	in'tkṵām	i'tkṵām	<i>swallow it</i>
iʔpo'moom	impo'moom	po'moom	iʔp'tkṵōōm	in'tkṵōōm	'tmoom	<i>swallow</i>
iʔpo'maitom	impo'maitom	po'maitom	iʔp'tkṵāĩtom	in'tkṵāĩtom	'tmaitom	<i>talk</i>
iʔpo'maʔp	impo'maʔp	po'maʔp	iʔp'tkṵāʔp	in'tkṵāʔp	'tmaʔp	<i>arrive</i>
iʔpo'masim	impo'masim	po'masim	iʔp'tkṵāsim	in'tkṵāsim	'tmasim	<i>laugh</i>
iʔpo'mætæxa	impo'mætæxa	po'mætæxa	iʔp'tkṵæ̃tæxa	in'tkṵæ̃tæxa	'tmætæxa	<i>stagger</i>
iʔpo'mookta	impo'mookta	ipo'mookta	iʔ'tkṵōōkta	in'tkṵōōkta	i'tkṵōōkta	<i>look at it/him/her</i>
iʔpo'moonʔ	impo'moonʔ	ipo'moonʔ	iʔ'tkṵōōnʔ	in'tkṵōōnʔ	i'tkṵōōnʔ	<i>stir it</i>
iʔpo'motx	impo'motx	po'motx	iʔp'tkṵōtx	in'tkṵōtx	'tmotx	<i>arise</i>
iʔpo'mii	impo'mii	ipo'mii	iʔ'tkṵĩĩ	in'tkṵĩĩ	i'tkṵĩĩ	<i>hear it/him/her</i>
iʔpo'miim	impo'miim	po'miim	iʔp'tkṵĩĩm	in'tkṵĩĩm	'tmiim	<i>sleep</i>
iʔpo'maai	impo'maai	ipo'maai	iʔ'tkṵāāĩ	in'tkṵāāĩ	i'tkṵāāĩ	<i>do it</i>
iʔpo'maaʔʃx	impo'maaʔʃx	po'maaʔʃx	iʔp'tkṵāāʔʃx	in'tkṵāāʔʃx	'tmaaʔʃx	<i>be fast</i>
iʔpom'pii	impom'pii	ipom'pii	iʔtkom'pii	intkom'pii	itkom'pii	<i>taste it</i>
iʔpom'panʃx	impom'panʃx	pom'panʃx	iʔptkom'panʃx	intkom'panʃx	tom'panʃx	<i>run</i>
iʔpon'ʃxok	impon'ʃxok	ipon'ʃxok	iʔtkon'ʃxok	intkon'ʃxok	itkon'ʃxok	<i>hack it off</i>
		pom'masoʔ			tom'masoʔ	<i>be yellow</i>
iʔpon'sanx	impon'sanx	ipon'sanx	iʔtkon'sanx	intkon'sanx	itkon'sanx	<i>carry him/her on back</i>
iʔpomo'sanx	impomo'sanx	pomo'sanx	iʔptkṵō'sanx	intkṵō'sanx	tmo'sanx	<i>carry on back (unspec.)</i>
iʔpo'miip	impo'miip	ipo'miip	iʔ'tkṵĩĩp	in'tkṵĩĩp	i'tkṵĩĩp	<i>carry it on head</i>
iʔpo'mæp	impo'mæp	po'mæp	iʔp'tkṵæ̃p	in'tkṵæ̃p	'tmæp	<i>carry on head (unspec.)</i>
iʔpom'miʃx	impom'miʃx	ipom'miʃx	iʔtkom'miʃx	intkom'miʃx	itkom'miʃx	<i>grind it</i>
iʔpomo'iʃx	impomo'iʃx	pomo'iʃx	iʔptkṵō'iʃx	intkṵō'iʃx	tmo'iʃx	<i>grind (unspec.)</i>

Seri (affirmative passive of first page)

iʔpo'paʔo	impo'paʔo	po'paʔo	iʔp'tpaʔo	in'tpaʔo	'tpaʔo	<i>see</i>
iʔpo'pakta	impo'pakta	po'pakta	iʔp'tpakta	in'tpakta	'tpakta	<i>look at</i>
iʔpo'pæ	impo'pæ	po'pæ	iʔp'tpæ	in'tpæ	'tpæ	<i>hear</i>
		po'paii			'tpaii	<i>do</i>
		paʔ'pii			taʔ'pii	<i>taste</i>
		paʔ'ʃχok			taʔ'ʃχok	<i>hack off</i>
iʔpaʔ'sanx	impaʔ'sanx	paʔ'sanx	iʔptaʔ'sanx	intaʔ'sanx	taʔ'sanx	<i>carry on back</i>
		po'pæp			'tpæp	<i>carry on head</i>
		paʔ'ifx			taʔ'ifx	<i>grind</i>

Negative passive of first page:

iʔpom'paʔo	impom'paʔo	pom'paʔo	iʔptkom'paʔo	intkom'paʔo	tom'paʔo	<i>see</i>
iʔpom'pakta	impom'pakta	pom'pakta	iʔptkom'pakta	intkom'pakta	tom'pakta	<i>look at</i>
iʔpom'pæ	impom'pæ	pom'pæ	iʔptkom'pæ	intkom'pæ	tom'pæ	<i>hear</i>
		pom'paii			tom'paii	<i>do</i>
		pomaʔ'pii			tomaʔ'pii	<i>taste</i>

Miscellaneous:

maʔ'taʔo	<i>did I see you?</i>
ma'taʔo	<i>did s/he see you?</i>
'kiʔja n'taʔo	<i>who did you see?</i>
'aʃja i'taʔo	<i>what did he see?</i>

Seri (continued)

<i>I ...!</i>	<i>you ...!</i>	<i>s/he ...!</i>	<i>I did ...</i>	<i>you did ...</i>	<i>s/he did ...</i>	
iʔ'χooʔo	iN'χooʔo	i'χooʔo	iʔ'jooʔo	ɪn'jooʔo	i'jooʔo	<i>see it/him/her</i>
iʔ'χooʃt	iN'χooʃt	i'χooʃt	iʔ'jooʃt	ɪn'jooʃt	i'jooʃt	<i>tattoo him/her</i>
iʔ'χoom	iN'χoom	i'χoom	iʔ'joom	ɪn'joom	i'joom	<i>swallow it</i>
iʔp'χ ^w am	iN'χ ^w am	'χ ^w am	iʔp'jam	ɪn'jam	'jam	<i>swallow</i>
iʔp'χoitom	iN'χoitom	'χoitom	iʔp'joitom	ɪn'joitom	'joitom	<i>talk</i>
iʔp'χooʃp	iN'χooʃp	'χooʃp	iʔp'jooʃp	ɪn'jooʃp	'jooʃp	<i>arrive</i>
iʔp'χoosim	iN'χoosim	'χoosim	iʔp'joosim	ɪn'joosim	'joosim	<i>laugh</i>
iʔp'χootæxa	iN'χootæxa	'χootæxa	iʔp'jootæxa	ɪn'jootæxa	'jootæxa	<i>stagger</i>
iʔ'χookta	iN'χookta	i'χookta	iʔ'jookta	ɪn'jookta	i'jookta	<i>look at it/him/her</i>
iʔ'χoonʔ	iN'χoonʔ	i'χoonʔ	iʔ'joonʔ	ɪn'joonʔ	i'joonʔ	<i>stir it</i>
iʔp'χ ^w atx	iN'χ ^w atx	'χ ^w atx	iʔp'jatx	ɪn'jatx	'jatx	<i>arise</i>
iʔ'χii	iN'χii	i'χii	iʔ'jii	ɪn'jii	i'jii	<i>hear it/him/her</i>
iʔp'χiim	iN'χiim	i'χiim	iʔp'jiim	ɪn'jiim	i'jiim	<i>sleep</i>
iʔ'χaai	iN'χaai	i'χaai	iʔ'jaai	ɪn'jaai	i'jaai	<i>do it</i>
iʔp'χaaʃʃχ	iN'χaaʃʃχ	'χaaʃʃχ	iʔp'jaaʃʃχ	ɪn'jaaʃʃχ	'jaaʃʃχ	<i>be fast</i>
iʔχo'pii	iNχo'pii	iχo'pii	iʔjo'pii	ɪnjo'pii	ijo'pii	<i>taste it</i>
iʔpχo'panʃχ	iNχo'panʃχ	χo'panʃχ	iʔpjo'panʃχ	ɪnjo'panʃχ	jo'panʃχ	<i>run</i>
iʔχo'ʃχok	iNχo'ʃχok	iχo'ʃχok	iʔjo'ʃχok	ɪnjo'ʃχok	ijo'ʃχok	<i>hack it off</i>
		χo'masoʔ			jo'masoʔ	<i>be yellow</i>
iʔχo'sanx	iNχo'sanx	iχo'sanx	iʔjo'sanx	ɪnjo'sanx	ijo'sanx	<i>carry him/her on back</i>
iʔpχ ^w a'sanx	iNχ ^w a'sanx	χ ^w a'sanx	iʔpja'sanx	ɪnja'sanx	ja'sanx	<i>carry on back (unspec.)</i>
iʔ'χiip	iN'χiip	i'χiip	iʔ'jiip	ɪn'jiip	i'jiip	<i>carry it on head</i>
iʔp'χæp	iN'χæp	'χæp	iʔp'jæp	ɪn'jæp	'jæp	<i>carry on head (unspec.)</i>
iʔχo'ifx	iNχo'ifx	iχo'ifx	iʔjo'ifx	ɪnjo'ifx	ijo'ifx	<i>grind it</i>
iʔpχ ^w a'ifx	iNχ ^w a'ifx	χ ^w a'ifx	iʔpja'ifx	ɪnja'ifx	ja'ifx	<i>grind (unspec.)</i>

Negative of previous page

iʔxo'maʔo	iNxo'maʔo	ixo'maʔo	iʔjo'maʔo	ɪŋjo'maʔo	ijo'maʔo	<i>see it/him/her</i>
iʔpxo'maɸp	iNxo'maɸp	xo'maɸp	iʔpjo'maɸp	ɪŋjo'maɸp	jo'maɸp	<i>arrive</i>
iʔxo'mookta	iNxo'mookta	ixo'mookta	iʔjo'mookta	ɪŋjo'mookta	ijo'mookta	<i>look at it/him/her</i>
iʔpxo'motx	iNxo'motx	xo'motx	iʔpjo'motx	ɪŋjo'motx	jo'motx	<i>arise</i>
iʔxo'mii	iNxo'mii	ixo'mii	iʔjo'mii	ɪŋjo'mii	ijo'mii	<i>hear it/him/her</i>
iʔpxo'miim	iNxo'miim	xo'miim	iʔpjo'miim	ɪŋjo'miim	jo'miim	<i>sleep</i>
iʔxom'pii	iNxom'pii	xom'pii	iʔjom'pii	ɪŋjom'pii	ijom'pii	<i>taste it</i>
iʔpxom'panʃx	iNxom'panʃx	xom'panʃx	iʔpjom'panʃx	ɪŋjom'panʃx	jom'panʃx	<i>run</i>

Affirmative Passive of previous page

iʔpxo'paʔo	iNxo'paʔo	xo'paʔo	iʔpjo'paʔo	ɪŋjo'paʔo	jo'paʔo	<i>see</i>
iʔpxo'pakta	iNxo'pakta	xo'pakta	iʔpjo'pakta	ɪŋjo'pakta	jo'pakta	<i>look at</i>
iʔpxo'pæ	iNxo'pæ	xo'pæ	iʔpjo'pæ	ɪŋjo'pæ	jo'pæ	<i>hear</i>
		xaʔ'pii			jaʔ'pii	<i>taste</i>

Negative Passive of previous page

iʔpxom'paʔo	iNxom'paʔo	xom'paʔo	iʔpjom'paʔo	ɪŋjom'paʔo	jom'paʔo	<i>see</i>
iʔpxom'pakta	iNxom'pakta	xom'pakta	iʔpjom'pakta	ɪŋjom'pakta	jom'pakta	<i>look at</i>
iʔpxom'pæ	iNxom'pæ	xom'pæ	iʔpjom'pæ	ɪŋjom'pæ	jom'pæ	<i>hear</i>
		xomaʔ'pii			jomaʔ'pii	<i>taste</i>

Seri (continued)

<i>I ...</i>	<i>you ...</i>	<i>s/he ...</i>	<i>I will ...</i>	<i>you will ...</i>	<i>s/he will ...</i>	
iʔ'miiʔo	im'miiʔo	i'miiʔo	iʔ'siiʔo	in'siiʔo	i'siiʔo	<i>see it/him/her</i>
iʔ'miiʃt	im'miiʃt	i'miiʃt	iʔ'siiʃt	in'siiʃt	i'siiʃt	<i>tattoo him/her</i>
iʔ'miim	im'miim	i'miim	iʔ'siim	in'siim	i'siim	<i>swallow it</i>
iʔp'moom	im'moom	'moom	iʔp'soom	in'soom	'soom	<i>swallow</i>
iʔp'miitom	im'miitom	'miitom	iʔp'siitom	in'siitom	'siitom	<i>talk</i>
iʔp'miiʔp	im'miiʔp	'miiʔp	iʔp'siiʔp	in'siiʔp	'siiʔp	<i>arrive</i>
iʔp'miisim	im'miisim	'miisim	iʔp'siisim	in'siisim	'siisim	<i>laugh</i>
iʔp'miitæxa	im'miitæxa	'miitæxa	iʔp'siitæxa	in'siitæxa	'siitæxa	<i>stagger</i>
iʔ'mookta	im'mookta	i'mookta	iʔ'sookta	in'sookta	i'sookta	<i>look at it/him/her</i>
iʔ'moonʔ	im'moonʔ	i'moonʔ	iʔ'soonʔ	in'soonʔ	i'soonʔ	<i>stir it</i>
iʔp'motx	im'motx	'motx	iʔp'sotx	in'sotx	'sotx	<i>arise</i>
iʔ'mii	im'mii	i'mii	iʔ'sii	in'sii	i'sii	<i>hear it/him/her</i>
iʔp'miim	im'miim	'miim	iʔp'siim	in'siim	'siim	<i>sleep</i>
iʔ'maai	im'maai	i'maai	iʔ'saai	in'saai	i'saai	<i>do it</i>
iʔp'maaʔʃx	im'maaʔʃx	'maaʔʃx	iʔp'saaʔʃx	in'saaʔʃx	'saaʔʃx	<i>go fast</i>
iʔm'pii	mim'pii	im'pii	iʔ'spii	in'spii	i'spii	<i>taste it</i>
iʔpim'panʃx	mim'panʃx	im'panʃx	iʔp'spanʃx	in'spanʃx	'spanʃx	<i>run</i>
iʔŋ'ʃxok	min'ʃxok	in'ʃxok	iʔ'ʃʃxok	in'ʃʃxok	i'ʃʃxok	<i>hack it off</i>
		im'masoʔ			'smasoʔ	<i>be yellow</i>
iʔŋ'sanx	min'sanx	in'sanx	iʔ'ssanx	in'ssanx	i'ssanx	<i>carry him/her on back</i>
iʔpmo'sanx	immo'sanx	mo'sanx	iʔpso'sanx	inso'sanx	so'sanx	<i>carry on back</i>
iʔ'miip	im'miip	i'miip	iʔ'siip	in'siip	i'siip	<i>carry it on head</i>
iʔp'mæp	im'mæp	'mæp	iʔp'sæp	in'sæp	'sæp	<i>carry on head</i>
iʔm'mifx	mim'mifx	im'mifx	iʔ'ssifx	in'ssifx	i'ssifx	<i>grind it</i>
iʔpmo'ifx	immo'ifx	mo'ifx	iʔpso'ifx	inso'ifx	so'ifx	<i>grind</i>

Negative of previous page

There are no negative forms of this tense.

i?'skwã?o	in'skwã?o	i'skwã?o	<i>see it/him/her</i>
i?p'skwãφp	in'skwãφp	'smaφp	<i>arrive</i>
i?'skwõõkta	in'skwõõkta	i'skwõõkta	<i>look at it/him/her</i>
i?p'skwõtx	in'skwõtx	'smotx	<i>arise</i>
i?'skwĩĩ	in'skwĩĩ	i'skwĩĩ	<i>hear it/him/her</i>
i?p'skwĩĩm	in'skwĩĩm	'smiim	<i>sleep</i>
i?skom'pii	inskom'pii	iskom'pii	<i>taste it</i>
i?pskom'panfχ	inskom'panfχ	som'panfχ	<i>run</i>

Affirmative Passive of previous page

i?pim'pa?o	mim'pa?o	im'pa?o	i?p'spa?o	ins'pa?o	'spa?o	<i>see</i>
i?pim'pakta	mim'pakta	im'pakta	i?p'spakta	ins'pakta	'spakta	<i>look at</i>
i?pim'pæ	mim'pæ	im'pæ	i?p'spæ	in'spæ	'spæ	<i>hear</i>
		ima?'pii			sa?'pii	<i>taste</i>

Negative Passive of previous page

i?pskom'pa?o	inskom'pa?o	som'pa?o	<i>see</i>
i?pskom'pakta	inskom'pakta	som'pakta	<i>look at</i>
i?pskom'pæ	inskom'pæ	som'pæ	<i>hear</i>
		sma?'pii	<i>taste</i>

Seri (continued)

<i>who ...</i>	<i>who will ...</i>	<i>Imperative</i>	<i>that I ...</i>	<i>that you ...</i>	<i>that s/he ...</i>	
'kiʔo	'siiʔo	'kaʔo	'ʔiiʔo	'miiʔo	'iiʔo	<i>see it/him/her</i>
'kiʃt	'siiʃt	'kaʃt	'ʔiiʃt	'miiʃt	'iiʃt	<i>tattoo him/her</i>
'kim	'siim	'kam	'ʔiim	'miim	'iim	<i>swallow it</i>
'koom	'soom	'am	iʔ'jam	ɪn'jam	'jam	<i>swallow</i>
'kaitom	'siitom	'kaitom	'ʔiitom	'miitom	'iitom	<i>talk</i>
'kaɸp	'siiɸp	'kaɸp	'ʔiiɸp	'miiɸp	'iiɸp	<i>arrive</i>
'kasim	'siisim	'kasim	'ʔiisim	'miisim	'iisim	<i>laugh</i>
'kætæxa	'siitæxa	'kætæxa	'ʔiitæxa	'miitæxa	'iitæxa	<i>stagger</i>
'kookta	'sookta	'ʔookta	'ʔi'ʔookta	mi'ʔookta	i'ʔookta	<i>look at it/him/her</i>
'koonʔ	'soonʔ	'ʔoonʔ	'ʔi'ʔoonʔ	mi'ʔoonʔ	i'ʔoonʔ	<i>stir it</i>
'kotx	'sotx	'atx	iʔ'jatx	ɪn'jatx	'jatx	<i>arise</i>
'kii	'sii	'ʔii	'ʔi'ʔii	mi'ʔii	i'ʔii	<i>hear it/him/her</i>
'kiim	'siim	'ʔiim	'ʔi'ʔiim	mi'ʔiim	i'ʔiim	<i>sleep</i>
'kaai	'saai	ʔaai	'ʔi'ʔaai	mi'ʔaai	i'ʔaai	<i>do it</i>
'kaaɸʃχ	'saaɸʃχ	'aaɸʃχ	iʔ'jaaɸʃχ	ɪn'jaaɸʃχ	'jaaɸʃχ	<i>be fast</i>
'kpii	'spii	iʔ'pii	'ʔi'pii	mi'pii	i'pii	<i>taste it</i>
'kpanʃχ	'spanʃχ	iʔ'panʃχ	'ʔi'panʃχ	mi'panʃχ	i'panʃχ	<i>run</i>
'kʃχok	'ʃʃχok	iʔ'ʃχok	'ʔi'ʃχok	mi'ʃχok	i'ʃχok	<i>hack it off</i>
'kwãsoʔ	'smasoʔ				i'masoʔ	<i>be yellow</i>
'ksanx	'ssanx	iʔ'sanx	'ʔi'sanx	mi'sanx	i'sanx	<i>carry him/her on back</i>
ko'sanx	so'sanx	a'sanx	iʔja'sanx	ɪnja'sanx	ja'sanx	<i>carry on back (unspec.)</i>
'kiip	'siip	'ʔiip	'ʔi'ʔiip	mi'ʔiip	i'ʔiip	<i>carry it on head</i>
'kæp	'sæp	'æp	iʔ'jæp	ɪn'jæp	'jæp	<i>carry on head (unspec.)</i>
'kkifx	'ssifx	i'ʔifx	'ʔiifx	'miiifx	'iifx	<i>grind it</i>
ko'ifx	so'ifx	a'ifx	iʔja'ifx	ɪnja'ifx	ja'ifx	<i>grind (unspec.)</i>

Negative of previous page

i'maʔo	'smaʔo	'kṵāʔo	ʔi'maʔo	mi'maʔo	i'maʔo	<i>see it/him/her</i>
i'maʔp	'smaʔp	'kṵāʔp	ʔi'maʔp	mi'maʔp	i'maʔp	<i>arrive</i>
i'mookta	'smookta	'kṵōōkta	ʔi'mookta	mi'mookta	i'mookta	<i>look at it/him/her</i>
i'mii	'smii	'kṵīī	ʔi'mii	mi'mii	i'mii	<i>hear it/him/her</i>
i'miim	'smiim	'kṵīīm	ʔi'miim	mi'miim	i'miim	<i>sleep</i>
i'maai	'smaai	'kṵāāī	ʔi'maai	mi'maai	i'maai	<i>do it</i>
im'pii	som'pii	kom'pii	ʔim'pii	mim'pii	im'pii	<i>taste it</i>
im'panʃχ	som'panʃχ	kom'panʃχ	ʔim'panʃχ	mim'panʃχ	im'panʃχ	<i>run</i>
im'masoʔ	som'masoʔ				im'masoʔ	<i>be yellow</i>
in'sanx	son'sanx	kon'sanx	ʔin'sanx	min'sanx	in'sanx	<i>carry him on back</i>

Affirmative Passive

ʔa'paʔo	'spaʔo		ʔi'paʔo	mi'paʔo	i'paʔo	<i>see</i>
ʔa'pakta	'spakta		ʔi'pakta	mi'pakta	i'pakta	<i>look at</i>
ʔa'pæ	'spæ		ʔi'pæ	mi'pæ	i'pæ	<i>hear</i>
ʔa'paii	'spaii				i'paii	<i>do</i>
ʔa'pii	sa'ʔpii				iʔa'pii	<i>taste</i>
			ʔiʔa'sanx	miʔa'sanx	iʔa'sanx	<i>carry on back</i>

Negative Passive

im'paʔo	som'paʔo		ʔim'paʔo	mim'paʔo	im'paʔo	<i>see</i>
im'pakta	som'pakta		ʔim'pakta	mim'pakta	im'pakta	<i>look at</i>
im'pæ	som'pæ		ʔim'pæ	mim'pæ	im'pæ	<i>hear</i>
im'paii	som'paii				im'paii	<i>do</i>
imaʔ'pii	smaʔ'pii				imaʔ'pii	<i>taste</i>

Seri (continued)

<i>what I ...</i>	<i>what you ...</i>	<i>what she ...</i>	<i>I can ...^a</i>	<i>you can ...</i>	<i>s/he can ...</i>	
ʔo'kooʔo	mo'kooʔo	o'kooʔo	iʔ'tkṵãʔo	in'tkṵãʔo	i'tkṵãʔo	<i>see it/him/her</i>
'ʔooʃt	'mooʃt	'ooʃt	iʔ'tkṵãʃt	in'tkṵãʃt	i'tkṵãʃt	<i>tattoo him/her</i>
'ʔoom	'moom	'oom	iʔ'tkṵãm	in'tkṵãm	i'tkṵãm	<i>swallow it</i>
			iʔp'tkṵãĩtom	in'tkṵãĩtom	'tmaitom	<i>talk</i>
			iʔp'tkṵãʔp	in'tkṵãʔp	'tmaʔp	<i>arrive</i>
			iʔp'tkṵãsim	in'tkṵãsim	'tmasim	<i>laugh</i>
ʔo'akta	mo'akta	o'akta	iʔ'tkṵõõkta	in'tkṵõõkta	i'tkṵõõkta	<i>look at it/him/her</i>
ʔo'anʔ	mo'anʔ	o'anʔ	iʔ'tkṵõõnʔ	in'tkṵõõnʔ	i'tkṵõõnʔ	<i>stir it</i>
			iʔp'tkṵõtx	in'tkṵõtx	'tmotx	<i>arise</i>
'ʔii	'mii	'ii	iʔ'tkṵĩĩ	in'tkṵĩĩ	i'tkṵĩĩ	<i>hear it/him/her</i>
			iʔp'tkṵĩĩm	in'tkṵĩĩm	'tmiim	<i>sleep</i>
iʔ'jaai	in'jaai	'jaai	iʔ'tkṵããĩ	in'tkṵããĩ	i'tkṵããĩ	<i>do it</i>
			iʔp'tkṵããʔʃx	in'tkṵããʔʃx	'tmaaʔʃx	<i>be fast</i>
ʔo'pii	mo'pii	o'pii	iʔtkom'pii	intkom'pii	itkom'pii	<i>taste it</i>
			iʔptkom'panʃx	intkom'panʃx	tom'panʃx	<i>run</i>

Negative of above

ʔi'maʔo	mi'maʔo	i'maʔo	(nonexistent)			<i>see</i>
ʔi'mookta	mi'mookta	i'mookta				<i>look at</i>
ʔi'mii	mi'mii	i'mii				<i>hear</i>
ʔi'maai	mi'maai	i'maai				<i>do</i>
ʔim'pii	mim'pii	im'pii				<i>taste</i>

^a Verbs in this tense are also generally followed by another morpheme (ʔo), thus making them distinct from otherwise homophonous verb forms. Thus, *I can see it* is actually [iʔ'tkṵãʔoʔo]

Seri (continued)

<i>to ...</i>	<i>to (passive) ...</i>	
i'ʔaʔo	ika'paʔo	<i>see</i>
i'ʔaʃt	ika'paʃt	<i>tattoo</i>
i'ʔam	ika'pam	<i>swallow</i>
i'kaitom		<i>talk</i>
i'kaʔp		<i>arrive</i>
i'kasim		<i>laugh</i>
i'kætæxa		<i>stagger</i>
i'ʔakta	ika'pakta	<i>look at</i>
i'ʔanʔ	ika'panʔ	<i>stir</i>
i'kotx		<i>arise</i>
i'ʔii	ika'pæ	<i>hear</i>
i'kiim		<i>sleep</i>
i'ʔaai	ika'paii	<i>do</i>
i'kaaʔʃx		<i>be fast</i>
iʔa'pii	ikaʔ'pii	<i>taste</i>
ika'panʃx		<i>run</i>
iʔa'ʃxok	ikaʔ'ʃxok	<i>hack off</i>
ika'masoʔ		<i>be yellow</i>
iʔa'sanx	ikaʔ'sanx	<i>carry on back</i>
iko'sanx		<i>carry on back (unspecified)</i>
i'ʔiip	ika'pæp	<i>carry on head</i>
i'kæp		<i>carry on head (unspecified)</i>
iʔa'ifx	ikaʔ'ifx	<i>grind</i>
iko'ifx		<i>grind (unspecified)</i>

Seri (continued)

*iʔa'maʔo (*to not see*), *ikam'paʔo (*to not be seen*) (i.e., there are no negative infinitives)

mai'ʔaʃt *to tattoo you*

The data below are given only as some items that may affect how you look at some of the verb data.

<i>my...</i>	<i>your...</i>	<i>his/her...</i>	<i>Unpossessed</i>	
ʔi'ʃit	mi'ʃit	i'ʃit	ʔa'ʃit	<i>head</i>
'ʔiiʃ	'miiʃ	'iiʃ	'ʔaaʃ	<i>nose</i>
ʔi'tææn	mi'tææn	i'tææn	ʔa'tææn	<i>mouth</i>

Other data which may be helpful (at least somebody thought so at one time):

ko'ʃikx	<i>who covers one's shoulders (with jacket)</i>
'ʃaap	<i>roadrunner</i>
pa'xaas	<i>squid</i>
nop	<i>mountain lion</i>
k ^w i'joomxk	<i>s/he took it to him/her</i>

The marking of stress in these data should not be taken as clearly delineating syllable boundaries.

The syllables which are marked [a'i] may be pronounced [ʔai] by many people and perhaps in most situations.

APPENDIX G: GLOSSARY OF KEY CONCEPTS^b

- ablaut rule** a rule which changes one vowel into another by changing one or more of its features
- alienable class** In many languages, the difference between nouns that do not have to be possessed by someone or something (the alienable class) and those that are typically possessed by someone or something (the inalienable class) is important. Kinship terms (such as *niece*) and body part words (such as *arm*) are the two most common classes of words that are typically referred as belonging to the inalienable class of nouns. Crystal 1991: “If a possessed item is seen as having only a temporary or non-essential dependence on a possessor, it is said to be ‘alienable’, whereas if its relationship to the possessor is a permanent or necessary one, it is inalienable.”
- allomorphic evidence** evidence used in determining underlying forms (including contrastive features) that consists of the various allomorphs that a given morpheme exhibits; contrasted with ‘distributional evidence’
- allomorphs** When a morpheme has more than shape, it has is said to have more than one allomorph. Two allomorphs of the past tense suffix in English are [t] (as in *wept*) and [d] (as in *seized*). Two of the allomorphs of the noun for ‘leaf’ in English are [lijf] and [lijv] (the latter occurring when the word is plural).
- allophone** the phonetic realizations of a phoneme
- arbitrary word classes** Sometimes the vocabulary of a language divides into groups for one reason or another; if the classes do not relate to any phonological, semantic, or syntactic feature of the words in question, the classes are said to be arbitrary and are something just memorized by the language speaker. The so-called ‘strong’ verbs of English (those that form their past tense in irregular ways, such as *speak/spoke*, *get/got*, *rise/rose*, *do/did*, etc.) are a small arbitrary word class of English.
- assimilation** any process by which one sound becomes more like another in its environment
- [ATR] “advanced tongue root”—a feature which distinguishes a ‘tense’ vowel such as [i], in which the tongue root advances, with a ‘lax’ vowel such as [ɪ] in which it does not
- [back] a feature which characterizes sounds produced by backing the tongue body, such as velars and uvulars, and back vowels
- bleeding order** a relationship between ordered rules in which the rule (A) that applies first “removes a structural representation to which another rule (B) would otherwise have applied” (Crystal 1991)
- C** The symbol ‘C’ is often used as a shorthand for any consonant (non-syllabic sound).
- coalescence** the fusion of two adjacent sounds which results in a sound which shares the properties of the two original sounds
- coda** the part of a syllable which follows the nucleus, such as the *t* of the syllable *kat*
- complementary distribution** When sounds occur in mutually exclusive environments, they are said to occur in complementary distribution.
- consonant mutation rule** a rule that changes one consonant into another by altering one or more of its features
- constraints on rules** principles by which the application of rules is affected (blocked or restricted or permitted) without complicating the rules in question by the addition of specific extra features, morpheme boundaries, etc.

^b Some glosses cite David Crystal (1991) *A dictionary of linguistics and phonetics*, Basil Blackwell: Cambridge, Mass. and Oxford, England.

[continuant] Sounds that are [-continuant] include those in which the air stream is completely blocked at the primary constriction in the vocal tract (such as *b, n, l*). The inclusion of laterals in the group of non-continuant is adopted by Chomsky & Halle in *The Sound Pattern of English*. Many other discussions of this feature define it to exclude *l*.

contour segments a way of describing affricates, prenasalized stops, and similar sounds which are phonetically complex and yet function phonologically as single sounds

contour tone a tone which is viewed as being inherently non-level, such as Falling or Rising

contrast in identical environment evidence for a distinctive feature which is found in contexts which differ only in that feature (minimal pairs)

contrast in noninfluencing environments evidence for a distinctive feature which is found in contexts which may also differ in other, but supposedly irrelevant, features

contrastive features phonological features which minimally distinguish sounds which contrast in a language (most commonly known as distinctive features)

[Coronal] the major place feature node which covers sounds which are pronounced using the front or blade of the tongue (dentals, alveolars, alveopalatals); many discussions of phonology have included palatal consonants with the coronals.

declination the gradual fall in pitch that occurs from the beginning of an utterance over some span of words.

deletion the loss of a feature or segment in a given context

derivation the formal representation of how an underlying form (or concatenation of underlying forms) undergoes the phonological rules of the language; the last stage of a phonological derivation is the surface form of the word, which is often the phonetic transcription (or something close to it)

derived environment an environment for rule application which is not found in a phonological representation as it occurs in the lexicon. One common kind of derived environment is that created when word formation rules join morphemes together.

dissimilation the change by which one sound becomes less alike a neighboring sound

distinctive features (see contrastive features)

distributional evidence evidence for deciding whether features are distinctive or not distinctive, based on the contexts in which the features occur (as opposed to allomorphic evidence)

[Dorsal] the feature place node that covers sounds which are produced using the back of the tongue (palatals, velars, uvulars).

downdrift the phonetic lowering of a high tone after a low tone

downstep the lowering of a high tone after a low tone which is not part of the phonetic representation. (The low tone which triggers the downstep may or may not be independently attested.)

epenthesis the insertion of a sound in a particular context, usually motivated by syllable structure patterns

feature (in phonology) a property of the sound. Sounds are viewed as a combination of various features such as [voice] and [nasal].

feature spreading the formalization of assimilation rules by drawing new association lines between a feature and a node

feeding order a relationship between ordered rules in which the rule (A) that applies first “creates a structural representation to which another rule (B) is applicable” (Crystal 1991)

formative The term ‘formative’ is often used as a slightly more formal way to refer to a morpheme. Crystal 1991: “A formally identifiable, irreducible grammatical element which enters into the construction of larger linguistic units, such as words and sentences.”

free variation “the substitutability of one sound for another in a given environment, with no consequent change in the word’s meaning” by a speaker (Crystal 1991)

[high] If the tongue body is raised in the production of a dorsal sound, the sound is [+high] (palatals and velars, high vowels). (Caution: The definition and use of this feature in current theory is different from earlier generative theory.)

inalienable class See ‘alienable class’.

intonation “the distinctive use of patterns of pitch, or melody” (Crystal 1991) that does not relate to lexical distinctions

[Labial] the major place feature node that covers sounds which are pronounced using the lips as articulators

labialization “a secondary articulation involving any noticeable lip-rounding” (Crystal 1991)

[low] If the tongue body is lowered in the production of a vowel, it is [+low].

major place features the feature nodes currently used most commonly to distinguish between the major points of articulation are [Labial], [Coronal], and [Dorsal]

minimal pair two utterances which are distinguished only by one feature or phoneme

minor rules rules which apply to a specially marked subset of words or morphemes since the majority of cases do not undergo the rule (even they may qualify structurally to do so). The rules that changes *foot* into *feet* in the plural form is a minor rule of English which applies to a small subset of nouns.

morpheme “the minimal distinctive unit of grammar, and the central concern of morphology” (Crystal 1991). A word such as *tree* is composed of one morpheme, and the word *trees* of two.

morphological conditioning When the distribution of suppletive allomorphs is determined by the presence or absence of another morpheme in the word, that suppletive allomorphy is said to have morphological conditioning.

morphological subclassification the division of the lexicon of a language based on morphological facts, such as whether a given root may co-occur with a certain affix. For example, some adjectives in English may combine with the prefix *un-* (e.g. *happy*, *certain*, *able*), and some may not (*funny*, *melancholic*, *proud*, *tall*, *sad*). This fact points to one morphological subclassification of English adjectives.

morphology the area of linguistics that deals with word formation

multiple function formative a formative that conflates more than one fairly obvious distinct semantic or syntactic feature. The case endings of Greek conflate gender, number and case. Some languages conflate subject person and tense, so that one prefix indicates both who did the action and also whether the action was past, present or future. A pronoun such as *us* could be viewed as multiple function formative that conflates person (first), number (plural), and case (accusative). A portmanteau (q.v.) is a more radical case of a multiple function formative.

nasalization the effect on sounds which are produced while the soft palate (or velum) is lowered, allowing air to escape through the nose

[nasal] the feature describing sounds which are produced with the soft palate lowered, allowing air to escape through the nose

natural class a grouping of sounds (in the case of phonology) which is based on some inherent feature(s) of the sounds. For example, the sounds that have the feature [+voice] form a natural class, and the sounds that have the feature [-voice] form another natural class. The sounds [p], [z], and [a] do not form a natural class because they do not share any features.

non-arbitrary word classes See ‘arbitrary word classes’.

nucleus the core part of a syllable, which may consist of one or more vowels and diphthongs, or even some consonant-like sounds (cf. syllabic nasals, liquids, etc.)

- obstruent** any sound which is not a sonorant is an obstruent, characterized by a low degree of resonance (oral stops, fricatives, and affricates—regardless of whether they are voiced or voiceless)
- onset** any segments which occur before the nucleus of the syllable
- palatalization** an articulation (most commonly, a secondary articulation) “involving a movement of the tongue towards the hard palate” (Crystal 1991)
- parsability of a string** the ability of a string of sounds to be properly syllabified
- phoneme** “the minimal unit in the sound system of a language, according to traditional phonological theories” (Crystal 1991). In theories which embrace the concept of distinctive feature as the minimal unit, phonemes are conventionalized groupings of those features.
- phonetics** the area of linguistics that deals with (especially) the pronunciation of sounds
- phonological allomorphs** allomorphs of a morpheme which are derived from the same underlying form by the application of a phonological rule (as opposed to suppletive allomorphs, which have distinct underlying forms)
- phonological conditioning** When the distribution of suppletive allomorphs is determined by phonological features of adjacent morphemes, the allomorphy is said to have phonological conditioning.
- phonological rule** a rule that applies to the phonological representations altering the values of phonological features
- phonology** the area of linguistics that deals with the sounds and (especially) the sound systems of languages
- pitch** “an auditory phonetic feature, corresponding to some degree with the acoustic feature of frequency” (Crystal 1991) which is then analyzed as either intonation or tone
- pitch accent** the prominence given to one syllable in a word which is tonal in nature
- Place** the node which dominates the nodes [Labial], [Coronal], and [Dorsal] which is used in rules where all of the place features spread
- place assimilation** changes in one sound by which it becomes more like an adjacent sound with respect to place features
- portmanteau** a subtype of multiple function formative which conflates two or more morphemes which otherwise occur independently in the language. For example, ‘was’ could be considered a portmanteau in English that conflates the verb *be* and the Past tense (which is elsewhere manifested as *-d*). The morpheme *du* in French is a portmanteau in French that conflates *de* ‘of’ and *le* ‘the’ (masc. sg.).
- postposition** A postposition is analogous to a preposition in English (such as *for*, *to*, *from*) except that it follows rather than precedes the word(s) with which it forms a phrase
- reduplication** a morphological process that repeats some part or pattern of a morpheme typically as a way of indicating something like repetitive or plural
- rewrite rule** a rule that formally changes one symbol into another or others, such as $PP \rightarrow P NP$ and such as “s \rightarrow z”
- rhyme** the constituent of the syllable composed of the nucleus and the coda
- sonorant** a sound which is high in resonance, “produced with a relatively free airflow, and a vocal cord position such that spontaneous voicing is possible, as in vowels, liquids, nasals and laterals” (Crystal 1991) Glides / semivowels are also sonorants. The classification of glottal stop has been a matter of some debate. In some languages it functions like a sonorant and in others it apparently does not.
- [sonorant]** the feature which formally distinguishes the class of sonorants (see above) from the class of obstruents

- stray consonant** a consonant which cannot be included in a syllable during syllabification due to a limit on the number of segments allowed in the syllable or due to restrictions on features
- structure-preserving rule** the output of a structure-preserving rule is similar to the kinds of ‘structures’ that occur as input to the rule; for example, such a rule does not produce sounds which do not occur in underlying forms
- suppletive allomorphs** When a formative has more than one shape in the lexicon, it is said to have suppletive allomorphs. The plural morpheme in English has (among others) the suppletive allomorphs “z” (as in *dog[z]*), “en” (as in *oxen*), and zero (as in *sheep*). See also ‘syntactic conditioning’, ‘phonological conditioning’ and ‘morphological conditioning’.
- suspicious pairs** phones which, because of their phonetic similarity, might be analyzed as being allophones of a single phoneme
- syllable** a phonological unit which consists of at least a prominent element (nucleus, most typically a vowel) and optionally with preceding elements (onset) and following elements (coda)
- syllable template** the pattern by which strings of phonemes are evaluated to determine how they may be organized into syllables; the **maximal syllable template** specifies the largest type of syllable permitted
- syntactic conditioning** Suppletive allomorphy is sometimes (but not commonly) dependent on syntactic factors of the word. In that case it is said to have syntactic conditioning.
- syntax** the area of linguistics that deals with the combination of words into phrases and sentences
- tone** the use of pitch to distinguish lexical items
- underlying form** the shape that a morpheme has in the lexicon (before any phonological rules have applied to it)
- underspecification of features in underlying forms** the omission of any value for a given feature in the lexical representation of a morpheme (because it is predictable from other features or from the contexts in which the morpheme occurs)
- utterance** “a stretch of speech about which no assumptions have been made in terms of linguistic theory” (Crystal 1991) An utterance may be a single syllable or word, such as “Wow!”, a phrase, a clause, a sentence, or a speech. (Because of the wide range of possible meanings for this word, some linguists prefer to use more specific terms such as phonological phrase or intonational unit.
- V** The symbol ‘V’ is often used as a shorthand for any vowel (syllabic sound).
- [voice]** this feature distinguishes sounds like [k] from sounds like [g]; in the former, the vocal folds are not vibrating whereas in the latter (which are [+voice]) they are
- voicing assimilation** the process by which the value of the feature [voice] of one sound affects another sound
- vowel harmony** the assimilation of one vowel to another vowel in the same word (typically in an adjacent syllable)
- word** a grammatical unit, the internal characterization of which is typically viewed as being within the domain of a theory of morphology and the distribution of which is viewed as being within the domain of a theory of syntax
- word structure rule** a rule that give information about the order of morphemes within a word, which are optional These are very theory-specific in form, but simple ones are $N \rightarrow N_{\text{stem}}$ - Possessor, and $V \rightarrow \text{Subject Agreement} - \text{Tense} - (\text{NEGATIVE}) - \text{Verb}_{\text{stem}}$

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