PHONOLOGY FROM THE GROUND UP: THE BASICS

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This is the April 2019 version of the text. Two indexes have been included, but they are incomplete.

This edition has not addressed recent changes in the expectations of the *Journal of the International Phonetic Association* with respect to the presentation of the facts. The next version will do so.

A preliminary Spanish translation of this work has been prepared and used. If you are interested in using it, please contact the author at the address above.

Contents

Part II The syllable

List of figures

List of tables

Preface

An understanding of phonological analysis has been considered a basic part of education and training in linguistics for nearly a century. This book attempts to provide detailed information on one important part of this field of study.

This kind of training is useful for anyone who is teaching language because it is so foundational. It is useful for native speakers who are thinking about their own languages as well as for outsiders who are attempting to analyze (or reanalyze) a language. It is useful for people who are working only in a classroom situation as well as for those who are "on the field," for those who are teaching as well as for those who are publishing results of their investigation. This training provides a broad understanding that is important for consultants and editors. It is considered foundational for anyone who is looking at the linguistic factors that are relevant for the development of a writing system (orthography) for an unwritten language or for evaluating existing or proposed systems.

Various chapters include short exercises that are an integral part of them. The reader should do them at that point (or after having read the whole chapter), write out an explicit answer, and then see the discussion in the appendix indicated to compare his or her answer with the one given there. If any questions arise at that point, s/he should re-read the chapter and, if necessary, speak with an instructor to deal with any doubts.

This book, like most introductions to phonology, examines data from numerous languages. These are usually referred to by their most commonly used names in English. However, we also utilize the codes of the International Organization for Standardization, specifically the three-letter codes of the ISO 639-3 set that were first published in 2007 (and sometimes updated—see the list on http://www-01.sil.org/iso639-3/codes.asp; see also http://www.iso.org/iso/home/standards/language_codes.htm and http://www.loc.gov/standards/iso639-2/faq.html#22). For example, the ISO 639-3 code for English is [eng], and the one for German is [deu]. This allows unambiguous reference to the same language no matter what language is being used to write about that language (for example, "German", "Deutsch", "Alemany", "Język niemiecki" or "Tedesco" to refer to the German language), and no matter what the speakers of the language may use to refer to their own language (since this may change over time). The use of these codes is becoming expected in publications and so it is good to become used to seeing, understanding and using them.

Some languages are especially prominent in the examples used in this book. These include languages on which the author or one of his students or colleagues has done extensive fieldwork on the language. These languages and language families include the following:

1. Seri. A language isolate spoken in northwestern Mexico. ISO 639-3 code: [sei].

2. Tlapanec (Subtiaba-Tlapanec). A small language family (genus-level)[1] spoken in southern Mexico. We look at data from more than one of the languages (Acatepec Me'paa and Tlacoapa Mi'phaa).
3. Aztecan. A language family (genus-level) spoken in central Mexico, most of the languages of which are referred to as Nahuatl.
4. Zapotecan. A large language family (genus-level) spoken in southern Mexico. We look at data from more than one Zapotecan language.
5. Quechuan. A large language family (genus-level) spoken in various countries of South America. We look at data from more than one language, including Quichua from Ecuador.
6. Romance. This well-known language family (genus-level) is represented in our data by Spanish, Galician and Brazilian Portuguese.

See appendix G for other languages that are represented through a solid amount of pertinent data.

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[1] On the notion of "genus", see the discussion in §2.1.

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Part I

OVERVIEW & KEY IDEAS

1

INTRODUCTION

A course in phonology using this book is expected to be taken after one has studied phonetics, since this book depends crucially on that foundation. Therefore, while some textbooks on phonology begin with a robust introduction to phonetics, this one does not. It assumes that the student is familiar with all of the basic terminology and concepts of the field of phonetics. It also assumes that the student has at least a rudimentary knowledge of morphology and syntax. Furthermore, concepts from sociolinguistics are referred to in various places, especially at the beginning.

Phonetics might be succinctly characterized as the study of the production and perception of human speech sounds—the physical properties of language. It relates specifically to the mouth and ears (in the case of spoken languages), or the hands and eyes (in the case of signed languages).

Phonology, on the other hand, might be characterized as the study of the organization of those sounds—the functional properties of language. It relates specifically to the brain. This fact makes it more abstract (but not simpler) than phonetics. And unlike phonetics, phonology only makes sense in the context of a particular language or set of languages.

The following excerpt from Cohn (1993:44) expresses the relationship between phonetics and phonology well:

> Phonetics is the study of the physical properties of sounds used in human speech: their production, their acoustics and their perception. Phonology is the study of how speech sounds pattern together. Yet there is also an implicit derivational relationship between the two: a phonological representation indicates the abstract, linguistic characteristics of sounds; the phonetic representation is the physical output or realisation of that phonological representation, what the speaker actually produces or the hearer perceives.

Another way that the difference between phonetics and phonology might be expressed is this: phonetics is an outsider's "view" of the sounds of the language while phonology is an insider's view of them.

Approaches to phonology change from decade to decade, and the field is littered with books that present once-fashionable ideas and theories that are no longer very relevant, although there is always something to learn from them. In this book we focus on some very basic ideas that continue to have relevance for the study and practice of phonology. After presenting these ideas, we then apply them to a range of facts found in human language.

Exactly what is studied or described under the label "phonology" has been presented in many different ways. This particular book takes a fairly narrow slice of the field, although this is difficult to explain right up front. We are *not* concerned here with the changes that are described under the labels of "lexical phonology", "morphophonemics", "morphophonology", "early phonology", or "rules" (despite the interesting patterns that are found there), but rather those that have been referred to as "postlexical phonology", "phonemics", "processes", "phonetic rules", "subphonemic rules", "late phonology", or simply "phonology" in an old, narrow sense. (The first group of topics is addressed in a separate book.)

If we take a modular approach that is currently and commonly espoused, using the labels in (1)

(1) Phonetics — Phonology — Morphology — Syntax

then we are considering here that phonology is actually composed of two parts: P-phonology and M-phonology. These two have not always been lumped together in the same field (phonology), and even in recent decades have sometimes been treated quite differently, as the labels mentioned in the preceding paragraph indicate.

P-phonology is closely tied to the phonetics component, while M-phonology is closely tied to the morphology component. This book focuses on P-phonology. The division of the subfields might be represented as in (2), or, to arrange the labels a bit differently, as in (3).

(2) Phonetics — P-phonology — M-phonology — Morphology — Syntax

(3) Morphology
M-phonology [more abstract]
P-phonology
Phonetics [less abstract]

1.1 Some characteristics of M-phonology

The M-phonology of a language is discoverable only as the morphology is explored; if a language has little morphology, then there will be little to include in the M-phonology. No matter how one approaches M-phonology (and there have been *many* interesting and engaging ways to do this) the descriptions are characterized by exceptions.

M-phonology seems to represent learned patterns of a different sort than P-phonology. When speakers say something out of the ordinary in the M-phonology—saying something like ***pron[aʊ]nciation*** rather than ***pron[ɜ]nciation*** or ***ins[ej]nity*** rather than ***ins[æ]nity***, for example—other speakers are likely to view it as an error.

M-phonology is easy to work on using published grammars and descriptions, because it deals with facts that are easy to write down.

1.2 Some characteristics of P-phonology

P-phonology, on the other hand, is very relevant to all languages, although it is still more complex in some than in others. The patterns described in it are expected to be virtually exceptionless (although we are still discussing human behavior here, not the operation of machines).

P-phonology deals with phonetic details that are more difficult to transcribe and that are appropriately accompanied by audio recordings (sadly lacking in too many cases). To work on P-phonology, one needs to have access to narrow transcriptions[1] or good impressionistic transcriptions (which are not easy to come by, and sometimes difficult to use), and recordings, and (better yet) direct contact with speakers.[2]

When speakers do something in the P-phonology that is unlike what one typically does in one's own dialect—like pronouncing *sitting* as **[ˈsɪtɪŋ]** (for many Britons) rather than as **[ˈsɪɾɪŋ]** (for most Americans), for example—other speakers are likely to view it as a difference of accent or speech register. They may wonder where you are from, or guess that you are from another generation, but not wonder if perhaps you were really a speaker of another language.

These phonetic details are discussed in the context of the PHONEMES of the language, which are characterized by DISTINCTIVE FEATURES, and which are organized into SYLLABLES—key ideas that are introduced in chapter §3. (Note: Differences in pronunciation may be due to a number of other factors as well. For example, speakers of

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[1] Narrow transcriptions contrast with broad transcriptions (see IPA 1999:28-30). Narrow transcriptions including more phonetic detail than broad transcriptions, but broad transcriptions have a very special definition. See the discussion in chapter §11. For one example of a text transcribed in both narrow transcription and broad transcription, see Marlett (2013b).

[2] For one example of a text written with an impressionistic phonetic transcription, with an accompanying recording, see Calderón Calderón et al. (2014). Good impressionistic transcriptions can vary quite a bit because they are not based on an intimate knowledge of the language. For example, the following are acceptable alternative impressionistic transcriptions of the same utterance: **[kũã]**, **[kũ̯a]** **[kʷã]**, **[kwã]**, and **[kw̃ã]**. When the facts are integrated into a phonological analysis, one of these would probably be chosen as more appropriate for the narrow transcription.

American English differ on whether they distinguish the vowels of words like *cot* and *caught*. This is not simply a small phonetic detail.)

As indicated in (3), M-phonology involves greater abstraction than P-phonology. Any abstraction requires justification, and this is a point on which linguists differ greatly. This is a topic that is addressed for P-phonology at various points in this book.

For an example from English that may illustrate for you the difference between M-phonology and P-phonology, consider the following words: *divide*, *dividing*, *division*, *divisive*, and *divisible*. Assuming that these words all have the same root (something meaning 'divide'), it is worth noting that the root ends in a different phonetic sound in each word: **[d]** in the first, **[ɾ]** in the second (in American English), **[ʒ]** in the third, **[s]** in the fourth, and **[z]** in the fifth. These ALLOMORPHS (as alternating shapes of morphemes like **[dɪvaɪd]**, **[dɪvaɪɾ]**, **[dɪvɪʒ]**, **[dɪvɪs]** and **[dɪvɪz]** are called) of the root are phonologically similar and phonologically related, at least historically. P-phonology deals with only the **[d]** and **[ɾ]** facts, while M-phonology may deal with the others.[3]

1.3 Our goal: understanding of the system

We want to keep in mind that our goal in studying the phonology of a language is not just to understand a hodgepodge of details about sounds in that language, but rather to understand the phonological system that is in play. We want to see the forest and not just the trees and their leaves. Thus as we work "from the (phonetic) ground up" to greater levels of abstraction, we always want to be thinking about the bigger picture and what is really going on—not just following steps and procedures as an intellectual exercise.

Therefore we do not espouse a cookie-cutter approach, nor a "Step A, Step B, Step C, Bingo! Result" methodology. Methodology is fine, but the results always need to be evaluated against the criterion of how they fit into the bigger picture.

Beckman's claim (2009:3) that "a phonological analysis is a model of how speech patterns are represented and processed in the minds of a community of speakers" probably represents a standard view. The speech patterns in mind here probably include both P-phonology and M-phonology (labels that are innovations of this textbook, to avoid other theory-specific labels), but there are differences of opinion about whether the model appropriate for one subset of facts is appropriate for the other subset. In many ways, phonological theory is still in its infancy.

This book also gives attention to how the results of an analysis of the basic sound system of a language are presented for the benefit of the scientific community as well as for the language community itself. In the case of the former, there are some well-established norms, and these form a framework that we can utilize. Therefore we begin early talking about PHONOLOGICAL DESCRIPTIONS or PHONOLOGICAL WRITE-UPS. Regardless of how one ends up analyzing a particular set of facts, it is important to leave a clear presentation of the facts that will be understandable to future generations.

If one were to survey recently published and current textbooks on phonology, one would discover that most of them focus on M-phonology, giving only a small amount of attention to P-phonology. That is one reason why the present textbook is relevant. The topic is important for those working on languages that have been previously unwritten and under-documented.

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[3] Donegan & Stampe (2009:5) give a concise description of such rules from the perspective of Natural Phonology:

> Morphophonological rules specify alternations of phonemes particular to certain morphosyntactic situations. Thus such rules are conventional and lack synchronic phonetic motivation. They might even be correctly described in terms of so-called "phonological features". In short, morphophonological rules—even quite productive rules, rules that might expand their lexical or grammatical domain ....—are part of morphology.

See also the discussion of morphophonological alternations and "automatic alternations" in Haspelmath & Sims (2010:217).

1.4 Why study P-phonology?

To finish this introductory chapter, we want to point out some of the reasons why a person may want to study and use a book such as this.

The study of phonology gives one the background for talking and writing in a clear and informed way about the system of sounds that a language uses—the blueprint, if you will, of the hundreds or thousands of sounds that are actually produced, recorded and transcribed. That in itself is a worthy scientific goal, and it is part of the greater linguistic enterprise.

Such a background is useful for work on speech analysis for technological research, for speech therapy, for child language development studies, and all kinds of work that compares languages.

Phonological analysis has also been a key part of efforts by language communities to develop written forms for use in the creation of written literature and for education. You will find that it is difficult to have meaningful discussions about language development issues if a serious phonological description—especially one focusing on the P-phonology—is not available in accessible form for the language in question (and not just one particular dialect of the language).

Understanding the concepts developed in this basic introduction to the field is also key to understanding the differences between a typical written form of a language and the words as they are actually pronounced. Setting aside very bizarre representations of sounds (such as *gh* for the sound [f] in the English word *tough*), a learner of a language may want to understand why words sound so different from the way they are written. An understanding of P-phonology can help a lot.

P-phonology is also relevant for understanding phonetic differences between dialects and for fine-tuning second language learning by understanding general facts about the pronunciation of the sounds of the language being learned.

1.5 Suggested additional reading

On one elaborated view of the distinction between the two types of phonological components described in this chapter, see Donegan & Stampe (2009). A sharp distinction between P-phonology (postlexical phonology) and M-phonology (lexical phonology) was made in the framework known as Lexical Phonology; see Mohanan (1982) and Kiparsky (1982), for example. The ideas of that framework were influential, but it is not a framework that is in use any longer. See also chapter 10 of Haspelmath & Sims (2010).

1.6 Key terms

The key terms mentioned in this chapter are:

1. PHONETICS: Phonetics is the study of the production and perception of human speech sounds—the physical properties of language.
2. PHONOLOGY: Phonology might be characterized as the study of the organization of the human speech sounds—the functional properties of language.
3. P-PHONOLOGY: P-phonology (a label introduced in this text) deals with basic facts of pronunciation of sounds of a language.
4. M-PHONOLOGY: M-phonology (a label introduced in this text) is concerned with the shapes of the morphemes of a language (the allomorphs).
5. ALLOMORPH: The different shapes that a morpheme has in the language are the allomorphs of the morpheme. (§1.2)
6. PHONOLOGICAL DESCRIPTIONS (PHONOLOGICAL WRITE-UPS) (§1.3)

Three other key terms (phoneme, distinctive feature, and syllable) were mentioned in passing in §1.2; they are discussed in chapter §3.

1.7 Reading questions

You can check your answers to these questions in appendix F.1.

1. True/False Phonetics is the same thing as phonology.
2. Which field of study is concerned with the production and perception of human speech sounds?
   a. phonetics
   b. phonology
   c. morphology
   d. syntax
3. Which field of study is concerned with the study of the organization of human speech sounds?
   a. phonetics
   b. phonology
   c. morphology
   d. syntax
4. True/False There have been many different kinds of approaches to the study of phonology.
5. Yes/No Is the following characterization of M-phonology vs. P-phonology on the right track? "M-phonology looks at phonological patterns that are discovered as the morphology of words is explored. P-phonology looks at phonetic details."
6. The text claims that P-phonology is of relevance to all languages, while M-phonology may be less important in some. Explain why this is true.
7. True/False M-phonology involves greater abstraction than P-phonology (in the way that the former is generally practiced).
8. True/False If a language has complicated morphology, it is likely to have much more that requires discussion in the area of M-phonology.
9. Give a brief explanation of how phonetics is different from phonology.
10. Why is it the case that an isolating language (one with little or no morphology) is going to have less to describe in the area of M-phonology than in P-phonology?
11. The root *pauc* in the words *paucal* and *paucity* is pronounced in two different ways: with **[k]** in the first and with **[s]** in the second. In what component is this allomorphy described: M-phonology or P-phonology?
12. True/False The only reason to study P-phonology is for the purpose of developing an orthography for an unwritten language.

1.8 Exercises

1. As a way to start getting refreshed on your use of IPA transcriptions, write your first and last name in a narrow (viz., detailed) IPA transcription, including with indication of stress (and/or tone, if that is appropriate). Be prepared to share this with others in the class.

2

OBJECT OF STUDY

2.1 What are phonological descriptions about?

Phonological descriptions of the type that we are discussing in this book are centered on the languages of particular speech communities. Fishman (1971:42) defined SPEECH COMMUNITY as a community "all of whose members share at least a single speech variety and the norms for its appropriate use" (although the term and the notion have been the subject of considerable debate).[1]

This means that we will be working a great deal with some representation of speech, primarily in the form of PHONETIC TRANSCRIPTIONS. This book therefore has the expectation of a background in phonetics. It assumes familiarity with basic terminology and symbols of the International Phonetic Association.[2] At no point in the book are we really concerned with either the actual or the future spelling conventions that a speech community might use for representing its words. (But what we study usually has been considered very pertinent to the discussions about writing systems and for that reason a course in phonology is a prerequisite for a course or workshop on orthography development.)

A speech community can be a very large group of people. Indeed, as an example, Bloomfield points out that (by his definition of the term) "Dutch and German actually form only one speech-community."[3] Typical phonological descriptions do not attempt to describe the speech of communities as large as that, but exactly where to draw the line is a serious question.

In some rare cases it may not be very difficult to decide what an appropriate object of phonological study might be.

Example: The Seri language in Mexico had only slightly more than 200 speakers at the middle of the twentieth century when serious linguistic work began to be done on it. This speech community was not entirely homogeneous (as no speech community ever is), but there was clear and unimpeded communication between all members of it. Furthermore, no other groups of people in the immediate area (nor even farther away) spoke any speech variety that was remotely similar. Thus it is clear that Seri is a single speech community and that a phonological study taking all of this community *and no more* into consideration is entirely appropriate. This kind of clear case is relatively uncommon.

—*Seri is best considered an isolate at present, although evidence assembled in the future might show some distant relationship to another language.

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[1] An entire chapter of Wardhaugh (2005) is devoted to the topic. See also the detailed historical review of the term and the dispute surrounding it in Patrick (2002).

[2] For the latest version of the IPA symbols, see http://www.langsci.ucl.ac.uk/ipa/ipachart.html. To obtain Unicode fonts for IPA symbols, see http://scripts.sil.org/cms/scripts/page.php?site_id=nrsi&id=FontDownloadsIPA.

See chapter 20 of Bauer (2007) for a short, but helpful, historical and critical perspective of the conventions of the International Phonetic Association (IPA). Also see chapter 21 of Bauer (2007) for some orientation to reading phonetics and phonology articles that use IPA (or, in fact, any) symbols.

[3] Bloomfield (1933:44). Bloomfield also points out that a large amount of variation may exist in a speech community that does not impede the functioning of that community except if one is comparing the outliers with each other. See the discussion of these topics in a basic sociolinguistics book.

It is more commonly the case that a community is part of a larger set of communities that have greater or lesser variation between them. As an example of this we might take at least the sense of LANGUAGE GENUS, which is "a group of languages whose relatedness is fairly obvious without systematic comparative analysis."[4] In this regard, English, Dutch and German (in all of their varieties) form a single language genus. In fact, more than thirty-five languages belong to this genus, according to Dryer (2013). We expect that a phonological description that attempts to describe something that is *more* inclusive than a single language genus will not be very helpful. Even a description that attempts to describe something as large as the entire Germanic language genus would be difficult to achieve except in very broad strokes. (We do not have any examples in mind to point you to.)

Case in point: Various linguistic publications refer to "Isthmus Zapotec". This binomial designation uses what might be best described as a name referring to an entire language genus of Mexico ("Zapotec") combined with a geographical modifier ("Isthmus", referring to the Isthmus of Tehuantepec). It might be like using the term "Great Plains Germanic" to refer to the speech of the people of Des Moines, Iowa and its environs. This binomial designation is meant (a) to *include* the speech of a large number of small communities that actually have a number of small differences among them, including those around the town of Tehuantepec (where the language is hardly spoken anymore) and Juchitán (the municipal center), and (b) to *exclude* the speech of some other communities that are found in the Isthmus of Tehuantepec. Because of these problems, one recent linguistic publication actually clarifies that it is about Zapotec as it is spoken in Juchitán, without really taking other data into consideration. At the same time, the official list of languages of Mexico now refers to this variety of Zapotec as "zapoteco de la planicie costera" (Zapotec of the coastal plain) in order to not delegitimize other varieties of Zapotec spoken in the Isthmus of Tehuantepec. A phonological write-up of Isthmus Zapotec is thus choosing to represent a regional variety of the Zapotec genus. It is not clear how representative this description is of the language or of the genus as a whole.

One might think that one simply has to focus on a single language (English and not Dutch, for example), but that is not a clear option in the majority of cases in the world precisely because we do not know where the language boundaries are—where one language stops and another one begins.[5] However, a phonological description of "a language" is a reasonable and worthy goal.

Case in point: Work on the dialect of Zapotec spoken in Juchitán (see the discussion just above) has been done with the assumption that Juchitán is the principal dialect of a number of closely related dialects. These other dialects have gone relatively undocumented. This work has also been done with the assumption that other less closely related varieties of Zapotec (such as the one spoken in Petapa) are irrelevant to the presentation of data from Juchitán. Thus the claim has been made implicitly that Juchitán Zapotec is a distinct language from that of towns such as Petapa.

One might propose that a proper object of study would be something identified as a language in a list such as appears in *Ethnologue*, to which is assigned an ISO 639-3 code (see note 4 above). This proposal is made on the assumption that such a list has drawn together the relevant information for determining language boundaries. In many cases, however, one cannot assume that this has been done for any number of reasons, including the fact that the relevant information has not been gathered or systematically analyzed. On top of that is the fact that such decisions inevitably involve political factors; they are not made just on the basis of pure science.

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[4] Dryer (1989:584); see also Dryer (2013).

[5] The list of languages in *Ethnologue* (Simons & Fennig 2018) is presented with recognition of this problem. It cannot be said to have solved it. One needs to be very careful with this list of "languages", as with any other, since many serious issues are involved.

Even more problematic are the language names used in the popular literature or even official government lists. For example, for many people in Mexico there is one Zapotec language, and that was the official government position for several decades. (Today, however, the government officially recognizes more than fifty separate Zapotec "variants" without deciding (as of the year 2015) how many languages there are.[6]) In some cases these names correspond to what are now being referred to as "macrolanguages", which is a technical designation that is applied (inappropriately, one might argue) to cases like Zapotec.[7]

One recent book on the phonology of English makes clear the difficulty of describing even one language, with all its "variants" (referring to dialects, sociolects, and idiolects):

> It is a rather difficult matter to define the sounds of a language, and doing so for English poses a special challenge. First, English is probably the most widely spoken language in the world, and the phonology varies with geographic and social differences. A detailed analysis of all of these variants in a single volume is quite impossible. (Hammond 1999:1).

2.1.1 *More thoughts on the notion 'genus'.* **GENUS** is a relatively new term in linguistics, and still not widely used. It is used in the *World atlas of language structures* (Dryer & Haspelmath 2013). It is useful in adding clarity to discussions by providing something clearer than the term 'family'. For example, Lyovin (1997), like other publications, refers to the Oto-Manguean family and the Mayan family, noting that both have branches. However, the reader is not made aware that while the Mayan languages are all so close as to make up only *one genus* (Mayan), the Oto-Manguean family is more comparable to the Indo-European family and comprises *eight distinct genera*. This example shows clearly the reason why the notion of genus is important.[8]

As mentioned above, the relatedness of languages within the same genus should be quite obvious if a representative corpus of data is examined. Loanwords and influence from neighboring languages can make the relatedness less obvious at first if the corpus of data is not representative. Languages can be related, of course, without being in the same genus, just like English is related to Spanish and Lithuanian and many other languages in the Indo-European family.

Case in point: Various local speech systems have been called Mixe in Mexico and they are adjacent to others that have been called Popoluca and others that have been called Zoque. A comparison of words from these languages makes it clear that these speech systems belong to the same genus; it is called Mixe-Zoquean in the literature. How many languages there are in this genus may or may not be clear because of the questions about how to define a language. But as for genus, we know there is one. There are other speech systems in Mexico that have been called Tepehua and Totonac. These—quite different from Mixe-Zoquean languages—are also similar to each other, despite major differences; they are said to belong to the Totonacan genus. As it turns out, these genera have been linked in recent serious comparative work by experts with the use of computers, and there is now very good reason to believe that these two genera have a common ancestor. This family has been dubbed Totozoquean (see Brown et al. 2011). This family comprises two genera; Totozoquean is not a genus. Note that it has taken decades of investigation by experts in historical

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[6] The official government list includes more than what appear in Ethnologue, and several of these officially recognized "variants" have not been assigned an ISO 639-3 code, and perhaps they may never be.

[7] See http://www.sil.org/iso639-3/scope.asp.

[8] It would seem that it would be especially helpful if there were ISO codes (at a different level from those for languages) assigned to language genera, such as Romance, Germanic, Zapotecan, Mixtecan, but this has not happened. Apparently some steps were taken to do this but work has not been completed. See the discussion of ISO 639-5 and ISO 639-6 in Wikipedia, for example. It might be noted here that the number of letters in the code does not correspond to the digit that follows the dash. ISO 639-3 codes happen to have three letters, but that is really only coincidental with the fact that they are called 639-3 codes.

linguistics to draw this conclusion. That fact in itself indicates that Totozoquean is deeper than the genus level.

It is probably not appropriate to call languages from different genera as being "sister languages". While they may be related and may even have some similarities in vocabulary and grammar—as Spanish and English do—since they come from a common ancestor, that does not mean that they are close enough to be called "sister languages".

Example: In earlier editions of *Ethnologue* and in the *International Encyclopedia of Linguistics* (Bright 1992), Seri and Salinan were linked in the same family (based on one publication that indicated the possibility of a relationship). As it turns out, the evidence linking these two languages is not strong, not obvious, and certainly not convincing at this time (Marlett 2008b). We could tell early on that these languages are *not* in the same genus (their relatedness is not "fairly obvious"). We also have reason to doubt that they are related at all, and until a relationship is shown by published convincing scholarship, one should be wary of claiming it.

Languages that are not in the same genus may or may not have similar typological traits; grammatical and morphological characteristics change over time and may be influenced by contact with neighboring languages.

Many presentations of linguistic family trees fail to help the reader know clearly where in the presentation the notion of genus applies. But without more information, one does not know if one is looking at a comparison of dialects, languages, genera, bigger families, or very big families.

2.2 Language variation

All speech communities have internal variation of different sorts, including phonetic differences between speakers. Hockett wrote that "if a language is spoken by at least two people, then there are always some differences of usage that an observer can detect if he looks closely enough."[9] Siblings in the same family, for example, may have very similar speech-patterns, but they are not identical. A husband and a wife may have no trouble communicating with each other (at least as far as the sounds are concerned), but one may not even have the same vowels as the other. The differences become more obvious as one looks at more inclusive groups within the community and as the size of the community increases.

Some of this kind of variation is often overlooked in phonological descriptions, simply for the sake of logistics. No one researcher or average team of researchers can be expected to include *all* of the variation found in a speech community. However, the omission of any mention or description of variation makes a write-up seriously incomplete.

A phonological description should also include a discussion of how the object of study was defined and why. For example, if someone were to describe the Spanish language only by recording and analyzing the speech of the mayor of Madrid, or ten individuals from Buenos Aires, we would not consider this appropriate. One might choose to write a description of the variety of Spanish spoken in one of those locations, but one would want to know why the object of study was circumscribed in that way.

When a particular variant of a language is described, it seems appropriate to relate that description to that of the bigger picture and not to treat that variant as if nothing else existed. We should be looking at the variant in the context of other facts of the language more generally.

It is quite common to see in descriptions that the focus of study is that of some elite class, such as the educated class, but there is no strictly linguistic reason for doing so. On the other hand, speakers in a language community are (we believe) able to point out people in their group whose speech is considered by many to be representative or admirable (or the opposite). A write-up should not ignore such facts.

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[9] Hockett (1958:471).

Notable quote. Non-prestigious dialects of languages are interesting in various ways. It is worth being aware of them with respect to phonetic and phonological differences. A. Kaye (2007:595) also points out other reasons why they are important: "… modern spoken Arabic dialects sometimes retain very archaic Semitic features. In fact, they may even preserve Proto-Semitic forms that have been lost in Classical Arabic—another indication that Classical Arabic is not to be regarded as their ancestral proto-language…. Rather, there were other Arabic dialects spoken alongside Classical Arabic all throughout history that served as the ancestral inputting ones to the contemporary picture of Arabic dialects."

2.2.1 *Suggested additional reading.* The topic of variation within a language community is usually addressed to some degree in standard sociolinguistic textbooks and general linguistic textbooks. It is not typically given much treatment, if any, in phonology textbooks. For an illustration of the IPA that focuses on a local dialect of English—that of Liverpool—see Watson (2007).

2.3 Examples

Some examples of introductions to phonological descriptions that clarify the object of study include those in §§2.3.1-§2.3.4.

2.3.1 *Mongolian.* The presentation by Svantesson et al. (2005) provides an excellent overview of the place of Mongolian within the larger context of Mongolic languages. It clarifies (p. 141) that "the dialect differences are rather small" for this language spoken by about 2.5 million people, but also shows that the phonemic inventories of two certain dialects are quite different. It clarifies that the topic of study is "the Halfh (Khalkha) dialect as spoken in Ulaanbaatar, the capital of the Republic of Mongolia" (p. xvi).

2.3.2 *Norwegian.* The presentation by Kristoffersen (2000) clarifies in the preface (p. v) that the study is about "the phonology of the variety of Norwegian spoken by the majority of the inhabitants of the most densely populated area of Norway, the south-eastern region surrounding its capital Oslo." It mentions elsewhere (p. 1) that Norwegian, Swedish and Danish are "to a large degree mutually intelligible." Like earlier accounts of Norwegian phonology, it focuses on what is called "Standard Østnorsk" (Standard East Norwegian), but includes other urban varieties of East Norwegian speech as well (p. 8).

2.3.3 *Portuguese.* Mateus & d'Andrade (2000) state in their introduction that they are describing European (not Brazilian) Portuguese, and that in particular they are focusing on "the standard dialects spoken in Lisbon and Coimbra" (p. 4).

2.3.4 *Tarifit Berber.* The study by McClelland (2008) is about "a mostly unwritten language" (p. ix) of Morocco. It clarifies that it focuses on one particular dialect, although native speakers readily recognize four other dialects "as within the 'Tarifit' language area" (p. 1). It is noteworthy that McClelland did not choose to describe one of those other dialects that, he points out, "is called the 'most pure' Berber of the north" (p. 1). McClelland does not clarify in this introduction how this particular Berber language (with about one million speakers, p. 1) relates to other Berber languages.

2.4 A checklist for the opening section of a write-up

Phonological descriptions that are prepared for publication follow different formats in different contexts, but certain information should be found in them regardless of the format, and certain guidelines are helpful in all cases. The following suggestions have in mind the introductory section of the "illustrations" that are published in the *Handbook of the International Phonetic Association* and the *Journal of the International Phonetic Association*, but they are applicable to other descriptions as well.

Topics to include in the opening section:

1. Name of the language as used by its speakers,[10] and other names that are legitimately used (or of historical interest). The name of the language should be given in narrow IPA transcription in addition to some other standardized spelling that may be available. Be sure to spell names correctly.
2. Language family information. (Cite sources. Avoid speculation.)[11]
3. Sociolinguistic context (neighboring languages, languages affecting this language, language(s) used in the schools, other languages that people speak if the multilingualism is a characteristic of the community, percentages of the population that speak the other languages).
4. Number of speakers, places where spoken, etc. (This is not always easy to find out, as in many cases with minority languages the data are simply not available, or not reliable when they are reported. Caveats about the data need to be added.) Statistics may have to be qualified; is the census reliable? Do speakers or other sources give conflicting information? Telling where the language is spoken may easily be made more precise today than in the past since GPS coordinates are readily obtained. Example: *Quioquitani Zapotec is the mother tongue of approximately 900 people in the town of Santa Catarina Quioquitani (16.316°, -96.283°, ex-district of San Carlos Yautepec)*. (Sentences preceding this one clarify in what state this is in the country of Mexico. Note the use of decimal coordinates; this is recommended.) Remember that there may be a significant number of speakers living outside of the traditional homeland.
5. Information about vitality, which may certainly vary by region. This is always of interest, and today there is additional information available through *Ethnologue* that gives information about how a language (presumably) is classified according to the EGIDS (Expanded Graded Intergenerational Disruption Scale). See https://www.ethnologue.com/about/language-status.
6. References to existing phonological studies of the language or (in their absence) to those of closely related languages (especially those in the same genus, see §2.1). If there are differences between the analyses, these should be pointed out concisely.
7. Information about the age, sex, and background of the person of whom the recordings are made (since recordings are expected).[12] For age, it is recommended that one include the year of birth of the person as well as his or her age at the time of the recordings. In some situations one fact or the other will be important. Is the person bilingual or multilingual (and in what languages)? What educational background does the person have?
8. The ISO 639-3 code for the language. If there are problems with the code for any reason, discuss them. (The code may have been assumed but never justified for this particular variety. Or it may have been inappropriately applied.) Since there are other codes (e.g. the WALS code), when a code is given, the code should be explicitly identified in order to avoid confusion.
9. If the language has dialects, discuss them briefly, and tell how the present description relates to them.

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[10] The word AUTONYM is a term sometimes used for this, although that may be confusing since it could also be taken as referring to the name of the ethnic group (the ETHNONYM). It is not unusual for the group's self-name (the AUTOETHNONYM) to be different from the name that speakers give to their language (the AUTOGLOTTONYM).

[11] The following paragraph from Campbell (2007:187) gives some important information to guide a writer:

> A number of terms have also been used for postulated but undemonstrated higher-order, more inclusive families (proposed but as yet unproven distant genetic relationships); these include *stock*, *phylum*, *macrofamily*, and the compounding element '*macro-*' (as in *Macro-Mayan*, *Macro-Penutian*, *Macro-Siouan* and the like). These terms have proved confusing and controversial, as might be expected when names are at stake for entities that have been postulated but where agreement is lacking. In order to avoid confusion and controversy, none of these terms should be used. That is, the term *family* is sufficient and clear. Since the entities called 'stock', 'phylum', and 'macro-' would be bona fide language families if they could be established (demonstrated) on the basis of the linguistic evidence available, ... it is much clearer to refer to these proposed but as yet unsubstantiated relationships as 'proposed distant genetic relationships' or 'postulated families'.

[12] The recordings of the words that appear in the languages used that are presented in the *Handbook of the IPA* are available at http://web.uvic.ca/ling/resources/ipa/handbook_downloads.htm.

10. If the variety of speech being described is only one variety of what might be considered a single language, tell how and why it was chosen.
11. If there are interesting and general sociolects, mention them. For example, if men's and women's speech patterns are different, or if a particular caste speaks differently, then these differences are important to point out.
12. Keep the information about the recordings that are made (date, kind of equipment, sampling rate, kind of microphone) since you may want to give that information in this section (or you may be asked to give it at some time). Be aware that you should get written permission from the person whom you record, using whatever standards are appropriate for the institutions with which you are affiliated. In the U.S., these standards are now set by the Institutional Review Board (IRB) of the relevant institution. (If the person being recorded is a co-author, the situation is different, of course.)
13. Indicate how the research has been supported and what institutions have been involved. (This information actually goes into a separate small section, in this genre of presentation, that is simply called "Acknowledgments".)
14. You should cite sources carefully and correctly. They should then appear in your list of references. Do not cite things that you have not checked personally, but do not fail to look at all relevant sources of information. If you cite something like *Ethnologue*, do not just put *Ethnologue* as the source, but rather cite the most recent edition by the normal protocols for citation (see Simons & Fennig 2018).

The information described in the preceding lines is helpful and important, as it gives the reader a clearer picture about the place of this language in the world and in its immediate context. It also helps to show that the person writing the description is familiar with whatever earlier research has been done.

The write-up should be in well-crafted prose — using complete sentences and good punctuation. Be careful to spell things correctly, including all names.

Example: Tunica. Haas (1941) includes some very important information that must be kept in mind when reading the description of this language. This information includes the fact that the speaker was the last person who could speak this language "with any degree of fluency" and that he in fact had not conversed in it for about twenty-five years (since the death of his mother), and in fact as a child preferred to speak to his mother in French. Such information is crucial to understanding the rest of the work.

As for the citation of the sources of information, use the style that is seen in the *Handbook of the IPA* illustration for Amharic (Hayward & Hayward 1999). That kind of citation, with works mentioned by author and year in the text itself (not in footnotes) is typical of linguistic publications.

2.4.1 *Other suggestions.* We present here some other general suggestions to help you produce a good presentation of the introductory material.

1. Document the sources of information with the best references possible; try to avoid second-hand sources. Web sites are only appropriately used in very special situations (such as government statistics, from government websites); the date on which you accessed them is typically mentioned as well. An ordinary web page is *not* a citable source of information, although you may use it to find such information.[13]
2. Be concise.
3. Have other people read this material (as well as the rest of the description) for accuracy and completeness.

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[13] We strongly recommend that you print out the page that you cite and write on it the exact URL, especially if the government page was hard to locate.

4. Translate the introduction (as well as the rest of the paper) into another, appropriately chosen language of wider communication (e.g., Spanish, French, Urdu, Chinese, etc.) that would make it more widely usable for people living in the country where the language being described is spoken. (If the original description is written in one of these languages, consider translating it into English to obtain the same effect for an international audience.) The process of translation may actually cause you to make improvements to the original. Then use this translation to obtain other input on the description.
5. Read other introductions and consider if they suggest something else that is interesting and relevant to include concisely in your introduction.
6. Begin the list of references that you use to write the introduction (as well as the rest of the paper). Keep track of *all* of the information from the sources that you need for your list of references. (Consider scanning the title pages and copyright page; you will be amazed at how easy it is to make a citation error or find a citation error; you will save time if you have scanned copies available for cross-checking.)
7. Use the style sheet of the journal in question (such as that of *JIPA*).[14]

2.5 Key terms and ideas

Key terms mentioned in this chapter include:

1. SPEECH COMMUNITY. (See the discussion at the beginning of the chapter. We will not use this term in any precise way.)
2. PHONETIC TRANSCRIPTION. There are different kinds of phonetic transcription, as we see later in this book (referring to the discussion in IPA (1999)).
3. A LANGUAGE GENUS is "a group of languages whose relatedness is fairly obvious without systematic comparative analysis." (§2.1)
4. ISO 639-3 CODES are used to reduce ambiguity and confusion when making reference to languages. (§2.1 and also the preface)

We saw in §2.2 that we can expect language variation within any speech community. No speech community is completely homogeneous. We discussed in §§2.3-§2.4 that it is important to contextualize a phonological description sociolinguistically.

2.6 Reading questions

You can check your answers to these questions in appendix F.2.

1. T/F A speech community is a community of people who share the same intonation patterns.
2. T/F A phonology course makes use of phonetic transcriptions.
3. T/F A speech community is rarely larger than 200,000 people.
4. T/F A phonological description of a language genus is a relatively easy goal to achieve.
5. T/F A phonological description of a single language is a reasonable goal.
6. T/F It is quite easy to determine language boundaries and hence to determine the focus of a phonological description.
7. T/F Linguistic variation between speakers of a language is appropriately ignored in a phonological study of the language.
8. T/F A phonological description describing a speech community that numbers less than 100,000 people does not need to mention any variation between speakers.

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[14] The style sheet of the *Journal of the International Phonetic Association* (JIPA) can be found at http://journals.cambridge.org/action/displayMoreInfo?jid=IPA&type=ifc. XLingpaper (http://www.xlingpaper.org) includes a style sheet that follows the *JIPA* style sheet.

9. T/F A phonological description should focus on the dialect of the educated class since other classes of people do not use the proper sounds.
10. Why is the notion of speech community relevant for the study of phonology?
11. T/F A phonological description of the language of a non-prestigious caste would be inappropriate.
12. T/F If two languages are historically related, they belong to the same language genus.
13. T/F If two languages are typologically similar, they belong to the same language genus.
14. T/F If two languages belong to the same language genus, they have at least 50% similar vocabulary.
15. T/F Only written languages have phonemes.
16. T/F The languages Mixe, Zoque and Popoluca cannot belong to a single genus.
17. Likely/Unlikely In 2010, after decades of research, it was shown that Mixe-Zoquean languages are related to Tepehua-Totonacan languages. Therefore we now are confident that Mixe-Zoquean languages and Tepehua-Totonacan languages together comprise a single language genus.
18. Language R has three dialects: eastern, central and western, with different linguistic and sociolinguistic characteristics. A phonological write-up should do which of the following?
    a. focus on the eastern dialect because that is the dialect spoken by the educated group
    b. focus on the central dialect because it is geographically closer to everyone
    c. focus on the western dialect because that is the dialect that a higher percentage of all of the population respect
    d. none of the above (at least not for the reasons given)
19. Given two Linguistic Systems, which is generally easiest to determine with respect to them?
    a. that they are dialects of the same language
    b. that they are in the same genus (like Germanic)
    c. that they are in the same large language family (like Indo-European)

2.7 Exercises

1. Find a phonological description (a book, an article, or a chapter in a more comprehensive description) and do the following:
    a. Find out if the author tells the scope of the study and how that was determined. Summarize that information.
    b. Find out if the author describes dialectal or idiolectal variation within this speech community as she or he defines it.
    c. See if you can find out where the language variety in question fits with Dryer's notion of genus. Use the list given in Dryer (2013) (see the link in appendix A.4).
2. List some phonetic differences that you observe between your own speech and that of a friend or relative who speaks the same language as you. The following version of this exercise is designed for American English speakers. First, record yourself pronouncing the following sentences (so that the data can be verified by someone else). [If recording is not an easy option at this time, you may skip this step.]
    a. I often go to the opera, but I don't take my dog unless my aunt goes with me.
    b. What route do you think the fog bank will follow as it heads inland?
    c. We don't usually see human footprints on this log, but the person who left them will soon be caught.
    d. Please address this envelope before you exit the room.
    e. If you go to buy tomatoes somewhere, don't go in your pajamas, but be sure to wear clean socks when you sit on your cot.
    f. A visa isn't necessary to buy cough medicine.
    g. A huge pot of gold isn't something that I have fought for either.

    Second, record your answers to the survey below in the table that is provided based on the pronunciations you have recorded. Have a friend check the accuracy of your answers. If none of the answers is really correct for you, put " C" in the cell.

	Pronunciation of	A	B	Your answer
1.	*often*	ˈɔfən	ˈɔftən	
2.	*aunt*	ˈɔnt	ˈænt	
3.	*route*	ˈɹaʊt	ˈɹuːt	
4.	*human*	ˈhjuːmən	ˈjuːmən	
5.	*envelope*	ˈɛnvəloːp	ˈanvəloːp	
6.	*tomatoes*	təˈmatoʊz	təˈmeːɾoʊz	
7.	*pajamas*	pəˈdʒaməz	pəˈdʒæməz	
8.	*visa*	ˈviːsə	ˈviːzə	
9.	*exit*	ˈɛgzɪt	ˈɛksɪt	
10.	*dog* and *fog* rhyme?	yes	no	
11.	*caught* and *cot* rhyme?	yes	no	
12.	*fought* and *pot* rhyme?	yes	no	
13.	*huge*	ˈhjuːdʒ	ˈjuːdʒ	
14.	*either*	ˈiːðɚ	ˈaɪðɚ	

3. The following language genera are found in Mesoamerica. Look up something about the speech communities related to them and describe the kinds of variation that are mentioned for them.
   a. Mayan
   b. Mixtecan
   c. Tequistlatecan
4. One genre of brief phonological description is the "illustration" type published by the *Journal of the International Phonetic Association*, about thirty of which also appear in the *Handbook of the IPA* (1999). Look at the one of American English (or another language with which you are familiar) by Peter Ladefoged (Ladefoged 1999:41-44) and see what ways the details of the description agree or disagree with the pronunciation that you know well.
5. Examine the Basic Vocabulary (Marlett 2009) of *The Zapotec Grammar Files* (see the link in the bibliography). Based on this small sampling, how likely is it that the varieties of Zapotec documented there can be described by a single phonological write-up? Note that these dialects have all been assigned different ISO codes. Do any of them look as though they are similar enough to be candidates for inclusion in the same phonological write-up? How do you relate these facts to the entry in Bauer (2007:365) for a single language called "Zapotec" (presumably meant to include all of the varieties shown in Marlett 2009)?
6. Read one or more of the introductions to the illustrations in IPA (1999) and consider what information should be added to them if one were writing them now with the guidelines presented in this unit. (As you can see, some of them are very slim in content.)
7. Choose a language in which you have interest and write an introduction for a hypothetical phonological write-up. You will need to do a bit of research to do this, but in some parts you may need to simply indicate that the information is not available to you from the resources you have at hand. (This may not be so hypothetical if you do it for the language that you are studying in a field methods course.)
8. A recent book that discusses languages of the world talks about "Zapotec" with no qualifiers. Use the resources that are mentioned in appendix A.1 and A.4 (and also others, as you wish) to write a brief (one paragraph) discussion of why this use of the name "Zapotec" is problematic. Then discuss how this exercise is important for you as you read other discussions of languages.

9. Choose one of the following names and write the introduction for a phonological write-up: Lakota, Dakota, Nakota, Santee, Assiniboine, Stoney, Santee, Sioux. You will need to do a bit of research to do this, but in some parts you may need to simply indicate that the information is not available to you from the resources you have at hand. Discuss the issues that arise as you research the matter of language vs. dialect with regard to these names. This is an artificial situation, and it is not a major research project for you. So the idea is to do *some* research and to write up something basic (about one page, something like the introductions you have seen), to show that you have grappled with the issues and that you are aware of what you should include in such an introduction, and that you can write. You will make references to work that you consult—just as you would in a real publication—but the actual reference list need not be included at this time. We are primarily interested in seeing how you would pull together the information that you have found and how you evaluate what you have found. For this exercise, as in typical linguistic publications, identify the sources in the paragraph in the following way (and not with footnotes): "As shown in Golla (2007:23), this language is ..." *Note that the authors/editors are listed by last name only, the year of publication is given, and the page number where the relevant information is found is also given.*
10. Look up each of the languages for which there is an illustration in the *Handbook of the IPA* and find out what genus it belongs to, and the name of another language in that genus.
11. Examine the data found in G.1.3. Do you believe the data support the proposal that the two "varieties" belong to the same genus (if not the same language even)? Why or why not? Then spend a few minutes looking at the way in which the words appear to shown animacy distinctions. (If you say "four stones" and "four goats", the word for "four" will be different.) Do you believe that the difference between how the [tpl] and [tpx] varieties say "four (animate)" is a question of P-phonology or of M-phonology? Explain.
12. Staged exercise: Introduction. Assume that you have written a phonological description of the dialect of the language described in Faust & Pike (1959). Write an introduction for that phonological description that is thorough but concise. *Use the guidelines and the checklists that you have available to you.* Use good prose. Develop your References section appropriately and include a References section. Only use information from legitimately published sources (including WALS and *Ethnologue*, both properly cited — see Dryer & Haspelmath (2013) and Simons & Fennig (2018). You may consult Wikipedia, but you may *not* cite any information from it. You should consult any sources cited in it and cite them directly, if appropriate.) Do not use footnotes. You may interact with others on your draft, but the research should be your own as should the wording. The total length of the introduction (without the references secton) should be less than one single-spaced typed page with 1-inch margins and 12 point Times New Roman (or Charis SIL) font.

3

KEY IDEAS

This book is organized around the discussion of three key ideas, each of which has had a prominent place in different periods of linguistics. None of them is accepted by all phonologists, and there are important points of disagreement about all of them even by people who accept them in one way or another. Nonetheless, they are fundamentally important to all approaches to phonology and for that reason are included in this book. Each of them is also very practical for people who are doing fieldwork on languages and helping with language development.

The first of these ideas is that of the **PHONEME**. This concept was prominent in the first part of the twentieth century, suffered neglect and abuse in the second part of the same century, but continues to have relevance today. The term is certainly part of the vocabulary of every linguist, although for some it is only a "convenient fiction."[1]

The second important idea is that of **DISTINCTIVE FEATURE**. Introduced early in the second half of the twentieth century, this notion has been hailed as one of the most important discoveries of modern linguistics.[2] It also does not come without controversy and some linguists deny that it has any of the importance that has been given to it.[3]

The third important idea is that of the **SYLLABLE**. Of these three concepts, the syllable may be the only one that the general public has heard about since it is used in elementary and middle school classrooms at one point or another. As a linguistic concept, it comes with certain problems,[4] and its importance in phonological description has varied at times.

These three key ideas figure together in the following sentence taken from an important book by two eminent linguists writing more than fifty years ago:

> "The distinctive features are aligned into simultaneous bundles called phonemes; phonemes are concatenated into sequences; the elementary pattern underlying any grouping of phonemes is the syllable." (Jakobson & Halle 1956:20)

The ideas obviously still have relevance into the twenty-first century. Ewen & van der Hulst (2001) devote a full section of more than fifty pages to a discussion of (distinctive) features and a full section of even more pages to a discussion of the syllable. The notion of the phoneme does not make it into the index (much less into a section by itself), but the word *phonemically* appears on page 1 and a basic understanding of the notion (and even the notation) is assumed throughout the book. See also the following paragraph from the conclusion of Goldsmith (2011) in which a leading phonologist writing more than fifty years after Jakobson & Halle (1956) takes up the same notions:

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[1] Silverman (2006:6). Likewise see Kaye (1989:149-154), where he refers to "the death of the phoneme." For a quite different view, see Derwing, Nearey & Dow (1986) and Donegan & Stampe (2009).

[2] Clements (1985:225).

[3] See the extensive discussion in Mielke (2008), summarized on p. 4:

> This book argues that the natural classes and distinctive features found in human languages can be accounted for as the result of factors such as phonetically based sound change and generalization, which can be described without reference to a feature system. A feature system can be constructed (by a language learner or a linguist) on the basis of the results, but the feature system critically does not need to be a driving force behind sound patterns. Facts that have been attributed to innate features are accounted for by independently needed concepts (such as language change and similarity). It follows that phonological distinctive features no longer need to be assumed to be innate.

[4] Witness the evaluation by Ohala (1978:183) that "the notion of the syllable is too ill defined to propose it as a cornerstone of speech."

Phonology, as a field, is still struggling to deal with the consequences of the development of the phoneme, which is at the same time its greatest achievement. By "the phoneme," we mean the abstract characterization of a set of sounds in a language which unifies all of the sounds into a relatively small inventory of elements which are then used to define contrasting morphemes and words. This insight is the beginning of all work in phonology. Yet at the same moment, two other types of analysis—analysis into syllables, and analysis into features, or in short, analysis into units both larger and smaller than the phoneme—are crucial for any descriptive account of the phonology of a language.

3.1 Phoneme

A notion basic to the idea of written language, either explicitly or implicitly, has been that of the PHONEME. In simple terms, the phonemes of a language are the sound-based entities of which morphemes are composed. This is an oversimplification, but it is a useful one.

We can relate this topic to the contrast between phonetics and phonology mentioned in §2.1. While the actual sounds of languages (the PHONES) are discussed in phonetics, some abstractions based on these (the phonemes) are discussed in phonology (and these are formally related to the phones).

Think of the phonemes of a language as the building blocks of the words. In themselves they have no meaning (what does a "p" mean?), but all of the words in the language can be made from them. It is supposed that on average a language has thirty-some phonemes—twenty-some consonants and a handful of vowels. In this regard, see Maddieson (2013a, 2013d) in the *World Atlas of Language Structures*. Note the range in the number of vowel phonemes in the database: minimum of two, maximum of fourteen; and the range of consonant phonemes: minimum of six, maximum of 122.[5]

An analogy that might be helpful: think of the phonemes as the chessmen in the game of phonology. We will want to know about how they move, how they are used, etc., but first we simply want to know what the pieces are. One might think of phonemes as the sounds that are in the speaker's head, and phones as the sounds that come out of the speaker's mouth.

Expanding on the chessmen analogy: The phonemes of a language are like the chessmen in a game of chess. Different speakers may play the game with the same chessmen, or they may play very well with slight differences. When people play chess using the very same chessmen, they have no problems. They also have few problems when the chessmen are only slightly different—they can recognize their opponent's bishop without trouble. Individual differences are no problem—the distinctive features are still there, but other features (the height, the texture, the material) are different.

This is like what different speakers of a language experience all the time. But things become more difficult under various circumstances. Imagine the bishops looking much more like the queen—still different from the queen, but similar enough that it makes quick moves difficult because the player has to think about what he really sees. Or imagine if half of the pawns are replaced by castles, and just where you expect to see a pawn in your opponent's set, you see a castle instead. That would impede the progress of the game a bit!

Finally, it could be possible that the pieces are so different that it makes playing the game very very difficult, or no fun at all. This would be analogous to people who speak different languages try communicating with each other.

It is common to see reference to "the phonemes of language X." The list of these phonemes may include something like those in (1).

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[5] The counting of phonemes is fraught with problems. See the brief discussion in Kaye (1989:151).

(1) a. Consonants: /p t k m n s ʃ l/
b. Vowels: /a e i o u/

It is also common to see the consonants and vowels presented according to some arrangement such as those shown in (2)-(3). (The particular labels used here are those you may be familiar with from a phonetics class. The labels used in phonological presentations may vary, and certainly those used in presentations aimed at popular audiences are commonly different. The presentation of the vowels in (3) has not used the vowel quadrilateral that you may know from phonetics class; we discuss this issue in a later chapter.)

(2)

	Bilabial	Alveolar	Postalveolar	Velar
Stop	p	t		k
Nasal	m	n		
Fricative		s	ʃ	
Lateral approximant		l		

(3)

	Front	Central	Back
Close	i		u
Mid	e		o
Open		a	

This language is claimed to have eight consonant phonemes and five vowel phonemes. We return to the ideas of consonants and vowels later.

Each language has its own inventory of phonemes. These have resulted from century after century of small changes that succeeding generations of speakers have unwittingly made. (No living language remains static.) If we were to find a new language on a never-before-visited island of the South Pacific, one question that might be asked is "What are its phonemes?"

Using the inventory of phonemes in (1), one might see that we can begin to make up lots of words from that relatively small set. Some of these might be those in (4).[6]

(4)

/pat/	'a container in which liquid is stored'
/map/	'a tool used for cleaning floors with water'
/ʃap/	'a room in which work is done'
/ʃip/	'a large sea-going vessel'
/paʃ/	'fancy'

It is actually quite remarkable that with only a few phonemes, an extremely large number of words can be formed and an infinite number of utterances. This is part of what is so incredible about the human language faculty.

At this point we want to make clear that we are talking about the sounds and *not* the letters of an alphabet that might be used to represent them. The words in (4), represented by symbols of the International Phonetic Association, could be represented in many other ways, whether with a Latin based script (the phoneme /ʃ/ could be written with *sh* or with *x* or with *ch*, for example), or another kind of script (such as Arabic), or not at all. It is assumed (in this approach) that a language makes use of a set of phonemes whether the language is written or not.

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[6] The symbols chosen for these words may not match your expectations, but that is irrelevant at this point. See the discussion of vowel symbols for English in Ladefoged (1999).

Not all phonemes are consonants and vowels. Some languages also use tones (or tone melodies, as we suggest later) as phonemes. In some descriptions, stress is described as a phoneme (although we will not do this); we address that topic in chapter §29.[7]

When we talk about the "sounds" of a language, we are using terminology that is vague (perhaps intentionally). The word "sounds" might be referring to all of the many distinguishable phones that we might perceive and record in some way. There might be hundreds of those if we are good at phonetic transcription. The word "sounds" might also be referring to the phonemes of the language, in which case the set is much smaller.

It is possible that not all of the speakers in the same speech community have exactly the same number of phonemes. This is just a fact of life when it comes to language. And it is probably the case that in a standard classroom in the United States, not all of the native English speakers in that classroom have the same vowel phonemes even if they have the same number of vowel phonemes.

We can think of the idea—or insight, as Anderson calls it[8]—of the phoneme as a testable hypothesis. The hypothesis is that any given language can be adequately analyzed (with respect to its phonology) on the basis of a limited inventory of sounds, the phonemes. We refer to this here as the PHONEMIC HYPOTHESIS.[9]

One practical spin-off of the phonemic hypothesis is the idea that a good alphabet for a language is centered on the representation of the phonemes of that language (although any discussion of alphabets must include many other factors). The matters of practical concerns and alphabets are not part of this book. Another practical result is just the facilitation of work on other parts of the language, including morphology and syntax. Words are easier to write once phonemic analysis is done. But this is not an argument for the phonemic hypothesis.

Two of the big questions in this book are:

1. How does one determine what the phonemes of a language are?
2. How does one prove it?

These questions are both easier and harder to answer than one might think. In fact, probably in every language there are important questions about the inventory of phonemes, or about some part of the analysis. These questions usually just get hidden or set aside in popular presentations, but they continue to challenge the careful analyst. A careful presentation of the phonology of a language must address those questions.

It is also worth reminding ourselves again that this is still a hypothetical notion and for some linguists is not what it has been claimed to be. Silverman states, for example, that "when we play with our language, there is no reason to assume that the elements we are manipulating are the genuine building blocks of the system."[10] In this respect, Silverman is taking quite a different stand on the role of the notion phoneme than what is or has been often claimed.[11]

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[7] In this book we do not talk about "junctures" (boundaries between morphemes or words) being phonemes, although this was common at one time.

One also finds other types of phonemes in the literature: phoneme of "length" and phoneme of "nasalization", for example. The pertinent facts are not usually analyzed in this way now. Haas (1941:14) refers to "the syllabic phonemes", by which she meant two types of syllables (stressed and unstressed). This terminology is *not* utilized at all in this way now.

[8] Anderson (1974:11).

[9] To be straightforward here, we should say that we do *not* in fact believe that the phonemic hypothesis as sketched out here is correct. We believe that the hypothesis has uncovered important facts about language, but it does not seem to be possible to analyze the phonological structures of languages only in terms of phonemes. They may be part of the story but they are not the entire story. The affirmation by Hualde, Olarrea & Escobar (2001:46, translation mine) seems to be uninteresting or untenable: "All human languages studied so far have been able to be reduced to a phonemic representation using a reduced number of symbols." One wants to know whether the "reduction" to phonemic representation yields a result that can be shown to be valid by some means.

[10] Silverman (2006:11).

[11] Silverman also goes on to claim that he believes that "our ability to consciously manipulate speech sounds does not derive from our implicit knowledge of [the phonology of the language we speak], at all" but rather from "our explicit knowledge of the orthographic (writing) system we use to visually … represent the language." This strikes us as a very strong claim to which the study of speech in language communities without a writing tradition will have something very relevant to contribute.

3.1.1 *Suggested additional reading.* Maddieson (2013a, 2013d) shows how the notion of phoneme is applied in cross-linguistic studies. Anderson (1974, chapter 1 on phonetic structure) gives a good overview of the nature of phonetic representations, the abstraction that segmentation implies, and a basic introduction to the notion of features. Anderson (1974, chapter 2 on the phonemic insight) presents a helpful overview of the history of the notion of the phoneme. Also see Hyman (1975, chapter 3) on the same topic. Silverman (2006) presents a position in which the notion of the phoneme is not accepted.

3.2 Distinctive feature

A second key idea that has been important in phonological theory is that of DISTINCTIVE FEATURE. The notion is relatively simple. Distinctive features (or contrastive features) are to the phoneme something like what atoms are to the molecule. A water molecule is composed of hydrogen and oxygen atoms. Distinctive features are *not* things like "speaking with a lisp." They are essentially the defining characteristics of the phonemes and are phonetically based in some way (either articulatorily or acoustically). "Features are psychological entities defined in terms of acoustic and/or articulatory realization that provide the link between cognitive representation of speech and its physical manifestation."[12]

Phonemes are viewed, under this hypothesis, not as indivisible units but rather as combinations of more elementary elements, namely the features. The phoneme /m/, for example, uses the lips and has the feature [Labial], whereas /n/ does not. Both of them involve the lowering of the velum to permit the movement of air through the nasal cavity. Therefore both of them have the feature [nasal] while the oral phonemes /p/ and /b/ do not.

Some of the big questions in distinctive feature theory are the following (once one accepts the claim that distinctive features exist).[13]

1. What are the distinctive features?
2. How are distinctive features organized?
3. How do the distinctive features interact with each other?
4. Are the definitions of the distinctive features universal?

These are topics that are discussed later in this book.

3.3 Syllable

A third key idea that has been important in phonological studies is the SYLLABLE. The notion of the syllable has been around for a long time, corresponding roughly to a sequence of sounds that cluster together around a single peak of sonority. A word like *normality* has four sonority peaks—o, æ, ɪ, and i—and four syllables: *nor*, *ma*, *li*, and *ty*.

The notion of the syllable comes with some common assumptions, all of which are very debatable (as we will see later). One of these assumptions today is that the notion has universal applicability and therefore has a fundamental place in phonological theory. (This has not always been assumed.) Another assumption is that all words are exhaustively parsed into syllables. (This is explained in chapter §5.)

Some common terms that are used include ONSET, NUCLEUS, and CODA. Oversimplifying the case a bit, we can say that the onset includes the sounds that precede the sonority peak and the coda includes the sounds that follow the sonority peak. The sonority peak itself is the nucleus. An example:

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[12] T. Hall (2007:312).

[13] Again, to be straightforward, we should point out that we do not in fact believe that distinctive feature theory as currently conceived and taught is correct. Distinctive feature theory has given some helpful ways for thinking about sounds and phonological processes, but it is far from clear that it is adequate for describing phonological processes generally in human language.

(5) /stɹænd/*strand*

Onset	Nucleus	Coda
stɹ	æ	nd

When a nucleus is a bit more complicated—having two sounds that are almost the same in sonority (two vowels or a vowel and a central approximant)—we use the term **diphthong**.[14] The word *sound* contains the diphthong /aʊ/ that functions as the nucleus of the syllable. The onset is /s/ and the coda is /nd/. The words *cow* and *town* contain the same diphthong.

A syllable that has a coda is a **closed syllable**, while one that has no coda is an **open syllable**. The word *town* /taʊn/ has a closed syllable (it has the coda /n/), whereas the words *through* /θɹuː/ and *cow* /kaʊ/ have open syllables (on the assumption that the latter has a nucleus that contains the diphthong, as mentioned above). The word *haughty* /hɔːti/ has two open syllables.

Further discussion of the details of the syllable is postponed until later. The point for now is that we may refer to the notion of the syllable (and its parts), but keep in mind that it is a hypothetical notion.

3.4 Some other useful concepts

In addition to terminology from phonetics that is used in this book (without explanation, as it is expected that you already know the terms and can review them on your own, if necessary), the concepts in the §§3.4.1-§3.4.4 are used.

3.4.1 *Segment.* It has been a common claim or assumption that the stream of human speech is appropriately (and even necessarily) divided into discrete units called **segments**, some of which are commonly called consonants (in which the articulators are more likely to be close to each other) and others that are commonly called vowels (in which the vocal tract is more open). This assumption is necessarily built into the phonemic hypothesis as well as the whole idea of phonetic transcription using consonant and vowel symbols, but it is not one that is uncontroversial or unchallenged. Think of a segment as just one of the sounds (analyzed or not) that can be written with a symbol.

3.4.2 *Sonorant.* A **sonorant** is a sound "produced with a vocal tract cavity configuration in which spontaneous voicing is possible."[15] Sonorants include nasals,[16] approximants (whether central or lateral), taps, most trills, and vowels. These sounds are all voiced in their typical usage. The prototypical sonorant sounds can be hummed. Some linguists take glottal stops as being sonorants (because of the way they pattern in some languages, despite not being voiced and despite not being hummable, obviously), and that is assumed to be the case in this book.[17] Sonorants have been identified with the distinctive feature [sonorant]. We will see various contexts in which the notion [sonorant] is very important despite not being a term taught in phonetics class.

3.4.3 *Obstruent.* A sound that is not a sonorant is an **obstruent**. Therefore obstruents include all oral stops, affricates, and fricatives. Just the opposites of sonorants, obstruents are formed with a configuration in the oral cavity that suppresses spontaneous voicing. Thus obstruents are easily and commonly voiceless, unlike sonorants. With respect to distinctive features, if a sonorant is [+sonorant], an obstruent is [−sonorant].

3.4.4 *Phonological phrase.* We discuss many examples in this text that correspond quite straightforwardly to the common notion of word. We do not make a distinction at this point between grammatical word and phonological

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[14] There may be some disagreement over the definition of a diphthong, but in this we follow Schane (1973:19-20), who says "a combination of a vowel and semivowel may constitute a diphthong, which functions like a single vowel. [...] Whether a sequence of vowel and semivowel functions as a diphthong depends on the structure of the language." See also the parallel treatment of this topic in Durand (1990:204). Easily accessible evidence for the analysis of diphthongs is available from English, Spanish and French.

[15] Chomsky & Halle (1968:302).

[16] We are referring here to the nasal consonants such as /m/ and /n/—what are called nasal stops by some linguists.

[17] Anderson (1974:298) uses essentially this same definition and also expresses his doubts about the proper inclusion of the "laryngeal glides *h* and *ʔ*" with it.

word, although that may be relevant at some point. But we do often make reference to the beginning or end of a PHONOLOGICAL PHRASE. While it may be important in some areas of study (such as of intonation) to distinguish between various kinds of phonological phrases, we only need a simple one here, and that is a stretch of speech that begins with a major pause and ends with a major pause. When we have occasion to use notation to represent this, we use the symbol ‖ (double vertical line) to indicate it.[18]

3.5 Key terms

The key terms discussed in this chapter include:

1. PHONEME. In simple terms, the phonemes of a language are the sound-based entities of which morphemes are composed. (§3.1)
2. PHONE. The phones of a language are the actual sounds of the language, distinguishing small contextual, stylistic and dialectal variations that are perceived and also including phonetic detail that may or may not be perceived by native speakers. (§3.1)
3. DISTINCTIVE FEATURE. The distinctive features of sounds are the (articulatorily or acoustically based) defining characteristics of the phonemes. (§3.2)
4. SYLLABLE. A syllable is an abstract organizational unit of phonology that groups an acoustically prominent element (usually a vowel) with adjacent less prominent elements (consonants). (§3.3)
5. DIPHTHONG. Two vowel-like sounds that occur together in the same syllable and are analyzed as forming the nucleus of the syllable form a diphthong. (§3.3)
6. CLOSED SYLLABLE. A syllable that has a coda is a closed syllable. (§3.3)
7. OPEN SYLLABLE. An open syllable is a syllable that has no coda. (§3.3)
8. SEGMENT. A segment is a sound that occupies a single position in the phonological string. It may be articulatorily simple, such as /m/, or it may be complex, such as [ᵐb]. (§3.4.1)
9. SONORANT. A sonorant is a sound that is "produced with a vocal tract cavity configuration in which spontaneous voicing is possible." Typical examples are [a j ɾ m l] (vowels, nasals and approximants, of any type). (§3.4.2)
10. OBSTRUENT. An obstruent is a sound that is not a sonorant. Typical examples are [p tʃ s] (stops, affricates, and fricatives, of any type) (§3.4.3)
11. PHONOLOGICAL PHRASE. For our purposes, a phonological phrase is a stretch of speech that begins with a major pause and ends with a major pause. (§3.4.4)

3.6 Reading questions

You can check your answers to these questions in appendix F.3.

1. T/F This course is organized around four key ideas.
2. T/F The key ideas around which this course is organized have achieved virtually unanimous support from phonologists.
3. In what period was the concept of PHONEME most prominent? (a) 19th century, (b) first part of 20th century, (c) second part of 20th century (d) 21st century.
4. In what period was the concept of DISTINCTIVE FEATURE introduced? (a) 19th century, (b) first part of 20th century, (c) second part of 20th century (d) 21st century.
5. T/F The notion of SYLLABLE is one that has always been important in phonological theory.
6. According to the text, "the sound-based entities from which morphemes are composed" refers to (a) words, (b) prefixes, (c) phonemes, (d) distinctive features.
7. T/F The notion of the phoneme involves an abstraction over the notion of "phone".

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[18] This is the IPA symbol for the end of an intonation pattern, as explained in IPA (1999:14).

8. T/F On average a language has about fifteen phonemes.
9. T/F The languages in a particular language genus have the same phonemes as the others in that genus.
10. The sonority peak of a syllable is called the ________ of the syllable.
11. T/F A language with few phonemes also has fewer words and therefore fewer utterances are possible.
12. T/F Languages that do not use alphabets do not have phonemes.
13. T/F Some phonemes are neither consonants nor vowels.
14. T/F The set of phones in a language is larger than the set of phonemes.
15. T/F The "phonemic hypothesis", as summarized in the text, is that any given language can be adequately analyzed on the basis of a limited inventory of sounds.
16. The three major parts of a syllable are: _______, _______, and _______.
17. T/F The defining characteristics of phonemes are known as distinctive features.
18. Which of the following is not considered to be a part of the basic structure of a syllable?
    a. onset
    b. diphthong
    c. coda
    d. nucleus
19. What term describes the opposite of a sonorant? ______________________

3.7 Exercises

1. Find a phonological description (a book, an article, or a chapter in a more comprehensive description—but not one of the illustrations of the IPA that are found in the *Handbook of the IPA*) and find the list of phonemes that is presented (assuming that one is given). How many are consonants? How many are vowels? Does the language have tones? How does this language fit within the ranges shown by Maddieson (2013a,2013b) for consonants and vowels? (What categories is it in?)

   Note: this assignment cannot be done appropriately using a dictionary (which may be talking about practical spelling and not phonemes), nor a website (which may be written by someone who does not understand the concepts we are discussing here, although of course there are indeed websites that present accurate information). It needs to be a technical write-up. This assignment requires doing research in a library.

Part II

THE SYLLABLE

At this point we take up a detailed discussion of the syllable. We have to jump in somewhere anyway, and while we have often started with the topics that are covered in part III of this book, there are advantages to starting with the syllable. One of these is the fact that one can begin thinking about the syllable structure of a language before doing much else and with a relatively small amount of data. Like everything else, not all of the answers will fall out right away (if ever), but it is a starting point.

This is a good time to mention that indeed, things are still constantly being probed and discussed regarding the nature of the syllable and its application to phonology. Languages that are familiar to us are sometimes the source of data whose importance has been overlooked. And it is certainly the case that previously undescribed and underdescribed languages have points that will raise questions about long-held claims regarding the syllable. It has happened already, and it will happen again. So as you read these topics, keep thinking!

4

THE BASIC NOTION OF THE SYLLABLE

As stated in chapter §3, the notion SYLLABLE has been a useful concept in phonological descriptions and theories (to varying degrees) for a long time, corresponding roughly to a sequence of sounds that cluster together around a single peak of sonority. Hammond (1999) devotes more than one hundred pages of his book to the description of English syllables, and says that the preliminary definition that he gives ("a recurring grouping of sounds across words") is revised considerably in those pages (never conclusively, it seems) and that "there are a number of fascinating intricacies to it" (p. 31). And that is the discussion for only one language! Ewen & van der Hulst (2001) deal with the syllable and related matters in about eighty pages of important discussion in their book, but no definition is given.

During a number of years of work in generative phonology, the notion fell out of use, but various facts brought it back into vogue, and more research made it even more prominent.[1] Furthermore, recent work has sharpened the issues that are of interest cross-linguistically. This does not mean that everyone accepts the claim that syllables are really important. Ohala (2008:184) claims that "the syllable is not a basic organizing principle. It is, rather, epiphenomenal; some language-specific organization of a collection of parametric modulations (of acoustic variables). There is no plan behind them ..."

A precise *definition* for this notion is not found in phonetics, however, and it is in fact a notion that continues to elude a universally applicable definition.[2] A recent approach is to describe it as a structural unit that provides organization to sequences of sounds,[3] just as earlier it was pointed out that the justification of including syllable structure in the representation of speech "must derive from the augmentation in our understanding of those facts that result from the assumption of its presence."[4]

If we do not know what a syllable really is (as one might conclude from the controversy), why bother with it? Various facts of language have pointed to the importance of this notion for basic descriptions, and these are briefly presented in this chapter.[5]

4.1 Poetry

We know that the syllable plays a role in the production and analysis of poetry in some languages. Certain kinds of poetry count the number of syllables in a line, for example. Some sonnets are built around iambic pentameter (a sequence of five iambs, see §29.7), as in Shakespeare's Sonnet 18:

(1) *(So long)(as men) (can breathe) (or eyes) (can see), (so long) (lives this) (and this) (gives life) (to thee), . . .*

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[1] See the discussion in Anderson (1974:252).

[2] Renowned phonetician Ladefoged (1982:220) wrote that "although nearly everybody can identify syllables, almost nobody can define them."

[3] Blevins (1995:207).

[4] Anderson (1982:546).

[5] Hammond (1999:31) presents as evidence for the syllable the claim that speakers of English, even those who are illiterate, "can readily count syllables." Rowe & Levine (2006:48) claim that "most adult speakers can easily determine how many syllables there are in most words." Such claims seem to me to be statements of faith and not statements based on evidence. The general claim may be debatable for languages in which the notion of syllable has not been taught. I wonder how many times someone has attempted to do this with a language that lacks a tradition of discussion of the subject and in which there is any complexity in the situation. My experience has led me to doubt that it is as easy or unproblematic as has been claimed. (Even in English it is not always clear. How many syllables are in the following words—*sour*, *hour*, *tower*, *power*, *our*? Or in *every*, *everyone*, *everything*?)

4.2 Edge phenomena

Within descriptive linguistics, however, we might start off by noting (see chapter §22) that some phonetic generalizations refer to the beginning of a syllable, or the end of a syllable. These particular phonetic generalizations cannot be captured by reference to the word or to pause. An example from Bulgarian is that /l/ is velarized in syllable-final position (Ternes & Vladimirova-Buhtz 1999).

Generalizations that are made with reference to the syllable must be looked at carefully, however, since in some cases the correct formulation is that the phenomenon happens when the consonant is in the Onset or is in the Coda (see §3.3), and not that the consonant is actually at the very beginning or the very end of the syllable, since the onset or coda may actually contain more than one consonant.

During the period of generative phonological theory (60s and 70s) in which the syllable was considered to be a non-essential or at least derivative concept, one sees formalizations of the type "X becomes Y when preceding C or #" (that is, X becomes Y when it precedes a consonant or a word boundary—sometimes indicated by ##), as shown in figure 1.

$$X \rightarrow Y / \_ \left\{ \begin{matrix} C \\ \# \end{matrix} \right\}$$

Figure 1. One way in which formalism attempted to avoid direct mention of the syllable

The fact that such a disjunction (itself an indicator of a problem) appeared so many times in so many languages, with variations that directly mimicked the syllable structure of the languages in question, was one reason why the notion of syllable was reintroduced into generative phonology. It was first re-introduced somewhat informally, using shorthand notations like X Y / __ $ (where the dollar sign or some other symbol, such as a period, was meant to indicate a syllable boundary, although syllables were not part of the formal apparatus of the theory). Such shorthand notations did not indicate for everyone at the time that the syllable was necessary. Hyman wrote in (1975:192) that "[w]hile the use of $ instead of C, V, and ## sometimes simplifies phonological statements [...], the fact that it can always be avoided is seen as evidence that it has no phonological status."

Despite such statements, work by people outside and then inside the generative phonological tradition eventually had sufficient influence to bring the notion of the syllable not only back into the theory, but for it to take on an even more important role than it had ever had before, as a survey of later literature reveals.

4.3 Possible word

Another major use of the notion of syllable has been to help describe what is a possible word. It has been a common claim (but not an uncontroversial one) that the words of a language must be parsable (analyzable) into syllables, and that languages impose restrictions that have to do with possible syllables. That is, if one knows what a syllable is, then one can derive what are possible words in the language based on that information. A word might have one syllable, or two syllables, or three syllables, or more. The possible word is therefore (on this view) directly related to what is a possible syllable.

This view raises several important questions that are partially addressed below. Crucially, it depends on the assumption (which is only an assumption, strongly challenged by some data) that words must be exhaustively parsable into syllables. That is, every part of every word must be described by the syllable template (or some other mechanism discussed below). The theory would not be much help in knowing what is a possible word if one did not need to check out the entire string of consonants and vowels in the "word" under examination.

Suppose we have a language L that has only CV syllables (where C stands for "any consonant" and V stands for "any vowel"). If we say that words in any language must be parsed into syllables, then a string of sounds in language

L that cannot be exhaustively parsed into these CV syllables cannot be a word. This represents an important insight into helping us understand what words in this language must look like.

In language L we expect to find words such as [tapa] (analyzable as [ta.pa], CV.CV) but not ones like [tapat] (which cannot be parsed—what to do with the final C?). This explanation correctly accounts for the non-existence of an infinite number of other words that one might otherwise imagine for language L. For this reason, a theory of language that incorporates these claims is more highly valued than one that does not.

Seri has a large set of possible syllables, and an average-sized inventory of phonemes. But the string of sounds [loːmʃ] had never been recorded. However, the string (a) has sounds of Seri, and (b) can be parsed into a well-formed syllable. In recent years, it was discovered that this is in fact a word (nearly forgotten and unrecorded) that means ‘baby mussel’. However, the string [loːʃm] is not a possible word of Seri because it cannot be parsed into a well-formed syllable or series of syllables.

This idea of “possible word” also depends on having some way of defining a syllable for that language. If we do not know clearly what a syllable is, then we do not know if we have found them all. The next chapter begins to look at the syllable more closely.

4.4 Word games and hidden languages

Speakers in many languages are able to spontaneously manipulate words in ways that demonstrate that they are accessing a certain kind of representation of those words in certain ways. When people make up new words based on existing words, perhaps as a game or as a kind of hidden language, it is possible and important—as well as interesting—to figure out what the “rules” are that they are using. Sometimes the rules make reference to the notion of syllable—not to consonant, or vowel, or onset. The existence of these rules supports the idea that we need the notion of the syllable in our tool kit when we analyze language.

An example of a word game that refers to syllables is given in Hombert (1973) for Bakwiri. In this word game, the last syllable of a word is transposed to the beginning of the word. A simple example (too simple because it has only two syllables, but the referenced article only included two-syllable words) is the following: mɔ̀kɔ̀ ‘plantain’ is changed to (word game version) kɔ̀mɔ̀.

Not all word games utilize the notion of the syllable, however. English Pig Latin moves the onset that occurs at the beginning of the word to the end and then adds the vowel [eː]. So the word *plaque* /plæk/ comes out as /ækpleː/ in Pig Latin.[6] The rule does not refer to the syllable *per se*. The hidden language of Spanish called Jerigonzo (or some variation on that name) similarly does not require the notion of syllable. Informally, the rule (in one “dialect” of it) says to insert the sound /p/ after every vowel and then put a copy that vowel after the /p/.[7] An example here helps to see it. The word *también* /tamˈbjen/ comes out as /tapamˈbjepen/.

There is another hidden language in Spanish, called Vesre, that utilizes the movement of syllables—not consonants, not onsets of syllables.[b] There is more than one set of rules for this game, but the general idea

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[6] See http://en.wikipedia.org/wiki/Pig_Latin.

[7] See http://en.wikipedia.org/wiki/Jeringonza.

is to move syllables. A word like *boliche* /boˈlitʃe/ comes out as either /tʃeˈlibo/ or /tʃeˈboli/. Such a game provides additional evidence for the necessity of the notion of syllable in linguistics.

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[b] See http://es.wikipedia.org/wiki/Vesre.

4.5 Suggested additional reading

Topics in this chapter are discussed in Ewen & van der Hulst (2001). See pages 122-128 of that work for discussion of the question of why syllables are a useful notion, including for answering the question of possible words, for describing edge phenomena, and for making certain other generalizations in a non-redundant way. The overview of the syllable provided in Goldsmith (2011) is also extremely valuable, as is that in Zec (2007).

4.6 Key terms

The key terms discussed in this chapter include:

1. SYLLABLE (as an organizational unit in language): A syllable is an abstract organizational unit of phonology that groups an acoustically prominent element (usually a vowel) with adjacent less prominent elements (consonants).
2. WORD (as composed of syllables): A word is a morpheme or combination of morphemes that is stored in the lexicon as a unit that can be used in the construction of phrases. A morpheme such as plural {s} is not a word in English, but the morpheme that essentially indicates plural in another language may in fact be part of a phrase rather than part of a word and thus be a word by this definition. (§4.3)
3. PARSABLE (expected of possible words): A string of segments is examined and checked against any conditions and constraints that the language might have (such as a syllable template) to determine whether and how those sounds fit those constraints. This is referred to as parsing the string. (§4.3)
4. EXHAUSTIVELY PARSABLE: Some theories claim that every real word must be completely, or exhaustively, parsable by those constraints in order to be judged a legitimate word of the language. (§4.3)

4.7 Reading questions

You can check your answers to these questions in appendix F.4.

1. T/F The definition and use of the syllable have been agreed upon in phonology for many years.
2. T/F The generalizations “X happens when Y is in the coda” and “X happens when Y is at the end of a syllable” are clearly distinguished in all languages.
3. T/F Understanding the theory of the syllable can help us parse the language in a way that shows us what possible words in the language might look like.
4. T/F The reason why the word [loːmʃ] cannot be a word of English is because English does not have the sound [ʃ]. (Then explain.)
5. T/F The word [bæpm] cannot be a word of English, because it cannot be parsed into syllables permitted in English. (Then explain.)
6. How does the matter of describing the possible syllables of a language contribute to the matter of describing what are possible words in the language?

4.8 Exercises

(No exercises have been included yet.)

5

SYLLABLE TEMPLATES

It has been claimed that one can find syllables of the shape CV in all languages and hence the syllable type CV has been called the **universal syllable**.[1] It therefore makes no sense in a language description to point out that a language has CV syllables, since all languages have such syllables. The question is whether a language has any other types of syllables, and if so, which types.

In some languages, CV is the only type of syllable; all words are parsable using it. In those cases, we may say that CV is the **maximal syllable template**[2] as well as a possible instantiation of that template. As we see below, V is also a common instantiation of that template. The maximal syllable template specifies what the largest syllable permitted in the language is (setting aside extrametrical consonants, discussed below). The syllable template CV thus permits us to describe two types of syllables in any language: CV and V.

To distinguish a syllable template from a syllable type, we may use labeled brackets as follows: $[CV]_{max}$. Note that no parentheses are used.[3] In the terminology of some, the syllable template must **license** the segments that appear in any word that exists in the language. As an example, if language M has the maximal syllable template $[CV]_{max}$, it will be possible to parse a word such as **[pata]**, but not a word such as **[pat]**, nor a word such as **[panka]**. In the latter two words, a consonant is ending up "unlicensed", with the result that in language M these would be impossible words. The description matches the facts. See the illustrations in (1).

(1)

```
[CV][CV]       [CV]        [CV][CV]
 ||   ||        ||          ||   ||
 pa   ta        pa t        pa  nka

  OK           Not OK       Not OK
              (unlicensed t) (unlicensed n)
```

Let's look at a language that arguably has a $[CV]_{max}$ template that is adequate for parsing all of its words: Madija.[4] Since this language has a $[CV]_{max}$ template (and no other "complications" of the type discussed in chapter §6), we know that there are no words that end in a consonant in Madija — hence no words such as **[pat]** — and that no words such as **[panka]** exist either. Why is this true? It is because we cannot parse these strings of sounds using the $[CV]_{max}$ template. When we take the string **[pat]** we can get up to the **[t]**, but the **[t]** has no place to go. It is not licensed by the template and therefore the string is invalid as a word. (Remember, we have assumed that parsing must be exhaustive.) When we take the string **[panka]**, we can parse the parts **[pa]** and **[ka]**, but the **[n]** has nothing to license it, and so the string **[panka]** is also invalid as a word in this language.

So what kinds of words does this template correctly describe Madija as having? The words shown in (2) are obviously simple to describe by this template, plus much longer ones.

(2)

a.	**po**	'he, him'
b.	**bani**	'meat'
c.	**dahoni**	'canoe'
d.	**tataɾade**	'a species of mouse'

---

[1] This observation is attributed to Jakobson (see Hyman 1975:161).

[2] Itô (1986).

[3] In some descriptive literature one sees (C)V as a way to say that both CV and V are possible. The parentheses are not used in the approach that uses the notion of maximal syllable template.

[4] Adams & Marlett (1987), (1990).

Of course, an adequate description must cover all of the data that exist in the language. At this point we have only shown that the [CV]$_{max}$ template gets us off to a good start.

5.1 What the template [CV]$_{max}$ allows for

The template [CV]$_{max}$ allows for syllable types V as well as CV. It is always assumed that the consonants in a syllable template are optional unless otherwise specified.

The language illustrated in (2), Madija, has the template [CV]$_{max}$. The largest syllable in this language consists of a consonant and a vowel, but smaller syllables also occur (consisting of a vowel alone—the vowel is always obligatory).[5] An example is the word /ohie/ 'sadness', which has two instances of syllables without onsets in the phonemic representation. This word is parsable with the [CV]$_{max}$ template, as shown in (3).

(3)

```
[CV][CV] [CV]
   |   | |     |
   o   h i     e
```

5.2 Other maximal syllable templates

It becomes immediately obvious that the [CV]$_{max}$ template is not going to handle all of the facts of languages in the world because in many languages one finds two consonants in the same syllable. In some languages we must posit a larger maximal template. Again, the template specifies the largest syllable allowed, and then by convention, subsets of that template are automatically allowed.

The template [CVC]$_{max}$ allows for syllable types V, CV, VC and CVC. The template [CCV]$_{max}$ allows for V, CV, and CCV. Larger maximal templates allow for even more syllable types. In the absence of some other restriction (such as the Obligatory Onset Parameter — see §5.4), one expects that the maximal syllable template automatically allows for a range of syllable types.

In a number of cases it is advantageous to generalize the template using X to cover both C and V. A template [CVX]$_{max}$ thus allows for both CVC and CVV (and also CV, V, VC and VV). That is, the maximal syllable in this case has only a simple onset but it may be more complex in other ways, whether with two vowel positions (perhaps a single long vowel) or a vowel and a consonant.

While no language in the world has a maximal syllable template smaller than [CV], many languages have maximal syllable templates that are larger. Some languages explicitly allow two vowel-like sounds in the syllable (as diphthongs), so one might add VV in the middle of some of these templates, such as [CVVC]$_{max}$. Seri arguably has three V positions in the maximal syllable template, in addition to codas.[6]

5.3 Caveat about word edges

Chapter §6 shows that word edges are often special. When one is determining the maximal syllable template, it is therefore important to be aware of this and take those facts into consideration. The easiest way to do this is (when possible) to utilize only word-internal syllables for determining the maximal syllable template. If that is not possible, one must do careful calculations to determine that the best analysis has been reached.

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[5] In some languages (e.g. Japanese), loanwords from other languages are restructured according to the native syllable template. In other languages, 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 that would not be possible words in their language since they violate the syllable template. Syllable structure studies typically set aside loanwords for discussion of the native language patterns and then look at the loanwords separately against that backdrop.

[6] In the case of Seri, the three V positions are typically filled by a long vowel and a short vowel, or a short vowel and a long vowel. For more information, see the discussion in Marlett (1988).

5.4 Obligatory Onset Parameter

In many languages a syllable without an onset does not exist: there are no words like *chaos* [ˈkʰe.as] in such languages, with word-internal onsetless syllables. In some languages (such as English) a word-medial syllable is fine without an onset. It has been proposed that this matter of requiring an onset is a parameter on which languages vary. For each language, therefore, one must indicate the way in which the parameter in (4) is set.[7]

(4) Obligatory Onset Parameter: [on/off]

If a language has this parameter set "off", then it is possible to find syllables without onsets inside of a word. Other words of this type in English (with word-medial onsetless syllables) are *oasis*, *doable*, *going*, *lion*, *suet* and *eon*, among many others. In English, this parameter is set "off". In Madija this parameter is also set "off", we believe, judging by the data shown in (3).

If a language has this parameter set "on", as is quite common cross-linguistically, it is not possible to find syllables without onsets inside of a word. (It may be possible to find them word-initially, however, but this is not relevant. See the discussion in chapter §6.)

Knowledge about how this parameter is set in a language is another aid in predicting what kinds of words to expect. If the Obligatory Onset Parameter is set "on", then we would not expect to find a two syllable word like *lion* (parsed *li.on*) that has a heterosyllabic vowel sequence.

5.4.1 *Short exercise: Lowland Oaxaca Chontal.* See the data in appendix G.2.2. Assuming that the data are representative of the language, determine whether this language has the Obligatory Onset Principle set "on" or "off". Why or why not? When you have written down your answer, see the discussion in appendix E.1.

5.5 Syllabification

We have used the term PARSE above, and it needs some explanation. By some algorithm, a string of sounds is scanned using the maximal 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 two.

First, we assume (as others have assumed) that languages organize any CV sequence into a syllable. A sequence such as CVCV is claimed to be preferentially (if not universally) syllabified as [CV] [CV], never as [CVC] [V].[8] That is, it is claimed that any consonant that immediately precedes a vowel is always TAUTOSYLLABIC (in the same syllable) with that vowel.[9] If there is any situation in which this is not the case, it would be highly unusual and need to have substantial justification to support it.

One way in which this parsing has been enforced has been to invoke the principle in (5).

(5) Maximize the Onset: When parsing, the Onset has priority over the Coda.

This principle has applicability in various situations. It is not necessarily a universal, however, although it is a good working principle to assume that it is.

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[7] See Ewen & van der Hulst (2001:139) where it is proposed that the default setting for this parameter is "on" (actually, "yes" in their formulation). As they point out: "In studies on first language acquisition the unmarked setting is considered to be the one which the child assumes unless the data of the language being learned indicates that the marked setting is appropriate."

[8] Itô (1986) proposes the following Universal Core Syllable Condition: if a consonant precedes a vowel, it is in the same syllable as that vowel. See the discussion in Blevins (1995:230-232), however, of some serious problems for the universality of such a claim.

It has been proposed by some analysts (e.g., Kahn 1976) that in English some sequences of CVCV are actually syllabified such that the middle C is both the coda of the first syllable and simultaneously the onset of the second syllable; it is AMBISYLLABIC. See the arguments against this proposal in Jensen (2000).

[9] Sounds that are tautosyllabic occur in the same syllable.

It is worth pointing out here an error that is commonly made by novices, corrected easily by simple examination of data that is close at hand. Novices often think that syllable boundaries and morpheme boundaries must coincide. They do not. There are morpheme boundaries that fall within a single syllable, as in the plurals of many nouns in English. Consider the word *cat-s*, where the morpheme break falls between two consonants, both of which are in the coda (*ts*), and the word *pea-s* where the morpheme break falls between the nucleus and the coda (*s*). And there are examples like *fil-ing* where the morpheme break falls between the onset (*l*) and the nucleus of the same syllable (*i*) since *filing* is syllabified **[ˈfaɪ.lɪŋ]**.[10]

5.5.1 *Short exercise: Marinahua.* See the data in appendix G.17. Assuming that the data are representative of the language, determine (a) what the maximal syllable template is (and argue against two obvious alternatives that one might initially propose), and (b) whether this language has the Obligatory Onset Principle set "on" or "off". Explain; illustrate how you parse examples #1 and #11. When you have written down your answer, see the discussion in appendix E.2.

5.6 Syllables and sounds

The syllable has figured implicitly or explicitly in the discussion of phonemes of languages. This topic is taken up in detail in chapter §9, but a simple example is given here. Imagine a language that has almost exclusively syllables of the shape CV (consonant followed by vowel), except for the syllables **[tʃa]**, **[tʃe]**, **[tʃi]**, **[tʃo]**, **[tʃu]**. Such examples have generally been understood *not* as exceptions of the shape CCV but as examples of syllables that begin with a complex segment—in this case, affricates. Now this certainly is not true of all apparent exceptions, but evidence supports such an analysis in certain cases.

5.7 Minor patterns

While it may be the case that all of the syllables of a language fit the proposed syllable template, we are convinced that things do not always work out the way they are expected to work out. There may be a very robust pattern for the language that can be captured by means of a syllable template, with a few exceptions. It would not be appropriate to shoe-horn these exceptions into the template. It would also not be appropriate to expand the template to cover these few exceptions because that would lead to a vastly greater set of expected forms than what actually occur.

5.7.1 *Case study.* Quiegolani Zapotec appears to robustly demonstrate that the maximal syllable template is [CCVC].[11] Consider words **/bzá̰/** 'bean' and **/bzḭ̌l/** 'spark' as examples of attested words; and consider ***/kábz/** and ***/kásp/** as illustrating impossible types of words.

Nevertheless, there are a few words, such as **/ngbǐz/** 'sun' and **/nwʈ͡ʂétʃ/** 'iguana', that do have three consonants in the onset. And there are few words, such as **/mtìlt/** 'jícama' (a tuber, *Pachyrhizus erosus*) and **/mlènʈ͡ʂ/** 'mosquito', that have two consonants in the coda.[12]

It seems inappropriate to say anything more about these odd words other than that they have unusual clusters and that those clusters happen to always begin with a sonorant consonant (whether in the onset or in the coda), a fact which itself may be coincidental. A complete phonological write-up would, however, mention them and list them for future study.

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[10] We also assume that syllabification issues most seriously center on something like the phonemic representation. If one decides to posit an abstract so-called underlying form **{tmkap}** in Seri (as one could justifiably do for the word **[toŋˈkap]** 'didn't s/he/it fly?'), that does not mean that one is positing syllables of the type that begin with **tmk**. It is argued in the literature that phonological operations take place precisely with the strategy of fixing such "underlying forms" to conform to expected syllable patterns—by inserting vowels, inserting consonant, deleting vowels, deleting consonants. At the same time, rules of phonetic detail and other "late" rules, especially fast speech rules, may create forms that do not conform to the standard syllable structure patterns of the language. Therefore narrow representations of casual pronunciation are also not the appropriate forms on which to base studies of syllable structure.

[11] Regnier (1993:62-62).

[12] Regnier (1993:62) mentions that there are eleven words that have the onsets with three consonants, and five different types of two-consonant codas with "one or two examples of each."

5.8 Syllabic nasals

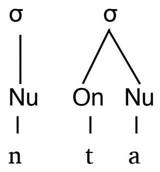
In some languages we find data such as the following (in addition to more ordinary data): a syllabic nasal at the beginning of a word. The difference between a syllabic nasal and a "normal" nasal is a slight difference in timing, and this fact means that even a clear description of the phonetic facts is not always simple. For example, the nasal in the word **/mtìlt/** 'jícama' cited in §5.7.1 could easily be a bit longer than a nasal at the beginning of simple CV syllable, but that does not make it syllabic.

When a nasal (or other sonorant) such as this is not clearly syllabic, it might be claimed to be part of a complex onset.[13] Regnier (1993) presents good evidence that this is the correct analysis for Quiegolani Zapotec. Part of that evidence (p. 60) is the striking fact that when speakers are asked to hum the words of this language, words like **/wnàʔ/** 'woman', which is phonetically **[u̯nà·ʔ]**, with a short vowel-like sound, are hummed as only one syllable.

Another hypothesis, which is a slight variation on the preceding one, is that the parsing algorithm for the language does not allow incorporation of the non-syllabic nasal[14] and that the nasal consonant is simply not incorporated except by a late "adjunction" rule that requires it to be pronounced with the rest of the string as the best it can be pronounced.[15] This hypothesis obviously does not accept some of the assumptions that are common in some views, including the requirement of exhaustive syllabification.

When a nasal is quite clearly syllabic, a word such as **[n̩ta]** is disyllabic, not monosyllabic. The first syllable has a nucleus that is occupied by a consonant rather than a vowel. In all languages that we have familiarity with, such situations are highly restricted. See the representation in (6) of this disyllabic word, where the symbol lower-case sigma (σ) is a convention to indicate a syllable. The syllable "node" dominates the Nucleus (Nu) and the Onset (On) in this representation.

(6)



A key point to note here is that the syllabic nasal is not in the same syllable as the next consonant in the string. In a language that allows this kind of situation, extra statements are necessary to indicate (a) that such a configuration (nasal as syllable nucleus) is permitted at all, and (b) the conditions under which they are found.

English has syllabic nasals in some words. The clear ones for us (in the author's dialect) are those following an alveolar stop, as in **[ˈdɪdn̩t]** 'didn't' and **[ˈmaɪtn̩t]** 'mightn't', or following a glottal stop that is in the position of the voiceless stop, as in **[ˈmaɪʔn̩t]** 'mightn't'. See also words like **[ˈbɜʔn̩]** 'button', **[ˈkʰaʔn̩]** 'cotton', **[ˈlæʔn̩]** 'Latin' and **[ˈhɪdn̩]** 'hidden'. In careful speech and in some dialects, the last group of examples is **[ˈbɜtən]**, **[kʰatən]**, **[ˈlætɪn]** and **[ˈhɪdən]**, respectively. Words with the past participle suffix after other consonants clearly have a schwa and not a syllabic nasal: see *ripen*, *spoken*, *risen*, and *fallen*. These facts suggest that the syllabic nasal in English is, in most cases, a further reduction of the sound sequences **[ən]** and **[ɪn]**, and therefore is restricted to those situations where that sequence of sounds may occur. The cases of **[n̩t]** are limited to suffix versions of the negative morpheme attached to the modal verbs *had*, *did*, *could*, *might*, and perhaps *has* as well.[16]

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[13] This kind of onset is not expected by the Sonority Sequencing Constraint discussed in §8.2.

[14] Perhaps precisely because of the Sonority Sequencing Constraint.

[15] It might be argued that when that unincorporated nasal follows a vowel-final word, it is incorporated into that preceding syllable, as that would be a natural and simple place for the nasal to occur phonetically, even in a language that might not otherwise allow consonant-final syllables. See the detailed proposal made in C. Black (1995).

[16] It is unclear to us whether the word *hasn't* in this dialect has a syllabic nasal or a schwa followed by nasal. It is possible that both pronunciations exist.

5.9 Syllables for general audiences

At least in some parts of the world and for certain languages, the syllable is a notion that is used in the teaching of reading and writing, albeit with none of the technicalities that we have introduced here and will introduce in the following chapters. Books to teach reading often introduce sounds not as individual phonemes but as parts of syllables since syllables can be pronounced easily whereas some phonemes (most consonants) do not fare so well on people's lips without something more to help them along. Therefore it helps to know basic facts about the syllable in order to provide the kind of support that teachers of the language need. However, the more complicated the facts are in this area, the more difficult it is to provide simple, straightforward advice to teachers.[17] The minimum needed, however, is some idea of how to divide words into syllables (which may also be necessary for setting up hyphenation rules for the language) so that teachers may develop appropriate teaching materials.

5.10 Summary and example

Part of the basic description of a language requires, on the views presented above in which the syllable plays a major role, that one indicate

(a) what the maximal syllable template of a language is, and
(b) whether the Obligatory Onset Parameter is set "on" or "off".

An example of how this might be stated is given in (7).

(7) Example: Madija

Maximal Syllable Template: [CV]

Obligatory Onset Parameter: off

A good description of a language would state the facts clearly in prose and, perhaps, with some formalism as well. And the facts would be illustrated. A sample write-up is included in §5.10.1. A few other examples of sample syllable write-ups using this approach are given in appendix D.2.

5.10.1 *The syllable in Madija.* The syllable in Madija is maximally [CV]. Every word in the language can be parsed with the [CV] maximal template. The words in (8) have been separated into syllables using a dot:

(8)	a.	**po**	'he, him'
	b.	**ba.ni**	'meat'
	c.	**da.ho.ni**	'canoe'
	d.	**ta.ta.ra.de**	'a species of mouse'

The onset of the syllable is not obligatory, neither word-initially nor word-medially. See the examples in (9). (The verbs given here do not inflect; auxiliary verbs must occur with them.)

(9)	a.	**o.di**	'hole'
	b.	**a.ma**	'bloody'
	c.	**ka.o**	'prick' (verb)
	d.	**kʰa.i**	'crack' (verb)

---

[17] My experience in helping to train young people to read and write the Seri language has shown me that one can do that very well without mentioning the syllable. Therefore I would contend that there is no need for that language to incorporate a discussion of the syllable into teacher training materials for that language.

5.10.2 *The syllable in other descriptions.* One should not expect to find discussions of syllables in all phonological descriptions that have been published in the past. Recall that for some number of years, the syllable was virtually ignored in generative phonological theory.

Nor should one expect to find those write-ups of the syllable that exist to be written with the use of templates. In some descriptions, syllables are described by simply making a list. (We find these to not be as interesting as one using a template and the notion of extrametricality discussed in chapter §6.) In other write-ups, something similar to the idea of a template is presented by use of parenthesis notation. For example, a generalization such as (C)V(C) is meant to indicate something that is equivalent to our $[CVC]_{max}$ template. Such an approach is used in Maddieson (2013e), which also uses the term 'canonical syllable' to refer to something like the maximal syllable template that encompasses all of the legitimate syllables in the language (probably including also those syllables that are also described in chapter §6).

5.11 Key terms

Key terms introduced in this chapter are:

1. **universal syllable**. The CV syllable type has been called the universal syllable because all languages attest at least this one type.
2. **maximal syllable template**. The template that describes the largest syllable permitted in the language (excluding extrametrical consonants, as discussed in chapter §6) is called the maximal syllable template.
3. **license**. A unit (such as a syllable node) licenses another unit by stating the conditions under which the latter may appear.
4. **obligatory onset parameter**. This is the parameter that indicates whether the language requires that any syllable must have an overt onset (with the possibility that initial syllables may be exceptional, as discussed in chapter §6). (§5.4)
5. **parse**. In phonological theory, a string of segments is examined and checked against any conditions and constraints that the language might have (such as a syllable template) to determine whether and how those sounds fit those constraints. (§5.5)
6. **tautosyllabic**. Tautosyllabic elements occur in the same syllable. The vowel [a] and the consonant [m] in the word [tam.bor] are tautosyllabic. (§5.4)

5.12 Reading questions

You can check your answers to these questions in appendix F.5.

1. How can a $[CVC]_{max}$ template account for a word-internal occurrence of a CV syllable?
2. How can a $[CVC]_{max}$ template account for a word-initial VC syllable?
3. T/F If the Obligatory Onset Parameter is set "on" in a language, no word can begin with a vowel in that language.
4. If the Obligatory Onset Parameter is set "on" in a language, which of the following words is *not* possible, regardless of the maximal syllable template and other parameters?
   a. tot.pa
   b. tue.ta.no
   c. tri.um.fo
   d. a.na.sa.zi
5. T/F The name *Alerus* is best syllabified [al.eɹ.us] (VC.VC.VC) because it allows for the simplest syllable type to be used throughout the word and the simple Maximal Syllable Template [VC].
6. T/F CV syllables occur in all languages.

7. T/F In a language that uses a [CV]$_{\text{max}}$, the /ɾ/ in the string /maɾko/ is licensed.
8. T/F Consonants in a syllable template are optional unless otherwise specified.
9. T/F The template [CVC]$_{\text{max}}$ allows for syllable types [VC] and [CVC] (among others).
10. T/F The template [CVVC]$_{\text{max}}$ with the Obligatory Onset Parameter "on" does not allow VVC syllables inside a word.
11. T/F When parsing a string of segments, one usually wants to maximize the onset.
12. Language Z has a [CVC]$_{\text{max}}$ template and the Obligatory Onset Parameter is set "on". What might be the largest set of monosyllabic words that we would find, according to CV patterns (assuming nothing else is going on)?
    a. CV, CVC
    b. V, VC, CV, CVC
    c. V, VC, CV, CVC, CCV, CCVC, CVCC, VCC
    d. CV, CVC, CCV, CCVC, CVCC
13. Language X has a [CVC]$_{\text{max}}$ template. In the absence of other evidence, how should the word **[bataŋ]** in Language X be divided into syllables? (Choose your answer carefully.)
    a. **ba.taŋ**, because the onset of the second syllable should be maximized in accordance with the "Maximize the Onset" principle.
    b. **bat.aŋ**, because the template should scan the first syllable and maximize its use.
    c. **ba.taŋ**, because of the Obligatory Onset Parameter.
    d. **bat.aŋ**, because codas are obligatory in a [CVC]$_{\text{max}}$ template.
14. If a syllable in language X has a maximal syllable template [CV], how does knowing that help us explain the nonexistence of words like [batman] in that language?
    a. It doesn't. The word does not exist because the people do not read comics.
    b. It doesn't. The word [batman] has sounds in it that do not match speaker intuitions.
    c. It doesn't. The word is too long for the syllabification to be completed.
    d. The string of phonemes b...a...t...m...a...n cannot be parsed into possible syllables.
15. True/False Constraints on poetical compositions sometimes make reference to the syllable.
16. What is one way in which the two syllable types [CVC] and [CVV] can be described using a single syllable template?
17. T/F The word *chaos* **[k^{h}e.as]** in English illustrates the syllable type [CVVC]. (Explain your answer.)
18. T/F The word *neon* **[ni.an]** in English is evidence that the Obligatory Onset Parameter is set to "off" in English.
19. T/F The word *inside* **[ɪnˈsajd]** in English is evidence that the Obligatory Onset Parameter is set to "off" in English.
20. Very briefly explain what is called the universal syllable and why it is called that.
21. Which of the following words is definitely *not* possible if the maximal syllable template is [CV]$_{\text{max}}$ and if there is initial extrametricality? a. [pal.ta] b. [glu.a] c. [sta.le] d. all are possible

It is also suggested that you take time to read the short description of this topic in Maddieson (2013e) and look at the map included there.

5.13 Exercises

1. Examine the basic data presented in a variety of IPA illustrations found in the *Handbook of the IPA* and determine simply whether (a) the maximal template [CV] appears to be correct or not, and (b) what the setting is for the Obligatory Onset Parameter. Of course, what you observe based on these limited data may be entirely incorrect, but you can show that you know how to apply the concepts in this unit. (Be sure to look at the data in the recorded text as well as the words in the lists.)
2. Salasaca Quichua: Examine the data in group 1 in appendix G.16.3 and determine the maximal template and the setting for the Obligatory Onset Parameter. Also, answer the following questions.
   a. Which data (name three by number) are problematic for a $[CV]_{max}$ template? Show why.
   b. Is the fact that #3 begins with a vowel a problem for the $[CV]_{max}$ template? Why or why not?
   c. Show how examples #3, 4, 8 can be handled by a $[CVC]_{max}$ template. (You should do this by drawing syllable diagrams (they do not need to show internal structure, so just a triangle above each syllable, labeled with a lower case sigma would suffice), or by just bracketing the syllables, and also stating in prose what you are thinking.)
   d. Consider whether this language appears to have the Obligatory Onset Principle set "on" or "off". Discuss this point, with data. (You may assume that the data presented here are entirely representative of the language.)
3. Salasaca Quichua prose write-up. Take the analysis that you proposed (perhaps corrected) for exercise M #2 and write a succinct but clear prose description of the facts, using examples to illustrate. You may follow the example shown in appendix D.2.1.
4. Suppose you receive a language report from a fieldworker that says the following.
   The syllables in this language are open (C)V and the initial consonant of the syllable is optional.
   Write a reply to this fieldworker that will (a) ask for data, explaining what kind of data would be good to accompany the statement, and (b) suggest a way to state for a linguistic audience that is thinking about templates and parameters.

6

WORD EDGES AND EXTRAMETRICALITY

6.1 When the syllable is not enough

If the syllable were adequate to describe all possible words (as combinations of syllables), then all words should be parsable by the maximal syllable template of the language. But in fact, this is not true for a large number of languages in some very specific situations. These complications do not negate the importance of the syllable template, but they show that the theory must be supplemented by something else. This chapter presents two ways in which *syllables at word edges* are often special.

6.2 The special nature of word-initial position

Word-initial syllables are often different from other syllables. It is extremely common — but not universal, despite earlier claims — for the first syllable of a word in a language to have a special status in that it (unlike a syllable in any other position) may occur *without* a consonant in the onset. We should *not* be surprised at all to discover that the only syllables in a language with no onset are restricted to word-initial position. That is, even in a language that has the Obligatory Onset Parameter set "on", one might find words such **[abi]**, **[onani]**, and **[amonehe]**.

This situation is so common that it has been proposed that it is universally true, although there is now evidence that this also is *not* the case.[1] Therefore, in the spirit of the parameters approach taken above, one might propose another parameter relating to word-initial position: the Word-initial Onset Exception Parameter. This parameter is apparently typically "on". That is, even in languages with obligatory syllable onsets, word-initial onsetless syllables are usually possible.

The importance of this point almost cannot be overstated since many descriptions of languages in the past failed to notice that onsetless syllables were found only in word-initial position and therefore made incorrect claims about the syllable structure of the language in question.

6.2.1 *Short exercise: Hixkaryana.* The words in (1) (given in broad transcription) are representative of the words that are found in Hixkaryana for the point in question.[2]

(1)	a.	**kænæ**	'fish'	e.	**ɸɔtwɔ**	'banana (sp.)'
	b.	**ɸɔɾu**	'plantain'	f.	**ʃɔɸɽe**	'sloth'
	c.	**ɯhɯ**	'mountain'	g.	**ehnɯ**	'river'
	d.	**aɾɯ**	'green leaf'	h.	**æɾkɔ**	'take it'

Unattested: words like **teɔ** and **kɔæ**. Also unattested: words like **kekɔɸ** and **kɔtek**. Also unattested: words like **ɸɽeʃɔ** and **ɾkɔke**.

Do the following steps; when you have finished writing down your answers, see the discussion in appendix E.3.

1. Show how each of the following maximal syllable templates is adequate or not adequate for these facts: (a) $[CV]_{max}$ (b) $[CVC]_{max}$ (c) $[CCV]_{max}$
2. Show why you believe that the Obligatory Onset Parameter is set "on" or "off".

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[1] Two languages are Yine (Urquía Sebastián & Marlett 2008) and San Francisco Ozolotepec Zapotec (Leander 2008).

[2] Derbyshire (1979).

6.3 The special nature of word-final position

Word-final positions are also sometimes special—a fact that has been seldom noticed, we believe. And the facts are problematic for some views of the relationship between syllables and words. In fact, the Hixkaryana data presented in §6.2.1 are quite relevant, especially in view of the fact that *no word in Hixkaryana ends in a consonant*. If the maximal template is [CVC]max, then the lack of word-final consonants is something that is unexplained by the syllable structure; one would have to add a specific constraint that relates to the word and not to the syllable.

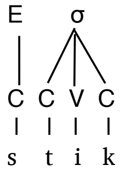
6.4 Extrametrical consonants and word edges

Many languages have other types of "special" syllables at the beginning of a word and/or at the end of a word. Monosyllabic words are therefore the most difficult ones to analyze when this is true since the single syllable is both word-initial and word-final—the most complicated situation. Some languages have a [CV]$_{max}$ template and yet allow word-final consonants. Or they may have a [CV]$_{max}$ template, and yet allow words to begin with two consonants.

Such special strings of sounds have been analyzed as having part of their licensing from the syllable template, and some licensing due to EXTRAMETRICALITY. If a language allows extrametricality, it must be specified where (beginning or end of the word, or both) and with what conditions. (Just any consonant? Only certain ones?)[3]

This is one case where the sounds of a word are not all accounted for by the syllable template. They might be represented graphically as shown below for a language which has a [CVC]$_{max}$ template and which allows (at least) word-initial extrametricality.

(2)



Note that word-medial consonants cannot be licensed by this type of extrametricality. The consonants must be at the word edge. A word such as [kanstim] *cannot* be handled by a [CVC]$_{max}$ template and extrametricality. The [s] in the middle of the word is a problem.

Furthermore, according to the proposals made in the literature, only one consonant at each edge may be extrametrical due to this factor. A word such as [strik] cannot be handled by a [CVC]$_{max}$ template and extrametricality.

6.5 Extrametrical consonants and morphemes

It has also been proposed for some languages that some inflectional morphemes may license additional extrametrical consonants at word edges. In these languages, the distribution of syllable types is superficially very different between monomorphemic words and inflected words.[4] This is obvious by comparing monomorphemic words with inflected words. The latter have more complicated clusters at word edges than the monomorphemic words.

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[3] This notion of extrametricality for syllabification is related to but not the same as the notion that is used in metrical theory for discussions of stress; the latter is also commonly referred to as "extraprosodicity".

[4] This has been claimed explicitly for Seri (Marlett 1988), and for San Francisco Ozolotepec Zapotec (Leander 2008).

6.5.1 *Case study: Seri.* An example from Seri is given here. While only one established monomorphemic word has an onset that has more than two consonants (the word for ‘rock lobster’, /ˈptkamn/), there are many inflected words with three consonant onsets as a result of inflection since there are inflectional prefixes that easily add an /s/, /t/ or /k/ to verb stems, as in the case of the words /ˈkʃχok/ ‘he who hacks it off’ (in which the /k/ is a prefix), /ˈtχtamt/ ‘was it abundant?’ (in which the /t/ is a prefix), and /ˈsχtamt/ ‘it will be abundant’ (in which, /s/ is a prefix). And, in fact, a prefix like /s/ can be added to the noun /ˈptkamn/ to say something like ‘it will be a lobster’: /ˈsptkamn/.[5] These facts seem to indicate that inflectional affixes in Seri simply are not restricted by certain syllable structure constraints.

6.5.2 *Short exercise: Tainae.* The Tainae language has the words in (3) (given in impressionistic transcription):[6]

(3)	a.	[ˈpuno]	‘a type of lizard’
	b.	[ˈabo]	‘father’
	c.	[ˈhabdo]	‘ghost’
	d.	[noˈandɨ]	‘we go down’
	e.	[ˈbdajo]	‘lorikeet’

but not words like *[habab], *[pan], *[dunab]. On the basis of these data (both those that are attested and those that are not attested), answer the following questions.

1. The maximal syllable template is most likely
    - a. [CV]$_{\text{max}}$
    - b. [CCV]$_{\text{max}}$
    - c. [CVC]$_{\text{max}}$
    - d. [CCVC]$_{\text{max}}$
2. The Obligatory Onset Parameter setting is
    - a. on
    - b. off
    - c. unknown
    - d. irrelevant
3. This language has Extrametricality in the following positions:
    - a. initial
    - b. final
    - c. initial and final
    - d. neither
4. This language appears to disallow what kind of syllables?
    - a. open
    - b. closed

After you have written your answers to these questions, see the discussion in appendix E.4.

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[5] Additional details: the underlying form of the irrealis prefix is actually {si}, but the /i/ drops out in the contexts shown here. Furthermore, irrealis forms in Seri are typically followed by an auxiliary form in most contexts.

[6] Carlson (1988).

6.5.3 *Short exercise: Hupa.* The syllable structure of Hupa[7] is described using the following generalizations in a 1964 description. How can these be re-stated using the notions of maximal syllable template, Obligatory Onset Parameter, the Word-initial Onset Exception Parameter, and extrametricality? When you have written out your answer, see the discussion in appendix E.5.

(1) Every syllable begins with a single consonant.
(2) The syllable final[8] may be a vowel, consonant, or biconsonantal cluster. The word may terminate as well in a triconsonantal sequence.
(3) [irrelevant at this point]
(4) Vowels never occur in sequence without an intervening consonant.

6.6 Two examples

Two examples of how extrametricality might be incorporated—or not incorporated—into a phonological description are given in (4)-(5). Other examples are given in appendix D.3.

(4) Madija does not permit extrametrical consonants in either word-initial or word-final position. As a result, words are exhaustively parsed by the syllable template given in (7).

(5) Diola Fogny permits an extrametrical consonant in word-final position.[9]

6.7 Suggested additional reading

See Durand (1990:section 6.1.1 on extrametricality). The topic is developed at length in Itô (1986).

6.8 Key term and ideas

The key term introduced in this chapter is EXTRAMETRICALITY: A consonant that is extrametrical is one that is excluded from consideration for syllable construction. It must be at the beginning or end of the word. A word-final consonant may be extrametrical for the purposes of determining the weight of a syllable. (§6.4)

A key idea in this chapter is that word edges are special with respect to possible syllables. They may allow for a restricted kind of exceptional syllables.

We also saw how word edges may be special in other ways. First, it is very common for word-initial syllables to lack an onset, regardless of whether or not word-medial syllables must have onsets. Second, it may be possible to disallow a word-final consonant even though word-medial syllables may have codas. (This may be a relatively uncommon situation.)

6.9 Reading questions

You can check your answers to these questions in appendix F.6.

1. T/F The Word-initial Onset Exception Parameter, when “on”, allows for onsetless word-initial syllables even when the Obligatory Onset Parameter is “on”.
2. T/F Word-medial consonants not licensed by the maximal syllable template can be licensed by extrametricality.
3. T/F Allowable extrametrical rules can be different between monomorphemic words and inflected words.
4. T/F The sequence of phonemes /pæn/ cannot be a word in a language that has a $[CV]_{max}$ syllable template.

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[7] Woodward (1964). We are using only the prose description given here. Other facts included in the article suggest that the facts are more complicated than they first appear to be.

[8] This is, we believe, another way to refer to the part of the syllable that follows the beginning of the syllable (what we call the rime in §7.1).

[9] This analysis is from Itô (1986). The syllable template is actually [CVVC], but a (phonotactic) constraint that disallows certain types of codas is overridden, as it were, by the possibility of a final extrametrical consonant.

5. Language F has syllable types CV, V, CVC, and VC. So does language G. But investigator of language G notices that V and VC syllables are only found word-initially; words like /pi.an/ and /ke.as/ do not exist in language G although they *do* occur in language F. What gives?
   a. In language G the Obligatory Onset Parameter is set “on” whereas in language F it is set “off”.
   b. In language G the maximal syllable template is [CVC], whereas in language F it is [VC].
   c. Word edges are known to be special; language G proves it.
   d. Language F and language G belong to distinct linguistic genera.
6. T/F All syllables have onsets.
7. Give a short clear answer why a word like [pabst] is not straightforward evidence of a [CVCCC] maximal template.
8. Explain how a person could find words like [staps] and [skild] and affirm that the maximal syllable template in the language might be [CVC].
9. T/F Monosyllabic words are ideal data for determining and presenting evidence relating to the maximal syllable template.

6.10 Exercises

1. Highland Oaxaca Chontal. See the data in appendix G.2.1.2. Use the data given there to consider the following maximum syllable templates and their interaction with (possible) extrametricality, and tell which words (if any) are problematic for an analysis that were to use them.
   a. $[CVC]_{max}$, no extrametricality
   b. $[CVC]_{max}$, initial extrametricality
   c. $[CVC]_{max}$, final extrametricality
   d. $[CVC]_{max}$, initial and final extrametricality
   e. $[CVCC]_{max}$, no extrametricality
   f. $[CCVC]_{max}$, no extrametricality
   g. $[CCVC]_{max}$, initial extrametricality
   h. $[CCVC]_{max}$, final extrametricality
   i. $[CCVC]_{max}$, initial and final extrametricality
   j. $[CCVCC]_{max}$, no extrametricality
   k. $[CCVCC]_{max}$, initial and final extrametricality

   As an example, consider possibility (a). We are going to attempt to parse the attested words with the template $[CVC]_{max}$ and not appeal to any extrametricality. We look at the data with the template in mind, and see that examples 9, 10 and 11 are problems. The [CVC] template cannot parse a word like 9 that has three word-medial consonants. So the answer for (a) is: “examples 9, 10, and 11 (at least) are problematic.”
2. Hejazi Arabic. See the data in appendix G.12.2. In this exercise you should pay attention to the long vowels (written with double symbols). They are important. You may want to review §5 as you do this exercise.
   a. Suggest a maximal syllable template.
   b. Discuss the Obligatory Onset Parameter.
   c. Discuss whether there is evidence or not for Extrametricality.
   d. Show how you analyze each of the following words: #1 #11 #3 #12 #5 #13 #7 #14 by showing how you parse them and account for all of the pieces. (For unattested words, show how your analysis accounts for their non-existence.)

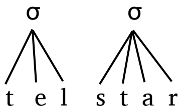
7

INTERNAL STRUCTURE OF SYLLABLES

7.1 Constituency issues

Some linguists in the past have viewed, or tried to view, the syllables as having a 'flat' structure, as illustrated in the following diagram.[1] That is, the consonants and vowels that occur in a syllable are simply linked directly to the syllable node. The syllable has no internal structure of any relevance. See the illustration in (1).

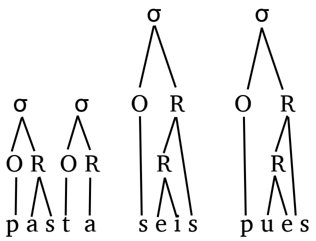
(1)



Versions of a flat structure have gained favor again as they have been enriched with other notions (such as the mora, which is introduced in §7.3); see Pierrehumbert & Nair (1995) and much other work.

Another common view has been 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 **RIME** (R) (or rhyme), as shown below for three words from Spanish.[2] Some of these syllables have 'branching' rimes, a fact that has relevance for the phonology of Spanish. See the examples in (2).

(2)



Phonological rules (as discussed in chapter §22) may make reference to the rime. For example, the rule in Spanish that trills `/r/` phonetically when it occurs after the vowel in a syllable applies to any `/r/` in a rime, not just to an `/r/` that occurs at the end of the syllable.[3]

Another view of the internal structure of the syllable is that there are three major constituents: **ONSET**, **NUCLEUS**, and **CODA**, with the latter two constituents usually grouped under a common node (**RIME**).[4] The nucleus is always the part that is perceived as the syllable peak.[5] See the representation of the English word *flat* in (3).

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[1] Important recent work has revived this view. See the discussion in Topintzi (2010).

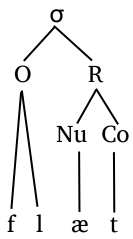
[2] Harris (1983).

[3] An example would be the *r* in *perspicaz*; the first syllable is *pers*. See Harris (1983) for a careful treatment of syllables in Spanish. The results he obtains are not those traditionally held for Spanish. The argumentation is clear, 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.

[4] A more formal version of this type of structure used the label N' (N-bar) instead of R. See the presentation in Ewen & van der Hulst (2001).

[5] See the important discussion in Yi (1999), however, in which evidence is given for the claim that Korean (and presumably other languages) arguably have a different kind of internal structure in the syllable. The claim is that Onset and Nucleus form a constituent ("Body") that then links up with the Coda to form the syllable.

(3)



As already mentioned in §3.3, syllable that has a coda is called a **closed syllable**, whereas one without a coda is called an **open syllable**.

7.2 Heavy and light syllables

One sometimes sees reference to a **light syllable** and a **heavy syllable**. In some languages one needs to be aware of the fact that syllables differ in "weight", which may be a relevant factor for other aspects of the phonology (such as stress placement, as discussed in chapter §29).

Most commonly the rime constituent is the part of the syllable that is relevant for the distinction between light and heavy syllables. If the rime contains any complexity at all, the syllable is heavy; otherwise the syllable is light. Thus a syllable with a long vowel or a diphthong is heavy, as is a syllable with a consonant in the coda.

(4) Light syllables: V, CV, CCV, CCCV, etc.

(5) Heavy syllables: VV, CVV, CCVV, CVC, CVCC, CVVCC, etc.

This is not the only way in which light and heavy syllables can be defined, however. Languages vary on this point.[6]

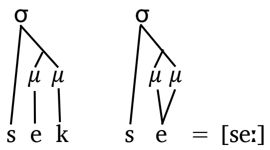
7.3 Syllable weight and moras

The rime of a light syllable, typically consisting of a short vowel, is sometimes said to have a single unit of weight. The unit of weight is referred to as the **mora**,, and is represented with the lower-case Greek "mu" (μ).[7]

(6) A common type of light syllable

The rime of a heavy syllable has more than one unit of weight, at least two moras. Heavy syllables typically have either a long vowel or a consonant (often but not necessarily a sonorant — it depends on the language) in the coda.

(7) Two kinds of typical heavy syllables



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[6] See the discussion of this issue in Topintzi (2010) where it is argued that some languages have heavy syllables because those syllables have complex onsets. This work, drawing on evidence from various languages, has strongly challenged the traditional view that has been outlined in this chapter.

[7] This notation is proposed as a replacement for the notation using the timing tier (using C's and V's) illustrated in chapter §9, but it does not appear to be completely adequate for doing so.

In some languages, a light syllable may include a “non-moraic” consonant in the coda. While it may look like a heavy syllable, it patterns with the light syllables.

(8) A less common type of light syllable

The weight of a syllable is often relevant for the stress facts of a language (see chapter §29, where it is shown that heavy syllables often ‘attract’ stress), or the conditions for a **minimal word** (see §10.2, where it is shown that often major lexical categories of words in languages require two moras).

7.4 Syllabic consonants

Consonants sometimes are the nucleus of the syllable. This is most commonly possible only if the consonant is a sonorant, although rare cases of obstruent as nucleus are also attested.[8] Such consonants are commonly referred to as **syllabic consonants**. The analysis of them in phonology is not entirely straightforward.

Languages most commonly have syllabic consonants only in special situations. English has syllabic consonants in words such as *couldn’t* [ˈkʊdn̩t]. It does not have any words such as [m̩p] or [dn̩t].

> The Seri language has almost no words with syllabic consonants, but in one situation they are found: when a nasal consonant appears (through prefixation) between a glottal stop and another consonant: [iʔm̩pii] ‘I taste it.’ (These conditions relate to what is possible for a syllable given the Sonority Sequencing Constraint; see §8.2.)

7.5 Other special syllables

In some languages, stressed syllables are specially licensed to contain more consonants (or vowels) than other syllables. Unstressed syllables might not allow a branching rime, for example, whereas a stressed syllable may.

> Example: Seri. The Seri language does not allow for complex nuclei in many syllables. A nucleus like /aː/ or /ai/ occurs only in one place in a word—in the *stressed* syllable of that word. (Marlett (1988))

7.6 Practical tips

1. Collect the data. Use only full word forms for the study, not pieces of words.
2. Distinguish between content words and function words (focusing on the former).
3. Set aside obvious or suspected loanwords during the initial study at least.
4. Set aside dubious data at first.
5. Be aware of morpheme boundaries. (This is relevant only if the addition of morphemes seems to be affecting the syllable structure.) If possible, focus on monomorphemic words first.
6. Analyze robust patterns first. (If only one word illustrates a pattern, do not overstate the case using it.)

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[8] Syllabic obstruents are mentioned in Ewen & van der Hulst (2001:121) and the references there to Berber and languages spoken in the northwest of the United States.

7. Do not be misled by what happens at word edges. Monosyllabic words are the most prone to mis-analysis! Such words are not the easiest data to analyze, although they may seem to be easy since they are so short.
8. Syllable structure analyses focus on how the phonemes of the language are organized. The assumption is that the data are not just raw phonetics. In many cases it may not make any difference, but in some cases it may.

7.7 Checklist for syllable structure write-ups

In one way or another the following questions should be addressed in a complete description of the syllables of a language.

1. Maximal syllable template: (specify the template)
2. Obligatory Onset Parameter: (specify the setting)
3. Word-initial Onset Exception Parameter: (specify the setting)
4. Extrametricality (give details)

In less technical presentations, the topics can be presented without technical jargon. And of course, each of the claims must be illustrated and supported with evidence. In a serious study (such as a thesis or dissertation), evidence against alternative analyses also needs to be presented.

While a listing of the various kinds of tokens of syllable types may be done, it is not necessary. (That is, if a $[CVC]_{max}$ template is proposed, one need not specify that [CV] and [VC] syllables are found.) However, it is instructive to show how the maximal syllable template and various parameters and conditions correctly describe what does occur in the language and also how they account for what does not occur in the language.

Discussions of syllable structure typically operate using phonemic representations—not underlying forms (which may be decidedly unpronounceable) nor phonetic forms (which may have their own complications due to vowels being deleted in fast speech, etc.).

Remember that the maximal syllable template may not in itself account for all of the syllables in the language. Extrametricality may be appropriately invoked to account for some consonants at word edges.

Remember to base the analysis on unequivocal patterns, not on the cases that might be analyzed another way. The maximal syllable template $[CCV]_{max}$ is not appropriately proposed if the data all contain what might be analyzed as affricates or labialized consonants, for example. A word such as [tʃip] might easily be analyzed as [CVC] since [tʃ] could be an affricate rather than a [t] followed by a [ʃ]. This topic is taken up in detail in chapter §9.

7.8 Suggested additional reading

Detailed language descriptions that discuss the internal structure of the syllable and how this relates to the language can be especially helpful. One excellent example is Harris (1983). See also the literature cited in Pierrehumbert & Nair (1995), where it is argued (as in other literature) that the Onset-Rime structure is not necessary.

7.9 Key terms

The key terms introduced in this chapter are:

1. ONSET. The onset of a syllable is the sound or group of sounds that precede the syllable nucleus. (If the nucleus includes a diphthong, the onset precedes the diphthong.) (§7.1)
2. RIME. The rime of the syllable is composed of whatever does not appear in the onset of the syllable. (§7.1)
3. NUCLEUS. The nucleus is the part of the syllable that is perceived as the syllable peak. It may include one or two vowels (perhaps more), a diphthong, or a syllabic consonant. It does not include the coda of the syllable. (§7.1)

4. **CODA**. The coda of a syllable includes the sounds that follow the nucleus of the syllable. (The coda does not include any part that is analyzed as a diphthong.) (§7.1)
5. **LIGHT SYLLABLE**. A light syllable has only one mora of weight—typically one that has a short vowel and no coda that contributes weight. (§7.2)
6. **HEAVY SYLLABLE**. A heavy syllable has more than one mora of weight—typically one that has a long vowel or a coda that contributes weight. (§7.2)
7. **MORA**. A mora is unit of weight that pertains to the syllable. (§7.3)
8. **MINIMAL WORD**. Some languages require that a noun or verb have a minimal weight of two moras. The minimal word in such a language must therefore either have two syllables or have a heavy syllable. (This is only mentioned here. It is discussed later.) (§7.2).
9. **SYLLABIC CONSONANT**. A consonantal sound (i.e., one that is not a vowel or a central approximant) that functions as the nucleus of a syllable is a syllabic consonant. (§7.4)

7.10 Reading questions

You can check your answers to these questions in appendix F.7.

1. T/F It is a common assumption among modern phonologists that syllables have no internal structure and that they are considered "flat".
2. T/F The nucleus and coda of a syllable are commonly grouped under the rime node when diagramming its internal structure.
3. T/F If the rime consists of only one regular vowel the syllable is light by traditional definitions.
4. T/F A light syllable may include a non-moraic consonant in the coda and a heavy syllable may end in a bimoraic vowel—such as a long vowel.
5. T/F Syllabic consonants are primarily sonorants.
6. T/F The maximal syllable template and various parameters, if done correctly, typically will describe what are possible words in a language.
7. T/F Heavy syllables most commonly are those that have two elements in the rime—VV or VC.
8. Which (two) of the following is not usually considered to be a light syllable?
   a. CV b. CCV c. CVV d. CVC
9. If the syllable is analyzed as having two constituents, what those called?
   ___________ and __________.
10. The nucleus and the __________ are often considered to be grouped under the __________ node if the internal structure of the syllable is represented.

8

CONSTRAINTS WITH RESPECT TO SYLLABLES

8.1 Language-specific constraints

In many languages there are constraints on the types of consonants that may occur in the coda of the syllable, or that may co-occur in the onset or coda. For example, English syllables may begin with /sn/ but not with /fn/ or /kn/. And /h/ can occur in the onset of a syllable in English, but not in the coda. Furthermore /h/ cannot co-occur with any other consonant in an onset since there are no words like [shɪn]. Such facts may be described, at least informally and initially, by language-specific constraints such as shown below.[1]

(1) Constraint: Only /s/ may precede a nasal in an onset.

(2) Constraint: /h/ does not occur in a coda.

(3) Constraint: The diphthong /aʊ/ does not occur before a tautosyllabic labial consonant (namely, /p, b, f, v, m/) in English. (Jakobson, Fant & Halle (1961:12) citing M. Joos)

(4) Constraint: /h/ does not co-occur with any other consonant.

(5) Constraint: Non-nasal consonants are disallowed in syllable-final position in Japanese. (Itô 1986:26)

(6) Constraint: Obstruent stops are disallowed in syllable-final position in Italian. (Itô 1986:38)

(7) Constraint: An obstruent cluster ending in /p/ is disallowed in Finnish. (Itô 1986:45)

These kinds of constraints about where certain sounds may or may not occur fall under the rubric of PHONOTACTICS. One tries to distinguish between systematic, significant constraints on distribution from those that are not systematic, which are perhaps best considered accidental gaps in distributional patterns. The difference between the two is not obvious in many cases.

> Example: Seri. The common fricative /ʃ/ virtually does not occur in syllable-initial consonant clusters. (One clear example is found in an archaic word.) The fricatives /ɸ/, /ɬ/ and /x/ are also not common as the first consonant of syllable-initial clusters of monomorphemic words, although /s/ and /χ/ are quite common in such clusters. Inflection of verbs readily produces many /sC/ clusters at the beginning of words. Therefore it seems to be the case that there is no good reason to propose a constraint prohibiting /ʃC/ onsets, despite their (virtual) nonexistence.

English actually has quite an array of constraints on its onsets and codas, and distinctive features are useful in stating such constraints as they allow reference to natural classes of sounds. Even if one does not use distinctive features to identify a group of sounds that are singled out by a certain phonotactic constraint, one should try to describe that class using some simple, phonetic label.

Note that some of the constraints in (1)-(7) are positive and some are negative.

8.1.1 *Short exercise: Tewa.* Examine the data in appendix G.23. Propose a maximal syllable template and then a restriction on what consonants may appear in the coda. When you have finished, see the discussion in appendix E.6.

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[1] For one of many treatments of such facts, see Hammond (1999).

8.2 Universal constraints

Some constraints are best viewed as related to a more general property of language, namely the expectation (but not requirement) that sounds that are higher in SONORITY (they are more resonant) are distributed closer to the syllable nucleus than sounds that are lower in sonority. A general sonority scale is the one given in (8).

(8) General sonority scale: obstruents < nasals < liquids < glides < vowels.[2]

That is, obstruents are less sonorous than nasals, which are less sonorous than "liquids" (lateral approximants and r-like sounds), which are less sonorous than "glides" (central approximants), which are less sonorous than vowels. One might formulate the expectation as in (9).[3]

(9) SONORITY SEQUENCING CONSTRAINT: The sonority of a syllable peaks at the nucleus and decreases toward the margins.

This is understood as meaning that sonority is expected to increase as one moves from the beginning of the syllable toward the nucleus and decrease as one moves toward the end of the syllable.[4]

Insofar as a language "obeys" this constraint, we can say that violations do not need to be ruled out by stipulation. For example, the onsets /pt/, /ps/, /gz/ and so forth would be ruled out by a tacit appeal to the constraint as given here. They do not need to be ruled out by a *language-specific* constraint. On the other hand, when they are permitted in a language (in contraexpectation of the constraint), they must be explicitly permitted.[5]

A word like *blast* in English obeys the Sonority Sequencing Constraint. The nonexistent word *lbast* does not, and can be viewed as being ruled out directly by this constraint. However, the nonexistent word *bnast* also obeys the Sonority Sequencing Constraint in its most general form. It must be ruled out by some additional mechanism. The same is true of a non-existent word such as *dlast*.

The Sonority Sequencing Constraint automatically allows codas such as /nt/ in English, and correctly rules out /tn/ in codas. The perfectly fine codas of English /pt/ and /ts/ are not allowed by the constraint, however, and so the phonology of English must explicitly state (in some way) that they are permitted.

8.2.1 *Short exercise: Quioquitani Zapotec.* Examine the data in appendix G.7.2. Which word-initial onset clusters obey the Sonority Sequencing Constraint (9)? Which do not? (After you have written out your answers, see the discussion in appendix E.7.)

8.2.2 *Case study: Seri.* While Seri allows for all kinds of violations of the Syllable Sonority Constraint of the obstruent-obstruent type, it does not allow violations of the constraint of the type sonorant-obstruent in an onset. When words are created that would violate the latter, they are fine as long as the preceding word ends in a vowel to permit the sonorant consonant to be syllabified with that word, as in (10), where the /n/ can be syllabified with the preceding /aː/.

(10) /ʔaː nsiːɸp aʔa/'you should arrive there'

When there is no preceding vowel, the same word is not allowed; a vowel is inserted in order to "fix" the problem and make it pronounceable. In this case the vowel is /i/, and it is inserted before the "stray" (unlicensed) /n/, as illustrated in (11).

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[2] This is the order presented in Kenstowicz (1994:254). See Selkirk (1984) for one attempt to make sonority scales more precise. The terms "liquid" and "glide" are not used in the IPA tradition, nor are they widely used outside of some traditions and some language families.

[3] This is adapted from Kenstowicz (1994:255).

[4] Ohala (2008:184) presents a critical assessment of this topic and an alternative. He states that "sonority is an empirically empty concept that can no more be determined for speech sounds than can their temperature." See also Ohala & Kawasaki-Fukumori (1997).

[5] This point is argued persuasively in Harris (1983).

(11) /insiːɸp aʔa/'you should arrive'

8.2.3 *Short exercise: Syllabification.* The word /kɜmpəs/ in a language could be parsed as CV.CCVC /kɜ.mpəs/ or as CVC.CVC /kɜm.pəs/. What factor would help decide the question, all else being equal? Explain. When you have written out your answer, see the discussion in appendix E.8.

8.3 Special nuclei

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*.

Sometimes other sounds are presented as being syllabic in English as well, such as in the word *spasm*. In some cases (including this one) it seems to be the case that there is in reality a short schwa before the sonorant consonant.

8.4 High vowels in onsets

It is also not uncommon to find the high vowel-like sounds, such as [i] and [u], in onset or coda positions.[6] In such cases, they are usually transcribed as [j] and [w], respectively (in the conventions of the IPA); but note that the difference is not one of features really, but of position in the syllable.[7]

8.5 Nucleus, onset, or coda?

The matter of whether a sound is to be analyzed 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 an approximant, since we know that there are languages in which approximants do function as onsets (as in English *yet*) or codas (no good examples in English).[8] Phonological and morphological evidence of the sort shown below is very important for making decisions about whether a sound is to be syllabified as a consonant or a vowel.

8.5.1 *Arguments from phonological rules.* Consider the following words from Spanish and Seri, which sound virtually the same except for the onset (they both rhyme with English *sigh*).

(12)	Spanish:	[aj]	'there is'	*hay*
	Seri:	[ʔaj]	'wind'	*hai*

This kind of sequence in Spanish has been analyzed as being a VC sequence, with the C /j/ as the coda of the syllable, just as other consonants may occur in the coda in Spanish.

Whereas one might think that the [j]in the Seri example should be analyzed as a syllable coda (since Seri also allows 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, as in (13a), and [iʔa] occurs after consonants, as in (13b).

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[6] In Pike (1947) the issue of whether a high vowel could function in a non-nuclear position was discussed under the rubric of INTERPRETATION. Sounds that can occur in either nuclear or nonnuclear positions were later called AMBIGUOUS (or ambivalent) sounds by some who taught Pike's methodology. This terminology is not widely used today in the literature, but it is useful at times.

[7] In earlier generative work, they were distinguished by the feature [syllabic] (see Chomsky & Halle (1968), for example; cited also in Anderson (1974). This feature has been abandoned for many years now that the syllable has been taken into the theory.

[8] The analyses of words like *toy* [t^{h}ɔɪ] usually posit a diphthong that occurs in the syllable nucleus. Similar analyses are given for words such as *die* [daɪ] and *hay* [heɪ]. These are not analyzed as instances of an approximant in the coda. One reason for this is that the occurrence of these approximants in English does not affect the occurrence of the usual array of options for the coda.

(13) a. [poː ʔa] ‘it is a peccary’ *cf.* /poː/ ‘peccary’
b. [ktam iʔa] ‘it is a man’ *cf.* /ktam/ ‘man’

The fact that the allomorph [ʔa] rather than [iʔa] occurs after [ʔaj] ‘wind’ shows that the [j] sound is really functioning as a vowel and for that reason we transcribe it as a vowel, perhaps marked phonetically with the appropriate diacritic to indicate that it is nonsyllabic.

(14) [ʔai̯ ʔa] ‘it is wind’ (the phrase is not *[ʔaj iʔa])

If this word actually ended in a consonant, we would *not* be able to easily handle the fact that we do not get [iʔa] for the modal word translated as “it is”. Informed by these facts, the phonological representation of the word for ‘wind’ is therefore /ʔai/, a CVV monosyllabic word. This kind of evidence is supported by other facts in the language, and we can actually propose the constraint in (15) for Seri.[9]

(15) Constraint: /j/ cannot occur in a coda in Seri.

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 √jaa ‘own’ might be analyzed (before studying the facts) as either being √iaː or √jaː.[10] Morphophonological evidence (based on the allomorphs of morphemes) can be brought to bear on this issue. The dependent irrealis prefix in Seri has the shape [po-] before consonants, as in (16a), and it has the shape [p-] before vowels, as in (16b).

(16) a. [poˈpanʃχ] ‘when s/he will run’ *cf.* [ˈtpanʃχ] ‘when s/he ran’
b. [ˈpiːm] ‘when s/he will sleep’ *cf.* [ˈtiːm] ‘when s/he slept’

However one chooses to describe such facts, it is clear that consonant-initial roots and vowel-initial roots pattern differently, which should come as no surprise. The allomorph [po-] occurs before the root in question: [ipoˈjaa] ‘when s/he will own it’ (not *[ipjaː]), establishing that this is a *consonant-initial* root.

Another fact comes from the common rule of nasal place assimilation (see chapter §17). The negative prefix {m} always assimilates to the point of articulation of a following consonant in Seri when it is not preceded by a stressed vowel; it appears as /m/ before a vowel. Since it changes to something like [ɲ] in a word like [itkoɲˈjaː] ‘when s/he didn’t have it’, we have additional evidence that the [j] functions as a consonant in this word. (The result is not *[ipomiaː].) In fact, constraint (17) generally holds in the language:

(17) Constraint: /i/ cannot precede another vowel (in the same syllable) in Seri.

Constraint (17) correctly rules out morphemes like {iat}, but allows ones like {aːi}. Constraint (15) correctly disallows morphemes like {paj}, but allows ones like {ja}. These two constraints make important, and accurate, claims about the phonotactics of Seri.

8.5.2 *Arguments from morphological 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 might we find for the analysis of a (phonetically monosyllabic) word such as /ˈʔaːit/ ‘blood’. The constraint on [j] that we have posited in (15) ought to rule out the analysis CVVCC, so the word is not [ˈʔaːjt], although it sounds just like that.

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[9] There are two exceptions to this constraint in Seri: the loanword /kaːj/ ‘horse’, which is extremely close phonetically but not phonologically to the word /kaːi/ ‘one who makes (it)’, and the word for ‘O’odham (Papago) person’: /ʔaˈpaːj/. These words take the vowel-initial allomorph of the declarative morpheme.

[10] We use the symbol √ to explicitly indicate a root or stem boundary.

Direct evidence against the analysis [ˈʔaːjt] comes from an interesting infixing rule of the language that breaks up consonant clusters after a stressed vowel under special conditions. (The stressed vowel may be long or short.) One of these conditions is to say something sarcastic like ‘Stone, my eye!’. The word for ‘stone’, which is /ˈʔast/, comes out as /ˈʔasat a/. (The final “a” is some kind of enclitic modal.) The “a” of interest is the infix that appears between the /s/ and the /t/. If there is no consonant cluster immediately after the stressed vowel, no /a/ can be inserted; see what happens with /ˈktam/ ‘man’: /ˈktam a/ ‘Man, my eye!’. Now, with that in mind, consider this: if the word for ‘blood’ is CVVCC, clearly we expect /a/ to be inserted; but if it is CVVVC, then we do not. The facts support the latter analysis, just as our constraint on [j] predicted: /ˈʔaːit a/ ‘Blood, my eye!’. (If the facts were [ˈʔaːjat a], the other analysis would have been supported. But the facts are not that way.)

8.5.3 *Arguments from suppletive allomorphy.* More evidence that supports our constraint prohibiting sequences of an /i/ and another vowel in Seri is based on the suppletive allomorphy of the passive morpheme. The passive morpheme has two suppletive forms: {p} before vowels and {aʔ} before consonants. Since the passive form of the verb for ‘own’ contains the second allomorph, as in [taʔˈjaː] ‘when it was owned’, we have clear evidence that the verb root for ‘own’ is √jaː; it is a CVV root. It is not √iaː, a VVV root.

8.5.4 *Arguments from stress placement.* Finally, the stress facts of the language support the analysis that roots beginning with a close-vowel/approximant have the consonant /j/ and not the vowel /i/. In order to present a convincing case here, we need to choose the data very carefully (to sidestep factors that could complicate the presentation). In Seri, stress falls on the penultimate syllable of the root (setting aside issues of syllable weight). A root such as √jaχ (which one might wonder how to analyze—as √iaχ or as √jaχ) has stress on the vowel /a/. If this were a two-vowel root, one might reasonably expect that the two vowels would be in two syllables and have stress on the /i/. But it does not. All verb forms with this root function as if it were a CVC root, and stress is on the vowel /a/: /iti koˈkjaχ/ ‘the one that is the last one’.

8.6 Suggested additional reading

Chapter 6 on “metrical structures” in Durand (1990) has a helpful discussion of these issues and their application to French and other languages.

8.7 Key terms and ideas

The key idea presented in this chapter is that there exist different constraints on how the sounds are incorporated into the syllables. This discussion falls under the rubric of phonotactics (§8.1). Some constraints may be strong cross-linguistic tendencies, codified as general constraints like the sonority sequencing constraint (§8.2), and some are language-particular.

This chapter also introduced the question of how one knows whether a particular vowel-like sound is supposed to be analyzed in specific cases, whether as a vowel or as a consonant. A variety of types of evidence were shown to be useful in some specific cases.

8.8 Reading questions

You can check your answers to these questions in appendix F.8.

1. T/F Sounds lower in sonority are usually closer to the syllable nucleus than sounds higher in sonority.
2. T/F In the $[CCV]_{max}$ language one should write a separate constraint for the onset /plu/.
3. T/F In some languages, vowels or consonants are inserted into inflected words so they maintain the syllable structure and constraints.
4. T/F Decisions about the analysis of an “ambiguous” sound can be safely made on the basis of the maximal syllable template alone.
5. T/F The Sonority Sequencing Constraint makes some clear predictions about the order in which consonants will appear in the onset and coda of a syllable.

6. T/F The Sonority Sequencing Constraint always makes accurate predictions about the order in which consonants will appear in the onset and coda of a syllable.
7. Why is the syllabification of the word [manta] in any language not likely to be **[ma.nta]** rather than **[man.ta]** if the maximal syllable template is $[\mathrm{CCVC}]_{\mathrm{max}}$?

8.9 Exercises

1. Corongo Quechua. See the data in appendix G.16.1.
   a. Suggest a maximal syllable template.
   b. Suggest a setting for the Obligatory Onset Parameter.
   c. Suggest a setting for the so-called "Word-initial Onset Exception Parameter"
   d. Discuss whether there is evidence or not for Extrametricality.
   e. Prose write-up. Take the analysis that you proposed for the answers above and write a succinct but clear prose description of the facts, using examples to illustrate.
2. Tlachichilco Tepehua. Examine the data in appendix G.33.
   a. Propose a maximal syllable template that handles all of the facts shown (with perhaps one exception, duly indicated).
   b. Indicate whether there is evidence or not for Extrametricality.
   c. Provide evidence for whether the Obligatory Onset Parameter is "on" or "off".
   d. Provide evidence for whether the Word-initial Onset Exception Parameter is "on" or "off".
   e. How do you parse examples 4, 10, 20, 28?
   f. Propose some phonotactic constraints to account for distributional facts that are not handled by any of the above.
   g. Someone notices that **[k]** occurs before C at the beginning of a word only in examples that are not monomorphemic. If words like 2,4, 6 and 8 are given a special analysis (taking the **[k]** as a proclitic, not as part of the same word), how does that affect other parts of your analysis?
   h. Make explicit questions about the kinds of data you would like to look for or ask about.
3. Spanish. Examine the data in appendix G.19.
   a. Divide the words into syllables.
   b. Propose a maximal syllable template.
   c. Discuss the Obligatory Onset Parameter.
   d. Propose some restrictions for the onsets and the codas.
   e. Consider what the proposed universal Sonority Sequencing Generalization can offer.
   f. Propose additional data that might help to understand the syllable in Spanish.
   g. Are there any facts yet to explain?

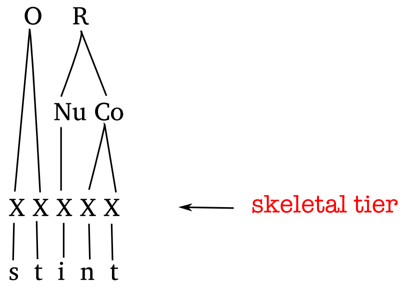
9

LINKING FEATURES TO THE SYLLABLES

9.1 Contour segments and the skeletal tier

Up until now we have ignored complications with respect to how distinctive features may link up to the syllable structure. For our discussion we will assume that there is a level of structure that intervenes between the syllable and the bundles of features (still informally represented by letters of the alphabet), often called the timing skeleton or the timing tier, but since it is no longer believed to be truly related to timing, we refer to it as the **SKELETAL TIER**. There may be other ways to provide a place to anchor the features, but this is at least a convenient graphic at this point. Since at this point it is irrelevant whether the unit on the skeletal tier is a consonant or a vowel, we will use simply X.

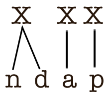
(1)



This level of structure has been claimed to be relevant for various reasons, but we examine only one here. There are combinations of sounds that occur together in many languages and which function together as a single unit in certain ways. We refer to these as **CONTOUR SEGMENTS** (a term now adopted quite widely).

Given the concept of the skeletal tier, a phonetic sequence such as **[nd]** might be analyzed as a prenasalized stop (single consonant with two parts, the first nasal and the second an oral stop). If **[nd]** is analyzed as a prenasalized stop, a word such as **[ndap]** might be represented as in (2).[1]

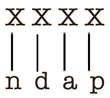
(2)



In such a case the preferred transcription phonetically (and phonemically, if that is the case) would be with a raised n: **[$^{\text{n}}$dap]**.

But the phonetic sequence **[nd]** might very well be linked to two 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:

(3)



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[1] This has been proposed by Clements & Keyser (1983), among others, and we adopt it here for the sake of explication. But Goldsmith (1990) gives some arguments why affricates should not be analyzed this way. Similarly, Lombardi (1990:375-425) considers affricates to have a single set of features and not be contour segments. Affricates are distinguished from stops as [+delayed release] in Chomsky & Halle (1968), but this feature is not widely used today.

In such a case the appropriate transcription uses **[ndap]** and does not use any superscripted letter. Note that this is only a hypothetical case. The sequence **[nd]** in the onset here would violate the Sonority Sequencing Constraint mentioned in §8.2. We might expect that the **[n]** would have to be syllabic, or would have to be syllabified with a preceding vowel. It is also possible that the language simply allows for sequences that violate the Sonority Sequencing Constraint. These options would have to be explored.

Other types of contour segments might include affricates and all those that are said to have "secondary" articulations (palatalized consonants, labialized consonants, glottalized consonants). But the analysis of these is not entirely clear, although we discuss them here under this label. (This particular label is relatively new. The idea is that during the articulation of the sound, there is some "movement from one thing to another" within the articulation itself — it is not just a simple segment.) [2]

Affricates are among the most common contour segments found in language, and so they are the poster-child of this kind of sound. They are interesting both phonetically and phonologically, and there is a considerable amount of literature about them (even new things). Important: what might be perceived as an affricate may not always be an affricate. For example, in the English word *chats*, the common understanding (which we believe to be correct) takes the first affricate-like sound as a contour segment and the second affricate-like sound as a sequence of consonants. In figure 2 we contrast three incorrect analyses of this word with the standard (and arguably correct) analysis.

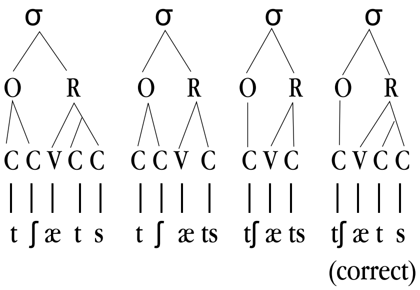

Figure 2. Various analyses (incorrect and correct) of English *chats*

Various facts may be brought to bear on the decision as to how a given phonetic sequence such as **[nd]** or **[tʃ]** or **[kw]** should be analyzed. Some of the possible arguments that have been or could be used are presented below.

9.1.1 *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 slot in the skeletal tier, unless there is compelling evidence to the contrary. There is no reason to complicate the syllable structure if the phonetic sequence can be analyzed as a single consonant—like an affricate—since we know that such things exist in other languages.

If the language does have clear cases of consonant clusters, the syllable structure itself will not provide helpful evidence. Of course this argument is relevant only if the phonetic sequence is of the type that can in fact be analyzed as a single consonant — as a legitimate affricate, or a consonant with secondary articulation, or a prenasalized consonant, for example.

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[2] See the discussion of these in T. Hall (2007:330-331).

Example: Seri. Seri has a word [tʃiʔ] 'pufferfish'. A priori, the sequence [tʃ] might be analyzed as a consonant cluster or as a single contour segment (an affricate). As a matter of fact, Seri has many kinds of complex onsets, as illustrated by the word [ktam] 'man'. There is no argument from the syllable structure—and no argument from any other part of the phonology—to analyze [tʃ] as an affricate in Seri, and there are other reasons for not analyzing it so.[c] So the word is a CCVC word.

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[c] Evidence from productive infixation shows that Seri speakers even subconsciously analyze the affricate /t͡ʃ/ of Spanish as a cluster as well. The word Spanish *cucaracha* [kukaˈrat͡ʃa] comes out in the infixed form (to indicate sarcasm (Mary B. Moser, p.c.), mentioned in §8.5.2 above) as [kukaˈrataʃa]; note that the [t] and [ʃ] are separated in the infixed form.

Example: Quiegolani Zapotec.

Quiegolani Zapotec has a word [gitʃ] 'grinding stone' (Regnier 1993). Again, the sequence [tʃ] might be analyzed as a consonant cluster, or alternatively as a contour segment. In syllable-final position, Quiegolani Zapotec only has a few clear cases of consonant clusters, and these clusters are all like [lt] (beginning with a sonorant). This fact provides an argument for treating the "sequence" [tʃ] in this language as an affricate. So the word for grinding stone is a CVC word.

9.1.2 *Short exercise: Cashinahua [ts] and [tʃ].* Take a quick look at the data in appendix G.11. Propose a maximal syllable template for these data (assuming them to be representative) and discuss explicitly how you would analyze the sounds [ts] and [tʃ] that are found there, and why. When you have jotted down your answer, look at appendix E.38.

9.1.3 *Short exercise: Gabri de Darbé.* Take a quick look at the data in appendix G.27. Propose a maximal syllable template for these data (assuming them to be representative) and discuss explicitly how you would analyze the sounds [mb], [nd], [ŋg], and [dʒ] that are found there, and why. When you have jotted down your answer, look at appendix E.39.

9.1.4 *Short exercise: Gor.* Take a quick look at the data in appendix G.28. Propose a maximal syllable template for these data (assuming them to be representative) and discuss explicitly how you would analyze the sounds [nd], [ŋg], and [dʒ] that are found there, and why. Set aside the word with a syllabic nasal (#4) because there are not enough data here to deal with it well. When you have jotted down your answer, look at appendix E.40.

9.1.5 *Argument based on phonotactics.* English has the word [hætʃ] and one might wonder if the [tʃ] is a consonant cluster that is analogous to the cluster [ts] that we observe in *hats* (compare *hat*), or whether it is a contour segment that occupies only a single consonant position in the syllable. One argument against the cluster analysis of [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. These facts count as evidence in favor of the contour segment analysis in English, and so [hætʃ] is analyzed as a CVC word.

Phonotactics of sounds in the onset also provide an argument in favor the affricate analysis. The cluster analysis would require us to have many onsets consisting of alveolar stop followed by postalveolar fricative (tʃ) even though otherwise we have no stop-fricative onset clusters in the language. Examples like [tʃɪp], [tʃɪk], [tʃɪt], [tʃɛk], etc. are numerous but onsets like *[pʃ], *[kʃ], *[ps], and *[ks] do not exist. The highly reasonable affricate analysis avoids the need for allowing for onset clusters of a unique type.

9.1.6 *Argument based on lack of independent existence of both "parts".* Another 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—see chapter §13) occurs independently.

This line of argumentation does not provide any help for the Seri, Quiegolani Zapotec, and English facts discussed above since [t] and [ʃ] both occur independently as well in these languages.

Example: Spanish. Consider the word [tʃato] 'flat' in standard Spanish. There is no phoneme /ʃ/ in native words in standard Spanish.[d] It is not possible for [tʃ] to be a cluster unless it corresponds to two independently attested phonemes.[e] Therefore we conclude that this is a contour segment — an affricate — in standard Spanish and not a consonant cluster.

[d] The sound [ʃ] occurs phonetically in some dialects of Spanish (such as Montevideo and central Buenos Aires); for these dialects, this argument would have to be very carefully presented.

[e] Those two phonemes a priori might be /t/ and /s/ rather than /t/ and /ʃ/, but one would have to have an explanation for the phonetic representation [ʃ] regardless.

9.1.6.1 *Short exercise: Seri [kw].* In Seri you can hear something that you might transcribe impressionistically as [kw]. The choice before you is to think of this as a cluster kw or as a labialized consonant k^w. You are able to learn from looking at other data in the language that there is a phoneme /k/ in the language but you also realize that there is no phoneme /w/ and no phoneme /u/. Which analysis do these facts provide evidence for and which do they provide evidence against. Why? When you have written out your answer, see the discussion in appendix E.11.

9.1.7 *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? The observation on how they interact can provide very important evidence.

Example: Chimalapa Zoque. A casual speech rule voices stops when they precede a voiced consonant: /haʔtmuspa/ 'he can make twine' is pronounced [haʔdmuspa] in casual speech (Knudson 1975). Fricatives do not undergo this rule: /ʔisjonpa/ '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 (patterning with other non-continuants), but not at all expected if it is a cluster of stop followed by fricative. Thus the evidence points to the existence of an affricate.

9.2 Alternative analyses reviewed

Phonetic sequences that might be taken as occupying either one X slot or two include those shown in (4) (where "t" represents any consonant, although in some cases the two parts must be homorganic):[6]

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[6] The Americanist tradition developed more explicit ways to indicate a contour analysis (or what was referred to as the "unit" analysis). For the affricate /tʃ/ they used /č/, for example. The IPA has not done this although the use of the tie bar indicates the contour analysis explicitly, as in /t͡ʃ/, as does the closely printed letter /ʧ/ but the results are still less aesthetically pleasing than the Americanist tradition.

(4)

Impressionistic phonetic transcription	Contour Analysis X	Sequence Analysis XX
tj or ti̯ (or even tʲ)	tʲ	tj or ti
tw or tu̯ (or even tʷ)	tʷ	tw or tu
th or tʰ	tʰ	th
tʔ or t’	t’	tʔ
ts	t͡s or ʦ	ts
tʃ	t͡ʃ or ʧ	tʃ
tɬ	t͡ɬ	tɬ
nd or ⁿd	ⁿd *	nd

*Another analysis is also possible, but often overlooked. Rather than a prenasalized stop, the contour segment could be a post-occlusive nasal, essentially [nᵈ]. A strong contender for this kind of analysis is the Mixtecan genus and the related Amuzgoan genus; see Marlett (1992) and McKendry (2001) for Mixtec and Coronado Nazario et al. (2009) for one variety of Amuzgo.

A few more examples of these analyses in specific languages are given in (5).

(5)

a. North Puebla Nahuatl: [CVC] template is adequate. [tɬakatɬ] ‘man’ is plausibly CV.CVC, with the lateral affricate [t͡ɬ] at the beginning and end of the word. (Brockway 1963)

b. North Puebla Nahuatl: [CVC] template is adequate. [omokwep] ‘s/he returned it’ is plausibly V.CV.CVC with the labialized consonant [kʷ] in the onset of the last syllable. Thus it would be better transcribed [omokʷep]. (Brockway 1963)

c. North Puebla Nahuatl: [CVC] template is adequate. [tʃipawak] ‘clean’ is plausibly CV.CV.CVC with the postalveolar affricate [t͡ʃ] at the beginning of the word. (Brockway 1963)

d. Seri: the template allows for many consonant clusters, including obstruents. There is no strong reason for analyzing the [ts] of [ˈʔapats] “Apache” as an affricate.[7] Therefore this word is taken as being CV.CVCC.

9.2.1 *Short exercise: English.* English is claimed to have at least one affricate: /tʃ/ *ch*, as in the word /hætʃ/ *hatch*, which is analyzed as a CVC word. What would your reply be to the following statement by a novice linguist with respect to the word *hats*? (Address all three reasons that the novice linguist gives.)

> The word *hats* demonstrates that English also has the affricate phoneme /ts/. First, it contrasts with *hatch*, which we know has an affricate. Second, it fits the CVC syllable pattern that we find in a great number of words. Third, we find this affricate in intervocalic position as well, as in words like *patsy*, *fatso*, *itsy bitsy*, *tootsie*, and *howitzer*.

When you have finished writing out your succinct answer, see the discussion in appendix E.9.

9.2.2 *Short exercise: Salasaca Quichua.* Examine the data in appendix G.16.3.2, recalling that you came up with a $[CVC]_{max}$ template for the data in G.16.3.1 if you did the exercise in appendixM and propose an analysis for what is transcribed impressionistically as [ts] and [tʃ]; this analysis should be able to keep the proposed template intact

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[7] By this analysis the word ends in a heavy syllable. As a matter of fact, final heavy syllables are commonly stressed in this language (Marlett 2008a). This word is therefore exceptional if /ts/ is a cluster. But other exceptional words for stress also exist. The alternative analysis, using an affricate, has no other support, however.

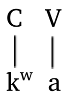
(and still not propose anything absurd). When you have written something down, see the discussion in appendix E.10.

9.3 Multiple possibilities

The fact that the syllable structure is potentially complex adds another set of possibilities to be considered when looking at certain types of sounds. For example, the phonetic string [ku̯a] has at least three possible analyses, each of which is arguably true for at least one language.

First, it is possible that this string should be analyzed as [kʷa] — with a velar stop that has secondary velarization. The string [kʷa] is a CV syllable, with a simple onset and a simple rime (which in turn has a simple nucleus). This is the analysis that is proposed for Seri. (Seri has no vowel /u/ and no approximant /w/ in its phoneme inventory.)

(6)



Second, it is possible that this string should be analyzed as [kwa] — with a velar stop followed by a consonant that is a labial-velar approximant. The string [kwa] is a CCV syllable, with a complex onset and a simple rime (and simple nucleus). This is the analysis most commonly proposed for English words like *quack*, *quote*, and *quick*.

(7)

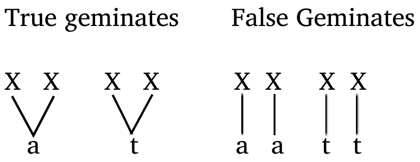
Third, it is possible that this string should be analyzed as /kua/ — with a velar stop in a simple onset followed by two vowel-like sounds in a complex nucleus—a diphthong. This is the analysis most commonly proposed for Spanish words such as *cual* 'which'.

(8)

9.4 Long vowels and consonants

Long vowels and consonants have been analyzed in modern work as single segments (actually feature complexes, of course) linked to two positions in the syllable. See §21.5 and the discussion of true geminates there. So-called false geminates—arising commonly when two morphemes come together and have identical sounds at the juncture—would, of course, be analyzed as having identical features linked to separate positions in the syllable.

(9)



In some cases, it may be argued that the "long vowel" actually belongs to two syllables. A good example of this comes from Spanish, as it turns out. Spanish is not a language that one would say has long vowels; it does have examples of hiatus (sequences of heterosyllabic vowels with no consonant between them), such as *veo* and *caos*. Now notice the data in (10).

(10) a. [ˈmoto] ‘motorcycle’ (informal)
b. [ˈmoko] ‘mucus’
c. [ˈmoθo] ∼ [ˈmoso] ‘young person’ (pronunciation and gloss vary by dialect)
d. [ˈmoxo] ‘I wet, dampen’
e. [ˈmoː] ‘mold’

The word in (10e), which just happens to be spelled as *moho*, using the always silent *h* symbol in Spanish, is *not* evidence that Spanish has long vowel phonemes. It can be taken as one more example of hiatus in the language (already established) but simply with what are coincidentally identical vowels in the two syllables. An informed phonetic transcription would legitimately transcribe the word in (10e) as [ˈmoo] (an option that is available anyway in the IPA, not just for cases like this).

9.5 Unrelatedness to phonemic analysis

The decisions about how the features link up to the skeletal tier are only indirectly related to claims about the phonemic status of the sounds. If [ʤ] is taken as an affricate, then it still must be decided if [ʤ] is a phoneme distinct from [ʧ] or [d] or [j], for example. And if [ʤ] 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. (We include [ʤ] here since in fact that pronunciation of /j/ as an affricate is common in different dialects of Spanish.)

9.6 These issues for general audiences

The analyses of facts introduced in this chapter have relevance for general audiences. For example, if a language has long vowels as phonemes, this is something to be pointed out clearly in materials used to teach the language, regardless of what kind of alphabet is used (see §12.6). But even if the language uses false geminates, it may be important for teaching materials to point this out and help readers and writers to be aware of them and know about them (and even more so if the language of wider communication, such as a national language, does not have them).

If a language has contour sounds of one sort or another, discussion of these is important for teaching reading and for discussing the language generally. This is especially true if languages of wider communication in the linguistic context do not have them.

9.7 Contour segments and alphabets

Contour segments (like affricates) are sometimes directly reflected in the alphabet or the presentation of the alphabet. For example, the affricate /ts/, as a single consonant despite its phonetic complexity, is represented by the letter <c> in the alphabet of Polish. But it may be just as practical to use something else to represent an affricate. The affricate /tʃ/ is represented by a letter plus an acute accent in the Polish alphabet: <ć>. The affricate /tʃ/ in Spanish is represented by the digraph <ch>, and for until recent years it was presented in the alphabet as a unit. The alphabet was recited in this way: a, b, c, ch, d, e, f … [ˈa ˈbe ˈse ˈtʃe ˈde ˈe ˈefe …]. The affricate /tʃ/ in English is also represented by the digraph <ch>, and sometimes the trigraph <tch> (as in *hatch*), but it is not presented in the alphabet as such (and Spanish has also moved recently to do the same—the alphabet is now a list of letters and not a list of phonemes).

A phonetic sequence that is analyzed as a sequence of phonemes (and not as an affricate, for example) is likely to be represented in alphabetic writing as a sequence of letters, as one might expect. The first part of [tʃiʔ] ‘pufferfish’ in Seri the sequence of phonemes /t/ plus /ʃ/. Since those phonemes are written as <t> and <z>, respectively, in the Seri writing system, the word [tʃiʔ] begins with <tz>, a sequence of letters representing a sequence of consonants.

It could easily be that the analysis makes no difference in the alphabetic representation. For example, whether [mb] is taken as the sequence /mb/ or as a prenasalized stop /$^{\text{m}}$b/ is unlikely to affect how it is written in the practical orthography. It will just be <mb>. Nevertheless, it may be important to understand the analysis for the sake of presentation to a general audience, as mentioned in §9.6, regardless of how it has affected the alphabet.

It is also worth mentioning here that alphabets do not necessarily reflect the analysis of sounds in a direct way. Single phonemes, like /ʃ/ can be represented with two letters; see <sh> in English and <ch> in French, for example. A sequence of phonemes can be represented with a single letter (unexplainedly); see <x> for /ks/ in English, <ξ> for /ks/ in Greek, and <Ψ> for /ps/ in Greek.

9.8 Suggested additional reading

See Goldsmith (1990), Kaye (1989), and Durand (1990) (among many other works) for discussion of the skeletal tier.

9.9 Key terms and ideas

The key idea discussed in this chapter was the existence of CONTOUR SEGMENTS (§9.1). Not all sounds that we might hear impressionistically as contour segments (affricates, prenasalized sounds, etc.) are correctly analyzed as contour segments, but there should be evidence to support that analysis if it proposed. Contour segments link the phonological features to the SKELETAL TIER (§9.1) in a way that is different from when we have consonant clusters.

9.10 Reading questions

You can check your answers to these questions in appendix F.9.

1. T/F The skeletal tier is helpful in describing contour segments.
2. T/F Secondary articulations, such as labialization, link to a different position in the skeletal tier than the consonant they modify.
3. T/F Casual speech data cannot help one determine the nature of an ambiguous CC segment or timing.
4. T/F Phonemically long vowels should always be linked to two separate positions on the skeletal tier.
5. T/F The word *fix* [fɪks] in English is a good illustration of a word matching a $[CVC]_{max}$ template since the coda of the syllable is written as a single letter in the practical writing system.
6. T/F A word such as *touch* /tɜtʃ/ in English cannot be analyzed with a $[CVC]_{max}$ template.
7. T/F The phonetic sequence [ku] is correctly analyzed as [kʷ] in some languages, as [ku] in other languages and as [kw] in others.
8. T/F In some languages what is heard as [tʃ] is correctly analyzed as a single consonant and in other languages it is correctly analyzed as a consonant cluster.
9. T/F In some languages the phonetic sequence [ai] (pronounced as a single syllable) is correctly analyzed as a VC rime and in others as a complex nucleus.
10. What is the syllable pattern attested by the word *fish* in English?
    a. CV
    b. CVC
    c. CVCC
    d. CCVCC
11. T/F The derivational prefix for Possessive in Quioquitani Zapotec is /ʃ/ before simple onsets and /ʃi/ before complex onsets. For this fact it is reasonable to propose that Extrametricality is operating in Quioquitani Zapotec.
12. The derivational prefix for Possessive in Quioquitani Zapotec is /ʃ/ before simple onsets and /ʃi/ before complex onsets. Given that /ʃ/ appears before what is heard as /ts/, which of the following conclusions is or are reasonable? (More than one may be reasonable.)
    a. /ts/ is an affricate.
    b. Extrametricality is optionally “on” .
    c. The syllable template permits three consonant onsets as long as the first consonant is a fricative.
    d. /ts/ occupies two consonant “slots” in the syllable template.

13. The derivational prefix for Possessive in Quioquitani Zapotec is /ʃ/ before simple onsets and /ʃi/ before complex onsets. Given that /ʃi/ also appears before what is heard as /pi̯/, which of the following conclusions is/are reasonable? (More than one may be reasonable.)
    a. /pi̯/ is a cluster best understood as /pj/.
    b. /pi̯/ has a simple onset and the beginning of a diphthong.
    c. Postalveolar consonants can be extrametrical in Quioquitani Zapotec.
    d. None of the above.

9.11 Exercises

1. Quioquitani Zapotec. See the data in appendix G.7.2. Additional information for you to use as you wish: the patterns illustrated by examples 16, 17, 23, and 32 are very rare in the language. Instructions for syllable structure: (Set aside the matter of vowel length for this exercise at this time.)
   Examples #2, 5, 7, and 9 contain a prefix that indicate that the noun is possessed (by someone or something). Compare these to the non-possessed forms of the nouns in examples #1, 4, 6 and 8. Why do you think the prefix sometimes appears as [ʃ] and sometimes as [ʃi]?
    a. Propose a maximal syllable template. Show how this template accounts for examples #10, 15, 18, 25. (If some part of the analysis is uncertain, mention it.)
    b. How should the consonant sequences [ts], [tʃ] and [dz] be analyzed? Should they be treated as affricates or two consonants? Why?
    c. How should the palatal approximant [j] (which might have been written as a non-syllabic [i]) be understood with respect to the syllable template? Diagram word #9.
    d. The onsets in #16, 17, 23 and 32 are different from the rest in that they contain what appear to contain at least three consonants. Propose a phonotactic constraint that describes these data. Then also propose a phonotactic constraint for the codas in #16 and 31. Given that these types of onsets and codas are very rare in Quioquitani Zapotec, how would you analyze them? Does your syllable template in (a) need to be adjusted? (You might review §5.7.)
    e. Should an analysis of the syllable structure in Quioquitani Zapotec include extrametricality? Give some reasons for/against including extrametricality.
2. Marinahua. See the data in appendix G.17. For each point, discuss your answer and present data that support it.
    a. Suggest a maximal syllable template. Additional "data": no words like [skata] are ever found and no words like [pistfa] are ever found.
    b. Suggest a setting for the Obligatory Onset Parameter.
    c. Suggest a setting for the so-called "Word-initial Onset Exception Parameter".
    d. Discuss whether there is evidence or not for Extrametricality.
    e. Additional information: the only consonants in apparent codas are [s], [ʂ] and [ʃ]. Propose a restriction that would allow these and disallow those such as [t], [ts], [k], [h] and [ɾ]. (Don't just give a "laundry list" of sounds that cannot appear in the coda like we just gave.)
    f. Does your analysis predict that words such as the following should exist or not exist: [katas]? If such words do not exist (and it turns out, they do not), what will you do? (There is no "right" or "wrong" answer at this point.)
3. Tlachichilco Tepehua. See the data in appendix G.33.
    a. Propose a maximal syllable template that handles all of the facts shown (with perhaps one exception, duly indicated). (You may have done this as an exercise in appendix I.)
    b. The sound(s) written as [tʃ] might be handled as a sequence of phonemes or as a single consonant (an affricate). Does either analysis cause a problem for your proposed syllable template? Explain. Do your phonotactic constraints provide evidence for one analysis or the other? Explain.

4. Staged exercise: syllable structure of Cocama. Use the data provided to you (a copy of Faust & Pike 1959) to write up a concise but thorough presentation of the syllable structure of the Cocama language. You may share your drafts with other students, but the write-up should be your own. Assume that you have limited space; the examples should be clear and incorporated into the paragraphs. The complete write-up should be less than one page in length.

Part III

PHONEMES & FEATURES: METHODOLOGY

10

BASIC METHODOLOGY: DATA

What counts for data in a phonological write-up? It may seem like an odd question to ask, but the answer is not entirely straightforward.

Usually we limit ourselves to utterances that are words (by some definition) or groups of words that occur in natural speech. We do not choose to use only a part of a word such as a prefix, root, or suffix. While the interest of the reader may be in only one sound in the word, a complete pronounceable word should be presented as the actual data. An analysis is only a hypothesis and should not be confused with the data itself, so the data need to be presented in a way that allows for easy cross-checking.[1]

While all of the data are ultimately of interest, the preference would be to use data that are pronounceable in isolation, and not just metalinguistically. Considers the words *the*, *a*, and *of*. These are fine words of English, and we certainly want to know how to analyze them. One might use them in a simple sentence if you are talking about words (Question: "What's the third word in the first sentence." Answer: "*Of*.") But in ordinary English usage, these words are not pronounced in isolation. They cannot be used as the answer to a question, for example (except one about the words themselves). Therefore such words should be presented in a natural context when they are used in discussions of the language, at least during initial stages of analysis, something like *the house*, *a house*, and *person of interest*.

Word classes to be careful about include all of the minor word classes (which vary from language to language), including prepositions, postpositions, articles, conjunctions, and perhaps adverbs, since words of these classes are not typically used in isolation. These words, just like others, are composed of the sounds we are investigating, but they often have different prosodic properties than the vast majority and so should be approached with this in mind.

The data may certainly be more than one word—a phrase, for example—since words in context are very interesting, as shown later in this book. In fact it is always important to have data that are phrasal in nature and not just a list of words.[2]

Sometimes it is not entirely clear (or agreed upon) where the word breaks are. The transcriptions may not necessarily represent the data in the same way that the ordinary orthography does. For example, one might present the phrase *an apple* as **[əˈnæpəlˠ]**, showing that the *n* of the article *an* is pronounced tightly with the initial vowel of the word *apple*, as the onset of the second syllable in this utterance.

10.1 Keeping control of morphological complexity

An important methodological principle in using data is to keep control of what is going on, as much as possible. Therefore you will find it helpful to use words that do not have morphological complexity (if possible), unless you have a clear idea of what is going on with those words. You do not know at first, of course, whether a word is morphologically complex, and some morphology may be unavoidable, but at initial stages you would steer away from (a) plural nouns, (b) conjugated verbs, and (c) inherently possessed nouns. Eliciting data that are not close to the culture (such as 'table', 'chair', and 'ballpoint pen' in many societies) is not helpful since these are likely to be borrowed words or very complex forms that you would not know how to deal with anyway. All data are important and interesting, but you want to take it in manageable amounts.

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[1] Some data that we find in write-ups and exercises appears to be just roots, if we can judge from the glosses. This is unfortunate, and we have to trust that it has not interfered with the presentation of a true picture. But we do not want to follow such examples.

[2] Some literature refers to "high level phonology", by which the authors usually mean they are discussing phenomena that are observed or understood only if phrases and even larger stretches of speech are taken into account. This term is not commonly used.

Example: Seri. The word for ‘roadrunner’ in Seri, which is /ʃaːp/, is a straightforward piece of data (one might presume, although it might not be), whereas the expression for ‘pillbug, sowbug’ in the same language is quite obviously not: /ˌmoːsniˈʔaːitˌiːsaχˈkʷkoaːnim/.[c]

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[c] These data are from M. Moser & Marlett (2010).

Example: Huixtepec Amuzgo. The Amuzgo words for ‘his/her father’ and ‘my father’—/t̪e˩/ and /t̪ɛ˧/, respectively—look very simple and perhaps appropriate for making conclusions about the vowels of Amuzgo, but since they are morphologically complex they should be used very carefully.[d] When morphologically complex forms are analyzed, one wants to look at them in the context of a **paradigm**, and sets of paradigms, not just as isolated items. This point should become clearer later in the book.[e]

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[d] Coronado Nazario et al. (2009).

[e] You have looked at paradigms in a course on morphology. Think of data presented carefully in rows and columns such that each row or column varies only one factor.

Words that are more likely to be morphologically complex cross-linguistically include names of parts of the body and kinship terms since they are most commonly used with a mention of the person or entity to whom the body part belongs or the person to whom the kinship term is related. Verbs are also very likely to be morphologically complex since categories like aspect, tense, and mood (among others) are commonly indicated by affixes.

10.2 Not all words in the language count the same

We generally limit ourselves to words in the language that are not interjections or mimetic words. Many interjections are words with a “purely emotive” function,[6] used in ways that make them distinct from other words in a language. Examples of interjections include *Whoops!*, *Yuk!* and *Wow!* Mimetic words are those like *swoosh*, *moo*, and *kerplunk* that include sounds that are meant to more directly resemble a physical event. While there may certainly be interest in studying these words, it is not unusual for them to use sounds that are not found in the “core” lexicon. If one is describing the core phonology of a language, it should not be necessary for one to resort to the expression for the clucking of a chicken as key evidence of the analysis.

Two examples of uncommon sounds found in interjections in English: the nasalized vowels in the negative interjection *unh unh* (or however it is written), and the glottal stop between vowels in the interjection *oh oo* (or however it is written).

One expects that the phonemes of a language are illustrated in the words of the core vocabulary, although there may be interesting exceptions that need special discussion. Core vocabulary in this context means words that are drawn from the **major word classes**: nouns, verbs and perhaps adjectives. While one is also expected to be able to analyze words from **minor word classes** (prepositions, conjunctions, adverbs, etc.), there may be advantages to treating them separately.

It has been discovered that in many languages there is a constraint on possible words in major word classes, often called the **minimal word constraint**. This constraint is usually something like “A word [of a major word class] must have at least two moras,” where **mora** is a unit of syllable weight that we saw in §7.3. This type of condition, if operating in a language, affects the kind of data that we will find in a list of nouns and verbs, at least. If we are unaware of the existence of such a constraint operating in a language, we may misunderstand something or miss some important facts.

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[6] Crystal (1985:160-161).

As a matter of fact, English is claimed to be governed by a minimal word constraint for members of the major word classes. Take the short vowel /e/ [ɛ] as representative of other short vowels, and note the possibility of words such as /pet/ [pʰɛt] *pet*, /pen/ [pʰɛn] *pen*, /pest/ [pʰɛst] *pest*, and /pepiː/ [pʰɛpiʲ] *peppy*, but the impossibility of words such as /pe/ [pʰɛ], /ple/ [plɛ], and /sple/ [splɛ].

Monosyllabic words with short vowels and no codas exist in English, but they are few and only found in minor word classes. Examples are /ə/ [ə] *a*, /ðə/ [ðə] *the*, and /hə̃/ [hə̃] *huh!*. Maybe you can think of a few more.

10.2.1 *Short exercise: Highland Oaxaca Chontal.* Examine the data in appendix G.2.1.1, comparing them if you wish with those in appendix G.2.1.2. Does it seem likely that this language has a minimal word constraint? Why or why not? If so, what might the constraint be? When you have written an answer, see the discussion in appendix E.12.

10.3 Loanwords

If we want to focus on the phonology of language P, we choose words and phrases that are true words and phrases of language P and not obvious loanwords from language Q.[7] This statement makes no sense, perhaps, for languages (such as English) that have done massive borrowing and have integrated those words into the core lexicon. We are not going to set aside a word like *pork* just because it was borrowed from French several hundred years ago, or words like *ski* that were borrowed from Norwegian. But at the same time, if we are going to describe English phonology, we probably do not want to get hung up over how to analyze things like *pièce de résistance*, *joie de vivre*, *raison d'être*, and *je ne sais quoi*, even though such phrases may occur in the speech of an educated English speaker.

If we are describing the phonology of a minority language of Mexico, we want to know about how neighboring languages and the national language (Spanish) or even English are affecting it, but those facts all need to be kept in perspective. This is not always easy to do, but unless one wants to be analyzing two or three languages simultaneously, it is important to do exactly that. Likewise, if we are describing the phonology of a language of Kenya or Pakistan, we would not want loanwords from Arabic to be key evidence.

Loanwords are very legitimately included in a complete phonological write-up to show that a characteristic of the language extends to them as well (showing generality) or does not extend to them (showing exceptionality).

If a claim about the core phonology cannot be made and supported well without the use of loanwords in the language, one should be very skeptical about that claim.

10.4 Suggested additional reading

For discussion of the minimal word and the Minimal Word Constraint, see Kenstowicz (1994), Hayes (1995), and Hammond (1999) (among many other works). See Marlett (2013a) for discussion of this constraint in one particular language.

10.5 Key terms and ideas

1. A PARADIGM is a set of words that are formally related to each other by some structural properties (e.g., Plurality, Possessor, Tense, Person agreement, Negation, Voice), and also the presentation of such words in a way that makes these relationships clear (such as by rows and columns). (§10.1)
2. MAJOR WORD CLASSES. The major word classes are those that contain the content words, which often have different prosodic properties than minor word classes. Major word classes are typically Noun, Verb, and Adjective. (§10.2)

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[7] Maddieson (2013a:3) makes the following comment about consonant inventories in his survey of the world's languages: "A difficult choice often concerns whether to include consonants found only in words borrowed from other languages; generally those sounds introduced just in the last few generations as the result of the spread of world languages such as English, Spanish, Russian, Mandarin Chinese, and Modern Standard Arabic have been excluded."

3. **MINOR WORD CLASSES**. The minor word classes are those that contain the function words, which are often shorter than major class words and often unstressed. Minor word classes typically include Preposition, Conjunction, Demonstrative, Pronoun, etc. (§10.2)
4. **MINIMAL WORD CONSTRAINT**. The Minimal Word Constraint is a well-known type of constraint that, with slight variations, a language may impose on the class of possible words. This constraint is usually something like "A word [of a major word class] must have at least two moras." Sometimes it requires two syllables. Not all languages include this constraint in their phonologies, but many do. (§10.2)
5. **MORA**. As used in much current phonological study, a mora is unit of weight that pertains to the syllable. (§10.2)

10.6 Reading questions

You can check your answers to these questions in appendix F.10.

1. T/F When showing an example of a sound within a word you only need to present the actual morpheme as your data, not the whole word.
2. T/F During initial stages of analysis one should try to avoid morphologically complex words.
3. T/F Studying mimetic words is very important for understanding the core phonology of a language.
4. T/F The Minimal Word Constraint (if active in a language) prohibits all words with a single syllable consisting of a short vowel and no coda, regardless of whether that syllable has an onset.
5. T/F **[jæ]** *yeah!* is an example of a word in a major word class in English.
6. T/F One should avoid analyzing or including loan words in a phonological write-up.
7. T/F When presenting vowel phonemes, short prepositions and conjunctions are good words to use.
8. Which of the following data are *less than ideal* for the basic evidence to show contrast in a language? (The correct answer requires the inclusion of a few of these.)
   a. **/pa/** 'to where?'
   b. **/gʷa/** 'that' (used only as an enclitic)
   c. **/sa/** 'will go'
   d. **/fald/** 'skirt' (only found in loanwords from Spanish, like this one)
   e. **/hug/** 'juice' (only found in loanwords from Spanish, like this one)
   f. **/noʔ/** 'first person exclusive pronoun'
   g. **/mjaʔk/** 'raven'
   h. **/mdʒin/** 'deer'
9. In language X, with the words **[ˈfɾɔs]** 'water' and **[ˈvɾɛt]** 'dirt' show, do these data show contrast between [f] and [v] that supports positing /f/ and /v/ as phonemes?

10.7 Exercises

1. Tainae. Examine the data in appendix G.22. Does it seem likely that this language has a minimal word constraint operating in it? Why or why not?

11

BASIC METHODOLOGY: TRANSCRIPTIONS

Work in phonology commonly (but not exclusively) centers on different kinds of transcriptions of language. There are many kinds of transcriptions of data, and it is important to distinguish them well.[1]

11.1 Orthographic representation

For the purposes of this presentation, we consider four words of English. These words are *punk*, *bank*, *shampoo*, and *bomb*. The words have just been presented in a particular representation that is commonly known as the ORTHOGRAPHIC REPRESENTATION or the PRACTICAL SPELLING. It is the representation (or one of the representations—since a language could have more than one)[2] that people within a community use to represent their language for day-to-day use. For the present course, this kind of representation is basically irrelevant. What we do in this course is certainly relevant to the concerns of someone dealing with orthographic representations, but those representations are not what we will be looking at. Of course, in the case of a language without a writing tradition, they do not even exist yet.

11.2 Narrow transcriptions

Another kind of representation is one that is often called a NARROW TRANSCRIPTION.[3] This kind of representation is commonly presented in SQUARE BRACKETS (although not necessarily), as you must know from the phonetics course that you took. The four words mentioned in §11.1 might be transcribed as follows in this kind of representation: **[pʰɜˑŋk]**, **[bæˑŋk]**, **[ʃæˑmˈpʰuw]** and **[baːm]**. Actually, there is a range of transcriptions that might be called narrow, depending on how much very fine detail is included. A person with a good ear may detect that there is some degree of nasalization on some of the vowels in the words above, and therefore transcribe them with that detail included, as in the case of **[bæ̃ˑŋk]**.

A narrow transcription—even one with the most detail commonly included—is an abstraction away from the physical reality. It is difficult or impossible to include information of many sorts that one may hear directly from the speaker or from a recording. The narrow transcriptions given above do not tell us whether the speaker is male or female, excited or relaxed, young or old—although we would probably be able to detect that from an audio recording. We do not know from such a transcription whether the word was pronounced loudly and quickly, or softly and slowly, or with hesitation. We do not know where the neutral tongue position is. We do not know if the speaker is from Dallas, Detroit, London, Brisbane, or New Delhi, although this might be quickly known by listening to an audio recording. Even these narrow transcriptions do not typically indicate how much aspiration is on the consonants and how much nasalization is on the vowels, and the International Phonetic Association does not (to the best of our knowledge) give clear advice on how to represent degrees of aspiration or nasalization.

A narrow transcription should be adequate for a person who is trained in phonetics to pronounce a word very well despite never having heard a native speaker pronounce it, although s/he might still have an accent due to the lack of knowledge about facts that are not easily represented in such transcriptions.

For this reason, audio and video recordings of language data (with appropriate metadata included) are extremely important. They should be part of the documentation of any language (but unfortunately they often are not). If one

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[1] We do not discuss here the type of representation that has been referred to as "underlying form", or "basic form". See §17.2, however.

[2] Norwegian, for example, has more than one recognized set of spelling conventions. The same is true of English, as well, since British English and American English have their own recognized norms, even if they are not given authoritative force in the way that is true of some languages. Compare British (and Canadian, and Australian) English *labour* and American English *labor*, for example—the same word with essentially the same pronunciation but spelled in two different ways. The Hindi-Urdu language has two authoritative centers with two distinct scripts: India (using Devanagari script) and Pakistan (using Nasta'liq script).

[3] IPA 1999:28-30.

is going to consult with someone on the analysis of the basic phonology of a language, one should insist on hearing the words spoken either directly by a speaker or through good quality recordings.

One should never assume that a phonetic transcription, even by a highly competent trained phonetician, has "got it" when it is produced early in one's experience with a language (even if the author is a native speaker of the language). Phonological analysis helps to refine one's hearing of certain sounds, and so later in one's experience one will know much better about what to be listening for.[4] Phonological analysis can dull one's hearing of certain features, however, and that is why one needs to be active on all fronts.

This issue of analysis brings us to another point. There is actually a difference between a narrow transcription that is based on analysis, and one that is not. The latter is called an impressionistic transcription,[5] or a general phonetic transcription. A phonetic transcription that is intended to reflect a careful analysis of the language and is tied into that analysis is also called an allophonic transcription or a systematic narrow transcription. You will see data that is labeled one way or another at various times in this book, especially in the exercises.

A phonetic transcription may also be less narrow. Different kinds of details may be omitted because they are simply irrelevant to the discussion at hand. This omission may be inappropriate in some cases, but in many situations the very fine phonetic facts about some items may just be irrelevant. And so phonetic transcriptions of the words mentioned in §11.1 might eliminate mention of the nasalization that one might hear, and they might eliminate mention of the consonant aspiration and vowel length that a phonetician definitely hears.

11.3 Broad and phonemic transcriptions

A transcription may even exclude even more information. The term used by the International Phonetic Association for this representation is broad transcription, or (almost equivalently) phonemic transcription.[6] A broad transcription may remove all those details that may be learned by simple conventions and still use ordinary phonetic symbols. Broad phonetic transcriptions of the words shown in §11.1 might be the following: /pɜnk/, /bænk/, /ʃæmˈpuː/, /bam/. The words are conventionally set off with diagonals (slashes, strokes, virgules—alternative names for the same symbol) to indicate that they are broad transcriptions. Broad transcriptions require more analysis—the type of analysis that we will be presenting in this book, in fact. But this means that one cannot just sit down and write a broad phonetic transcription from the first day, since one has not done this analysis yet. A good amount of this book is devoted to helping you learn just what that "adequate amount of analysis" in fact is.

Consider the following example. Imagine a word that is phonemically /ˈkama/. In fact, you don't have to imagine it. That word exists in Spanish (it means 'bed') and it exists in Seri (it means a particular kind of skate, *Raja binoculata*). Let's also imagine it exists in an English-like language called Englishoid.[7] As we see later in this book, each language has its own set of patterns that determine how the specific phonemes are pronounced. In Spanish, this means that the stressed vowel is lengthened slightly, and so the narrow representation is [ˈkaˑma]. In Seri, this means that the consonant after the stressed vowel is lengthened considerably and even the vowel after that is lengthened, and so the narrow representation is [ˈkamːaː]. In Englishoid, this means that the voiceless stop is aspirated and the unstressed vowel is centralized to a schwa-like vowel, and so the narrow transcription is [ˈkʰamə]. There might even be a subdialect of Englishoid that nasalizes vowels before a nasal consonant, and the result would be [ˈkʰãmə]. The steps from narrow transcription to phonemic transcription require analysis. And you can see that one cannot just read the narrow transcription off the phonemic transcription without (explicit or subconscious) knowledge of the phonetic details.

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[4] This point is made in Ladefoged (2003:1): "Without knowing the phonology of a language you cannot describe the phonetics. You need to know what it is that you have to describe. ... The phonology has to be clear before you can make a meaningful description of the phonetics; and without a description of the sounds, you cannot get very far with the phonology."

[5] IPA 1999:28-29.

[6] See the detailed discussion of these terms in IPA (1999:28).

[7] As a matter of fact, the name used for a specific genus of mollusk uses this word as a name, and it is spelled *Chama*.

The sound patterns that are captured by the Conventions section of the description are usually so ingrained and subconscious that a speaker easily carries them over when pronouncing the words of another language. To learn to pronounce the voiceless stops without aspiration (when speaking Spanish or Seri) requires acquiring new patterns on the part of the English speaker just as learning to pronounce them with aspiration requires acquiring new patterns by the native Spanish or Seri speaker. A language learner who does not use these patterns (perhaps because no one ever pointed them out) will always be judged as having a heavy foreign accent. Unfortunately, language learning materials do not always make these patterns known to the language learner. A serious phonological description cannot fail to include them.

11.4 Avoiding ambiguity

A transcription that does not include an indication of the type of transcription that it is may cause confusion. The use of square brackets around (relatively) narrow phonetic transcriptions helps, but this does not make clear how narrow the representation is. The use of diagonals around (supposed) phonemic transcriptions clearly indicates that analysis has been done and some phonetic detail has been removed (although one might disagree with the analysis). Orthographic representations do not have a standard convention associated with them, but sometimes one sees angle brackets (e.g., <shampoo>) or just the use of italics (e.g., *shampoo*) to distinguish them clearly.

11.5 Practical notes

Two practical notes are worth mentioning here. First, it is a good idea (especially when the facts are interesting) to not fail to keep a fairly narrow transcription of all of the data. You may forget or change your analysis later; or you might become inconsistent. Second, it is important to not forget that your broad transcription in itself is not how the word is pronounced. If you start to use it as a direct representation of the phonetic facts, you will be remembering the facts incorrectly. You might easily begin to mispronounce the word.

One thing important about a set of data presented as phonetic data is that it be represented consistently. To avoid confusion, it should not mix narrow with broad phonetic representations of the language.

11.6 Different traditions

There is more than one set of conventions for phonetic transcriptions, although the most well known is the set maintained by the International Phonetic Association (IPA). People working on American Indian languages have been used to using a different set of conventions, and there are other sets from other locations in the world. In this book we utilize fairly exclusively the IPA conventions since these have the widest usage and are related to an association that systematically explains and updates them (see http://www.langsci.ucl.ac.uk/ipa/). Our point of view (not shared by everyone) is that these conventions are quite suitable for most details of a phonological study and write-up. When one switches to something less standard because it seems more convenient in the short-run, the chances are greatly increased for misunderstanding the data or for limiting its longevity over time.[8]

11.6.1 *Short exercise: Pigafetta's transcription.* Read the following paragraph from Bergreen (2004:249-250). (The paragraph is from an account of Ferdinand Magellan's 1519-1521 trip in search of a new route to the Spice Islands; Antonio Pigafetta was the chronicler of the voyage. The incident described here took place on an island in what is now the Philippines.) What kind of "phonetic transcription" (narrow, impressionistic, broad, phonemic) is the author describing? What kind of punctuation would be used today for this kind of transcription (diagonals, square brackets, angle brackets)? Was the transcription written using the conventions of the IPA? Explain your answer. When you have finished writing your answer, see the discussion in appendix E.13.

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[8] For another appraisal of the conventions of the IPA and additional background, see Bauer (2007:127-136).

> During the meal, Pigafetta gave the king a presentation that made almost as large an impression as Magellan's show of force: it was the power of the written word. Pigafetta coaxed the king to name various objects surrounding them, and recorded a phonetic transcription. "When the king and the others saw me writing and when I told them their words, they were all astonished."

11.7 Key terms

The key terms introduced in this chapter are:

1. ORTHOGRAPHIC REPRESENTATION. An orthographic representation is any one of perhaps several ways of writing a language for use by the speech community, whether or not there has been standardization or officialization of the norms that govern its use. (§11.1)
2. NARROW TRANSCRIPTION. A narrow transcription is a transcription of an utterance that contains some or considerable phonetic detail, whether based on an analysis or not. If it is based on an analysis, it might be called a systematic narrow transcription or an allophonic transcription. Such transcriptions are traditionally written inside of square brackets. (§11.2)
3. IMPRESSIONISTIC TRANSCRIPTION. An impressionistic transcription is a kind of narrow transcription that contains some or considerable phonetic detail and is *not* based on an analysis of the language but rather the transcriber's impressions. Such transcriptions are traditionally written inside of square brackets. (§11.2)
4. SQUARE BRACKETS. These conventionally enclose narrow (whether systematic narrow or impressionistic) transcriptions. (§11.2)
5. BROAD TRANSCRIPTION. A broad transcription is a phonetic transcription that omits all or much of the non-distinctive phonetic detail of the text. As used by the IPA, a broad phonetic transcription is "a connected text represented in terms of phonemes" (IPA 1999:29), sometimes with "the extra implication that, as far as possible, unmodified letters of the roman alphabet have been used." It is used almost equivalently with the term PHONEMIC TRANSCRIPTION. (§11.3)
6. PHONEMIC TRANSCRIPTION. A phonemic transcription represents a text using symbols for the phonemes (including diacritics for suprasegmentals like tone and nasalization), leaving out predictable phonetic detail that is not carried by the symbols themselves. The expression is almost used equivalently to BROAD TRANSCRIPTION. (§11.3)
7. DIAGONALS / slashes / strokes / virgules. These conventionally enclose phonemic (broad) transcriptions. (§11.3)

11.8 Reading questions

You can check your answers to these questions in appendix F.11.

1. T/F Narrow transcriptions are typically presented in square brackets.
2. T/F A phonetically trained individual should be able to pronounce a word fairly well based on a narrow transcription alone.
3. T/F A phonemic transcription may exclude some irrelevant features, even if phoneticians clearly hear them.
4. T/F When starting the analysis of a "new" language it is better just to use a broad phonetic transcription.
5. T/F Orthographic representations are marked between slashes as in the word /house/.

12

BASIC METHODOLOGY: PRESENTATION OF CONTRASTING ELEMENTS

One of the most common ways to perceive the difference between two different phonemes of a language is by seeing them presented in contrast. We say that sound A contrasts with sound B if an utterance X has a different meaning from an utterance Y and the difference between the two utterances is isolatable to the difference between A and B. When this is the case—unless there is a better story (which is sometimes the case)—we say that A and B are separate phonemes. (We also see some cases below where this simple statement must be interpreted carefully.)

When two utterances that have different meanings differ in only the exchange of one phoneme for another, we say that those two utterances are a minimal pair.[1]

Some examples of minimal pairs in English include those in (1) (cited in a narrow transcription, as indicated by the square brackets, of course, in the author's dialect):

(1)	/s/	vs.	/ʃ/	[ˈseɪv]	'save'	vs.	[ˈʃeɪv]	'shave'
	/a/	vs.	/ɜ/	[ˈdak]	'dock'	vs.	[ˈdɜk]	'duck'
	/ɹ/	vs.	/l/	[ˈɹɪp]	'rip'	vs.	[ˈlɪp]	'lip'

The elements contrasted in a minimal pair may be in any position in the utterance—at the beginning, in the middle, or at the end; before a vowel or before a consonant; after a vowel or after a consonant. Depending on the facts of the language, it is appropriate to try to show contrasts in more than one position as a way to fully demonstrate the contrasts.

For example, to further demonstrate the contrast between /s/ and /ʃ/, one might point to the words [ˈbæs] 'bass' and [ˈbæʃ] 'bash' (the contrast in final position). It is more difficult to find minimal pairs with these sounds in word-medial position, but words such as [ˈɹɛsəlˠ] 'wrestle' and [ˈspɛʃəlˠ] 'special' are just as adequate (as discussed more in §12.2.2) to show contrast even though they are not minimal pairs. The sounds /s/ and /ʃ/ occur between the same vowels in words with the same stress patterns (stressed syllable followed by unstressed syllable).

We have some preference for examples of contrast (whether minimal pairs or not) that contain only one morpheme. This is because when one includes polymorphemic data, one is (perhaps) losing a bit of control over the variables that may be involved. For example, the two words [stɚ] 'stir' and [stɚː] 'stirrer' are not good evidence for demonstrating that English has short and long versions of the central rhotacized vowel. Although it is a minimal pair, there is more than one analysis possible. Comparison with [tʰiːtʃɚ] 'teacher' shows, of course, that there is a suffix /ɚ/ and so we should view the long rhotacized vowel as a simple juxtaposition of two instances of that vowel, and we would transcribe it more perspicuously as [stɚɚ].

In the case of words like [ˈkʰɪsɪŋ] 'kissing' and [ˈfɪʃɪŋ] 'fishing', we are quite confident that we know what is going on with the formation of these words—a root is followed by a suffix. The roots are [ˈkʰɪs] 'kiss' and [ˈfɪʃ] 'fish'—we can get those words without a suffix attached at all. The suffix [ɪŋ] is found in thousands of words in English, and is not a problem either. But in other cases that we see later in this book, the formation of words may be more complex. If we do not know what is going on when they are formed, we need to be very careful about using the data as the primary evidence for something we want to claim.

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[1] This definition differs from the one used by some that says that a minimal pair is "any pair of words that differ by just one sound in the same position" (Roca & Johnson 1999), since our definition refers specifically to the phonemes, eliminating some potential confusion and some incorrectly identified pairs of words.

Example from Tenango Otomi. The following triplet appears in a write-up to support the claim that /p/, /b/, and /f/ are distinct phonemes in Tenango Otomi.[b]

(1)	dáˈpǎ̃dĩ	‘I knew’
	dàˈbǎ̃dĩ	‘he will know’
	dàˈfǎ̃dĩ	‘it will be known’

These examples obviously show that there is a superficial contrast at least among these three consonants, but (in our view) these are *not* optimal data for showing the phonological contrast because the evidence is morphologically complex and the reader is not told how the pieces all work. (What is the root, for example?)

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[b] Blight & Pike (1976:51).

Example from Papantla Totonac. The following pair of words appears in a write-up to support the claim that /s/ and /ʃ/ are distinct phonemes in this variety of Totonac: /ʃuːɬ/ ‘he skinned it (a large thing)’, /suːɬ/ ‘he skinned it (a small thing)’ (Aschmann 1946:36). Again, while such data do show that there is a superficial contrast between the two sibilants, they are not optimal for showing the phonological contrast since we are not told how these two extremely similar verb words are related.

A simple example from English: the word [pʰæt] contrasts phonetically with the word [pʰæts], which contrasts with the word [pʰætʃ]. This might lead a naïve analyst to propose that in English there are the following three phonemes: alveolar stop, alveolar affricate and postalveolar affricate. This is not the correct solution. The second of these words is an inflected word that has the suffix <-s> in numerous other words (*keeps*, *packs*, ...) and therefore we are on firmer ground if we posit a consonant cluster /ts/.

It should be easy to demonstrate robust contrasts in a language using many examples—perhaps not always with minimal pairs (which should be considered a luxury)—but with abundant data, nonetheless. Some phonemes are indeed unusual in a language—for whatever reason historically—and this needs to be recognized and mentioned.

The fact that two sounds are phonemes in a language does not mean that they will have the same distribution in the language. One of them may simply not appear in every kind of context where the other one may appear. The study of the distribution of sounds is called PHONOTACTICS, as was mentioned in chapter §8.

Taking the phonemes /s/ and /ʃ/ of English again to illustrate, we note that only /s/ appears before a stop consonant at the beginning of a syllable. Examples like /spil/ ‘spill’, /stil/ ‘still’, and /skil/ ‘skill’ are common, but words like /ʃpil/, /ʃtil/ and /ʃkil/ are either non-existent or marginal.[3, 4] And only /ʃ/ appears before /ɹ/ at the beginning of words; examples like /ʃɹil/ ‘shrill’, /ʃɹimp/ ‘shrimp’, and /ʃɹed/ ‘shred’ are found, but words like /sɹil/, /sɹimp/, and /sɹed/ are not. These two sibilant phonemes have different distributional (phonotactic) patterns in English.

Pairs like /ʃin/ ‘shin’ vs. /bin/ ‘bin’ are also minimal pairs, but they just are not very interesting since the two phonemes in contrast (/ʃ/ and /b/) are so different phonetically. Our attention in this book is on pairs of sounds that are more similar. The reason for this will become more evident as the course proceeds.

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[3] Some speakers use the word /ʃtik/, but it is quite unusual.

[4] We generally follow the *second* possible set of conventions used by Ladefoged (1999:42) for transcribing English vowel phonemes, specifically /i e u/ for the vowels that are phonetically [ɪ ɛ ʊ], and /iː eː oː uː/ for those that are phonetically diphthongized. We use /a/ rather than /ɑ/, however, as permitted within the IPA system, and we use /ɜ/ rather than /ʌ/. (The latter symbol is very commonly used in American linguistics, however, despite not being the closest symbol on the IPA vowel quadrilateral.) See the discussion in the box at the end of this section.

Sometimes the presentation of minimal pairs is complicated by the fact that phonetic details become involved. This is, in fact, what a good part of this book is all about, but we illustrate it here in a simple way. There are two bilabial oral stop phonemes in English: /p/ and /b/. This is shown by numerous minimal pairs in the language, but not quite so easily as for those shown in (1). Consider the following examples comparing the phonemes /p/ and /b/. The words are written phonemically as well as phonetically.

(2)	/p/	vs.	/b/:	/pit/	[pʰɪt]	‘pit’
				/bit/	[bɪt]	‘bit’
		and		/tæp/	[tʰæp]	‘tap’
				/tæb/	[tʰæˑb]	‘tab’

The data in (2) include two minimal pairs by the definition given at the beginning of this chapter. Note that the only difference between each pair of phonemic transcriptions is between /p/ and /b/. However, if we looked only at the narrow transcriptions, we might not be sure what we have. In the first pair, the /p/ is phonetically aspirated—as is typical of voiceless stops in this position in English. This pair does *not* establish pʰ as a phoneme of English, however, but rather simply the contrast between /p/ and /b/—regardless of how /p/ is actually pronounced. This statement is based on the result of the analysis that we do—as we show in this book.

In the second word of the second pair of words given in (2), the vowel is phonetically lengthened slightly—as is typical of vowels before voiced consonants in English. If we look at the phonetic representations, we would not think that we have a minimal pair at all since there are two differences: vowel length and also the switch between [p] and [b]. But the analysis that we give for these data is that the only phonological difference between *tap* and *tab* is located in the consonants and that the difference in the vowel length is a subsidiary phonetic effect. This is made clear in the phonemic transcriptions—a simple minimal pair.

Thinking about English vowel transcription. It is well known that English has a robust inventory of vowels. These vowels may be transcribed in more than one way, even within the IPA tradition, for more than one reason. The issue is worth discussing because it illustrates a more general point: phonemic (or broad) transcription may utilize symbols that are different than those used in narrow transcription. In the case of the English vowel [ɪ], for example, while it would be considered standard to use the symbol ɪ in a narrow transcription of the word *fit*, it is possible that the broad transcription might be with the symbol i instead, and use the symbolization iː for the representation of the nucleus of the word *feet*. We try to give a brief explanation here why one might do this.

The so-called lax vowels of American English are those that are found in words like *tack*, *peck*, *tick*, *lock*, *took*, and *tuck*. Narrow transcriptions of these might use [æ], [ɛ], [ɪ], [a] (or [ɑ]), [ʊ], and [ɜ], respectively. The so-called tense vowels are those that are found in words like *mane*, *mean*, *moan*, and *moon*. These vowels tend to diphthongize slightly as well as be slightly longer than the lax vowels, and might be narrowly transcribed, respectively, as [e], [eː], [eɪ], or [eʲ]; [i], [iː] or [iʲ]; [o], [oː], [oʊ], or [oʷ]; and [u], [uː], or [uʷ]. (This kind of arrangement of phonetic facts for short and long vowels is not unusual.)

The phonemicization of the contrast between [ɪ] and [iʲ], as in *fit* and *feet*, presents some options. One (accepted) option is to focus only on the quality differences: the contrast is /fɪt/ vs. /fit/. Another (accepted) option is to focus on the length differences: the contrast is /fit/ vs. /fiːt/. A third option is to include both quality and length in the transcription: the contrast is /fɪt/ vs. /fiːt/. Once one makes a decision, obviously it is important to be consistent.

But is it just an arbitrary decision? Or are there some principles? Or evidence to consider? In this particular case, it seems important to consider how tense vowels are like diphthongs in some respects. The use of length in the representation of them makes it possible to easily correlate tense vowels with heavy syllables just as diphthongs are related with heavy syllables. This seems to be a significant fact, as we show here.

The first fact has to do with the operation of the minimal word constraint in English. Words (of a major word class) must have more than one mora. For this reason, monosyllabic words ending with lax vowels do not exist: *[sta], *[stɛ], *[trɪ], *[kʊ], etc. On the other hand, tense vowels can easily occur in this kind of word: see *lay*, *fee*, *toe*, and *blue*. Diphthongs, of course, can also occur: see *cow*, *soy*, and *rye*. So diphthongs and tense vowels are patterning together.

The second fact has to do with distribution of vowels in rimes that end in codas like *nk* in English. Diphthongs in English do not combine with such codas (except in "words" like *oink*, obviously not core vocabulary): *[saɪŋk], *[soɪŋk], *[saʊŋk]. These are not even imaginable words of English. Now notice that tense vowels also do not occur with such codas: *[siːŋk], *[seːŋk], *[soːŋk], and *[suːŋk]. If these syllables with tense vowels have heavy nuclei, just like syllables with diphthongs have heavy nuclei, then a constraint prohibiting certain /VVCC/ rimes in English will be relatively easy to formulate.

For reasons like these, one might make a non-arbitrary decision to choose to present tense vowels phonemically in English with length represented—not only to indicate the phonetic facts, but also to serve the bigger picture of the phonology of English.

12.1 Presentation of the inventory of phonemes

When one is organizing data to demonstrate phonemic contrast, different styles of presentation may be used. The different styles include certain common elements, however, as shown below. We focus here on the style of presentation in the *Journal of the International Phonetic Association* (*JIPA*).

One presents the phonemes that one is proposing, thus alerting the reader to the fact that an analysis has been made and some conclusions drawn. In *JIPA* the phonemes are generally shown using the standard arrangement of the IPA consonant chart. The standard chart includes the following categories, from top to bottom: *Plosive, Nasal, Trill, Tap or Flap, Fricative, Lateral fricative, Approximant, Lateral approximant*. (Singular nouns are used to label the rows, as if they were part of a compound such as "plosive phonemes", "fricative phonemes", etc.) Affricates are commonly presented as an additional row, immediately following the plosive row.[5] Ejectives are presented in separate rows (most logically right after the plosive row). Aspirated sounds are presented in a secondary row within the same major row in some illustrations in the *Handbook of the IPA*, and in the same cell as the non-aspirated version in one.[6]

The columns present different points of articulation and are labeled accordingly using a standardized set of terminology. But in a presentation, unnecessary points of articulation are omitted. For example, if the language has no glottal consonants, no glottal column is presented. In each column the voiceless consonants are written to the left and the voiced consonants to the right.

Therefore the consonants of American English, for example, appear as shown in table 1, in the order Stop (or Plosive), Affricate, Nasal, Fricative, Approximant, and Lateral approximant, for the rows.

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[5] It does not take very long to see that the illustrations in IPA (1999) are not entirely consistent in how the rows are presented.

[6] See the Thai illustration (Tingsabadh & Abramson 1999).

	Bilabial	Labio-dental	Dental	Alveolar	Post-Alveolar	Palatal	Velar	Glottal
Stop	p b			t d			k g	
Affricate					tʃ dʒ			
Nasal	m			n			ŋ	
Fricative		f v	θ ð	s z	ʃ ʒ			h
Approx.				ɹ		j	w	
Lateral approx.				l				

Table 1. Consonants of American English

Again, note that this chart presents the phonemes of the language, not the phonetic data. It does not present the phonetic data, but rather the conclusion the analyst has made by analyzing the data.[7]

The presentation of vowels in the IPA illustrations is slightly different. The characteristic IPA vowel quadrilateral is used, but without labels. The vowels are plotted into that vowel space and a large dot is put at the point in the chart that corresponds to its supposed prototypical pronunciation. Or the dot may be placed at a point that corresponds to an average of the actual measurements that are made on recorded data using a program such as PRAAT or Speech Analyzer.[8] The correct vowel symbol for the phoneme is written adjacent to this dot (either before or after).

As an example, see the quadrilateral in figure 3 that plots the vowels of English as presented in Ladefoged (1999:42) in the *Handbook of the IPA*. The English vowels are not plotted where the cardinal vowels are pronounced because the English vowels are not the cardinal vowels. The symbol that appears on the quadrilateral is the one that is chosen to represent the phoneme in the particular write-up.

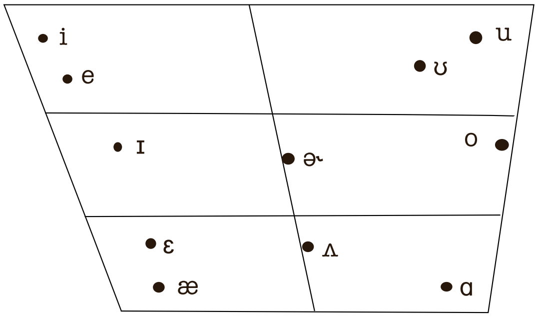

Figure 3. Vowels of American English (excluding the diphthongs), following Ladefoged (1999:42)

There may be some indecision about what symbol to use for the vowel phoneme. Of course, whatever decision is made for the prose presentation generally is also followed in the quadrilateral. *The symbol used for the vowel phoneme (not the phonetic symbol) is what appears in the quadrilateral.* The IPA system gives a fair amount of latitude on this point because it is straddling both a narrow phonetic transcription and also a phonological one (as should become clearer later in this book). For example, whereas the vowels of English found in the words **[bɪt]** 'bit' and **[bijt]** 'beet' have particular representations in a narrow transcription, the presentation of the phonemes could represent a slight abstraction that then uses a different representation, such as **/bit/** and **/biːt/**, respectively. And in that case,

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[7] This is the normal situation for the illustrations that have been published. The illustration of Brazilian Portuguese (Barbosa & Albano 2004), however, departs from this norm.

[8] See information about these tools in appendices A.5 and A.6.

the symbols that appear in the quadrilateral would be *different* from the ones shown in figure 3.[9] See the description of Hausa in Schuh & Yalwa (1999), for example.

An important point to note is that it is very common in these kinds of write-ups to use the “lower-case a” [a] to represent a low vowel, regardless of its actual pronunciation if there is no other low vowel in the language that it contrasts with, rather than something like the “script a”—[ɑ]—that was used in Ladefoged (1999).[10] This kind of usage falls within the guidelines of the IPA.

The dots that are plotted for the vowels in this presentation represent an abstraction over a range of pronunciations. (A detailed phonetic study might include dozens of dots for each vowel.) It is rarely the case that the dot will appear exactly where the dot appears for the cardinal vowel or the vowel as it is taught in a phonetics class. The primary cardinal vowels represent the extremes of the system; most languages do not use precisely those vowels in their system. The dots for actual language vowels therefore typically appear inside the quadrilateral somewhere, not on the extreme edge. Look up Ladefoged’s plotting of English vowels on p. 42 for an example.

The symbols used in these presentations are the standard ones of the IPA, following the conventions outlined in IPA (1999). They are neither the local practical orthography nor a personal or regional adaptation of the IPA symbols.

It is not always the case that the consonants are easy to put on the chart. For example, there are consonants of the Spanish language that have a wide range of pronunciations depending on various factors, including dialect. The sound that appears in the word *llama* ‘flame’, for example, varies phonetically between the following: [ˈʒama], [ˈʃama], [ˈjama], [ˈʎama], and [ˈdʒama], not only between dialects but (some of these) in the speech of a single speaker. So where does that go in the consonant chart? All phonologists would not agree on the same answer, but whatever is done needs to be made clear and a reason given for it. (We also think that it is appropriate to not ignore the various dialects when writing up a language.)

12.1.1 *Short exercise: Consonants.* A published phonological description of a language says that “the consonants are /b d g p t k ʔ v s h m n ř/.” The final symbol in that list is the Americanist symbol for the common alveolar tap. Unfortunately, the description does not give more phonetic details about the meaning of these symbols. Present these consonants in a format that is similar to the one used for English consonants in table 1 in §12.1. Include discussion about anything that seems to you to be problematic or uncertain. When you have finished, check your answer with that given in appendix E.14.

12.1.2 *Short exercise: Vowels.* A published phonological description of a language says that the vowels in the language are high vowels /i ɨ u/, mid vowels /ë o/, and low vowel /a/. The symbol <ë> is an Americanist symbol for an unrounded close-mid back vowel — the unrounded counterpart of <o>. Unfortunately, the description does not give more phonetic details about the meaning of these symbols as they are being used. Assume that the unrounded vowels /ɨ ë/ actually represent *central* unrounded vowels rather than *back* unrounded vowels (as might be thought). Present these vowels (with the correct symbols!) in a format that is similar to the one used for English vowels in figure 1 in §12.1. Include discussion about anything that seems to you to be problematic or uncertain. When you have finished, check your answer with that given in appendix E.15.

12.1.3 *A checklist for presentation of phonemes in write-ups.* When you present the phonemes in a chart form, as in the illustrations of the IPA, use the following guidelines.

1. Use a standard order of presentation of the phonemes, such as found in IPA (1999), both for rows (classes of sounds), columns (places of articulation), and within cells (voiceless on the left, voiced on the right). See the illustrations in IPA (1999) for other details.

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[9] See the four options that Ladefoged discusses for English in his presentation (1999:42).

[10] The names of letters used in phonetics are taken from Pullum & Ladusaw (1996), an excellent resource for dealing with phonetic symbols from different traditions.

2. Use the standard symbols and conventions of the IPA (or some other regionally recognized system, properly identified and documented, if the publication is not the *Journal of the International Phonetic Association*; do not assume that the reader will be able to figure out a non-standard system). Note: common errors are the use of "g" rather than "ɡ" for the voiced velar stop (at least the latter is preferred), and "r" rather than "ɾ" (for a tap).
3. Since such a chart is identified as an inventory of phonemes, the symbols in the chart are not written between diagonals.
4. Ensure that the column headers use the terminology that is appropriate—not personalized labels.
5. Columns for places of articulation that are not needed are simply omitted. Dental and alveolar are not combined simply to save space even if there is only one consonant in one or the other.
6. Ensure that the labels for the rows use the terminology that is appropriate. In the case of the IPA, the convention is to use singular nouns (not plural): Plosive (or stop), Nasal, etc.
7. Consider indicating rare phonemes in some way, such as with parentheses or asterisk and a paragraph or footnote of explanation.
8. Check to see that no labels (such as "Front") are written on the vowel trapezoid.
9. Be sure there is a large dot for each vowel that is plotted in the vowel trapezoid and that the correct symbol is used. (For guidance on the representation of diphthongs, see the illustrations in IPA (1999) of languages that have diphthongs.) Most likely the dot should be inside the quadrilateral, not on the edge, and most certainly not outside of the quadrilateral.

There is no doubt that you will see published phonological write-ups, even within the genre of the illustrations of the IPA, that do not follow all of these guidelines. Nevertheless, these do seem to be the general and most followed guidelines.

12.2 Presentation of supporting data

When data are presented, glosses of the data are also given, and the glosses should translate the word exactly. If the word means 's/he saw him/her', the gloss should be exactly that and not something like 'saw' or 'he saw him'.

The proposed phonemic representation of the word in question is included in the illustrations of the IPA that are published in IPA (1999). This seems to be an appropriate way for one to put all of one's analysis on clear display. *Therefore note that the columns of data illustrating the phonemes in the IPA illustrations are written in phonemic transcription, not phonetic transcription.* Non-contrastive phonetic detail is suppressed in these data.

Some traditions (not the IPA illustrations) prefer to see the narrow transcription displayed clearly alongside the broad transcription. The following presentation of the obstruents of English gives both representations (phonemic/broad and narrow). It also presents the contrasts in two positions in the word—initial and final. In many cases it is highly relevant to see such facts presented clearly.

(3)

	Initial			Final		
/p/	/pit/	[pʰɪt]	'pit'	/tæp/	[tʰæp]	'tap'
/b/	/bit/	[bɪt]	'bit'	/tæb/	[tʰæˑb]	'tab'
/t/	/tip/	[tʰɪp]	'tip'	/sæt/	[sæt]	'sat'
/d/	/dip/	[dɪp]	'dip'	/sæd/	[sæˑd]	'sad'
/k/	/kil/	[kʰɪˑlˠ]	'kill'	/sæk/	[sæk]	'sack'
/g/	/gil/	[gɪˑlˠ]	'gill'	/sæg/	[sæˑg]	'sag'
/tʃ/	/tʃin/	[tʃɪˑn]	'chin'	/lɜntʃ/	[lɜntʃ]	'lunch'
/dʒ/	/dʒin/	[dʒɪˑn]	'gin'	/lɜndʒ/	[lɜˑndʒ]	'lunge'
/f/	/fæt/	[fæt]	'fat'	/lajf/	[lɜjf][11]	'life'

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[11] The phonetic representation here reflects the pronunciation in a dialect in which the diphthong /aj/ is pronounced differently before voiceless consonants.

/v/	/væt/	[væt]	‘vat’	/lajv/	[laɪv]	‘live’
/θ/	/θik/	[θɪk]	‘thick’	/bæθ/	[bæθ]	‘bath’
/ð/	/ðis/	[ðɪs]	‘this’	/beːð/	[beɪð]	‘bathe’
/s/	/siːl/	[siːlˠ]	‘seal’	/ɹejs/	[ɹeɪs]	‘race’
/z/	/ziːl/	[ziːlˠ]	‘zeal’	/ɹejz/	[ɹeɪz]	‘raze’
/ʃ/	/ʃiːld/	[ʃiːlˠd]	‘shield’	/paʃ/	[pʰaʃ]	‘posh’
/ʒ/	/ʒanɹə/	[ʒanɹə]	‘genre’	/beːʒ/	[beɪʒ]	‘beige’
/h/	/hiːl/	[hiːlˠ]	‘heal’	—[12]		

If the data given do not adequately answer all of the potential questions about alternative analyses of the data, additional data should be presented. Furthermore, any data shown should be backed up by many more examples that could be presented if necessary and as appropriate. In the case of /ð/, /ʒ/ and /h/ in English, additional notes should be added to discuss their limited distribution.

It is certainly possible to look for contrast in other positions in the word, such as intervocalically (compare *supper* and *rubber*, for example, to contrast /p/ and /b/ in one such context), or such as preceding a consonant (compare *plaque* and *black*). Some contexts are not great because they do not allow all options. For example, in an onset preceding the consonant /t/ in English we only find /s/.

Since the vowel /a/ is less likely to influence the pronunciation of a consonant (as you will learn in this course), it seems desirable for one to try to use this vowel when presenting the phonemes. When that is not possible, then another central vowel is recommended, such as /ɜ/ or /ɨ/, if possible, or a back vowel. Consider the following presentation of the obstruent phonemes of English with this recommendation in mind. This time the narrow representation is omitted, as is typical in the IPA illustrations. The vowels in question are those of the author’s dialect. In this list, blanks have been left where no appropriate words were found with these particular vowels. These are believed to be accidental gaps. In these cases it is usually *not* recommended that blanks be left unless no possible words can be found at all in the language to illustrate the contrast.

(4) Data presented to show contrast (note lack of diagonals and no data given in narrow transcription)

	Initial		Final	
p	pat	‘pot’	tap	‘top’
	pɜp	‘pup’	kɜp	‘cup’
b	batʃ	‘botch’	kab	‘cob’
	bɜt	‘butt’	kɜb	‘cub’
t	tap	‘top’	kat	‘cot’
	tɜk	‘tuck’	kɜt	‘cut’
d	dat	‘dot’	kad	‘cod’
	dɜk	‘duck’	kɜd	‘cud’
k	kap	‘cop’	sak	‘sock’
	kɜt	‘cut’	sɜk	‘suck’
g	gat	‘got’	bag	‘bog’
	gɜm	‘gum’	bɜg	‘bug’
tʃ	tʃap	‘chop’	batʃ	‘botch’
	tʃɜk	‘chuck’	tɜtʃ	‘touch’
dʒ	dʒak	‘jock’	ladʒ	‘lodge’
	dʒɜt	‘jut’	bɜdʒ	‘budge’
f	fag	‘fog’		
	fɜs	‘fuss’	tɜf	‘tough’

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[12] The line here indicates that no examples of /h/ in word-final position will be found because they are not possible.

v				
			lɜv	‘love’
θ				
	θɜm	‘thumb’		
ð				
s	sak	‘sock’		
	sɜk	‘suck’	fɜs	‘fuss’
z				
			bɜz	‘buzz’
ʃ	ʃap	‘shop’	paʃ	‘posh’
	ʃɜt	‘shut’	kɹɜʃ	‘crush’
ʒ	ʒanɹə	‘genre’	koɹˈsaʒ	‘corsage’
h	hat	‘hot’	—	
	hɜt	‘hut’	—	

Because there may be complications due to word stress (as will be shown later in this book), it is recommended that the words be major class words (see §10.2) and not minor class words that may be typically unstressed.

Case study: In some languages of Mexico, the phonemes **t**, **d**, and **ɾ** have been posited on the basis of data such as the following: **ˈtaka** ‘sun’, **ˈdaka** ‘stone’, **ɾa** (third person enclitic pronoun). Unfortunately, these data do not establish anything about the phonemic status of the tap other than it exists. The prosodic properties of the third person enclitic pronoun (unstressed, phonologically bound to the preceding word) make this example completely unconvincing for establishing the tap as a phoneme. If this is the best evidence, then clearly another analysis is in order.

Words should generally have the same prosodic pattern so that any interference from word stress is eliminated. Thus it is helpful to not mix data that have a TROCHAIC stress pattern (like *páper*) with those that have an IAMBIC stress pattern (like *contról*).

12.2.1 *Presentation of vowel phonemes.* When vowels are presented, it is helpful to present the vowels in different positions that may be possible—stressed and unstressed, open syllables and closed syllables. Care should be taken to use consonants in such words that are as uncomplicated as possible—stops (not affricates), oral sounds (not nasal), not rhotics (r-sounds), voiceless (not voiced). Reasons for this advice will become obvious later in this book. The main reason is to avoid consonants that may affect the vowels in some obvious way (if possible).

The data in (5) represent good examples for the vowels and true diphthongs of American English (author's dialect) in two positions: open syllable of monosyllabic word, and closed syllable of monosyllabic word. (The symbols used are not the exact phonetic values; they are abstractdions.)[13]

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[13] This list follows Ladefoged (1999:42-43, column 2) except that it also includes **ɔː** (for the author's dialect) and the rising diphthong **juː**. It is assumed here that the rhotacized vowel in the word ‘bird’ is in fact phonemically a vowel followed by the rhotic approximant. Therefore **ɚ** is not included here. The symbol **a** is used instead of **ɑ** and **ɜ** instead **ʌ**.

(5)

i	—		pik	‘pick’
iː	biː	‘bee’	piːk	‘peek’
e	—		pek	‘peck’
eː	beː	‘bay’	beːk	‘bake’
æ	—		pæk	‘pack’
a	spa	‘spa’	pak	‘pock’
ɔː	sɔː	‘saw’	tɔːk	‘talk’
oː	boː	‘bow’	poːk	‘poke’
u	—		tuk	‘took’
uː	bluː	‘blue’	buːt	‘boot’
ɜ	—		p3k	‘puck’
aj	taj	‘tie’	kajt	‘kite’
aw	baw	‘bow’	pawt	‘pout’
ɔj	tɔj	‘toy’	tʃɔjs	‘choice’
juː	kjuː	‘cue’	kjuːt	‘cute’

12.2.2 *Minimal pairs are not necessary.* If one controls for potential interference effects, data that do not even approach being minimal pairs are perfectly adequate for demonstrating contrast. One need not worry about finding minimal pairs, but one does need to worry about ensuring that the data presented are as convincing as possible. An important part of this course is to learn about what things one needs to be on the look out for when looking at the context.[14]

12.3 Expectations

The study of phonemic inventories cross-linguistically has led to certain expectations that may guide us as we look at new sets of data. None of these expectations should be taken as an inviolable constraint, however, so none of them can be used as a reason for making a certain analysis. Some of these expectations may not be clear until more of the course is completed, but they are included here nevertheless so that they are put in one place.

12.3.1 *Interchangeability.* One expects, a priori, that the consonants of a language will all be interchangeable in some position, such as at the beginning of a word. Of course, in actuality this may not be the case, but before looking at the facts there is no reason to expect that one will be not possible in some position.

We can take the consonant phonemes of English and make simple words that begin with them (not one long list of minimal pairs, perhaps, but that is irrelevant): **pik** ‘pick’, **tik** ‘tick’, **kik** ‘kick’, **bit** ‘bit’, **dig** ‘dig’, **gil** ‘gill’, **tʃik** ‘chick’, **dʒæk** ‘jack’, **fæt** ‘fat’, **væt** ‘vat’, **θik** ‘thick’, **sin** ‘sin’, **ʃin** ‘shin’, **mit** ‘mit’, **nik** ‘nick’, **lik** ‘lick’, **wik** ‘wick’, **jel** ‘yell’, and **hit** ‘hit’. Three consonants that are regularly included in the list of phonemes of English and which are not found in many common words in this position (if at all) are **ð**, **ŋ** and **ʒ**; these consonants are in fact interesting for other reasons as well. Actually, **ð** is found in a few common words in this position, including **ðis** ‘this’, **ðæt** ‘that’, and **ðeɹ** ‘there’—also an interesting fact.

One should be aware that some phonemes may have a skewed distribution that is due to something from the history of the language without implying a defect of the analysis. The phoneme **h** in English does not occur in syllable codas; this fact alone does not cause serious doubt about its analysis.

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[14] The presentation of data in minimal pairs is sometimes used in field write-ups from the classical phonemic tradition (characterized best perhaps by Pike (1947) with the notation CIE (contrast in identical environment). Such a label is not typically used in published phonological write-ups. Likewise the presentation of other data in fieldwork sometimes used the notation CAE (contrast in analogous environment). This label is also not used in published write-ups.

Example: Quioquitani Zapotec.[o] Quioquitani Zapotec has various consonants (such as voiced fricatives and affricates) that are robustly attested in syllable codas, but which are not found in syllable onsets. This distributional oddity, not expected a priori, would cause an analyst to think about alternative analyses, but it does not automatically mean that the straightforward analysis is incorrect. In this case, once a person knows something about the development of the branch of Zapotec to which Quioquitani Zapotec belongs, the skewed distribution makes sense.

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[o] Ward et al. (2008).

12.3.2 *Frequency.* One also expects, a priori, that the consonants of a language have a moderately similar frequency in the language—and there should be hundreds if not thousands of examples of each. Of course, this may not be true, but there is no reason to expect, before looking at the facts, that one consonant or the other is going to be rare.

For example, we can find many examples with **s** in English and also many examples with **ʃ**, whether or not the number of words is the same. If one can only find five examples of a supposed phoneme in a language, one might become a bit uneasy. It is possible, of course, that the phoneme is disappearing from the language for some reason, which would be interesting to document.

Example: Seri. The voiced lateral approximant **l** in Seri seems to be a marginal sound, although it is attested clearly in a few words. It is found in one archaic word (**loːmʃ**, the word for a baby mussel was remembered by only a few people and not recorded until after more than fifty years of fieldwork), a couple of place names, nicknames based on Spanish, a loanword from Spanish *dulce* (**loːlsi** ‘candy’, now falling out of use), and in the expression used to call a dog (**[lɛkɛlɛkɛ]**).

Example: Seri. The labial-velar approximant **w** in Seri does not occur as a phoneme—at least not in any general way. After more than fifty years of fieldwork, it was attested in the word used to talk to a child about urinating. If this word had been found fifty years earlier (perhaps it did not exist then), the labial-velar sound might have been mentioned in a footnote, but it would not have been included in the list of phonemes.

It is possible that the phoneme is only marginally attested because it is in fact a sound that only appears in loanwords; this also should be documented. The tap **ɾ** in Seri is an example of such a phoneme. This shows that it helps to know about neighboring languages that may be influencing the language in question.

It is also possible that one has made an error in the analysis and the facts should be re-examined.

Examples: Mixtecan languages. The tap **[ɾ]** is found only in enclitics and not in nouns and verbs in various Mixtec languages. This observation should be a red flag that something important about the phonology needs to be looked at carefully. Similarly in Mixtec the voiced velar stop **[ɡ]** occurs extremely rarely—like in one or two words—as well as (what have been thought to be) the prenasalized stops **[ᵐb]** and **[ᵑɡ]**. The simple infrequency of these sounds demands a careful investigation. And their infrequency needs to affect how they are presented in a write-up.

Example: Seri. An early analysis of Seri phonology mentioned that nasalized vowels (as phonemes) occurred only after kʷ. This extremely odd phonotactic statement was an invitation for another analysis to be given (and it has been; you will learn about these facts later in this book).

12.3.3 *Groups of similar sounds.* One tends to expect that phonemes come in groups that share certain general features. A language will have a series of stops (almost certainly), some fricatives (almost certainly), one or more nasals, and one or more approximants. If one has a voiced stop or fricative, one expects to find more than one in the inventory. Therefore a consonant inventory such as the following would be highly suspect: p, d, ʃ, ɣ, ŋ, l. It would be suspect because there is only one voiceless stop, only one voiced stop, only one voiceless fricative, only one voiced fricative, and an unusual nasal.[16]

12.3.4 *Marked vs. unmarked sounds.* One strongly expects that if a phoneme of a MARKED category is found, one of the UNMARKED category will also be found. (The marked category is the one that is more unusual cross-linguistically for a particular type of sound.) Voicing is a marked feature on obstruents, while it is the unmarked feature on sonorants (see §3.4). If we found d in a language but not t, we would be surprised. If we found m̥ in a language but not m, we would also be surprised. Aspiration is a marked feature, and so if we saw tʰ as a phoneme but did not see t, we would be surprised.

As mentioned earlier, these are only expectations. However, we know of cases where analyses have been published that run counter to them that are apparently well documented. Various examples could be given.

Example: Amharic. Amharic is described as having b but no p in native words (Hayward & Hayward 1999)—and actually, it is quite common for a language to lack p but still have b; some of these situations are well-described in the linguistic literature.

Example: Mangseng. Mangseng (a language of Papua New Guinea) has voiced fricatives β and ð, but the only voiceless fricative is s (Lloyd Milligan, p.c.).

Example: Yine. One presentation of the phonemes of Yine includes a nasalized glottal fricative, but no non-nasalized glottal fricative (Urquía Sebastián & Marlett 2008). This unusual situation (in fact, this unusual sound) could have been glossed over in some way, but instead the unusual nature of this sound is highlighted in the description. For example, rather than opting for a simplified symbol, such as a simple h, the nasal feature is highlighted by always using tilde above the consonant so that this unusual phoneme is clearly presented.

At the same time, analyses have been published that run counter to these expectations, only to be shown later on to be wrong. So they are guidelines that are worth remembering.

One counterexample that stands out with respect to our expectations has to do with vowels. One may think that if a language has short and long vowels, the long vowels are the "marked" case. A language that has n (number) long vowels should also have n short vowels, by the expectation outlined above. And that is correct for some languages

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[16] It was proposed in Pike (1947:59) as a "premise" that "sound systems have a tendency toward phonetic symmetry." This generalization has been repeated and used in various ways. We suggest that it is not helpful since it can easily lead one to make inappropriate claims about the system of the language that are not warranted. In many ways phonetic (and phonological) systems are not symmetrical.

(such as Seri).[17] But for English (and other languages), it is not. Note that in the inventory of English vowel phonemes presented in Ladefoged (1999:42-43), the number of long vowels and the number of short vowels do not match.[18]

12.4 A checklist for the presentation of data in write-ups

1. Use punctuation correctly: square brackets for narrow phonetic transcriptions and diagonals for phonemic (or broad) transcriptions. However, in the "evidence of contrast" section of the illustration of the IPA genre, no diagonals are used around the data because the data is assumed to be only phonemic.
2. Do not use loanword data except when the relevance of the data is discussed and the source identified.
3. Do not include interjections as data except in a section that is dealing with interjections.
4. If appropriate, use an explicit statement (not just by punctuation) to make it clear what kinds of transcriptions are being presented.
5. Present the contrasts in different word positions, as possible, such as word-initially, intervocalically, and word-finally (for consonants). (Do what makes sense for the language.)
6. Be careful to control for the effects of vowels on consonants by using the low central vowel for showing contrasts, if possible.
7. Control the possible interference from morphology by using monomorphemic or other well-controlled data for showing the basic contrasts, if possible.
8. Ensure that the data presented in the "evidence of contrast" section is represented only using phonemic representation, based on your phonemic analysis. (If you are writing for a genre different than the illustration of the IPA, then you may choose to also include a phonetic representation of each word here. But it is crucial that you give your phonemic analysis clearly.)
9. The order of presentation should follow the order of the rows and columns used in the consonant chart or from top to bottom in the trapezoid.
10. Glosses are presented with single quote marks around them (not double).

12.5 A note on sources

One must be careful when using published sources, for various reasons. First, the symbols that people have used vary widely. Different symbols have been used in different traditions and different areas of the world. Furthermore, especially in the decades before easy access to different fonts, it was easier to use a symbol found on a normal typewriter than do something that required complicated maneuvers. On top of that, it has been considered not very important what particular symbol is used for certain sounds (within certain parameters) since the phoneme has been considered an abstraction. Some sources fail to give detailed information about the phonetic value of the symbols they use, assuming that the choice of symbol makes it entirely clear. But conventions have changed, and so some sources become less easy to interpret. This is a problem that continues to make the use of published materials difficult, but it serves as a reminder to all of us that it is important to *explain* what we are doing and then explain some more.

Example: Hixkaryana. The published works use the symbols *r* and *ry* (in community-based spelling) to represent two distinct rhotic phonemes (Derbyshire 1979, Derbyshire 1999). The linguistic symbols used to represent the second rhotic were **[ɾ,]** "r" with a subscript right hook (not reproduced here correctly) in Derbyshire (1979) and **[ɹ]** in Derbyshire (1999). In Derbyshire (1979) this rhotic is not explained, and in Derbyshire (1999:27) it is said to be a "palatal **ɹ** with lateral release." The problem is that the symbols used are either not standard or are used in an unusual way, and the explanation given for its phonetic value is not very clear—in part because the sound is quite difficult to describe and has different phonetic values in

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[17] See Marlett, Moreno Herrera & Herrera Astorga (2005).

[18] Students of the history of the English language know about vowel shifts that have changed the qualities of the long vowels, creating an asymmetry in the inventory. Other Indo-European languages demonstrate that the point is still true that the numbers of long vowels and short vowels may not be the same.

related languages. As a result, secondary works have taken different interpretations about what this sound really is.

12.6 Phonemes for general audiences

It is not uncommon for publications aimed at a popular audience within a language community to include a list of the "sounds" of the language. This kind of list can be confusing in that it conflates the idea of the "sounds" (usually referring to the phonemes) and the idea of an alphabetic (or similar) representation of those sounds.

The alphabet in English is a list of letters that are used to represent words. School children and even adults are rarely exposed to a list of the "phonemes" of English. People generally—even those who may read and write very well—cannot tell you how many vowel phonemes (or "vowel sounds") there are in English. They know there are five, or six vowels (meaning "letters representing vowels") in English, namely "*a*, *e*, *i*, *o*, *u* and sometimes *y*." They cannot tell you that there are something like a dozen vowel phonemes in the language. The English alphabet does not identify **tʃ** as a phoneme. We just have the letter <c> and the letter <h> and we know that we write the **tʃ** sound with that combination of letters. We might talk about the **tʃ** sound, and we know that the combination <ch> is common, but that does not make it to the list that we memorize for our "abc's".

The alphabet in Spanish (before a fairly recent reform that changed it to be more in the style of English, as a list of letters) was much more like a list of symbols that directly represented the phonemes of Spanish. That traditional alphabet of Spanish was more like a list of symbols representing phonemes (with a couple of oddities, like an <h> that represents no sound at all). The sound **tʃ** in Spanish, in that alphabet, was listed as <ch> (referred to as "che") and which appeared after the letter <c> (which raises other issues that we do not discuss here).

It is our impression that alphabets in languages that have only recently developed written forms are more likely to be of the style of the traditional Spanish alphabet. People want to see the list of their sounds and how they are represented more than a simple list of letters.

These facts, and especially the differences between a popular alphabet as letters and a popular alphabet as direct phoneme representations, are important to remember when looking at materials that were prepared for a popular audience in the language.

12.7 Suggested additional reading

The literature on the phonemic principle is large, and varied. A good modern overview of some of the issues involved is found in section 2 of Cole & Hualde (2011).

12.8 Key terms and ideas

The important idea in this chapter is that the phonemes of a language can be cues for distinguishing meanings in that language. When we say that the sounds **[tʃ]** and **[dʒ]** are phonemes—which we would then write with diagonals as **tʃ** and **dʒ**—we know that they have the potential, of distinguishing morphemes (at least barring special situations). In English, we could think of the words *chug* **[ˈtʃɜɡ]** and *jug* **[ˈdʒɜɡ]** to see that this is true, along with many others. These sounds contrast in English. They contrast just as clearly in words like *choice* and *joist*, and *latch* and *lodge*, even though these examples are not minimal pairs, since the consonants are in very similar contexts (word-initial before a vowel in one pair, word-final after a vowel in the other).

The relationship between meaning and phonemes.

Two words can be the *same* phonemically and still have *different* meanings. These are the simple cases of homonyms. The words *bat* (flying mammal) and *bat* (instrument for hitting a ball) are both phonemically **bæt**. *Sore* and *soar* are also homonyms. A word may have more than one meaning in various ways, including having various senses and facets of meaning, and it may also have metaphorical extensions. These do not affect its phonemic analysis, of course. This is something one learns about in a semantics course.

Phonemic differences do not always signal different meanings. Synonyms are very different in their sounds, but they mean about the same thing. Some examples are *shrub* and *bush*, *begin* and *start*.

Sometimes an occasional word has one pronunciation in one dialect and another, very similar, pronunciation in another dialect: consider *route* **ɹawt** vs. *route* **ɹuːt**, *data* **dejtə** vs. *data* **dætə**, *either* **iːðɚ** vs. *either* **ajðɚ**. (The important point here is that these are just occasional differences, not systematic differences.)

It may also be that two separate phonemes in a language merge together as one phoneme in a particular regional dialect, usually by one just being pronounced like the other. Phoneme X merges with phoneme Y. In some dialects of American English the contrast between **a** and **ɔ** has been lost, so that words like *cot* and *caught*, *rot* and *wrought*, *hock* and *hawk*, *Don* and *Dawn* are pronounced the same. In cases like this, we can find two speakers who say the “same” word with different phonemes (for the vowel). The difference in phonemes in this case does *not* correlate with a difference in meaning—we are seeing phonetic facts from two different dialects.

Key terms presented in this chapter include the following:

1. **CONTRAST**. Two sounds are said to contrast in a language if the systematic replacement of one for the other can at least potentially alter the meaning of the utterance.
2. **MINIMAL PAIR**. When two utterances that have different meanings differ in only the exchange of one phoneme for another, we say that those two utterances are a minimal pair.
3. **PHONOTACTICS**. The distribution of sounds and especially combinations of sounds in a language is referred to as phonotactics.
4. **TROCHAIC**. Trochaic stress refers to a left-headed prominence in a foot, as illustrated by the word *paper* (strong-weak). (§12.2)
5. **IAMBIC**. Iambic stress refers to a right-headed prominence in a foot, as illustrated by the word *prefer* (weak-strong). (§12.2)
6. **MARKED** and **UNMARKED**. The value of a feature for a sound is said to be “marked” if it is the unexpected value for that sound based on cross-linguistic or other general considerations. For example, the feature [voice] has the unmarked value of positive for sonorants but negative for obstruents because sonorants are generally voiced while obstruents are most typically voiceless. Similarly, the unmarked value of [nasal] for vowels is negative; many languages have only oral vowels, but no language has only nasalized vowels. (§12.3.4)

12.9 Reading questions

You can check your answers to these questions in appendix F.12.

1. T/F We say that sound A contrasts with sound B if an utterance X has a different meaning from an utterance Y and the difference between the two utterances is isolatable to the difference between A and B.
2. T/F **[dak]** and **[tək]** are a minimal pair.
3. T/F It is important that even phonemes that are rare in the language be recognized and mentioned.
4. T/F An example of a phonotactic pattern in language X might be that only sibilants precede stops in a syllable onset.
5. T/F A common presentation of the phonemes in a language is in based on an IPA chart.
6. T/F A good way to indicate rare phonemes in one’s phoneme chart is with an asterisk and an explanatory footnote.
7. T/F The word *lobster* has a trochaic stress pattern.
8. T/F Consonants in a language are rarely interchangeable within a certain word position.
9. T/F Most consonants appear hundreds of times in a language.

10. Is the following pair of words good evidence for establishing that b and w are separate phonemes? [bɜdnaŋ] 'his frog', [wɜdnaŋ] 'cupboard'. Explain.
11. T/F A phoneme that appears rarely in a language may be newly entering the language through borrowing, or it may be disappearing from the language.
12. T/F The following consonant inventory is highly suspect: p, b, t, d, k, g, n, ŋ, s, z, w.
13. T/F In the pair of sounds [p] and [b] in English, the sound [b] is unmarked since it occurs in more words.
14. T/F The presentation of vowels in an IPA illustration expects the presentation of the typical vowel qualities of that language to be plotted in the quadrilateral.
15. Explain succinctly why a good linguist, well-trained in phonetics, may be unable to transcribe a language *phonemically* during the first day (and perhaps longer) of contact with a language.
16. Is the following pair of words good evidence for establishing that b and w are separate phonemes? [be] 'Run!', [we] 'Sleep!' if we know that the imperative verb word is simply the stem of the verb? Explain.

12.10 Exercises

1. Guanano. The following presentation of phonemes is used in a write-up of Guanano); see N. Waltz & C. Waltz (1967). Re-work the presentation in a way that fits guidelines of the IPA illustrations. You need to consider (a) choice of symbols, (b) row labels and order, (c) column labels and order, and (d) placement of the symbols within the table. For vowels, you need to use a trapezoid (quadrilateral) rather than a table. Explain your decisions if there is anything at all interesting (there are a few points to discuss). If you have doubts about something, make a note of it in your answer. Some questions you may have may be answered by looking at the *Handbook of the IPA* for advice or for a model.

   For non-IPA symbols—be careful! Check a resource andor check with someone who is familiar with them. In fact, we would prefer that you check your understanding of the symbols with us before turning in your answer.

	Labial	Alveolar	Palatal	Velar	Glottal
Stops					
- Aspirated	ph	th		kh	
- Unaspirated	p	t		k	
- Voiced	b	d		g	
Sibilants		s	č		
Flap		r			
Continuants	w		y	h	
Glottal stop					ʔ

	Front	Central	Back
High	i	ɨ	u
Low	e	a	o

Available from the prose description in the article: a. The symbol **č** represents “an alveopalatal grooved affricate.”
b. **h** represents “a glottal continuant.”
c. The high front and back vowels are clarified as being [i̞] and [u̞] (both slightly lowered), respectively.
d. The so-called low vowels are actually front open-mid and slightly raised [ɛ̝], central open [a]; and back open-mid [ɔ].

You might also compare your answer with the current presentation of these facts on Wikipedia. How do they match up? (And do not assume that the presentation on Wikipedia is accurate.)

2. English. Minimal pairs are not the most important evidence in phonology, but they are rather fun to find. And *unless there is a better story to explain them (as there sometimes is)*, they are appropriate evidence for showing contrast between phonemes. (Of course, they are not necessary to prove contrast.) Think of your own minimal pairs for obstruents in English. Choose two of the following pairs of phonemes and present five minimal pairs to illustrate the contrast, if possible: p b; t d; k g; f v; s z; s ʃ; t θ; d ð.
3. English. Present the sonorant consonants of American English using the style of presentation shown in (3) of §12.2, but use only one good example for each sonorant in each position. Use the following inventory (from Ladefoged 1999:41) without referring to any phonological write-up of English: m n ŋ j w ɹ l.
4. English. Think of your own minimal pairs for vowels in English. Present a couple of them for at least ten distinct pairs of vowels. For example (using Ladefoged’s symbols):

Pair one				
i	pit	‘pit’	tik	‘tick’
iː	piːt	‘peat’	tiːk	‘teak’

5. Look for and present five minimal pairs for consonants in another language—either one that you speak, or know, or learn about in a book. For the consonants that you present in these pairs, choose ones that are quite similar rather than an uninteresting pair like k s. Tell what language and what the source of the data is.
6. Take a look at the “illustrations” of different languages presented in the *Handbook of the IPA*. Choose one and notice how the data are presented for demonstrating the phonemes of the language. In the list of data for the stops in the language, how many of the words shown were presented as minimal pairs?
7. Seri. The following phonemes were presented in a 1965 write-up of Seri (E. Moser & M. Moser 1965). Present these phonemes in a way that fits the guidelines of the IPA illustrations. You need to consider (a) choice of symbols, (b) row labels and order, (c) column labels and order, and (d) placement of the symbols within the table. For vowels, you need to use a quadrilateral rather than a table. If you have doubts about something (and you certainly should have some), make a note of it on your answer. Some questions you may have may be answered by looking at the *Handbook of the IPA* for advice or a model.
   a. Stops: p t k k^w ʔ “labial, dental, velar, and glottal”
   b. Flat spirants: f ɬ x X “labial, alveolar, velar and back velar”
   c. Groovedrounded spirants: W s š X^w “labial, alveolar, alveopalatal retroflex, and back velar”
   d. Nasals: m n ŋ “labial, dental, and velar”
   e. Oral sonants: l r y “lateral”, “flap”, “palatal”
   f. Vowels: i e o a “high close front”, “mid open front”, “mid close back” and “rounded”, “low open central”, respectively
   g. Nasalization: “a suprasegmental phoneme which occurs with ... any vowel”.

8. Staged exercise: Cocama consonant phonemes. Using the data provided to you from Faust & Pike (1959), prepare a consonant chart (using the IPA chart—we recommend adapting one of the standard charts that we have given you separately) to chart the *exact* consonant phonemes that Faust & Pike posit. You are not being asked to reanalyze the facts (although you will have to figure out the symbols that they are using). You should indicate in some way (with a table footnote) whether there is anything notable about any phoneme. Then, prepare a presentation of evidence of these phonemes as you have learned in this chapter. You should show the contrast in two positions; we recommend one column for the onset of stressed syllables and another column for the onset of the syllable following a stressed vowel.
9. Castilian Spanish. If you have access to a copy of Martínez-Celdrán et al. (2003), examine the data that are given to prove the consonant phonemes and evaluate that evidence by the criteria presented in this chapter. There are some observations (and suggestions) that you should make.

13

BASIC METHODOLOGY: PRESENTATION OF PHONETIC DETAIL

When the phonemes of a language are pronounced, many details are involved. Some of those details are of more interest to us than others since we can perceive them easily or measure them with instruments.

A phoneme is pronounced in ways that agree with its basic composition. A phonological write-up tells how the phonemes are pronounced and especially makes clear any language-particular facts about them. In the illustrations published in the *Handbook of the IPA* and in the *Journal of the IPA*, this is done through prose statements such as those in (1)-(2).

(1) Voiceless stops are moderately aspirated.

(2) Voiced sounds tend to have a degree of breathiness in the pronunciation of most speakers.

It is very relevant, for example, that in Guerrero Amuzgo the dental stops are pronounced with the tip of the tongue (they are apico-dentals), and that they are pronounced with the back of the tongue raised (they are velarized) (Bauernschmidt 1965). The use of the symbol **t** is in itself not sufficient for indicating these important facts. But the conventions of the IPA would also not suggest that one should always represent this phoneme as **t̺ˠ**. Instead, one uses the simple symbol and gives the details of the pronunciation in other ways. Very general statements, like those in (1)-(2), are given as general remarks when the consonants are first presented.

A phoneme may also be affected in its pronunciation by three other major factors:

(i) adjacent phonemes,
(ii) stress, and
(iii) position in the syllable or other domain.

When a phoneme has different pronunciations depending on one or more of these factors, we say that the phoneme has different **ALLOPHONES**—variant pronunciations. The phonetic details about these pronunciations are interesting facts about the language and are included in phonological write-ups.

Such details of pronunciation in fact often have a cluster of properties. Some of these are listed in (3). You may want to examine this list throughout the course to see how many of these characteristics are true of other cases that we look at. None of them is an absolute necessity—we know of exceptions to all of them. Regardless, it is quite often the case that they correctly characterize the cases that we will be seeing.

(3) a. *The phonetic detail has obvious phonetic motivation that relates to the movement of the articulators or something related to perception.*
b. *Speakers are generally unaware of the phonetic detail.* It is claimed (and seems to at least be generally true) that speakers of a language abstract away from phonetic detail when considering the sounds of their language.[1] An English speaker would say that the word *kick* begins and ends with the same sound, although they are in fact almost always phonetically different.
c. *The phonetic detail is automatic and exceptionless.*

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[1] This point is strongly contended and in fact is faced with some important evidence against it.

13.1 The effect of adjacent sounds

Phonemes affect the pronunciation of other phonemes because the articulators are moving toward or away from another point of articulation as the phoneme is being pronounced. Generally, then, it is a matter of timing differences between two independent gestures that causes a phoneme to have a slightly different form in a particular context. Numerous examples of this are given in the following chapters, but one very simple one is shown here to illustrate.

Consider how the phoneme t in English is pronounced in the following words by pronouncing each of them to yourself: *tea*, *Tom*, *take*, and *two*. If you are like many speakers of English, you may notice that your lips are rounded when they pronounce the t in the word *two*. The same rounding happens when the t is pronounced in *tune*, *tool*, and *tweak*. In anticipation of the rounding that typically occurs with the vowel u or the approximant w, the lips become rounded before those sounds are pronounced. That is, the rounding of the lips—needed for the round vowel and approximant—begins to happen before the round sonorants are even pronounced. We then say that t has (at least) two pronunciations—two allophones: [t] and the same stop with simultaneous lip-rounding, but with no after-glide (unfortunately there is no unambiguous IPA notation for this). We are able to show where each of these allophones is found in the language.

13.2 The effect of stress

As mentioned above, stress on a particular part of a word may affect how a phoneme is pronounced. We will see various examples of this below, but it is easily illustrated from English. The voiceless stop phonemes p, t, and k are aspirated quite significantly when they precede a stressed vowel, and much less so (if at all) when they precede an unstressed vowel. Compare the two instances of stops in the words *papyrus*, *tattoo*, and *cocoon*, for example (ignoring lip-rounding on the consonants): [pəˈpʰaɪɹəs], [tæˈtʰuʷ], [kəˈkʰuʷn].

13.3 The effect of position

A phoneme may also have a different pronunciation depending on where it occurs in the syllable, word or utterance. We illustrate this with another very simple example from English. It is a notable fact of English that the phoneme l has two allophones: what is sometimes called the “clear l”, which is the alveolar lateral approximant, and the “dark l”, which is a rather strongly velarized lateral approximant. The velarized approximant is found in syllable codas, while the non-velarized approximant is found in syllable onsets. Compare [lɛt] let ‘let’ and [tʰɛlˠ] tel ‘tell’. The phoneme l in English has (at least) two allophones: [l] and [lˠ]. Their distribution relates to where they occur in the syllable.

When one allophone occurs in a particular context (such as syllable-initially) and another allophone of the same phoneme occurs in another context (such as syllable-finally), and these two contexts are mutually exclusive, we say that those sounds, those allophones, occur in complementary distribution. They do not contrast with each other—nor can they—because they are variations of the same phoneme.

13.4 Variation

Other phonetic details have been treated under the rubric of variation (that may or may not also be related to specific contexts, as those mentioned above). Variation is a normal and expected part of language and should be discussed in any reasonably complete description. Some variation is due to the fact that the articulatory organs are parts of the human body and not mechanical devices that can make the same sound exactly the same every time. This variation may be hardly noticeable, but sometimes it is in fact easily observable. How much someone rounds the lips when pronouncing the vowel u, for example, may vary from word to word. How much velarization is pronounced with the l may vary, as may how much aspiration occurs on the voiceless stops.

Some variation is due to speech style—such as casual or careful—and here we are often able to indicate the difference in a narrow transcription. Consider the phonetic difference between careful speech, spoken with deliberate enunciation—*What do you think?*, and casual speech *Whaddya think?*. In various places in the following chapters we see specific examples of this kind of variation.

Some variation is due to differences between individuals in the speech community—the **IDIOLECTS** of people. While some differences may be limited to specific words that are just pronounced differently, they may also be more systematic. We know an adult speaker of American English who always pronounces the phoneme **θ** as **[f]**, unlike her parents or her siblings. Another person might just always pronounce words with a bit of nasalization (the so-called "nasal twang") even though other people in the local community do not.

Finally, some differences are due to dialectal differences that may be small or large, geographically based, socially based (sociolects), or generationally based.

13.4.1 *Geographically based dialects.* The phoneme **x** (if one may use that abstraction) in Spanish varies from typically **[h]** in the Caribbean area, to **[x]** in many locations elsewhere (and most generally), to **[χ]** in parts of Spain (especially Castile). If the word for 'sash, band' **faxa** is investigated in Spanish, it is found that the range of pronunciation will include at least these three transcriptions: **[ˈfaha]**, **[ˈfaxa]**, and **[ˈfaχa]**. This fact makes it obvious that when phonetic data from a language are presented, it is relevant to tell what dialect they are from.

Like Spanish, English is known for its abundance of dialects. Unlike Spanish (where most of the variation is found in the consonants), English variation is more prominent in the vowels. Some differences are quite striking (such as illustrated by the two famous pronunciations of *tomato* (one with **[a]** and one with **[eʲ]**), or the two common pronunciations of *envelope* (one with **[ɛ]** and one with **[a]**), while others are very slight but easily detected by any native speaker, permitting one to realize that another person is from somewhere else.

The pronunciation of the diphthong **aw** as **[əw]** in a word like *out*, can tip one off that a speaker probably is Canadian.

13.4.2 *Socially based dialects.* Speakers from different social groups (including castes), even in the same geographical area, may pronounce words differently. These differences give important information to the hearer about the speaker. In some languages, women use different allophones than men—an important fact to know when choosing someone to be a language teacher.

Example: the Seri word for 'orange'. While most of the Seri language community today refers to the orange (fruit) as **saʔˈmɛːs**, one family (or clan) refers to it as **ʃaʔˈmɛːs**. This is not a matter of difference of phonetic detail (both **s** and **ʃ** are phonemes in the language) nor is it a matter of a systematic difference between dialects since this is the *only* lexical item in which this difference is found. (There is reason to believe that the pronunciation with **ʃ** is the closest to the etymological source of the word.)

Example: an emphatic word in Seri. Some Seri speakers use the pronunciation **ʔipi** for the emphatic word that is sometimes translated 'self', but many also use the pronunciation **ʔapi** for this word. Again, this is not a matter of some phonetic detail since both **i** and **a** are phonemes, and the difference between **a** and **i** is found in the speech of both groups in thousands of words. We do not even know how this difference in the pronunciation of this one word is mapped out, whether by clans or age group or some other configuration.

13.4.3 *Historically based dialects.* Pronunciations of words change over time. One may compare recordings of data made in 1950 with those made in 2000 and notice that there are at least consistent phonetic differences—small, perhaps, but noticeable.

13.5 Phonetic detail in phonological write-ups

Phonological descriptions include information about the details of pronunciation of the phonemes. A write-up should essentially cover all of the obvious phonetic facts of the language and demonstrate how the proposed analysis—which is minimally an inventory of phonemes and details about their pronunciation—covers the known facts. A phonological write-up without rather detailed information about the pronunciation of the phonemes is like having a skeleton without flesh and blood.

As mentioned at the beginning of this chapter, very general facts about the pronunciation of phonemes are given in simple prose statements in the illustrations of the IPA. Some examples from the *Handbook of the IPA* are given in (4), but they should not be taken as the upper limit on all that can be said about sounds in general.

(4) a. Hebrew: **k** is aspirated and **p, t** are slightly aspirated. (Laufer 1999)
  b. Hungarian: **t, d, n, l, r** are laminal dental. (Szende 1999)
  c. Irish: The voiceless series [of plosives] are slightly preaspirated. (Ní Chasaide 1999)
  d. Sindhi: The vowels **ɛ** and **ɔ** tend to be diphthongized, as **[ɛə]** and **[əʊ]**. (Nihalani 1999)

Guidelines for these particular prose statements might include those in (5):

(5) a. Include statements that refer to a class of sounds in general but which do not introduce allophones.
  b. Do not include statements about the distribution of phonemes (phonotactics), unless an entire section is developed and presented on this topic.
  c. Mention important differences between this speech variety and another dialect or closely related language.

13.5.1 *Discussion of allophones.* Other details about the pronunciation of phonemes, specifically those details that come under the rubric of allophony, are described in the IPA illustrations in a section somewhat curiously called "Conventions".

It is helpful for these phonetic details to be stated in general terms (without making incorrect statements), in prose, and with sufficient data to establish the point beyond a reasonable doubt. In some publications and for some audiences, it may be appropriate to also add a formalism of some sort, but *this formal presentation should never be in lieu of the prose statement*. However, the formalization of a prose statement may be a good way for one to show that a particular claim is natural and expected.

Consider now the kind of data and analysis presented in §13.2. One might present such data in a straightforward phonological write-up as in (6).

(6) Initial aspiration: A syllable-initial voiceless consonant is aspirated at the beginning of a stressed syllable. Examples include: **impoːɹtənt[ɪmˈpʰoɹʔn̩ʔ]** 'important', **pəteːtoː [pəˈtʰeɪɾoʊ]** 'potato', **enkuɹədʒ [ɛnˈkʰʊɹədʒ]** 'encourage'. The aspiration also happens when the syllable-initial voiceless consonant is followed by a sonorant consonant, in which case the aspiration may blend into a voiceless version of the sonorant consonant: **pɹeː [ˈpʰɹ̥eʲ]** 'pray', **pleː [ˈpʰl̥eʲ]** 'play', **twin [ˈtʰw̥ɪn]** 'twin'. See examples like **spin [ˈspɪn]** 'spin', **stik [ˈstɪk]** 'stick' and **skip [ˈskɪp]** 'skip' where the voiceless stop is in the onset of the stressed syllable but not aspirated since it is not syllable-initial.

One presumes that counterexamples to the generalization do not exist. One also presumes (unless told otherwise) that the generalizations given in this section account for all of the data—that there are not hundreds or even dozens of other examples of aspiration in English, for example, that also exist but for which nothing is mentioned. *If one generalization does not cover all of the data, then a second and maybe a third generalization are also necessary.*

We have suggested that it is appropriate to present phonetic details in some general fashion. One does find descriptions (usually from the mid-twentieth century—the structuralist period of American linguistics—or modeled after such) that present data quite differently. Rather than a general statement about aspiration, for example, these descriptions say something about p having an allophone [pʰ] in a particular context, and then later something about t having an allophone [tʰ] in the same kind of context, and then later something about k having an allophone [kʰ] in that same context. While such descriptions are not particularly hard to read, the lack of generalization (or attempt at generalization) over classes of sounds that do things similarly (like undergo aspiration) is viewed negatively today. This is *not* the way that you want to present the analysis now.

A sample structuralist-style presentation that lacks generalization:
The phoneme p has two allophones: [pʰ] in utterance final position, [p] in utterance initial or medial position.
The phoneme t has two allophones: [tʰ] in utterance final position, [t] in utterance initial or medial position.
The phoneme tʃ has two allophones: [tʃʰ] in utterance final position, [tʃ] in utterance initial or medial position.
The phoneme k has two allophones: [kʰ] in utterance final position, [k] in utterance initial or medial position.

A prose generalization that is preferable:
A voiceless noncontinuant[b] is aspirated in utterance final position.

Note: The fact that nothing is said about aspirating such consonants elsewhere is understood to mean that they are not aspirated elsewhere. (If they were aspirated somewhere else, another statement would be necessary.)

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[b] The term "noncontinuant" encompasses more than stops and affricates, but the phrase "voiceless noncontinuant" adequately captures the natural class of sounds that we want to group here.

A second deficiency of the structuralist presentations of allophones is the fact that they are formally able to describe nonsense, since they are not constrained by any formal device. An abnormal or even impossible situation is no harder to describe in that way than a normal situation. Of course, this is also true of a prose rule. Prose rules are not a substitute for a formal description. They should be taken as ways to make a formal description more accessible.

A third deficiency of the structuralist presentations of allophones is the fact that they are often unrevealing. This point makes more sense once the use of features is introduced (as in most of the following sections). The structuralist presentation of allophones depends on the use of basic symbols and does not make use of features, despite the fact that features elucidate what is going on.

13.6 Descriptions of phonetic detail in the real world

While access to a phonemic description and phonemic transcription is always helpful, those are often not enough to meet the needs of interested people. People may need or want to know about phonetic details.

For example, people who are learning a language as a second language should want to know how to pronounce words well, and just knowing the phonemes is not enough. People learning English will need to learn about the aspiration of voiceless stops in certain positions, the lengthening of vowels in certain positions, the centralization of vowels in certain positions, and (for American English) the pronunciation of t and d as flaps. Otherwise the learner will also sound as if she or he had an accent, and in fact may be misunderstood. People learning Spanish will need to learn about how the voiced stops are pronounced (not as stops, in fact), how voiceless stops are not aspirated, how vowels are not centralized, and many other things.

People who are learning to speak a language need to know that different dialects may pronounce the phonemes differently. The phonemic representation purposefully omits many phonetic details that may readily identify the speaker as being from a particular dialect. But a person who wishes to imitate the dialect of a Peruvian, a Bolivian, an Argentinian, or someone from Spain must know significant phonetic details that do not appear in a phonemic transcription.

It is therefore important to remember that even someone well-trained in reading IPA symbols will not sound like a native speaker of a language if she or he simply pronounces the symbols that appear in a phonemic or broad transcription. Such a transcription should put the pronunciation in the ballpark, but a description of general phonetic details in the language is necessary in order to flesh out that basic transcription.

13.7 Key terms and ideas

Key terms introduced in this chapter are:

1. **ALLOPHONES**. The contextual, dialectal or stylistic pronunciations (including the basic pronunciation, if such may be said to exist) are called the allophones of a phoneme.
2. **COMPLEMENTARY DISTRIBUTION**. Sounds are said to occur in complementary distribution when they occur in mutually exclusive contexts. (§13.3)
3. **VARIATION**. Many details of pronunciation vary from speaker to speaker due because of personal differences, geographical and social dialects, speech registers, rate of speech, etc. (§13.4)
4. **IDIOLECTS**. Idiolects are the speech variations that are found in a speech community that are characteristic of individuals rather than groups (which would be referred to as dialects). (§13.4)

13.8 Reading questions

You can check your answers to these questions in appendix F.13.

1. T/F Prose statements can help one elaborate on the exact pronunciation of a phoneme in conjunction with an IPA chart.
2. T/F Allophones are variant pronunciations of a particular phoneme.
3. T/F The slight change in "place of articulation" is common with consonants when speakers are anticipating the placement of a following sound.
4. T/F Speakers are generally aware of the phonetic details of phonemes.
5. T/F Stress rarely affects how a phoneme is pronounced.
6. T/F When one allophone occurs in a particular context and another allophone of the same phoneme occurs in another context, these allophones occur in complementary distribution.
7. T/F Variation in speech can be due to speech style, the idiolect, the geographical region, the social group(s), the age, or the sex of a speaker.
8. T/F When one is discussing allophony, if one generalization does not cover all of the data, then a second and maybe a third generalization are also necessary.
9. T/F It is more positively viewed today to present phonetic details as generalizations about a class of sounds than about specific phonemes and their allophones.

Part IV

PHONEMES & FEATURES: TYPOLOGY

This part of the book begins to look more closely at facts about the distribution of sounds in languages. It is important to point out the use of two conventions here.

First, when two (or more) forms are presented with a *tilde operator* between them, such as in [visə] ∼ [vizə] 'visa', we mean to indicate that both forms are possible, although the conditions might not be specified. (They may represent casual speech vs. careful speech, or something along those lines.)

Second, when a form is preceded by an asterisk, we mean to indicate that the form is considered an unacceptable pronunciation (at least in the dialect under consideration), such as in [pʰasi] *[pʰazi] 'posse'.

14

VOICE

One of the first phonetic distinctions that you probably learned about in phonetics class was that of voicing—the difference between **[p]** and **[b]**, for example. The relevant distinctive feature for this has commonly been referred to as [VOICE].[1]

If the feature [voice] is BINARY—either positive or negative—then the sound **[p]** is [-voice] and the sound **[b]** is [+voice]. If, on the other hand, the feature [voice] is PRIVATIVE—either present or not present—then **[b]** has it and **[p]** does not. (The difference between binary (or polar) and privative features is explained a bit more later. The difference may seem trivial at this point, but in fact the two views of features make different claims.)

(1) Definition: A sound is [+voice] if it is pronounced with vibration of the vocal folds.

Or, using the privative feature [voice] rather than the binary feature:

(2) Definition: A sound has the feature [voice] if it is pronounced with vibration of the vocal cords.

The distinction of voicing is one that is *not* exploited in all languages.[2] That is, there are languages that have phoneme inventories that have only voiceless obstruents, and only voiced sonorants. Voicing exists, of course, and voicelessness exists, but it is not distinctive for the two major sets of sounds. Seri is one such language, of many.[3] (You may want to review the definitions of sonorant and obstruent given in §§3.4.2-§3.4.3.)

It is always important to remember that what sounds like a voiced stop to an English speaker may not be a voiced consonant, but rather a simple unaspirated voiceless stop. See discussions of VOT (voice onset time) in the phonetics literature.[4] In this chapter we are looking at cases of real voicing.

No language has been found in which all of the stops are voiced whereas there are languages in which the stops are only voiceless. This observation, among others, has led to the claim that the UNMARKED VALUE of [voice] for stops is negative. More generally it is taken as evidence that it is appropriate to claim that voiced stops (or voiced obstruents, actually) are the marked category when compared with their voiceless counterparts.

At the same time, sonorants have [+voice] as their default value. No language has only voiceless vowels or only voiceless nasals.[5]

This relationship between the cross-linguistic expectations for voicing can be expressed by the UNIVERSAL REDUNDANCY RULE (which applies if something more specific is not indicated) in (3).

(3) $[\alpha \text{ sonorant}] \rightarrow [\alpha \text{ voice}]$

This rule makes use of the feature [sonorant] that was introduced in §3.4.2. It is interpreted in the following way: if the variable α is positive, then any [+sonorant] that is not specified for a value of the feature [voice] will be assigned the feature [+voice]. If the variable α is negative, then any [–sonorant] that is not specified for a value of the feature [voice] will be assigned the feature [–voice].

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[1] It has also been proposed that [voice] is inadequate and should be replaced by other features. See Anderson (1974:301-302). Despite that proposal, most work simply uses [voice]. For more discussion of voicing from a phonetic point of view, see chapter 2 of Ladefoged (1971).

[2] See Maddieson (2013c).

[3] See Marlett, Moreno Herrera & Herrera Astorga (2005).

[4] VOT: "the interval between the release of a plosive and the start of vocal-fold vibration in a following vowel" Harris (2007:120).

[5] Several languages in southeast Asia have voiceless nasals contrasting with voiced nasals (Ladefoged & Maddieson 1996:111).

If we take [voice] and [sonorant] as privative features, then the redundancy rule would be recast as follows (and interpreted about the same way)

(4) [sonorant] → [voice]

While in some languages there may be a predictable relationship between [sonorant] and [voice], it is also true that in many languages the voicing distinction is very important. One can see this is true in English, for example, because of pairs of words such those in (5).[6]

(5)

Onset		Coda	
pæt	'pat'	tæp	'tap'
bæt	'bat'	tæb	'tab'
tip	'tip'	pæt	'pat'
dip	'dip'	pæd	'pad'
kud	'could'	dɜk	'duck'
gud	'good'	dɜg	'dug'

These facts show that you cannot predict the distribution of the feature [voice] when it comes to stops in English (at least not in simple onsets or simple codas).

If a language utilizes [voice] as a distinctive feature, then one expects to find pairs of words of the sort illustrated in (5) where nothing but the feature [voice] is signaling the difference between the two words.

The lack of a distinctive feature [voice] does not mean, however, that the feature [voice] is entirely lacking. In all human languages certain sounds are typically voiced: the vowels and the nasal consonants, for example. But the feature is not *distinctive* for these sounds in these cases since the absence of voicing (as in voiceless vowels or voiceless nasals) is not being used at all to distinguish lexical items.

A common inventory of phonemes therefore might include those in (6).

(6)

voiceless sounds:	(stops)	p	t	k
	(fricatives)		s	x
voiced sounds:	(nasals)	m	n	
	(vowels)	a e i o u		

Note that while some sounds are voiced and some sounds are voiceless, voicing is not distinctive in this language. Voicing is entirely predictable based on the value of the feature [sonorant], as mentioned in the paragraph before (3). The sonorants are voiced and the obstruents are voiceless.

Consider now, however, a hypothetical language that does not utilize [voice] as a feature distinguishing phonemes. The vocabulary of this language might include words such as the one in (7).

(7)

sapa	[sapa]	sota	[sota]
tampa	[tampa]	santa	[santa]
kaspa	[kaspa]	kasta	[kasta]

---

[6] Remember that in phonemic transcriptions one is allowed to use symbols a bit differently than in narrow phonetic transcriptions. See IPA (1999:30, section 6). Also see the discussion in Ladefoged (1999:42) of the application of these principles for English vowels.

Over the years one community of speakers of this language might begin to allow the vibration of the vocal cords that happens with a nasal consonant to lag a bit such that the **p** in **tampa** begins to sound a bit like a **[b]** (perhaps transcribed as **[p̂]** using IPA conventions), and eventually the **p** is pronounced as a full-fledged **[b]**. Similarly the **t** after the nasal begins to sound like **[d]**. The words would thus be pronounced in this community as shown in (8).

(8)	sapa	[sapa]	sota	[sota]
	tampa	[tamba]	santa	[sanda]
	kaspa	[kaspa]	kasta	[kasta]

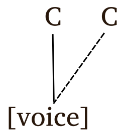
Such a situation is actually quite natural. Changes that produce this have happened in many places and times during human history. Obviously this is a small phonetic change prompted by a slight shift in the timing of the articulation of the sounds—the vibration of the vocal cords and the movement of articulators needed to switch from **m** to **p** are not precisely synchronized—and so the words sound slightly different.

In such a case we do *not* say that the phonemes of the language have changed. The basic building blocks of the phonology and the basic construction of words have not changed. Instead, all that has happened is that this community of speakers has added a new PHONETIC DETAIL to the pronunciation, which is something like (9):

(9) Phonetic detail (voicing): The voicing of a consonant causes an immediately following consonant to be voiced.

Or more formally:

(10) Phonetic detail (voicing)



In this quasi-formalism,[7] the feature [voice] (taken here as privative, as explained at the beginning of this chapter, and appearing here because of a redundancy rule, as explained in (4)) is linked to a consonant (as indicated by the solid line), and spreads to the immediately following consonant (as indicated by the dotted line).[8]

Let us look at the steps one by one. We first start with the representation shown in (11) (where the letters actually represent various distinctive features, perhaps, but we have not learned about them all) for three sample words.

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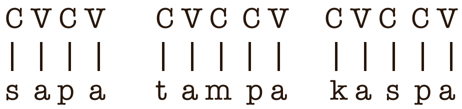
[7] By "quasi-formalism" we refer to a way of presenting an analysis of facts that draws on some of the formalisms of certain theories without attempting to implement all of the details of those theories that use them. In particular, the devices that we use are drawn from the developments in generative linguistics that came from the inclusion of ideas from autosegmental phonology (see Goldsmith 1976 and much ensuing literature).

[8] Anyone looking at the linguistic literature from the past few decades will see that alternative formalisms have been used. A very common formalism was the rewrite rule of the type X Y __ Z (meaning "X is replaced by Y when X appears before Z"), or X Y Z __ (meaning "X is replaced by Y when X appears after Z"). In this case, the rule might be stated as in (i):

(i) $$\mathrm{C} \rightarrow [+\mathrm{voice}] \;/\; \underset{[+\mathrm{voice}]}{\mathrm{C}} \quad \_\_\_$$

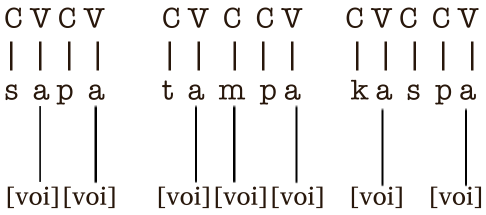
That is, a consonant is "rewritten" as having the feature [+voice] when it appears following a consonant that is [+voice]. This particular formalism was shown to be excessively powerful and uninsightful. One should learn how to understand it primarily for the purpose of being able to read the older literature. But the formalism is no longer considered appropriate for phonological descriptions. In fact, rule-based frameworks of any sort have become less popular as constraint-based frameworks have developed (see Optimality Theory, for example). The facts covered by the relatively informal descriptions that come out of the present course would be addressed in a different way within a constraint-based theory.

(11)



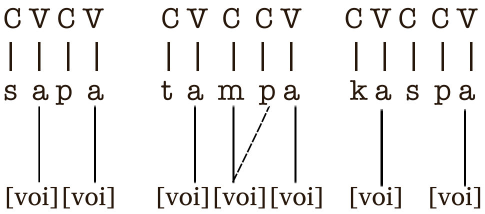
We now represent the addition of voicing (shown here with the abbreviation [voi]) that the redundancy rule given in (4) formally supplies.

(12)



The next step (for the innovative dialect in question, but not for the conservative dialect) is that the voicing of a consonant extends to an immediately following consonant, giving the result shown below, where the feature [voice] of the **m** is shared with the following **p**—making it, in effect, of course, not **[p]** phonetically, but **[b]**.

(13)



The step between the last two representations is what is being captured by the quasi-formal rule shown in (10).

The claim is that the speakers of this innovative dialect are using the same phonemic inventory as the conservative dialect which does not have this small phonetic detail. The claim is that what is "in the heads" of the speakers as far the *distinctive* features of the languages, despite dialectal differences, is the same. While the phonetic differences may be noticeable to an outsider, and may in fact be noticed by speakers of another dialect (perhaps with some value judgment attached), these differences are claimed (under the phonemic hypothesis) to be relatively inconsequential.

What is happening here is something that we will see repeatedly in this course: one sound is becoming more like another sound in the context. The technical term is **ASSIMILATION**. In the case above, the stops (which are unvoiced) are assimilating to the voicing of the preceding consonants.

The formalism given in (10) is defective in one important way,[9] and that is that in many cases of phonetic voicing assimilation the voicing assimilation is only partial. See, for example, the discussion of different speech styles in Spanish in Harris (1969). In a word such as **mismo** 'same', the **s** in some dialects in some speech styles is neither **[s]** nor **z**, but rather something more like **[s^z]** (a good phonetic transcription convention for this is not readily accessible)—beginning voiceless and ending voiced. This kind of gradience in phonetic assimilation should not be shoehorned into a black-and-white, positive-or-negative presentation just because of the convenience of formal features.

As a result of this situation, we will assume for the purposes of this course that any "spreading" of a feature by the dotted association lines drawn in the quasi-formalism of a phonetic detail rule is in fact actually only a partial assimilation that may in fact be variable. Thus we are claiming this is the typical situation for this kind of rule.

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[9] The formalism itself (adapted from that used in autosegmental phonology, see Goldsmith 1976) is not problematic, but rather the use of it for this kind of gradient facts.

When one looks at a “new” set of phonetic data to discover the role of [voice] in the language (or dialect of a language), the following steps would be taken:

1. Look for places in which voicing of obstruents cannot be explained by the context, or (less commonly) places in which the voicelessness of sonorants cannot be explained by the context. If voicing is not predictable, then contrasting pairs of words (whether minimal or not) should be easy to find.
2. If evidence of contrast cannot be found for a pair of sounds (such as [p] and [b]), then one should presume that the “marked” member is explained by some PHONETIC DETAIL RULE (also called an ALLOPHONIC RULE). One would begin looking in the context for a phonetically motivated explanation, and for voicing differences that means looking at voicing in the context, especially voicing of immediately adjacent sounds.[10]

14.1 Some tips

1. Voicing differences at the beginning of words preceding vowels are usually indicative of contrast, as they would be hard to explain otherwise.
   Examples in English: *pat*, *bat*.
2. Voicing differences in intervocalic position are usually indicative of contrast, as they would be hard to explain otherwise.
   Examples in English: [ˈsɜpɚ] ‘supper’, [ˈɹɜbɚ] ‘rubber’.
   However, be aware of differences in the stress patterns on this point as they may be very important. For example, the onset of an unstressed syllable is more likely to become voiced than the onset of a stressed syllable. For this reason, [aˈpa] and [ˈaba] display the consonants in quite *different* contexts.
3. Voicing differences after a voiced consonant are usually indicative of contrast as they would be hard to explain otherwise.
   Examples in English syllable codas: [ˈmɪnt] ‘mint’, [ˈwɪnd] ‘wind’.
4. Voicing differences before a voiced consonant are usually indicative of contrast as they would be hard to explain otherwise.
   Examples in Albanian syllable onsets: [ˈfrik] ‘fear’, [ˈvrim] ‘hole’.[11]
5. Pairs such as [ɾats] ‘rots’ vs. [ɾadz] ‘rods’ are *not* sufficiently helpful because there are two differences between them—[t] vs. [d] and [s] vs. [z]—which means that we do not know how to analyze them. More data are necessary before a conclusion can be drawn.
6. It is incorrect to assume that a voicing contrast for stops means that the language has a voicing contrast for fricatives.

14.1.1 *Short exercise: the sibilants in Fa d'Ambu.* Examine the data in appendix G.36 and determine if the voicing of the sibilants [s] and [z] is contrastive or not. Discuss. When you have finished, compare your solution with the one given in appendix E.17.

14.2 Alternation evidence (allomorphy) pointing to an analysis

The procedure above involves examining a corpus of data for the distribution of the relevant sounds in different places in the word, and this is something that one always needs to do. Sometimes, however, there is other evidence that one might see that is of a different nature and that might suggest an analysis. This evidence comes from ALTERNATIONS in the shape of morphemes (the ALLOMORPHS of morphemes).

A simple example from English is the morpheme that is the root of the following words: *late*, *later*, *lately*. This morpheme has three different pronunciations in American English, as seen in the following narrow transcriptions of

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[10] We see in chapter §22 that voicing is also affected by other contexts.

[11] Newmark (1957:26).

these words: [ˈleɪt], [ˈleɪɾɚ], [ˈleɪʔliː]. We want to think about how those three allomorphs are related, especially since those particular alternations (between [t], [ɾ] and [ʔ] are found in many words of English. If we did not notice them before, we should be noticing them now.

Consider the following hypothetical phonetic data (offered here for the lack of a specific language example).

(14)

Present tense	Past tense	Future tense	
[pasa]	[ilbasa]	[spasa]	'jump'
[toto]	[ildoto]	[stoto]	'run'
[kɾefo]	[ilgɾefo]	[skɾefo]	'play'

One obviously looks at these data and begins to make hypotheses about the morphemes involved. A reasonable set of hypotheses is that there is no affix for present tense, that there is a prefix for past tense (namely {il-}), and that there is a prefix for future tense (namely {s-}). (Your previous background in morphological analysis should have prepared you to get this far in the analysis.)

We also notice that the verb roots change shape in the different tenses, but the changes are fairly straightforward. A voiceless stop appears at the beginning of the root in the present tense and the future tense, but a voiced stop appears there in the past tense.

If we were to assume that these allomorphs are to be accounted for in some way—an assumption that virtually all phonologists make—then we look for some simple explanation. One of those might be that the consonant at the beginning of the root is voiced when it immediately follows a voiced consonant. In case we did not notice this distributional fact in other places in the corpus, the evidence here from carefully controlled and easily understood data is "in our faces" and demanding explanation. The simplest statement about these data might be (15).

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

But this statement is incorrect since it is contradicted by words such as [kɾefo] in which the tap is voiced and not voiceless. So we then attempt to formulate another simple statement that is not contradicted by the facts. It might be (16):

(16) An obstruent assimilates in voicing to an immediately preceding consonant.

This statement appears to be correct.

The alternation evidence therefore might lead us to discover a phonetic detail rule (allophonic rule) that operates generally in the language. If that is the case for the data above—that is, if there are no contrastive voiced stops in the language—then the data would be written phonemically as shown in (17).[12]

(17)

Present tense	Past tense	Future tense	
pasa	ilpasa	spasa	'jump'
toto	iltoto	stoto	'run'
kɾefo	ilkɾefo	skɾefo	'play'

14.2.1 *Short exercise: Galician fricatives.* There is no evidence of contrast between [θ] and [ð], nor between [s̺] and [z̺] in Galician. Nevertheless, [ð] and [z̺] occur in the data shown in appendix G.3. Give a single prose rule and a single (corresponding) quasi-formal rule to account for these facts. (At this time you may ignore the important question of how to specify "fricatives"; just use C for "any consonant" at this time.) Also write out the phrase for

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[12] We assume here that the other parts of the data do not have other phonetic details to deal with.

'ten months' in phonemic transcription with appropriate notation. When you have written out an answer, see the discussion in appendix E.16.

14.3 Voicing across word boundaries

One indication that an assimilation rule is "active" in a language is when it can be seen operating across word boundaries. Then we know that it is not just a matter of memorizing how a list of words is pronounced, since we see the rule operating *after* the words are put together in a phrase. (Presumably all sentences in a language are not memorized!) This is the source of the term POSTLEXICAL mentioned in chapter §1. The rules apply after ("post") the words are formed ("lexical"). The term may be a bit obtuse, but it is still widely used.

Example: voicing in Arara of Pará. Consider the examples in (1) from Arara of Pará, a language that has both voiced and voiceless stops as phonemes.[m]

(1)

In isolation or following an obstruent-final word	Following a vowel or a sonorant consonant	
kambɔt	gambɔt	'firewood'
kambiluŋɔ	gambiluŋɔ	'wound'
tapɛda	dapɛda	'paper'
pɯlɛptɛ	bɯlɛptɛ	'knife'
puguŋɔ	buguŋɔ	'foot'
tʃigu	tʃigu	'urine'

Note: No words begin with b d g in isolation. No words begin with p t k in the context indicated in the second column. This language has no fricatives.

Assuming for now that the basic form of these words is the form given in the first column (an assumption that should never be made without considering the alternatives), we see that voicing assimilation is taking place across word boundaries. The stops (but not the affricate) are becoming voiced when they occur after a voiced sonorant, but only after the word is put into a phrase and follows such a sound. This kind of phonetic detail is something that is not stored in the mental lexicon, it is claimed, and thus part of the phonetic detail of the language that needs to be described. The generalization (given the assumptions made above) would be (2).

(2) Word-initial stops are voiced when they follow a sonorant.

By some conventions that a certain theory might include, this generalization might be made even a bit simpler, but that is not relevant at this point.[n]

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[m] The data are from Isaac and Shirley Souza (personal communication), I. Souza (2010), and S. Souza (2010). You can see more data in appendix G.8.

[n] If one assumes that these word-initial stops are basically voiced, we need to have them devoice following pause *and* also following an obstruent—two contexts that are not immediately able to be united formally. This is one reason why one might choose to use the voicing solution rather than the devoicing solution. However, the final analysis of this set of facts has not been written yet.

14.4 Expectations

As was pointed out in at the beginning of this chapter, we do not expect to find languages in which all of the obstruents are voiced and all of the sonorants are voiceless, because of the relationship between [sonorant] and [voice]. And, in fact, this expectation based on past experience continues to be upheld with experience with more languages.

It is perhaps less clearly implied by the relationship between [sonorant] and [voice] that we also do not expect to find a voiced obstruent without finding its voiceless counterpart—that if we have a **b** phoneme we should also find a **p** phoneme in any given language, for example. However, in this case the facts are a bit more complicated, since such cases have in fact appeared in the literature.[15]

Some instances of "voiced obstruent without voiceless counterpart" are attributable to the misrepresentation of the facts. One of the most common of these is the use of **v** for what is actually not a labiodental fricative (an obstruent), but a labiodental or even a bilabial approximant (a sonorant). The convenience of the symbol or the similarity with a more familiar sound has sometimes led field linguists to leave written documentation that is either incorrect or misinterpreted. This has been a special problem with languages of the Americas, it seems.

A language may have apparent counterexamples to this expectation because of loanwords. This is one reason for being aware of the sociolinguistic context and history of a language as much as possible.

14.5 Limited distribution

Consider the following facts of English. Many words begin with a voiceless stop (*pill*, *pit*, *pin*, *pun*, *put*, *pat*, *pan*, etc.) and words commonly begin with a voiced stop (*bill*, *bit*, *bin*, *bun*, *but*, *bat*, *ban*, etc.). The initial voiceless stop in these examples is commonly aspirated, as is well known.

There are also many words that begin with a sibilant followed by a voiceless unaspirated stop: *spill*, *spit*, *spin*, *spun*, *spat*, etc. And we also see that similar words that have a voiced stop here are not possible: **sbill*, **sbit*, **sbin*, **sbun*, **sbat*.

This is not an uncommon type of situation. If one were to suppose (as is commonly supposed) that the unaspirated bilabial stop in a word like *spin* is the same phoneme as the aspirated bilabial stop in a word like *pin*, then we simply have two allophones of **p** (in different contexts), and these are different from **b**. But we also need to note (or we should make it clear that we have noticed) that **b** systematically never occurs as the second consonant of a cluster that begins with the (voiceless) sibilant **s**.

For some people, that is all there is to the story—some phonemes simply do not occur in certain positions. For other people, the situation is not so clear. First, some have in fact proposed that it is neither the phoneme **p** nor the phoneme **b** in the word *spin*, but rather something else, a so-called archiphoneme.[16] This notion has not gotten much traction, especially in recent decades, and we do not use it in this course; but one might think of it this way. If the stop in *pin* has the feature specification [-voice] and the stop in *bin* has the feature specification [+voice], then the stop in *spin* could just not mention the feature [voice], making it formally distinct from the others.

Even if one wishes to analyze the unaspirated stop of *spin* as an allophone of one of the other stop phonemes, however—as is more typically proposed—it may not be as simple and straightforward as one thinks. Interesting data from child language acquisition suggests, at least, that children go through a stage in which it seems they actually take the unaspirated stops after **s** to be allophones of the voiced phoneme. The data are those in which a child reorders the phonemes, pronouncing **[bəˈskɛɾiʲ]** instead of **[spəˈgɛɾiʲ]**, (for *spaghetti*), to use a famous example.[17]

14.6 Change over time

Languages change over time, usually in very small steps. We have discussed a situation in the paragraphs around (11) in which the movement of the articulators and the initiation of voicing become slightly out of synchronization, with the result that we begin to have voiced allophones in a language. Further changes could take place (and have, in the histories of many languages) that then leave the voiced allophones in a place where the original explanation is no longer viable and the speakers re-interpret the voiced sound as simply being a voiced phoneme. It is always

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[15] See the discussion of Amharic in Hayward & Hayward (1999).

[16] We would generally not suggest that the notion be used in a phonological write-up; see the discussion of underspecification in chapter §17. For one recent illustration that utilizes this notion, however, see Barbosa & Albano (2004).

[17] (Reference needed.)

instructive to learn how these developments have taken place, and so the study of historical linguistics enriches the study of phonology.

One of the ways in which the phonemic inventory of a language may be affected is through the massive borrowing of words from another language. While it is possible that the here-and-there borrowing of words may not affect a speaker's view of the words of his core vocabulary, it is also possible (and likely) that a massive borrowing of words or a language-use switch (from being dominant in language A to being dominant in language B) may cause the speaker to alter his or her (subconscious) view of the phonemes of the language.

One case of this is that of Salasaca Quichua, which is a variety of a language complex (Quechua) which generally does not have voiced obstruents, not even as allophones. Salasaca Quichua developed voiced allophones in contexts that are very natural: following nasals. These became "phonologized" as phonemes in their own right in this variety because of further complications and also because of the massive influx of voiced consonants via Spanish loanwords.[18]

14.7 Narrowing the focus of study

We are looking in this section at sounds distinguished by the feature [voice]. Any pair of sounds that are distinguished only by this feature need to be examined to determine whether or not this feature distinguishes them contrastively or not. Such pairs of sounds—those similar enough to require analytical study—have sometimes been referred to as SUSPICIOUS PAIRS in work following Pike (1947). This term is not used in the general literature.

Some procedures for analyzing phonetic data have recommended putting all of the phones found in a corpus of data into a single phonetic chart to register in one place what one has found. The next recommended step is to circle the suspicious pairs that one finds there. If you find this kind of procedure helpful, then by all means use it. Such phonetic charts and lists of suspicious pairs do not have any place in a modern phonological write-up, however.

14.8 Seeing voicing in spectrograms

Instrumental analysis using tools that are easily available today (such as PRAAT or Speech Analyzer)[19] can help in the documentation of phonetic facts. Consider the instrumental representations of the Isthmus Zapotec words **[niːsːa]** 'water' and **[niːza]** 'ear of corn' in figures 4 and 5, respectively. The bottom part of the graphs indicates the periodic activity of the vocal folds. It can be seen in the lower part of the graph for 'ear of corn' that vibration continues during the production of the fricative. But in the lower part of the graph for 'water' there is no indication of any vibration. (The curved lines in the middle are pitch tracings; see chapter §26.)

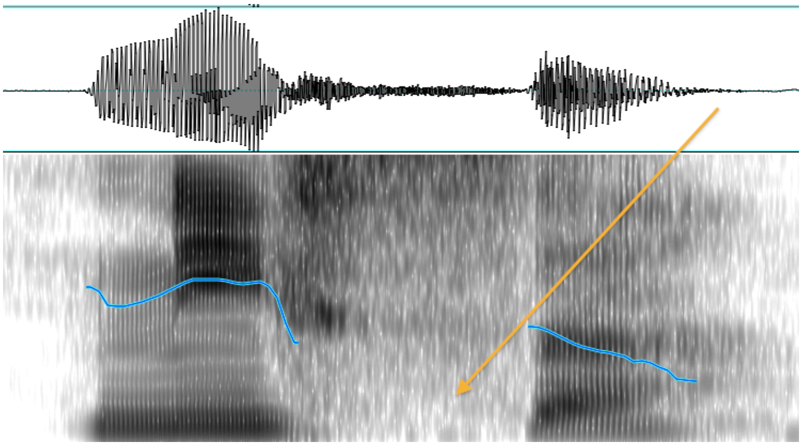

Figure 4. Isthmus Zapotec **[ˈnisːa]** 'water'

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[18] Chango Masaquiza & Marlett (2008).

[19] See information about these tools in appendices A.5 and A.6.

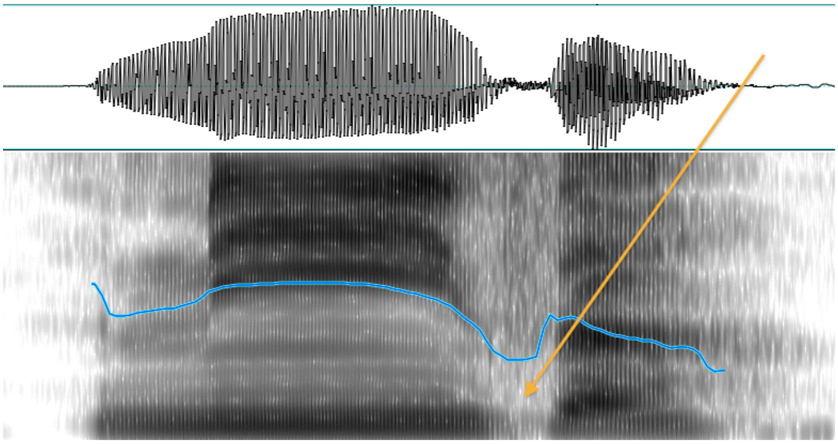


Figure 5. Isthmus Zapotec [ˈniːza] ‘ear of corn’

These graphs do not tell us how we should analyze the data, but they help to confirm the phonetic facts that we are dealing with.

14.9 Typology

We can survey the role of [voice] in the languages of the world and see that there are four major groups, speaking in very general terms. We discuss those groups here and look at two major characteristics, summarizing the results in table 2.

	No contrastive voicing	Contrastive voicing
No spreading of [voice]	*Chinese, …*	*Hindi, …*
Spreading of [voice]	(none in the Handbook)	*Farsi, …*

Table 2. Typology of voicing

First, we ask ourselves whether the feature [voice] is distinctive or not. There are languages in which the feature [voice] does *not* distinguish sounds at all: sonorants are voiced and obstruents are voiceless (as we expect from what is expected cross-linguistically for those groups of sounds). In other languages, the feature [voice] is, in fact, used to distinguish sounds, especially obstruents. This characteristic is presented in the heading of table 2.

A second characteristic looks at whether the feature [voice] spreads to other sounds in the language (*specifically, in the P-phonology*), producing voiced allophones of certain voiceless phonemes, or voiceless allophones of certain voiced phonemes. This characteristic is presented in the left-hand column of table 2.

We may then see how particular languages fit into this typology. The examples in table 2 are taken from and based on the illustrations published in the *Handbook of the IPA*, which could easily be supplemented with others. There are languages like Chinese in which voicing is *not* distinctive and does *not* produce allophones. So Chinese is listed in the top left cell. A language like Hindi, however, does have distinctive voicing, while still not displaying any evidence of that feature spreading to other sounds. While none of the languages in the handbook lacks contrastive voicing but still has voiced allophones, you will see data presented in appendix G of this book that shows this. (You may be asking, well, how does that work? That is a good question to ask.) And Farsi is a language that has contrastive voicing and also has produces allophones through spreading of the feature [voice].

14.10 Key terms

The following key terms were introduced in this lengthy chapter:

1. **[VOICE]**. The feature [voice] indicates whether the vocal folds are vibrating (+) or not (−).
2. **BINARY**. The claim has been that most features (but not all) are binary in nature—either positive or negative.
3. **PRIVATIVE**. Some phonologists view certain features as being privative—either present or not present (as opposed to being positive or negative, which would be taking them as binary).
4. **VOT**, voice onset time, is "the interval between the release of a plosive and the start of vocal-fold vibration in a following vowel" (Harris 2007:120).
5. **UNMARKED VALUE**. The value of a feature for a sound is said to be "marked" if it is the unexpected value for that sound based on cross-linguitic or other general considerations. For example, the feature [voice] has the unmarked value of positive for sonorants but negative for obstruents because sonorants are generally voiced while obstruents are most typically voiceless.
6. **UNIVERSAL REDUNDANCY RULE**. It has been proposed that some feature values are supplied by language-independent rules under certain conditions (such as when the language does not over-ride them by explicit specification either lexically or by rules).
7. **PHONETIC DETAIL** is information about how a phoneme is pronounced generally or in a particular context.
8. **ASSIMILATION** is any process by which one sound becomes more like another sound in the context. An example is the voicing of a consonant after a voiced consonant.
9. **PHONETIC DETAIL** rule (**ALLOPHONIC RULE**) is an expression telling how a phoneme is pronounced in a particular context.
10. **ALTERNATIONS** in the shapes of morphemes is another way of referring to the allomorphs that a morpheme may have in different contexts, whether suppletive or not suppletive. (§14.2)
11. **ALLOMORPHS**. The different shapes that a formative (or morpheme, if you will) has in the language are the allomorphs of the morpheme. (§14.2)
12. **POSTLEXICAL** is a term used to describe certain types of rules (or application of rules) that tend to be those that add phonetic detail in a fairly automatic way, rules that tend to be unnoticed by native speakers. Postlexical rules correspond closely to what are called allophonic rules in some approaches to phonology, and to the phonetic facts described under "Conventions" in the illustrations of the IPA. (§14.3)
13. **SUSPICIOUS PAIR** refers to pairs of sounds that are similar enough phonetically (or because of what we know about language) to be examined more carefully to determine whether they are contrastive or not contrastive in a language. (The expression is not widely used today.) (§14.7)

14.11 Wording

The following examples illustrate acceptable wording for stating generalizations regarding voicing assimilation in prose descriptions. It is recommended that you use similar wording in write-ups that you may produce. Note how extraneous information (place of articulation, for example) is not mentioned, and how the statements attempt to make clear the assimilatory nature of the process.

1. A consonant (obstruent fricative etc.) assimilates in voicing to an immediately preceding voiced consonant.
2. A consonant is voiced when it precedes a voiced consonant.
3. A consonant is voiced before a voiced consonant.
4. A sonorant is devoiced following a voiceless consonant.

14.12 Checklist for presenting phonetic details in the Convention section

When you present phonetic details in a section that provides them, as in the illustrations of the IPA, use the following guidelines.

1. Use a separate paragraph (not numbered) for each generalization.
2. Write clear, well-constructed sentences.
3. The generalization should refer, as much as is appropriate, to a class of sounds, not to a list of phonemes.
4. The generalization should make intuitive sense. If it does not, it is perhaps simply wrong.
5. The generalization should state the truth and not be falsified by the facts.
6. The generalization should be expressed in a way that captures the facts well. For example, if voicing happens after voiced consonants, the statement should say that, not that it happens after nasal consonants (even though they may be the only voiced consonants). Of course, you may point out other relevants facts, but you should not leave the reader wondering whether you have presented all of the relevant facts.
7. Each generalization should deal with only one kind of fact. For example, optional voicing between vowels and obligatory voicing after a voiced consonant are two separate things and should be separated into two separate discussions.
8. The statement is made and then an illustrative example (or set of examples, as appropriate). Those examples are given first in phonemic transcription (with diagonals) and then in narrow phonetic transcription (with square brackets) and then the gloss (using single quotation marks around the gloss).

14.13 Reading questions

You can check your answers to these questions in appendix F.14.

1. T/F If the feature [voice] is privative then [k] is [-voice] and [g] is [+voice].
2. T/F The unmarked value of [voice] for stops is positive.
3. T/F A Universal Redundancy Rule for voicing may look like this: [α obstruent] → [α voice].
4. T/F The following set of words shows voicing as a distinctive feature on nasals: pan paŋ pam
5. T/F When the voicing of a consonant causes an immediately following consonant to be voiced we can add the new voiced consonant to the phoneme inventory.
6. T/F What is "in the heads" of the speakers as far as the distinctive features of the languages, despite dialectal differences, is the same.
7. T/F When one sound changes under the influence of an adjacent sound, we say that the sound is assimilating.
8. T/F The "spreading" of a feature by the dotted association lines drawn in a phonetic detail rule is in fact actually only a partial assimilation that may in fact be variable.
9. T/F One of the first steps in discovering the role of [voice] in a language is to look for the voicing of consonants that cannot be explained by context.
10. T/F This pair of words would generally indicate contrast of [voice] of stops: [pats] and [padz].
11. T/F One should always examine the distribution of relevant sounds in different places in the word.
12. T/F There is alternation evidence in the following table that suggests that the hypothesis "A consonant is voiced intervocalically" might be true.

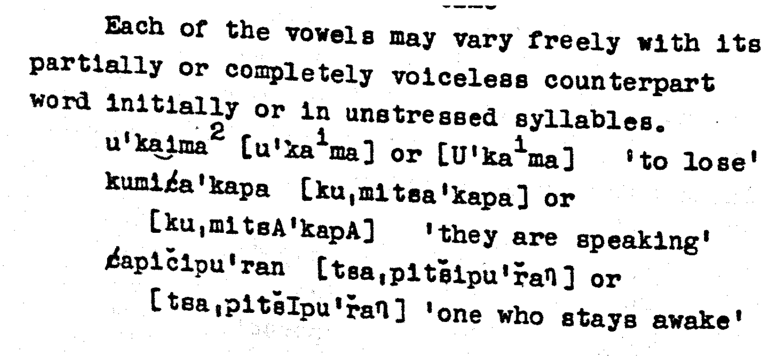
Present	Future	
[tasa]	[adasa]	'sing'
[pebe]	[abebe]	'dance'
[miɾeju]	[amiɾeju]	'sleep'

13. T/F The allophones of a phoneme do not vary because they stay constant over time.
14. T/F The phonemic inventory of a language may change as the perceptions of sounds are affected by contact with other languages.
15. T/F A list of suspicious pairs is a common requirement in a phonological write-up.
16. What is the unmarked value of the feature [voice] for sonorants? ________
17. If the phoneme f is pronounced as [v] in some contexts, in which of the following contexts would that most likely be true?
    a. before a voiceless stop b. before a voiced consonant c. in a syllable coda
18. What is less than optimal about the following prose rule? */p/, /t/, and /k/ assimilate in voicing to an immediately preceding consonant.*
19. What is less than optimal about the following prose rule? *Stops are voiced after nasal consonants.*
20. What is less than optimal about the following prose rule? *Stops and fricatives assimilate in voicing to an immediately preceding consonant.*

14.14 Exercises

1. Some short questions
    a. Look for and name the language(s) in the illustrations of the IPA in the *Handbook of the IPA* in which the distinctive feature [voice] is not relevant. You will see this in the phoneme chart by looking for languages that have no voiced series of any obstruent and no voiceless series of any sonorant.
    b. Look for and name three languages in the Illustrations of the IPA section of the *Handbook of the IPA* in which the distinctive feature [voice] is relevant. You will see this in the phoneme chart by looking for languages that have a voiced obstruent somewhere or a voiceless sonorant (very rare).
    c. Look at the artificial data presented in (8) in this chapter and answer the following questions.
        i. How might we expect a word such as palka to be pronounced in this dialect of this language?
        ii. Why isn't a word such as pasta pronounced as [pasda]?
        iii. Why isn't a word such as taka pronounced as [taga]?
        iv. What result might you expect if the two words un and taka were put together in a phrase?
    d. How many languages in the *Handbook of the IPA* present counterexamples to the expectation "no voiced obstruent without voiceless counterpart"?
    e. The description of Hungarian in Szende (1999:106) in the *Handbook of the IPA* says that h is voiced in intervocalic position. Present that descriptive statement in a quasi-formal notation, as shown in this chapter.
2. Brazilian Portuguese. What do the data in appendix G.4.1 (that is, Part 1) demonstrate about the sounds [s] and [z]? Is voicing distinctive for them? Are there two phonemes s and z? Write the words for 'hunt' and 'house' phonemically.
3. Brazilian Portuguese. Examine the data in appendix G.4.2 (that is, Part 2). Assume for the purposes of this exercise that the sibilant in coda position is s (voiceless). Give a prose rule and a quasi-formal rule to account for the fact that it is phonetically voiced in certain contexts. (You may assume that in absolute-final position nothing has to be said.)
4. Swampy Cree. Examine the data in appendix G.20. Look at the stops and affricates, focusing on the question of voicing. (There is not enough there to study the preaspirated stops.) Present an analysis following the format shown in appendix D.4.
5. Korean. Examine the data in appendix G.18.1. Look at the stops and also [ts] and [dz], focusing on the question of voicing. Present an analysis following the format shown in appendix D.4. Discuss briefly how this rule lends support for or against the analysis of [ts] as an affricate in Korean.
6. Spanish. Examine the data in appendix G.19. Look at the fricatives except [ð], focusing on the question of voicing. Present an analysis following the format shown in appendix D.4.

7. Egyptian Arabic. Examine the data in appendix G.12.1. Give the inventory of fricative phonemes, setting aside [h]. Present an analysis following the format shown in appendix D.4.
8. Galician. Examine the data in appendix G.3. Look at the fricatives. Present an analysis following the format shown in appendix D.4. (These data were partially treated in §14.2.1.)
9. Tainae. Examine the data in appendix G.22.2. Look at the voiceless stops, voiced stops, and flap r. Present an analysis following the format shown in appendix D.4. Hint: be sure to try to understand the expressions for 'black person' and 'white person' (not a literal translation, obviously). The data are there. Detail: the source tells us as that the coronal stops are alveolar. Parts of this exercise are not easy; do what you can do easily and well and explain where you see difficulties.
10. Staged exercise: Cocama voiced stops and affricates. Scour the copy of Faust & Pike (1959) that you have received. Set aside any loanwords from Spanish that appear in the article (most, if not all, have been identified) and describe the facts regarding voiced stops and affricates in a prose rule, giving crucial examples. Do not use the phrase "its voiceless counterpart" in your prose. The following statements (paraphrased slightly) also appear in Faust (1978:32): whenever a suffix beginning with [p] is attached to a word that ends in a nasal, the [p] becomes [b]; whenever a suffix beginning with [t] is attached to a word that ends in a nasal, the [t] becomes [d], whenever a suffix beginning with [k] is attached to a word that ends in a nasal, the [k] becomes [g]. Similar statements appear on p. 147 regarding the affricates.
11. Staged exercise: Cocama voiceless vowels. Rewrite the description in figure 6 from Faust & Pike (1959) in a way that uses IPA symbols and simple prose wording, with examples. If you need additional examples to clarify some doubts you have about the actual facts, ask. Do not use the phrase "its voiceless counterpart" in your prose.



Each of the vowels may vary freely with its partially or completely voiceless counterpart word initially or in unstressed syllables.

u'ka͜ima^2 [u'xa^{1}ma] or [U'ka^{1}ma] 'to lose'

kumića'kapa [ku,mitsa'kapa] or
[ku,mitsA'kapA] 'they are speaking'

ćapičipu'ran [tsa,pitšipu'řaŋ] or
[tsa,pitšIpu'řaŋ] 'one who stays awake'

Figure 6. Voiceless vowels in Cocama (Faust & Pike 1959:12)

15

MANNER OF ARTICULATION

15.1 Stop vs. continuant in contrast

In many languages, including English, the difference between a stop articulation and a fricative articulation is contrastive.[1] For the labial sounds [b] and [v] in English (differing slightly in point of articulation as well) we find contrastive pairs such as those in (1).

(1)

Initial	Medial	Final
bail	*rubble*	*tub*
vale	*shovel*	*love*
bane	*baby*	*grub*
vane	*wavy*	*dove*

You can surely think of many more.

Alveolar stops in English also contrast with the corresponding interdental fricatives and with the rhotic approximant ɹ. The sets in (2) contrast the voiceless consonants t and θ with each other.

(2)

Initial	Final	Initial	Final
tin	*rat*	*tick*	*pat*
thin	*wrath*	*thick*	*path*

And the sets in (3) contrast the voiced consonants d, ð and ɹ with each other.

(3)

Initial	Final	Initial	Final
dale	*code*	*dice*	*fade*
they	*clothe*	*thy*	*bathe*
rail	*core*	*rice*	*bare*

We include the English rhotic approximant in this discussion because in some languages an r-sound (usually a tap) is in complementary distribution with a coronal stop; they are allophones. For an example, see §15.2 below.

You should notice that the net we are casting when looking at sounds to compare is big enough to include some that do not have *exactly* the same place of articulation—LABIAL (whether bilabial or labiodental), CORONAL (whether interdental, dental, alveolar, postalveolar, retroflex, or palatal), and DORSAL (velar or uvular), for example. (These three labels are widely used in phonology, unlike in phonetics.) We do this precisely because in some languages these slight differences in place of articulation are not relevant, as shown below. These general place names are also discussed more in a later unit.

Some sounds are presented (4) using these categories for the sake of illustration.

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[1] For more details about different manners of articulation from a phonetic point of view, see chapter 6 of Ladefoged (1971).

(4)

Labial		Coronal					Dorsal	
Bilabial	Labio-dental	Inter-dental	Dental	Alveolar	Post-alveolar	Palatal	Velar	Uvular
ɸ	f	θ	s̪	s	ʃ	ç	x	χ

The difference between [b] and [β], between [d] and [ð], and between [d] and [ɾ] is not one of voicing; they are all voiced. The phonological feature that has most commonly been used to distinguish these sounds from stops and affricates is [CONTINUANT].

The definition of the feature [continuant] is a bit controversial because it depends on what factors are taken into consideration. We use the following one in this book:[2]

(5) [continuant]: A continuant sound is one that is made without a complete blockage of the oral tract.

It is very important to note that other linguists have proposed other definitions of this feature that in effect classify the sounds a bit differently. This fact should be remembered when one is thinking about the universality of features. If a given feature is universally pertinent, then there also has to be agreement about the definition of that feature—something that is obviously not true when one looks at the literature.

We understand by the definition in (5) that nasal consonants are [−continuant] although air is passing through the nose. (Read the definition carefully and notice that it mentions "the oral tract".) This classification of nasals has sometimes been controversial.

We also understand that by this particular definition the lateral approximant [l] is [+continuant].[3]

We understand that the type of obstruction of the airstream in the production of taps and trills is not sufficient to classify them as [-continuant]. We therefore take them as [+continuant].[4]

The following chart summarizes these interpretations of the definition provided (presenting the groups in the same order as used in the IPA charts, adding Affricate to the list between Stop and Nasal). Note that some sonorants are [+continuant] and some are [-continuant].

(6)

	[continuant]	[sonorant]
Stop	−	−
Affricate	−	−
Nasal	−	+
Trill	+	+
Tap or Flap	+	+
Fricative	+	−
Lateral fricative	+	−
Central approximant	+	+
Lateral approximant	+	+
Vowel	+	+

---

[2] Anderson's (1974:298) statement is "Noncontinuant sounds are made with a complete blockage of the oral tract." Anderson explicitly includes laterals in the class of continuant sounds.

[3] Chomsky & Halle (1968:317), Halle & Clements (1983:7) and T. Hall (2007:319) propose a slightly different definition that in effect causes laterals to be classified as noncontinuants. T. Hall (2007:333, note 4) points out some of the difficulties of both definitions.

[4] T. Hall (2007:333, note 4) also states that "among rhotics it is unclear what feature distinguish r from ɾ. Another controversial question is whether or not flaps like ɾ are plus or minus [continuant]."

The classification of a sound by a feature such as [continuant] that is a bit controversial is not done just on the basis of some physical factor. It has been important to consider how particular language facts play out when they are viewed with the feature in mind. (For linguistic theory that posits universals, the difficulty comes when the facts of one language suggest one thing and the facts of another language suggest another.) See the discussion of Spanish in §15.2.

The feature combination [-continuant], [-sonorant] gives us an important NATURAL CLASS of sounds: stops and affricates. As much as possible, we want to think about sounds as groups that may pattern together. The features [+continuant], [-sonorant] gives us the set of fricatives in a language. What natural class does the combination [–continuant], [+sonorant] give?

15.2 Lack of contrast: Manner assimilation

In many languages a phoneme that is a stop in some contexts is a continuant (fricative or approximant or tap) in other contexts. In these other contexts the articulators do not approach each other sufficiently to make a total occlusion, and the result is that the phoneme has a continuant allophone.

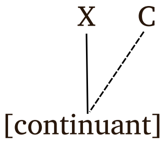
The Ondarroa dialect of Basque is interesting in this regard since the phoneme **d** has three allophones: sometimes **[d]**, sometimes **[ð]**, and sometimes **[ɾ]**.[5] The continuant allophones only occur intervocalically, and in some situations both are possible, with the tap allophone "preferred in rapid speech."

(7)	**bide**	**[biɾe]**	~	**[biðe]**	'way'
	abade	**[aβaɾe]**	~	**[aβaðe]**	'priest'

Part of the formal problem of these particular processes is that the feature [continuant] is not adequate to account for the phonetic details.[6]

It has been proposed that formally the feature [+continuant] spreads from one sound in the environment to the stop phoneme, resulting in the continuant allophone. (Sometimes there are conditions on both sides of the affected consonant.) The spreading of the feature [continuant] can be quasi-formally expressed as in (8) (where X stands for either a consonant or a vowel).

(8)



This rule might be called Fricativization or Spirantization (based on the word spirant, a synonym for fricative). This particular quasi-formal rule (which may be slightly different in a particular language, of course) is expressing the generalization that when two sounds are immediately adjacent to each other, the first of which may be a vowel or a consonant that is [+continuant] and the second of which is a consonant, the feature [+continuant] becomes associated with the second sound as well.

Spanish is a good example of a language in which there is a lack of contrast between voiced stops and voiced approximants/fricatives. Here we base the presentation on the data from certain well-known varieties of Spanish (since there are also varieties in which the pertinent details are different). Note the complementary distribution in table 3 as well as the allomorphy displayed by morphemes such as the one for 'cow'.

---

[5] Hualde (1991:76). Hualde also notes that in other domains (such as across word boundaries other than clitic boundaries) only the tap allophone is found intervocalically: **s̺aldi danak [s̺aldi ɾanak] *[s̺aldi ðanak]** 'all the horses'.

[6] The rule that Hualde (1991) gives (spreading the feature [sonorant]) is also less than satisfactory, however, in light of later developments of feature theory, specifically feature geometry (see §17.3).

Context	Stop articulation	Continuant articulation
At beginning of utterance (like in a word list)	**[ˈbaka]** ‘cow’, **[ˈdama]** ‘lady’, **[ˈgama]** ‘range’	——
After a nasal	**[ˈambos]** ‘both’, **[ˈanda]** ‘goes’, **[ˈoŋgo]** ‘fungus’	——
After a lateral	**[ˈbalde]** ‘bucket’	**[ˈalβ̞a]** ‘dawn’, —— **[ˈalɣ̞o]** ‘something’
After a vowel	——	**[laˈβ̞aka]** ‘the cow’, **[laˈð̞ama]** ‘the lady’, **[laˈɣ̞ama]** ‘the range’
After the tap	——	**[ˈjeɾβ̞e]** ‘boils’, **[ˈaɾð̞e]** ‘burns’, **[ˈlaɾɣ̞o]** ‘long’
After a fricative	——	**[es̬ˈβ̞oso]** ‘sketch’, **[ˈdes̬ð̞e]** ‘since’, **[los̬ˈɣ̞atos]** ‘the cats’

Table 3. Distribution of stops and fricative allophones in Spanish

The complementary distribution is clear and is supported by evidence from the allomorphs of the nouns for ‘cow’, ‘lady’ and ‘range’. The stop and continuant sounds are therefore appropriately grouped together as phonemes. One is labial, one is coronal, and one is dorsal.

These data also show a challenge for a completely simple generalization. Specifically, the question is why the stop allophone is used in words such as ‘bucket’.[7] If a lateral is [+continuant], as claimed above and as evident by the presence of **[β]** and **[ð]** in the words for ‘dawn’ and ‘something’, then the fact that we have **[balde]** (with the stop **[d]**) is surprising. The solution to this problem has something to do with the fact that the sequence **[ld]** is HOMORGANIC (the two sounds are pronounced at the same point of articulation).[8]

The data from Spanish in table 3 seem to indicate that “stop” phonemes are simply phonetically continuants in certain contexts. Other languages also do something very similar intervocalically, but the feature [continuant] is not adequate. Voiced fricatives may also become approximants.[9] The simple generalization for one of these other languages might be:

(9) Voiced fricatives are realized as approximants intervocalically.

---

[7] Harris (1969:37-40) lays out these facts in some detail, but the actual final proposal seems to be problematic. He takes the lateral to be [-continuant], but does not give a clear explanation as to why the continuant allophones of b and **g** appear after it. Barlow (2003) proposes that the opposite analysis is correct; rather than stops becoming continuants, she argues, continuants are becoming stops. These facts have been the topic of various analyses and debates. Harris (**reference needed**) critiques Barlow’s analysis. A key fact to note (pointed out by Harris) is that the stop allophones occur phrase-initially and after homorganic consonants.

[8] Pointing out this fact is not the same as proposing a solution. We're not sure that a good solution has in fact been proposed.

[9] In fact it is more commonly claimed today that the Spanish intervocalic sounds presented in the examples above are approximants. The difference has to do with whether or not the sound has or does not have the “noise” that is characteristic of fricatives. For similar facts in a related language, see the Galician illustration in Regueira 1999.

Since fricatives and approximants are both [+continuant], obviously that is not the feature that is changing. This kind of assimilation very commonly applies across word boundaries and is thus classified as a postlexical operation when it does (see the discussion of postlexical in §14.3) whether or not the rule produces allophones.

Example: Aguaruna. In Aguaruna, the stop **p** has the allophone **[ɸ]** before **h**, and the stop **t** has the allophone **[ɬ]** before **h** (Larson & Pike 1964). (No comparable allophone of **k** occurs.) Sufficient information is not given in the source to adequately formalize the process here, but we may assume that the feature [+continuant] is spreading from the glottal fricative (and not from any other continuant consonants that may occur in the same position, about which we are not given information). The fact that a lateral fricative results from the spreading of this feature is an interesting detail that shows that the simple spreading of [+continuant] is insufficient in itself.

Probably not all cases of spirantization are cases of the spreading of the feature [+continuant]; they are not assimilatory. Rather, they are simply cases of lenition (weakening) in prosodically weak positions. Flapping of **t** and **d** in American English in foot-medial position (e.g. **pætəd [ˈpʰæɾəd]** *patted* and **pædəd [ˈpʰæɾəd]** *padded*) is one such example.

At least a couple of alternative analyses have been proposed to deal with this. One has been to use the feature [consonantal] and another has been to use the feature [approximant]. These two features are introduced and contrasted here but not developed further.

(10) **[CONSONANTAL]**: Consonantal sounds are "produced with a radical obstruction in the midsagittal region of the vocal tract; nonconsonantal sounds are produced without such an obstruction".[10]

The feature [consonantal] has been important in the phonological literature for a considerable time.

(11) **[APPROXIMANT]**: [+approximant] sounds have a constriction in the vocal tract that allows a frictionless escape of air, unlike [-approximant] sounds.

(Note that the feature [approximant] does not match up exactly with the label "approximant" in the IPA tradition.)

See the values of the features [consonantal] and [approximant] for major sets of sounds in (12).

(12)

	[consonantal]	[approximant]
Stop	+	−
Glottal stop	−	−
Affricate	+	−
Nasal	+	−
Trill	+	−
Tap or Flap	+	−
Fricative	+	−
Lateral fricative	+	−
Central approximant	−	+
Lateral approximant	+	+
Vowel	−	+

15.2.1 *Short exercise: Wayana stops.* The stops in Wayana (Jackson 1972:48) are claimed to be **p t k**, and it is claimed that they become voiced before voiced consonants.

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[10] Chomsky & Halle (1968).

1. Write the preceding generalization in quasi-formal notation, as simply as possible, with the assumption that the one fricative in the language, **s**, does not become voiced in any circumstance.
2. Write the following words phonemically (assuming that **i**, **l**, **ɤ** and **a** are phonemes): **[ipɤlɤp]** 'I was winded', **[ipɤlɤbjai]** 'I am getting winded'.
3. Write the following word phonetically using the information that you have: **umɤkjai** 'I am coming'.

Note: this exercise relates to chapter §14 as well as the present chapter. After you have written out your answers, see the discussion in appendix E.18.

15.2.2 *Short exercise: Tlacoapa Mi'phaa consonants.* Examine the data in appendix G.1 for the distribution of [b] and [β], [d] and [ɾ], [g] and [ɣ] *in simple onsets* (just to narrow the focus a bit). Can you propose something about the distribution of these sounds in which each pair are allophones of three different phonemes? Then see the discussion in appendix E.19.

15.3 Seeing the difference between fricatives and approximants in spectrograms

Again, analysis using tools such as PRAAT can help document the phonetic facts. Consider the waveform graph and spectrogram in figure 7 for the first syllable of the German word *wasser*, which begins with a voiced labiodental fricative. (These graphs were made from the recording accompanying Kohler 1999.)

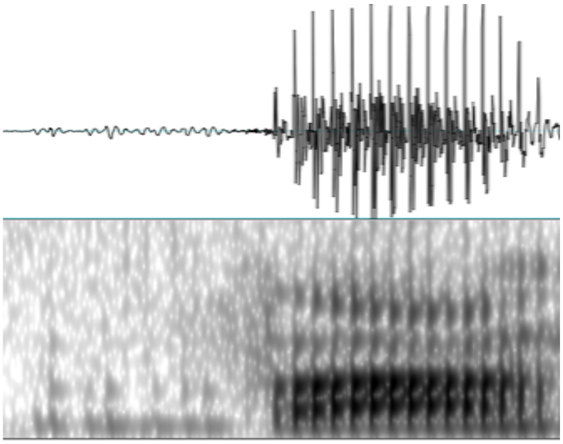

Figure 7. The syllable [va] in German *wasser*.

The first part of the waveform graph shows the "random speech waves" that are typical of turbulent airflow that characterizes fricatives. See the discussion in Baart (2010:19).

Now compare to that the waveform graph and spectrogram in figure 8 that were made from the recording of the Galician phrase *o veciño* 'the neighbor' in Regueira (1999), in which it is claimed that the phoneme b (written as <v> in this word) has the approximant allophone [β̞] rather than a fricative allophone.[11]

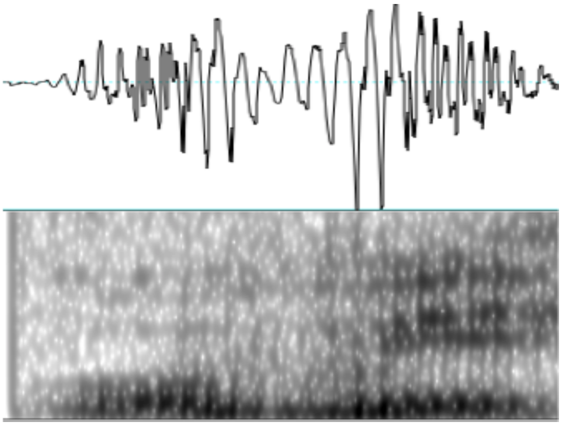

Figure 8. The syllables [oβ̞e] in Galician *o veciño*.

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[11] Note the "lowering sign" diacritic under the beta symbol; this indicates in this case that the sound is not a fricative but rather an approximant. See IPA (1999:16, 19, 25, 182); it is explained that the symbol is interpreted to mean that the diacritic indicates that there is less closure.

This graph shows the first two syllables, namely **[oβ̞e]**. It is quite noticeable that the random speech waves of typical of fricatives are not found in this graph, but rather the periodic waves of sonorants, including approximants (Baart 2010:20-21).

15.4 Rhotics and laterals: contrast and lack of contrast

In many languages, including English and Spanish, there are two contrasting sonorant non-nasal consonants: one a rhotic and one a lateral.[12] Examples of contrast in Spanish:

(13)	**sueɾo**	‘serum’	**muɾo**	‘wall’	**mar**	‘sea’
	suelo	‘ground’	**mula**	‘mule’	**mal**	‘badly’

Examples of contrast in English between **ɹ** and **l** (to which you can add many more):

(14)	**peːɹ**	*pair*	**ɹip**	*rip*
	peːl	*pail*	**lip**	*lip*

As a result of finding such contrasts, a feature to distinguish these sounds has been posited: **[LATERAL]**.

(15) “Lateral sounds are produced by lowering the mid section of the tongue at both sides or at only one side, thereby allowing the air to flow out of the mouth in the vicinity of the molar teeth; in nonlateral sounds no such side passage is open.”[13]

Lateral approximants, lateral taps, and lateral fricatives are all [+lateral].

In many other languages an r-sound and an l-sound are not contrastive with each other; the manner feature [lateral] for them is not distinctive phonologically and there is only one phoneme. The most relevant factors in the context are the (a) position in the syllable and (b) the kinds of vowels before andor after the consonant. This kind of rule also very commonly applies across word boundaries and is thus classified as a postlexical operation when it does (see the definition of postlexical rule in §14.3).

The data in (16) from Tswana show the relevance of particular vowel qualities:[14]

(16)	**[khuɾu]**	‘turtle’	**[lefifi]**	‘darkness’
	[baɾisa]	‘flock’	**[loleme]**	‘tongue’
	[loxaɾima]	‘lightning’	**[xobala]**	‘read’
	[mosaɾi]	‘woman’		
	[poɾi]	‘goat’		

We do not find contrast between **[ɾ]** and **[l]** in this language. The tap appears before the close vowels **i** and **u** while the lateral approximant appears before the others. There is therefore only one phoneme since they are in complementary distribution.

Two problems arise in this situation. First, can one decide which of these allophones is “the phoneme” (if that is even a proper question to ask)? Does **ɾ** become **[l]**, or rather does **l** become **[ɾ]**? To put it another way, is the feature [lateral] distinctive in this language, or is the feature [lateral] not distinctive in the language? The answer is not clear if the distribution of the two sounds is relatively similar. Quite commonly an arbitrary decision is made, which itself is indicative of a problem. If one takes the feature [+lateral] as somehow unusual—something that is added—then that

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[12] The label “liquid” has often been used to group such sounds, but it is not clear that there is a very good reason to group these sounds in most languages. The term “rhotic” includes a wide range of so-called “r-sounds”. See the chapter on rhotics in Ladefoged & Maddieson (1996).

[13] Chomsky & Halle (1968:317).

[14] Whitley (1978), Doke (1926), and Doke (1954).

would mean one is using the non-lateral allophone as basic, and the feature [lateral] is not a distinctive feature in this language.

Second, although one might use the feature [+lateral] to describe one of the allophones, where does this feature come from? This feature just appears out of nowhere since it is not part of the features used to describe the vowels.

On the other hand, if one posits l as the phoneme and [ɾ] as the allophone, then in the appropriate context the (distinctive) feature [+lateral] is being changed to [-lateral]. The mechanics of this change do not follow easily from the features of the sounds in the environment, however. We do not know where this particular problem has been addressed and resolved satisfactorily, and so we leave it open.

15.5 Examples of some phonetic details

The following statements of phonetic detail are found in the corresponding illustrations published in the *Handbook of the IPA*. (We have adapted the presentations slightly.)

(17)
- a. American English: t, d, and n are pronounced as flaps when they are in intervocalic position before an unstressed vowel: [ˈsɪɾi] *city,* [ˈɹɛˑɾi] *ready*, [ˈpɛˑɾ̃i] *penny*. (Ladefoged 1999)
- b. Amharic: b is pronounced as an approximant when it occurs between sonorants: gʷʊlbət [gʷʊlβ̞ət]. (Hayward & Hayward 1999)
- c. Catalan and Galician: The stops have approximant allophones when they follow a sonorant continuant (viz., vowel or lateral, except in the case of ld, as in Spanish). (Carbonell & Llisterri 1999, Regueira 1999)
- d. German. The voiced uvular fricative can be pronounced as an approximant when it occurs in intervocalic position. (Kohler 1999)
- e. Japanese. In fast speech, b can be pronounced [β]. (Okada 1999)
- f. Japanese: g tends to be pronounced [ɣ] when between vowels. (Okada 1999)

15.6 Key terms

Key terms introduced in this chapter are:

1. LABIAL. This is the feature that describes sounds made with the lips. It is currently viewed as a privative feature node (not a binary feature) and includes bilabial, labiodental and labial-velar consonants. (§15.1)
2. CORONAL. This is the feature that describes sounds made with the crown of the tongue (from the tongue tip and the blade, excluding the back. It is currently viewed as a privative feature node (not a binary feature) and includes interdental, dental, alveolar, postalveolar, retroflex, and palatal consonants. (§15.1)
3. DORSAL. The feature that describes sounds made with the back of the tongue is the feature Dorsal, whether the sounds are velar or uvular. It is currently viewed as a privative feature node (not a binary feature). (§15.1)
4. A sound is [+CONTINUANT] if the airstream is not completely blocked in the oral tract. (§15.1)
5. NATURAL CLASS. This is a group of sounds that pattern together in some way in a certain language. To be "natural", this class is expected to share the value of some particular feature or set of features. (§15.1)
6. Sounds that are [+CONSONANTAL] are "produced with a radical obstruction in the midsagittal region of the vocal tract; nonconsonantal sounds are produced without such an obstruction". (§15.2)
7. [+APPROXIMANT] sounds have a constriction in the vocal tract that allows a frictionless escape of air, unlike [-approximant] sounds. (§15.2)
8. The feature [LATERAL] is the feature that (when positive) describes sounds made "by lowering the mid section of the tongue at both sides or at only one side, thereby allowing the air to flow out of the mouth in the vicinity of the molar teeth" (Chomsky & Halle 1968:317). (§15.4)

15.7 Wording

The following examples illustrate acceptable wording for stating generalizations regarding manner assimilation in prose descriptions. It is recommended that you use similar wording in write-ups that you may produce. Note how extraneous information is not mentioned. In these cases, it is difficult to show the assimilatory nature of the process and still use fairly common terminology.

1. A stop becomes a continuant when it occurs intervocalically.
2. A fricative becomes an approximant when it is in intervocalic position.
3. A voiced stop assimilates to a preceding (continuant) vowel and becomes a continuant.

15.8 Reading questions

You can check your answers to these questions in appendix F.15.

1. T/F Common groupings of different places of articulation that are contrastive in many languages are labial, coronal and dorsal.
2. T/F Dorsal sounds include post-alveolar, palatal, velar and uvular.
3. T/F l, m and θ are always all classified as [+continuant].
4. T/F The features [+continuant], [-sonorant] gives us the set of fricatives and affricates in a language.
5. T/F Sounds that are homorganic are pronounced at the same place of articulation.
6. T/F [lateral] is a distinctive feature in languages where rhotic and lateral sonorants contrast.
7. T/F Which two of the following are not [+continuant]? a. ð b. ɾ c. m d. a e. tʃ

15.9 Exercises

1. Madija. Examine the data in appendix G.15.1 and propose an analysis for the sounds [ɾ] and [l]. Follow the format suggested in appendix D.4.
2. Daga. Examine the data in appendix G.14 and propose an analysis for the following consonants seen there: [t d s ɾ l]. Follow the format suggested in appendix D.4.
3. Cashinahua. Examine the data in appendix G.11 and propose an analysis for the following consonants seen there: [p b β t d ɾ k]. Follow the format suggested in appendix D.4.
4. Korean. Examine the data in appendix G.18.2 and propose an analysis for the consonants [ɾ l] seen there. Take the data from loanwords into consideration in how you finalize your solution. Follow the format suggested in appendix D.4.
5. Albanian. Examine the data in appendix G.10.2 and propose an analysis for the labio-dental fricatives and approximants and the interdental fricatives and approximants.
6. Tlacoapa Mi'phaa. Examine the data in appendix G.1 for the distribution of [b] and [β], [d] and [r], [g] and [ɣ] *in simple onsets* (just to narrow the focus a bit). Can you propose something about the distribution of these sounds in which each pair are allophones of three different phonemes? Then see the discussion in appendix E.19.

16

NASALIZATION

16.1 Distinctive feature

As you know from your study of phonetics, some sounds are made with the soft velum lowered such that the airstream is allowed to pass through the nasal cavity. If at the same time the airstream is blocked from passing through the mouth, as in the case of [m] and [n], the sound is called a nasal. If air also passes through the mouth, the sound is said to be nasalized. In both cases the same feature has been used to describe the sound: [NASAL]. Proposals for this feature being binary have been made and also for it being privative (see the discussion at the beginning of chapter §14).

In most languages (but not all) there is a contrast of some sort between oral consonants and at least one nasal consonant (most commonly n).[1]

In a language that has d and n, the feature [sonorant] may be adequate to distinguish the two consonants, but if the language also has l, then the feature [nasal] is especially relevant. As the table in (1) shows, the feature [continuant] may also be used to distinguish l from n (if laterals are taken as [+continuant]).

(1)

	t	d	l	n
[sonorant]	–	–	+	+
[voice]	–	+	+	+
[nasal]	–	–	–	+
[continuant]	–	–	+	–

Evidence of the contrast between oral and nasal stops in English includes examples such as the following (for b vs. m, and d vs. n):

(2)

b vs. m		d vs. n	
Initial	Final	Initial	Final
ban	*rub*	*dip*	*toad*
man	*rum*	*nip*	*tone*

Some languages have also been analyzed as having a contrast between (simple) oral stops and prenasalized stops (such as ᵐb and ⁿd).[2] The stop begins with a brief nasal articulation. The correct analysis of these sounds with respect to the feature [nasal] has been debated in the literature.[3] Do they have the distinctive feature [+nasal] or not? We do not take a position on this question here.

In many languages (more than 20% of the languages in one sample),[4] there is also a contrast between oral vowels and nasalized vowels. It is common to analyze the nasalized sounds as vowels with the distinctive feature [+nasal]. The vowel a is [-nasal] and the vowel ã is [+nasal]. Mezquital Otomí is a language that has been analyzed as having an oral vs. nasal vowel contrast. See the data in (3).[5] (Tones on the unmarked syllables are not known from the source of the data.)

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[1] See Maddieson (1984:61) for discussion of the languages known to not have any nasal.

[2] See the discussion of the phonetics of prenasalized stops in Ladefoged & Maddieson (1996:119-123).

[3] See, for example, the discussion in Anderson (1974:268-274).

[4] See Maddieson (1984:130).

[5] Hernández Cruz, et al. (2004).

(3)	àgi	‘to bury’
	à̃gi	‘to hide’
	áʔtsi	‘to take out (food or liquid)’
	ẵtsi	‘to plane (wood)’
	ʃăgi	‘to be uncombed’
	ʃà̃gi	‘to stink’

In some cases it has been argued that a phonetic contrast between oral vowels and nasalized vowels is due to the nasalization of a vowel by a nasal consonant and then the loss of the nasal consonant. Under such an analysis (which requires careful argumentation), a vowel such as [ã] is phonemically an. This is the analysis proposed in Loos (1969:177-180) for Capanahua. See the data in (4).[6]

(4)	a.	tʃiponki	[tʃipõŋki]	‘downriver’
	b.	ʔonampan	[ʔ̃õnãmpã]	‘I will learn’
	c.	boon	[bõõ]	‘hair’

Under this analysis, the language does not have (phonemic) nasalized vowels despite having many phonetically nasalized vowels and approximants.

In yet other cases, it has been proposed that nasalization is a feature that is independent of the sounds themselves and is instead a feature of the morpheme or word. Under such a proposal, a word such as [kãõ] is analyzed as kao plus the feature [+nasal]. The vowels in themselves are not [±nasal] but rather the morpheme itself has the feature [+nasal]. Such an analysis is not immediately obvious, and in fact was not contemplated in linguistic theory until relatively recently.

Some Mixtec languages have been analyzed in this way.[7] The nasal feature is considered AUTOSEGMENTAL since it is not a property of a particular segment, strictly speaking. This is illustrated by the following data from Nuxaa Mixtec. A morpheme can be simply oral; an example is (5).

(5) ‘louse’tʃuku [tʃuku]

Or a morpheme can have the feature [nasal]. It is claimed that the feature [nasal] is not a feature of a vowel but rather a feature of a given morpheme because we only need to know that the morpheme has it. It is associated with the right edge of the morpheme that it is a feature of (by language-specific convention if not universally so) and then spreads (if possible) to adjacent sonorants. The word [tʃukũ] ‘fly’ is such a morpheme. As shown in (6a), the morpheme is just simply the consonants and vowels and the feature [nasal]; that is all that needs to be memorized. In (6b) we see the association of the feature by the conventions we have adopted. And (6c) shows the phonetic form that occurs after the lack of spreading of [+nasal] any farther leftward.

(6)
[nasal]
a. /tʃuku/

[nasal]
b. |
tʃuku

c. [tʃukũ]

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[6] This is a slight reinterpretation of the original analysis.

[7] Mixtec languages are spoken in Mexico and belong to the Mixtecan genus, part of the Oto-Manguean language family. See Marlett (1992) and McKendry (2001) for an orientation to the analysis discussed here. Such analyses may be viewed as one type of evidence against a simplistic notion of the phoneme and for a theory that includes distinctive features. However, phonemicists in the past commonly proposed Nasalization as a suprasegmental phoneme, so it is clear that their theory was broad enough to encompass this type of abstraction.

If this is the correct view of the architecture of Mixtec phonology (and we believe that it is), then this accounts for why words such as (7)-(8) are not found in this language, for the reasons indicated.

(7) Unattested **[tʃũkũ]**

(Both syllables are nasalized, separated by an obstruent. The analysis proposed above does not provide any way for the first vowel here to become nasalized, thus accounting for the impossibility of such a word in Mixtec.)

(8) Unattested **[tʃũku]**

(The first syllable is nasalized and the second syllable not nasalized. The analysis proposed above does not provide any way for the first vowel here to become nasalized, thus accounting for the impossibility of such a word in Mixtec.)

If we simply posited nasalized vowels for Mixtec, these facts would not be accounted for, as in fact was recognized by some people who had proposed more traditional analyses.[8]

Consonants that are distinctively [+nasal] may be other than the usual nasal consonants (such as **m**). Distinctively nasalized voiced obstruent fricatives are rare, if they exist at all.[9] At least four languages (two in Peru, and two in northern Namibia) have been described as having a distinctively nasal glottal fricative.[10]

With regards to the presentation of unusual phonemes such as nasalized glottal fricative, it is recommended that the unusualness not be suppressed or hidden such as by using a simple representation that could cause it to be confused with something else. That is, something like **h̃** should not be written as **h**, just to make it look cleaner. The nasalization of that sound is an important feature in the language. If people in the future can misunderstand and misconstrue the facts because of a simplification in the presentation, they will do it. Therefore it is better to keep things clear by using the appropriate symbols as well as using clearly written prose.

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[8] It is important to point out here that although the practical orthography of Mixtec languages always represents the nasalization with a final <n>—for example, the word for 'fly' is written *chukun*—no one has ever claimed (nor would anyone claim) that the phonetic nasalization in these languages is due to the loss of a final nasal consonant. (Mixtec languages do not have closed syllables.) The use of <n> is only an orthographic representation that happens to work very well.

[9] See Ladefoged & Maddieson (1996:131-134).

[10] The Namibian languages are Kwangali and ThiMbukushu (Ladefoged & Maddieson 1996:133), and **h** contrasts with **h̃**. The other languages are Yine (previously known as Piro; Matteson 1965, Urquía Sebastián & Marlett 2008), and Arabela (Rich 1963), and in these the nasalized glottal fricative has no non-nasalized counterpart.

16.1.1 *Short exercise: Awara.* Use the data found in appendix G.9. Look at prenasalization, or whatever it is, in the first two columns of these data. Assume that what is written as **[mb]** is an impressionistic transcription—it could really be **[^{m}b]**, for example. And vice versa. So there are more data here to consider than might first be apparent.

1. Do prenasalized stops contrast with the (aspirated) voiceless stops?
2. Do prenasalized stops contrast with the nasal consonants?
3. Do prenasalized stops contrast with voiced stops?
4. Do prenasalized stops occur intervocalically? (Be careful here.)
5. Do prenasalized stops occur word-initially? (Be careful here.)
6. What does the word game do and how does it help you analyze a word like #11?

When you have finished, see the discussion in appendix E.35.

16.2 Loss of a distinctive feature

A consonant may also lose its distinctive feature [+nasal] under certain conditions. One example of this is found in Hixkaryana, where nasals optionally denasalize when they follow an obstruent other than **h**.[11] Consider the examples in (9).

(9) a. **wetmænɔ** **[wɪtmænɔ]** ∼ **[wɪtbænɔ]** 'I gave him meat'
b. **wæhɔsnɔ** **[wæhɔsnɔ]** ∼ **[wæhɔsdɔ]** 'I caught it'
c. **tɯtʃenɔtɲe** **[tɯtʃiənɔtɲe]** ∼ **[tɯtʃiənɔtɟe]** 'cold'

The denasalization process may apply across word boundaries, as shown in (10).

(10) **tʃuɸ mɔnɯ** **[tʃʊɸ mɔnɯ]** ∼ **[tʃʊɸ bɔnɯ]** 'that (is) grass'

The Hixkaryana examples become even more interesting, however, in that contrast between voiced stops and their corresponding nasals is said to exist, although the contrast is "only in phrase-initial position".[12] Unfortunately, the meaning of the expression "phrase-initial position" is not explained in the source, nor is it made clear why "word-initial position" is not adequate. Setting that question aside, we note the data in (11) that were provided (where the morphological composition here is a bit hypothetical, based on the shapes of the morphemes in other contexts):

(11)

Phonetic	Gloss	Morphological composition
[bænhɔnɔ]	1sg-dance-ImmedPast	**{k-mænhɔ-nɔ}**
[bænhɔnɔ]	1pl.incl-dance-ImmedPast	**{t-mænhɔ-nɔ}**
[mænhɔnɔ]	3sg-dance-ImmedPast	**{∅-mænhɔ-nɔ}**

These data were taken as showing that there were phonemes **b** and **m** (among others). But, of course, the morphological complexity of these forms, and the limited distribution of the voiced stops in the language generally, plus the obvious denasalization process that is applying optionally on heterosyllabic clusters (see above), suggest that one should be very careful about positing the voiced stops. An alternative analysis, which helps understand the restricted distribution of the voiced stops, is to claim that tautosyllabic clusters like **km** and **tm** obligatorily have the nasal consonants denasalizing and then the voiceless stop deleting. The phonemic representations of the words in question would be **kmænhɔnɔ**, **tmænhɔnɔ**, and **mænhɔnɔ**, respectively.[13]

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[11] Derbyshire (1979:180).

[12] Derbyshire (1979:180).

[13] This kind of phonemicization of the data would not have been considered possible in approaches to phonology in earlier decades, and even today might be considered unusual.

Note that if this is taken as the *only* way in which voiced stops occur in the language (as is being proposed in this reanalysis of Derbyshire's work), in monomorphemic examples the exact stop before the nasal is not determinable from the surface form. Thus 'silver-beaked tanager', phonetically **[bæʃme] ∼ [bæʃbe]**, might be analyzed as **kmæʃme**, but actually the initial **k** might be **t** or even **p**.

16.3 Non-distinctive feature

16.3.1 *Nasalization on consonants.* In some languages, prenasalization is not a distinctive feature of voiced stops even though it occurs phonetically. That is, in those languages there are two series of stops: voiceless and voiced, the latter sometimes or often with prenasalization. Prenasalization enhances the perception of the consonant, but is not itself the phonologically important feature in such languages. It is a phonetic detail in those cases and not a distinctive feature.

If a language clearly has phonemic nasalized vowels, it is possible that a sequence such as **ãb** could be heard impressionistically as **[ã^{m}b]** or even **[a^{m}b]**. That is, the so-called prenasalization of the voiced stop could be simply a phonetic fact that is conditioned by the nasalized vowel.

Prenasalization of a stop may be a phonetic correlate of a stop in a particular position. In Cashinahua a voiced stop may be "lightly prenasalized" when it is at the beginning of a major phonological phrase. In the same language, a voiceless stop may be lightly prenasalized following a nasalized vowel, especially a stressed one (Kensinger 1963:209). Similar facts are found in numerous languages.

Example: Busa. **dãbo** 'life' is pronounced **[d^{n}ã^{m}bo]**. In this language there is also a slight prenasalization that occurs before an approximant in the onset of a syllable with a nasalized vowel: **jĩ** is **[^{ɲ}jĩ]** 'cold, wet', and **wɛ̃** **[^{ŋ}wɛ̃]** 'year' (Wedekind 1972).

Example: Peñoles Mixtec. **t** is pronounced with a nasal transition before a nasalized vowel. Thus **tũː** 'black' is pronounced **[t^{n}ũː]** (Daly & Daly 1977:24).

Example: Me'phaa nasals. **j** is pronounced with nasalization on it when it appears in the context of nasalized vowels. The result is **[j̃]**—a nasalized palatal approximant, which can sound very much like a palatal nasal. As a result, one can see words like those in (1), which might appear in *impressionistic* (but less than accurate) transcriptions.[n]

(1) **[iniː]** 'type'
[iɲiːʔ] 'edible tuber'

This near-minimal pair is a good illustration of the error of taking such data and making quick conclusions. The contrast here is *not* between two phonemes **n** and **ɲ**, nor between **n** and **j̃**, but rather between **n** and **j**. The word for edible tuber would be transcribed in a more accurate, narrow transcription, as **[ĩj̃ĩːʔ]**. In order to come to the correct conclusion, one needs to be thinking about the big picture as well as examining the phonetic facts. In this case, in fact, reflecting on the analysis leads the linguist back to examine the phonetic facts more carefully.

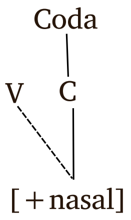
[n] These data omit tones and are not taken from any particular variety, but are illustrative of the language generally. See Marlett & Neri Remigio (2012) for details from one variety, namely [tpx].

16.3.2 *Nasalization on vowels.* In many languages the feature [nasal] is not distinctive for vowels, but it is a feature that appears on them in specific contexts. This has been explained as resulting from the lack of precise synchronization between the movements of certain articulators (tongue, lips) and the raising or lowering of the soft velum. An example in English is that words such as **boːn** 'bone' may have a pronunciation **[bõʷn]**. Nasalization on the vowel in these cases is not distinctive; it is a result of the phonological context. And nasalization like this may vary considerably between different speakers as well as between different dialects. The rate of speech may also affect it.

It is more likely for a vowel or approximant to become nasalized before a nasal consonant when they are both in the same syllable (that is, they are TAUTOSYLLABIC).

A quasi-formalization of the process of nasalization due to a tautosyllabic nasal consonant that follows a vowel is shown in (12):

(12)



This kind of formalization is inadequate to handle the partial nasalization of the type illustrated by Peñoles Mixtec in §16.3.1 above, however. A rule of the type shown in (12) would be expected to make a sound completely nasal, not just partially so.

Non-distinctive nasalization has also been found in the context of glottal consonants, due to a relationship between laryngeal and nasal articulations (recently called rhinoglottophilia). This kind of nasalization cannot be described by simple spreading a distinctive feature [nasal] from the glottal consonants since they have none (at least not in the cases that we are referring to).

(13) Hixkaryana: **u** is nasalized in word-final[15] position following **h**: **tɔhu** **[tɔˑhũ]** 'stone'. (Derbyshire 1979:182)

16.4 Typology

The great majority of languages have nasal consonants as well as oral consonants as phonemes. No language has only nasal consonants. Some languages have nasalized vowels as well as oral vowels as phonemes. No language has only nasalized vowels.

The general claim has been that contrastive nasalization is always binary—oral or nasal—and that there is no systematic phonological contrast between more than these. (Phonetically there may be several degrees, of course, although rarely are these represented. In fact, there is no systematic way to do this in the IPA tradition.) However, this claim has been challenged in the past[16] and is now being disputed more generally, creating new challenges for distinctive feature theory.[17]

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[15] Unfortunately, no data are given to clarify whether the context is really word-final position or whether it is phrase-final. See the discussion of the importance of this distinction in chapter §22.

[16] See especially Merrifield (1963), Merrifield & Edmondson (1999), and Blevins (2004) on the basis of Palantla Chinantec.

[17] See Hajek (2009).

As mentioned above, in some cases it has been argued that the feature [nasal] is abstractly related not to particular sounds but rather to words or morphemes. (It is heard on the vowels and consonants, of course.) This type of analysis is part of the evidence that a theory of segmental phonemes is not sufficient, and that one must include some kind of theory of features.

16.5 Some phonetic detail rules

The following phonetic detail rules are found in the illustrations presented in the *Handbook of the IPA*.

(14) a. Hindi: Vowels are nasalized when they (immediately) precede nasal consonants. (M. Ohala 1999)
b. Farsi: Vowels are nasalized when they (immediately) precede or (immediately) follow nasal consonants. (Majidi & Ternes 1999)
c. Taba: Vowels tend to be nasalized when they (immediately) precede nasal consonants. (Bowden & Hajek 1999)

16.6 Nasalization in real life

When it comes to practical writing systems, nasalization can be a challenge in various ways. When it is nondistinctive, the usual successful practice is to not represent it in the writing system. There are exceptions, however. For example, the post-occlusive nasal transition in Peñoles Mixtec described in §16.3.1 is salient enough for Mixtec speakers (perhaps because of contact with Spanish) that it was important for them to write the transitional <n>: *tnuu* 'black'.

The distinctive nasalization of Mixtec (and other similar languages) has been successfully represented by writing a word-final <n> for the nasalization rather than using a nasalization diacritic on every vowel that is nasalized. However, other interesting facts of this system are overridden by the use of symbols from the Spanish language alphabet, presumably because of the impact of the Spanish language on Mixtec speakers. Therefore a word such as **[tũj̃ũ]**, which could have been written *tuyun* is instead written *tuñu* in Mixtec languages. On the other hand, in closely similar and related Trique languages, the more linguistically sophisticated analysis was implemented successfully.

In modern Otomi languages, distinctive nasalization on vowels is indicated by a diacritic. In Eastern Highland Otomi a subscripted diacritic—the "Polish hook", as it is called in Pullum & Ladusaw (1996:261)—is written under the vowel. This same diacritic is used in standard Polish orthography to indicate nasalization. In the Mezquital Otomi, nasalization is indicated with a diaeresis over the vowel (unless adjacent to a nasal consonant). The challenge in Otomi has been how to deal with numerous vowel phonemes, tone, and nasalization in a way that meets the twin challenges of practicality and adequacy.[18]

16.7 Key terms

Key terms introduced in this chapter are:

1. [NASAL] is the feature (sometimes analyzed as binary, sometimes as privative) that indicates whether or not the air stream is passing through the nasal cavity. (§16.1)
2. The term AUTOSEGMENTAL is used to refer to the idea that in phonological structure certain features operate somewhat independently of other features. (§16.1)
3. TAUTOSYLLABIC elements occur in the same syllable. (§16.2)

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[18] For Eastern Highland Otomi, see Voigtlander, Katherine & Artemisa Echegoyen (1985). For Mezquital Otomi, see Hernández Cruz, et al. (2004).

16.8 Wording

The following examples illustrate acceptable wording for stating generalizations regarding nasal assimilation in prose descriptions. It is recommended that you use similar wording in write-ups that you may produce. Note how extraneous information (place of articulation, for example) is not mentioned, and how the statements attempt to make clear the assimilatory nature of the process.

1. A vowel is nasalized when it immediately precedes a tautosyllabic nasal consonant.
2. A vowel is slightly nasalized when it immediately follows a nasal consonant.
3. An approximant is nasalized when it occurs between two nasalized vowels.

16.9 Reading questions

You can check your answers to these questions in appendix F.16.

1. T/F In a language that has d, n, l and z the features [sonorant] and [lateral] are adequate to distinguish the four consonants.
2. T/F In some languages [õ] is analyzed as being a [+nasal] phoneme and in others the [+nasal] feature of a following nasal consonant is being transferred to the non-nasal vowel.
3. T/F Prenasalization on a consonant is always the result of either a [+nasal] distinctive feature or assimilation to a [+nasal] sound in the context.
4. T/F It is common for vowels and approximants to become nasalized when they are tautosyllabic with a nasal consonant.
5. T/F A few languages have only nasal consonants.
6. T/F One of the new discussions among phonologists relates to feature assignments for words and morphemes, not only phonemes.
7. T/F In Hindi, vowels are nasalized when they immediately precede nasal consonants. This indicates that [nasal] is a distinctive feature on vowels in this language.
8. If you see the following in a phonological write-up, what advice would you give to the consultee? (Choose from the options below.)

   Evidence of contrast between voiced stop and prenasalized voiced stop: **tabokã [tabokã]** 'crocodile', **ta^{m}boka [tã^{m}boka]** 'cloud'.

   a. "This is good evidence. That is enough data."
   b. "You are on the right track. Now just look for some word-initial examples."
   c. "Since you seem to have nasalized vowels, the prenasalization on the consonant might be due to the nasalization of the vowel spreading to the voiced stop."
   d. "You should not posit nasalized vowels. Consider word-final nasalization instead."
9. If a vowel is nasalized before a nasal followed by a consonant but not before a nasal followed by a vowel, what is the best way to state the context?

16.10 Exercises

1. Propose quasi-formal rules (of the type shown in §16.5) for the informal descriptions given in (14) of chapter §16.
2. Examine the nasalized vowels and approximants in the Arabela data presented in appendix G.21. The way in which you present the results will depend on your analysis, but you should still think about the implications for a presentation of the phonology in the style of the illustrations of the IPA. Good prose discussion would be helpful.
3. Tewa. Examine the data in appendix G.23 and propose an analysis for the nasalized vowels and approximants there.
4. Tlachichilco Tepehua. Examine the data in appendix G.33 and propose an analysis for the nasalized vowels and approximants there. At the same time consider whether there is evidence for a minimal word constraint in the language (and what it is). Discuss the facts.

17

PLACE OF ARTICULATION: NASALS

This chapter considers the places of articulation of nasal consonants.

17.1 Contrast

Most languages (but not all) have one or more nasal consonants as phonemes. The distinction between the different nasals can be shown by the kind of evidence that we have already seen for other phonemes. And likewise, the distinction between nasal and non-nasal consonants can also be shown.

If a language is claimed to have **m** as a phoneme, it must be shown that it contrasts with any other nasal consonants that may occur in the language and also with whatever other labial consonants that may occur in the language, including the labial-velar approximant (if there is one in the language).

Modern English is commonly claimed to have three nasal consonants. Two of these are uncontroversial, while one has a more interesting history. Consider the evidence in (1):

(1)	Word-initial		
	m	**mɜt**	*mutt*
	n	**nɜt**	*nut*
	ŋ	—	(not found in word-initial position)
	Morpheme-medial, intervocalic		
	m	**pɜməl**	*pummel*
	n	**fɜnəl**	*funnel*
	ŋ	—[1]	
	Word-final after a “short” vowel		
	m	**slim**	*slim*
	n	**sin**	*sin*
	ŋ	**siŋ**	*sing*
	Word-final after a diphthong		
	m	**tajm**	*time*
	n	**fajn**	*fine*
	ŋ	—	
	Word-medial, intervocalic		
	m	**slimiŋ**	*slimming*
	n	**siniŋ**	*sinning*
	ŋ	**siŋiŋ**	*singing*

Such data account for why the velar nasal is often claimed to be a phoneme (as in the description of English in Ladefoged 1999). Later in this chapter we see why the gaps above have suggested to some that the case is not so clear.

Some languages have very clear evidence to support positing a velar nasal or a palatal nasal (or some other one). The data in (2) show that Spanish has three nasal phonemes, although there is a decided skewing in distribution.

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[1] One example is often cited: *dingby*.

(2)

m	ˈmata	‘plant’
n	ˈnata	‘cream’
ɲ	—[2]	
m	ˈkama	‘bed’
n	ˈkana	‘gray hair’
ɲ	ˈkaɲa	‘sugar cane’
m	—	
n	ˈpan	‘bread’
ɲ	—	

Thai has three nasal consonant phonemes, each of which occurs in word-initial position.[3]

(3)

	Broad transcription	
m	mā:n	‘demon’
n	nā:n	‘long time’
ŋ	ŋā:n	‘work’

§17.2 shows why nasals must be examined carefully. They are best contrasted using contexts in which they precede vowels since before consonants they often take on the place of articulation of the consonant that follows them.

17.2 Allophones

In many languages—perhaps the majority—nasal consonants present some amount of phonetic variation with respect to their place of articulation, especially when they precede another consonant. When they precede a consonant, it is very frequently the case that (perhaps with some additional factor involved) the nasal consonant shares the place of articulation of the consonant that immediately follows. The consonants are thus said to be HOMORGANIC (sharing the same place of articulation).

In English, for example, when there is a sequence of a nasal consonant and another consonant in the same syllable and in the same morpheme, the nasal consonant is pronounced at the same place of articulation as the consonant that follows. Consider the data in (4) (presented in a narrower transcription—aspiration has not been included, however):

(4)

Attested words		Impossible words		
[kæmp]	*camp*		*[kæŋp]	*[kænp]
[tɛnt]	*tent*	*[tɛmt]	*[tɛŋt][4]	
[tɛnd]	*tend*	*[tɛmd]	*[tɛŋd]	
[pɪɲtʃ]	*pinch*	*[pɪmtʃ]	*[pɪŋtʃ]	
[tɪɲdʒ]	*tinge*	*[tɪmdʒ]	*[tɪŋdʒ]	*[tɪndʒ]
[tæŋk]	*tank*	*[tæmk]		*[tænk]

We also see, however, that the three nasals claimed to be phonemes do in fact appear before the inflectional suffixes {–z} and {–d}.

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[2] Three words with an initial palatal nasal are listed in DEM (2010), plus two that are chopped forms of standard words.

[3] Tingsabadh & Abramson (1999).

[4] One word that is like this, however, is [æŋst] *angst*.

(5)	[dɪm]	*dim*	[dɪmz]	*dims*	[dɪmd]	*dimmed*
	[pɪn]	*pin*	[pɪnz]	*pins*	[pɪnd]	*pinned*
	[pɪŋ]	*ping*	[pɪŋz]	*pings*	[pɪŋd]	*pinged*

The facts from Spanish are quite similar, although the inventory of nasal phonemes is different (it is m, n, ɲ). Morpheme-internally the nasals are always homorganic with the immediately following consonant.

(6)	[kampo]	‘camp’	*kan̪po	*kaɲpo	*kaŋpo
	[samba]	‘samba’	*san̪ba	*saɲba	*saŋba
	[tɾjuɱfo]	‘triumph’	*tɾjumfo	*tɾjun̪fo	*tɾjuɲfo
	[tan̪t̪o]	‘so much’	*tamto	*taɲto	*taŋto
	[tjɛn̪d̪a]	‘store’	*tjɛmda	*tjɛɲda	*tjɛŋda
	[baŋko]	‘bank’	*bamko	*ban̪ko	*baɲko
	[gɾaŋxa]	‘farm’	*gɾamxa	*gɾan̪xa	*gɾaɲxa
	[taŋgo]	‘tango’	*tamgo	*tan̪go	*taɲgo

Furthermore, we also find straightforward alternation facts from certain morphemes in Spanish where the same prefix has different forms. Sometimes it is [kom], sometimes it is [koɱ], sometimes it is [kon̪], and sometimes it is [koŋ]. The nasal consonant is homorganic with the consonant that follows it.[5]

(7)	[kompoˈneɾ]	‘to compose’
	[kombiˈβiɾ]	‘to live together’
	[koɱfoɾˈmaɾ]	‘to conform’
	[kon̪t̪eˈneɾ]	‘to contain’
	[koŋkuˈriɾ]	‘to concur’
	[koŋgɾeˈɣaɾ]	‘to congregate’

We have three obvious facts to take care of. First, we have a labiodental nasal, a dental nasal, and a velar nasal in the phonetic facts; these do not occur in other contexts.[6] If they are not phonemes in their own right, then we may presume they are allophones of something. How do we account for them? Second, we have the allomorphs of the prefix that begins with [ko] and ends with a nasal. How are they explained? Third, the potential contrast between nasal consonants that is exploited elsewhere is NEUTRALIZED (made irrelevant and undetectable) when a nasal precedes a consonant; in this position there is no contrast. Note that whereas we have three contrasting nasals in front of a vowel in Spanish, we have only the option of a homorganic nasal in front of a consonant.

Furthermore, it is not just a matter of memorizing the right nasal consonant in the words in question. The juxtaposition of words in a phrase creates situations where items are put together and pronounced without having been memorized as a lexical item.

(8)	[un oso]	‘a bear’	[kon eneɾxia]	‘with energy’
	[um pat̪o]	‘a duck’	[kom pat̪i]	‘with Patty’
	[uŋ gat̪o]	‘a cat’	[koŋ ganas]	‘with great interest’

Part of the solution that has been proposed is that Spanish (and many other languages) has a rule of nasal place assimilation that is along the following lines:

(9) Nasal Place Assimilation: A nasal assimilates in place of articulation to an immediately following consonant.

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[5] We set aside for now the complications that arise when the consonant that follows is a nasal consonant.

[6] We set aside dialects in which a couple more contexts arise in which the velar nasal appears.

This rule guarantees that we will have various nasal consonants as allophones even if we have only one, two or three phonemes in the language (if the language allows nasals in syllable-final position or otherwise allows a nasal to precede a consonant). The phonetic facts are therefore accounted for.

In the cases of the words for ‘a’ and ‘with’ in Spanish, we have good reason to propose that these morphemes have the **BASIC FORMS** **un** and **kon**, respectively, since these are the forms that appear in the most neutral environment phonetically (before a vowel).[7] Once we take those basic forms, we can apply the rule of nasal place assimilation and obtain the correct phonetic facts. One way of showing this is the **DERIVATION** in (10).[8]

(10)	Basic form[9]	un pat̪o	un gat̪o	un oso	kon pat̪o
	Nasal Place Assimilation applies	um pat̪o	uŋ gat̪o	—[10]	kom pat̪o
	Phonetic form	um pat̪o	uŋ gat̪o	un oso	kom pat̪o

What is written in (10) for the basic forms could also be presented as the phonemic transcriptions of the words in question (although this is not always the case—basic forms might be posited that are even more abstract, but we postpone this topic until later).

It is less obvious exactly what we should propose for the basic forms of the nouns in (6). One approach has been to assume that the basic forms utilize phonemes of the language; therefore the basic forms can only include the three nasal phonemes of Spanish. In the case of **[kampo]**, **[samba]**, **[tan̪t̪o]**, and **[t̪jɛn̪d̪a]**, this is not a problem. One would simply posit **kampo**, **samba**, **tanto**, and **tjɛnda**.

The other words in (6) require another type of decision. One proposal within an approach consistent with the phonemic hypothesis is that the basic form will contain the nasal phoneme that is closest phonetically to the phone that is attested. While this is a bit vague at this point, one might assume, as a result, that the labiodental nasal will be grouped with the bilabial nasal, and the velar nasal with the palatal nasal. But, in fact, it would seem odd to propose that the word **[baŋko]** is phonemically **baɲko** (with a palatal nasal). The usual proposal (in this kind of approach) has been that the word **[baŋko]** is phonemically **banko** (with a dental nasal).

The lack of a principled way to strictly follow the phonemic hypothesis in these situations led some people in a different direction. They propose instead that the basic forms of these words do not specify which nasal it is phonemically since that information appears to be irrelevant given the assimilation rule that supplies all the necessary details. If the place of articulation of the nasal does not have to be memorized for these words, then one might assume that it is not part of the basic form. Instead, the basic forms of the morphemes are **UNDERSPECIFIED** with respect to the place features of the nasals. If we use the capital letter “N” to indicate a consonant that is only [+nasal] and does not have a place of articulation indicated, the basic forms of these morphemes could be shown as **kaNpo**, **saNba**, **taNto**, **tjɛNda**, **tɾjuNfo**, **baNko**, **gɾaNxa**, and **taNgo**.[11] The nasal consonant then receives its place features from the Nasal Place Assimilation rule, yielding the phonetic forms we have.

One word suffices to demonstrate the difference between these two analysis: the word for ‘tango’. In one analysis, this word contains the phoneme **n**; the phonemic representation is **tango**. In the other analysis, this word never contains the phoneme **n**; its basic form is **taNgo** and its phonetic form is **[taŋgo]**. How do we decide between these analyses? That depends on the kind of evidence one accepts as being determinative. At this point, we will not make a decision.

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[7] Better than the examples in (8) would be those with **[a]** following the nasal, such as **[un as]** ‘an ace’, and **[kon aɾðoɾ]** ‘with fervor’. The vowel **[a]** is less likely to have any effect on a preceding consonant than other vowels. See chapter §18.

[8] A derivation in a model of phonology such as we are using is a demonstration of how the surface forms (phonetic in this case) are related to any abstraction that might be posited. It is “the mapping of a lexical form onto its correspondent surface form in a series of steps, each defined by a rule” (Roca & Johnson (1999:688).

[9] The **t** in these forms is dental. We takes this as a phonetic detail that is handled separately, and so we ignore it here.

[10] This line indicates that the conditions for the rule in question were not met and the rule could not apply. In this case, there is no consonant following the nasal and so assimilation cannot happen.

[11] The capital N was used by people who proposed the archiphoneme mentioned in §14.5.

Testing hypotheses. In principle there is no reason that more information could not be brought to bear on this question and help us to make a decision. Imagine, for example, that Spanish speakers used or learned to use a word game that is analogous to the "word transformer" rule that Seri speakers use for rhetorical effect (see §8.5.2). The speaker takes a word and changes it in a spontaneous way, producing a word form that very likely has never been uttered before; thus the result is something that is not likely to have been memorized. The word transformer rule has to operate on some mental representation of the word in question. Therefore we should have interest in the implications of the data we find since it makes us pay attention to something other than our perception of the phonetic data.

So suppose that Spanish had a word transformer rule that did this (very similar to Seri): show sarcasm by adding the syllable `[ta]` after the word, plus break up a consonant cluster after the stressed vowel (if one exists) with the vowel `[a]`. The results of applying the word transformer rule to some simple cases are shown in (1). Check for yourself that the results are what you would have predicted.

(1)

		basic word	transformed word
a.	'flower'	'flor	'florta
b.	'milk'	'letʃe[a]	'letʃeta
c.	'drinking glass'	'baso	'basota
d.	'dandruff'	'kaspa	'kasapata
e.	'earthquake'	'sismo	'sisamota

The big question now is how what would the output of this word transformer rule be for words like **['kampo]** 'field' and **['baŋko]** 'bank'? There are four obvious hypotheses to test. The first (call it hypothesis A) is that the speakers are manipulating the phonetic forms themselves; this hypothesis would essentially claim that the phonological analysis being taught in this book is irrelevant to language. The second (call it hypothesis B) is that the speakers are manipulating an abstraction that does not assign any place of articulation to the nasal (the archiphoneme analysis). The third (call it hypothesis C) is that speakers are manipulating an abstraction that posits the phoneme **n** for the pre-consonantal nasals. And the fourth (call it hypothesis D) is that speakers are manipulating an abstraction that posits **m** in the case of **['kampo]** but **n** in the case of **['baŋko]**.

To test these hypotheses, we should look for speakers of Spanish who are not potentially influenced by learned spelling—illiterate speakers—since we are not interested in spelling games but rather outputs of mental representations. As we see it, the four hypotheses make the predictions shown in (2).

(2)

Input word:	['kampo]	['baŋko]
Hypothesis A output:	['kamapota]	['baŋakota]
Hypothesis B output:	['kanapota] ?	['banakota] ?
Hypothesis C output:	['kanapota]	['banakota]
Hypothesis D output:	['kamapota]	['banakota]

Hypotheses B and C might make the same predictions if we assume that Hypothesis B is supplemented by a particular additional rule to tell us how an "unspecified nasal" is pronounced when it is suddenly placed before a vowel. Regardless, as you can see, the results for the different hypotheses are otherwise clearly distinguishable. They are testable. Unfortunately, to the best of our knowledge, no such testing of these hypotheses has been done for Spanish (nor for English).

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[a] We assume that **tʃ** is an affricate, not a sequence of **t** and **ʃ**.

17.2.1 *The velar nasal in English.* We may now return to the question of the velar nasal phoneme in English. As shown in (1) at the beginning of this chapter, the distribution of the velar nasal in English does not mirror that of the other two nasals. The data in (1) show that nasals within a morpheme are homorganic with an immediately following consonant. Given that fact, the data in (11) are relevant to look at now. Here we are concerned about nasals followed by voiced stops or the voiced affricate. (Not all phonetic details are included.)

(11)

Medial		Final	
[tɜmbəl]	*tumble*	*[nɜmb]	
[k^{h}ændəl]	*candle*	[stænd]	*stand*
[bɜɲdʒi]	*bungie*	[p^{h}lɜɲdʒ]	*plunge*
[sɪŋgəl]	*single*	*[sɪŋg]	

Note that voiced bilabial and velar stops do not appear word-finally after nasal consonants although voiced alveolar stops do, as does the postalveolar affricate.

One analysis that has been proposed for the velar nasal in English has been that it is not a phoneme but rather the result of assimilation to the place of articulation of an immediately following velar consonant, just as it is with a word such as **[tʰæŋk]**. The complicating factor is that a voiced velar stop (and also a voiced bilabial stop) is deleted when it occurs following a nasal in word-final position. Thus "underlying" **hæng** (or **hæNg**, if one prefers) goes through the following derivation to become phonetic **[hæŋ]** 'hang'.

(12)	Basic form	**hæng**
	Nasal Place Assimilation	**hæŋg**
	Final Voiced Stop Deletion	**hæŋ**
	Phonetic form	**hæŋ**

We do not present here all of the arguments for and against this particular analysis except to point out one well-known set of complications. The deletion of the final voiced consonant happens before a "word boundary" that does not correspond to what the common person thinks of as the end of the word. The word **[hæŋiŋ]** 'hanging', for example, shows that the velar stop is lost even when the root is followed by an inflectional suffix.

The word **[kʰɪŋliʲ]** *kingly*, from the noun *king* followed by the suffix *ly*, shows that the velar stop is lost before a derivational suffix, and therefore contrasts with the situation found in **[sɪŋgliʲ]** *singly*, from the noun *single* followed by the suffix *ly*, where the velar stop does not delete because it is not in "word-final" position after a nasal.

The pair of words **[fɪŋgɚ]** *finger* (monomorphemic, with a velar stop in the middle) and **[sɪŋɚ]** *singer* (root *sing* plus derivational suffix *-er*, with no velar stop phonetically) illustrate the same point.

And finally, compare the words **[lɔŋ]** *long* and **[lɔŋgɚ]** *longer*. In the simple adjective, the velar stop is not present but in the comparative form it is present.

Thus you can see that any analysis that tries to account for the distribution of **[ŋ]** in English by deriving it only as an allophone of some non-velar nasal is not going to be very simple.

Example: Maidu. Data from Maidu (Paul 1967) suggest that nasal place assimilation is happening across word boundaries. Compare the allomorphs of the root for 'big'. This morpheme ends in **[m]** when the root is followed by a vowel, as in **[nem-ɨ]** 'it is big'; and it ends in **[ŋ]** when it is followed by a velar stop or a labial-velar approximant (a fact that supports the claim that labial-velars are essentially velars in at least this language), as in **[neŋ waksi]** 'big crane'. See also the phrase 'all kinds of seeds', which combines **[hadak'am]** 'all kinds' and **[kom]** 'seeds': **[hadak'aŋ kom]**.

17.2.2 *Short exercise: Pangutaran Sama.* Examine the data in append G.34 and propose an analysis for the nasal consonants (setting aside the syllabic nasals). When you have finished, compare your solution with the one given in appendix E.21.

17.3 Formalism

People who formalize a rule such as that in (9) wish to make the formalism at least as simple as the prose rule, of course. This, in fact, was quite a challenge for a long time, and earlier formal accounts of this assimilation rule were clumsy and ultimately judged inadequate.[13] The problem started with the fact that, unlike the simple rules of assimilation we have seen earlier (where one feature, such as [voice] or [nasal], was involved), in this case we have nasals changing in

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[13] See the discussion of this point in Ewen & van der Hulst (2001:3-8, 30-32).

various ways—sometimes becoming bilabial, sometimes labiodental, sometimes alveolar, sometimes velar, etc. We do not review the clumsy and complicated (although sophisticated-looking) rules that were proposed for many years.[14]

The solution to the problem ultimately came in the proposal that distinctive features are organized and not just loosely associated. This proposal is known as **FEATURE GEOMETRY** and has been highly influential.[15] Detailed discussion of the proposal would lead us away from the topic of this chapter at this point, so we defer it until a later time. At this point, we only use a small part of the proposal.

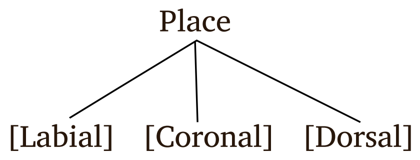
Let us first assume that bilabial and labiodental consonants have the feature [Labial] (meaning that the lower lip is involved in their articulation), that coronal consonants (such as those that are interdental, dental, alveolar, postalveolar, or palatal) have the feature [Coronal] (meaning that the front of the tongue is active in their articulation), and that velar and uvular consonants have the feature [Dorsal] (meaning that the back of the tongue is raised in their articulation).[16] These terms were introduced in §15.1. Part of the table presented there is repeated here.

(13)

Labial		Coronal					Dorsal	
Bilabial	Labio-dental	Inter-dental	Dental	Alveolar	Post-alveolar	Palatal	Velar	Uvular

Next we follow the proposal made in feature geometry that these three features are in fact organized under a single feature **NODE** called “Place”. (Note that labels for nodes of this type are not enclosed in square brackets.)

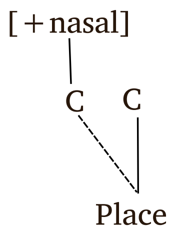
(14)



The diagram in (14) is meant to indicate how the features are organized, and these features have generally been taken as privative features; they are either present or they are not. Under standard proposals, most sounds have only one of these place features.

Once we have this concept in place, the formalization of the Nasal Place Assimilation rule can thus be given simply as shown in (15).

(15)



In rule (15), the first consonant is specified as being a nasal. It says nothing about the place of articulation of that nasal. It is saying that whatever place of articulation that nasal has is irrelevant. (In some language, of course, that place of articulation might matter and the rule would be slightly different; a feature would have to be specified.)

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[14] The rules utilized Greek variables that ensured feature matching, and several features that related to place of articulation. Explanation of these formalisms are found in virtually any textbook of that era, but of course are rarely seen today.

[15] Clements (1985) and Sagey (1986) are important works that inspired a great deal of subsequent work. See the discussion in T. Hall (2007).

[16] The names of these three features are typically capitalized because they are most commonly claimed to be non-terminal nodes; they have other features under them. The feature [round] is often claimed to be organized under the feature [Labial], for example. Discussion of this topic is reserved for later.

Rule (15) says that the nasal consonant receives the values of the place features (those dominated by Place) of the consonant that immediately follows it, whatever consonant that is and whatever place features those are. This quasi-formal rule is a rather elegant and simple way to say precisely what the prose rule says.

17.3.1 *A special mention about generalization and specifics.* It has been a guiding principle in linguistics, and in science generally, that the simpler solution is the better one (the principle of economy). This principle can be kept in mind when rules are formulated (whether in prose or in some notation) as we write descriptions for facts that we see. If, for example, we can accurately say that nasals assimilate to the point of articulation of an immediately following consonant—even without direct evidence to that effect—then we prefer that statement over one that says, for example, that the coronal nasal assimilates to the point of articulation of an immediately following stop. We only want to complicate the rule (by adding more specific conditions) if the facts compel us to do that.

Thus the guiding principle, which we should keep in mind for all future topics, is that we try to state rules as generally as possible, while not making absurd predictions nor predictions that are immediately falsified by the data at hand.

Procedurally one might work in either of the following ways. First, one might start with a very general rule and then only add conditions as absolutely required by the data (or common sense). Second, one might start with a very specific rule and then peel off the conditions on it as much as possible without creating problems with the data. Either way of working requires one to return to the data again and again to verify the validity of the hypothesis. The first method might help us to look for specific data more quickly.

17.3.2 *Short exercise: Allomorphs of a Seri article.* See the data in part 1 of appendix G.5.1. You will notice that the definite article for horizontal position has various allomorphs (when it is written phonetically). Can you spot a reason for this allomorphy? Explain. Is there a way to determine the “basic” or most neutral form of the article? Provide an informal account and also a quasi-formal rule. When you have written out your best answer, see the discussion in appendix E.20.

17.4 Some phonetic detail rules

The phonetic detail rules in (16) are found in the illustrations of languages found in the *Handbook of the IPA*. Some of the rules seem to be too specific, and others seem to be incomplete. It is possible that more general or simpler rules could be proposed for some or all of them. They are included here primarily to give you an idea of how common this kind of nasal place assimilation is, and how similar the facts are from language to language. It is interesting to note that in Hausa, as in many other languages (including Maidu, as noted above), when it comes to nasal place assimilation, the labial-velar approximant behaves as a Dorsal consonant and not as a Labial consonant. This is the kind of evidence that would suggest it is most appropriate to list w in the velar column when it is presented rather than in the bilabial column.

(16) a. Czech: A labiodental nasal can result from the assimilation of the nasal to a labiodental fricative. (Dankovi ová 1999)
b. Czech: A velar nasal results from the assimilation of the nasal to a velar. (Dankovi ová 1999)
c. Dutch: The nasal n is pronounced [ɲ] before j. (Gussenhoven 1999)
d. Hausa: The nasal n is pronounced [ɲ] before j and [ŋ] before velar consonants and before the labial-velar approximant w. (Schuh & Yalwa 1999)
e. Hebrew: The nasal n is pronounced [ɲ] before j and (generally) [ŋ] before velar stops. (Laufer 1999)
f. Hindi: A nasal consonant assimilates to the place of articulation of a following consonant. In some loanwords from Sanskrit this assimilation does not apply. (M. Ohala 1999)
g. Farsi: m is [ɱ] before f v. n is [ŋ] before k ɡ, and postvelar before (postvelar) ɣ. (Majidi & Ternes 1999)
h. Slovene: n is pronounced velar before k ɡ x and [ɱ] before f ʋ. (Šuštaršic & Komar 1999)

In some respects the facts regarding n in Tenango Otomi are quite straightforward. We are told that it has a velar allophone when it precedes k, g, and w.[17] What is interesting is that the velar allophone also occurs before the glottal fricative and the glottal stop, h and ʔ, respectively. These facts are probably not best treated as more examples of assimilation to place of articulation, since glottal consonants are commonly viewed as not having the features that would be relevant, but that is something that actually requires more discussion.

17.5 Suggested additional reading

The literature on feature geometry discusses the advantages of a hierarchical view of features with respect to place assimilation. See Clements (1985), Clements & Hume (1995), and T. Hall (2007).

17.6 Wording

The following examples illustrate acceptable wording for stating generalizations regarding nasal place assimilation in prose descriptions. It is recommended that you use similar wording in write-ups that you may produce. Note how extraneous information (place of articulation, for example) is not mentioned when it is not relevant, and how the statements attempt to make clear the assimilatory nature of the process.

1. A nasal assimilates to the place of articulation of an immediately following consonant.
2. A nasal assimilates to the place of articulation of an immediately following obstruent.
3. A coronal nasal assimilates to the place of articulation of a consonant that immediately precedes it.

17.7 Key terms

Key terms introduced in this chapter are:

1. HOMORGANIC consonants are pronounced at the same place of articulation. (§17.2)
2. NEUTRALIZATION refers to situations in which an existing contrast in a language is not relevant. For example, the important contrast between voiceless and voiced stops in English is NEUTRALIZED when a stop follows s in an onset. In that context only the voiceless stop may occur. The contrast between nasals is often neutralized in certain contexts (they either assimilate to a following consonant or they are pronounced in only one way). (§17.2)
3. The BASIC FORM of a morpheme is the representation of that morpheme by which (in some view of phonology) all non-suppletive allomorphs can be derived through the application of phonological rules. (§17.2)
4. The values of a particular feature may be UNDERSPECIFIED (e.g., not made explicit) in a certain context or even generally, at some level of representation. For example, some propose that the nasal of a word like *lamp* is not specified lexically as being labial, but rather acquires that feature from its context (through Nasal Place Assimilation). (§17.2)
5. DERIVATION: "The mapping of a lexical form onto its correspondent surface form in a series of steps, each defined by a rule" (Roca & Johnson (1999:688). (§17.2)
6. FEATURE GEOMETRY is the approach to the organization of features in which the features are hierarchically arranged under nodes, some features dominating other features. (§17.3)
7. A NODE is part of the architecture of features that is proposed in feature geometry. Some nodes (e.g. Place) are simply labeled. Some nodes (e.g. Labial) are proposed to actually be features themselves. (§17.3)

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[17] Blight & Pike (1976:52-53). For some reason, no mention is made in the description of what happens before the phoneme x, which is also velar. This omission is unfortunate. If the data simply have not been found, that should have been mentioned. Note that this is another case in which the labio-velar approximant acts phonologically like a velar consonant in that the nasal before it becomes a velar. Thus this is another case in which it should appear in the velar column of a phonological chart.

17.8 Reading questions

You can check your answers to these questions in appendix F.17.

1. T/F If a language claims to have **m** as a phoneme, **m** must contrast with all other nasal consonants that may occur in the language.
2. T/F When analyzing nasals it is very important to show contrast of the nasals directly preceding another consonant.
3. T/F Neutralization of contrast occurs when there is an environment in which the distinctive features of a class of sounds are overridden by contextual features making it impossible in that environment to see that there are distinct phonemes of that class.
4. T/F Some linguists propose that when place of articulation assimilates for all nasals one does not need to specify the exact place of articulation of the nasal in the basic form and can indicate the underspecified phoneme with "N".
5. T/F A form may need to pass through more than one phonological rule in a certain order—a derivation—before the phonetic form becomes evident.
6. T/F Feature geometry theory proposes that distinctive features are organized and not just loosely associated.
7. T/F Following feature geometry formalism, the Nasal Place Assimilation rule can be stated that the node [+nasal] spreads to a consonant articulated at any place in the mouth.
8. If you see the following in a phonological write-up, what advice or comment would you give to the consultee? (Choose from the options below.)

   Evidence of contrast between nasal consonants **m, n, ŋ**.
   bambi 'flower'
   bandi 'tree'
   baŋgi 'cloud'

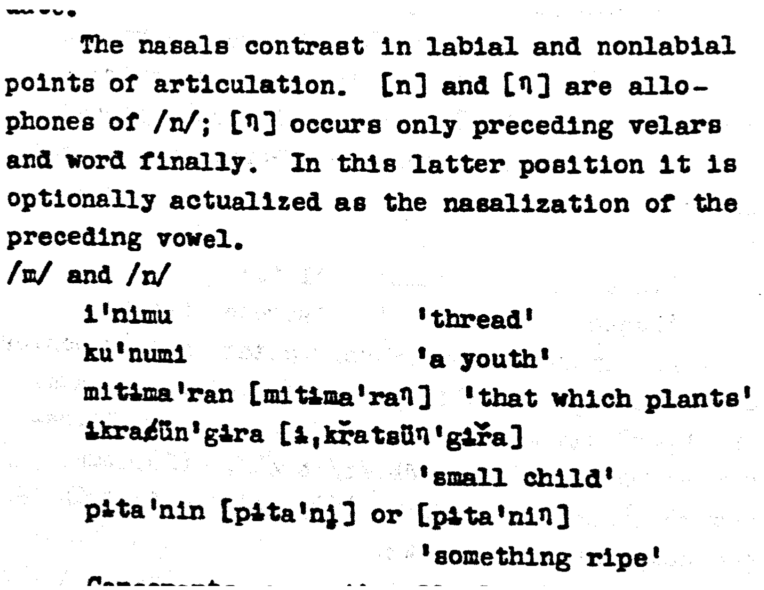
   a. "This is good evidence. That is enough data."
   b. "You are on the right track. Now just look for some word-initial examples."
   c. "You have the right conclusion but the evidence is weak."
   d. "You have not shown contrast between the nasals."
9. If you see the following in a phonological write-up, what advice or comment would you give to the consultee? (Choose from the options below.)

The phoneme **m** has the following allophones: **[m]** before **p**, **b** and vowels; **[ɱ]** before **f** and **v**.
The phoneme n has the following allophones: **[n]** before **t**, **d**, **s**, and vowels; **[ɲ]** before **tʃ** andj; **[ŋ]** before **k** and **g**.

   a. "This is a nice, clear presentation."
   b. "The facts would be better described by a general rule of nasal place assimilation (and the two phonemes already posited)."
   c. "You should probably have only one nasal phoneme."
   d. All of the above.
   e. None of the above.
10. In Feature Geometry, what is the label of the node that dominates [Labial], [Coronal] and [Dorsal]? ________
11. What is one good reason for which a labial-velar approximant is correctly located in the velar column of a consonant chart rather than in the bilabial column?

17.9 Exercises

1. Albanian. Examine the data in appendix G.10.1 and propose an analysis for the nasal consonants seen there. Follow the format suggested in appendix D.4. Provide a quasi-formal representation for any nasal place assimilation process you may observe.
2. Highland Oaxaca Chontal. Examine the data in Part 2 of appendix G.2.1.2 and propose an analysis for the nasal consonants seen there. Follow the format suggested in appendix D.4. Provide a quasi-formal representation for any nasal place assimilation process you may observe.
3. Chumburung. Examine the data in appendix G.30.1 and propose an analysis for any nasal place assimilation process you may observe. Is there a place in the syllable or word where you do not find a contrast? Explain. Follow the format suggested in appendix D.4.
4. Lowland Oaxaca Chontal. Examine the data in appendix G.2.2. Analyze the stops, nasals and voiced fricatives. Follow the format suggested in appendix D.4.
5. Gabri de Darbé. Examine the data in appendix G.27. Analyze the nasals, setting aside for now the final nasal in #1. Discuss the facts.
6. Gor. Examine the data in appendix G.28, setting aside #4 for now. Analyze the nasals for contrast or lack of contrast. What alternative analyses seem to present themselves? Discuss them.
7. Nabak. Examine the data in appendix G.24.1. Analyze the nasals for contrast or lack of contrast. After you have made a proposal, with evidence, examine the distribution of nasals in consonant clusters (both before consonants and following consonants). What phonotactic restrictions appears to exist?
8. Staged exercise: Cocama nasals. Rewrite the description in figure 9 regarding the occurrence of [ŋ] before a consonant using simple prose and a well-chosen example. (Ignore other facts.) You have already seen, and may trust the claim, that there are two phonemic nasals: m and n. Think carefully about what you claim. And take the additional information into consideration (Faust 1978:32) (which is referring to the letters used in the practical orthography: "whenever a suffix beginning with <p> is attached to a word that ends in <n>, ... the <n> becomes <m>."



The nasals contrast in labial and nonlabial points of articulation. [n] and [ŋ] are allophones of /n/; [ŋ] occurs only preceding velars and word finally. In this latter position it is optionally actualized as the nasalization of the preceding vowel.

/m/ and /n/

i'nimu	**'thread'**
ku'numi	**'a youth'**
mitɨma'ran [mitɨma'raŋ]	**'that which plants'**
ɨkraćün'gɨra [ɨ,křatsüŋ'gɨřa]	**'small child'**
pɨta'nin [pɨta'nɨ̨] or [pɨta'niŋ]	**'something ripe'**

Figure 9. Place of articulation of nasals in Cocama (Faust & Pike 1959:18)

18

PLACE OF ARTICULATION: NON-NASAL CONSONANTS

This chapter considers the place of articulation of non-nasal consonants.

18.1 Contrast

Most of the consonants in the languages of the world are pronounced in three regions of the mouth that have been grouped under the three major labels introduced in §15.1: LABIAL, CORONAL and DORSAL. See the characterization of these labels presented there. The table is repeated here.

(1)

Labial		Coronal					Dorsal	
Bilabial	Labio-dental	Inter-dental	Dental	Alveolar	Post-alveolar	Palatal	Velar	Uvular

All spoken languages exploit these general areas of articulation in some way, although not necessarily in the same way, of course. These three labels are meant to include most of the places of articulation that are distinguished in a standard phonetics class, but they do not include all of them. (Glottal and pharyngeal consonants are not included under them, for example.)

It is not uncommon for a language to have at least one stop in each area. The consonant inventory of Seri, for example, includes p t k. English has two stops in each region (voiceless and voiced): p b t d k g.

It is also not uncommon for a language to have at least one fricative in each area. Modern English has no dorsal fricative, however. Arara of Pará is one of the few languages that have no fricative in their inventory of phonemes at all.[1]

It is less common for a language to have nasal phonemes in each area. Spanish has m n ɲ (bilabial, alveolar, palatal). Modern English has m n ŋ.[2] Seri and Capanahua have only m n;[3] the velar nasal that occurs is an allophone in these languages.

Other types of consonants do not typically have members in each area. Affricates, taps and trills are most commonly coronal. The most common approximants are palatal j, bilabial β̞ and labial-velar w. Languages do not commonly (if ever) make a contrast between labial-velar, bilabial, and labio-dental approximants.

18.1.1 *Glottal, pharyngeal, epiglottal.* Besides the consonants that are pronounced in these three major areas, there are also glottal, pharyngeal, and epiglottal consonants. Languages with glottal consonants are not rare, but those with pharyngeal and epiglottal consonants are relatively limited. The languages included in the *Handbook of the IPA* that have phoneme consonants in these regions are shown in table 4.

---

[1] I. Souza (2010). Fricatives do not even occur as allophones in this language.

[2] See discussion of the velar nasal in §17.2.

[3] On Seri, see Marlett, Moreno Herrera & Herrera Astorga (2005). On Capanahua, see Loos (1969).

Glottal	h	Amharic, Arabic, Hong Kong Cantonese, English, Farsi, German, Hausa, Hebrew, Hindi, Hungarian, Irish, Japanese, Korean, Sindhi, Swedish, Taba, Thai, Tukang Besi, Turkish
	ɦ	Czech, Dutch, Igbo
	ʔ	Arabic, Farsi, Hausa, Hebrew, Thai, Tukang Besi
Pharyngeal	ħ	Arabic
	ʕ	(none in the *Handbook of the IPA*)
Epiglottal	ʜ ʢ ʡ	(none in the *Handbook of the IPA*)

Table 4. Languages presented in the Handbook of the IPA having glottal, pharyngeal and epiglottal consonants

Although all of the languages listed in table 4 that have a glottal stop also have a glottal fricative, this is not necessarily the case in all languages. Seri, for example, has a glottal stop and no glottal fricative.[4]

18.1.2 *Labial.* Consonants articulated using the lower lip are considered LABIAL. It is very rarely the case that a language exploits the difference between bilabial consonants and labiodental consonants. Labial stops are always basically bilabial (it is not easy to articulate a labiodental stop). Labial fricatives are generally either bilabial or labiodental, or there may be allophonic variation between them, or there may be dialectal variation. English and Spanish have a labiodental fricative f. Most speakers of Seri (apparently) use a bilabial fricative ɸ, although some have a labiodental fricative instead. (The phoneme is labial, fricative, and voiceless; it is not *distinctively* bilabial nor labiodental.) Many languages have the labial-velar approximant w or the bilabial approximant β̞ (although the latter has sometimes been misreported as v or β).[5]

Since the phonetic difference between the bilabial and labiodental places of articulation is not exploited phonologically, phonological theory has made the claim that the feature [Labial] is sufficient for phonological purposes.[6] Despite this fact, however, presentations of the phonology of a language using the format of the illustrations of the IPA utilize both columns in the phonetic chart. This is true for other places of articulation mentioned below; in the IPA tradition it is considered appropriate to be very clear about the actual phonetics of the language.

18.1.2.1 *Short exercise: Tainae fricatives.* Take a couple of minutes to examine the voiceless labiodental and bilabial fricatives in the Tainae data in appendix G.22.2 (that is, part 2). Do they contrast phonemically? How would you describe these facts? When you have finished, compare your answer with the one given in appendix E.41.

18.1.3 *Coronal.* Consonants articulated with the front of the tongue (rather than the back) are considered CORONAL. All languages include at least one coronal consonant, generally either dental or alveolar. Very few languages exploit a contrast between dental and alveolar places of articulation, but such a contrast has been found in different parts of the world. An interdental consonant is also classified as a coronal sound.

Some languages make a difference between a dental or alveolar consonant and a postalveolar one. Since a postalveolar stop is more difficult to articulate without some friction, one commonly finds affricates rather than stops at this place of articulation. English contrasts alveolar stops and postalveolar affricates (both voiceless and voiced).

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[4] See Marlett, Moreno Herrera & Herrera Astorga (2005).

[5] Note the "lowering sign" diacritic under the last symbol; this indicates in this case that the sound is not a fricative but rather an approximant. See IPA (1999:16, 19, 25, 182); it is explained that the symbol is interpreted to mean that the diacritic indicates that there is less closure.

[6] As a matter of fact, there has been no rush to try to figure out how to distinguish them by features at all. Although proposals have been made, T. Hall (2007:323) points out that "it is not clear what feature distinguishes bilabials vs. labiodentals."

(2)

	Initial		Final	
t	tin	*tin*	bæt	*bat*
d	din	*din*	bæd	*bad*
tʃ	tʃin	*chin*	bætʃ	*batch*
dʒ	dʒin	*gin*	bædʒ	*badge*

Modern non-Castilian Spanish has only one coronal fricative (except in loanwords, primarily from indigenous languages of the Americas). As expected, it is voiceless. Example: ˈsapo ‘toad’.

English has a robust contrast between two alveolar fricatives and one postalveolar fricative (voiceless). It also uses a voiced postalveolar fricative in many words, but the distribution is skewed because ʒ is hardly attested in initial position. (How many more words like *genre*, with an initial ʒ, can you think of?)

(3)

	Initial		Final		Medial, intervocalic	
s	sip	*sip*	liːs	*lease*	ˈkæsəl	*castle*
z	zip	*zip*	pliːz	*please*	ˈdɹizəl	*drizzle*
ʃ	ʃip	*ship*	kæʃ	*cash*	ˈspɛʃəl	*special*
ʒ	ʒanɹə	*genre*	beːʒ	*beige*	ˈmɛʒəɹ	*measure*

In some languages a contrast is made that exploits the part of the tongue that is used more than the place on the roof of the mouth where it touches. Thus there are cases where a contrast is made between an apical articulation (using the tongue tip) and a laminal articulation (using the tongue blade). Some languages also use retroflex articulations. (The latter is considered a place of articulation in the IPA system. Some linguists prefer to see retroflexion as a tongue shape rather than a place in the mouth.)

The general consensus in phonological theory has been that it is possible and desirable to have one feature cover all of the places of articulation mentioned in this section: interdental, dental, alveolar, postalveolar, retroflex, and palatal. Given the various kinds of contrasts that can be made in the coronal region, however, coronal sounds will need to be distinguished using more features. Discussion of what features exactly can be or should be used to make these distinctions is postponed until later.

18.1.3.1 *Short exercise: English sibilants.* Keeping in mind the data shown in (3), now look at the data in (4).

(4)

a.	[ʃɹiʲk]	*shriek*
b.	[ʃɹɪl]	*shrill*
c.	[ʃɹɪmp]	*shrimp*
d.	[ʃɹɛd]	*shred*
e.	[ʃɹawd]	*shroud*
f.	[ʃɹɜb]	*shrub*
g.	[ʃɹɜg]	*shrug*
h.	[sɹ...]	(no words or syllables like this)
i.	[slɪp]	*slip*
j.	[slæp]	*slap*
k.	[sliʲp]	*sleep*
l.	[slɜm]	*slum*
m.	[sloʷp]	*slope*
n.	[ʃl...]	(no words or syllables like this)

Do the facts (taken together) suggest that [s] and [ʃ] are separate phonemes or not? Explain. What are abstract representations of examples (4f) and (4l) (think of two for each) might you propose and why? (You should review the discussion in §17.2.) When you have written out your answer, see the discussion in appendix E.23.

18.1.4 *Dorsal.* Consonants articulated with the back of the tongue are considered DORSAL. It is common to find consonants in the velar region. In some languages we also find uvular consonants.

Quechuan languages are among those that distinguish between velar and uvular stops. Seri distinguishes between velar and uvular fricatives.

Since languages may contrast one or two places of articulation in this region, the feature Dorsal in and of itself is not sufficient. It is commonly claimed that velars are [+high] while uvulars are [-high].

(5) [HIGH]: “High sounds are produced by raising the body of the tongue above the level that it occupies in the neutral position; nonhigh sounds are produced without such a raising of the tongue body.” (Chomsky & Halle 1968:304).[7]

18.2 Allophones

18.2.1 *Labial.* As mentioned above in §18.1.2, it is possible to find dialectal and idiolectal variation between bilabial and labiodental fricatives.

(6) Sample prose statement: The labial fricative is generally bilabial but is labiodental in the dialect spoken by people who are more proficient in the national language and use it more.

It is also common to find the labial-velar approximant [w] and the bilabial approximant [β̞] as allophones, the former especially common before back vowels and the latter before front vowels.

(7) Sample prose statement: The labial approximant is bilabial before front vowels and labial-velar before back vowels: wito [ˈβ̞ito] ‘tree’, wata [ˈwata] ‘sky’.

18.2.2 *Coronal.* A coronal consonant may change its precise place of articulation under the influence of a vowel or another consonant in the context.

A very common and obvious change is for a consonant to become postalveolar in the environment of a close front vowel or a palatal approximant. This process has been called PALATALIZATION.

(8) Sample prose statement: The coronal fricative, which is generally alveolar, is postalveolar when immediately preceding close front vowels: sami [sami] ‘bread’, sima [ʃima] ‘land’.

Another example: in the idiolects of a few speakers of Spanish (as we have personally observed), the phoneme s tends to be pronounced [ʃ] before the approximant j, as in the word biˈsjon *visión* ‘vision’. (Spanish does not have the phoneme ʃ in native words.) For most speakers this is pronounced [biˈsjon], but in the idiolects in view here it is pronounced [biˈʃjon].

The same kind of change occurs in American English in casual speech. The fricatives s and z become postalveolar, and the stops t and d become postalveolar affricates, when they precede the approximant j. Examples include:

---

[7] While the accepted definition for this feature has not changed in the least during the last few decades, it is now claimed to be relevant only for consonants that are dorsal (as well as for vowels). This was not always the case. So earlier work had ʃ as being [+high], but that is not possible now since ʃ is Coronal and not Dorsal. This means, among other things, that within current theories the feature [high] cannot be relevant for describing palatalization (see §19.1.2).

(9)

	Careful	Casual
I'll miss you.	[aɪlˠ mɪs juʷ]	[aɪlˠ mɪʃ jə]
As you leave, . . .	[æz juʷ liʲv]	[æʒ juʷ liʲv]
What you saw was . . .	[wat juʷ sɔː waz]	[watʃ jə sɔː wəz]
Did you find it?	[dɪd juʷ faɪnd ɪt]	[dɪdʒ jə faɪnd ɪt]

In English it is also common to hear a postalveolar affricate instead of an alveolar stop when it precedes ɹ.[8]

(10)

	Careful	Casual
truck	[tɹʒk]	[tʃɹʒk]
drink	[dɹɪŋk]	[dʒɹɪŋk]

While it is perhaps most common to find **REGRESSIVE** or **ANTICIPATORY PALATALIZATION** (the tongue is anticipating the position that it will be in for the close front vowel that follows the consonant), as in the preceding examples, some languages have examples of **PROGRESSIVE PALATALIZATION** where the close front vowel precedes the consonant that it affects.

It should also be remembered that a voiced dental stop can have an approximant allophone, which is interdental. (This change of place of articulation is a side-effect of the introduction of the feature [+continuant] in those languages. See §15.2.)

18.2.2.1 *Short exercise: Cashinahua sibilants.* Examine the data in appendix G.11 for the sounds [ʂ] and [ʃ]—there are not many words to look at and you will need to just do the best with what you find there. What kind of analysis do the data seem to point toward? When you have written down something, see the discussion in appendix E.24.

18.2.3 *Dorsal.* It is very common for a velar consonant to have pre-velar allophones when the consonant precedes a close front vowel, as in English kiː *key* [ˈk̟ʰij] and Spanish kiso *quiso* 'she wanted' [ˈk̟iso]. Sample prose statement:

(11) The dorsal obstruents k and x are fronted when they immediately precede a front vowel: kiːpɛ [ˈk̟iːpɛ] 'good', xiːmɛ [ˈx̟iːmɛ] 'sardine'.

It is also possible for a velar consonant to have a uvular (or a backed velar — not quite so far back) allophone in the environment of a back vowel. In Castilian Spanish, the dorsal fricative can be pronounced uvular when it precedes a back vowel: xunjo *junio* 'June' [ˈxunjo] ∼ [ˈχunjo].

In fact, fronting and backing of a dorsal consonant depending on an adjacent (typically tautosyllabic) vowel is extremely common. Sometimes such facts are considered so minor that often they are not even mentioned in a language description. But they certainly can be. See IPA (1999:28) for the use of subscript plus and subscript underbar.

18.2.4 *Glottal.* One of the key facts about glottal stop to consider is whether it is actually a consonant in the language or not. It may be a sound that is inserted phonetically under certain conditions, such as before a vowel at the beginning of an utterance, or after a vowel at the end of an utterance. See §24.1.3.

A glottal stop may also be an allophone of another stop. This situation is sometimes referred to as **DEBUCCALIZATION**. The place features of the stop are eliminated and the bare consonant remains—a voiceless glottal stop. This is true in some dialects of English where a t is often a glottal stop in syllable-final position. Thus the sentence *Hit me!* can be pronounced either [ˈhɪt miː] or [ˈhɪʔ miː], the latter without any movement of the tongue to the alveolar ridge.

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[8] Children hear this so clearly that reportedly they write the t in these words as *ch* in early stages of writing.

Some speakers of Hixkaryana pronounce non-labial stops as glottal stops when they precede a nasal. Thus **koseɲetnɔ** ‘I dreamt’ can be pronounced as **[kɔseːɲitnɔ]** by some people and as **[kɔseːɲiʔnɔ]** by others. And **nækɲɔhnɔ** ‘he burnt it’ can be pronounced as **[nækɲɔhnɔ]** or as **[næʔɲɔhnɔ]**.[9]

A glottal fricative may also be an allophone of another fricative. In some varieties of Spanish, the fricative **s** debuccalizes to **[h]** in syllable codas.

Some of the literature clarifies that **h** is actually a voiceless version of the tautosyllabic vowel that it precedes or follows. This level of detail is often omitted in descriptions because it is usually seems unnecessary. If there is something more unusual in how **h** is pronounced, however, the detail would be important to include.

18.2.5 *Summary of features that help fine-tune the place features.* Figure 10 summarizes some of the facts discussed in this chapter regarding place features for some common places of articulation. It also adds some features that have not been mentioned, including **[ANTERIOR]**, **[DISTRIBUTED]**, and **[STRIDENT]**. These are given succinctly in (12)-(14). The feature [round] is discussed in chapter §19.

(12) [anterior]: sounds pronounced at or in front of the alveolar ridge are [+anterior].[10]

(13) [distributed]: sounds pronounced with “a constriction formed by the tongue front that extends for a considerable distance along the direction of airflow” are [+distributed] and those pronounced with “a constriction formed by the tongue front that extends only for a short distance along the direction of air flow” are [–distributed].[11]

(14) [strident]: sounds that “are marked acoustically by greater noisiness than their nonstrident counterparts” (Chomsky & Halle 1968:329) are [+strident].[12]

See T. Hall (2007:324-326) for a summary discussion of some of the complications regarding these features. The chart in figure 10 follows Hall’s presentation. Note that palatals are classified as Coronals in this chart, which appears to be a general consensus and a departure from some earlier claims. Nevertheless this chart oversimplifies in some ways.

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[9] Derbyshire (1979:180).

[10] In recent work, this feature is used only for Coronal sounds.

[11] Sagey (1986:278), quoted in T. Hall (2007:325). In recent work, this feature is used only for Coronal sounds.

[12] In some recent work, this feature is used only for Coronal sounds. In the past it also was used distinguish bilabial (non-strident) from labiodental (strident) fricatives.

<table>
<tr><th colspan="2">[Labial]</th><th colspan="5">[Coronal]</th><th colspan="5">[Dorsal]</th></tr>
<tr><th>Bilabial</th><th>Labiodental</th><th>Dental</th><th>Alveolar</th><th>Postalveolar</th><th>Retroflex</th><th>Palatal</th><th colspan="3">Velar</th><th colspan="2">Uvular</th></tr>
<tr><th colspan="2"></th><th></th><th></th><th></th><th></th><th></th><th>Plain</th><th>Palatalized</th><th>Labialized</th><th>Plain</th><th>Labialized</th></tr>
<tr><td colspan="2">[high]</td><td></td><td></td><td></td><td></td><td></td><td>+</td><td>+</td><td>+</td><td>–</td><td>–</td></tr>
<tr><td colspan="2">[anterior]</td><td>+</td><td>+</td><td>–</td><td>–</td><td>–</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">[distributed]</td><td>+</td><td>–</td><td>+</td><td>–</td><td>+</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">[round]</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>+</td><td></td><td>+</td></tr>
<tr><td colspan="2">[strident]</td><td>θ –
s̪ +</td><td>s +</td><td>ʃ +</td><td>ʂ +</td><td>ç –</td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

Note 1: It is uncertain what feature should distinguish bilabial and labiodental.
Note 2: The Dental column is meant to include Interdental as well.

Figure 10. Use of certain features for fine-tuning the place of articulation of consonants

18.2.6 *Some phonetic detail rules.* The following phonetic detail rules are found in descriptions of languages found in the *Handbook of the IPA* and elsewhere (where noted). There may be ways in which these prose statements should be improved.

(15) a. Farsi: **v** is **[w]** after **o**. (Majidi & Ternes 1999)
b. Hungarian: **h** is **[ç]** in syllable-final position after front vowels and **[x]** in word-final position after back rounded vowels. (Szende 1999)
c. Korean: **h** is **[ç]** before **i** and **[j]**, and **[x]** before **ɯ**. (Lee 1999)
d. Yine: The consonant **w** is an unrounded bilabial approximant before a close front vowel: **wiwi** **[ˈβiβi]** 'relative (vocative)'. (Urquía Sebastián & Marlett 2008)

An interesting situation arises in Seri that is borderline on how it might be treated. When a verb that begins with **p** is inflected with the prefix **kʷ**, the **p** assimilates (for some speakers) to the **kʷ**, the result being a long labial-velar stop. The facts are illustrated in (16).[13]

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[13] In current spelling practice in the Seri language, the **p** is written as <p> in this situation. This does require some teaching because a **k** also assimilates to **kʷ**, with the result that there is sometimes phonetic ambiguity: **[kʷːaˈtikpan]** could be **kʷpatikpan** or it could be **kʷkatikpan** since both of these phonemic forms gives the same phonetic output. It does not require very much instruction to see understand how and why to write the forms as *cöpaticpan* and *cöcaticpan*, respectively.

(16) a. [poˈpanʃχ]‘if she will run’
b. [kʷpoˈpanʃχ] (some speakers) ∼ [kʷːoˈpanʃχ] (other speakers) ‘if she will run like himherit’

18.3 Key terms

Key terms introduced in this chapter are:

1. [+ HIGH]: the tongue body is raised above neutral position. (§18.1.4)
2. PALATALIZATION: In this chapter we refer to (non-secondary) palatalization, which is the shift to a postalveolar place of articulation from a different one (which might be alveolar or velar). (§18.2.2)
3. REGRESSIVE (a.k.a. ANTICIPATORY) PALATALIZATION: If the influencing environment for palatalization *follows* the consonant that palatalizes, the palatalization is said to be regressive (or anticipatory). (§18.2.2)
4. PROGRESSIVE PALATALIZATION: If the influencing environment for palatalization *precedes* the consonant that palatalizes, the palatalization is said to be progressive. (§18.2.2)
5. DEBUCCALIZATION refers to the “suppression of the supraglottal articulation” that results in a glottal stop or fricative (Kenstowicz 1994:159). (§18.2.4)
6. [+ ANTERIOR] describes (coronal) sounds pronounced at or in front of the alveolar ridge. (§18.2.5)
7. [+ DISTRIBUTED] describes (coronal) sounds “produced with a constriction that extends a considerable distance parallel to the direction of airflow” (Kenstowicz 1994:159). (§18.2.5)
8. [+ STRIDENT] describes (perhaps only coronal) sounds that are characterized by greater noisiness. (§18.2.5)

See chapter §15 for Labial, Coronal, and Dorsal.

18.4 Wording

The following examples illustrate acceptable wording for stating generalizations regarding place assimilation in prose descriptions. It is recommended that you use similar wording in write-ups that you may produce. In various cases it is difficult to make clear the assimilatory nature of the process using simple terminology.

1. Velar consonants are fronted slightly when they precede a front vowel.
2. Velar consonants are fronted slightly when they occur with a tautosyllabic front vowel.
3. Velar consonants are backed slightly when they occur with a tautosyllabic back vowel.
4. A coronal sibilant is postalveolar when it precedes a high front vowel.
5. A labial-velar approximant is realized as a bilabial approximant when it precedes a front vowel.

18.5 Reading questions

You can check your answers to these questions in appendix F.18.

1. T/F Most of the consonants in the world are pronounced in three major regions of the mouth that have been grouped as labial, alveolar and velar.
2. T/F Three groups of rarer consonants are glottal, pharyngeal and epiglottal.
3. T/F Labiodental fricatives and bilabial fricatives contrast with each other in a large number of languages.
4. T/F Within the coronal group very few languages exploit a contrast between alveolar and postalveolar places of articulation.
5. T/F One uses the tongue blade when articulating an apical sound.
6. T/F The following are all dorsal sounds: k, x, dʒ.
7. T/F [w] and [β̞] are quite commonly allophones.

8. T/F It is common to see a consonant pronounced differently in the context of a close front vowel (or its non-syllabic equivalent, the palatal approximant).
9. T/F *Got you!* pronounced as [gatʃ jə] is an example of palatalization in casual speech.
10. T/F When a consonant palatalizes due to a close front vowel that precedes it, the process is referred to as progressive palatalization.
11. What place of articulation is quite close to the dental place of articulation and rarely contrasts with dental? (That is, a language is likely to not have contrastive stops or contrastive fricatives at both dental and ____________________ places of articulation?)
12. The labiodental approximant (sometimes carelessly transcribed as β or even v) is quite commonly an allophone of what sound?
13. What feature is claimed to be relevant for distinguishing between an interdental fricative like θ and a dental sibilant?
14. What is the articulator node (feature, label) to which consonants such as the following are assigned for their place of articulation in distinctive feature theory? θ t d tʃ s ʃ n ____________________
15. T/F The bilabial approximant [β̞] is commonly an allophone of the interdental approximant [ð̞].
16. If you see the following in a phonological write-up, what advice or comment would you give to the consultee? (Choose from the options below.)

    Evidence of contrast between the stop d and the affricate dʒ.
    dabi 'cloud', **pado** 'sun'
    dʒiba 'rain', **padʒi** 'tree'

    a. "This is a nice, clear presentation."
    b. "You should consider the possibility of palatalization before close front vowels. You should present better evidence."
    c. "You should consider the possibility of velarization before central and back vowels. You should present better evidence."
    d. "The lack of evidence from verbs is problematic."
17. Why is the following evidence inadequate to show contrast between [s] and [ʃ]? Data: [ˈsahap] 'leaf', [ˈʃihap] 'fish'.

18.6 Exercises

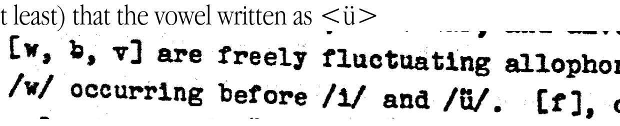
1. Seri. Examine the data in appendix G.5.4 and propose an analysis for the labial fricatives seen there. Follow the format suggested in appendix D.4. If you would like to know more information about the two speakers, what would that be?
2. Weighty assignment: Nabak. (a) Examine the data in appendix G.24.1 and propose an analysis for all of the consonants seen there (viz., everything not written with vowel symbols—the vowels are not sufficiently represented here for analysis). Follow the format suggested in appendix D.4. Show the contrasts in three positions (word-initial, intervocalic, word-final). (b) Give a very concise discussion of the syllable structure using what you have learned from previous chapters. (c) Discuss something about phonotactics with respect to what consonants occur in syllable-final position.
3. Daga. Examine the data in appendix G.14 and propose an analysis for the following consonants seen there: [β w v]. Follow the format suggested in appendix D.4.
4. Korean. Examine the data in appendix G.18.3 and propose an analysis for the sibilants [s] and [ʃ]. Present the results in the same way that you usually do (following the format suggested in appendix D.4).

5. Tetelcingo Nahuatl. Examine the data in appendix G.26 and propose an analysis for all of the bilabial and labial-velar sounds, excluding [m]. Write up the results (following the format suggested in appendix D.4). Note: you may need to reconsider how the sequence [kw] is transcribed in the data. If you do, explain why and be sure to reconsider how and what you present as phonemes.

   You may find it helpful for this exercise—and as a general practice—to set up a table of the sounds and the features that are used to distinguish them from each other, such as the following. If these particular features are not helpful, look for ones that are—especially given the contexts in which the various sounds appear.

β̞	β̞̊	w	w̥	b	
					[voice]
					[Dorsal]
					[continuant]

6. Tainae. Examine the data in appendix G.22.1 and come up with (and write up in the usual way) your own analysis of [w], [v] and [β] before continuing.
   Carlson's analysis: [w] is actually u that is linked to an onset position of the syllable. There is no phoneme v. He adds: "It is not necessarily the case that [v] must have full status as a phonological segment, even though it cannot be predicted in all cases. If it can be shown that at least some surface forms of [v] are derived from underlying u, then it does not matter if the presence of [v] can be totally predicted by those who would not normally use it" (Carlson 1988:35). He presents an optional rule that essentially says that "w" (which is really a u, he says, but that is a minor detail) becomes [v] intervocalically. But the optional rule is further constrained by the following statement: "Since there is no way to predict it on the surface, the feature which restricts application of rule of ["v" substitution] would need to be marked on the individual forms at the lexical level" (Carlson 1988:36-37).
   Instructions: Compare your analysis with Carlson's, and discuss briefly the differences between the two (if any). Is there any reason to choose one over the other?
7. Pangutaran Sama. Examine the data in appendix G.34 and analyze the two lateral phones that are found there: [l] and retroflex [ɭ].
8. Staged exercise: Cocama. Rewrite the description in figure 13 from Faust & Pike (1959) in a way that uses IPA symbols and simple prose wording, with examples. Assume (for now, at least) that the vowel written as <ü> in this description is the close front rounded vowel.



[w, b, v] are freely fluctuating allopho

/w/ occurring before /i/ and /ü/. [f], c

Figure 11. The labial-velar approximant in Cocama (Faust & P

9. Madija. Examine the data in appendix G.15.2 and propose an analysis for the following consonants seen there: [p p^h b β̞ w]. Follow the format suggested in appendix D.4.

19

SECONDARY LABIALIZATION, PALATALIZATION OR VELARIZATION

Before reading this chapter, take a careful look at the data in appendix G.5.9 so that you can appreciate the presentation that follows. Try to give an analysis, and then continue reading this chapter.

19.1 Contrast

In many languages there are consonants with a secondary characteristic of labialization, palatalization, or velarization that is distinctive. A secondary articulation is an approximant-like articulation of a lesser degree that accompanies a primary articulation of a higher degree.[1] Secondary palatalization is sharply distinguished here from situations in which the place of articulation is different. A change from [s] to [ʃ] is palatalization. A change from [s] to [sʲ] involves secondary palatalization.

19.1.1 *Secondary labialization.* Labialization is "the addition of a lip rounding gesture".[2] In some languages this is a distinctive feature, and it is typically also accompanied by velarization (raising of the back of the tongue). The most common labialized consonants cross-linguistically are dorsal.

For example, in Seri a labialized voiceless velar stop contrasts with the simple voiceless velar stop. The words in (1) show this contrast in final position.

(1)	k	ˈkpok	'what falls down'	ˈkʔak	'who is blind'
	kʷ	ˈʔokʷ	'sawn wood'	iˈtakʷ	'did sheit kill ithimher?'

The contrast is not easy to perceive before pause, but the difference is very important in the language, and the labialization is very apparent when the labialized consonant precedes a vowel.

(2)	k	ˈkpok iʔa	'it is falling down'
	kʷ	ˈʔokʷ iʔa	'it is sawn wood'

Seri has two labialized fricatives: xʷ (in contrast with x) and χʷ (in contrast with χ).

Some other languages in which there are labialized velar consonants are: Amharic, Hong Kong Cantonese, Hausa, and Igbo (see the illustrations in the *Handbook of the IPA*).

It has been claimed that some languages have entire series of labialized consonants, such as pʷ, tʷ, sʷ, etc. But many languages have only labialized velar consonants if they have any at all.

A traditional claim has been that labialized consonants have the distinctive feature [ROUND], although this is not the only possible analysis.

(3) [+round]: "Round sounds are made with rounding and protrusion (usually) of the lips caused primarily by constriction of the orbicularis oris muscle."[3]

One issue that is involved with this is the place of this feature [round] in the system if one assumes feature geometry. If [round] is dependent on the node [Labial], then a labialized velar must have two Place nodes activated:

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[1] Ladefoged & Maddieson (1996:354-368). Other secondary articulations that are much less common are also discussed in that work.

[2] Ladefoged & Maddieson (1996:356).

[3] Anderson (1974:299).

both [Labial] and [Dorsal]. But this might seem to imply that both are equivalent, which does not seem to be true. For this reason, some people working in feature geometry have proposed ways in which consonants with secondary articulations have an additional (subordinate) node that licenses additional features.[4]

19.1.2 *Secondary palatalization.* Some languages have palatalized consonants that contrast with simple consonants. These include Russian, Hausa (**kʲ**, **gʲ**) and Irish (in opposition to velarized consonants).

There has been some debate about the correct distinctive feature for palatalized consonants. The feature [+high] has commonly been used in the past—see §18.1.4—but in itself this feature does not distinguish between "plain" velar consonants and velar consonants with secondary palatalization. It is also unavailable (in current frameworks) to sounds that do not have a Dorsal node.[5]

19.1.2.1 *Short exercise: Salasaca Quichua.* Examine the data in appendix G.16.3.3, recalling that you came up with a [CVC]$_{\text{max}}$ template for the data in G.16.3.1 if you did the exercise in appendix M and propose an analysis for what is transcribed impressionistically as **[kw]**, **[kʰw]**, and **[tʰj]**. When you have jotted down your ideas, and reasons for making the decisions you did, see the discussion in appendix E.22.

19.1.3 *Secondary velarization.* Velarized consonants are also found as phonemes, although this secondary modification is less common than those previously discussed.[6] Irish is one language that is claimed to have velarized consonants, typically in opposition with palatalized consonants.[7]

Velarized consonants were once said to have the feature [+high] (see §19.1.2) and also the feature [+back], where "back sounds are made with the tongue body retracted (and slightly raised) from the neutral position for speech." But be aware that this claim is called into question by work that restricts the feature [high] to the Dorsal node.[8] It has also been suggested, within certain approaches to features, that the feature [Dorsal] is adequate for describing these sounds.

19.2 Allophones and phonetic details

Secondary articulations may not be distinctive. The phonemes **ʃ** and **ɹ** of English are typically articulated with liprounding (without velarization or off-gliding), but the rounding is not considered distinctive.

Several consonants in Guerrero Amuzgo are claimed to be typically velarized—not necessarily in opposition to other consonants, but as a basic phonetic correlate of the consonants (Bauernschmidt 1965).

In many languages certain consonants tend to be pronounced with a degree of secondary palatalization when they precede a front vowel or a palatal approximant.

For example, in Tataltepec Chatino the velar stop **k** is pronounced with a palatal off-glide when it precedes the vowel **e**: **keː** **[kʲeː]** (or perhaps better, **[cʲeː]**) 'head'.[9] The **k** is almost certainly palatal before **i** as well, but the secondary palatalization is not heard in that situation. Similar facts are commonly found in other languages of the region.

It is also very natural to round the lips when pronouncing a consonant before a round vowel, as in *tone* and *cone*. This rounding has also been called labialization, but it is important to distinguish it phonetically from the

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[4] See the discussion of two proposals in Clements & Hume (1995:284-288).

[5] Anderson (1974:300). T. Hall (2007:328) states: "Another unresolved question is the correct representation of secondarily palatalized segments.... According to Sagey (1986:216ff) palatalized segments consist of the articulator node representing the primary place plus [DORSAL, –back] ...." Hall also points to work that presents alternative approaches, but obviously the issue is not resolved.

[6] Ladefoged & Maddieson (1996:361). The IPA convention for representing velarization has changed in recent years. Whereas it used to be indicated by a superimposed tilde (see IPA (1999:25, 182)), it is now shown by a superscript gamma after the consonant.

[7] See Ní Chasaide (1999).

[8] Anderson (1974:300).

[9] Leslie Pride, personal communication.

secondary labialization that is heard as a transition between the consonant and the vowel. There is no special diacritic to indicate this lip-rounding in the IPA system. Ladefoged & Maddieson (1996:358) utilize a subscript w, written *under* the consonant, to represent it. Likewise, the feature [round] does not distinguish between simple lip rounding (like what happens for many speakers when they pronounce the syllable [ku]—the lips are rounded when the [k] is pronounced) and the off-glide type of labialization. Since both symbols and formal features inadequately express the exact facts, a good description should include a clear prose statement to convey the information. And even if the problem of symbols and features were resolved right now, the descriptive prose will be helpful for years to come.

In some languages, consonants are velarized in certain positions (especially in the rime of the syllable).[10] The velarization of the l of English is very characteristic of the language, and especially notable in the coda. See words like tɔːl [tʰɔːlˠ] *tall* and silt [sɪlˠt] *silt*.

With respect to this process in English, we can see evidence from allomorphy (see the discussion in §14.2) that would have made us consider the possibility of relating [l] and [lˠ]. Consider the words [majlˠ] *mile* and [majlədʒ] *mileage*, and [fɪlˠ] *fill* and [fɪlɪŋ] *filling*. It is reasonable to consider how the variation in the roots between these words is to be accounted for. This would lead us to look at the contexts in which [l] and [lˠ] occur, and this in turn would lead us to at least consider the possibility of relating these sounds as allophones of one phoneme.

19.2.1 *Short exercise: Seri.* See the data in appendix G.5.5. You may assume (correctly) that Seri has labialized velar consonants that are phonemes, as indicated in §19.1.1. Notice what automatically happens when words occur in phrases, however. How do you describe this by rule? Give both a precise prose rule and a quasi-formal rule. (These facts have implications for how words might be written in the practical orthography. You might think about this point as well.) When you have written down something, see the discussion in appendix E.25.

19.2.2 *Some phonetic detail rules.* Some of the languages illustrated in the *Handbook of the IPA* have allophones with secondary articulations.

(4) a. Taba: t is slightly palatalized when it precedes i. (Bowden & Hajek 1999)
[This wording may be a bit ambiguous. A narrow transcription would help here.]
b. Bulgarian: l is velarized when it precedes central and back vowels. (Ternes & Vladimirova-Buhtz 1999)

19.3 Sequences of consonants

If we compare words like *kick* and *quick* in English, or *canto* 'I sing' and *cuánto* 'how much' in Spanish, we might think that we have evidence that contrasts two phonemes k and kʷ. After all, we might have written them as [kʰɪk], [kʰʷɪk] and [ˈkanto], [ˈkʷanto], respectively. While such analyses are good initial guesses, there are reasons for claiming that they are *not* the correct analyses for either of these languages. The lessons that we learn from these cases are important ones for other situations as well. They show that what may appear to be simple and straightforward examples of contrast—minimal pairs, even—are not what they appear to be. We always need to be aware of the implications of the analysis for the system as a whole.

In Spanish we can see that we commonly find complex syllable nuclei—diphthongs—of which one element is a sound that we transcribe here as an approximant (either j or w). There are words such as *pues* pwes 'then', analyzed as p (onset) followed by we (nucleus) followed by s (coda), and *pies* pjes 'feet', analyzed similarly as having a simple onset and a complex nucleus. Spanish has alternations between simple syllable nuclei and complex nuclei, as in *costar* kosˈtaɾ ('to cost') vs. *cuesta* ˈkwesta ('it costs'), and *pensar* penˈsaɾ('to think') vs. *pienso* ˈpjenso ('I think'). Since the alternative analysis with a diphthong is well motivated, it is not necessary nor recommended to

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[10] Ladefoged & Maddieson (1996:360-361) point out that for some speakers of American English, the lateral approximant is velarized in all positions.

posit a phoneme k^w for Spanish. The word *cuanto* is therefore transcribed phonemically as kwanto.[11] And if that is the correct analysis, then we would probably want to revise our impressionistic phonetic transcription to reflect it: [ˈkwanto] rather than [ˈk^wanto].

The situation for English is different, but it is still possible to avoid positing the phoneme k^w. English has various types of complex syllable onsets (beside having some diphthongs as well). The onset can be C+ɹ, as in *prick*, *trip* and *crypt*, or C+l, as in *play* and *clay*, or C+j, as in *puke* and *cute* (unless you take this as a complex nucleus), or C+w, as in *twin* and *swim*. Thus it is possible that what is heard impressionistically (or naïvely) as [k^w] is really just kw. We do not need to nor want to add another phoneme k^w for English in this case.

If k^w were a phoneme of English, we might expect to find it in all of the positions in which k is found, such as in word-final position. The fact that we do not find it there in English would be a problem for the k^w analysis. (It would not make it automatically wrong, however.) But the complex onset analysis permits a direct explanation. We do not find kw in word-final position because we do not have codas that have a sequence obstruent-sonorant: pl, tj and kɹ are also disallowed. (See also the discussion of such facts in chapter §8.)

Although we have argued here that Spanish and English do not have labialized consonants, there are other languages in which one cannot argue in this way, and the labialized (or palatalized) consonants have a distribution that is similar to (although perhaps not identical to) that of simple consonants.

19.4 Key terms and ideas

The key term introduced in this chapter was the feature [ROUND] (§19.1.1).

A distinction was made between simple palatalization (involving a change in place of articulation) and secondary palatalization (involving a characteristic that is added to a sound). Other secondary characteristics of labialization and velarization were also presented. It is obvious from the discussion of the formalization of these characteristics within feature theory that there have been many changes and various challenges that have not been resolved yet.

Now you should read the discussion of the data presented in appendix G.5.9 that you examined when you began this chapter. The discussion is given in appendix E.37.

19.5 Reading questions

You can check your answers to these questions in appendix F.19.

1. T/F The feature [round] in Feature Geometry has been assumed to be dominated by Dorsal since it is relevant for labialized velars.
2. T/F An appropriate feature to distinguish velar consonants and velars with secondary palatalization is [high].
3. T/F Velarized consonants are commonly characterized as [–high] and [+back].
4. T/F Palatalization and secondary palatalization result in the same thing phonetically.
5. T/F It is very important to mention simultaneous lip-rounding and velarization in prose as IPA symbols can be ambiguous as to the timing of the secondary articulation.
6. T/F When you have a minimal pair you can be certain the two contrastive sounds are phonemes.
7. What is the process called that involves the addition of a lip rounding gesture?
8. T/F Labialized alveolar stops are about as common as labialized velar stops.
9. T/F Lip-rounding is a distinctive feature (since it is so visible) and therefore a contrastive feature on any vowel or consonant that has it.
10. T/F Labialized consonants such as k^w are common cross-linguistically.

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[11] Some people prefer to use the symbolization kuanto, but there is no real difference if it is clear that this word has only two syllables.

19.6 Exercises

1. Albanian. Examine the data in appendix G.10.2 and propose an analysis for the laterals seen there. Follow the format suggested in appendix D.4. Provide a quasi-formal representation for showing any phonetic process you may observe.
2. Tlacoapa Mi'phaa. Examine the data in appendix G.1 and propose an analysis for what are transcribed impressionistically as [kw] and [gw]. Discuss this and syllable structure generally.
3. Salasaca Quichua. Examine the data in appendix G.16.3.3 and propose and analysis for what are transcribed impressionistically as [kw] and [gw]. Discuss this and syllable structure generally.

20

STATES OF THE GLOTTIS

In many languages there are consonants or vowels with glottal modifications that may be distinguished phonetically from similar consonants and vowels.[1] Voicing (discussed in chapter §14) is a common modification of this type. When the vocal folds are too far apart for vibration to happen, the sound is considered voiceless. When the vocal folds are brought together tightly and thus do not vibrate at all, we have a glottal stop or fricative. In between the two extremes are several variations in the laryngeal setting for sounds, and these are referred to as PHONATION TYPES. With respect to vowels, Ladefoged & Maddieson recognize "five steps in the continuum of modes of vibration of the glottis", which are the following:[2]

(1) a. breathy voice (the vocal folds are open but still able to vibrate)
  b. slack voice (something between breathy and modal)
  c. MODAL voice (the "normal" kind of vowel phonation)
  d. stiff voice ("produced with the body of the vocal folds, the vocalis muscle, stiffened")
  e. creaky voice ("the most constricted setting in which vibration will occur")

Due to the relative rarity of the slack and stiff voice phonation types, we do not discuss those types further here.

Glottal features contrast in some languages while in others they are non-contrastive. In this chapter we look at various cases of both situations.

20.1 Contrast: glottalization and laryngealization

Maddieson (2013d) refers to three types of glottalized consonants: ejectives, implosives, and glottalized resonants.[3]

20.1.1 *Ejectives.* Ejectives (written with an apostrophe after them in the IPA system) are most commonly stops and affricates; ejective fricatives are rare.

Ejective stops contrast with simple stops in many languages.[4] Ejective stops in natural language are always voiceless.[5]

Quechuan languages typically include an ejective stop and affricate series. The data in (2) are from Cusco Quechua.[6]

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[1] See Maddieson (2013d) for the consonants. For more discussion of phonation from a phonetic point of view, see chapter 2 of Ladefoged (1971).

[2] Ladefoged & Maddieson (1996:49, 315-320).

[3] The term "resonant" is sometimes used to refer to sonorant consonants. For more discussion of the phonetics of glottalized consonants and implosives, see chapter 3 of Ladefoged (1971).

[4] Ladefoged & Maddieson (1996:78-81).

[5] Ladefoged & Maddieson (1996:80): "We do not know of any linguistic use of voiced ejectives."

[6] Rodríguez Champi (2006).

(2)

	Initial		Medial	
p	**paɾa**	‘rain’	**apaj**	‘carry!’
p’	**p’aka**	‘broken’	**hap’ij**	‘grab!’
t	**taki**	‘song’	**qata**	‘blanket’
t’	**t’ika**	‘flower’	**mat’i**	‘forehead’
tʃ	**tʃaki**	‘foot’	**patʃak**	‘hundred’
tʃ’	**tʃ ’aki**	‘dry’	**mutʃ ’a**	‘kiss’
k	**katʃi**	‘salt’	**tʃaka**	‘bridge’
k’	**k’aspi**	‘stick’	**ɲuk’u**	‘crippled’
q	**qata**	‘blanket’	**eqo**	‘dwarf’
q’	**q’atʃu**	‘grass for guinea pigs’	**waq’a**	‘crazy’

As a matter of fact, the distribution of ejectives in Quechuan languages displays the kind of asymmetry that was noticed for nasalization in Mixtec languages (see §16.1).[7] Only the first obstruent of a morpheme that is in an onset can be an ejective, whether that obstruent is the first consonant in the word (as in **p’aka** ‘broken’) or whether it is preceded by a sonorant (as in **mat’i** ‘forehead’). This suggests that a kind of autosegmental analysis is appropriate for the relevant feature in Quechua just as was the case for [nasal] in Mixtec.

Hausa has several ejectives (alveolar, palatal, palatalized velar, velar, labialized velar) but no bilabial one.[8] On the other hand, it has exactly two implosives: bilabial and alveolar.[9] Ladefoged & Maddieson suggest that laryngealization is the primary distinguishing feature of these implosives rather than ingressive airstream (typical of implosives). Similar facts are reported for other languages.

20.1.2 *Implosives.* Implosives are a second group of glottalized consonants discussed by Maddieson (2013d), who also distinguishes between two phonetic types of them (which we do not discuss here).

20.1.3 *Glottal features on vowels.* It has been proposed for some languages (especially many in Mesoamerica from the Oto-Manguean language family) that the vowels have contrastive glottal features. Zapotec languages have been described as having a contrast between simple vowels (technically called **MODAL** vowels) and either one or even two types of glottalized vowels. Isthmus Zapotec is of the more complex type.[10] It has laryngealized vowels, which vary somewhat phonetically but sound much like creaky voice or sometimes like a vowel interrupted by a short glottal stop:

(3) a. **[zæ̰̀]** or **[zæ̰̀ʔæ̰̀]** ‘green corn’
b. **[bṵ̌]** or **[bṵ̀ʔṵ́]** ‘charcoal’

Isthmus Zapotec also has “checked” vowels, which also sometimes vary phonetically, but they typically sound like a vowel cut short by a glottal stop: **[bàʔ]** ‘tomb’. Under the common analysis, a word such as **[bàʔ]** does not have a glottal stop, and the word does not end in a consonant. (The IPA does not have a special way to indicate this kind of vowel.)

It has been proposed for Mixtec languages that what is heard as **VʔV** (that is, vowel—glottal stop—vowel) is the realization of a distinctive feature that is a morpheme-level feature and not a segment-level feature, similar to what was proposed for nasalization in Mixtec.[11]

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[7] Parker & Weber (1996).

[8] Schuh & Yalwa (1999).

[9] These are called “creaky voice implosive[s]” in Ladefoged & Maddieson (1996:85) since they are slightly different phonetically than the common implosives.

[10] Pickett et al. (2010).

[11] Macaulay & Salmons (1995).

20.1.4 *Glottal features in the real world.* It is not possible to do a survey here of how glottal features have been represented in practical writing systems of the world. We can point out, however, that the analysis of these features in a language may affect how these are represented and, more importantly, how the language writing system is taught.

Since the first part of the twentieth century, when an alphabet for Isthmus Zapotec was first put into use, the vowels have been analyzed as being of three types: modal, creaky, and “checked” (see §20.1.3). Modal vowels have been written without modification, creaky vowels with two identical vowel symbols (e.g., *saa*) and checked vowels with a special kind of straight apostrophe following the vowel symbol (e.g., ***saꞌ***). These vowels types are taught as such in literacy materials; that is, the double vowels are taught together, and the vowel-apostrophe sequence is taught as a unit rather than teaching the apostrophe as a separate letter.[12]

Writing conventions in Mixtec languages have been different, but the principle of teaching the vowel together with its laryngeal modification is also used in those languages.

20.1.5 *Pertinent features.* Ejectives and implosives are distinguished from other consonants by having the feature [+constricted glottis].

> An extreme degree of constriction or narrowing of the glottal opening results in glottalized or laryngealized sounds. In consonants, these are the ejective, implosive, and laryngealized types; in vowels, the creaky voiced type and the glottalized vowels associated with certain tonal accents in Vietnamese, Acoma, and Danish.[13]

The glottal stop **?** is often assumed to be [+constricted glottis].

Ejectives must be distinguished from implosives, however. Ejectives are always [**-**voice] while implosives are most commonly [+voice].[14] Obviously some details of these sounds present a challenge for any set of simple features, but the following presentation is fairly standard.[15]

(4)

	p t k	p’ t’ k’	b d g	ɓ ɗ ɠ
[voice]	–	–	+	+
[constricted glottis]	–	+	–	+

The same feature [+constricted glottis] is also used for laryngealized vowels. It is not clear how feature theory should distinguish laryngealized vowels from the “checked” vowels mentioned in §20.1.3. Chávez Peón (2010) proposes that the so-called checked vowels have the feature [**–**continuant].

20.2 Contrast: aspiration

20.2.1 *Aspirated consonants.* Some languages, including Korean and Thai, have aspirated consonants as phonemes. Very commonly these are voiceless aspirates. The following examples are from Cusco Quechua[16] and can be compared to the simple stops and ejectives shown in (2) above. They also have the same restriction as ejectives in Quechua, explained above, and cannot co-occur with ejectives.[17]

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[12] The apostrophe is not mentioned in the alphabet, however. See Pickett et al. (2007:xiii).

[13] Anderson (1974:302).

[14] See the detailed discussion of these sounds in Ladefoged & Maddieson (1996:78-90).

[15] T. Hall (2007:317).

[16] Rodríguez Champi (2006).

[17] See Parker & Weber (1996).

(5)

	Initial		Medial	
pʰ	pʰaka	‘groin’	ɾupʰa	‘hot’
tʰ	tʰaka	‘thick (liquid)’	ʎutʰu	‘quail’
tʃʰ	tʃʰuʎunku	‘ice’	utʃʰa	‘sheep excrement’
kʰ	kʰapu	‘perforated’	ɾakʰu	‘thick’
qʰ	qʰata	‘side, slope’	laqʰa	‘dark’

Some Indo-European languages (such as Hindi, Sindhi and Bengali)[18] have been described as having voiced aspirated or breathy or murmured consonants.[19]

Various other languages—including dialects of Italian and English—have been described as having preaspirated voiceless stops, either contrastively or phonetically.[20] The question arises as to how these should be represented in terms of features in order to appropriately distinguish them from (post-)aspirated stops. (It is not clear to us that this question has been answered adequately if indeed it has been addressed.)

20.2.2 *Breathy vowels.* Some languages have been described as having aspirated, or breathy, vowels. They may sound like a bit like a vowel followed by **h**, but they function as simple vowels, not as a vowel followed by a consonant. Such languages include varieties of Zapotec as well as other Oto-Manguean languages including Jalapa de Díaz Mazatec (by one analysis).[21]

20.2.3 *Pertinent feature.* The feature proposed for aspirated sounds (whether voiceless or voiced) is **[+spread glottis]**;[22] this relates to widening of the glottal opening, with increased airflow. The glottal fricative **h** is often assumed to be [+spread glottis].

The same feature [spread glottis] has been claimed to be the relevant feature for distinguishing the so-called voicedvoiceless stops in German, rather than the more familiar feature [voice] that has been so commonly used.[23] The difference between the two analyses is presented in (6) which [spread glottis] is represented as a privative feature.

(6)

		p t k	b d g
Analysis 1:	[voice]	–	+
Analysis 2:	[spread glottis]	✓	

Sometimes even very familiar facts may be open to a different analysis that may lead to different and better results.

20.2.4 *Feature geometry.* Work in feature geometry has proposed and argued that the features mentioned in this chapter as well as the feature [voice] are all grouped under a single node, called Laryngeal in the literature, as shown in figure 12. (This tree does not show all of the other features or labels; the point is that the laryngeal features are grouped together under one node.) The advantage of having them under one node is that rules of assimilation and neutralization can therefore express the generalization easily by making reference to the single node that dominates them.[24]

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[18] M. Ohala (1999); Nihalani (1999); Miller (2008).

[19] See the discussion of the phonetic facts in Ladefoged & Maddieson (1996:57-63).

[20] See Silverman (2003) and Stevens & Hajek (2010), for example, and the works cited there. Preaspiration in Icelandic is discussed in Clements (1985). Ladefoged & Maddieson (1996:70-73) discuss the so-called pre-aspirated consonants that are found phonetically in some languages. They conclude that “we do not know of any language in which it is necessary to regard pre-aspiration as a feature required for distinguishing underlying forms.” It is not clear, however, whether all of the languages in question are handled well by alternative analyses.

[21] Silverman et al. (1994).

[22] Anderson (1974:301).

[23] Jessen & Ringen (2002).

[24] T. Hall (2007:318).

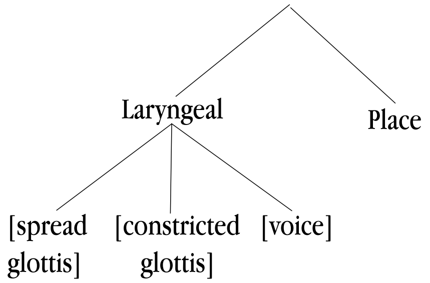


Figure 12. The laryngeal node and the features that it dominates

20.3 Allophones

It is common to find these same phonetic features of glottalization and aspiration in languages in which they do not have a contrastive function.

20.3.1 *Aspiration.* English voiceless stops are aspirated significantly, but not contrastively, when they occur in a simple onset of a stressed syllable or word-initially. We return to this topic in chapter §22.

According to Ladefoged (2003:5), it is generally true that the degree of aspiration found on dorsal consonants is greater than that found on labial and coronal consonants. Furthermore, the degree of aspiration found preceding front vowels is greater than that found preceding back vowels.

Aspiration is a phonetic detail in many languages. It is only non-distinctive on voiceless stops and affricates, and more commonly occurs on the onsets of stressed syllables. In Damana voiceless stops are aspirated whenever they occur before a vowel (Williams 1993:4), as shown in (7).

(7)	ˈtudu	[ˈtʰudu]	‘breast’
	ˈsakən	[ˈsakʰən]	‘seeks’
	ˈpaka	[ˈpʰakʰa]	‘cow’
	ˈmiku	[ˈmikʰu]	‘monkey’

20.3.1.1 *Short exercise: Awara.* Use the first two columns of data found in appendix G.9. Is aspiration predictable or not predictable? How would you write up these results? When you have finished, see the discussion in appendix E.27.

20.3.2 *Laryngealization.* Many speakers of English pronounce their vowels with creaky voice, especially when relaxed.

20.3.3 *Some phonetic detail rules.* Some of the languages illustrated in the *Handbook of the IPA* have allophones with aspiration.

(8)
- a. Amharic: A voiceless stop or affricate is moderately aspirated. (Hayward & Hayward 1999)
- b. Arabic: A simple voiceless stop is aspirated. (Thelwall & Sa adeddin 1999)
- c. Farsi: A voiceless stop is strongly aspirated when it is word-initial and lightly aspirated elsewhere. (Majidi & Ternes 1999)
- d. German: A syllable-initial voiceless stop is aspirated before a stressed vowel. (Kohler 1999)
- e. Japanese: A voiceless stop or affricate is moderately aspirated. (Okada 1999)
- f. Swedish: A syllable-initial voiceless stop is aspirated in a stressed syllable. (Engstrand 1999)
- g. Turkish: A voiceless stop tends to be aspirated in syllable-initial position. (Zimmer & Orgun 1999)

In Tenango Otomi, the voiceless stops are “frequently preaspirated when ... they are initial in a stressed syllable” (Blight & Pike 1976:52). Likewise, in the same language, a sequence of glottal stop and a voiced stop is frequently actualized as a voiced implosive (Blight & Pike 1976:52).

20.4 Sequences of consonants

It is always necessary to consider the possibility that what sounds like a glottalized or aspirated sound is really a sequence of sounds and not a phoneme in itself. If the language has **ʔ** as a phoneme, then what is heard as **[k’]** might really be simply **[kʔ]**. Similarly, if the language has **h** as a phoneme, then what is heard as **[k^h]** might really be **[kh]**.

Example: Seri. Glottal stop exists as a phoneme, and a verb root may begin with a glottal stop. These roots must be inflected, as shown below where various verb forms are given. (The particular glosses for these various verb forms are not relevant and so they are omitted here.)

(1)	**kʔɛmɛ**	‘form into a larger group of people than expected’
	tʔɛmɛ	
	sʔɛmɛ	
	poʔɛmɛ	
	joʔɛmɛ	
	χoʔɛmɛ	

The words written as **[kʔɛmɛ]** and **[tʔɛmɛ]** might have been written down impressionistically by a transcriber as **[k’ɛmɛ]** and **[t’ɛmɛ]**. If one compared these to the words **[kɛmɛ]** and **[tɛmɛ]**, which are two parallel forms of a different verb (meaning ‘depleted’), one might inaccurately conclude that with these minimal pairs one definitely has evidence for ejectives in Seri. After all, one has a minimal pair, as shown in (2).

(2) a. **[k’ɛmɛ]**‘what forms into a larger group of people than expected’
b. **[kɛmɛ]**‘what is depleted’

But this would be the wrong conclusion, as should be obvious. This is one reason why the analysis of conjugated or inflected words should be approached with care, and use should be made of the paradigmatic information available to understand what is actually going on. To say it another way: the minimal pair **[kɛmɛ]** and **[k’ɛmɛ]** does mean that these two words are different in some way. But that difference can be best explained, in this case, not by positing two phonemes **k** and **k’**, but rather a contrast between a single consonant **k** and a consonant cluster **kʔ**.

20.4.1 *Glottal stop in the real world.* We are not able to give a survey here of how glottal stop has been represented in the languages of the world, but we can affirm that it has varied a great deal. Languages where the phonetic glottal stop is best analyzed as something to do with the syllable nucleus in some way have been discussed in §20.1.4 above. There is still other variation in the representation of a true glottal stop. In the case of Seri, where glottal stop is correctly analyzed as an actual consonant (patterning in some way with the sonorant consonants, as a matter of fact), the choice was made in the mid twentieth century, when the alphabet was first developed, to use the letter <h> rather than a symbol such as a straight apostrophe. This convention works well in the language because of the significance of the phoneme **ʔ** in grammatical morphemes of the language, as well as in roots, of course. The letter <h> gives appropriate visual space for this important consonant, as in the word *hiiho* ‘my seeing ithimher’.

20.5 Key terms

Key terms introduced in this chapter are:

1. MODAL voice is the term applied to the "normal" production of vowels, in contrast to marked situations such as breathy voice and creaky voice.
2. [+CONSTRICTED GLOTTIS]: the glottal aperture is narrowed beyond its neutral position (Chomsky & Halle 1968:315). This feature is used to classify creaky voice, ejectives and implosives. (§20.1.5)
3. [+SPREAD GLOTTIS]: the glottal aperture is opened wider than its neutral position, with increased airflow. This feature is used to classify breathy voice and aspiration. (§20.2.3)

20.6 Reading questions

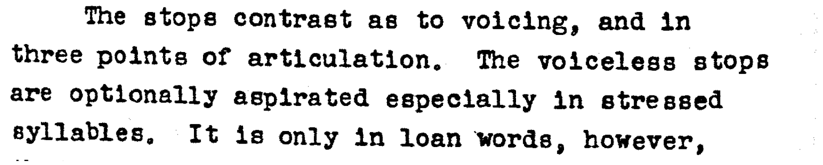
You can check your answers to these questions in appendix F.20.

1. T/F Phonation types are variations in the laryngeal setting for sounds.
2. T/F The mode of vibration of the glottis during "regular" pronunciation of vowels is called Normal Voice.
3. T/F Voiced ejective stops are common in many languages and most often contrast with voiced simple stops.
4. T/F Implosives and glottalized resonants are two types of glottalized consonants discussed by Maddieson.
5. T/F A "checked" vowel typically sounds like a vowel cut short by a glottal stop.
6. T/F Ejectives and implosives have the feature [-constricted glottis].
7. T/F Aspiration of consonants is commonly non-distinctive on voiced stops.
8. T/F What might be transcribed impressionistically as **[tʼ]** (ejective) might be analyzed as the cluster **[tʔ]** if **[ʔ]** is a phoneme in the language.
9. What sounds have the feature [+constricted glottis]?
   a. Ejectives, laryngealized vowels.
   b. Voiced stops, voiced fricatives, voiced vowels
   c. Voiceless stops, voiceless fricatives, voiceless vowels
   d. Aspirated consonants and **h**
10. What features does the Laryngeal node dominate?
11. What laryngeal feature do breathy vowels and aspirated consonants have in common?

20.7 Exercises

1. Swampy Cree. Look at the preaspirated stops in appendix G.20. What might be some reasons for why these are analyzed as preaspiration rather than (a) a consonant cluster that begins with **h**, or (b) a kind of aspirated vowel (since such have been proposed for other languages).
2. Weighty assignment: Madija. Examine the data in appendix G.15.2 and propose an analysis for all of the labial (including labial-velar) consonants, the coronal consonants. Present the results following the format suggested in appendix D.4. Furthermore, write the following Madija words phonemically: 'my liver', 'my lower lip', 'my word', 'his son', 'rubber', 'a monkey'. Discuss why the aspirated consonants should be analyzed as contrastive aspiration rather than (a) a consonant cluster that ends with **h**, or (b) non-contrastive aspiration.
3. Tlacoapa Mi'phaa. Examine the data in appendix G.1 and consider whether there is reason to think of the **h** sometimes as aspiration even though it is written otherwise. (Look at the glottal stops. Additional information: in other varieties in this genus, there is no **h** nor aspiration after glottal stop.) Then, consider the distribution of aspiration otherwise. (This exercise, with this little amount of data, has no clearcut answer at this time on this last topic.)

4. Staged exercise: Cocama aspiration. Rewrite the description in figure 13 from Faust & Pike (1959) in a way that uses IPA symbols and simple prose wording, with examples. If you need additional examples to clarify some doubts you have about the actual facts, ask. Do not use the phrase "its voiceless counterpart" in your prose.



The stops contrast as to voicing, and in three points of articulation. The voiceless stops are optionally aspirated especially in stressed syllables. It is only in loan words, however,

Figure 13. Aspirated consonants in Cocama (Faust & Pike 1959:14)

21

LENGTH

In this chapter we look at the topic of the length of a sound—the duration of its articulation. Long vowels and long consonants are sometimes referred to as GEMINATES.

We assume that length is a marked situation, that a language is simpler if it does not have long vowels or consonants. For that reason, we first look at the various factors that may give rise to phonetic length and that do *not* require us to posit geminates in a language.

21.1 Length due to stress

It is highly expected that stress may result in a longer vowel or consonant. A common situation:

(1) A vowel is lengthened when it is stressed.[1]

When this is the case, we simply find data such as that in (2) from Spanish. Note that whenever a vowel is stressed, it is a bit longer; and when a vowel is not stressed, it is not long. Length is predictable and therefore not phonemic. (The nondistinctive lengthening is indicated in these data with a raised single dot.)

(2)	a.	[ˈsaˑpo]	ˈsapo
	b.	[paˈsoˑ]	paˈso
	c.	[epaˈsoˑte]	epaˈsote
	d.	[baˈtaˑta]	baˈtata

Note: Non-contrastive lengthening may exist in a language even if the language also has distinctive length.

In some languages, stress does not affect the stressed vowel itself, but rather the consonant that follows the stressed vowel. When this is the case, we find data such as that in (3). (These are hypothetical data. Real language examples are given later in this chapter.)

(3) a. [ˈtapˑo]
b. [paˈkatˑe]
c. [saˈtakˑa]

Note that whenever a vowel is stressed in these data, the consonant following it is long; and when a vowel is not stressed, the consonant following it is not long.

Vowel lengthening may be related to something a bit more abstract but akin to stress. Short vowels in Chickasaw are lengthened in open syllables that are “metrically strong” (head of iambic feet—a topic that must be postponed until later) (Gordon & Munro 2007). The head is indicated below by an asterisk above the syllable.

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[1] Laver (1994:152).

	foot	foot	foot	
	*	*	*	
	σ σ	σ σ	σ	
/asabikatok/	[(aˈsa·)	(biˈka·)	(ˈtok)]	'I was sick'
/tʃipisalitok/	[(tʃiˈpi·)	(saˈli·)	(ˈtok)]	

Figure 14. Vowel lengthening in metrically strong syllables in Chickasaw

21.2 Loss of length related to loss of stress

It is also the case that if a language has contrastive length, that length may be lost perceptually or at least severely reduced, when a word appears in a certain context, such as in a position of reduced stress. For example, while Seri has contrastive vowel length, the long vs. short vowel contrast is essentially removed (in favor of short) in two common situations. First, in non-final positions of compound expressions and even in some simple phrases, vowel length is phonetically missing or virtually missing. Second, in clauses that have reduced stress, vowel length is also phonetically missing on all of the words. One must know the words from other contexts in order to know whether the word has a long vowel or not.

21.3 Length related to voicing

Many times the voicing of an adjacent consonant (as well as stress) is a conditioning factor of vowel length. In English, as in many other languages, vowels are lengthened when they occur before a voiced consonant. As a result, the vowel of the word *hid* is slightly longer than that of the vowel in *bit*: **[hɪ·d]** vs. **[hɪt]**, respectively.[2]

Example: Isthmus Zapotec. Compare the length of the vowels in the data from Isthmus Zapotec, conditioned by similar factors, and the corresponding graphs, in figures 4 and 5 in chapter §14. At the same time, compare the length of the consonants that follow the stressed vowel. This length, which is quite apparent in the graphs, is also not distinctive.

21.4 Contrast

Length is a factor that has contrastive significance in many languages. Therefore one might think of length as a phonemic feature (as was sometimes claimed in the past), although the analysis actually proposed today is usually different.

Contrast in the length of a vowel is much more common than contrast in the length of a consonant, although both are attested. A language may have one or the other, or both, or neither.

21.4.1 *Vowels.* A minimal pair for vowel length may be as simple as this example from Maidu (Paul 1967): **kole** 'snail', **koleː** 'sister's child', although one important fact is missing. Convincing data for vowel length must always include indication of stress (if the language has stress) since stress is a major factor that may cause length to occur allophonically.

Furthermore, it is important to be aware that minor class words may be unstressed and thus appear to contrast with (stressed) major class words in vowel length. As an example, the noun **ʔaχ** 'water' in Seri sounds slightly different in context than the word **ʔaχ** 'just' because the former is a noun (and at least always potentially stressed), whereas the adverb is unstressed.

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[2] Laver (1994:151).

Languages change over time, and vowel length is something that changes as well. Latin had long vowels as well as short vowels. The contrast was either lost or evolved into something else in the languages that developed from Latin.

Other Indo-European languages also have or have had long vowels. The contrast between long vowels and short vowels in English was very important, but like what happened to Latin there have been major changes in the pronunciation of these vowels. The distinction remains in the popular terminology often used to describe the vowels: the so-called "long i" in the second syllable of the word *divine* (actually pronounced as the diphthong [aɪ]) versus the so-called "short i" in the second syllable of the word *divinity* (actually pronounced as [ɪ]). See the discussion of the vowels of English in Ladefoged (1999).

It is not unusual for a long-short vowel contrast in a language to be "enhanced" by quality changes in the vowels as well. The differences in vowel quality may in fact be perceptually more relevant than the differences in vowel length. Some common pronunciations of vowels cross-linguistically are given in (4).

(4)

	Short	Long
"i"	[ɪ]	[iː]
"e"	[ɛ]	[eː]
"u"	[ʊ]	[uː]
"o"	[ɔ]	[oː]
"a"	[ə]	[aː]

It is especially important in such cases for the long vowels and the short vowels to be presented separately in the quadrilateral in the IPA illustration so that the phonetic differences are not ignored.

21.4.1.1 *Short exercise: Seri [o] and [oː].* Examine words 6 and 10 in appendix G.5.4. On the face of it, what do these words seems to indicate about vowel length in Seri? When you have finished, see the discussion in appendix E.26.

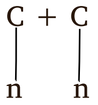
21.4.2 *Consonants.* The contrast between a single consonant and a long consonant is not uncommon.[3] Geminate consonants are not commonly found in word-initial position nor in word-final position, however. Southern Balochi has a contrast between simple consonants and geminate consonants in word-final position: **bɾaːt** 'brother', **baʈ** 'duck', **baʈː** 'rice'; **kaʃ** 'side' **waʃː** 'good', **kaʃː** 'take out'.[4]

21.5 Sequences of identical sounds: false geminates

In some cases where there is a contrast between long and short sounds, the contrast may be attributed to the simple juxtaposition of two identical sounds. That is, [kː] is really not a long **k** phonologically, but rather a sequence of identical velar stops. Or [a] is not really a long **a**, but rather a sequence of two identical vowels.

The evidence in these cases may be clear: there is a prefix **{k-}**, for example, and there are roots that begin with **k**. One **k** plus another **k** produces a "long" **k**. These cases are referred to as FALSE GEMINATES, contrasted with the TRUE GEMINATES discussed above. See the representation of false geminates in (5).

(5)



false geminates

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[3] Ladefoged & Maddieson (1996:91-95).

[4] Saeed Zubair, personal communication.

In English there is a negative prefix *un-* that may be attached to a root that begins with an *n*, and the result is a long *n* (not very long, to be sure): *unnerve*. The length of the nasal in this word contrasts with the one in the word *unearth*. In such a case we do not say that there is a long nasal phoneme nː, but rather we say that there is a sequence nn that results from the juxtaposition of two morphemes.

Of course, the contrast between one consonant and two consonants might be incorrectly thought of as a contrast between a short consonant and a long consonant. Consider the following three partial paradigms from Seri, written impressionistically. We have minimal pairs to contrast long and short consonants, such as those that are tagged with "⇐" in the second and third columns of data.

(6)

	REALIS.T (3:3)	IRREALIS.INDEPENDENT (3:3)	SUBJECT.NOMINALIZED
'taste'	iˈtpiː	iˈspiː	ˈkpiː
'point at'	iˈtːis	iˈstis	ˈktis
'look for'	iˈtkaː	iˈskaː	ˈkːaː ⇐
'smell'	iˈtsiː	iˈsːiː ⇐	ˈksiː
'hear'	iˈtiː	iˈsiː ⇐	ˈkiː
'carry items'	iˈtoːn	iˈsoːn	ˈkoːn
'hold'	iˈtaː	iˈsaː	ˈkaː ⇐

It should be obvious that the contrast between the typical consonants and the "long" consonants in the highlighted forms would not motivate positing new consonant phonemes nor even a distinctive feature of length for the consonants. The data simply show that two identical consonants that happen to come together because of the morphology of the language will sound different than a single consonant. The REALIS.T form of 'point at' is simply the t of the prefix and the t of the root coming together. The IRREALIS.INDEPENDENT form of 'smell' is similarly the s of the prefix and the s of the root being juxtaposed, and likewise *mutatis mutandis* for the SUBJECT NOMINALIZED form of 'look for'. Those three forms in less impressionistic but completely accurate transcriptions would be iˈttis, iˈssiː, and ˈkkaː.

Seri has a suffix that indicates imperfective aspect, and its basic form is clearly {tim}, as illustrated by the form iˈssiːtim 'sheit will smell itthem' (imperfective), composed of the prefixes {i} and {s} followed by the root {siː} and the suffix {tim}. See also isaˈʔistim 'she will undercook itthem' (imperfective), composed of the prefixes {i} and {s} followed by the stem {aˈʔis} and the suffix {tim}.

When this suffix {tim} follows a verb stem that ends in t, such as the stem {aˈʔit} 'sharpen', a phonetically long t results, quite unsurprisingly. See the form [isaˈʔitːim], which is reasonably transcribed, after this analysis, as isaˈʔittim.

Moreover, the difference is not simply esoteric and uninteresting. Direct evidence from the infixation rule discussed in §8.5.2 reveals that speakers do indeed treat these words as having two t's.

It has been argued persuasively in some languages that a phonemic tap followed by another phonemic tap is realized as a phonetic trill. That is, ɾɾ is [r]. This may result in a surface contrast between [ɾ] and [r], of course, but the real contrast is between a single ɾ and a sequence of the same.

Another example of a false geminate might be found in a language in which there are vowel-initial roots and vowel-final prefixes. It would be expected that the combination of these might result in a long vowel phonetically. The data in (7) are from Seri and illustrate what *might* be analyzed as a case of false geminates.

(7)			
	Root {aʔka} ‘be located’	t-aʔka [ˈtaʔka]	‘is it located?’
	Prefix {a} Causative	i-t-a-aʔka [iˈta:ʔka]	‘did she put it?’ (‘did she cause it to be located?’)

21.5.1 *Restrictions on false geminates.* Many languages disallow a juxtaposition of identical consonants (false geminates) inside of a morpheme even if they allow clusters of consonants to occur. English has many consonant clusters, but it does not allow identical ones inside of the same morpheme. The same is true of Seri. A monomorphemic noun can begin with **tk** or **kt** but not **tt** or **kk** in that language.[5]

21.5.2 *Short exercise: Mangseng.* Examine the data in appendix G.6 and propose an analysis for the long r-sound that is seen there. (You may be given access to the recordings as well.) Show why your analysis seems to be correct. When you have finished, see the discussion in appendix E.28.

21.6 Examples of true geminates

Despite the fact that there might be false geminate vowels in Seri (see (7)), it has been argued that most *roots* with long vowels in Seri are actually *true* geminates, as depicted below for the verb root {a:s} ‘deflate’.[6] This is what current phonological theory expects to be the case.[7] One proposed analysis for this kind of situation is shown in (8), where a single set of features (abbreviated by the letter “a”) is linked to two V positions in the skeleton.

(8)

The paradigm in (9) provides important support for the claim that morpheme-internal long vowels in Seri are true geminates and not false geminates.

(9)	A	B	C	D
	‘stand’	‘not stand’	‘deflate’	‘not deflate’
TRL {t}	tap	tmap	ta:s	tma:s
IRR.DEP {po}	po:p	poˈmap	pa:s	poˈma:s
IRR.IND {si}	si:p	smap	sa:s	sma:s
YRL {jo}	jo:p	joˈmap	ja:s	joˈma:s

Additional forms provide more evidence for the basic forms of the prefixes shown on the left. Verbs with roots like ‘deflate’ that begin with a long **a** cause the vowels of the prefixes to delete. Note that those prefix vowels are all missing in column C. But verbs with roots like ‘stand’ that begin with a short **a** do something else; a long vowel results that has the quality of the prefix vowel, as shown in column A.

Using the metaphor of input-output that is common in linguistics—see (10)—we can see how the surface forms are derived from the basic forms. The difference between short vowels and long vowels is important.

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[5] One might argue that on general grounds it is not necessary to have a language-specific rule prohibiting identical sequences (if they are prohibited), but rather that it is necessary to have a language-specific rule that permits such sequences. See the discussion of filters in Harris (1983:34), for example.

[6] See Marlett (1981).

[7] This topic is beyond the scope of this text, but see discussions of the Obligatory Contour Principle in the literature. This principle was first proposed for analyses of tone (hence the word *contour*), but it was quickly pulled into the general literature.

(10) {po + a:s} ⇒ pa:s (Delete a vowel before a long vowel.)
{po + ap} ⇒ po:p (Merge a vowel with a short vowel.)

But what if we attempted to reanalyze this as a difference between short vowels and sequences of short vowels? The deletion rule would have to be recast as something else. In the case of {po + aas} becoming paas (phonetically [pa:s], of course), we would have to say that a vowel is deleted before a vowel only if that vowel is followed by an identical vowel. Such an odd condition, plus other evidence from the morphology, suggests that this is the wrong way to look at the facts. The difference really is one of short vowel versus long vowel (true geminate).

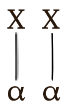
Facts such as these—which are found when looking at the language more broadly, especially the morphology—are very important clues and should definitely be taken into consideration for the analysis and the presentation of an analysis of the basic phonology of a language.

21.7 Formal representation

There has been much discussion with respect to the formal representation of long or lengthened sounds. One proposal that has been long abandoned is that of using a feature such as [+long], a feature that was used during a period of generative phonology.

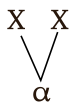
Another proposal (more typical of the structuralist period) that has been eschewed in recent years is one that claims all (contrastive) long segments are simply sequences of identical sounds. Suppose one had a contrast between [pat] 'horse' and [pa:t] 'cow'. The analysis now disfavored proposed that the latter is paat, a sequence of two identical vowels (within the same morpheme). See the discussion of the facts in (9). We might depict the disfavored analysis as shown in (11), where two positions in the syllable are linked to two identical segments.[8]

(11)



A more favored analysis for true geminates claims that the long sound is actually one set of features linked to two positions in the syllable, as shown in (12).

(12)



In the case of the long consonants of Southern Balochi, we take them as true geminates, as shown in (13). The language allows consonant clusters in the coda, and (unlike English) allows for true geminates.

(13)

Somewhat similar to this analysis, although formally distinct, is one that utilizes the notion of MORA (the unit of syllable weight mentioned in §7.3). Long vowels have two of these, whereas short vowels have only one. The word [pa:t] would be represented as in (14) (where the letters represent feature combinations).

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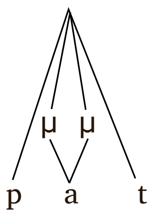
[8] (11) is the representation for false geminates.

(14)



These theoretical proposals have simplified part of the analytic task by limiting the possible analyses that one might propose even before seeing any facts. And in many cases the proposals have been shown to be correct by other evidence.

When length is due to an allophonic rule, the formal representation is much less certain. What at one time for some linguists seemed to be a simple matter of relegating certain facts to the "universal phonetic component"—which may not have the same structure as the so-called "phonological component" of grammar—may no longer be so simple.

21.8 Some phonetic detail rules

Some of the languages illustrated in the *Handbook of the IPA* have allophones involving length.

(15)
a. Catalan: b and g are lengthened when they follow a stressed vowel and precede l. Example: pɔblə [pɔbːlə]. (Carbonell & Llisterri 1999)
b. Hebrew: Vowels and consonants of stressed syllables become long.[9] (Laufer 1999)
c. Farsi: Vowels are lengthened when they are stressed. (Majidi & Ternes 1999)
d. Sindhi: A vowel is lengthened when it occurs in an open syllable. (M. Ohala 1999)
e. Swedish: A consonant is lengthened when it occurs after a short stressed vowel. (Engstrand 1999)
f. Taba: A vowel is lengthened slightly when it is stressed. (Bowden & Hajek 1999)
g. Taba: A vowel is lengthened slightly when it occurs before a voiced consonant. (Bowden & Hajek 1999)

21.9 Length in real life

Long vowels and long consonants (thinking only of true geminates) that are contrastive in a language are typically represented distinctively in some way. Numerous ways have been used to do this; it is not possible to do a survey of all of the possibilities here, but a few options are mentioned in (16).

(16)
a. Long consonants: twin consonant symbols (Hungarian, as shown in Szende 1999; Taba, as shown in Bowden & Hajek 1999).
b. Long vowels: twin vowel symbols (many languages); vowel symbol followed by single consonant whereas short vowels are represented by vowel symbol followed by a double consonant (Taba, as shown in Bowden & Hajek 1999); acute accent and over-ring (or combining ring above) (Czech, as shown in Dankovi ová 1999; Hungarian, as shown in Szende 1999). See also the use of diacritics (and also non-use of them) in Croatian illustrated in Landau et al. (1999). In some languages, long vowels are not distinguished orthographically from short vowels (for Hausa, see Schuh & Yalwa 1999).

Noncontrastive vowel and consonant length is typically not represented, of course.

Contrastive vowel length in Seri is represented in phrases, regardless of the actual phonetic vowel length (see [ˈiti ˌtix] *iti tiij* 'she was sitting on it' (since the verb for 'sit' has a long vowel), but in compounds the etymological vowel length is not shown (see *moosni* 'black sea turtle', but *mosnipol* 'leatherback sea turtle'.

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[9] This rule as given is vague; it should be stated more explicitly.

Seri has contrastive vowel length (only found in stressed syllables) and also non-contrastive vowel length (very common in unstressed syllables). **ˈsiːmɛt** **[ˈsiːmːɛːt]** ‘bread’ is written *siimet*.

If a language has long vowels, one should expect that one might find additional evidence of the importance of them in the way the language works. In the case of Seri, this evidence is found in many places. A small part of the evidence is presented in (9) above. Other evidence is found in the interaction between long vowels and stress; see the discussion in §29.8.

A different kind of evidence comes from other prefixes where a completely different forms appears (a suppletive allomorph). For example, setting aside other interesting details, the imperative prefix in Seri is **k** when it precedes a short **a**-initial root, but it is **ʔ** when it precedes a long **a**-initial root.

Facts such as these, which when understood help the language make sense, emphasize the importance of understanding the phonological system of a language.

21.10 Key terms and ideas

The key terms introduced in this chapter refer to the analysis of phonetically long sounds. GEMINATES are phonetically long segments (whether consonants or vowels) that are analyzed as occupying two positions in the skeleton. TRUE GEMINATES are formalized as a single feature configuration associated with two such positions. A FALSE GEMINATE is formalized as a sequence of two identical feature configurations that are associated with two positions in the skeleton.

The notion of MORA, a unit of syllable weight, appeared in §21.7. It was introduced in §7.3.

In this chapter we also saw the importance of looking at patterns in the morphology of a language for clues as to how the vowels of a language should be analyzed.

21.11 Reading questions

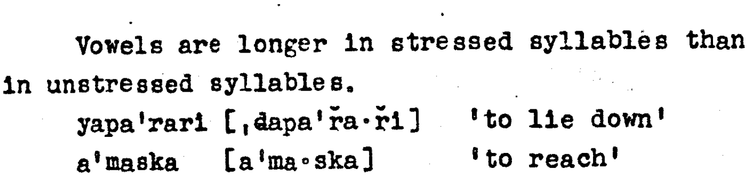
You can check your answers to these questions in appendix F.21.

1. T/F Long vowels and long consonants are sometimes referred to as geminates.
2. T/F When presenting convincing data for vowel length one must always include a discussion of stress as well.
3. T/F It is common for the contrast between long and short vowels to be further “enhanced” by quality changes of the vowels.
4. T/F Vowels and consonants may lengthen phonetically for many reasons including being in the context of a stressed syllable.
5. T/F Long consonants are most commonly found word-initially.
6. T/F Clusters of identical consonants inside a morpheme are often not allowed.
7. T/F Long segments have two moras.
8. T/F A phonetically long consonant is in some cases simply the concatenation of two identical consonants.
9. Which pair of words is the best evidence for showing contrastive vowel length in language X?
    a. **[ˈkuːli]** ‘to stink’, **[ˈkʊl]** ‘engine’
    b. **[ˈkaːl]** ‘state’, **[kal]** ‘only’
    c. **[ˈkeːli]** ‘tree’, **[ˈkeli]** ‘stone’
    d. **[ˈkoləː]** ‘fizzy drink’, **[ˈkoləp]** ‘chair’
10. When referring to ________________, **[kː]** is a false one in the case of k+k and a true one in the case of **kː**.
11. T/F [+long] is the most common and accepted way to represent the feature associated with long vowels and consonants.
12. Long vowels have two of these and short vowels have only one of these. What is it?
13. T/F Vowels are often somewhat longer before voiced consonants (or, they are often shorter before voiceless consonants). Compare **[bɪt]** and **[bɪˑd]** in English. Therefore one should also be careful when setting up contexts for comparing vowel length.

21.12 Exercises

1. Murui Huitoto length. Examine the data in appendix G.25.
   a. Make morpheme cuts as best you can.
   b. Do not worry about the allomorphs [–t] and [–d] of the suffix that appears before the final [–e] (the –e being third person subject, reportedly). No one has figured this out satisfactorily yet.
   c. Make an explicit and clear proposal for how to understand the “minimal pairs” for vowel length seen in lines 6, 7 and 10. Transcribe the words phonemically (as best you can based on this analysis).
2. Weighty assignment: Seri length (unguided). Examine the length facts—of consonants as well as vowels—in the data in appendix G.5.6. You will need to do a bit of morphological analysis as you work on these data. (This exercise is not simple.)
3. Seri length (guided).You should study the data in appendix G.5.6 for 30 minutes first and attempt your own write-up before doing this exercise.

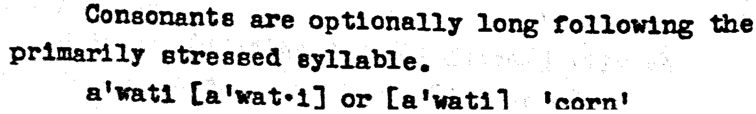
   Evaluate each of the following proposed analyses of these data. (Each one is partial since there is more going on in these data than what any one simple rule can cover.) For each one write at least a couple of sentences of discussion.
   a. Long vowels are all accounted for by the effect of stress. Vowels are long when they occur in a stressed syllable andor follow a stressed syllable: ˈkopoɬ [ˈkoːpːoːɬ] (11).
   b. Long vowels are contrastive in the language. A stressed vowel may be long or short.
   c. Vowel length in unstressed syllables is unpredictable and therefore phonemic. Compare ˈʔopːaːtx (6) and ˈsapˑtim (14).
   d. Long consonants are contrastive in initial position. Therefore long consonants are phonemic in the language. Compare ˈkːamˑ (10) and ˈkoːsˑ (29).
   e. Long consonants that occur before the stressed vowel (at least) are correctly analyzed as false geminates, concatenations of identical consonants resulting from the morphological structure of the words. They do not occur in monomorphemic words. Examples (disregarding the strengthlength of the consonant after the stressed vowel): ˈk-kam [ˈkːamˑ] (10), imˈmam iʔa [iˈmːamː iʔa] (32). (The placement of the stress mark is difficult in the latter case.)
   f. Consonants are more strongly articulated when they immediately follow a stressed vowel: ˈkoːs [ˈkoːsˑ] (29). When such a consonant precedes a vowel, it is lengthened: ˈkoːs iʔa [ˈkoːsː iʔa] (30).
   g. Vowel length in unstressed syllables is predictable and it depends on the length of the preceding consonant, unless it is in a separate word. A vowel is long if it is preceded by a long consonant: ˈʔopatx [ˈʔopːaːtx] (6). The condition about it not being in a separate word is required to account for ˈkoːs iʔa [ˈkoːsː iʔa] (30).
   h. Vowel length in unstressed syllables is predictable based on stress. (Therefore phonemic vowel length is only found in stressed syllables.) A vowel is long when it occurs in the syllable following a stressed syllable in the same word, separated from the stressed vowel by only one consonant: ˈʔopatx [ˈʔopːaːtx] (6).
4. Staged exercise: Cocama vowel length. Rewrite the description in figure 15 from Faust & Pike (1959) in a way that uses IPA symbols and simple prose wording, with examples. If you need additional examples to clarify some doubts you have about the actual facts, ask. Do not use the phrase “its voiceless counterpart” in your prose.
5. Staged exercise: Cocama consonant length. Rewrite the description in figure 16 from Faust & Pike (1959) in a way that uses IPA symbols and simple prose wording, with examples. If you need additional examples to clarify some doubts you have about the actual facts, ask. Do not use the phrase “its voiceless counterpart” in your prose.



Vowels are longer in stressed syllables than in unstressed syllables.

yapaˈrari	[ˌđapaˈr̆a·r̆i]	'to lie down'
aˈmaska	[aˈma·ska]	'to reach'

Figure 15. Lengthened vowels in Cocama (Faust & Pike 1959:14)



Consonants are optionally long following the primarily stressed syllable.

aˈwati [aˈwat·i] or [aˈwati] 'corn'

Figure 16. Lengthened consonants in Cocama (Faust & Pike 1959:18)

22

EDGE PHENOMENA

Various types of phenomena tend to occur at the edges of certain phonological units such as the syllable, phonological phrase or utterance, or (much less frequently, and certainly with more debate) at the edge of morphological units such as the word.

It is important to clarify something before continuing with this topic. When one pronounces a list of individual monosyllabic words, as in a corpus, each item is (a) a phonological phrase, (b) a word, and (c) a syllable. If one asserts that some phonological process happens in “final position,” the description is inappropriately vague because one could take that statement as referring to each of these different and easily distinguished domains.

In order to present a precise description, one must look for evidence to distinguish between these contexts. What happens “syllable-finally” should also happen at the end of the first syllable of a disyllabic word, if “syllable” is the pertinent domain. What happens “word-finally” should also happen at the end of a word in the middle of an utterance, if “word” is the pertinent domain. And what happens “phrase-finally” should happen only in the very final position of some kind of major phonological phrase (before a significant pause), if “phonological phrase” is the pertinent domain.

With this clarification in mind, we now look at examples of non-assimilatory processes that occur in different contexts: initial or final position of some domain.[1] (Cases of epenthesis are postponed until chapter §24.)

22.1 Final position

Some common processes tend to happen in final position. Many of these seem to be a kind of LENITION (or WEAKENING) in which certain features are lost or subdued in some way.

22.1.1 *Devoicing.* It is common to notice a partial or complete devoicing at the end of a phonological phrase—devoicing of the last consonant or even of the last vowel. This kind of devoicing may also happen in the coda of a syllable.

You may have noticed that many times English-speakers pronounce the word *and* with a final voiceless stop—as **[æˑnd̥]**—when they make a pause before continuing. It is actually quite common for phrase-final obstruents in English to have very little voicing, if any, in natural discourse.

German illustrates this kind of devoicing in a major way; word-final stops are typically devoiced to the extent that any distinction between voiced and voiceless stops is virtually undetectable. So a word such as **rad** ‘wheel’ sounds almost identical to **rat** ‘advice’.[2]

In Spanish one can perceive the devoicing (as well as the trilling) of the tap in phrase-final position in some styles of speech in some dialects, such as in the word **floɾ** ‘flower’, pronounced as **[flor̥]**.

Final devoicing can also affect vowels. In Chickasaw, “vowels in final position often end in a breathy voiced phase, characterized by noise and decreased amplitude. The breathy voicing often culminates in complete devoicing” (Gordon & Munro 2007:311).

22.1.2 *Loss of other features.* It is common for a consonant to lose some distinctive features other than [voice] in final position.

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[1] Some people working with distinctive features once proposed assigning the feature [-voice] to the syllable, word and phrase boundaries so that these facts could be handled by an assimilation rule. Such an approach seems misguided in its attempt to formalize the facts that way.

[2] There is quite a bit of discussion about this topic in the literature—even about the actual facts. See Jessen & Ringen (2002) for some references and a new proposal.

In American English, for example, the voiceless alveolar stop **t** loses its place features and is pronounced as a glottal stop in syllable-final position in certain speech styles. Examples: *What?* **[waʔ]**, *meltdown* **[ˈmɛlʔdaʊn]**, *It's not what you think!* **[ɪtsˈnaʔwaʔjuˈθɪŋk]**. Facts such as these have prompted some people to propose that the glottal stop is a [–continuant] consonant that has no place features associated with it.

Other facts suggest that the glottal fricative **h** is a [+continuant] consonant that has no place features associated with it. For example, in some Caribbean dialects (and others) of Spanish the sibilant **s** is pronounced **[h]** in syllable-final position. For example, while **este** 'east' is commonly pronounced **[ˈɛste]** in most dialects, it is pronounced **[ˈɛhte]** in these Caribbean dialects as well as in some others. This is taken as another case of debuccalization (as we saw in §18.2.4).[3]

22.1.3 *Type of release.* Consonants tend to have different kinds of releases when they occur in phrase-final position.

Example: Seri. A plain voiceless stop (i.e., not a labialized one) may be pronounced in one of three ways at the end of a phrase: (a) unreleased, e.g. **[ʔant ˈkap˺]** 'Get down!', (b) with a voiceless homorganic nasal release, e.g. **[ʔant ˈkap$^{\text{m̥}}$]**, and (c) with aspiration, e.g. **[ʔant ˈkap$^{\text{h}}$]**.[d]

[d] E. Moser & M. Moser (1965). This might be taken as an instance of strengthening (see §22.2) but we do not believe that it is since it is such a limited situation.

22.1.4 *Velarization.* It is quite common to find that a consonant in final position is velarized. We saw in §19.2 that in American English the lateral **l** is pronounced with secondary velarization when it is in the coda of a syllable: **silt [sɪl$^{\text{ɣ}}$t]**. (This example shows that the lateral is not necessarily in syllable-final position.) Some varieties of Spanish velarize a nasal whenever the nasal is in syllable-final position and not preceding a consonant to which it can assimilate in place of articulation. Therefore a word such as **pan** 'bread' is often pronounced **[paŋ]**, for example.[5]

22.1.5 *Other processes.* In Spanish a tap may be pronounced as a trill when it occurs in syllable-final position in stressed syllables in some dialects: **ˈbaɾbaɾo** 'barbarous' **[ˈbaɾbaɾo] ∼ [ˈbarbaɾo]**. (This typically happens for reasons of emphasis in Spanish.)[6]

In some dialects of British English, the voiceless stops are preglottalized when they follow a vowel and precede certain consonants: **ˈpɒpkɔn [ˈpɒʔpkɔn]** 'popcorn' (other details, including aspiration, were apparently omitted in this transcription).[7]

22.1.6 *Short exercise: More allomorphs of a Seri article.* Examine the data in part 2 of appendix G.5.1. How do they relate to the analysis proposed for the data in part 1 (see the short exercise in §17.3.2)? If the previous analysis cannot be tweaked to account for these data in an appropriate way, what proposal might you make? When you have written out your best answer, see the discussion in appendix E.29.

22.1.7 *Short exercise: Quioquitani Zapotec stops.* Examine the data in appendix G.7.2.2. You may want to consider how you might analyze them before reading any further right now. Make explicit whatever you claim. You may assume (correctly) that there is no evidence of contrast for aspirated stops; they are very limited in their distribution.

Now consider the following proposed analysis for these facts:

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[3] Harris (1983:45) and Harris & Kaisse (1999), among many references.

[5] The word-final nasal may be RESYLLABIFIED with the vowel of a following vowel-initial word. **este pan es bueno** would put the **n** of **pan** as the onset of **es**, and thus the **n** would not be pronounced as a velar nasal.

[6] Harris (1983:65).

[7] Roach (1973), cited in Laver (1994).

Analysis: There is a contrast between voiceless obstruents and voiced obstruents. Vowels are slightly longer when they precede a voiced obstruent. Voiceless stops are aspirated in syllable-final position. (There are some cases of resyllabification, such as when the next word begins with a vowel. So CVC V is syllabified or resyllabified as CV.CV.) Voiced obstruents have a strong tendency to devoice when they are syllable-final, and especially in phrase-final position.

Your task is to rewrite the data phonemically based on this analysis (assuming that every other phonetic detail shown is phonemic). Use diagonals to enclose these phonemic transcriptions. Compare your answers with those given in appendix E.30.

22.2 Initial position

Some common processes apply to sounds in initial position. Many of these seem to be a kind of FORTITION (or STRENGTHENING), where certain phonetic features enhance the perceptibility and distinctiveness of the sounds.

22.2.1 *Aspiration.* It is quite common for voiceless stops to be aspirated at the beginning of a stressed syllable. The degree of aspiration varies considerably, however, with English being known for having a higher degree than many languages.

22.2.2 *Preglottalization and prenasalization.* Voiced stops may have preglottalized allophones or prenasalized allophones in initial position.

22.2.3 *Affricate-formation.* Sibilants may become affricates in initial position.

22.2.4 *Trilling.* A tap is pronounced as a trill in word-initial position in Spanish.[8] Example: **ɾoxo [roxo]** ‘red’. The trilling of the **ɾ** is optional when it is in syllable-initial position following a sonorant, as in **enˈɾike [ɛnˈɾike] ∼ [ɛnˈrike]** ‘Enrique’.

22.2.5 *Obstruentization.* Approximants may have obstruent or obstruent-like allophones in initial position. A **w** is optionally pronounced as **[gʷ]** in Highland Puebla Nahuatl (H. Key & M. Key 1953), and a **j** is optionally pronounced as **gʲ** in many varieties of Zapotec.[9] In some varieties of Spanish, the approximant **j** is pronounced as **[ʒ]** in syllable-initial position, and even as **[dʒ]** in phrase-initial position.[10] Approximants may be pronounced with occlusive onsets—**j** as **[ᵈj]**, for example.

22.2.6 *Other.* The alternation between **[ɾ]** and **[l]** that occurs in some languages (see §15.4) is often best described with reference to the syllable (at least in part): one allophone occurs if the consonant is in the syllable onset and the other allophone if it occurs in the coda.

22.2.7 *Short exercise: Tucano.* Examine the data in appendix G.13. Make a proposal about the voiceless vowels and the prenasalized stops. You may assume that it is well established that voiceless stops contrast with voiced stops. When you have written down something specific, see the discussion in appendix E.31.

22.3 Theoretical questions about boundaries

In this chapter we have referred to phonological phrases, words and syllables. On the notion of phonological phrase, see §3.4.4. The concept of the syllable is quite straightforward although the definitions and formalism are not so simple (see chapters §4-§5). The concept *word* can be quite controversial; no universally accepted definition has been found.[11] What is written as one word could be analyzed as more than one in some cases, and what are written

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[8] Harris (1969, 1983).

[9] For one example, see H. Lyman (2007:8) for Choapan Zapotec.

[10] Harris & Kaisse (1999), for example.

[11] It would be hard to know where to begin with the literature on this topic, but we suggest Anderson (1992:17-21).

as two or more words could be analyzed as only one. And if we do not have an adequate definition for this concept, then its use in phonological description could be problematic in some situations.

Some concepts have purposefully not been mentioned in this chapter because apparently their role in the pronunciation of phonemes is very limited. These concepts are *morpheme* and *root*. It appears to be the case that there are no phonetic detail rules that apply to a sound on the condition that it occurs at the beginning or end of a morpheme, or on the condition that it occurs at the beginning or end of a root. It has been claimed that phonetic rules are "blind" to morpheme boundaries and that the only grammatical boundaries that they can "see" are word boundaries.[12]

One practical result (but see the problems below) has been that some analysts have assumed or claimed that a list of words in a language is adequate for discovering the phonemes, and that one does not need to know *anything* about the morphological structure of those words. If morpheme boundaries are irrelevant to the expression of phonetic details, this would be a reasonable deduction.

One's view on this issue has a direct impact on how one uses data. If morpheme boundaries are irrelevant, then any list of words is about the same as another. And this was a common view in the structuralist period, although it has also pervaded later periods of phonological theory as well. But if morpheme boundaries are *not* irrelevant, then one should be very careful about how one utilizes words that are morphologically complex.

One way in which these observations have been incorporated in a theory of phonology has been the following: after words are formed in the morphological component of the grammar, and before entering the phonological component, the boundaries between the morphemes are eliminated through a step that has been called BRACKET ERASURE.[13]

A word such as *industrialization* is composed of various morphemes and we can show its morphological composition in the following way (in which the brackets are a convention from morphological tradition and *not* because the representation is phonetic—because it is *not* phonetic).

(1) [[[[**indɜstɹi**]$_{N}$ **æl**]$_{A}$ **ajz**]$_{V}$ **eːʃən**]$_{N}$

A noun root (*industry*) is adjectivalized (*industrial*), and the derived adjective is then verbalized (*industrialize*), and the derived verb is nominalized.

Before entering the phonological component in which one applies the phonetic detail rules (the P-phonology, in the terminology we introduced in chapter §1.2), the form goes through bracket erasure and this gives the result **indʌstɹiælajzeːʃən**. Thus any reference to morpheme boundaries in the next component is made *impossible*, it is claimed.

Although the cases to show it may be few, it does appear that the convention of bracket erasure is incorrect (at least in its strong form, as usually presented). A few examples of phonetic detail rules have been found in which one has to know something about the morphology of the language. These same examples show the problem in using morphologically complex words without some analysis of them.

Example: Seri. A consonant is strengthened (potentially lengthened) when it follows a stressed nucleus (having one or two moras). The word **ˈʔast** 'stone' has a strongly articulated (and potentially long) **[s]**, and the word **ˈʔaːpis** 'tobacco' has a strongly articulated (and phonetically long) **[p]**. This strengthening applies to prefix consonants in words such as **ˈmoka** (composed of the prefix **{mo}** followed by the prefix **{k}** followed by the root {a}): the **k** is strongly articulated and phonetically long. But the strengthening never

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[12] The claim was built into early generative phonology by the way that morpheme boundaries were invisible (see Chomsky & Halle 1968:67: "We assign a very special status to formative boundary, in the following way. We assume that the presence of + can be marked in a rule, but that the absence of + cannot be marked in a rule). Lexical Phonology later made this even more explicit with the mechanism of bracket erasure at the end of the word-forming "lexical" component (referring to brackets that were the notational equivalent of the + boundary; see Kiparsky 1982 and Mohanan 1982).

[13] Kiparsky (1982).

applies to a suffix. The plural of koː 'guitarfish' is koːtax. The t in the plural word does not lengthen; note that the t belongs to the suffix. In fact, there is a phonetic contrast between koːtax [ˈkoːtax] 'guitarfish (pl.)' and koːtax [ˈkoːtˑaˑx] 'ant', since in the word for 'ant' the t is not part of a suffix and therefore is pronounced strong (and long), as expected. The words are phonemically identical and prosodically identical but phonetically distinct—something that requires an explanation of a type that requires recourse to the word-internal morphology.

22.4 Phonetic detail rules

The following edge-related phonetic processes are found in the languages illustrated in the *Handbook of the IPA*.

(2) a. Amharic: An obstruent is devoiced in phrase-final position. (Hayward & Hayward 1999)
b. Bulgarian: An l is velarized in syllable-final position. (Ternes & Vladimirova-Buhtz 1999)
c. Catalan: An obstruent is devoiced in phrase-final position. (Carbonell & Llisterri 1999)
d. Catalan: An l tends to be velarized in syllable-final position. (Carbonell & Llisterri 1999)
e. Catalan: In some dialects, in emphatic speech, an initial postalveolar fricative is pronounced as an affricate. (Carbonell & Llisterri 1999) [The source does not disambiguate the meaning of "initial".]
f. Dutch: An ɾ is pronounced as [ɹ] in syllable-final position. (Gussenhoven 1999)
g. Dutch: In emphatic speech, an ɾ is pronounced as a trill in word-initial position. (Gussenhoven 1999)
h. Farsi: A voiceless stop is strongly aspirated in word-initial position. (Majidi & Ternes 1999)
i. Farsi: An obstruent tends to devoice in word-final position. (Majidi & Ternes 1999)
j. Farsi: A nasal devoices in word-final position after a voiceless consonant. (Majidi & Ternes 1999)
k. French: The uvular fricative ʁ is pronounced as an approximant in final position. (Fougeron & Smith 1999) [The source does not disambiguate the meaning of "final".]
l. Hausa: A tap is pronounced as a trill in word-initial or word-final position. (Schuh & Yalwa 1999)
m. Hungarian: h is [ç] in syllable-final position after front vowels. (Szende 1999)
n. Hungarian: h is [x] in word-final position after back rounded vowels. (Szende 1999)

22.5 The text in an IPA illustration

The final section in an IPA illustration, as published in the *Handbook of the IPA* or in the *Journal of the IPA*, contains a short text—approximately six sentences—to show words in typical context. Most of the words given earlier in the paper probably would have been given in isolation and thus would display all of the edge effects that might be evident in a language.

In the Handbook, the text was a translation of Aesop's fable of how the North Wind and the Sun engaged in a contest. (See http:en.wikipedia.orgwikiThe_North_Wind_and_the_Sun.)

Of course, one cannot and need not rely on this text alone to provide information about words in context, but a connected text like this provides important information about intonation and timing that is very important.

It is not required that the text be the North Wind text, for various reasons. A short text that is indigenous to the language being illustrated is possible to use, in which case a free translation of the text is also appropriately included.

One sometimes sees a transcription of the text in more than one way in this section, which can be quite helpful. The primary transcription here is the broad transcription, but sometimes a narrow transcription is also given. Every detail that is shown in the narrow transcription should have been covered in the Conventions section of the illustration. Both of these transcriptions contain only IPA symbols—which means that they do not include punctuation like commas and periods but rather the symbols to indicate the major and minor groups. See the symbols ‖ and | (respectively) in the *Handbook*.

It should be noted here (because of common mistakes) that sentence-initial words and proper names are not different in phonetic transcription. For example, the name “Bill” and the word “bill” are both transcribed the same.

Sometimes a transcription of the text utilizing the community-based “orthography” is also included. In our opinion, this is appropriate if the spelling conventions have been widely adopted and even officialized in some way, or have a reasonably long history of usage. But if the writing system of the language is just being developed and various conventions tested and implemented, the text should *not* be presented here in that format. Discussion of a writing system is a separate task, related to but not isomorphic with a phonological analysis, and so should be done elsewhere.

22.6 Key ideas

This chapter shows the importance of the edges of words and especially phonological phrases for certain phonological processes. A key idea introduced in this chapter is that there must be a limited use of boundaries in phonological rules, at least in P-phonology. One way to ensure that this is true has been the proposed use of BRACKET ERASURE (§22.3), which simply means that word-internal boundaries are not relevant for P-rule application.

The following terms were also introduced:

1. LENITION (WEAKENING) “refers to an increase in the vocalic nature of a segment, and typically involves voicing and the gradual widening of the stricture in the oral tract” (Davenport & Hannahs 1998:134). (§22.1)
2. FORTITION (STRENGTHENING) refers to the enhancement of a sound to make it more distinct from other sounds to which it is adjacent. (It is basically the opposite of lenition.) (§22.2)

22.7 Reading questions

You can check your answers to these questions in appendix F.22.

1. T/F One may take a short cut when analyzing edge phenomena and just look at monosyllabic words since they are simultaneously phonological phrases, words and syllables.
2. T/F Devoicing is a type of lenition or weakening because voicing is lost or subdued.
3. T/F Some phonologists propose **ʔ** and **h** have no specific place features.
4. T/F Velarization and aspiration of stops are both common types of weakening or lenition.
5. T/F It is common for a language to display strengthening (fortition) processes in word-final position.
6. T/F Preglottalization, affricate-formation and obstruentization are common examples of strengthening in stressed syllables or in initial positions.
7. T/F When analyzing edge phenomena it is important to understand the syllable structure and morphology of language of study.
8. T/F Studying words after “bracket erasure” has taken place means that we look at morphologically complex words like <prefabrication> no differently than we do words like <tip>, paying no attention to morpheme breaks in the former.
9. Devoicing, loss of a feature, and velarization are common types of “final position” phenomena referred to as __________________.
10. Name two common types of consonant strengthening in word- or syllable-initial positions: ________, ________.

22.8 Exercises

1. Kotoko d'Afade. Examine the data in appendix G.29. Analyze the nasal consonants. What nasal consonants are phonemic? What allophones would you posit? Explain. What other information might you wish to see in order to make a stronger conclusion? Follow the format suggested in appendix D.4. Provide a quasi-formal representation for any nasal place assimilation process you may observe.
2. Seri nasals. Examine the data in appendix G.5.2 and propose an analysis for all of the nasal consonants seen there, including the nasalized labial-velar approximant. Follow the format suggested in appendix D.4. Provide a quasi-formal representation for any nasal place assimilation process you may observe.
3. Tewa. Examine the data in appendix G.23 and propose an analysis for the nasal consonants.
4. Staged exercise: Cocama vowel nasalization. Rewrite the description found in exercise I.8 regarding the occurrences of nasalized vowels from Faust & Pike (1959) in simple prose wording, with examples. You have already seen, and may trust the claim, that there are two phonemic nasals: m and n. Think carefully about what you claim.
5. Staged exercise: Cocama velar nasals. Rewrite the description in found in exercise I.8 regarding the occurrences of [ŋ] in final position. Use simple prose wording and clear examples. You have already seen, and may trust the claim, that there are two phonemic nasals: m and n. Think carefully about what you claim. And take the additional information into consideration (Faust 1978:61): "when a vowel-initial suffix is attached to a word that ends in [what Faust claims is] n, the n changes to m. Example (written in the orthography): *tuan* 'that which is big', *tuam-eranun*." We understand these first of these words to always be pronounced [tuaŋ] or [tuã] in isolation.
6. Spanish. Examine the data in appendix G.19.2. While there are words there that are taken at face value as evidence of direct contrast between the flap and trilled r's, one might also suggest an analysis that accounts for all facts (including the highly skewed distribution) without positing two phonemes. See if you are able to come up with a proposal along those lines.
7. Nabak. Examine the aspirated consonants in appendix G.24.1. Propose an analysis, discussing alternatives that may require more data to decide between.

23

VOWELS

In this chapter we look only at vowel quality, omitting reference to length (see chapter §21), laryngeal features (see chapter §20), and nasalization (see chapter §16).

23.1 Contrast

Some languages have only three contrasting vowels, some have four, more have five or six, and others have many more. (The counts here look only at vowel quality contrasts in stressed syllables, and do not include diphthongs. Discrepancies in vowel inventory counts can occur when these factors are not clearly distinguished.)

(1)

Some languages with three:	Quechua (before contact with Spanish), Arabic
Some languages with four:	Seri
Some languages with six:	many varieties of Zapotec, Bulgarian, Farsi
Some languages with seven or more:	Amharic, Catalan, Dutch, Hong Kong Cantonese (11), French (10), German (14), Thai (9)

For reasons of perceptual distinctiveness, it makes sense for languages to take advantage of the different areas of the vocal tract for making vowels and therefore if there are three vowels, they are most likely to be i, a, and u. If there are only four vowels, it is likely that two are close and two are open, two are front and two are central or back.

The most common system when there are five vowels is i e a o u, as in Spanish. In some languages a different five-vowel system is found, however. For example, in Huajuapan Mixtec the traditional Mixtec vowel u has been replaced with the front rounded vowel y (Cowan & Pike 1967).

In many languages of Africa there is a contrast between two series of vowels that have been labeled in different ways: [±ATR] (Advanced Tongue Root) and [±expanded pharynx]. The feature [ATR] is also being used in recent years to distinguish [i] from [ɪ] (and similar so-called "tenselax" pairs) in English. The vowel [i] is [+ATR] and the vowel [ɪ] is [–ATR].[1] Such vowels are also described in various ways, and the distinction is not easy to detect in many cases. (People reportedly often misanalyze the vowels in these systems.) Very often the vowels of a word's affixes "harmonize" to have the same feature for ATR as a certain vowel of the root.

23.1.1 *Short exercise: Albanian [ə] and [ɑ].* Examine words 14 and 16 G.10.2 and think about the implication of these facts. Write down some comments. When you have finished, see the discussion in appendix E.32.

23.2 Features for vowels

The distinctive features used for vowels in phonological studies are typically quite different than terms used in phonetic descriptions, and even in phonological treatments there are various proposals. Some of the significant things to point out are the following:

First, the feature [syllabic] that appeared in Chomsky & Halle (1968) has been dropped in favor of a richer view of syllabic structure. And the feature [vocalic] that also appeared in the literature at that time is not used now.

Second, it is worth repeating the point from chapter §21 that the feature [long] is not used now, in favor of some other mechanism for showing length (skeletal tier or moraic structure).

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[1] See the discussion in Odden (2005:140-141).

Third, the tripartite division of vowels into front, central and back (typical of phonetic descriptions) has been purposely avoided (in most presentations) in favor of a bipartite division that result from the division of vowels (using somewhat confusing terminology) into [–back] vowels (the front ones), and [+back] vowels (the central and back ones).

Fourth, the tripartite division of vowels into high, mid and low (typical of Americanist phonetic descriptions) or the four-way division of vowels into close, close-mid, open-mid, and open (in the IPA system) is typically replaced by a division of vowels using the features [high] and [low]. Some vowels are simultaneously [–high] and [–low], which then gives a three-way cut that mimics the Americanist division into high, mid, and low.

Fifth, finer distinctions than those given by the features mentioned above are achieved by features such as [ATR] (advanced tongue root) and [round].

Setting aside the node [Dorsal] (supposedly shared by all vowels in some frameworks) and the node [Labial] (shared by all round vowels), the features for common vowel qualities that the aforementioned features give us are shown in table 5. The value of the feature [ATR] is left blank for some of the vowels because it is unclear to me whether that value is clearly determined. T. Hall (2007:333) gives the low front vowels as [–ATR] and the low back vowels as [+ATR]; he also gives the round vowel **[u]** as [+ATR] while its unrounded version as [–ATR].

It can also be seen that in this chart the close central vowel and the close back vowel are not distinguished by these features, nor are the open-mid central vowel and the open-mid back vowel. This is due to the fact that, it has been claimed, these vowels are not in contrast with each other in any language. They must be distinguished in some way on the phonetic level other than by normal features, one would have to say.

	i	**ɪ**	**e**	**ɛ**	**a**	**ɑa †**	**ɒ**	**æ**	**ɨ & ɯ**	**ɜ & ʌ**	**u**	**ʊ**	**o**	**ɔ**	**y**	**ɤ**
[back]	–	–	–	–	–	+	+	–	+	+	+	+	+	+	–	+
[high]	+	+	–	–	–	–	–	–	+	–	+	+	–	–	+	–
[low]	–	–	–	–	+	+	+	+	–	–	–	–	–	–	–	–
[ATR]	+	–	+	–					+	–	+	–	+	–	+	+
[round]	–	–	–	–	–	–	+	–	–	–	+	+	+	+	+	–

Table 5. A common view of vowel features in the early 21st century

†This is the common low central vowel (sometimes written as *a*) *or* the low back vowel, while the preceding column is the low front vowel.

See T. Hall (2007) for a discussion of these features and a relatively common and standard view of vowel features in current American linguistics. In that work, the feature [round] is presented as privative.

23.3 Allophones

The quality of the vowel tends to be affected by the factors presented in the following sections.

23.3.1 *Type of syllable.* Vowels may have different allophones depending on whether the vowel is in an open syllable or a closed syllable.

Some descriptions of Spanish indicate that the vowel **e** has a slightly more open allophone when it is in a closed syllable: **pesaɾ [peˈsaɾ]** ‘to weigh’, **peskaɾ [pɛsˈkaɾ]** ‘to fish’.

23.3.2 *Stress.* Stress may affect the quality of a vowel. Unstressed vowels often tend to be slightly centralized. This is the case in Hixkaryana, where the close vowels **e**, **ɯ** and **u** are said to have the allophones **[ɪ]**, **[ɯ̞]** and **[ʊ]** in unstressed syllables.[2]

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[2] Derbyshire (1979:181-182).

A vowel of English tends to be more centralized when it is unstressed. In some descriptions this has meant that a schwa-like vowel is an allophone of more than one phonemic vowel. Consider *volume* **ˈvaljuːm [ˈvaljuʷm]** and *voluminous* **[vəˈluʷmənəs]** (in the dialect of the author).

In some languages vowels may become more diphthong-like, especially in stressed syllables. In Hixkaryana, the vowel **e** starts higher and moves to a central off-glide under a set of conditions, including stress. In the following examples, the penultimate syllable is claimed to be stressed: **ʃeɲenɔ [ʃiɲiːᵊnɔ]** 'new thing', **tɯswænætuɽemɯ [tɯswænæːtʊɽiːᵊmɯ]** 'green thing'.[3]

23.3.3 *Length of the vowel.* Short vowels may have more centralized pronunciations than long vowels, and long vowels may have slightly diphthongized allophones. This is claimed for English, for example. Thus the contrast between short and long close front vowels, written phonemically as **i** vs. **iː**, may have a phonetic realization that is **[ɪ]** vs. **[iʲ]**. The distinctiveness in the system is one of length, it would be claimed, but the change in quality in the short vowel (from close to near close) is a phonetic cue that is produced and perceived. The phonemic representations of the vowels shown in (2) thus do not directly match any of the "allophones".[4]

(2)	**i**	**[ɪ]**	**pik**	*pick*
	iː	**[iʲ]**	**piːk**	*peek*
	e	**[ɛ]**	**pek**	*peck*
	eː	**[eʲ]**	**teːk**	*take*
	u	**[ʊ]**	**kuk**	*cook*
	uː	**[uʷ]**	**kuːp**	*coop*
	oː	**[oʷ]**	**koːp**	*cope*

23.3.4 *Adjacent sound.* Adjacency to certain sounds may affect the quality of a vowel.

Uvular consonants may cause a vowel to have a more open or a more back quality. In Seri the vowel **iː** is much more like **[ɪ͡ɨ]** when it precedes a tautosyllabic uvular fricative: **tiːχ [tɪ͡ɨχ]** 'that one'.

There are dialects of English in which the diphthong **aj** has the allophone **[ɜɪ]** when it precedes a voiceless consonant whereas it **[aˑɪ]** before a voiced consonant. You can check out the following data in your own dialect.

(3)	*tight*	**tajt**	**[tʰɜɪt]**
	tide	**tajd**	**[tʰaˑɪd]**
	ripe	**ɹajp**	**[ɹɜɪp]**
	bribe	**bɹajb**	**[bɹaˑɪb]**
	rice	**ɹajs**	**[ɹɜɪs]**
	rise	**ɹajz**	**[ɹaˑɪz]**

In Hixkaryana there is no contrast between **[i]**, **[ɪ]** and **[e]**. These are taken as one phoneme **e** since **[e]** is the most widely distributed allophone. The vowel **[i]** occurs after postalveolar consonants: **jukɽekæ [jʊkɽikæ]** 'earth'.[5]

Nasalization on a vowel commonly causes it to have a slightly different quality.[6]

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[3] Derbyshire (1979:181).

[4] See Ladefoged (1999:42).

[5] Derbyshire (1979:181).

[6] See Beddor (1993).

23.3.5 *Miscellaneous.* Some contexts for allophones are less common and varied in nature. In Hixkaryana, for example, the vowel **ɯ** is claimed to have an allophone of a *syllabic alveolar nasal* when it precedes **h** at the beginning of a word: **ɯhæhnɔhnɔ [n̩hæhnɔhnɔ]** ‘I approached him’. In this case, knowing the morphology of the word in question, and knowing that the first morpheme here is **[ɯ]** everywhere else makes this easier to analyze.[7]

23.4 Diphthongs

A diphthong is a syllable nucleus that has two distinct targets. It is traditional to write one of the vowels of a diphthong as an approximant, although in some cases this may not be possible or there may be some reason not to do so. Ladefoged (1999) points out that the diphthongs of English are transcribed in more than one way, and we know that yet other conventions have been used as well. For the diphthong in *buy*, one sees **[aj]**, **[aʲ]**, and **[aɪ]**, for example.

Not all concatenations of vowel and approximant are diphthongs. The description of a language that has only simple open (CV) syllables, for example, need not talk about diphthongs at all in order to describe the sequence **jo**. Likewise, the description of a language that has only simple CV and CVC syllables need not talk about diphthongs in order to describe the sequence **oj**.

It is possible to distinguish the following phonetically similar but analytically distinct objects since they may have different consequences for other parts of the phonology (especially stress placement):[8]

a) A sequence of approximant and vowel might be best analyzed as a syllable onset followed by a simple syllable nucleus and not as a diphthong. Two examples in English are *yam* **jæm** and *yes* **jes**.
b) A sequence of an approximant and a vowel might be best analyzed as a diphthong. Three examples in Spanish are **jelo** ‘ice’, **jama** ‘flame’, and **sjento** ‘hundred’.[9]

There are rising diphthongs—such as **we** in Spanish **pweɾta** ‘door’—that end in a vowel; the sonority rises as one moves from an approximate to a full vowel. The sequence **juː** in the word **kjuːt** ‘cute’ in English is sometimes analyzed as a rising diphthong. And there falling diphthongs—such as **aw** in English **haws [haʊs]** *house*, and **aw** in Spanish **kawsa** ‘cause’—that end in an approximant; the sonority decreases as one moves from a full vowel to an approximant.

The long vowels **iː**, **eː**, **oː**, and **uː** in English are pronounced as falling diphthongs, but they are not typically referred to as diphthongs, or they may be distinguished from the “true diphthongs”.[10]

The vowels **e** and **o** in Damana are pronounced as diphthongs **[eʲ]** and **[oʷ]**, respectively: **ˈte [ˈtʰeʲ]** ‘field’, **ˈbo [ˈboʷ]** ‘light’, **ˈpebu [ˈpʰeʲbu]** ‘friend’ (Williams 1993:4). Apparently there is no reason to consider them diphthongs phonologically.

The vowel **i** in Guerrero Amuzgo is pronounced as the diphthong **[ə̆i]** when it follows a (phonetically) velarized consonant (Bauernschmidt 1965), but there is no reason to consider it as a diphthong phonologically.

The pronunciation of **iː** as **[ɪ͡ɨ]** in Seri mentioned at the beginning of §23.3.4 is a type of phonetic diphthongization.

It is worth noting that phonemic diphthongs are charted differently and separately from monophthongs in IPA presentations. They are plotted with an arrow, where the beginning of the arrow is the first part of the diphthong and the arrowhead points to the ending part of the diphthong. See the various examples in IPA (1999), such as Ladefoged 1999:42 for English, Gussenhoven 1999:76 for Dutch, and Ní Chasaide 1999:114 for Irish, to mention a few.

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[7] Derbyshire (1979:181-182).

[8] See Harris (1983) for discussion of the relevant facts of Spanish.

[9] Harris (1983).

[10] See Ladefoged (1999:42) where they are included in the vowel quadrilateral as monophthongs.

23.4.1 *Short exercise: Jalapa de Díaz Mazatec.* Examine the data in groups 1 and 3 of appendix G.35. If you feel that there is sufficient evidence for determining vowel contrasts (as you should), chart the phonemic vowels on a trapezoid and also chart the diphthongs on a separate trapezoid using the method illustrated in IPA (1999). When you have finished, see the discussion in appendix E.43.

23.5 Vowels in descriptions and in real life

The proper treatment of vowels in a phonological description and their representation both there and in real life can sometimes be quite vexing. Various issues arise. One of these is where to plot the vowel in the trapezoid if it has a wide range of pronunciations. This topic was addressed briefly in §12.1. The basic suggestion was to plot the vowel as it occurs in an open stressed syllable where it does not have anything special in the environment. One would avoid having a palatal consonant near it, for example, to avoid any effect that such a consonant might have on it.

Another issue is the matter of the symbol to be used. The IPA tradition is to have a symbol for any vowel (excluding laryngeal features, length and nasalization). Significant latitude is given in this regard, with many people (especially phonologists) opting to use a roman letter if at all possible. However, the decision is still not easy.

One simple example is the four vowel system of Seri; the vowels are phonetically most commonly [i] (varying to [ɪ] in closed syllables), a vowel that is between [ɛ] and [æ] but is not [e], a vowel that is between [o] and [u] but is not [ʊ], and a low central vowel. What symbols should be used? The cases of i and a are not particularly problematic. For the other front vowel, the obvious options are e, ɛ and æ, and all of them have been used at one time or another. One is easier to type (which is an irrelevant consideration for a technical write-up), one presents the vowel as a mid vowel and one presents the vowel as a low vowel. In most recent work the symbols used are those that are closest phonetically to the actual pronunciation, namely ɛ and o. One reason for this is the fact that when phonologists see the symbols i e a u they think they know how the vowels sound and how the symbols work, and in this case they would be mistaken on both counts. So the use of ɛ and o at least draws a bit of attention to some unusual facts.

A serious phonological study of Seri verb conjugations shows that the language operates with only two features (other than length): a feature that groups i and ɛ together vs. o and a (which is no surprise, but good to know about), and a feature that groups i and o together vs. ɛ and a (which may be surprising, but very good to know about). The IPA trapezoid presentation does not make this obvious, which is one reason why phonologists would insist on seeing something such as the following table presented in a phonological write-up.

	[–back]	[+back]
[–low]	i	o
[+low]	ɛ	a

This presentation then begs for an explanation of the dissonance between what people usually expect in terms of symbols and features, but this is precisely what needs to happen so that important phonetic facts and important phonological facts are not just ignored.

When it comes to actually choosing vowel symbols for a practical writing system, language communities have been faced with a myriad of considerations, including ease of keyboarding, legibility, cultural acceptability, and elegance. Linguists steeped in phonetic symbols (whether IPA, Americanist or other) have been terrible guides in these concerns, it seems.

23.6 Key terms

Key terms introduced in this chapter are:

1. RISING DIPHTHONG: a complex syllable nucleus that moves from one place of articulation to another that is more prominent (as in we). (§23.4)
2. FALLING DIPHTHONG: a complex syllable nucleus that moves from one place of articulation to another that is less prominent (as in ew). (§23.4)

23.7 Reading questions

You can check your answers to these questions in appendix F.23.

1. T/F If a language has only three contrasting vowels they are most likely to be i, e, and a.
2. The quality-features of a vowel may be affected by the following factors:
   a. Stress
   b. The kind of syllable that the vowel is in
   c. Adjacent sounds
   d. Length of the vowel itself
   e. a, b
   f. all of the above
3. T/F Length, adjacency to certain sounds and nasalization could hypothetically cause three different changes on one vowel.
4. T/F What is phonetically a diphthong may have more than one phonological representation.
5. If a diphthong is “a syllable nucleus that has two distinct targets”, which of the following representations dodoes not have a diphthong?
   a. [pi̯e] = [pje], in which p is the onset
   b. [toː] in which t is the onset
   c. [wɛst] in which w is the onset
   d. [ku̯al] = [kwal], in which k is the onset
   e. b, c
   f. a, d

23.8 Exercises

1. Tainae. Examine the following words in the data presented in appendix G.22.2: #4, #6, #14, #16, #31, #33. Are these good data for establishing that [ɪ] and [i] are distinct phonemes?
2. Swampy Cree. Examine the data presented in appendix G.20. Look at the long vowels. What analysis do you propose for them?
3. Gabri de Darbé. Examine the data in appendix G.27. Analyze the *close non-front* vowels for contrast or lack of contrast. Discuss the facts.
4. Gor. Examine the data in appendix G.28. Analyze the close vowels for contrast or lack of contrast. Analyze the voiced bilabial stops for contrast or lack of contrast. Discuss the facts.
5. Chumburung. Examine the data in appendix G.30.2. Analyze the round vowels for contrast or lack of contrast and the distribution of these vowels. Discuss the facts.
6. Chumburung. Examine the data in appendix G.30.3. [Detailed instructions needed.]
7. Chumburung. Examine the data in appendix G.30.4. [Detailed instructions needed.]

8. Jalapa de Díaz Mazatec. Study the data in group 4 in appendix G.35. Assuming (as you should) that you do *not* want to add the vowel [y] to the vowel inventory posited earlier (see appendix E.43), propose a motivated analysis. Rewrite some of the key words phonemically.
9. Jalapa de Díaz Mazatec. Study the data in groups 5 and 6 in appendix G.35. Assuming (as you should) that you do *not* want to add the vowels [ɯ] and [ɤ] to the vowel inventory posited earlier (see appendix E.43), propose a motivated analysis. Rewrite some of the key words phonemically.
10. Pangutaran Sama. Study the vowels in the data presented in appendix G.34 and make a proposal for the vowel phonemes. Present the vowels in a quadrilateral and provide the best evidence for the contrasts (in two positions—the stressed syllable and the syllable following the stressed syllable).
11. Staged exercise: Cocama vowel phonemes. Using the data provided to you from Faust & Pike (1959), prepare a quadrilateral to plot the vowel phonemes that Faust & Pike posit. You are not being asked to reanalyze the facts (although you will have to figure out the symbols that they are using). You should indicate in some way (with a table footnote) whether there is anything notable about any phoneme. Then, prepare a presentation of evidence of these phonemes as you have learned in this chapter. You should show the contrast in two positions; we recommend one column for the stressed syllable and another column for vowels in post-tonic syllables.
12. Staged exercise: Cocama diphthongs. Using the data provided to you from Faust & Pike (1959), prepare a quadrilateral to plot the diphthongs that Faust & Pike posit. You are not being asked to reanalyze the facts (although you will have to figure out the symbols that they are using). You should indicate in some way (with a table footnote) whether there is anything notable about any phoneme. Then, prepare a presentation of evidence of these phonemes as you have learned in this chapter. You should show the contrast in two positions; we recommend one column for the stressed syllable and another column for diphthongs in post-tonic syllables.

24

EPENTHESIS

Some sounds that appear in a phonetic transcription are not allophones of any particular phoneme but may simply be present because of certain phonetic conditions. We refer to these as epenthetic consonants and vowels.

24.1 Epenthetic consonants

24.1.1 *Transitional or intrusive stops.* When **m** precedes a voiceless consonant in English, there is a tendency for a transitional **[p]** to occur between the **m** and the consonant. The voiceless bilabial stop represents a transition between a voiced bilabial nasal stop and a voiceless consonant. Sometimes this transitional consonant is written in the common spelling, but sometimes not. Possible examples are: *consumption* (based on the root *consume* plus the suffix *-tion*), *redemption* (based on the root *redeem* plus the suffix *-tion*), *dreamt* (**[dɹɛmᵖt]**), based on the root *dream* plus the suffix *-t*).

In Kumiai, the sequence **mt** is "frequently" pronounced with an short **[p]** between the nasal and the stop (Langdon 1970:28). Thus **ʔəmtan** 'naked' can be pronounced **[ʔəmᵖtan]**. Similarly, the sequence **n̪k** can be pronounced **n̪ᵗk**. And **ʔəxpan̪k** 'whale' can be pronounced **[ʔəxpan̪ᵗk]**. (Superscript consonants for this purpose are not an IPA convention, but they are sometimes used to indicate how short the consonants are.)

In some cases it is difficult or impossible to determine if there are three consonants phonemically, or two consonants phonemically plus the epenthetic consonant. For example, in the case of *empty* one might propose that it is phonemically **emtiː**, but one would need a reason to not simply claim the word is **emptiː**. Similarly for *glimpse* (**glims** or **glimps**) and *exempt* (**egzemt** or **egzempt**). Even in cases like *consumption* and *dreamt*, although it may be obvious that epenthesis is involved, it is not absolutely certain that the epenthesis is a phonetic detail as opposed to something more phonological in nature.

A similar case is found in Spanish, where **[b]** appears between **m** and **ɾ**. There are many examples such as **[ombɾe]** 'man', **[ambɾe]** 'hunger', **[mjɛmbɾo]** 'member', **[sombɾa]** 'shadow' and **[kumbɾe]** 'summit'. There are no examples with **[mɾ]**. Therefore one could propose that **[b]** is a transitional sound that is required phonetically in Spanish, in which case the word for 'man' would be phonemically transcribed **omɾe**. In the absence of counterevidence to this analysis, one would assume that it is correct. But since **b** is a phoneme of Spanish, it is also possible that the **[b]** that was introduced in the history of Spanish (for the reasons just cited) has become phonologized and is now part of the phonemic representation: **ombɾe**. One would like to have other evidence to help know which of these representations the speakers have internalized. (A word transformer rule that put an **a** after each syllable would provide interesting information—for example, do you get **om-a-bɾe-a** or **om-a-ɾe-a**?)

Transitional consonants are also sometime referred to as intrusive consonants. In English there is also a tendency to insert a transitional stop between a nasal and a fricative that follows it. See the data in (1).

(1)	*teensy*	**tiːnsiː**	**[tiːntsiː]**	
	tenth	**tɛnθ**	**[tɛntθ]**	(from **{ten}** + **{θ}**)
	tense	**tɛns**	**[tɛnts]**	(homophonous with *tents*)
	dance	**dæns**	**[dænts]**	
	response	**ɹəspans**	**[ɹəspants]**	
	rinse	**ɹɪns**	**[ɹɪnts]**	
	convention	**kənvɛnʃən**	**[kənvɛntʃən]**	(from **{kənviːn}** + **{ʃən}**)

The same question arises in these cases as to whether the epenthetic consonant has become phonologized or not.

Examples where a voiced stop is inserted in casual speech, at least, in English include: *bans* (making it homophonous, or almost so, with *bands*) and *wins* (compare with *winds*). It may be that a speaker may nearly maintain the distinction between these pairs of words only with conscious effort since she knows that in one case the simple word ends in a nasal and in the other case it ends in a consonant cluster.

This type of epenthesis may also account for the fact that there is no contrast in English between nasal+fricative **nʃ** and nasal+affricate **ntʃ**.

It is proposed in Marlett & Weathers (2018) that glottal stop and glottal fricative in Tlacoapa Me'phaa have a nasal transition when they appear between the open vowel **a** and a nasalized vowel; thus **àʔùūⁿ** 'iguana' is realized phonetically as **[ã̀ʔᵑũ̀ũ̄]** (impressionistically transcribed as transcrita **[ã̀ʔŋũ̀ũ̄]** in appendix G.1.1).

24.1.1.1 *Short exercise: Mangseng.* Listen to the recordings of the data in appendix G.6 (if they are available to you), specifically paying attention to the sequences **[mr]** and **[nr]**. What phonetic detail, if any, do you hear and would want to include in a more narrow transcription? Discuss your proposal. Illustrate the implications of your proposal by writing the word for 'your mother's brothers'. When you have finished, see the discussion in appendix E.33.

24.1.2 *Hiatus avoidance.* When two heterosyllabic vowels are juxtaposed, **HIATUS** is said to exist. Words such as *ion*, *geode* and *chaos* in English are examples in which hiatus occurs between the vowels.

Languages often tend to avoid vowel-vowel sequences under some set of circumstances. In English, some speakers insert a glottal stop between the words *the other*: **ðə ˈʒðəɹ [ðəˈʔʒðɚ]**. Some dialects of English notably have an intrusive "r" after a non-close vowel before another vowel: *law* **[ɹ]** *and order*, *India* **[ɹ]** *and China*.[1]

Example: Madija epenthesis. In Madija, a glottal stop is inserted between two identical vowels (on one analysis, Adams & Marlett 1990). Therefore **onii** 'other (fem.)' is **[oniʔi]** and **owaa** 'other (masc.)' is **[owaʔa]**. Glottal stop is not a phoneme.

But in other situations in the Madija language where two vowels are juxtaposed, the epenthetic consonant takes on features from the context. When the vowel **i** precedes another (distinct) vowel, the epenthesized consonant is **[j]**—and it is no coincidence that the consonant is precisely that rather than **w**. Thus **tia** 'you' is **[tija]**. The approximant **[j]** is not a phoneme in the language either. It occurs only in this situation.

When the vowel **o** precedes another (distinct) vowel, the epenthesized consonant is **w**. Now in this case we have different facts, since **w** is a phoneme of the language, and it occurs root- and word-initially in **wati** 'his liver', for example (a word in which there is no overt marking for third person possessor). See (1a).

(1)		'his ...'		'my ...'	
	a.	**[wati]**	b.	**[owati]**	'liver'
	c.	**[amoɾi]**	d.	**[owamoɾi]**	'foot'

Since **w** is a phoneme, however, the situation is a bit more complicated than with the other epenthetic consonants. Is a word like **[owaʔa]** to be analyzed as **oaa**, or as **owaa**? The word for 'my liver' is **[owati]**, as seen in (1b). But we know that in this case the **[w]** corresponds to the beginning of the root. But in the word **[owamoɾi]** 'my foot' in (1d), we know that the root is vowel-initial by comparison

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[1] See the discussion and references in Uffmann (2007).

with **[amoɾi]** ‘his foot’ (1c), and therefore that the **[w]** is epenthetic. Are the phonemic representations of these words **owati** and **owamoɾi**, respectively, or **owati** and **oamoɾi**? And by what criteria would one make the decision? The answers are not entirely clear, but we suggest that the epenthesis of **[w]** is an M-rule—and that ‘my foot’ is **owamoɾi**—while the insertion of **[j]** mentioned above is a P-rule.

24.1.3 *Glottal stops with vowels at phrase boundaries.* It is very common for a glottal stop to be pronounced before a phrase-initial vowel, or after a phrase-final vowel. The glottal stop in these cases is not an allophone of any consonant or vowel. Many English speakers pronounce a glottal stop before a vowel-initial utterance, and cannot imagine not doing so. Thus the utterance *Easy!* is actually **[ʔi^{j}zi^{j}]** for them.

It may be uncommon for a language to contrast the absence of a (phonemic) glottal stop with the presence of a glottal stop in phrase-initial position, but it is possible even though it may be hard to hear. In Seri, for example, the possessive prefixes are **{ʔi}** (first person), **{mi}** (second person), and **{i}** (third person). The nouns **ʔiːɸ** ‘my nose’ and **iːɸ** ‘hisherits nose’ contrast phonetically.

In Highland Puebla Nahuatl a glottal stop is inserted phrase-finally after a vowel. Therefore a word such as **ʃkita** ‘Look!’ has two pronunciations: **[ʃkita]** when it precedes another word, and **[ʃkitaʔ]** when it is at the end of the phonological phrase (H. Key & M. Key 1953).

24.2 Prevowels and epenthetic vowels

Some vowels are much shorter than phonemic vowels. Because of their shortness, one might decide to write them as approximants when they occur before or after a vowel (when they are **[ĭ]** or **[ŭ]**), and in some cases they are not really vowels at all. The following paragraphs discuss three types of situations. The first two have been described in various works as epenthetic vowels, transitional vowels, excrescent vowels, or related expressions. We follow Operstein (2010) here in using a new term, PREVOWEL, for these very short vocalic entities.

24.2.1 *Prevowel as anticipation.* Some prevowels can be seen as transitions between a vowel and another sound with special characteristics. For example, there may be a transition between a vowel and a palatal or palatalized consonant that immediately follows it. See the examples in (2) from Texmelucan Zapotec (including one in which the consonant is not palatal or palatalized, in which there is no transitional vowel).[2]

(2)	**nan**	**[nan]**	‘soot’
	naɲ	**[na^{j}ɲ]**	‘inside’
	lac	**[la^{j}c]**	‘flat’
	laɟ	**[la^{j}ɟ]**	‘liver’
	mbaʎã	**[mba^{j}ʎa]**	‘my compadre’

One way to think of this is as anticipatory palatalization. A more general term, recently introduced for this and related phenomena, is CONSONANT PREVOCALIZATION.[3]

Another example of prevocalization is found in Hixkaryana. A palatal on-glide precedes **ɲ** when this nasal follows the vowel **e**. Thus **weɲtʃænɔ** ‘I heard it’ is **[we^{j}ɲtʃænɔ]**.[4]

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[2] Speck (1978:21). We have omitted the detail of vowel length in this presentation and adapted the symbols. Speck analyzed these as cases of diphthongization before a palatal consonant; see Operstein (2010) for extensive discussion on why the consonant prevocalization analysis is a better one.

[3] Operstein (2010) presents a detailed overview and analysis of these facts and introduces the term consonantal prevocalization. A key point of her analysis is that the prevocalization is part of the consonant and not part of the vowel that precedes it (i.e., these are not diphthongs).

[4] This is our reinterpretation of Derbyshire (1979:181).

Similar facts may be found as anticipatory labialization, but the vocalic transition is round. In Seri, the prevowel is heard as a very short **[o]** when a rounded consonant follows an open vowel like **[a]** and more like a very short **[u]** when a rounded consonant follows the close vowel **[i]**.[5]

(3)	Phonemic	Impressionistic	
	iˈtakʷ	**[iˈtaŏkʷ]**	‘did sheit kill ithimher?’
	iˈsiːkʷ	**[iˈsiːŭkʷ]**	‘sheit will kill ithimher’
	ˈkaːxʷ	**[ˈkaːŏxʷ]**	‘seep willow *(Baccharis salicifolia)*’
	ˈʔaχʷɬ	**[ˈʔaŏχʷɬ]**	‘*Leukoma grata* clam’

If these are analyzed as consonant prevocalization, the systematic phonetic transcriptions **[iˈtaʷkʷ]**, **[iˈsiːʷkʷ]**, **[ˈkaːʷxʷ]**, and **[ˈʔaʷχʷɬ]** would be appropriate.

Operstein (2010) points out that consonant prevocalization may also happen before certain kinds of *plain consonants* (i.e., consonants that are not palatal, palatalized nor labialized). Consider the examples in (4) from Brazilian Portuguese.[6]

(4)	**aˈxos**	**[aˈxoʲs] ∼ [aˈxoʲʃ]**	‘rice’
	ˈlus	**[ˈluʲs] ∼ [ˈluʲʃ]**	‘light’

Operstein’s treatment of these facts relies on a careful investigation of the tongue positions that are actually used for these so-called plain consonants regardless of their distinctive features. The prevocalization is definitely related to such facts.

24.2.2 *Central prevowel.* Sometimes a schwa-like prevowel appears between two consonants, or between pause and a consonant, as a kind of transition between them. We refer to this as a central prevowel. For example, the phonemic sequences **tlipi** ‘a vine’, **tsɾɯɾɯ** ‘river’, and **ktentʃi** ‘tear (of eye)’ in Yine tend to be pronounced **[tə̆lipi]**, **[tsə̆ɾɯɾɯ]** and **[kə̆tentʃi]**, respectively (Urquía Sebastián & Marlett 2008:367).

A central prevowel appears before **l** in English codas when the vowel nucleus contains an **i** or **j**: **fiːl** **[ˈfiə̆l]** ‘feel’, **fajl** **[ˈfajə̆l]** ‘file’.[7]

Seri has various kinds of consonant clusters, including tautosyllabic stop-stop clusters. Occasionally (but not commonly) these are pronounced with an amount of open transition between them. Thus **ktam** ‘man’ is sometimes pronounced **[ˈkə̆tam]** rather than the usual **[ˈktam]**.

24.2.3 *Epenthetic vowel to permit syllabification.* While the examples of intrusive stops and of prevowels discussed above are taken as phonetic details that are appropriately *not* included in broad or phonemic transcriptions,[8] there is one type of epenthesis that is quite different. A sound is inserted to permit the syllabification of a consonant. The examples needed to see this clearly as a P-phonology type of process must be the same words extracted from different phonological contexts, and they need to be a general process as opposed to something relevant for only one word.

We want to set aside cases of historical epenthesis from those in which a process is currently active. In the history of Spanish, for example, syllables that were once possible, including **ske**, became dispreferred and then impossible. The vowel **e** was inserted to syllabify the initial **s**. And so words such as **eskwela** ‘school’ resulted, whereas they were

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[5] E. Moser & M. Moser (1965:54, note 7), Marlett (1981), and Marlett, Moreno Herrera & Herrera Astorga (2005).

[6] These data are from Operstein (2010:13) who cites various sources for the Brazilian Portuguese facts.

[7] Data adapted slightly from Operstein (2010:180).

[8] As Operstein (2010) points out, prevowels may be reanalyzed eventually as full vowels. This has happened in the history of many languages. Sometimes the language may have both prevowels and prevowels that have become full vowels; see evidence for distinguishing them in Catalan that is reviewed in that Operstein (2010).

previously pronounced **skwela**. Now the word is **eskwela**, however, and no epenthesis is involved in contemporary Spanish; it was a historical process. If a vowel-final word precedes it, the **e** still appears: **la eskwela** 'the school'. One can put a vowel-final morpheme before this word, in a compound, and the **e** still appears: **auto-eskwela** 'driving school'.

24.2.3.1 *Case study: Seri syllabification and [i]-Epenthesis.* A study of possible syllables in Seri shows that while syllables may begin with obstruent clusters (such as **kt**, as in **ktam** 'man'), or with obstruent-sonorant clusters (such as **km**, as in **kmaːm** 'woman'), no syllables begin with sonorant-obstruent clusters (such as ***mka**, or ***nta**). This is not surprising, since the latter would be violations of the Sonority Sequencing Constraint; see (9) in chapter §8.

If one were to find a word such as **imˈpos** 'six-weeks threeawn' (a plant), there is no reason necessarily to not simply analyze the word as shown: a CV syllable **im** and a CVC syllable **pos**. No epenthesis is necessarily involved.

But as it turns out there is also verb inflection morphology that concatenates various morphemes, in the order DIRECT.OBJECT-SUBJECT-TENSE-STEM. Simplifying only slightly here for the sake of presentation, the first- and second-person singular subject prefixes are **ʔ-** and **m-**, respectively. The first- and second-person singular direct object prefixes are **ʔim-** and **ma-**, respectively. Third person is unmarked in all of the examples that we see in (5). The words are given here as they appear in isolation. (The **m** assimilates in place of articulation to the immediately following consonant.)

(5)

	(Direct Object)	(Subject)	(Mood)	Stem		
a.	**ma** 2.sg.DO	**ʔ** 1.sg.Sbj	**t** Realis	**aʔo** see	**maʔˈtaʔo**	'I saw you'[9]
b.	**ʔin** 1.sg.DO		**t**	**aʔo**	**ʔinˈtaʔo**	'she saw me'
c.	**ma**		**t**	**aʔo**	**maˈtaʔo**	'she saw you'
d.		**iʔ** 1.sg.Sbj	**t**	**aʔo**	**iʔˈtaʔo**	'I saw himherit'
e.		**in** 2.sg.Sbj	**t**	**aʔo**	**inˈtaʔo**	'you saw himherit'

The point of interest here is the **i** that appears in the second column, before the glottal stop and before the nasal. This vowel comes and goes. If there is a vowel-final word before the verbs there, the **i** does not appear.

(6)

a.	**ʔaptko ʔtaʔo**	'I already saw himher it'
b.	**ʔaptko ntaʔo**	'you already saw himher it'
c.	**ʃo ʔtaʔo**	'I saw one'
d.	**ʃo ntaʔo**	'you saw one'

If there is a consonant-final word before the verb, the **i** appears.

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[9] This verb is a "non-final" form that cannot occur in a simple declarative sentence.

(7) a. ʔipkix iʔtaʔo ‘I saw this one’
b. ʔipkix intaʔo ‘you saw this one’
c. ʔaχʃ kop iʔtaʔo ‘I saw the dog’
d. ʔaχʃ kop intaʔo ‘you saw the dog’

The proposal: i-Epenthesis takes place when a consonant cannot be syllabified properly. If there is a vowel preceding the glottal stop or the nasal consonant, those consonants can be syllabified as the coda of the preceding syllable: [ʃon.ta.ʔo], for example. (Syllabification is not limited to only a simple word.) If there is no vowel—as when the unsyllabified consonant is after a pause or after a consonant—the **i** is epenthesized, allowing syllabification. This epenthesis takes place after words have been put together in a phrase—an important point to know. This places this particular case of epenthesis squarely in the area of P-phonology (postlexical phonology).

24.2.3.2 *Short exercise: Quioquitani Zapotec [i].* Quioquitani Zapotec appears to robustly demonstrate that the maximal syllable template is [CCVC], with some exceptional examples that have CCC onsets beginning with a nasal and a few exceptional examples with CC codas that also begin with a nasal. Examine the data in appendix G.7.2, noting especially the allomorphy that the possessive prefix (added to derive a possessed noun from an unpossessed noun) displays. Propose an analysis that makes sense of these facts. Then see the discussion in appendix E.34.

24.3 Some postlexical rules

Some of the language illustrations in the *Handbook of the IPA* include mention of epenthesis that could be considered postlexical.

(8) a. Amharic: A prothetic [ɨ] is often inserted before a word-initial **r**: rəʒʒim [ɨrəʒʒim] ‘tall’.
b. Amharic: [ɨ] may also be inserted after word-final consonants, when the following word begins with a consonant: lɨbs ləbso [lɨbsɨ ləbso] (no gloss given).
c. Farsi: Word-initial vowels are preceded by [ʔ]. (Majidi & Ternes 1999)
d. Farsi: Vowels in hiatus are separated by [ʔ]. (Majidi & Ternes 1999)[10]

In Tenango Otomi, “there may be voiceless open transition” between two voiceless stops that occur in sequence (Blight & Pike 1976:52). Also in Tenango Otomi, the nasals have a brief stop release when they precede an oral vowel (Blight & Pike 1976:53). Thus **m** is [m^{b}] and **n** is [n^{d}] in this context. Examples (reconstructed here, perhaps incompletely) are ˈmóhi [ˈm^{b}óhi] ‘plate’ and nĩˈne [nĩˈn^{d}e] ‘your mouth’. (A phonetic unit such as [m^{b}] is perceptually distinct from the sequence **mb** in the language.)

24.4 Suggested additional reading

Operstein (2010) presents a rich array of facts from numerous languages around the world as part of her discussion of consonant prevocalization. See N. Hall (2006) for more details about the intrusive vowels that we have called central prevowels above.

24.5 Key terms

The following key terms were introduced in this chapter:

1. EPENTHETIC SOUNDS. Vowels and consonants are sometimes inserted into the phonological string, especially to make words more pronounceable. These sounds are referred to as epenthetic or epenthesized sounds. The term is also sometimes extended to include intrusive vowels and intrusive consonants, although these might be conceived of as not actually affecting the phonological string. (§24.1)

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[10] Data were not provided to show that the rule correctly refers to word-initial rather than utterance-initial position.

2. **TRANSITIONAL CONSONANT**. A transitional consonant is a short consonant that bridges between the articulation of one sound and that of another sound. A transitional consonant is not analyzed as being a segment in the same way as a full consonant. (§24.1)
3. **INTRUSIVE CONSONANT**. This is an alternate term for transitional consonant. (§24.1)
4. When two heterosyllabic vowels are juxtaposed, there is said to be a case of **HIATUS**. (§24.1.2)
5. **PREVOWELS** are short vowels that occur before a consonant, typically as some kind of transition to that consonant. (§24.2)
6. **CONSONANT PREVOCALIZATION** is the inclusion of a prevowel as part of the pronunciation of a consonant. (§24.2.1)

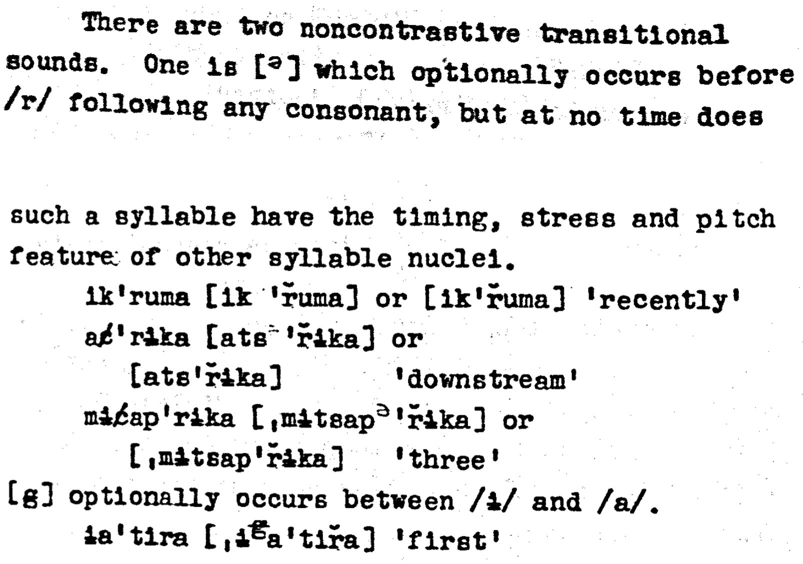
24.6 Reading questions

You can check your answers to these questions in appendix F.24.

1. Which of the following words contain a hiatus between vowels? (Multiple answers are possible.)
   a. *feast*
   b. *piece*
   c. *duet*
   d. *loaf*
2. Which of the following words contain a hiatus between vowels? (Multiple answers are possible.)
   a. *house*
   b. *campaign*
   c. *does*
   d. *knowing*
3. T/F Sounds may appear in a narrow phonetic transcription but not be allophones of any phoneme.
4. T/F A consonant might be a phoneme and also be epenthetic in some circumstances.
5. T/F One of the most common consonants to be epenthesized is a glottal stop.
6. A common type of vowel epenthesis is:
   a. “inserting” an approximant as anticipatory palatalization
   b. “inserting” an open transition between two consonants
   c. “inserting” a vowel to permit syllabification
   d. “inserting” a short approximant as prelabialization
   e. all of the above
7. In Seri, when the prefix {m} is added to the verb pas, the result is mpas when the preceding word ends in a vowel but it is impas when the preceding word ends in a consonant. This is an example of vowel epenthesis that is motivated, one might argue, by what?
   a. Pragmatics
   b. Sonority Sequencing Constraint
   c. “Maximize the Onset” principle
   d. Coda conditions

24.7 Exercises

1. Arara of Pará. Examine the data in appendix G.8.1. Provide an analysis and discuss the facts regarding glottal stop. Follow the format suggested in appendix D.4.
2. Arabela. Examine the distribution of glottal stop in the data in appendix G.21. What analysis might be proposed for this set of facts with respect to glottal stop? Give the phonetic detail rule with an appropriate set of convincing data in a succinct format.
3. Seri. Examine the data in appendix G.5.10 and propose an analysis to account for the alternate forms of words.
4. Murui Huitoto. Examine the data in appendix G.25. The velar approximant [ɰ] only appears after the vowel [ɯ]. How can this be accounted for? Give a phonemic representation of the word in the first column of 9.
5. Staged exercise: Cocama. Rewrite the description in figure 17 from Faust & Pike (1959) in a way that uses IPA symbols and simple prose wording, with examples. (You will have to look up the appropriate symbol to use for what they write as a superscripted barred-g; you should think in terms of a back approximant of some sort, not a fricative.)



There are two noncontrastive transitional sounds. One is [^{ə}] which optionally occurs before /r/ following any consonant, but at no time does

such a syllable have the timing, stress and pitch feature of other syllable nuclei.

ik'ruma [ik 'r̆uma] or [ik'r̆uma] 'recently'
ać'rɨka [ats^{ə}'r̆ɨka] or
[ats'r̆ɨka] 'downstream'
mɨćap'rɨka [ˌmɨtsap^{ə}'r̆ɨka] or
[ˌmɨtsap'r̆ɨka] 'three'

[ǥ] optionally occurs between /ɨ/ and /a/.

ɨa'tira [ˌɨ^{ǥ}a'tir̆a] 'first'

Figure 17. Epenthesis in Cocama (Faust & Pike 1959:18,20)

25

DELETION AND COALESCENCE

There are situations in which a sound is deleted in some context, especially in fast speech. We are concerned in this chapter about cases of deletion in the synchronic phonology of a language, not about cases of deletion in the history of the language. The fact that the velar stop that was once pronounced at the beginning of the word *knight* is not pronounced in Modern English is not of concern to us here.

We are also not concerned here about cases of deletion that are the result of word-formation rules in which the consonant is not pronounced even in careful speech. An example would be the loss of the root-final **t** in the word *extinct* when the suffix *–tion* **{–ʃən}** is added: *extinction* is pronounced **[ɛkstɪŋkʃən]** and never **[ɛkstɪŋktʃən]**. While this type of deletion is commonly included in phonological studies and is certainly related to phonology, it seems to be appropriately addressed within the domain of M-phonology rather than the kind of basic phonology that we are presenting in this book.

A similar example is the kind of deletion that may be posited to describe the allomorphs of morphemes such as the root in *paradigmatic* (note the **ɡ** that is pronounced) and *paradigm* (note the lack of the **ɡ** in actual speech, even very careful speech). We are not dealing with cases like this.

25.1 Consonants

A very simple example of deletion would be the simplification of sequences of identical consonants that appears to happen when two words are juxtaposed. The sequence **ðð** that happens when the word *with* precedes *the* does not seem to be pronounced as **[ðː]** but rather as only one, except in very careful speech.[1]

A similar example, from Spanish, is the simplification of **ss** to **[s]** in word sequences such as *los servicios* 'the services'. And when one word ends in **ɾ** and the next word begins with **ɾ**, as in *ver resultados* 'to see results' and *por Raquel* 'by Raquel', the first **ɾ** is not pronounced in normal speech.[2]

We suspect that a recording of the Seri phrase **iˈʔamok kop** (night the) 'the night' spoken at a normal rate would not allow one to detect that there are two velar stops in succession in these two words. We know that the noun for 'night' ends in a **k** (by looking at it in any other context) and that the word for 'the' begins with a **k** (by looking at it in multiple contexts), but in normal speech the juxtaposition of these two stops is phonetically just like a single stop.

Deletion may also happen word-internally. The noun *fact* in English ends in the consonant cluster **kt**. The plural form of this noun is **fækts** in very careful speech, but is very commonly pronounced without the **t**, making the word homophonous with *fax* in normal speech. The same deletion also happens in the word *expects* in normal speech, although all speakers know the verb root ends in **kt**.

It is possible to write a rule for what we see happening here. To begin, for the English example just mentioned, we might propose something quite specific, as in (1):

(1) (in casual speech)
k t s
⇓
∅

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[1] Some speakers of English use **θ** for the final consonant of the word *with*. There still seems to be the deletion of a consonant in the sequence *with the* for these speakers

[2] Harris (1983:63).

It is also possible that a much more general rule can be formulated, eliminating a stop that occurs between two obstruents in the coda of a syllable, in casual speech.

Example: Hueyapan (Morelos) Nahuatl. The mini-paradigm in (1) presents Hueyapan Nahuatl data in rather narrow transcription (based on the source, Campbell 1976). The past tense is formed in part by adding the prefix **{o}**, deleting the last vowel of the verb root, or by making other changes to the end of the verb that do not concern us here.

(1)

	'she ___ (Present)'	'she ___ (Past)'
'die'	**miɣiʔ**	**omik**
'fall'	**wetsiʔ**	**owets ~ oets**
'grow'	**wejaʔ**	**owejak ~ oejak**
'delay'	**wehkaviʔ**	**owehkaŋ ~ oehkaŋ**
'?'	**wi...**	**owi... (* ~ oi...)**
	'she ___ (Future)'	
'come'	**wala-s**	**oalah (* ~ owalah)**

It is apparent from these forms (despite the gaps, mentioned explicitly by the author but not illustrated with data, unfortunately) that a **w** may delete after an **o**, although the conditions are variable. It never deletes in the context **o_i**, it optionally deletes in the context **o_e**, and it always deletes in the context **o_a**. This variability suggests that the rule deleting **w** is part of the phonetic detail of the language. The words in the last column can be represented as **omik**, **owets**, **owejak**, and **owalah**. One might not detect this deletion based on a simple presentation of these verb forms in a haphazard list of words, but examination of the forms here leads to the relatively straightforward proposal shown above.

25.2 Vowels

A sequence of vowels may also be simplified. For example, in Spanish the sequence **aa** in *va a salir* 'is going to leave' is commonly reduced to **a** (causing orthography problems for inexperienced Spanish-language writers). (This particular simplification may be highly restricted. Compare the identical sequence of words, but in a different construction, *va a casa* 'goes home' in which the simplification does not seem to occur.)

Some deletions may be limited only to specific morphemes, which suggests that they are not general deletion rules, of course, but rather a morpheme-specific property (that is interesting nonetheless). The schwa of the masculine singular article in French is omitted when that article precedes a vowel, even in careful speech.

(2)

a.	*le ciel*	**ləˈsjɛl**	'the sky'
b.	*le bras*	**ləˈbʀa**	'the arm'
c.	*l'arbre*	**ˈlaʀbʀə**	'the tree'
d.	*l'orage*	**loˈʀaʒ**	'the storm'

Similarly, the vowel of the indefinite article in Seri is omitted whenever that word precedes a vowel, even in careful speech as long as the words are pronounced connected.[3]

(3) a. *hast zo ntaho* **ˈʔast ʃo nˈtaʔo** ‘did you see a stone?’
stone a
b. *hast z itaho* **ˈʔast ʃ iˈtaʔo** ‘did she see a stone?’

As with the French example described above, this regular deletion is not a simple phonetic deletion rule but a property of a particular morpheme.

It is claimed that in Hixkaryana certain morphemes (all apparently of a grammatical nature) may lose their final vowel in what might be viewed as casual speech.[4] Thus the hearsay morpheme may be **[hatɯ]** or it may be **[hat]**, and the immediate past collective morpheme may be **[-tʃowɯ]** or it may be **[-tʃow]**. These examples are especially noticeable in the surface forms because otherwise no words in Hixkaryana end in a consonant.

25.3 Interaction of deletion and other processes

A deletion rule may interact with other processes in the language and produce interesting results that may at first be misanalyzed.

Example: Highland Totonac. Let us look at two processes in Highland Totonac (Aschmann 1946). The first devoices a short simple vowel in phrase-final position. Thus **kuku** ‘uncle’ is pronounced **[kuku]** when it is not phrase-final, but **[kuku̥]** when it is phrase-final. This kind of devoicing rule is completely natural, and is similar to what is described for other languages in chapter §23.

The second process deletes the phoneme **h** when it occurs in phrase-final position. Thus **kukuh** ‘sand’ is pronounced **[kukuh]** when it is not phrase-final, as in the phrase **[kukuh kuʔ]** ‘it is still sand’, but **[kuku]** when it is phrase-final.

When two process refer to the same context, it is important (as well as interesting) to see how they interact. In this case from Totonac, we have two processes that refer to phrase-final position. And we see that the result of those two processes is to produce words that look as though they were minimal pairs for voicing of the vowel, when they are pronounced as in a word list.

(1) a. **[kuku̥]** ‘uncle’
b. **[kuku]** ‘sand’

But when we look at the complete picture, we realize that they are actually minimal pairs for the presence or absence of **h** in the phonemic form.

(2) a. **kuku** ‘uncle’
b. **kukuh** ‘sand’

Thus the *superficial* contrast between voiced and voiceless vowels in phrase-final position is correctly seen as due to an interaction of rules applying to forms that do not actually contrast voiced and voiceless vowels.

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[3] This is all the more interesting since the indefinite article follows the noun with which it forms a phrase. The indefinite article therefore actually syllabifies with the following word, with which it is not syntactically connected—a case of wrong-way cliticization.

[4] Derbyshire (1979:182).

Example: Hueyapan (Morelos) Nahuatl. The analysis of many words in this language causes one to propose (correctly) that **[k]** and **[ɣ]** are in complementary distribution, allophones of **k** (Campbell 1976). Some data that illustrate this claim were presented in (1). They are repeated here, and could be expanded by considerable other evidence to substantiate the claim.

(1)

	'she ___ (Present)'	'she ___ (Past)'
'die'	**[miɣiʔ]**	**[omik]**

The phonetic detail rule in (2) would be proposed.

(2) Spirantization & Voicing:[e] A velar stop is realized as a voiced fricative when it occurs intervocalically.

Thus the data in (1) is transcribed phonemically as **mikiʔ** and **omik**.

So far so good. But later one comes across a pair of words such as the following:

(3) a. [nikoa] ‘I buy it’
b. [niɣoa] ‘I shell it’

We have what looks like a minimal pair for [k] and [ɣ] here despite the fact that we seem to have good reason (from lots of other data) for saying that these are allophones of k. The word [niɣoa] is not problematic, of course, but the word [nikoa] does seem to be problematic.

Such examples as these are precisely the type that were in mind when the warning was given in §10.1 to be careful with morphologically complex forms. Yes, all of the data are relevant, but when morphologically complex forms are considered, they should be looked at paradigmatically because we expect k to be [ɣ] intervocalically.

A careful look at these facts with more information about verb inflection is helpful. When we look at the words within their paradigms, we learn that the morphemes in question are those shown in (4).

(4)

First person subject	{ni}
Third person object	{k}
‘buy’	{koa}
‘shell’	{oa}

If we concatenate the morphemes together in the order that we expect them to appear, we get the following basic (underlying) forms: {ni + k + koa} ‘I buy it’, and {ni + k + oa} ‘I shell it’. If we take these forms as the phonemic representations (something that cannot always be done), we get nikkoa and nikoa, respectively. The application of the SpirantizationVoicing rule to nikoa produces [niɣoa]. Should SpirantizationVoicing affect the word nikkoa? No, because the no single k is intervocalic. So the problem is really not SpirantizationVoicing.

The only issue is that the word nikkoa is pronounced [nikoa]. Therefore what we seem to need is a rule of degemination (reducing two identical consonants to only one consonant of the same quality). Perhaps this rule only applies to kk—that is not known from the data that we have, but is strongly suggested to be the case. We give the rule informally as (5).

(5) Degemination: $C_i\, C_i \Rightarrow C_i$

The upshot of this discussion is that [nikoa] and [niɣoa] are indeed a minimal pair, but not because k and ɣ are distinct phonemes in this language, but rather because a single k contrasts with a sequence kk—hardly anything earth-shaking and easily demonstrable from readily available verb paradigms.

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[e] It is actually uncertain which is the primary change here—spreading of [+voice] and concomitant spirantization, or spreading of [+continuant] and concomitant voicing. We assume that a constrained theory of phonology would only allow one of these to be spread in a given rule.

25.3.1 *Short exercise: Awara.* Use the data found in appendix G.9. Decide what the basic rule is for making new words in the “play language”. (There are many details that you do not need to handle at this point.) What kind of rule do you need to account for the play language version of the word for ‘machete’. Show why. When you have finished, see the discussion in appendix E.36.

25.4 Some postlexical rules

Some of the language illustrations in the *Handbook of the IPA* include mention of deletion that could be considered postlexical.

(4)
a. Tukang Besi: When two vowels come together across a word boundary, the first of these often deletes.
b. Catalan: A geminate lateral is reduced to [l] in colloquial speech: [illuˈzio] ~ [iluˈzio] ‘illusion’.
c. Catalan: Final clusters of nasal or lateral stops are reduced by dropping the stop: pɔnt [pɔn] ‘bridge’.
d. Japanese: Final unaccented su is very often reduced to [s].

25.5 Deletion in the real world

Knowing about postlexical deletion is helpful when thinking about writing words in normal contexts. You quickly realize that simply having a great audio recording of the utterance is not enough. One example from Seri: there is a enclitic (written as a separate word, by decision of community members) that is the voiceless uvular fricative χ, written *x* in the community spelling. This enclitic follows verbs and has an important semantic effect that is nevertheless hard to gloss. A verb in the irrealis mood that might be translated ‘when he arrives’ (in the future), is translated ‘if he arrives’ when this enclitic follows the verb. A verb that might be translated ‘after she arrived’ is translated ‘whenever she arrived’ when this enclitic follows the verb. A variety of examples (all in irrealis mood) are given in (5).

(5)

	‘when …’		‘if …’	
a.	*paha*	b.	*paha x*	‘she will cry’
c.	*poop*	d.	*poop x*	‘she will stand’
e.	*peec*	f.	*peec x*	‘she will plant’
g.	*pooitom*	h.	*pooitom x*	‘she will speak’
i.	*pas*	j.	*pas x*	‘she will sing’
k.	*piij*	l.	*piij x*	‘she will sit’
m.	*pootax*	n.	*pootax x*	‘she will go’

The example to look at here is (5n). The sequence χχ in *pootax x* is not really perceptibly long in ordinary speech, but we know that the enclitic *x* is there grammatically and writers act as though it is there. So despite the phonetic evidence suggesting that there is no obvious difference between (5m) and (5n) we can legitimately affirm that the phrase (5n) is phonemically poːtaχ χ.

In a similar way, we can look at (main clause) irrealis forms, as shown in (6). These verb forms are typically followed by an auxiliary type verb and modal that are written together as *aha* in the practical spelling.

(6)

a.	*siipxa aha*	‘it will be few’
b.	*siip aha*	‘she will stand’
c.	*seec aha*	‘she will plant’
d.	*siitom aha*	‘she will speak’
e.	*soos aha*	‘she will sing’
f.	*siij aha*	‘she will sit’
g.	*siitax aha*	‘she will go’

The example to look at here is (6a). The sequence aa in *siipxa aha* is not really perceptibly long (and we clearly hear three syllables, not four), but we know that the word *aha* is there grammatically. A naïve writer who is spelling out the words syllable by syllable will not write it, but once learning the pattern, will realize that is entirely appropriate to write the word always as *aha*.

One more example that is slightly different. Now that you know about the fact that identical vowel-vowel sequences across words in Seri sound just the same as a simple vowel, consider the following expression (of many that could be pointed out):

(7) a. *iti quinol* ‘one who touches (with hand)’ (agentive nominalization)
b. *iti iquinol* ‘to touch (with hand)’ (infinitive)

The second word in (7a) is clearly a **k**-initial word (based on thousands of other words for which we understand the morphology completely), and the second word in (7b) is clearly an **ik**-initial word (for the same reasons). And the first word is undoubtedly **iti**. Because of the simple postlexical deletion rule, the two expressions in (7) are homophonous, but that does not mean that they have to be thought of as phonemically identical and they do not have to be written the same. In fact, writing them differently preserves visually an extremely important morphological and semantic difference, despite the phonetics.

Examples such as these emphasize the importance of understanding and remembering the grammatical facts of a language while doing phonological analysis and then while making that information accessible to those who are doing language development.

25.6 Coalescence

When two (or more) sounds fuse to become one sound, the term coalescence is used to describe the process. In historical linguistics, coalescence may be a snapshot *post hoc* view of something that has taken place in two stages: assimilation of one sound to another and then deletion. In this brief section we are concerned only with coalescence as the best conception of the (postlexical) fusion of two phonemes as a single sound that is different from each of them. Therefore many examples of coalescence in the phonological literature (which are historical or belong to the morphophonology of the language) are not discussed here.

Two consonants may fuse to become one consonant phonetically. In Seri, for example, the sequence **kʷʔ** that arises from the concatenation of what we know to be the prefix **kʷ-** and what we know to be the prefix **ʔ-** is pronounced as a labialized velar ejective: **[k’ʷ]**. The labialization is pronounced after the glottal closure and so we know that the sounds have coalesced to become one. Since there is no labialized velar ejective as a phoneme in the language, this process is part of the P-phonology.

A vowel and a consonant may fuse to become one segment. One example that illustrates this would be a language in which a vowel followed by a tautosyllabic nasal is realized as simply a nasalized vowel (and never as a nasalized vowel followed by a nasal consonant). Hypothetical examples are **pan [pã]** and **tænk [tæ̃k]**.

Two vowels (or a vowel and an approximant) may coalesce into a single segment. In some (perhaps many) cases the resulting segment is also long, as might be expected. Hypothetical examples are **daj [deː]** and **baw [boː]**.

25.7 Key ideas

The main idea developed in this chapter is that there are situations in which a consonant or vowel may be deleted in the P-phonology. The deletion may be only in casual speech and connected speech. Not all cases of the loss of a consonant or vowel are treated in this way.

25.8 Reading questions

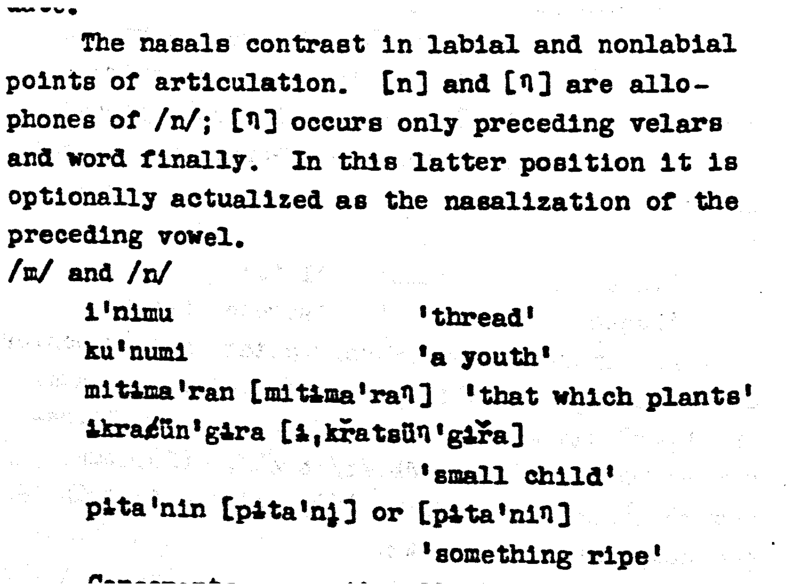
You can check your answers to these questions in appendix F.25.

1. T/F The deletion of a consonant is always handled by a postlexical (P-phonology) process.
2. T/F Vowel deletion most often occurs when identical vowels are found next to each other.
3. T/F More than one process may affect a vowel or consonant in a particular position, especially in inflected words.

4. Why is the following pair of words inadequate evidence for showing that [k] and [ɣ] are both phonemes in this language? [niˈkoa] ‘I buy it’, [niˈɣoa] ‘I shell it’.

25.9 Exercises

1. Seri. Study the data in appendix G.5.3 and come up with observations about situations where sounds appear for one speaker but not for another.
2. Fa d’Ambu. Study the data in appendix G.36. [Detailed instructions needed.]
3. Jalapa de Díaz Mazatec. Study the data in groups 6, 8 and 9 in appendix G.35. Assuming (as you should) that you do *not* want to add a sixth vowel [e] to the vowel inventory posited earlier (see appendix E.43), propose a motivated analysis. At the same time, propose an analysis for the sounds [w] and [β], and the sounds [h] and [χ].
4. Staged exercise: Cocama deletion. Rewrite the followng description from Faust (1978:11) (our summary, for these purposes) in a way that uses IPA symbols and simple prose wording, with examples: In casual speech, the vowels a, u and ɯ—but not the front vowels—are dropped when they occur at the end of a word and precede a vowel-initial word. A phrase such as [makaˈtipa na ˈutsu] ‘Where are you going?’in careful speech may occur as [makaˈtipa ˈnutsu] in casual speech. A phrase such as [ta uˈkaka ta ˈutsu] ‘I am going home’ in careful speech may occur as [tuˈkaka ˈtutsu] in casual speech.
5. Staged exercise: Cocama vowel nasalization. Rewrite the description in figure 18 regarding nasalized vowels from Faust & Pike (1959) in simple prose wording, with examples. If you need additional examples to clarify some doubts you have about the actual facts, ask.



The nasals contrast in labial and nonlabial points of articulation. [n] and [ŋ] are allophones of /n/; [ŋ] occurs only preceding velars and word finally. In this latter position it is optionally actualized as the nasalization of the preceding vowel.

/m/ and /n/

i'nimu	'thread'
ku'numi	'a youth'
mitɨma'ran [mitɨma'raŋ]	'that which plants'
ɨkraćün'gɨra [ɨ,kr̆atsüŋ'gɨr̆a]	'small child'
pɨta'nin [pɨta'nɨ̰] or [pɨta'niŋ]	'something ripe'

Figure 18. Nasalized vowels in Cocama (Faust & Pike 1959:18)

26

PITCH

Speakers of a language do not speak in a complete monotone; there are always variations in the FUNDAMENTAL FREQUENCY (F_0) of the sounds they make.[1] Changes in fundamental frequency are perceived as changes in PITCH, which is used for linguistic purposes as well as having extralinguistic communicative effects.

An extralinguistic effect of pitch might show exasperation, excitement or surprise. The difference in fundamental frequency between the response *Me!* at one moment and *Me!* at another moment of greater excitement does not change the lexical or grammatical meaning of the sentence in any way, although it may reveal something about the speaker's emotional state.

26.1 Stress

One linguistic use of pitch is integrally tied with STRESS in some languages, a kind of syllable prominence that is commonly employed cross-linguistically. (Stress is taken up in chapter §29.) The difference between the pitch in *permit* (noun) and *permit* (verb) in English is linguistically significant and has nothing to do with a person's emotional state. Similarly, in Spanish the difference between *hablo* 'I speak' (with high pitch on the first syllable, referred to as the stressed syllable) and *habló* 'she spoke' (with high pitch on the second syllable, which is the stressed syllable in this word) obviously makes a difference in word meaning.

26.2 Tone

A second linguistic use of pitch is called TONE, taken up in chapter §28. In this situation, the differences in pitch have the potential to change the lexical meaning of words. English does not do this, nor do most Indo-European languages, but the majority of the world's languages do. Languages that use pitch in this way are commonly referred to as TONE LANGUAGES.

Nupe is a tone language, illustrated by the following words pronounced at different pitches (represented here using one of the conventions used in the IPA).[2] These words are otherwise identical.

(1)	a.	ba ˥	'to be sour'	(at a comparatively higher pitch)
	b.	ba ˧	'to cut'	(at a comparatively normal pitch)
	c.	ba ˩	'to count'	(at a comparatively lower pitch)

26.3 Intonation

A third linguistic use of pitch is called INTONATION, discussed in chapter §27. Intonation has several subtypes, each of which can affect the meaning of an utterance in some way. These are discussed in chapter §27.

26.3.1 *Intonation melodies.* The differences in pitch between *Me!* (pitch falling from high to low) and *Me.* (pitch falling from mid to low) and *Me?* (pitch rising from low to high) are all linguistically important, but the word meaning is the same (all referring to the speaker).

These distinctive pitch patterns (whether simple or complex) can be referred to as TONE MELODIES. When they are used as intonation, we can refer to them as INTONATION MELODIES. Various uses of intonation melodies are discussed in chapter §27.

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[1] The fundamental frequency of the speech wave "corresponds to the pitch of a sound as we hear it" (Baart 2010:44). It is the rate at which "wave cycles are repeated" (Baart 2010:95). It is expressed in cycles per second, using the notion of hertz (Hz).

[2] George (1970), cited in Hyman (1975:213).

26.4 Relative pitch

We observe that different people speak at different pitch levels. Adults typically have lower-pitched voices than children. Men typically have lower-pitched voices than women, averaging somewhere around 120 Hz (hertz) for adult males and 210 Hz for adult females, with quite a bit of variation between them, of course.[3] The fundamental frequency that they operate at is different.

Age also affects the fundamental frequency that a speaker uses; emotional state and even type of discourse also affect the fundamental frequency. And yet those differences are not taken to indicate different meanings of utterances. Speakers always adjust to the fact that their interlocutors are operating with a different fundamental frequency. Therefore we know that it is not absolute pitch that is significant to communication, but the relative pitch of one syllable compared with the syllables around it.

Compare the graphs in figure 19; these represent the same word pronounced by two middle-aged adults, one female and one male.[4] The bottom graphs are tracings of the pitch, both with the same scale. You should be able to see that the fundamental frequencies are quite different (one centered around 200 Hz and one around 100 Hz).

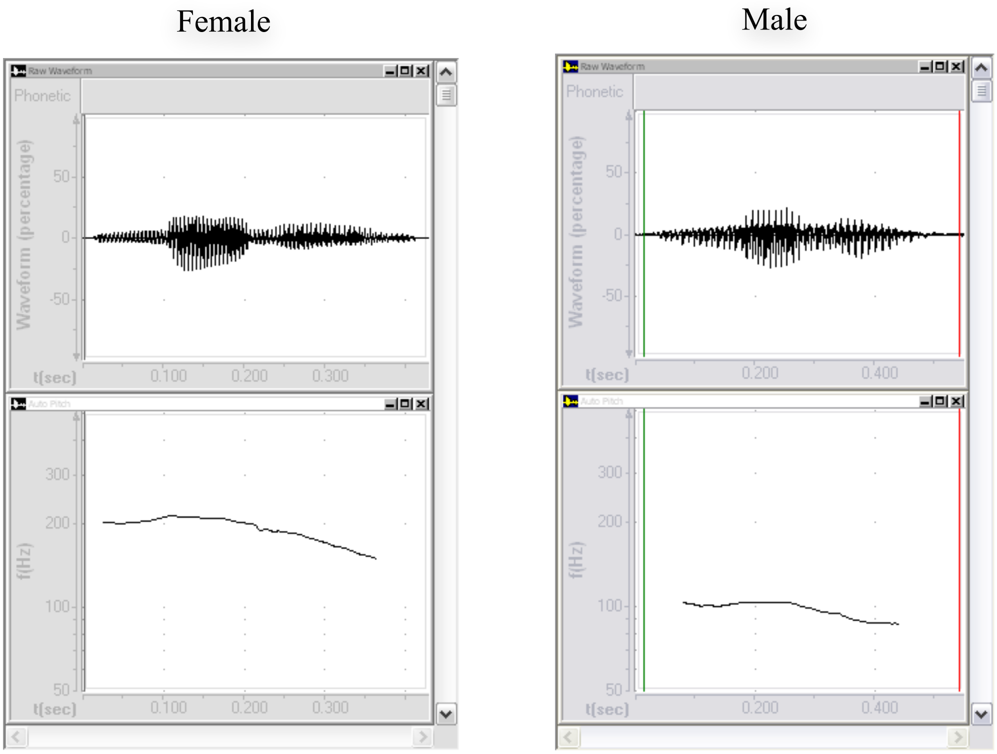

Figure 19. Examples of fundamental frequency differences between men and women

If it were absolute pitch that were relevant, we might say that the morpheme ba in Nupe (see (1)) spoken at 180 Hz means 'to be sour' and ba spoken at 150 Hz means 'to cut'. But that is certainly not true. Not every speaker, nor even one speaker for every utterance, pronounces the morpheme meaning 'to be sour' at 180 Hz. The absolute pitch is not the relevant fact.

So if an English-speaking man says [ˈbɜk] 'buck' at 120 Hz and an English-speaking female repeats it back at 200 Hz, the perception is that the two words are the same; the man does not think "I wonder why she changed the word."

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[3] Traunmüller & Eriksson (1994).

[4] These graphs were produced from files recorded on a digital recorder, trimmed using a simple audio editor (Wavepad in this case) and then opened in Speech Analyzer (see appendix A.6).

This is different than the voicing in the onset or in the coda, where [ˈpʰɜk] and [ˈbɜˑg] are taken as words that are different from [ˈbɜk]. In this respect, the matter of fundamental frequency is different from many other phonetic features.

Moreover, the actual RANGE of the fundamental frequency in which a speaker operates may vary. That is, the difference between high pitch and low pitch for one male adult is not the same as the difference between high pitch and low pitch for another male adult. And the typical range for the difference in English is different than the typical range for the difference in another language.

26.5 Key terms

Key terms used in this chapter are:

1. The FUNDAMENTAL FREQUENCY of the speech wave "corresponds to the pitch of a sound as we hear it" (Baart 2010:44). It is the rate at which "wave cycles are repeated" (Baart 2010:95). It is expressed in cycles per second, using the notion of hertz (Hz).
2. PITCH: "The higher the frequency the higher the pitch. The difference between the terms frequency and pitch lies in a technical distinction: frequency is an objective, measurable property, while pitch is subjective, resulting from human perception (Davenport & Hannahs 1998:58)."
3. RANGE of the fundamental frequency refers to the span from the lowest to the highest frequency that is under consideration. (§26.3)

The importance of relative pitch was a point made in §26.4.

Stress, tone, tone languages, tone melodies, intonation and intonation melodies were mentioned in this chapter. They are taken up in the chapters §27-§29.

26.6 Reading questions

You can check your answers to these questions in appendix F.26.

1. T/F Variations in the fundamental frequency of sounds are changes in pitch.
2. Pitch analysis is significant in determining possible contrasts in:
   a. Intonation
   b. Stress
   c. Tone
   d. a and b
   e. All of the above
3. T/F When contrasting pitch, it is important to look at the absolute pitch since it is the most significant to communication.

27

INTONATION

Intonation is an obvious characteristic of a language, but difficult to describe easily.[1] Speakers often comment that speakers of another regional dialect have a “sing–song” pronunciation precisely because the intonation patterns in that dialect are slightly different than those in their own dialect. Spanish speakers typically use the simple phrase, *Cantan* (‘they sing’) to describe what they do in a particular dialect (other than their own), although we know that everyone in every dialect is in some way “singing” because we all use rises and falls in pitch.

Despite its importance in communication, intonation is one of the most difficult things about language for a person to use correctly when speaking another language. This is a matter for language learners to be well aware of.

We claim here that all languages, even tone languages, use intonation in some way,[2] although it is certainly true that they do not use all of the subtypes of intonation that we mention in this unit.

27.1 Functions of intonation

Tench (1996) lists six major functions of intonation cross-linguistically. His categorization differs somewhat from what other authors have used, but we follow it here in order to present a range of facts.

27.1.1 *Organization of information.* The first function is the organization of information, including the grouping of thoughts, and indication of new information vs. given information. Presumably the entire topic of information prominence is to be included here. Some languages (but certainly not all) use pitch in a way to indicate that a word in an utterance has contrastive focus, for example. The higher pitch on the underlined syllables in the sentences in (1) indicates some kind of focus on the word that the syllable is part of.

(1) a. *Bill knit me a red sweater.* (e.g., not Mary)
b. *Bill knit me a red sweater.* (e.g., not bought)
c. *Bill knit me a red sweater.* (e.g., not you)
d. *Bill knit me a red sweater.* (e.g., not blue)
e. *Bill knit me a red sweater.* (e.g., not scarf)

A language that does not use pitch for showing different kinds of information prominence will use function words (so-called *discourse particles*) and word order for that purpose. If one tries to use pitch for the same effect in such a language, the result is virtual nonsense.

27.1.2 *Realization of communicative functions.* A second function is the realization of communicative functions (commands, statements, questions, etc.), plus indication of deference and authority. Compare the English examples in (2) and note the use of punctuation to try to express the differences in pitch.

(2) a. *Bill is going to Los Angeles.* (Statement; falling intonation)
b. *Bill is going to Los Angeles?* (Question; rising intonation)

Compare the tracings of two very simple utterances shown in figure 20. The one on the left is the simple (verbless) question *Too much?* while the one on the right is the answer *Too much*. The differences in the intonation are quite evident. (You should be able to tell from the fundamental frequency that the speaker is a male.)

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[1] One book that claims to present “the phonology of English” does not even mention intonation.

[2] Hawkins (1984:193).

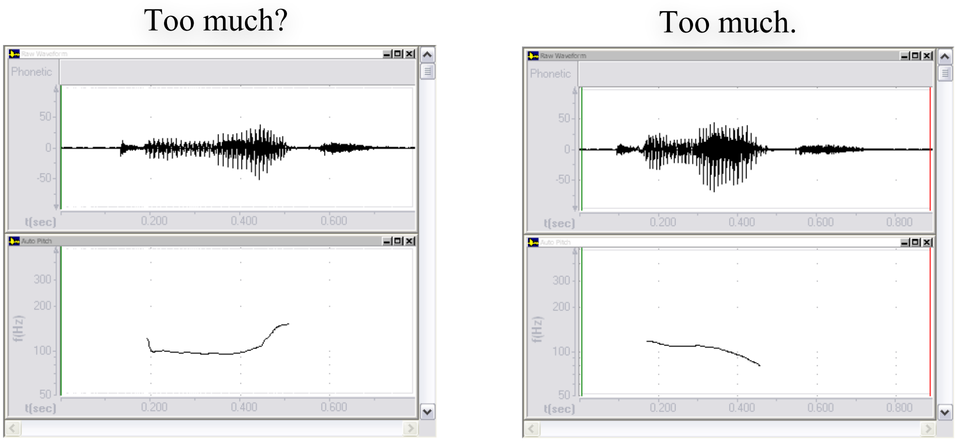

Figure 20. Yes-no question contrasted with statement

Language and even dialect variation on this is considerable. British and American English differ on how question intonation is realized, for example. Some languages do not have separate intonation patterns for statements and commands, and even if they do, they certainly might not permit the kind of differences expressed in the English examples above. (The language may require a "question particle" to be used in questions and thus "minimal pairs" for intonation like the English example above do not exist.)

One striking example of the use of pitch differences to indicate deference was documented for Lachixío Zapotec, where people who are to be respected are addressed with the voice put into a high register—a falsetto.[3] In the past, children, men and women all used this particular setting for this purpose.

27.1.3 *Expression of attitude.* Tench's third category is the expression of attitude, which is an important but very under-described aspect of language. For one simplistic example, think about the intonation that one may use with the word *yeah* when one is not really believing what is being said. No punctuation is really available to indicate it, so one might write, *"Yeah, yeah" he muttered*, and hope that the correct idea is communicated.

27.1.4 *Indication of syntactic structure.* A fourth use of intonation is the indication of syntactic structure. Intonation is an important aid to the hearer in processing the audio input. If you read this paragraph out loud, you will notice the changes in pitch that are audible at the places where commas and periods appear. These slight changes in pitch (potentially accompanied by brief pauses) do not affect the meaning in the same way as interrogative intonation, for example, but they can affect how we understand sentences. Notice how the placement of "comma" intonation in (3b) (after the name used as a vocative) makes it entirely different in meaning from (3a).

(3) a. Bill knit me a sweater.
b. Bill, knit me a sweater.

Ladefoged claims 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."[4] This seems to be true.

Inside of a particular major syntactic domain (most commonly a clause or a sentence) pronounced with an expected intonational pattern, we may observe a gradual fall in pitch. This gradual fall in pitch has been called

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[3] Persons (1997). It is not entirely clear that this kind of speech is properly described under "intonation", but it should be documented and presented somewhere in a complete description of language use.

[4] Ladefoged (1982:227).

DECLINATION. At the end of the domain, or at least at some major pause, there is a "resetting" of the voice at a higher pitch to start all over again. A tracing of the fundamental frequency, ignoring some small bumps that might be caused by stressed syllables, might look like the line shown in figure 21.

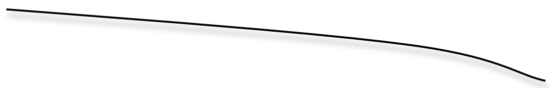

Figure 21. Illustration of declination

Declination happens in languages that are tonal as well as those that are not. And it is one of the reasons why we know that absolute pitch is not relevant for understanding tone and intonation, but rather relative pitch.

In a tone language, declination means that what is really a *high* tone might be pronounced at a *lower* frequency than a *low* tone that occurs earlier in the sentence. This pitch decrement "serves a useful linguistic purpose in signaling clause and sentence boundaries,"[5] which seems to be one function of intonation generally in non-tone languages, of course.

There is a difference between *She read and graded papers*, where the intonation makes it clear that she performed two activities relating to papers, and *She read, and graded papers*, where the intonation suggests that she did a general activity of reading (perhaps including the papers), and another activity of grading papers.

27.1.5 *Indication of textual structure.* Tench's fifth use of intonation is the indication of textual structure. One can observe this somewhat clearly in the dialects of English that tend to use rising intonation even on declarative sentences that are not "paragraph final". The rising intonation seems to be a signal that the speaker is still completing the presentation of a key idea or is at least not ready for the hearer to take his or her turn at speaking yet.

27.1.6 *Identification of speech styles.* A final category is the identification of speech styles—distinguishing kinds of language events, such as conversation, prayer, prayers in unison, incantations, formal reading, recitations of nursery rhymes, pronouncements, etc. Liturgical language has special intonational patterns as well as other characteristics that set it apart from everyday language.

27.2 Domain

An important feature of INTONATION MELODIES, as opposed to lexical tone melodies, is the fact that they are distributed over an entire phrase; they are not assigned to a morpheme or word *per se*. A good illustration of this is provided by the set of examples in (4), which start from monosyllables and end with polysyllabic phrases, using the same pair of intonation melodies.

(4)

Exclamation — HL melody	Surprise — HLH melody
Tom!	*Tom!?*
Tommy!	*Tommy!?*
telephone number!	*telephone number!?*

Studies of intonation very often refer to various parts of the domain of a particular melody. A domain of the melody may be the clause, and in that domain there is a unit called the NUCLEUS (not to be confused with the nucleus of a syllable), which is the locus of the melody in the domain, the spot from which the rest of the superficial characteristics of the melody are determined. For example, in a simple reading of the sentence in (5), the word *tamales* is the nucleus and carries the falling melody.

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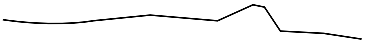
[5] Ohala (1978:31-32).

(5)



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.[6]

27.3 Transcription

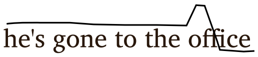
Many ways of transcribing intonation have been used, but apparently there is still little or no agreement on the best method even for English, much less for broad cross-linguistic use. Some systems are analogous to a phonetic transcription, and others are obviously phonemic in that they require more information to actually pronounce them accurately, or require a use of capitalization that cannot be used for standard phonetic transcriptions. Some samples are given (6).[7]

(6) Straight lines: ~~he's gone to the~~ office

Numbers: ^{2}he's gone to the ^{3}o^{1}ffice

Letters:
M H L
he's gone to the office

Contours:



he's gone to the office

Diacritics:
he's gone to the \office
vs.
he's gone to the /office?

he's gone to the `*office*
vs.
he's gone to the ´*office*?

27.4 Communicative functions

In the next few paragraphs we compare the intonation melodies used in English with those used in some other languages.

27.4.1 *Statements.* English simple declarative statements are characterized by a HL tone melody on the nucleus of the utterance.[8] The nucleus is often a word that is in the constituent that presents new information. For example, in the exchange, A: *What did you buy?* B: *I bought a guitar*, the falling intonation in the response occurs on the word *guitar*.

In Seri, declaratives are characterized by a gradually falling melody that begins at mid level, represented below as ML. The pitch tracing in figure 22 for the biclausal example in (7) has some odd dips and rises that are sometimes caused by the consonants in the utterance and sometimes by common technical issues of the software. Nevertheless, you can see the general downward trend. (This is a topic in need of more study.)

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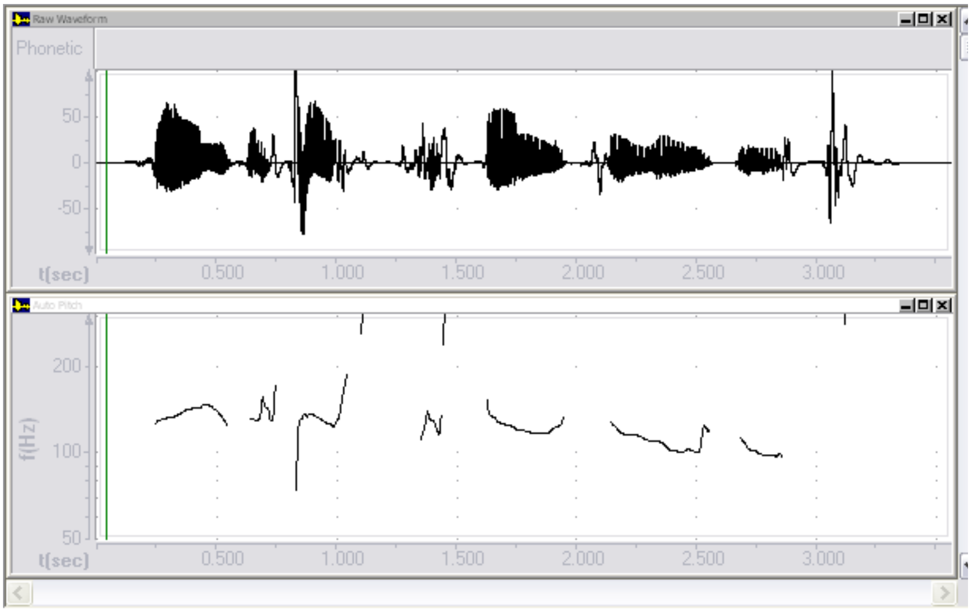
[6] Brown et al. (1980).

[7] Hawkins (1984:195). Straight lines: Fries (1940), Pike (1945). Numbers: Pike (1945), Trager & Smith (1951), Fontanella de Weinberg (1980). Contours: Armstrong & Ward (1931); this graphical representation of pitch is used in many works as part of the phonetic representation. Diacritics: Tench (1996), using diagonals; Hawkins (1984), using accents. Other systems of diacritics may be found in Lee (1960). The underlining indicates the place where the intonational melody is realized.

[8] Hawkins (1984:205).

(7) ML
Juan quih tafp, zixcám z iyoohit.
J. the arrived fish a she.ate.it
'Juan arrived and ate a fish.'



xwaːn kɪʔ ˈtaɸp ʃɪχ ˈkam ʃ iˈjoː ʔit

Figure 22. Pitch tracing for Seri declarative sentence: *Juan quih tafp, zixcám z iyoohit*.

27.4.2 *Polar questions.* If we change the intonation pattern on English words, we can change the meaning of the utterance from a simple statement to a question. If we say *tamales* with a rising intonation, we are asking a polar (yes-no) question, which might be *Are these tamales?*, or *Do you want tamales?*, but not *What are tamales?* The latter is a content question and as such requires a different intonation pattern in English. This kind of simple switch of intonation to change a statement into a question is not possible in all languages.

In Seri, for example, this just would not make any sense without a correctly formed verb or otherwise appropriate morphology. A polar question is given in (8).

(8) HL
Zixcám quih tpee?
fish the was.she.given.it?
'Was she given fish?'

But languages do commonly have a different intonation pattern for properly formed polar questions. In Seri, these are marked by a falling melody that begins at high level (indicated below by HL). Compare the pitch tracing in figure 23 for polar question (8) with the one in 22 above for a statement. Notice the sharply higher start on the pitch of the last word in the pitch tracing of the question.

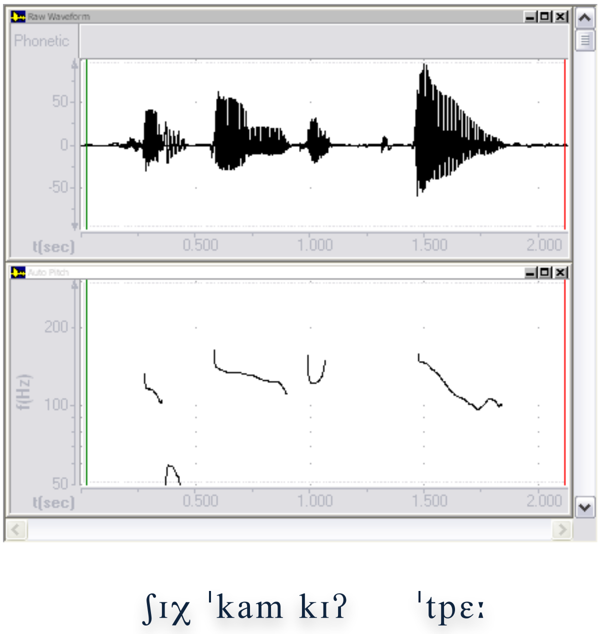


Figure 23. Pitch tracing for Seri polar question: *Zixcám quih tpee?*

Apparently this is similar to the pattern found in Hausa (a tone language), for example, where one effect of question intonation is "to raise the last high tone of the phrase to an extra high pitch with a sharp fall" (Schuh 1978:245)

Notice how different these patterns are from English, and therefore imagine how odd Seri and Hausa would sound if pronounced with English intonation. Note that this rising intonation pattern is not used in content questions in English (see below), nor in tag questions, which are looking for confirmation, such as at the end of *Classes started yesterday, didn't they?*

It has been claimed that polar questions cross-linguistically almost invariably have "either a 'terminal rise' or in some way a higher pitch than the corresponding statement pattern."[9]

27.4.3 *Content questions.* Simple questions that expect an answer other than yes or no have a couple of common intonation melodies in English: *Where did she go?* (HL) and *Where did she go?* (HLH). In fact, cross linguistically, both patterns are commonly found.[10]

In Seri, such content questions have a sharply rising melody that appears on the question word, followed by a low melody on the question marker (if it appears), and then the rest of the clause is rather flat, but drifting down (except for the normal slightly higher pitch that is part of the stressed syllable on the verb).

(9) LH L
Quíih *ya* *ntaho?*
who(m)? QM did.you.see.himherit?
'Whom did you see?'

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[9] Cruttendon (1986:162) citing findings presented in Bolinger (1978).
[10] Cruttendon (1986:165) citing findings presented in Ultan (1978).

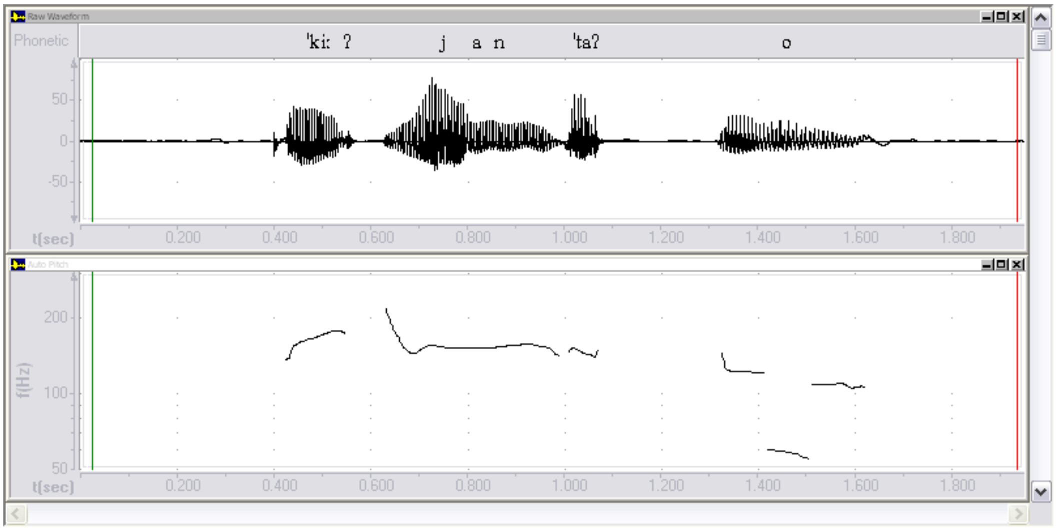

Figure 24. Seri content question: *Quíih ya ntaho?*

27.5 Key terms

The key terms introduced in this chapter are:

1. DECLINATION refers to the gradual fall in pitch within a particular utterance. (§27.1.4)
2. An INTONATION MELODY is a particular tonal pattern that is used in a language and associated with particular communicative functions. (§27.2)

27.6 Reading questions

You can check your answers to these questions in appendix F.27.

1. Tench posits six major functions of intonation including:
   a. Information prominence
   b. Expression of attitude
   c. Declination
   d. b & c
   e. a & b
2. T/F Intonation patterns can give important conversation clues to the hearer.
3. T/F The nucleus of an intonation melody within a specific domain provides the reference point for determining the rest of the characteristics of the melody.
4. Intonation patterns often distinguish:
   a. Yes-No questions
   b. Statements
   c. Open-ended (content) questions
   d. Commands
   e. All of the above

28

TONE

A defining characteristic of a tone language is the use of contrastive melodies for lexical items.[1] A morpheme has a tone pattern (melody) that is just as much a part of its physical form as the consonants and vowels that it is also composed of. (Actually, a morpheme in a tone language also may be *only* tone, or *only* consonants and vowels. We take up those possibilities later in this chapter.)

The relatively autonomous behavior of tones from the vowels (and sometimes consonants) on which they occur has led to the use of the term autosegmental in studies of tone, since tones can be manipulated independently ("auto") of the consonants and vowels ("segmental" material). Phonological theories have also extended the use of this term to other aspects of phonology, but most have still recognized that tonal properties of language are different from features such as [continuant], [voice], and [Dorsal], for example.

Perhaps one of the most important insights of recent years of research on tone systems in the world is the idea that tone languages function with melodies and not with tones. (Of course, not everyone may agree with this or have expressed it in this way.) That is, rather than just adding another feature such as [+High Tone] to the list of distinctive features for vowels, we see morphemes as having particular melodies such as High, or High-Low, or High-Low-High.

To put it another way, consider a word transcribed with high pitch on each syllable: **bádágálú** 'manioc'. An older way of thinking about this word would be to say that it has four syllables, each of which has a vowel, each of which is bearing a high tone. The newer way of thinking about such words would be to say that the morpheme has four syllables and a High tone (a simple melody) that happens to be spread across all of those syllables.

Imagine, for example, a language that had two supposed "tones" in the older way of looking at things—the tones High and Low—and also had three syllable morphemes. If the tones could just be randomly associated with the syllables (as expected *a priori*, given that conceptualization), one would expect eight patterns of words to be possible:

(1)
Low – Low – Low
High – High – High
Low – Low – High
High – High – Low
Low – High – High
High – Low – Low
Low – High – Low
High – Low – High

It seems that languages with this type of complexity might not exist. Instead, languages seem to function with a restricted set of melodies for morphemes. And very commonly, if they have two tones, what is really significant is that those tones are used to construct melodies that are four in number.

(2)
a. H
b. L
c. HL
d. LH

Obviously it is much easier to internalize a very restricted set of melodies than it is to memorize tones for each individual syllable (which could vary randomly, one would expect). But more important is the fact that the more restricted view (using tone melodies) is able to account for so many facts.

The use of the four melodies shown in (2) makes the prediction that in such a language one will find only four melodies on disyllabic monomorphemic words. We now combine this with another insight, namely that tones are

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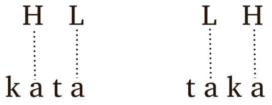
[1] This unit draws heavily on unpublished work by Keith Snider that is based on extensive experience with tones in languages of Africa. He is now using the phrase tone pattern instead of "melody".

associated with tone-bearing units (commonly vowels, but not only vowels) through universal as well as language-specific conventions.

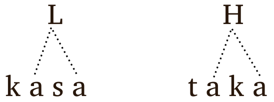
The association of the melodies HL and LH to disyllabic morphemes is straightforward in most cases. One just links each tone to the **tone-bearing units** (TBU), one to one.

(3)



The association of the melodies H and L to disyllabic morphemes is also not complicated if one assumes (as is commonly done) that an individual tone in a melody can be linked to more than one TBU.

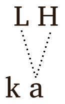
(4)



The situation is especially interesting when there are fewer or more TBU's than there are tones. Consider first the case of fewer TBU's. The simple melodies are easy, so we ignore them here. The complex melodies are more interesting. Sometimes one of them is simply blocked from appearing on a single TBU, and so on a short word it could be the case that no HL melody is found.

But suppose that LH is permitted on short words. One option that is actually attested, as well as theoretically possible, is for that melody to be mapped to a single TBU, resulting phonetically in a rising pitch.

(5)

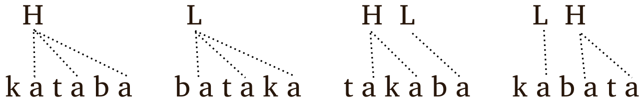


This would cause a novice to think that the language in question actually has three phonemic tones (Low, High, and Rising) when in reality it does not. The reality is that it has four melodies (revealed clearly by the polysyllabic morphemes).

Note well: Because of facts such as these, the use of monosyllabic roots for the demonstration of tonal melodies brings the greatest number of complications.

The same four melodies may be associated, perhaps, with morphemes that have more than two TBU's. Again, one option that is actually attested, as well as theoretically possible, is for those melodies to be mapped in a left-to-right fashion with the TBU's, and the last tone to be linked to more than one TBU, as shown below.

(6)



It has been an important claim in the past couple of decades of tone research that what is heard as three identical tones on three successive syllables in the same morpheme (as in **kátábá** above) is in fact only one tone melody (a simple high) that is associated with the three syllables in question.

The sometimes controversial but commonly invoked principle that has been articulated as being responsible for ensuring this result and disallowing a "monotone melody" H H H (or even H H) of identical tones within a morpheme is called the Obligatory Contour Principle.[2] It basically says: *αα. (You can't have two of the same thing side by side (in a given domain).)

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[2] Goldsmith (1976).

28.1 Allophonic variation

Just as segments display variation by their context, melodies also have some variation that may be viewed as “allophonic”.

First, it is not uncommon for a high tone to be pronounced at a lower pitch than expected when it is preceded by a low tone, being produced at what might be called a mid pitch level.[3] The phonetic rendition of H-L-H-L in a word such as **bí-kàtá-sà** (three morphemes, the first with the melody H, the second with the melody LH, and the third with the melody L) would be as in figure 25.

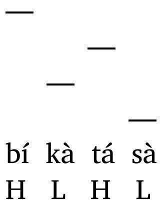

Figure 25. Representation of the effects of incremental shift downward (downstep)

While the first three syllables of the word are clearly perceived as being High-Low-Mid, the language does not have a Mid tone.

Tones may also have special realizations in certain contexts, such as phrase-final position. It is not uncommon for tones (especially Low, but sometimes also High) to be realized as a sharply falling pitch. The fall is perceptually important but phonologically not significant.

Note well: Because of the influence of phrase-final position, words pronounced in isolation (as in word lists!) are often not the clearest examples of tonal melodies.

28.2 Transcription issues

More than one notation has been developed for transcribing tone, and a reader of phonology must always be aware of these. Furthermore, people make all kinds of adaptations when they are working on particular languages.

One common non IPA notation is to use a superscript number after the syllable in question to indicate the tone with the convention “the higher the tone, the higher the number.” In some publications, one sees a superscript 5 for high tone and superscript 1 for low tone, with the numbers 2, 3 and 4 for in-between tones.

The Americanist tradition was the *opposite*, with low tone indicated by a high number and a high tone indicated by a low number. Thus 1 was high tone and 3 (or 5) was low tone. One must always be aware of this issue when reading any literature.

Another common non IPA convention is to write H (for high), M (for mid) and L (for low) somewhere above the word. Simple rising and falling tones might be indicated as LH and HL, respectively. This kind of transcription is most commonly used only in discussions of the analysis of the tones of the language in question.

One IPA convention for transcribing tone is to use diacritics above the vowels to indicate tone, with acute accent for high tone, grave accent for low tone, and a macron for mid tone. This notation is especially useful for systems that have been analyzed as having two or three relatively stable pitches on vowels. But the *Handbook of the IPA* (p. 14) indicates that it can be adapted to other situations as well (but perhaps not very practically).

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[3] When this shift to a lowered pitch continues, it is referred to as DOWNSTEP. We do not go into this topic here.

(7)

e̋	Extra high	ě	Rising
é	High	e᷄	High rising
ē	Mid	ê	Falling
è	Low	e᷅	Low rising
ȅ	Extra low	e᷈	Rising-falling

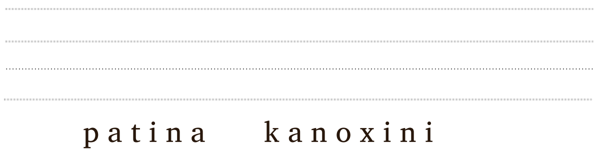
Finally, a system of tone marks using what are called “tone letters” is an official IPA convention that is especially useful for languages where “the lexical contrasts are predominantly dependent on the pitch movement on each syllable... The vertical stroke is assumed to represent five possible pitch heights within the speaker’s range, and the position of the line shows the height and movement (if any) of the pitch on the preceding syllable.” (We do not show here the diacritics for the second column. See page 203 of the *Handbook of the IPA* for how they should appear.)

(8)

e˥	Extra high	˩˥	Rising
e˦	High	˦˥	High rising
e˧	Mid	˥˩	Falling
e˨	Low	˩˨	Low rising
e˩	Extra low	˧˥˧	Rising-falling

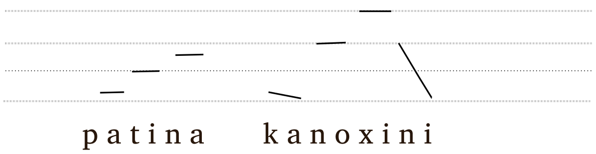
While any of these transcription systems might be used in a write-up for the IPA, it has been strongly suggested that none is particularly appropriate or convenient for initial, impressionistic transcriptions that one needs to make during fieldwork because they are so specific. A quite different type of transcription is appropriate when the analysis is still in process, and one that is helpful for writing data phonetically without causing the analyst (or the reader) to be biased toward a particular analysis. The transcription system used in work by Keith Snider is the use of a space above the segmental transcription that is divided into three spaces, where the middle dotted line indicates the midrange of the pitch range, as shown here.

(9)



The transcriber indicates the tones impressionistically using only two types of lines: a broad line that goes horizontally to indicate what seems to be a level pitch, and a broad line that goes at an angle upwards or downwards to indicate what seems to be a rising or falling pitch. Where the pitch begins and ends (impressionistically) is relevant, but nothing else. These broad lines are placed in the pitch space where they seem to be, without committing the transcriber to make a decision about how they are actually analyzed.[4]

(10)



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[4] Unfortunately, at this time there is no way to keyboard these as Unicode characters into most programs.

28.3 Methodological strategies

The facts that we have seen so far suggest that the methodological principles for discovering contrasts in language outlined in chapter §10 need to be both reiterated and adjusted for looking at tonal phenomena. The morphemes being looked at need to be organized by several important factors, which are listed in §§28.3.1-28.3.6.

28.3.1 *Morphological complexity.* Since each morpheme has its own melody, it is important to separate the words into groups that take this into consideration. Inherently possessed nouns are separated from simple nouns; compound nouns (or even what are plausibly compound nouns) are put into a separate group. Simple verbs are analyzed separately from compound verbs or derived verbs, as simple as the latter may seem.

28.3.2 *Number of tone-bearing units.* Since melodies accommodate to the number of TBU's available, the number of syllables and the shape of the morpheme (particularly the nucleus and coda) are relevant. Organize the data by those factors.

(11) a. Monosyllabic morphemes in particular should be divided between those with open syllables and closed syllables.
b. Those with diphthongs should be separated from those with monophthongs.
c. Those with short vowels should be separated from those with long vowels.
d. Those with sonorants in the coda should be separated from others.
e. Those with special phonation features (e.g., laryngealization) should be grouped separately.

All of these factors (and others) are relevant in various languages.

28.3.3 *Prosodic pattern.* If there is any hint that the language has stress as well as tone, group the words by the patterns that you see. For example, disyllabic words with penultimate stress should be put in one group and those with final stress in another.

28.3.4 *Noun classes.* Be aware of what may be noun classes (especially in Bantu languages, but also in others) that may introduce special complications. (You would want to be aware of what others working in the same language family have found, to profit from the years of research that they have done.)

28.3.5 *Variety of contexts.* Furthermore, it is important to see morphemes in a variety of contexts since it may be that only in one of those contexts is it possible for the lexical melody to be realized clearly.

Note well: Do not just take a list of nouns in isolation and try to figure out the tones. A noun in isolation is only one context and it may not be the most revealing situation since it is also at the end of an utterance.

For example, if one is looking at the noun meaning 'sparrow', the types of utterances shown in (12) should be examined (using the word order of Zapotec languages to illustrate).

(12)	sparrow	'sparrow'
	plural sparrow	'sparrows'
	one sparrow	'one sparrow'
	two sparrow	'two sparrows'
	sparrow this	'this sparrow'
	sparrow that	'that sparrow'
	plural sparrow this	'these sparrows'
	one sparrow big	'a big sparrow'
	one sparrow little	'a little sparrow'
	plural sparrow that	'those sparrows'
	sparrow big that	'that big sparrow'

sparrow red that	'that red sparrow'
sparrow mine	'my sparrow'
sparrow yours	'your sparrow'
saw man that sparrow	'that man saw the sparrow'
saw man plural sparrow that	'the man saw those sparrows'

28.3.6 *Loanwords.* As with the analysis of consonants and vowels (see §10.3), loanwords may present special characteristics and so should be set aside at first.

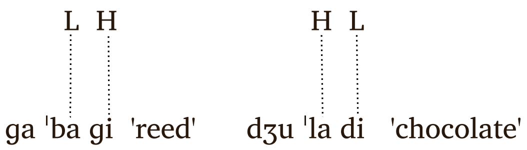
28.4 Mismatches

We have already seen cases where the number of TBU's does not line up with the number of tones in the melody. In some cases (as illustrated in (6)), this simply means that one tone ends up spreading to the TBU's that are lacking a tone.

28.4.1 *Default tone.* The situation may also be resolved by a DEFAULT TONE being inserted to provide a pitch for the toneless TBU.[5]

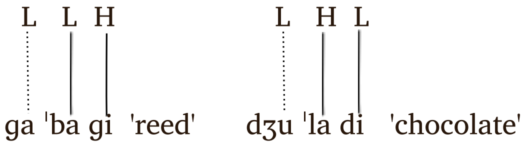
This appears to be what is happening in Isthmus Zapotec, where the tone melody of a root aligns with the stressed foot of the root. The melodies required for the following words are apparently LH and HL, respectively, and these are linked up by the association principle just mentioned (referring to the stressed foot). See this step in (13).

(13)



The first syllable of these words still has no tone, but in this language, rather than the first tone of the melody spreading to that syllable, a "default" tone (L, in this language) is associated with those TBU's. See the result in (14).

(14)



28.4.2 *Toneless morphemes.* A particular morpheme may have no lexical melody of its own, although it has a TBU. These have been called (lexically) toneless morphemes. The pitch that it is pronounced with may be due to either (a) the tone of an adjacent morpheme spreading to it, or (b) a default tone being inserted.

28.4.3 *Tone with no TBU.* A particular morpheme may have a lexical melody but no TBU in its lexical representation. This is not uncommon with functional morphemes (including those showing tense, aspect, noun class, etc.) and so this situation has sometimes been referred to as "grammatical tone", although the terminology is not particularly insightful. It may result from the historical loss of a vowel that leaves behind its tone to handle the function that the vowel plus tone originally had. The morpheme in the modern language may have only a consonant or not even a consonant associated with it as part of its basic form.

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[5] A default tone is the tone that a language may assign by a default tone assignment rule (if the language has such a rule) to "guarantee that if a vowel does not otherwise have a tone value, one is automatically assigned" (Odden 2005:318).

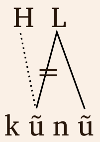
Atatlahuca Mixtec. The morpheme for Present tense (to use a simple label) in Atatlahuca Mixtec is a High tone—no consonant or vowel with it. Compare the following three verbs, which show that the Future "tense" is unmarked and allows the underlying tone melody of the verb to appear.[f]

(1)

Melody	Future	Present	Gloss
LH	nᵈùkú	nᵈúkú	'look for'
L	kũ̀nũ̀	kṹnũ̀	'weave'
M	kɨ̄βɨ̄	kɨ́βɨ̄	'enter'

The representation of the present tense of 'weave' would be as shown in (2), where the solid lines indicate the association of the melody of the root morpheme and the dotted line indicates the association of the melody from the prefix. The latter causes one association line of the root melody to be detached, indicated by the double hatch mark.

(2) (Present)



resulting in kṹnũ̀

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[f] The data are presented here in a somewhat narrow transcription, an interpretation of the facts presented in Alexander (1980). We do not know, however, what the melodies of these verbs really are since a full study of them has not been done.

28.5 Key terms

Key terms introduced in this chapter are:

1. A TONE MELODY is a particular tonal pattern that is used in a language and associated with set of lexical items.
2. AUTOSEGMENTAL relates to the relatively autonomous behavior of certain features of speech—particularly tone melodies in this chapter.
3. Tones and segmental material are ASSOCIATED with each other. In some formal presentations this is indicated through the use of association lines.
4. TONE BEARING UNITS are the particular units in the segmental representation with which tone melodies associate. They are typically vowels, but they are also consonants in some cases.
5. A DEFAULT TONE is the tone that a language may assign by a default tone assignment rule (if the language has such a rule) to "guarantee that if a vowel does not otherwise have a tone value, one is automatically assigned" (Odden 2005:318). (§28.4.1)

28.6 Suggested additional reading

Suggested additional reading: Maddieson (2013f).

28.7 Reading questions

You can check your answers to these questions in appendix F.28.

1. T/F Tone languages have contrastive melodies on lexical items.

2. T/F Within Autosegmental theories of tone, tone is described as another contrastive feature of vowels, i.e. with [+ high tone].
3. In the newer way of thinking about tone, the word **[pápíkáp]** would be analyzed as:
   a. Three high tones on a tier that is separate from the vowels.
   b. One high tone on a tier that is linked to three tone-bearing units.
   c. Three high-tone vowels.
   d. A HL melody.
4. Tones are said to be associated with:
   a. Vowels
   b. Tone bearing units
   c. Individual syllables
   d. The timing tier
5. T/F The use of monosyllabic words for tone analysis is the easiest and most informative analytic tool because it can show you straightforward contrasts.
6. T/F The Obligatory Contour Principle disallows two of the same tone in one morpheme.
7. T/F It is possible to have allophonic variations of tone based on intonation or assimilation to surrounding tones.
8. T/F When analyzing tone it is important to group similarly inflected words together.
9. Factors that can be relevant for grouping words for tone analysis are:
   a. Vowel length
   b. Syllable type
   c. Sonority
   d. Palatalization
   e. All of the above
10. T/F It is sometimes proposed that a “default tone” is inserted to then associate with a toneless TBU.
11. T/F A single unattached tone can serve as a morpheme in some languages and can affect the existing tones of the root word in various ways.

28.8 Exercises

1. Acatepec Me'paa. Examine the representative data in appendix G.1.4. How many tone melodies are needed for monomorphemic nouns and what are they? How are the pitch contours of the monosyllabic words accounted for?
2. Marinahua. Examine the representative data in appendix G.17. How can these be analyzed with a minimum of melodies? And without melodies?

29

STRESS

STRESS refers to the degree of prominence that appears on a syllable (or mora) in an utterance. Generally one speaks about primary stress on only one syllable in a word because one syllable is more prominent than the others. There may also be secondary, tertiary, and even quaternary stress. The IPA transcription system provides a simple way to show primary and secondary stress in contrast to an unstressed syllable. The example given in IPA (1999:15) is the one in (1).

(1) [ˌpærəsaɪˈkɒlədʒi]*parapsychology*

Not all languages are analyzed as having stress. Tone languages, in particular, may not have stress, but some do. Non-tone languages commonly have stress, but not all do.

Some specific examples in the *Handbook of the IPA*: Amharic is described as having "weak stress"[1] and for Hindi it is said that it is "controversial as to whether there is even phonetic word stress."[2] No mention of stress is given for the descriptions of Chinese, Hausa, Igbo, and Japanese. These are all tone languages; presumably there is no word stress. The description of Thai, which is also tonal, does indicate where stress falls, but it does not tell how one knows that a syllable is stressed.[3]

29.1 Phonetic correlates of stress

Stress is an abstract notion since there is no phonetic correlate that can be directly measured for it that is applicable to all languages. Instead, stress has to be understood on a language-particular basis. Some syllable in a word may be more prominent than others. How that prominence is actually signaled will vary from language to language. For this reason, it is commonly expected today that discussions of stress in a language will also include discussion of the actual phonetic correlates. One should not just tell where a word is stressed, but also how stress is actually realized.[4]

29.1.1 *Higher amplitude.* Figure 26 represents the three syllable word *apoyo* [aˈpo·jo] in Spanish, which has stress on the penultimate syllable. The program has extracted a measurement of the magnitude—something very closely related to amplitude. One can see that the amplitude of the stressed syllable is greater than the other two syllables. Amplitude is a factor that is correlated with stress in many languages, although it may not be the primary phonetic correlate. (Measurements of intensity or amplitude are related to measurements of "magnitude" in Speech Analyzer; the measurements are in decibels.)

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[1] Hayward & Hayward (1999).

[2] M. Ohala (1999).

[3] Tingsabadh & Abramson (1999).

[4] The phonetic correlates of stress in English are not mentioned at all in one recent major publication. The author simply says that stressed syllables are more prominent than the others.

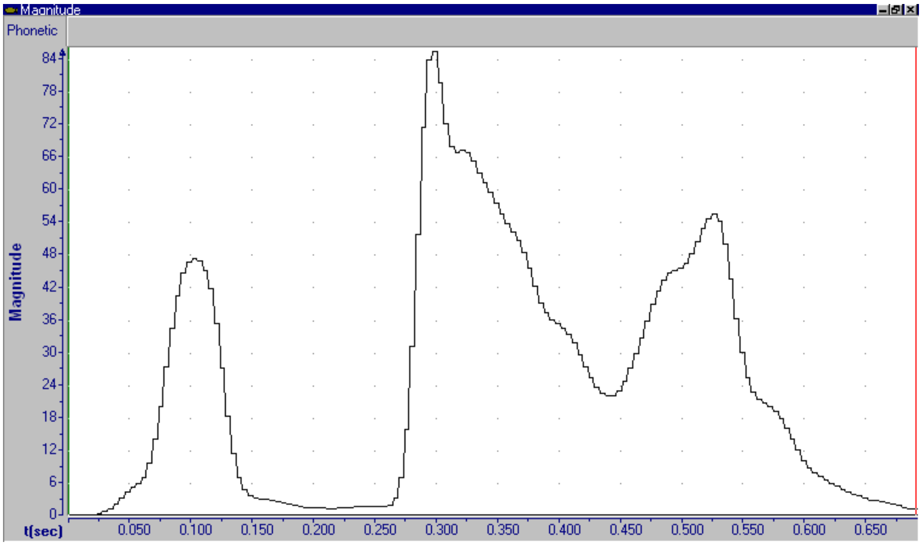

Figure 26. Measurement of magnitude for the Spanish word *apoyo*

29.1.2 *Lengthening of the syllable nucleus.* It is also common (but not universal) for the nucleus of the stressed vowel to be longer than the nucleus of an unstressed vowel. Figure 27 shows the word *beleza* **[bəˈleˑzɐ]** in Brazilian Portuguese; the word has penultimate stress. Notice how the stressed vowel has about twice the length as the first vowel (although the amplitude of those two syllables happens to be about the same).

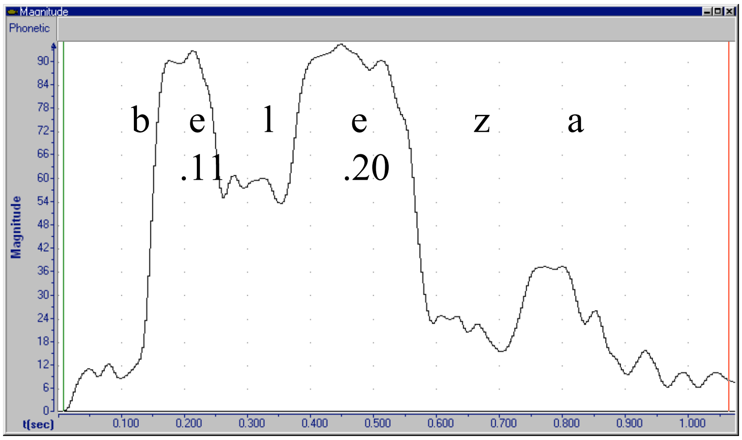

Figure 27. Vowel duration and amplitude in the Brazilian Portuguese word *beleza*

29.1.3 *Lengthening of a consonant that follows the stressed syllable.* Length as a phonetic correlate of stress may appear on a consonant that follows the stressed syllable—which means that actually stress is signaled by a phonetic feature in a syllable other than the one where stress is assigned. This is the situation in Seri, where a consonant (and also the vowel following that, under certain conditions) is lengthened very noticeably because of stress on the vowel before it. The word *quisil* **kisiɬ** 'little', with penultimate stress, is phonetically **[ˈkɪsːiːɬ]**. See Figure 28.

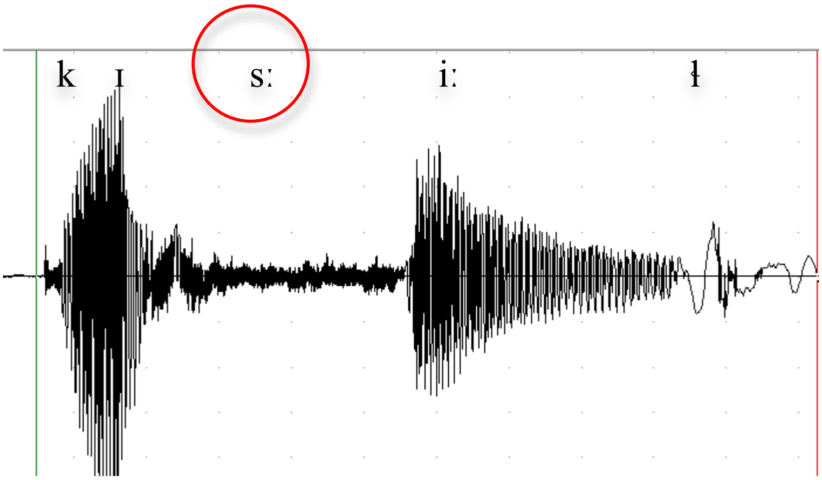

Figure 28. Consonant length after stressed vowel in Seri word *quisil*

29.1.4 *Variation on the sounds in the stressed syllable.* Sounds may have certain variants in stressed syllables. Consonants may have stressed allophones, for examples, when they are in the onsets of stressed syllables. Many of the phenomena discussed in chapter §22 are relevant here since a syllable onset is the beginning of a phonological unit where sounds may be pronounced more strongly.

29.1.5 *Lack of variation on the sounds in the stressed syllable.* A stressed syllable may also be signaled by the *lack* of variation that is found. The coda of a stressed syllable is stronger than the coda of an unstressed syllable in Seri, for example, and thus a nasal in the coda of a stressed syllable is more stable phonetically; it does not undergo nasal place assimilation and phrase-final velarization. Vowels in unstressed syllables in English tend to become centralized while those in stressed syllables tend to maintain more of the distinctive features. Vowel length in Seri is maintained distinctively only in stressed syllables.

29.1.5.1 *Short exercise: Arabela velar consonants.* Take a *few* minutes to look at the distribution of velar consonants in the Arabela data in appendix G.21: [k x ɣ]. Do they show evidence of contrast? If so, mention which forms show this. If they do not, try to give at least an informal characterization of where they occur. (Be sure to consider the allomorphy evidence that are evident from the different words referring to ‘father’.) When you have finished, see the discussion in appendix E.42.

29.1.6 *Higher pitch.* A stressed syllable in many languages has a higher pitch than an unstressed syllable. Figures 29 and 30 show the fundamental frequency of the words *caminho* kaˈmiɲo in Brazilian Portuguese (penultimate stress) and *quisil* ˈkisiɬ of Seri (penultimate stress), respectively.

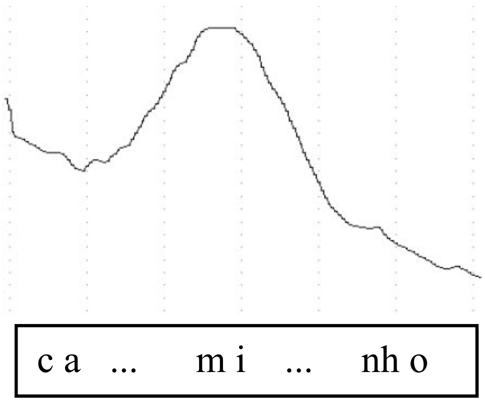

Figure 29. Pitch tracing for Brazilian Portuguese *caminho*

Figure 30. Pitch tracing for Seri *quisil*

None of these factors is the only one that is useful or that is appropriate for all languages nor even exclusively so within a language, since intonation patterns may also interact with them.

29.2 Stress placement

For languages that have stress, the question arises as to where in an utterance one finds stress. This topic has been the focus of many years of research by many people. One small presentation here is hardly sufficient to begin to introduce the subject. Indeed, entire courses and books are devoted to the topic.

In some languages, such as French, it has been claimed that stress is not a word-level characteristic at all. It should not be presumed that a language has stress, whether or not the language is tonal.

It has been claimed that “although French is often described as having stress on word-final syllables, in connected speech this is preempted by the accent on the final syllable of a group of words.”[5] But an examination of the pitch tracings of the first sentence in the connected text included with the illustration (see figure 31) shows that every (non-function) word does in fact have a higher pitch on the last syllable (excepting schwas).[6]

(2) *La bise et le soleil se disputaient, chacun assurant qu’il était le plus fort.*
(Translated literally, The North_wind and the sun were_arguing, each claiming that_he was the more strong.)

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[5] Fougeron & Smith (1999:80).

[6] This pitch tracing was extracted using PRAAT.

One can also detect a drop in pitch generally in the last part of the sentence, which is attributable to the intonation pattern.

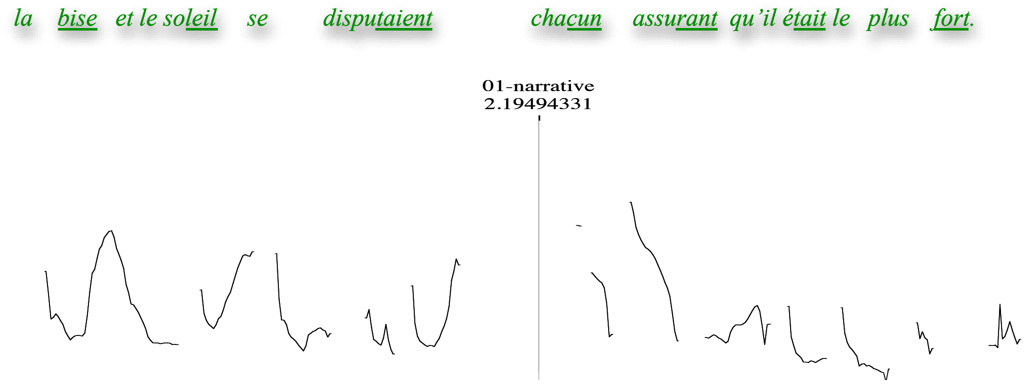

Figure 31. Pitch tracing of French example

29.2.1 *Major class words and minor class words.* It is important to distinguish two classes of words for the discussion of stress. It is not uncommon for only major class words (such as nouns, verbs, and adjectives) to be stressed. Minor class words (such as conjunctions, prepositions and some adverbs) may simply not have any stress at all. This difference may result in pronunciation differences as well, of course. The stressed word will have all the language-particular characteristics relating to stress (amplitude, aspiration, vowel length, etc.) and the unstressed word will not.

It is commonly the case that unstressed words are not usable in isolation (except when being discussed as objects, as in a language class). And closely related languages may differ on this point. For example, the subject pronoun that means 'I' in Spanish is *yo*, and is easily used in a sentence such as *¿Yo?* (something like, 'Who, me?'). On the other hand, the corresponding subject pronoun in French, *je*, cannot be used in isolation this way. One must use an entirely different pronoun, *moi*, in the comparable sentence.

Some examples of differences between stressed and unstressed words are given in (3):

(3)

Stressed		Unstressed		
ˈmas	'more'	**mas**	'but'	Spanish
ˈel	'he'	**el**	'the (masc.)'	Spanish
ˈpaɾa	'stops'	**paɾa**	'for'	Spanish
ˈsi	'yes'	**si**	'if'	Spanish
ˈeste	'east'	**este**	'this'	Spanish
ˈnaʊ	'now'	**naʊ**	(discourse marker)[7]	English
ˈwɜn	'one'	**wɜn**	(unspecified person)[8]	English
ˈʔaχ	'water'	**ʔaχ**	'just'	Seri

For this reason, discussions of stress-placement in a language pertain only to certain classes of words.

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[7] As in the example, *Now, if you think I'm going to let you have candy before lunch, . . .* where the word *now* is not referring to time and is unstressed.

[8] As in the example, *If one is in doubt about his intentions, . . .*, which contrasts with *If óne is found, then two are likely to be found*.

Moreover, in some languages such as English and Spanish, the stress-assignment rules make a distinction between nouns and verbs since the rules for them are different from each other.[9]

29.3 Morphological information

While many descriptions of stress placement make reference only to word boundaries, it is clearly the case in some languages that the domain of reference for generalizations about stress placement is the root and not the word. These cases have not been well documented in the literature, but they include Seri.[10]

A number of suffixes in English are “invisible” with respect to stress placement in that they are not relevant. One example is the suffix *-ous* in a word such as *dangerous*. Hammond calls them “neutral suffixes” and summarizes a short presentation with the comment “there is a set of affixes that allow the rightmost stress to occur outside the three-syllable window, and that allow a heavy syllable to be skipped over by the rightmost foot. The simplest treatment of these is to suppose that these affixes are not included in the prosodic word. … More could be said on this point, but that would require a treatment outside the scope of this book.”[11]

Example: Seri. The Seri data in (1) show that in polysyllabic nouns stress typically falls on the penultimate syllable.

(1)	ˈkama	‘big skate *(Raja binoculata)*’
	ˈʔakat	‘shark’
	ˈkoːtax	‘ant’
	koˈmima	‘Coulter brickell-bush’
	moˈxɛpɛ	‘sahuaro cactus’
	χpaˈsipip	‘dragonfly’
	kaskaˈmama	‘a stinkbug’

Once we begin to look at inflected words, however, we see that it does not work to assign stress to the penultimate syllable of the word. Compare the following forms. (Morpheme breaks are shown. Note that the IPA convention of indicating stress with a raised vertical stroke before the onset of the stressed syllable makes these facts a little bit less obvious.)

(2)	ˈʔaːʔo	‘road’
	ˈʔaːʔo-ɬkam	‘roads’
	takaˈʃaka	‘inchworm’
	takaˈʃaka-tax	‘inchworms’
	ˈt-kap	‘as it flew’
	po-ˈkap	‘when it will fly’
	ˈt-kap-tox	‘as they flew’

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[9] See Hammond (1999) and Harris (1983).

[10] Marlett (2008a).

[11] Hammond (1999:322). On the notion of “heavy syllable”, see §29.8. It should also be noted here that Hammond’s use of the term “prosodic word”, to exclude a whole set of suffixes, does not seem to be standard usage.

If the generalization to "stress the penultimate syllable" of polysyllabic words is stated as applying to the root rather than to the word, the data in (2) are not problematic at all. The generalization for stress does not tell us anything about where word breaks are found since it does not make reference to word boundaries.

29.4 Reference to word boundary

Languages in the *Handbook of the IPA* that mention stress placement relative to a word boundary include the following:

(4) a. First syllable: Finnish, Czech, Hungarian, Irish, Sindhi.
  b. Penultimate syllable: Taba, Tukang Besi.
  c. Final syllable: Thai, Turkish.

For a much more complete survey of types of stress systems, see the report in Goedemans & van der Hulst (2013a) and also the extensive presentation in van der Hulst et al. (2010).

29.4.1 *Domain.* There have been numerous proposals on how to account for the different types of stress systems. In one way or another they set parameters on how languages differ. One parameter that must be examined is the DOMAIN OF STRESS ASSIGNMENT. The domain of stress may be the word (most commonly so, apparently) or the root. In this regard one must also know whether certain morphemes (such as proclitics and enclitics) are part of the domain of word stress assignment.

29.5 Foot

A key concept in discussions of stress has been the (metrical) FOOT, where a (metrical) foot is simply a prosodic grouping of a certain number (usually one or two) of syllables. Languages vary as to exactly how feet are constructed. In English, it is claimed that a foot may have a maximum of two syllables. A word like *Minnesota* has two feet, with two syllables each: *(Minne)(sota)*.

29.6 Alignment

A parameter along which languages vary, obvious from the few examples in (4), has to do with what edge is relevant for constructing or aligning the feet. One may count syllables from the left edge or the right edge. In English the right edge of the word is relevant, and so the foot structure of a word such as *banana* is *ba(nana)* rather than **(bana)na*.

This is very sketchy at this point; you will have to read a more detailed work to understand this all. One recent work, Hammond (1999), dedicates about 180 pages to explaining how this works in English alone.

29.7 Headedness

Another parameter relating to (metrical) feet is how they are headed: are they left-headed or right-headed? The head is the most prominent syllable of the foot. If a binary foot is left-headed, the foot is a TROCHEE. If a binary foot is right-headed, the foot is an IAMB. English is characterized as having left-headed feet (trochees): *(Mìnne)(sota)*, *ba(nana)*.

29.8 Quantity sensitivity or insensitivity

In many languages, including English, the weight of a syllable is relevant to the placement of stress. Syllable weight is measured in moras, and a language that counts heavy syllables differently than light syllables is said to be a quantity sensitive language with respect to stress. Note that when the final syllable has a long vowel or diphthong, it is stressed: *about*, *balloon*, *agree*, *explain*. Final syllables that are heavy by having two consonants in the coda are also stressed: *insist*, *adept*. You surely have thought of counterexamples to the last statement—or to various statements made above. Obviously, there is more to this story.[12]

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[12] See Hammond (1999) for one attempt to explain the facts of English stress. For a survey of quantity-sensitive stress systems, see Goedemans & van der Hulst (2013a, 2013b).

Example: Seri. Look back again now at the data in §29.3 where it was shown that stress regularly falls on penultimate syllables in Seri. This is only part of the story, however. When the final syllable is heavy in almost any way (long vowel, vowel cluster, or a consonant cluster (more on that below, in §29.9), it is the final syllable rather than the penultimate syllable that is stressed. See the examples in (1).

(1)	**koˈneː**	'grass'
	patpaˈjoː	'juvenile zebra-tailed lizard *(Callisaurus draconoides)*'
	χomkaˈʔiːɸt	'oregano *(Lippia palmeri)*'
	χomkaˈʔai	'an unidentified small round flounder'
	saˈpatχ	'sweetbush *(Bebbia juncea)*'
	taˈkamn	'slipper lobster *(Evibacus princeps)*'
	koˈnamx	'a large unidentified grasshopper'

This is a fairly typical pattern for languages to have. What is a bit surprising is that a simple closed syllable in final position is not considered heavy. On this topic, see §29.9.

29.9 Extrametricality

Finally, it has been proposed that in some cases a syllable at the word margin may be marked as EXTRAMETRICAL or that a consonant at a word margin may be extrametrical (thus perhaps making a heavy syllable light insofar as metrical structure is concerned). The idea of extrametricality is meant to formalize a common observation that (in some languages) a syllable or a consonant at a word edge is invisible when stress rules are applied.

29.10 Stress in the real world

Consider now a representative set of the Seri facts, setting aside the concerns about suffixes (they do not affect the placement of stress and they do make this part a bit more complicated in the real world). The language has a very robustly attested pattern of (a) stressing the final syllable if it is heavy (ignoring the final consonant as we have pointed out), and (b) otherwise stressing the penultimate syllable. Examples have been shown above. There are exceptions, however. See the representative set of examples in (5), now written in the practical orthography but with stress explicitly shown in all examples.

(5)

Penultimate stress because final syllable is light	
cáma	'big skate *(Raja binoculata)*'
bácat	'shark'
cóotaj	'ant'
comíma	'Coulter brickell-bush'
mojépe	'sahuaro cactus'
xpasípip	'dragonfly'
cascamáma	'a stinkbug'

Final stress because final syllable is heavy	
conée	'grass'
patpayóo	'juvenile zebra-tailed lizard *(Callisaurus draconoides)*'
xomcahíift	'oregano *(Lippia palmeri)*'

xomcahái	‘an unidentified small round flounder’
sapátx	‘sweetbush *(Bebbia juncea)*’
tacámn	‘slipper lobster *(Evibacus princeps)*’
conámj	‘a large unidentified grasshopper’

Irregular stress (either antepenultimate or final stress on light syllable)

cótotaj	‘boojum tree *(Fouquieria columnaris)*’
hémeja	‘desert woodrat (?) *(Neotoma lepida)* (?)’
satómatoj	‘mesquite driftwood’
xahícosa	‘a rock shell *(Haustellum elenensis)*’
hamác	‘fire’
joját	‘saya *(Amoreuxia palmatifida)*’
xojmás	‘an unidentified land snail’

Now think about how to accurately and yet efficiently write stress in the language, since writing it explicitly everywhere just because of some complications is simply not very practical. What was done in the second edition of the dictionary that was published was essentially to write stress only when the regular rules are not obviously followed (in this case, even when the exception is due to the addition of a suffix, which in the real system is not relevant).[13] As a result, of course, a very high percentage of the words do not appear with a stress mark on them in the dictionary, and yet it is entirely clear which syllable is stressed (the rules having been presented carefully in the introduction). Stress is only written on words that are exceptional by this algorithm. See the first column in (6) to see the actual spelling used in that dictionary; the second column repeats the information in (5) to show the exact placement of stress.[14]

(6) Penultimate stress because final syllable is light

cama	*cáma*	‘big skate *(Raja binoculata)*’
hacat	*hácat*	‘shark’
cootaj	*cóotaj*	‘ant’
comima	*comíma*	‘Coulter brickell-bush’
mojepe	*mojépe*	‘sahuaro cactus’
xpasipip	*xpasípip*	‘dragonfly’
cascamama	*cascamáma*	‘a stinkbug’

Final stress because final syllable is heavy

conee	*conée*	‘grass’
patpayoo	*patpayóo*	‘juvenile zebra-tailed lizard *(Callisaurus draconoides)*’
xomcahiift	*xomcahíift*	‘oregano *(Lippia palmeri)*’
xomcahai	*xomcahái*	‘an unidentified small round flounder’
sapatx	*sapátx*	‘sweetbush *(Bebbia juncea)*’
tacamn	*tacámn*	‘slipper lobster *(Evibacus princeps)*’
conamj	*conámj*	‘a large unidentified grasshopper’

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[13] M. Moser & Marlett (2010). The first edition of the dictionary, M. Moser & Marlett (2005), did not use that algorithm based on the modern analysis, but rather one that may be, perhaps, easier for an outsider to remember. As a result, the first edition had to write accents on many more (hundreds, perhaps thousands) more words.

[14] There are a few other special rules that are also used. Good writers of the Seri language may not even bother to write stress at all, which may cause some confusion for someone who does not know the language. Unlike in Spanish, where the use of written accent marks is highly prescribed, in Seri that kind of rigidity has not developed yet, although we do not know what may happen in the future. The tradition of writing Seri is very young.

Irregular stress (either antepenultimate or final stress on light syllable)

cótotaj	*cótotaj*	'boojum tree *(Fouquieria columnaris)*'
hémeja	*hémeja*	'desert woodrat (?) *(Neotoma lepida)* (?)'
satómatoj	*satómatoj*	'mesquite driftwood'
xahícosa	*xahícosa*	'a rock shell *(Haustellum elenensis)*'
hamác	*hamác*	'fire'
joját	*joját*	'saya *(Amoreuxia palmatifida)*'
xojmás	*xojmás*	'an unidentified land snail'

29.11 Phonemic vs. non-phonemic stress

To end this very short introduction to stress, we point out how some current views of stress are different from those from earlier periods.

One may read the statement that "stress is phonemic" in a given language simply because one finds pairs of words such as *permit* (noun) and *permit* (verb), or *combine* (farm implement, noun) and *combine* (verb), which differ only in stress. It is concluded in these descriptions that stress placement cannot be predicted since one cannot simply count some number of syllables from the word edge. Hence (they say) stress is phonemic.

In most cases this seems like an inappropriate claim, since it implies that stress is unpredictable and hence memorized just like the difference between **t** and **s** is memorized. It is inappropriate because there may be much more that should be said.

Alternative one: Perhaps 95% of the words are completely regular with respect to stress and only 5% are irregular. Do we really want to simply say "stress is phonemic" and stop there? One would hope not.

Alternative two: Perhaps stress is completely regular based on some morphological information that is different from just knowing where the word breaks are found. Nouns might have different patterns than verbs (as is claimed for English and Spanish). Perhaps stress is not assigned based on counting syllables from the edge of the word but rather from the edge of the root (as is claimed for Seri). A random pair of words such as **ˈtaka** 'tree' and **taˈka** 'sits down' are thus superficially interesting but not indicative of unpredictable stress. It may be that stress is perfectly well behaved in these words and straightforwardly assigned if one knows where the roots begin. In these cases we would not want to simply say "stress is phonemic" and stop there.

Today it is generally not acceptable to find some simple set of facts and just say "stress is phonemic". Even if there are exceptions (which may be so marked in the lexicon), as there may well be, languages have general patterns of stress placement that can be described. Those general patterns are worth understanding and describing.

29.12 More than words

Up to this point we have talked about stress primarily in terms of its placement in individual words. That is an important topic, but it is not all that there is. Words are used in compounds, phrases, and sentences, and in these situations it is highly likely that one "primary" stress will be reduced to a secondary stress. In the phrase *the cookie monster*, for example, the second word has greater prominence than the third word, even though each of the those two words has penultimate stress. Sometimes a juxtaposition of two words produces what has been called a "stress clash" and one of the words takes on a quite different pattern in that context. A famous example from English has been *thirteen cowboys*, where the final-stressed word *thirteen* is pronounced as a penultimate stressed word in this context, putatively in order to avoid having two primary stresses adjacent to each other. (Obviously there is more to the story.)

Other languages present other interesting challenges to a complete description of stress patterns. One example, from Seri, is illustrated by the pairs of sentences in (7)-(9). Note that the identical sequence of morphemes and sounds appear, but the difference in the stress on one word changes the meaning completely.

(7) a.

ˈkiikɛt	kʔ	ˈiiki	joˈpanʃχ
‘herhis.mother’	‘the’	‘towards.himher’	‘she.ran’

‘Herhis mother ran toward herhim.’

b.

ˈkiikɛt	kʔ	ˌiiki	joˈpanʃχ
‘herhis.mother’	‘the’	‘towards.himher’	‘she.ran’

‘She ran toward herhis mother.’

(8) a.

ˈkootax	tintika	ʃiχkiˈsiiɬ	kap	ˈiti	jaˈxast
‘ant’	‘the’	‘child’	‘the’	‘on.himherit’	‘she.stomped’

‘The child stomped on the ant.’

b.

ˈkootax	tintika	ʃiχkiˈsiiɬ	kap	ˌiti	jaˈxast
‘ant’	‘the’	‘child’	‘the’	‘on.himherit’	‘she.stomped’

‘The ant stomped on the child.’

(9) a.

ˈkootax	tintika	ˈiti	jaˈxast
‘ant’	‘the’	‘on.himherit’	‘she.stomped’

‘The ant stomped on himherit.’

b.

ˈkootax	tintika	ˌiti	jaˈxast
‘ant’	‘the’	‘on.himherit’	‘she.stomped’

‘She stomped on the ant.’

These facts, and related ones, while discussed briefly in unpublished work, have not been given a proper analysis.

29.13 Key terms

Key terms introduced in this chapter were:

1. **stress** refers to the degree of prominence that appears on a syllable (or mora) in an utterance.
2. The **domain of stress assignment** refers to the string of segmental material that is scanned for the purposes of determining which unit (e.g., syllable) is going to receive greater prominence. (§29.4.1)
3. A metrical **foot** is a prosodic grouping of a certain number of syllables. (§29.5)
4. A foot with two syllables, the first of which is most prominent, is a left-headed foot, referred to as a **trochee**. (§29.7)
5. A foot with two syllables, the second of which is most prominent, is a right-headed foot, referred to as an **iamb**. (§29.7)
6. A syllable at a word margin may be outside the domain of stress assignment—**extrametrical**.

29.14 Reading questions

You can check your answers to these questions in appendix F.29.

1. T/F It is important to analyze stress since it is contrastive in all known languages.
2. Stress can be perceived in which of the following ways?
   a. higher amplitude
   b. lengthening of the syllable nucleus
   c. higher pitch
   d. certain allophones that occur in stressed syllables

   e. the blocking of certain sounds changes in stressed syllables
   f. all of the above
3. T/F It is common for major class words to have stress while minor class words in the same language do not.
4. T/F When determining the domain of stress assignment, one is generally deciding between the word or the root.
5. T/F English is characterized as having right-headed feet (iambs) as in (Minne)(sota)
6. T/F Placement of stress may differ according to syllable type.
7. T/F When a pair of words like [gi'ta] 'cloud' and ['gita] 'flower' are found, the best analysis is to say that stress is phonemic.

29.15 Exercises

1. Tetelcingo Nahuatl. Study the data in appendix G.26 and determine the stress rule for the language.
2. Isthmus Zapotec. Study the data in appendix G.7.1 and determine whether there may be some reason to posit stress as well as tone in this language. If so, determine what the phonetic correlates of stress may be. Write up your results in simple statements that might be included in a concise phonological description.
3. Seri. Study the data in appendix G.5.7 and come up with observations about major patterns that you see about where stress occurs on words. (The data are representative, but the list of words does include some exceptional words.) What factors are relevant? Does extrametricality play a role?
4. Tabaru. Study the representative data in appendix G.31 and come up with analysis that is simple to cover both the stress facts and the allomorphy. (This exercise begins to involve what we would call the M-phonology. Any more comments than this one would detract from the interest of this exercise. Be creative.) Be sure to read the footnotes and any data that may appear on the second page.
5. Staged exercise: stress in Cocama. Use the data provided to you (a copy of Faust & Pike 1959) to write up a concise presentation of the facts relating to primary stress. You do not need to cover the effects of stress on consonants and vowels (since those are described elsewhere).

30

PHONEMIC ANALYSIS AND THE QUESTION OF ABSTRACTION

The procedures that were outlined in chapters §11–§12 and then illustrated being put into practice in the ensuing chapters have been standard practice for linguists in the last century and up to the present. Of course, there have been differences of opinion about what this means and how it is actually done, but for the most part, criticism of this approach has been that the procedures have not gone far enough—that there should be *greater* abstraction in the phonological representation than what "phonemicists" from the twentieth century really were happy with.

We have seen various examples of where certain features of sounds are predictable and hence, for some linguists, should not be in the phonological representation. For example, in a language in which all syllable-final nasals are either (a) homorganic with a following obstruent or (b) otherwise velar, it might be claimed that the final consonant is stored in the mental lexicon as [+nasal] and nothing more. Besides the obvious nasal place assimilation rule, a simple rule, perhaps based on some universal principle, would supply the rest of the features of the nasal consonant in syllable-final position and make it velar when not assimilated. This is clearly more abstract than saying that the word **[tʃaŋ]** ends in specifically a velar nasal, as in **tʃaŋ** or a specifically an alveolar nasal, as in **tʃan**. Such an example illustrates in a small way the large and on-going debate about how abstract phonological representations can be or should be.

At the other end of the debate is the position that even the degree of abstraction represented by the phonemic analysis illustrated in this book is not defensible. That is, some argue that just because a linguist *can* do phonemic analysis does not mean that this has anything to do with what speakers are doing; phonetics is enough, they would argue.

Throughout this book we have tried to draw out the importance of evidence other than the observed patterns in the language (such as complementary distribution and allomorphy) for a particular analysis. We have seen the relevance of word games and secret languages, for example, that demonstrate the speaker's ability to interact in real time with some kind of representation of his or her language. Sometimes, we believe, that ability demonstrates that some degree of abstraction is in play. On the other hand, very little, if any, such evidence (referred to as "external evidence" in the literature)[1] supports any degree of abstraction that resembles what has been commonly proposed in the tradition of generative phonology.

One example that illustrates that at least a minimal amount of abstraction is necessary is from labialization spreading in Seri. The feature [+round] on a back consonant spreads to adjacent back consonants, and even applies across word boundaries. An example of the latter is the effect that the rounding of the final consonant of the word **ˈanχʷ** 'much' has when it precedes a word like **kaˈtikpan** 'working' in the sentence **ˈanχʷ kaˈtikpan iʔa** 'she is working a lot'. The phonetic representation is **[ˈanχʷ kʷaˈtikpan iʔa]**. The fact that the rounding spreads from the labialized uvular fricative in the first word and now affects the velar stop at the beginning of the second word is scarcely noticed by native speakers.

This same spreading of [+round] can be seen—or hypothesized—as operating word-internally as well. The name for Tiburón Island is **[taˈʔɛʷxʷkʷ]**, where the last two consonants are clearly spoken with lip-rounding, although the off-glide is actually only perceived after the final consonant—very clearly so when a vowel-initial word follows this consonant. There is a slight amount of transitional labialization before the (very lenis) velar fricative. So the question is whether the phonemic representation is (a) **taˈʔɛxʷkʷ**, or

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[1] Campbell (1986:164): "We need sources of 'external evidence', that is, evidence not confined to surface-pattern regularities, but evidence showing speakers behaving linguistically in ways where they must call upon their knowledge of the rules and underlying forms of their language in overt and revealing ways. Some sources of external evidence that have been employed with some success are metrics and verse, word games (secret languages, disguised speech), experiments, borrowing, speech errors, orthography construction, and language change."

(b) **taˈʔɛxkʷ**, or (c) **taˈʔɛxʷk** (or something else). If we stay as close as we can to the phonetic ground, we expect that maybe option (a) is correct. If we abstract away some of the labialization (later added by spreading), then option (b) or (c) is correct. Either one of the last two analyses represents some degree of abstraction away from the phonetic facts.

As a matter of fact, the question is not unanswered. The a-infixation rule of the language, used to indicate disbelief, splits up consonant clusters following a stressed vowel. The consistent result of infixation that has been given over the years, by people who do not read, is **[taˈʔɛʷxʷ-a-k a]** (with an enclitic following the word as well), supporting option (c) unequivocally. This example clearly illustrates the need to consider *some* degree of abstraction as valid. If speakers only had access to the phonetic representation, the result should have been ***[taˈʔɛʷxʷ-a-kʷ a]**.

So at one extreme we have representations of words that are laden with phonetic details and at the other we have representations that are stripped of many phonetic facts and may in fact be very different from the phonetic facts. The big question is whether what linguists commonly do (discover patterns) is relevant to the study of human language (thinking about how a person internalizes and uses the lexicon of his or her language).

It is entirely possible that even the amount of abstraction that is commonly proposed in phonemic analysis is not clearly motivated in all cases. One argument that has been given in favor of such an abstraction has been that it so easily correlates with what is acceptable for a community writing system.[2] The claim (based on a good amount of cross-linguistic experience) is that a phonemic representation rendered into appropriate symbols matches what makes sense to speakers when they write. As an example, it would be claimed that a representation of an utterance like the one in (1) is likely to be successful if it adheres closely to the phonemic representation rather than to the more abstract (putative) underlying representation that one might come up with, and rather than to the narrow transcription that (it is claimed or assumed) contains phonetic details that are not relevant to the speaker because they are so automatic. (The four "practical orthography" representations in (1) are simply there to show that the choices of symbols and word breaks are not directly dependent on the phonemic representation itself.)

(1)	**{oχ**	**m-si-m-o-aʔit**	**a-ʔa}**
	oχ	**insˈkmoːʔit**	**aʔa**
	[oχ	**insˈkw̃õːʔːiːt**	**aʔa]**
	och	*inscmoo'it*	*a'a*
	och	*inskmoohitaha*	
	ox	*inskmoo7it*	*a7a*
	ox	*inscmoohit*	*aha*
	Don't eat like that!		

However, this kind of argumentation is actually a bit problematic. What might work for a writing system depends on multiple factors—to do just enough to enable the reader to link the written form to some meaning—that we cannot take it for granted that this in itself signals the relevance of that representation for the reader.

But there are also other problems. Experiences of field workers in preliterate communities have demonstrated that a written form based entirely on phonemic principles has been rejected, irrespective of the symbols chosen. In many of these situations, the community (or at least some relevant subset of the community that is being polled) opts for a representation that is actually more like the phonetic facts than the phonemic facts. Why would this be so if speakers have internalized a highly abstract form of their language? A major reason, it would seem, is that languages occur in a sociolinguistic context. When speakers of a language that has **[d]** and **[ɾ]** as allophones (by phonemic analysis) are also being constantly exposed to and educated in a different language in which these two sounds are phonemic, it is quite to be expected that they become aware of those sounds as individual sounds in their

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[2] This is one kind of external evidence that is mentioned in Campbell (1986:164). See the quotation in the preceding footnote.

own language and—unless conditioned by education and a strong written tradition of their own—may transfer the phonemic contrast of the other language on to their own language.

This appears to be what has happened in the case of Tlapanec languages, for example. There is little doubt that [ɾ] can be analyzed as an allophone of d. Regardless, five centuries of increasing contact with Spanish (in which the tap is a phoneme) have resulted in a situation in which speakers today, for whom Spanish is a second language, have accepted without reservation a writing system in which the Me'phaa tap is directly represented as <r> in the community-based spelling. And various other similar situations arise in Me'phaa phonology as well.

To say this another way, there may be evidence that speakers are unaware of certain phonetic details of their own speech, but their awareness may be changed drastically by various factors, one of which is systematic exposure to another language. It is for this reason that phonemic systems (assuming they exist) are often different in a language whose speakers are bilingual in another, sociolinguistically dominant language, and especially if the latter is a language of education. The minority language need not have incorporated large numbers of loanwords for this to happen. Any shift in perspective would not happen for all speakers at the same time, and it would not necessarily be evident that it has happened at all, unless we have ways to discover what has happened. We also do not know how much interference (as we might call it) from another language—or even another dialect of the same language—is necessary for there to be a shift in perception. But since perception always involves context, we have to remember that language is spoken in sociolinguistic contexts, which are therefore relevant.

Unfortunately, in most of the interesting cases we do not have good external evidence to support one hypothesis over another (how much abstraction is really supported?), and so the question remains unanswered. Linguists continue to assume that the abstractions (including the phonemic representations) that they propose are linguistically relevant. They hope they are, and in fact they may be pretty close when it comes to doing something that is relevant for developing a community writing system. But that is not enough of a reason to claim that the result is psychologically real.

30.1 Suggested reading

There is considerable literature on this topic, but probably not anywhere near enough since this topic is like the proverbial can that continues to be kicked down the road. Reading that might be suggested for this includes the following: Ladefoged (1970), Campbell (1986), Ohala (1986), Eddington (1996), Eddington (1999), Silverman (2006), Cole & Hualde (2011), and van Oostendorp (2013).

A

Helpful information and resources available on-line

A.1 *Ethnologue* site

Ethnologue provides comprehensive information about languages around the world. It is a suitable place to find the correct ISO 639-3 code for a language (but also see http:www-01.sil.orgiso639-3codes.asp). The other information (such as population figures) may be the most accurate available, but it should be crosschecked with other sources, and the latter may be the most appropriate for citations.

URL: http:www.ethnologue.com

A.2 *Glottolog* site

Glottolog is "an initiative of the Max Planck Institute for the Science of Human History, Jena" and "provides a comprehensive catalogue of the world's languages, language families and dialects. It assigns a unique and stable identifier (the Glottocode) to (in principle) all languoids, i.e. all families, languages, and dialects."

URL: http:glottolog.org

A.3 International Phonetic Association (IPA)

The IPA maintains a website to provide access to helpful charts and other information.

new URL: https:www.internationalphoneticassociation.org

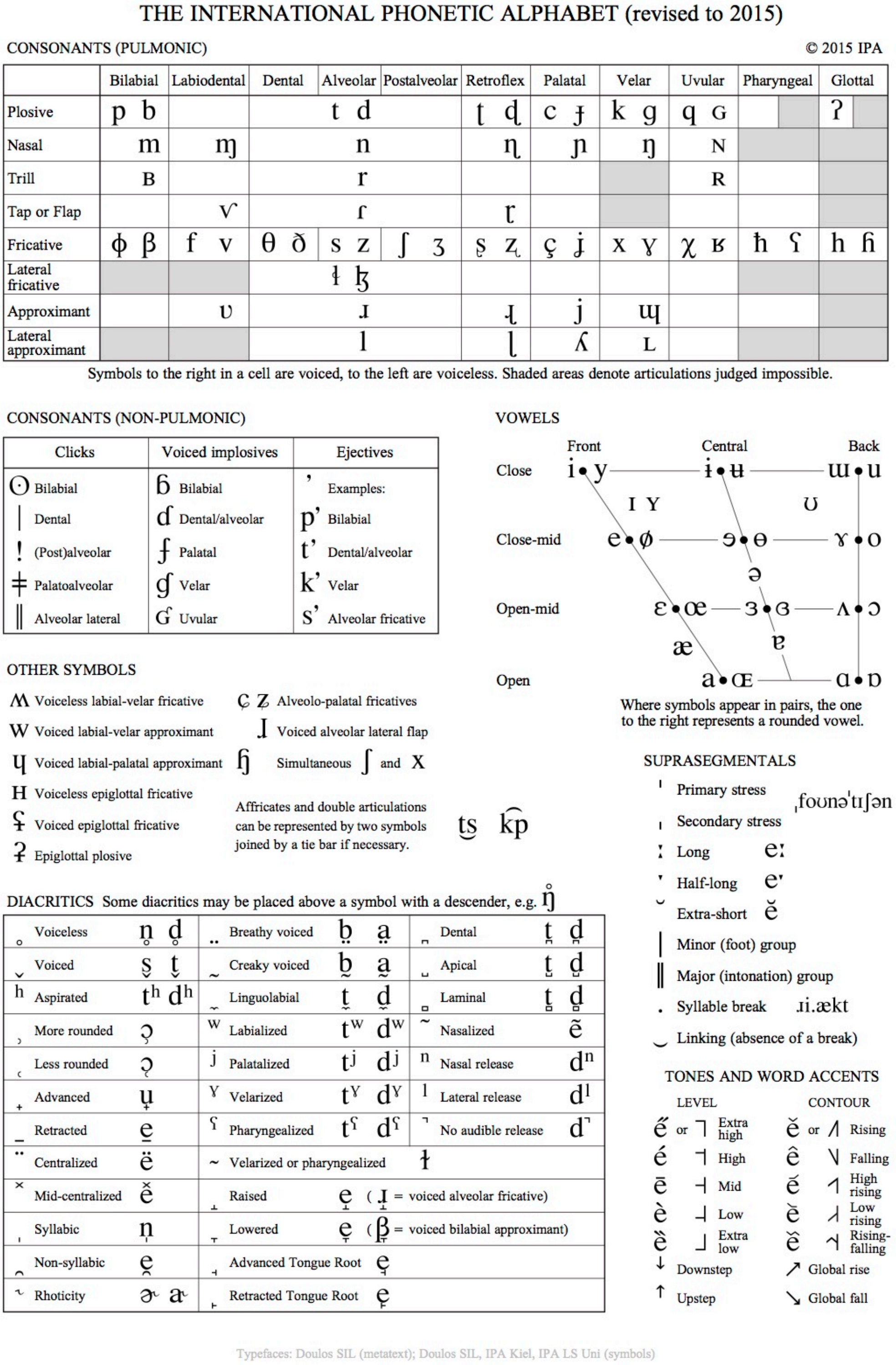
URL for the alphabet charts: https:www.internationalphoneticassociation.orgcontentipa-chart

One can also access from this site basic information about the *Journal of the International Phonetic Association*, including guidelines for contributors (their style sheet).

URL: https:www.internationalphoneticassociation.orgcontentjournal-ipa

URL for style sheet (updated 4 September 2014): http:assets.cambridge.orgIPAIPA_ifc.pdf

IPA Chart, http:www.internationalphoneticassociation.orgcontentipa-chart, available under a Creative Commons Attribution-Sharealike 3.0 Unported License. Copyright © 2015 International Phonetic Association.



THE INTERNATIONAL PHONETIC ALPHABET (revised to 2015)

CONSONANTS (PULMONIC) © 2015 IPA

	Bilabial	Labiodental	Dental	Alveolar	Postalveolar	Retroflex	Palatal	Velar	Uvular	Pharyngeal	Glottal
Plosive	p b			t d		ʈ ɖ	c ɟ	k ɡ	q ɢ		ʔ
Nasal	m	ɱ		n		ɳ	ɲ	ŋ	ɴ		
Trill	ʙ			r					ʀ		
Tap or Flap		ⱱ		ɾ		ɽ					
Fricative	ɸ β	f v	θ ð	s z	ʃ ʒ	ʂ ʐ	ç ʝ	x ɣ	χ ʁ	ħ ʕ	h ɦ
Lateral fricative				ɬ ɮ							
Approximant		ʋ		ɹ		ɻ	j	ɰ			
Lateral approximant				l		ɭ	ʎ	ʟ			

Symbols to the right in a cell are voiced, to the left are voiceless. Shaded areas denote articulations judged impossible.

CONSONANTS (NON-PULMONIC)

Clicks	Voiced implosives	Ejectives
ʘ Bilabial	ɓ Bilabial	ʼ Examples:
ǀ Dental	ɗ Dental/alveolar	pʼ Bilabial
ǃ (Post)alveolar	ʄ Palatal	tʼ Dental/alveolar
ǂ Palatoalveolar	ɠ Velar	kʼ Velar
ǁ Alveolar lateral	ʛ Uvular	sʼ Alveolar fricative

VOWELS

	Front		Central		Back
Close	i • y		ɨ • ʉ		ɯ • u
		ɪ ʏ		ʊ	
Close-mid	e • ø		ɘ • ɵ		ɤ • o
			ə		
Open-mid	ɛ • œ		ɜ • ɞ		ʌ • ɔ
		æ	ɐ		
Open	a • ɶ				ɑ • ɒ

Where symbols appear in pairs, the one to the right represents a rounded vowel.

OTHER SYMBOLS

ʍ Voiceless labial-velar fricative
w Voiced labial-velar approximant
ɥ Voiced labial-palatal approximant
ʜ Voiceless epiglottal fricative
ʢ Voiced epiglottal fricative
ʡ Epiglottal plosive
ɕ ʑ Alveolo-palatal fricatives
ɺ Voiced alveolar lateral flap
ɧ Simultaneous ʃ and x

Affricates and double articulations can be represented by two symbols joined by a tie bar if necessary. t͜s k͡p

SUPRASEGMENTALS

ˈ Primary stress ˌfoʊnəˈtɪʃən
ˌ Secondary stress
ː Long eː
ˑ Half-long eˑ
˘ Extra-short ĕ
| Minor (foot) group
‖ Major (intonation) group
. Syllable break ɹi.ækt
‿ Linking (absence of a break)

DIACRITICS Some diacritics may be placed above a symbol with a descender, e.g. ŋ̊

◌̥ Voiceless	n̥ d̥	◌̤ Breathy voiced	b̤ a̤	◌̪ Dental	t̪ d̪
◌̬ Voiced	s̬ t̬	◌̰ Creaky voiced	b̰ a̰	◌̺ Apical	t̺ d̺
ʰ Aspirated	tʰ dʰ	◌̼ Linguolabial	t̼ d̼	◌̻ Laminal	t̻ d̻
◌̹ More rounded	ɔ̹	ʷ Labialized	tʷ dʷ	◌̃ Nasalized	ẽ
◌̜ Less rounded	ɔ̜	ʲ Palatalized	tʲ dʲ	ⁿ Nasal release	dⁿ
◌̟ Advanced	u̟	ˠ Velarized	tˠ dˠ	ˡ Lateral release	dˡ
◌̠ Retracted	e̠	ˤ Pharyngealized	tˤ dˤ	̚ No audible release	d̚
◌̈ Centralized	ë	◌̴ Velarized or pharyngealized	ɫ		
◌̽ Mid-centralized	e̽	◌̝ Raised	e̝ (ɹ̝ = voiced alveolar fricative)		
◌̩ Syllabic	n̩	◌̞ Lowered	e̞ (β̞ = voiced bilabial approximant)		
◌̯ Non-syllabic	e̯	◌̘ Advanced Tongue Root	e̘		
˞ Rhoticity	ɚ a˞	◌̙ Retracted Tongue Root	e̙		

TONES AND WORD ACCENTS

LEVEL		CONTOUR	
e̋ or ˥	Extra high	ě or ˩˥	Rising
é ˦	High	ê ˥˩	Falling
ē ˧	Mid	e᷄ ˧˥	High rising
è ˨	Low	e᷅ ˩˨	Low rising
ȅ ˩	Extra low	e᷈ ˧˦˧	Rising-falling
ꜜ	Downstep	↗	Global rise
ꜛ	Upstep	↘	Global fall

Typefaces: Doulos SIL (metatext); Doulos SIL, IPA Kiel, IPA LS Uni (symbols)

A.4 The World Atlas of Language Structures Online (WALS)

This is a very helpful site in many ways. From the website:

> WALS is a large database of structural (phonological, grammatical, lexical) properties of languages gathered from descriptive materials (such as reference grammars) by a team of more than 40 authors (many of them the leading authorities on the subjects).

URL: http:wals.info

It is here that you can also find a tentative list of the genera into which the languages are grouped.

http:wals.infolanguoid

The site is also a good place to find the ISO 639-3 codes of many languages. Beware, however, of confusing other codes that are also given on that site, such as the WALS code and the Glottocode. The WALS code looks like the ISO 639-3 code in that it has three letters, but the systems are different.

A.5 PRAAT

This program is widely used for analyzing speech. (Mac, Windows, Linux, etc.)

http:www.fon.hum.uva.nlpraat

A.6 Speech Analyzer

This is another program that is used for analyzing speech. (Windows only.)

http:software.sil.orgspeech-analyzer

A.7 Fonts and keyboards

It is helpful to know about the availability of Unicode fonts that include the IPA symbols. Four options (including the popular Doulos SIL and Charis SIL), available for PC and Mac, are freely available at http:scripts.sil.orgcmsscriptspage.php?item_id=IPAhome. One also needs to be able to keyboard the characters in an efficient way, and at this same site information is given about keyboarding options ("keyboards" that can be installed on one's computer to facilitate working with the IPA fonts).

B

Glossary

allomorphs. The different shapes that a formative (or morpheme, if you will) has in the language are the allomorphs of the morpheme. They may be the result of postlexical rules or lexical rules applying to a single basic form (if one believes in such). An example of allomorphs: **[pɪt]** ~ **[pɪʔ]** *pit*. They may be suppletive, in that one does not posit a single underlying form for them, such as the difference between plural **{z}** and plural **{ən}** in English. See §1.2.

allophones. The contextual, dialectal or stylistic pronunciations (including the basic pronunciation, if such may be said to exist) are called the allophones of a phoneme. Example: **t** has the allophones **[t]**, **[tʰ]**, **[ɾ]**, and **[ʔ]**. See chapter §13.

alternations. "Alternations in the shapes of morphemes" is another way of referring to the allomorphs that a morpheme may have in different contexts, whether suppletive or not suppletive. See **allomorphs** and §14.2.

angle brackets are sometimes used to set off the practical or orthographic representation of a word, distinguishing such from the phonetic or phonemic or other representation of a word. Example: **<tough>** for **[tʰɜf]** **tɜf**. See §11.4.

assimilation is any process by which one sound becomes more like another sound in the context. An example is the nasalization of a vowel before a nasal consonant. See chapter §14.

association of tones with tone-bearing units. On the assumption that tones are on a separate tier from the segmental material (consonants and vowels), there is a step in which the tones must be linked, or associated, with the tone bearing units. See chapter §28.

autosegmental. The term autosegmental is used to refer to the idea that in phonological structure certain features operate somewhat independently of other features. This has been especially used in the area of tones, but other features may be construed as autosegmental as well. See chapter §28.

The **basic form** of a morpheme is the representation of that morpheme by which (in some theories of phonology) all non-suppletive allomorphs can be derived through the application of phonological rules. In the case of the allomorphs **[pɪt]**, **[pɪʔ]** and **[pɪɾ]** in English, the basic form is arguably **{pɪt}**. The allomorphs **[pɪʔ]** and **[pɪɾ]** are derived by Debuccalization and Flapping, respectively, in the appropriate contexts. See §17.2.

binary. The claim has been that most features (but not all) are binary in nature—either positive or negative. A contrasting view for some features (in some approaches) is that they are **privative**. See chapter §14.

bracket erasure. It is claimed within certain theories of phonology that the "brackets" that formally mark the edges of morphemes, which come with the morphemes as they are put together to form words, are eliminated (erased) at a certain point, making the accessibility of morpheme boundary information unavailable to the phonology. In particular, this has to do with postlexical rules, claiming that bracket erasure takes place before postlexical rules can apply, to account for the (supposed) fact that postlexical rules do not ever require knowledge of word-internal morpheme boundaries. See §22.3.

A **broad transcription** is a phonetic transcription that omits all or much of the non-distinctive phonetic detail of the text. As used by the IPA, a broad phonetic transcription is "a connected text represented in terms of phonemes" (*Handbook of the IPA*, p. 29), sometimes with "the extra implication that, as far as possible, unmodified letters of the roman alphabet have been used." It is used almost equivalently with the term **phonemic transcription**. See §11.3.

closed syllable. A syllable that has a coda is a closed syllable. See §3.3.

The **coda** of a syllable includes the sounds that follow the nucleus of the syllable. (The coda does not include any part that is analyzed as a diphthong. In some views it does not include consonants that are extrametrical or considered word-level appendices to the syllable.) See §3.3 and §7.1.

complementary distribution. Sounds are said to occur in complementary distribution when they occur in mutually exclusive contexts. See §13.3.

A **consonant** is a sound that functions as either the onset or coda in a syllable. It may be an obstruent or a sonorant (including central approximants, which are very "vowel-like" in their open articulation). See §3.4.1.

[continuant]. A sound is [+continuant] if the airstream is not completely blocked in the oral tract. (Not all definitions of this feature are the same, and there are problems or doubtful cases with all of the proposed definitions.) See §15.1.

contour segments are combinations of sounds that occur together in many languages and which function together as a single unit in certain ways. Affricates and prenasalized stops are two examples. See §9.1.

contrast. Two sounds are said to contrast in a language if the systematic replacement of one for the other can at least potentially alter the meaning of the utterance. See chapter §12.

coronal is the feature that describes sounds made with the crown of the tongue (from the tongue tip and the blade, excluding the back. It is currently viewed as a privative feature node (not a binary feature) and includes interdental, dental, alveolar, postalveolar, retroflex, and palatal consonants. See §15.1.

declination is the normal, gradual fall in pitch that is observed in a particular domain such as a clause or sentence. See §27.1.4.

default tone. In some approaches to tone analysis, a tone may be designated as the tone that is supplied when the lexical representation does not otherwise indicate one. See §28.4.1.

derivation. "The mapping of a lexical form onto its correspondent surface form in a series of steps, each defined by a rule" (Roca & Johnson (1999:688). See §17.2.

diphthong (rising; falling). Two vowel-like sounds that occur together in the same syllable and are analyzed as forming the nucleus of the syllable form a diphthong. If the sonority rises from one to the other, it is called a **rising diphthong** (example: the [ju] of *cute*). If the sonority falls from one to the other, it is called a falling diphthong (example: the [aw] of *bound*.) See §3.3.

The **distinctive features** of sounds are the (articulatorily or acoustically based) defining characteristics of the phonemes. See §3.2.

domain for intonation. An intonation contour is relevant for a particular span of words, which is called the domain of that contour. See §27.2.

domain of stress assignment. For the purpose of applying stress rules, it is important to know whether one counts syllables from the edge (beginning or end) of a word or from the edge of a root (the less common situation). See §29.4.1.

dorsal. The feature that describes sounds made with the back of the tongue is the feature Dorsal, whether they are velar or uvular. It is currently viewed as a privative feature node (not a binary feature). See §15.1.

epenthetic sounds. Vowels and consonants are sometimes inserted into the phonological string, especially to make words more pronounceable. These sounds are referred to as epenthetic or epenthesized sounds. The term is also sometimes extended to include intrusive vowels and intrusive consonants, although these might be conceived of as not actually affecting the phonological string. See chapter §24.

extrametrical and **extrametricality**. A consonant that is extrametrical is one that is excluded from consideration for syllable construction. It must be at the beginning or end of the word. A word-final consonant may be extrametrical for the purposes of determining the weight of a syllable. A syllable that is extrametrical is one that is excluded from consideration in certain algorithms for assigning stress to a word. See §6.4 and §29.9.

FEATURE GEOMETRY is the approach to the organization of features in which the features are hierarchically arranged under nodes, some features dominating other features. See §17.3.

A FOOT (METRICAL FOOT) is a grouping of syllables or moras in which one of them is stronger than the other. (The stronger syllable or mora in this grouping is referred to as the head.) See §29.5.

The FUNDAMENTAL FREQUENCY of the speech wave "corresponds to the pitch of a sound as we hear it" (Baart 2010:44). It is the rate at which "wave cycles are repeated" (Baart 2010:95). It is expressed in cycles per second, using the notion of hertz (Hz). See chapter §26.

GEMINATES (FALSE; TRUE) are phonetically long segments (whether consonants or vowels) that are taken as occupying two positions in the skeleton. True geminates are formalized as a single feature array associated with two such positions. A false geminate is formalized as a sequence of two identical feature arrays that are associated with two positions in the skeleton. See chapter §21.

GENUS. A language genus is "a group of languages whose relatedness is fairly obvious without systematic comparative analysis" (Dryer 1989:584). See §2.1.

HOMORGANIC consonants are pronounced at the same place of articulation. In the string [mb], the nasal and the stop are homorganic. See §17.2.

IAMBIC stress refers to a right-headed prominence in a foot, as illustrated by the word *prefer* (weak-strong). An IAMB is a foot that has this characteristic. See §29.7.

IDIOLECTS are the speech variations that are found in a speech community that are characteristic of individuals rather than groups (which would be referred to as dialects). See §13.4.

INTONATION is the use of pitch variation for linguistic purposes other than distinguishing between lexical or grammatical meaning. See chapter §27.

INTONATION MELODIES are distinctive pitch patterns that are used for a variety of purposes other than distinguishing between lexical or grammatical meaning. See §27.2.

LABIAL is the feature that describes sounds made with the lips. It is currently viewed as a privative feature node (not a binary feature) and includes bilabial, labiodental and labial-velar consonants. See §15.1.

[LATERAL] is the feature that describes sounds made "by lowering the mid section of the tongue at both sides or at only one side, thereby allowing the air to flow out of the mouth in the vicinity of the molar teeth" (Chomsky & Halle 1968:317). See §15.4.

LICENSE. A unit (such as a syllable node) licenses another unit by stating the conditions under which the latter may appear. See chapter §5.

The MAJOR WORD CLASSES are those that contain the content words, which often have different prosodic properties than minor word classes. Major word classes are typically Noun, Verb, and Adjective. See §10.2.

MARKED. See the discussion of UNMARKED.

MAXIMAL SYLLABLE TEMPLATE. The template that describes the largest syllable permitted in the language, excluding extrametrical consonants, is called the maximal syllable template. See chapter §5.

MINIMAL PAIR. When two utterances that have different meanings differ in only the exchange of one phoneme for another, we say that those two utterances are a minimal pair. (This definition differs from the one used by some that says that a minimal pair is "any pair of words that differ by just one sound in the same position" (Roca & Johnson 1999), since our definition refers specifically to the phonemes, eliminating some potential confusion and some incorrectly identified pairs of words.) See chapter §12.

MINIMAL WORD. See MINIMAL WORD CONSTRAINT.

The MINIMAL WORD CONSTRAINT is a well-known type of constraint that, with slight variations, a language may impose on the class of possible words. This constraint is usually something like "A word [of a major word class] must have at least two moras." Sometimes it requires two syllables. Not all languages include this constraint in their phonologies, but many do. See §10.2.

The MINOR WORD CLASSES are those that contain the function words, which are often shorter than major class words and often unstressed. Minor word classes typically include Preposition, Conjunction, Demonstrative, etc. See §10.2.

MODAL voice is the term applied to the "normal" production of vowels, in contrast to marked situations such as breathy voice and creaky voice. See chapter §20.

MORA. As used in much current phonological study, a mora is unit of weight that pertains to the syllable. See §7.3 and §10.2.

M-PHONOLOGY is the part of a language description that is concerned with the shapes of the morphemes of a language (the allomorphs). See §1.1.

A NARROW TRANSCRIPTION is a transcription of an utterance that contains some or considerable phonetic details, whether based on an analysis or not. Such transcriptions are traditionally written inside of square brackets. See §11.2.

[NASAL] is the feature (sometimes analyzed as binary, sometimes as privative) that indicates whether or not the airstream is passing through the nasal cavity. See chapter §16.

A NATURAL CLASS is a group of similar sounds that pattern together in some way in a certain language. To be "natural", this class is expected to share the value of some particular feature or set of features. See §15.1.

NEUTRALIZATION refers to situations in which an existing contrast in a language is not relevant. For example, the important contrast between voiceless and voiced stops in English is neutralized when a stop follows s in an onset. In that context only the voiceless stop may occur. The contrast between nasals is often neutralized in certain contexts (they either assimilate to a following consonant or they are pronounced in only one way). See §17.2.

A NODE is part of the architecture of features that is proposed in FEATURE GEOMETRY. Some nodes (e.g. Place) are simply labeled. Some nodes are proposed to actually be features themselves (e.g. Labial). See §17.3.

The NUCLEUS (OF INTONATION MELODY)is the locus of the intonation melody in the relevant domain. See §27.2.

The NUCLEUS (OF SYLLABLE) is the sonority peak of the syllable, whether simple or complex (such as when it contains a diphthong). See §7.1.

The OBLIGATORY ONSET PARAMETER is the parameter that indicates whether the language requires that any syllable must have an overt onset (with the possibility that word-initial syllables may be exceptional.) See §5.4.

An OBSTRUENT is a sound that is not a sonorant. Typical examples are [p tʃ s] (stops, affricates, and fricatives, of any type). See §3.4.3.

The ONSET of a syllable is the sound or group of sounds that precede the syllable nucleus. (If the nucleus includes a diphthong, the onset precedes the diphthong.) Not all syllables have onsets. See §3.3 and §5.4.

An OPEN SYLLABLE is a syllable that has no coda. See §3.3.

An ORTHOGRAPHIC REPRESENTATION is any one of perhaps several ways of writing a language for use by the speech community, whether or not there has been standardization or officialization of the norms that govern its use. See §11.1.

PALATALIZATION (REGRESSIVE, ANTICIPATORY; PROGRESSIVE; SECONDARY). Palatalization may refer to the change from a non-palatal place of articulation to a palatal one, such as from s to ʃ. If the influencing environment follows the consonant that changes in this way, such as an immediately following front vowel, the palatalization is said to be regressive or anticipatory. If the influencing environment precedes the consonant that palatalizes, the palatalization is said to be progressive. Secondary palatalization refers to the more minor change in articulation of a consonant in which one observes (most commonly) an off-glide from the consonant in question. See §18.2.2.

A PARADIGM is a set of words that are formally related to each other by some structural properties (e.g., Plurality, Possessor, Tense, Person agreement, Negation, Voice), and also the presentation of such words in a way that makes these relationships clear (such as by rows and columns). See §10.1.

PARSE, PARSABLE, EXHAUSTIVELY PARSABLE. In phonological theory, a string of segments is examined and checked against any conditions and constraints that the language might have (such as a syllable template) to determine whether and how those sounds fit those constraints. This is referred to as parsing the string. Some theories claim that every real word must be completely, or exhaustively, parsable by those constraints in order to be judged a legitimate word of the language. See §5.5.

PHONATION TYPES refers to the different configurations of the vocal folds that are relevant for language, including breathy voice, modal voice, creaky voice, etc. See chapter §20.

The PHONES of a language are the actual sounds of a language, distinguishing small contextual, stylistic and dialectal variations that are perceived and also including phonetic detail that may or may not be perceived by native speakers. See §3.1.

The PHONEME of a language are the sound-based entities of which morphemes are composed. See §3.1.

The PHONEMIC HYPOTHESIS is the hypothesis that any given language can be adequately analyzed, with respect to its phonology, on the basis of a limited inventory of sounds (the phonemes). See §3.1.

A PHONEMIC TRANSCRIPTION represents a text using symbols for the phonemes (including diacritics for suprasegmentals like tone and nasalization), leaving out predictable phonetic detail that is not carried by the symbols themselves. The expression is almost used equivalently to BROAD TRANSCRIPTION. See §11.3.

PHONETIC DETAIL is information about how a phoneme is pronounced generally or in a particular context. See chapter §13.

A PHONETIC TRANSCRIPTION records, using alphabetic symbols and diacritics, the pronunciation of utterances, either in considerable detail (a narrow transcription) or in less detail (a broad transcription). See §11.2.

PHONETICS is the study of the production and perception of human speech sounds—the physical properties of language. See chapter §1.

PHONOLOGICAL PHRASE. For our purposes, a phonological phrase is a stretch of speech that begins with a major pause and ends with a major pause. See §3.4.4.

PHONOLOGY might be characterized as the study of the organization of the human speech sounds—the functional properties of language. See chapter §1.

PHONOTACTICS. The distribution of sounds and especially combinations of sounds in a language is referred to as phonotactics. See §8.1.

P-PHONOLOGY deals with basic facts of pronunciation of the sounds of a language. See §1.2.

postlexical is a term used to describe certain types of rules (or application of rules) that tend to be those that add phonetic detail in a fairly automatic way, rules that tend to be unnoticed by native speakers. Postlexical rules correspond closely to what are called allophonic rules in some approaches to phonology, and to the phonetic facts described under "Conventions" in the illustrations of the IPA. See §14.3.

The **practical spelling** or **practical orthography** of a word is basically the same as what we have referred to as the **orthographic representation**.

privative. Some phonologists view certain features as being privative—either present or not present (as opposed to being positive or negative, which would be taking them as binary). It is claimed, for example, that the place features Labial, Coronal and Dorsal are either present or not present, and so a p is not [-Coronal], but rather simply with Labial present. See chapter §14.

range with respect to fundamental frequency (F_0) is the set of possibilities between the highest F_0 and the lowest F_0 that a speaker or group of speakers (such as adult males) uses. See §26.3.

The **rime** (or **rhyme**) of the syllable is composed of whatever does not appear in the Onset of the syllable. See §7.1.

A **segment** is a sound that occupies a single position in the phonological string. It may be articulatorily simple, such as m, or it may be complex, such as [^{m}b]. An intrusive stop or transitional vowel is not analyzed as being a segment in the same way as a full consonant or vowel. See §3.4.1.

The **skeletal tier** is part of the representation of an utterance that plays a role in some theories of phonology for anchoring various parts of the phonological structure. In one version, the tier is composed of sequences of C and V; in another version, X is used and then enriched by explicit reference to parts of the syllable (such as Nucleus). See §9.1.

A **sonorant** is a sound that is "produced with a vocal tract cavity configuration in which spontaneous voicing is possible." Typical examples are [a j ɾ m l]. See §3.4.2.

The **sonority**, or resonance, of a sound is a useful but elusive (and somewhat controversial) concept that is meant to differentiate between the most highly "sonorous" sounds (vowels) and the least sonorous sounds (voiceless stops), ranking other sounds between them. See §8.2.

sonority sequencing constraint: the sonority of a syllable peaks at the nucleus and decreases toward the margins. See §8.2.

One definition of a **speech community** is a community "all of whose members share at least a single speech variety and the norms for its appropriate use" (Fishman 1971:42). See §2.1.

square brackets have various uses, including enclosing the names of distinctive features and ISO 639-3 codes (by the conventions of the ISO). They also are typically used to enclose narrow transcriptions, or at least transcriptions that are not considered phonemic transcriptions (based on considerable analysis). See §11.2.

strengthening refers to the enhancement of a sound to make it more distinct from other sounds to which it is adjacent. **fortition** is a synonym. (**lenition** is the opposite.) See §22.2.

stress is an abstract notion that refers to the prominence of one syllable in a domain over other syllables. See chapter §29.

suspicious pairs refers to pairs of sounds that are similar enough phonetically (or because of what we know about language) to be examined more carefully to determine whether they are contrastive or not contrastive in a language. (The expression is not widely used today.) See §14.7.

syllabic consonant. A consonantal sound (i.e., one that is not a vocalic sound) that functions as the nucleus of a syllable is a syllabic consonant. See §5.8 and §7.4.

A SYLLABLE is an abstract organizational unit of phonology that groups an acoustically prominent element (usually a vowel) with adjacent less prominent elements (consonants). See chapters §4-§9. (See also LIGHT SYLLABLE; HEAVY SYLLABLE; OPEN SYLLABLE; CLOSED SYLLABLE; UNIVERSAL SYLLABLE.)

TAUTOSYLLABIC elements occur in the same syllable. The vowel [a] and the consonant [m] in the word [tam.bor] are tautosyllabic. See §5.5.

TONE is the contrastive use of pitch melodies to distinguish lexical items. See chapter §28.

TONE LANGUAGES are those in which pitch melodies distinguish lexical items. See chapter §28.

TONE MELODIES are the arrangements of pitch that a tone language utilizes for distinguishing lexical items. They may include High, Low, High Low, Low High, etc. See chapter §28.

TROCHAIC stress refers to a left-headed prominence in a foot, as illustrated by the word *table* (strong-weak). A TROCHEE is a foot that has this characteristic. See §29.7.

UNDERSPECIFIED. The values of a particular feature may be underspecified (e.g., not made explicit) in a certain context or even generally, at some level of representation. For example, some propose that the nasal of a word like <lamp> is not specified lexically as being labial, but rather acquires that feature from its context (through Nasal Place Assimilation). Some also propose that glottal stop is a consonant that is always unspecified for Place. See §17.2.

UNIVERSAL REDUNDANCY RULE. It has been proposed that some feature values are supplied by language-independent rules under certain conditions (such as when the language does not over-ride them by explicit specification either lexically or by rules). A rule of this type is: [α sonorant] implies [α voice], meaning that (when otherwise not specified), a sonorant sound has the feature [+voice] and an obstruent has the feature [-voice]. See chapter §14.

UNIVERSAL SYLLABLE. The CV syllable type has been called the universal syllable because all languages attest at least this one type. See chapter §5.

UNAMRKED VALUE; MARKED VALUE. The value of a feature for a sound is said to be "marked" if it is the unexpected value for that sound based on cross-linguistic or other general considerations. For example, the feature [voice] has the unmarked value of positive for sonorants but negative for obstruents because sonorants are generally voiced while obstruents are most typically voiceless. Similarly, the unmarked value of [nasal] for vowels is negative; many languages have only oral vowels, but no language has only nasalized vowels. See chapter §14.

UNMARKED CATEGORY, MARKED CATEGORY. The marked category is the one that is more unusual cross-linguistically for a particular type of sound. For example, voiced stops are the marked category when compared with voiceless stops (the unmarked category). See §12.3.4.

VARIATION. Many details of pronunciation vary from speaker to speaker due because of personal differences, geographical and social dialects, speech registers, rate of speech, etc. See §2.2.

[VOICE] The feature [voice] indicates whether or not the vocal folds are vibrating (+) or not ( ). See chapter §14.

A VOWEL is an unobstructed sound that functions as part of the nucleus of a syllable. (Some vowel-like sounds—"vocoids", to use a term that never became very popular—function in onsets or codas and are then considered consonants, although they may have virtually no more obstruction than a typical vowel. These vocoids functioning as consonants are usually referred to as approximants in the IPA tradition, and sometimes as semivowels or semiconsonants in other traditions.) See §3.4.1.

WEAKENING refers to a phonological process that makes a sound more like its context. Rules of assimilation are one kind of weakening, as are rules of intervocalic voicing, nasalization, and spirantization. See §22.1.

A WORD is a morpheme or combination of morphemes that is stored in the lexicon as a unit that can be used in the construction of phrases. A morpheme such as plural {s} is not a word in English, but the morpheme that essentially indicates plural in another language may in fact be part of a phrase rather than part of a word and thus be a word by this definition. (This definition does not cover what is sometimes called a "phonological" word.) See §4.3.

C

Review of formalization

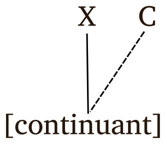
This appendix presents a brief overview of things to consider when formalizing a rule using the autosegmental-style notation that has been presented in this book.

Assimilation rules are taken as being the spreading of a particular feature. This therefore requires that we know about a restricted set of accepted features that are appropriate for use, and how they are organized (the question of feature geometry). Features have been introduced in various places in this book. For a relatively recent set of commonly accepted features (and, in footnotes, a discussion of some of the problems), see T. Hall (2007). Some discussion of the geometry of features is also presented in that work. A very influential article with respect to feature geometry was Clements (1985). These underpinnings are very important for how we formalize rules and even for how we may say things in a prose description.

A rule must identify accurately the items that are affected and the context in which they are found when the change occurs. In our notation that usually means beginning with a letter C, V, or X as a way to indicate a segment. The letter C is a shorthand way of referring to an X that is not linked to a syllable nucleus, and a V is a shorthand way of referring to an X that is linked to a syllable nucleus. (C is *not* shorthand for [+consonantal].)

The input to the rule should be stated as generally as is reasonably possible (trying to avoid absurd predictions). A rule of thumb is: do not include a feature specification unless the rule will not produce the correct output without it. Of course, if you are going to spread a feature, that feature must be part of the input. For ease of presentation, we may put some features "above" the skeletal tier and leave the area below the skeletal tier for showing the features that spread. The key point is to have the features attached to the skeletal tier by association lines and (if done formally) to have the proper intervening nodes represented as well. In example (1) below, the rule spreads feature [+F]. It is unnecessary to say that the second element begins as [–F].

(1)



If the second element must be specified as being [–G], that feature would be included. If other information is necessary, such as "if and only if C is in the coda," then an association line to a Coda node is added.

D

Sample write-ups

In this appendix various parts of a phonological write-up are presented

D.1 Sample introductions

A few drafts of minimal introductory sections are included here. While they are intended to be as accurate as possible, they are only illustrative drafts that could be and should be expanded in various ways using the checklist given in §2.4.

D.1.1 *Madija.* Madija (also known by the exonym Culina, ISO 639-3 code [cul]) is spoken by about 400 people in Peru and 2500 in Brazil in the Juruá Purús river basin, and is very closely related to Dení [dny] (Dixon 2004), which has about 700 speakers (all population figures from Lewis 2009). Madija, along with a few other languages, comprise the Arauan genus (*Word Atlas of Language Structures*, http:wals.infolanguoidgenusarauan, Campbell 1997:182).

D.1.2 *Seri.* (The following paragraph is adapted only slightly from the introduction that appears in Marlett, Moreno Herrera & Herrera Astorga 2005. One change is the use of the decimal coordinates for the locations. The decimal versions are more concise and work better cross-linguistically since they avoid the abbreviations N, S , E, and W.)

Seri (self-designation: *Cmiique Iitom* **[kw̃ĩkˈiːtom]**) is a language isolate spoken in the state of Sonora, Mexico, by about 800 people, in the towns of *Haxöl Iihom* (El Desemboque, 29.504, –112.396) and *Socaaix* (Punta Chueca, 29.014, –112.161). In this description we present a variety that is typical of the majority of speakers. The recordings are of one of the authors (XMH), a male speaker born in 1964. The technical description is based on E. Moser & M. Moser (1965), although the analysis has been updated to agree with the data and arguments presented in later work such as Marlett (1988).

D.1.3 *Isthmus Zapotec.* (The following paragraph is a shortened revision of the introduction that appears in Pickett et al. 2010.)

Isthmus Zapotec (autoglossonym: [dìdʒàˈzàˑ]) is the common name used for a variety of Zapotec (Zapotecan genus, Oto-Manguean family, Campbell 1997:158) spoken on the Isthmus of Tehuantepec, Oaxaca, Mexico. It is the mother tongue of many inhabitants of various cities and towns, as well as many smaller communities, with some lexical, syntactic and phonetic variation between towns only a few kilometers apart. The ISO 639-3 code for this variety is [zai]. The best current, but unofficial, estimates for the number of speakers put it at about 104,000. In the city of Tehuantepec, the language is no longer widely used. In certain other locations, including Juchitán de Zaragoza (16.433, 95.018), Spanish is becoming the dominant or the only language spoken by many people born after about 1990, although Zapotec is still dominant in many outlying towns, including San Blas Atempa.

D.1.4 *Cocama.* Cocama is a language in the Tupi-Guaraní genus (*Word Atlas of Language Structures*, http:wals.info languoidgenustupiguarani, Campbell 1997:200). The ISO 630-3 code is [cod]. The language is spoken in Peru, and also in Colombia and Brazil. While there may be a couple of thousand speakers, the language is losing speakers since apparently most young people are not learning to speak it (Lewis 2009). Some basic facts of the phonology of this language are described in Faust & Pike (1959) and Vallejos Yopán (2010).

D.1.5 *Lowland Oaxaca Chontal.* Lowland Oaxaca Chontal and Highland Oaxaca Chontal are the only surviving members of the Tequistlatecan genus (Lewis 2009, *Word Atlas of Language Structures*, http:wals.infolanguoidgenus tequistlatecan, Campbell 1997:159-160), which is a linguistic isolate. (They are not to be confused with the Mayan language called Chontal, spoken in Tabasco, Mexico.) Lowland Oaxaca Chontal (ISO 639-3 code [clo]) had fewer than one thousand speakers in 1990 (Lewis 2009), mostly in the towns of San Pedro Huamelula (16° 1 0 N, 95° 40 0

W) and Santiago Astata (15° 59 N, 95° 40 W). In 1950 it was reported as having between 8000 and 9000 speakers (Morrison & Waterhouse 1950:35). The only publication on the phonology of this endangered language is Morrison & Waterhouse (1950), but see also P. Turner (1967) and Waterhouse (1980) on Highland Oaxaca Chontal (ISO 639-3 code [chd]).

D.2 Sample syllable descriptions (basic)

A few sample descriptions of basic syllable facts are included here. (Other parts of the descriptions are addressed in later sections.)

D.2.1 *Spanish.* (This description is based on the facts and analysis presented in Harris 1983.)

The maximal syllable template is [CCXXC], where XX may be either approximant-vowel or vowel-approximant—either a rising diphthong or a falling diphthong, respectively. Only three segments may appear after the onset. This template allows for a variety of possible syllables, illustrated here with examples of them in the first syllable of two-syllable words (with a dot separating the syllables for explicitness): [CV] *no.ta*, [V] *o.tro*, [CCV] *pla.ta*, [CVC] *par.te*, [CXV] *pie.za*, [CVX] *pau.ta*, [CXVC] *pien.sa*, [CCVXC] *claus.tro*, [CCXVC] *clien.te*, [XVC] *hier.ba* **jer.ba**, [XV] *hielo* **je.lo**, [VX] *au.la* **aw.la**, [VXC] *aun.que* **awn.ke**.

The syllable onset is not obligatory: *le.al*.

D.2.2 *Isthmus Zapotec.* (This description is based on facts presented in Marlett & Pickett 1987. The examples below include tone marks.)

The maximal syllable template is [CVV].[1] Every word in the language can be parsed with the [CVV]$_{\text{max}}$ template. The words in (1) have been separated into syllables using a dot and illustrate the syllable types permitted.

(1) a. **zì.dì** ‘salt’
b. **bù.pù** ‘foam’
c. **dià.gà** ‘ear’
d. **gië** ‘stone’

There are no words of the shape CVC, CVVC, VC, CVCCV, or CVCCVC; such words would not be parsable by the [CVV] template.

The onset of the syllable is obligatory. There are no words of the shapes CV.V, CVV.V, or CV.VV.[2] Therefore the Obligatory Onset Parameter is set “on”.

D.2.3 *Tetelcingo Nahuatl.* (This description is based on facts presented in Pittman 1961.)

The maximal syllable template is [CVC]. (Data should then be presented to illustrate the syllable types this template generates: CV, V, CVC, VC.)

D.2.4 *Seri.* (This description is based on facts presented in Marlett 1988 and Marlett In preparation.)

The maximal syllable template is [CCVVVCCC]. Some examples to illustrate the complex onset, the complex nucleus and the complex coda are: **ˈsɬɛːkox** ‘heron’, **ˈkaiː** ‘mature’, **ˈkoːskɬ** ‘gray’.

D.2.5 *Hixkaryana.* (This description is based on facts presented in Derbyshire 1979.)

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[1] This presentation does not mention syllables that end with a phonetic glottal stop. These are not analyzed as consonant-final syllables, but the facts are discussed elsewhere.

[2] See the discussion of word-initial syllables in appendix D.3.2.

The maximal syllable template is [CCVC]. (However, no word ends in a consonant.) Examples of words parsed into syllables using this template: **ɔw.tɔ** ‘village’, **tɔw.kɽe** ‘sappy’.[3]

D.3 Sample extrametricality descriptions

The descriptions of the syllables (such as those given in appendix D.2) are supplemented by mention of extrametricality and the situation for word-initial onsets and word-medial onsets, as shown in the following sections, in order to describe words accurately.

D.3.1 *Spanish.* Word edges are not exceptional in Spanish. There are no extrametrical consonants.

D.3.2 *Isthmus Zapotec.* (This description is based on facts presented in Pickett et al. 2007 and Marlett & Pickett 1987.)

Words typically begin with a consonant, although a few native words with an initial vowel are attested: see **ìkè** ‘head’ and **ìzà** ‘year’. Initial **g** is also commonly dropped by some speakers, resulting in vowel-initial words in their idiolects: see **[gùbă]** ∼ **[ùbă]** ‘vapor’, for example. There are no extrametrical consonants. [Note: This paragraph supplements the information in D.2.2 where it is noted that onsets are obligatory in the language. Word-initial position is exceptional.]

D.3.3 *Seri.* (This description is based on facts presented in Marlett 1988 and Marlett In preparation.)

Words may have an extrametrical consonant at the beginning. Thus the maximal syllable template (which has two consonants in the onset) is easily expanded by one in word-initial position, especially with the addition of prefixes consisting of a consonant. Examples: **ˈkʃχok** ‘who hacks it off’, **ˈtχtamt** ‘is it abundant?’, **ˈptkamn** ‘Cortez spiny lobster’.

D.4 Sample phoneme presentation (limited, as for exercises)

This section summarizes briefly the basic facts presented at length in chapters §12-§13 that are relevant for the specific purpose of writing up exercises found in this textbook that reflect, minimally, the type of presentation used in IPA (1999). See also the checklist given in appendix D.5.

The presentation includes three parts:

(2) a. Phonemes: a chart (trapezoid in the case of vowels) that tells what phonemes are being proposed. (If the exercise is focussing only on certain sounds, do not put other sounds into your presentation.)
b. Evidence of contrast: a table that gives examples of those phonemes in key positions using data that is the most convincing for showing the contrast between all of the sounds in question. *Only the symbols of phonemes appear in the presentation here. Allophones are not directly represented.*
c. Details: as appropriate, a statement in clear prose that tells any phonetic details that are relevant, especially those that relate to particular allophones. NOTE: a good prose rule makes generalizations (rather than listing sounds or even groups of sounds—if you have to use a conjunction (like *and* or *or*), you may have missed something important. Furthermore, the prose rule should mention significant facts, not incidental facts. The rule should be accurate, and it should not make wrong predictions. It is also a good idea to illustrate the effect of the rule with a clear example (phonemic representation and phonetic representation).

(Some exercises may also request the presentation of a quasi-formal rule that utilizes particular features and conventions. It is a good idea to try to do that anyway so that you can make your thinking and your writing sharper.)

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[3] Actually it is a bit hard from the source to find good examples to illustrate this syllable template. Furthermore, it is unclear what the exact nature of the rhotic in the word for ‘sappy’ really is, nor how to symbolize it. The source calls it an “apico-postalveolar flap with a distinct lateral release.” We have used a retroflex symbol here.

Sample:

Phonemes (those that are relevant for the exercise):

	Bilabial	Alveolar	Velar
Stop	p	t	k

Evidence of contrast:

	Initial		Intervocalic		Postnasal	
p	ˈpasu	‘meat’	ˈkapa	‘cat’	ˈsampa	‘moon’
t	ˈtapa	‘fish’	ˈmata	‘dog’	ˈsinta	‘sun’
k	ˈkata	‘milk’	ˈnaka	‘horse’	ˈsanko	‘light’

Details:

A stop is voiced when it immediately follows a voiced consonant: ˈsampa [ˈsamba] ‘moon’, ˈsinta [ˈsinda] ‘sun’, ˈsanko [ˈsaŋgo] ‘light’, ˈtolto [ˈtoldo] ‘stone’. A fricative does not voice in this position: ˈtansa [ˈtansa] ‘hair’.

(In addition, it is recommended for homework that you consider presenting a quasi-formal rule, using features, as a way to sharpen your thinking and your analysis of the facts. In some cases you may find that this attempt to formalize will draw attention to either errors on your part, the need for more data, or the need for revisions to the theory.)

D.5 Summary checklist for write-ups of homework assignments

Presentation of the sounds:

____ 1. Are the *phonemes* presented in the chart (or trapezoid)? (For homework, irrelevant sounds may be omitted.)

____ 2. Are the allophones properly *not* included in the chart (or trapezoid)? (Only phonemes are presented.)

____ 3. Are the columns and rows correctly *labeled*? (For homework, irrelevant rows and columns may be omitted. If the data do not clarify a phonetic detail, such as dental vs. alveolar, make a note of it and move on.)

____ 4. Are the correct *symbols* used?

Common errors:

____ a. Rows in the wrong order. (Note that the IPA chart is different from typical Americanist charts in the placement of the row for fricatives.)

____ b. Columns mis-labeled. (Note that the IPA chart uses the label Postalveolar rather than the typical Americanist label Palato-Alveolar.)

____ c. Symbols placed to the left when they should be to the right. (Note that the IPA convention always puts voiceless sounds on the left side of the appropriate cell and the voiced sounds on the right side. And they are never in the middle of the cell.)

____ d. Symbols are sometimes simply placed in the wrong column or row.

____ e. Symbols that are not IPA symbols are sometimes used. Only IPA symbols representing the phonemes are used in this part of the presentation.

Presentation of the evidence of contrast:

____ 5. Are the data presented in *phonemic* transcription *without diagonals*? (For homework, sounds that are not being analyzed in a particular exercise may be simply written as they are given.) In the IPA illustration genre, these data in the columns are in *phonemic* transcription and therefore the presentation is not cluttered with diagonals *in that particular place*. Other genres may request a different convention. You must remember what you are doing here.

____ 6. Are the data chosen well?

____ 7. Are potential positions of the phonemes being properly illustrated? (E.g., word-initial, word-medial between vowels, word-final after vowels, or whatever seems to elucidate the facts appropriately.)

____ 8. Are the data glossed? The standard punctuation in linguistics is to put the gloss between single quote marks. (On homework you may use simply the number of the example to save time, and make checking your work easier.)

Note: Do *not* present the sounds by category, and certainly not one-by-one. All of the consonants should be presented in the same table, in each position that is used. The order in which they appear should follow the order of the consonant chart.

Phonetic detail (discussing allophones):

____ 9. Is the phonetic detail rule expressing a *reasonable* generalization (e.g., voicing in a voicing context, nasalization in a nasal context, etc.)?

____ 10. Does the phonetic detail rule refer to a class of sounds rather than a laundry list of sounds insofar as this is possible (e.g., say “fricatives” rather than “θ, s, and ʃ”)?

____ 11. Does the phonetic detail rule use terms that make clear the *motivation* for the generalization expressed (e.g., “Fricatives are voiced when they precede a voiced consonant” rather than “Fricatives are voiced before nasals”)?

____ 12. Does the phonetic detail rule make accurate claims? (It can’t say that something becomes voiced in a specified environment when there are counterexamples in the data, unless those counterexamples are explained.)

____ 13. Is an example (with gloss) given for each point that nicely illustrates the claims that are being made? Here the use of diagonals and square brackets is important. (This is just very helpful for a reader, as you will quickly realize.)

E

Discussion of short exercises

E.1 Discussion of Lowland Oaxaca Chontal (§5.4.1)

The Obligatory Onset Parameter is apparently “on”. The existence of word-initial vowels is irrelevant. Since we do not see any word-medial vowel clusters, and if the data are representative for the language, then the *lack* of word-medial syllables without onsets needs to be explained. The “on” setting of this Obligatory Onset Parameter does just that.

E.2 Discussion of Marinahua (§5.5.1)

The maximal syllable template must be greater than [CV] apparently, and not [CCV]. A good proposal would be [CVC], assuming that [ts] and [tʃ] are affricates. Thus #1 is CV and #11 is CVC.CV. The [CV] template would be inadequate for #11. The template [CCV] would predict that [skata] and [pistfa] should be possible, but they are not. (But we also do not have an explanation as to why (apparently) no word ends in a consonant, so there is more to think about.) The Obligatory Onset Parameter is set “off” since there are two syllable words like #8.

E.3 Discussion of Hixkaryana onsets (§6.2.1)

1a. Regarding the [CV] template: words (e-h) are problematic for this template as it would not be able to handle the word-medial consonant clusters.

1b. Regarding the [CVC] template: this would straightforwardly handle all of the words shown here. For example, (e) would be t.w . Of course, not every C in the template needs to be matched up with something in the string that it is parsing. What is *unaccounted* for, however, is why there are no words that end in consonants. (Notice that all of these words end in vowels.)

1c. Regarding the [CCV] template: this would parse all of the words in a mechanical sense and it would account for why no word ends in a consonant. However, the parsing would require there to be violations of the Sonority Sequencing Constraint (notice that (h) would have ɾk onset). The template predicts, however, that words like ɸɽeʃɔ and ɾkɔke should be possible. The fact that they are not is problematic.

2. The Obligatory Onset Parameter is “on”, therefore requiring that there be no cases of word-medial vowel clusters. This accounts for the lack of words like teɔ.

E.4 Discussion of Tainae syllables (§6.5.2)

1. (b) This template straightforwardly accounts for the initial consonant cluster in example (e) and the word medial consonant cluster in (c). It also straightforwardly accounts for the lack of word-final consonants. The other template options shown here have a problem with one or the other of these facts.

2. (b) The Obligatory Onset Parameter is set “off”. Example (d) has a word-medial syllable that begins with a vowel.

3. (d) There is no evidence of extrametricality at all.

4. (b) There are no closed syllables if [CCV] is the maximal template and there is no final extrametricality.

E.5 Discussion of Hupa syllables (§6.5.3)

The maximal syllable template is [CVCC]. The Obligatory Onset Parameter is set “on” (thus disallowing any sequences of vowels). The Word-initial Onset Exception Parameter is set “off” (thereby disallowing any words that do not begin with a consonant). There is extrametricality on the right edge of the word (thus allowing for three consonants at the end of a word).

E.6 Discussion of Tewa syllables

The maximal syllable template seems to be $[CVC]_{max}$. The coda must be a nasal consonant.

E.7 Discussion of Quioquitani Zapotec onsets (§8.2.1)

The onsets that obey the Sonority Sequencing Constraint are: 13 (**pj**), 29 (**ml**), 31 (**nl**),

The onsets that do not obey the Sonority Sequencing Constraint are: 5 & 27 (if **ts** is a cluster), 7 (**ʃts**), 9 (**kp**), 10 (**pk**), 12 (**ʃp**), 14 (**ŋg**), 16 (**ŋkʷʃ**), 17 & 32 (**ŋgb**), 20 (**ms**), 23 (**ŋkʷtʃ**), 25 (**mtʃ**).

E.8 Discussion of syllabification exercise (§8.2.3)

The Sonority Sequencing Constraint would be violated by the syllabification CV.CCVC since the nasal (high sonority) would be farther separated from the syllable nucleus by a stop (low sonority). There is no reason to syllabify the word that way, since one could parse the first syllable as CVC, which is apparently permitted, without any problem.

E.9 Discussion of English exercise (§9.2.1)

The reasons given are not convincing. Regarding the first point: the sequence **ts** would contrast with the affricate just the same; it does not have to be an affricate in order for it to contrast. So the argument is specious. Regarding the second point: the fact that the word **hæts** could be analyzed as CVC does not mean that it *must* be so analyzed in a language that has similarly complex codas (like *lapse*, *tax*) or the possibility of extrametricality. Therefore that argument does not carry any weight. Regarding the third point: the sequence **ts** intervocalically could be easily analyzed as heterosyllabic, with the **t** being in the coda of the first syllable and the **s** being in the onset of the next syllable. There is no argument for an affricate here either.

E.10 Discussion of Salasaca Quichua (§9.2.2)

These could be taken easily as affricates [ts] and [tʃ]. The syllable structure would therefore still be $[CVC]_{max}$.

E.11 Discussion of Seri [kw] (§9.1.6.1)

The better analysis of the two before us is to posit a labialized velar stop. Since there is no phoneme **w**, we have no basis for positing a consonant cluster **kw**. Since there is no phoneme **u**, we have no basis for positing a cluster [kw] that corresponds to the sequence **ku** either.

E.12 Discussion of Highland Oaxaca Chontal (§10.2.1)

It would definitely appear to be the case that there is a minimal word constraint (two syllables required) since one-syllable words are all typically of minor word classes.

E.13 Discussion of Pigafetta's transcription (§11.6.1)

Of course the transcription would not have been IPA since the IPA tradition dates from the late 19th century. It would have to be an impressionistic transcription (of sorts) since a broad transcription and even a narrow transcription require an analysis. Phonological analysis did not develop in Europe until a few centuries later. But even if it had developed before Pigafetta's day, he would not have had time to do an analysis during the minutes or few hours in which he was first transcribing the language they had made contact with.

E.14 Discussion of consonant inventory exercise (§12.1.1)

The inventory of consonants would be:

	Bilabial	Labio-dental	Inter-dental	Alveolar	Post-Alveolar	Palatal	Velar	Glottal
Stop	p b			t d			k g	ʔ
Nasal	m			n				
Tap				ɾ				
Fricative		v		s				h
Approx.								
Lateral approx.								

(The columns like "Interdental", "Postalveolar", and "Palatal" could be omitted.) While most of these are probably uncontroversial, we do not have information from the source as to whether the consonants t and d are alveolar (rather than dental, for example), and we do not have information about the fricative v. Perhaps this is only a convenient symbol for a bilabial fricative (which would have been more difficult to type).

E.15 Discussion of vowel inventory exercise (§12.1.2)

The vowels would be plotted something like shown in figure 32, assuming that we have interpreted the symbols correctly.

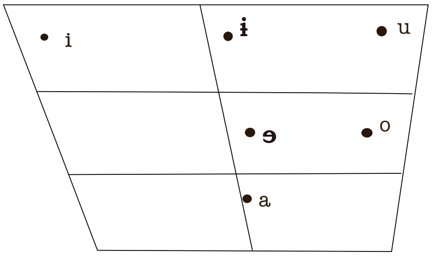


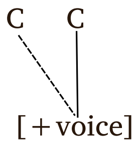
Figure 32. Sample of how vowels are plotted in a quadrilateral

This exercise should remind us that good prose descriptions of the sounds of a language are important. Symbols may be misunderstood or misinterpreted, especially if the point of reference (such as the *Handbook of the IPA*) is not clearly mentioned.

E.16 Discussion of Galician fricatives (§14.2.1)

Prose rule: Fricatives are optionally voiced (partially or fully) when they precede a voiced consonant.

Quasi-formal rule (optional, with variable output):



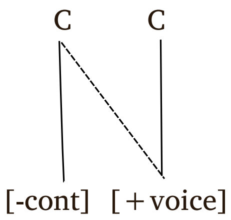
Phonemic representation of 'ten months' is deθ meses (assuming that the diacritics on the d and s are not relevant—this is an irrelevant detail here).

E.17 Discussion of the sibilants in Fa d'Ambu

Voicing is contrastive in the sibilants. The voiceless and voiced sibilants appear at the beginning of words in #1 y #4, and between vowels in #21 and #24. Voicing is not predictable and is therefore contrastive.

E.18 Discussion of Wayana stops (§15.2.1)

Quasi-formal rule:



The two words are written phonemically as ipɤlɤp and ipɤlɤpjai.

The word is written phonetically as [umɤgjai].

E.19 Discussion of Tlacoapa Mi'phaa consonants (§15.2.2)

The following pairs of sounds do not contrast: [b] and [β], [d] and [r], [g] and [ɣ].

Regarding [b] and [β], only [b] occurs in final syllables and [b] freely alternates with [β] in non-final syllables. There is no contrast.

Regarding [g] and [ɣ], only [g] occurs in final syllables and [g] freely alternates with [ɣ] in non-final syllables. There is no contrast.

Regarding [d] and [r], only [d] occurs in final syllables and only [r] occurs in non-final syllables. There is no contrast.

This distribution has suggested that Mi'phaa has an iambic (weak-strong) prosodic structure. In strong syllables, the stop allophone occurs. In weak syllables, the stop allophones alternates with or is replaced by the weaker (fricative) allophone. (Consonant clusters present an additional set of contexts that are different from the ones just described but do not change the basic analysis.)

E.20 Discussion of allomorphs of a Seri article (§17.3.2)

The nasal in each allomorph of the definite article for horizontal position has the same place of articulation as the immediately following consonant that appears in the word that follows. This could be a case of nasal place assimilation. Under this hypothesis, the pronunciation of the definite article is not memorized for each context in which it appears but rather is the simple result of assimilation. The form that occurs before a vowel ends in [m], which would not be the result of any assimilation, and so this would be viewed as the most basic form. The following assimilation rule (which may need revision when other facts are considered) would describe these facts: A nasal assimilates in place of articulation to an immediately following consonant. In fact, we see data in this set of data that require this rule to be revised, because the nasal of the root for 'sleep' does not change place of articulation despite the different contexts, as you should have noticed. While more data might be necessary to discover the exact conditions, the following revised rule is accurate for the data at hand: A nasal assimilates in place of articulation to an immediately following consonant if the nasal is in an unstressed syllable. The quasi-formal rule would look just like (15) except that there would need to be the additional mention of the condition "in an unstressed syllable."

E.21 Discussion of the nasal consonants in Pangutaran Sama

There are four nasal phonemes: m, n, ɲ and ŋ. They appear word-initially before a vowel in #17, #9, #7, and #61. They appear between vowels in #28, #41, #44, and #79. They appear word-finally in #115, #113, #—(ɲ), and #91. Before a consonant, there is neutralization: the nasal consonant before a consonant is always homorganic with the consonant that follows it. (It is presumed that the nasal in #5 is actually at the point of articulation of the affricate.)

E.22 Discussion of Salasaca Quichua (§19.1.2.1)

While these could all be taken as contour segments (labialized k, labialized aspirated k, palatalized t) the evidence to do so is not very strong since there is evidence of diphthongs in the language. Thus the forms are just as convincingly taken as k followed by a diphthong, aspirated k followed by a diphthong, and t followed by a diphthong.

E.23 Discussion of English sibilants (§18.1.3.1)

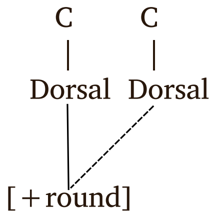
There is no doubt that the two sibilants are separate phonemes; the evidence is simply overwhelming that they are. However, the phonotactics of the two sibilants are not the same. Before the rhotic, only the postalveolar sibilant occurs. Before the lateral, only the alveolar sibilant occurs. In these particular contexts, there is a neutralization of the contrast. The abstract representations that could be proposed for the two words are the following. First, representations that simply write the phoneme that occurs could be proposed (and this is typical): ʃɹɜb and slɜm, respectively. Second, representations that utilize the notion of archiphoneme have been proposed (although this is not what we encourage here). Using capital S for the sibilant that is not specified for place like the N that is a nasal that is not specified by place, the representations would be Sɹɜb and Slɜm, respectively. This example could lead to a discussion about why this situation occurs and what the evidence would be for using the straightforward first analysis (not using an archiphoneme approach, nor its equivalent in feature theory).

E.24 Discussion of Cashinahua [ʃ] and [ʂ] (§18.2.2.1)

On the face of it, these data indicate that the difference between [ʃ] and [ʂ] is contrastive since there is superficial contrast in what look like two good pairs of words: #20 and #23, #24 and #26. Notice that there is contrast before two distinct vowels. (We may have questions about what the verb forms glossed as infinitives really are, but the data still appear to be strongly indicative of the contrast.)

E.25 Discussion of Seri phrases (§19.2.1)

The feature [+round] is spreading from one dorsal consonant (on which it is distinctive) to an immediately following dorsal consonant (in the next word in these data, although it also happens word-internally). It does not spread to non-dorsal consonants. The spreading is a postlexical rule that has the phrase as its domain. A simple prose statement would be: "Rounding of a dorsal consonant spreads to an immediately following dorsal consonant (in the same phrase)." It could be formalized as shown here.



In the practical orthography the labialization is only written on the first dorsal consonant—the consonant on which it is distinctive—not on the consonant to which it spreads in connected speech. This practice has been successful.

E.26 Discussion of Seri [o] and [oː] (§21.4.1.1)

On the face of it, these data indicate that vowel length is contrastive in Seri in some way. The words are both monosyllabic stressed words, but one has a short vowel and one has a long vowel. We do not know from these data whether there is more to the story, but at least we know that we should pay close attention to vowel length in this language because it is contrastive in some way.

E.27 Discussion of Awara aspiration (§20.3.1.1)

Aspiration is predictable. Voiceless stops are aspirated when they occur in the onset of a syllable: **kahat [kʰahat]** ‘betelnut’.

E.28 Discussion of Mangseng [rː] (§21.5.2)

The data contain both a simple r (usually a solid trill, it seems) and a long r (an even longer trill). The data do not support an analysis in which there are two phonemes (short r and long r) nor do they support an analysis in which the long r is an allophone. Instead, quite simply, the long r appears to be simply what is heard when a r-final morpheme is concatenated with an r-initial morpheme. The word for ‘our (inclusive) opposite-sex siblings’ is evidently composed of a reduplication-style prefix (something to do with plurality), the root, the suffix **{r}** (for first person plural inclusive) and the plural suffix **{re}**. The phonemic transcription is **lulurre**.

E.29 Discussion of allomorphs of a Seri article (part 2, §22.1.6)

The allomorphy in part 2 cannot be due to the nasal place assimilation rule seen earlier since there is no consonant following the nasal consonant that can be influencing it; the nasal appears in final position. Furthermore, we see here that there is some variability in pronunciation; this variability was not seen in the previous data. The analysis that works here is that, while the basic form of the article is **kom**, some speakers (with some variability) may pronounce the phrase-final nasal—with some conditions, perhaps, such as needing to be in an unstressed syllable—as a velar nasal. We know that the correct formulation of this process does not refer to word-final position, since we have data in part 1 that shows the word-final nasal as being either **[m]** (before a vowel) or as assimilating in place of articulation to a following vowel.

E.30 Discussion of Quioquitani Zapotec stops (§22.1.7)

The data are transcribed phonemically as in the following table. Note that all indications of vowel length, aspiration and devoicing have been removed.

		Gloss			Gloss
1.	**ˈʦìt**	‘egg’	2.	**ˈʃʦǐt à̰**	‘my egg’
3.	**ˈʧòp**	‘two’	4.	**ˈʧòp ˈʦìt**	‘two eggs’
5.	**ˈmɛ̀kʷ**	‘dog’			
6.	**ˈtòb**	‘agave’			
7.	**ˈlíʥʲ**	‘home’			
8.	**ˈníz**	‘ear of corn’			
9.	**ˈnìs**	‘water’	10.	**ˈʃpǐd má**	‘its snout’
			11.	**ˈʃìg ɾé**	‘this gourd container’

The facts re-stated, with examples: Voiceless stops are lightly aspirated in syllable-final position: **ʦìt [ˈʦìtʰ]** ‘egg’, **ʧòp [ˈʧòpʰ]** ‘two’, **mɛ̀kʷ [ˈmɛ̀kʷʰ]** ‘dog’. In the phrase **ʃʦǐt à̰ [ˈʃʦǐt à̰]** ‘my egg’ (notice the tone change from the unpossessed form given earlier) the **t** is syllabified with the enclitic pronoun and is not aspirated since it is not syllable final in this context.

Voiced obstruents (especially the stops and affricates) strongly tend to devoice when they are in syllable-final position; however, unlike the phonemically voiceless stops, they are not aspirated in this position. The devoicing in phrase-final position is more complete in phrase-final position than in simple syllable-final position. Examples: **tòb** **[ˈtòˑb̥]** ‘agave’, **lídʑʲ** **[ˈlíˑdʑ̥ʲ]** ‘home’, **níz** **[ˈníˑz̥]** ‘ear of corn’, **ʃpǐd má** **[ˈʃpǐˑd̥ má]** ‘its snout’, **ʃìg ɾé** **[ˈʃìˑg̊ ɾé]** ‘this gourd container’. (The slightly longer vowels before phonemically voiced consonants helps to maintain the contrast between voiceless and voiced obstruents despite the phonetic devoicing in final position.)

E.31 Discussion of Tucano (§22.2.7)

Prenasalization: Voiced stops are prenasalized phrase-initially: **dasɛ** **[ⁿdasɛ]** ‘toucan’ in phrase-initial position, **[dasɛ]** elsewhere when not phrase-final.

Final devoicing: Vowels drift to voicelessness in phrase-final position: **dasɛ** **[dasɛɛ̥]** ‘toucan’ when the word is phrase-final, and **[dasɛ]** in phrase-medial position.

E.32 Discussion of Albanian [ə] and [a] (§23.1.1)

On the face of it, these data indicate that the difference between **[ə]** and **[a]** is contrastive since there is superficial contrast. The problem with jumping to conclusions here is that the two words being compared are essentially two forms of the same word (one indicated as specific). Maybe these two vowels are both phonemes, but we certainly would not want to base our conclusion on data like this pair of words.

E.33 Discussion of Mangseng (§24.1.1.1)

There appears to be a transitional stop between a nasal and a trill—more clearly so between the bilabial nasal and the trill than between the alveolar nasal and the trill. This intrusive stop is not phonemic; it is a detail of the pronunciation of the nasal-trill sequences (perhaps only of the ones that are not at the same place of articulation). The word **[keβɔmᵇre]** ‘your mother’s brothers’ would be phonemically **keβɔmre** (assuming at this point that the other sounds are phonemic). Thus there is no phoneme **b**; the word is *not* phonemically **keβɔmbre**. It is important to remember that an impressionistic transcription of this word might have been **[keβɔmbre]**; if so, the question of the proper analysis of **[b]** still must be investigated, and the answer is still the same in this case.

E.34 Discussion of Quioquitani Zapotec [i] (§24.2.3.2)

The prefix used to derive obligatorily possessed nouns from simple nouns has two allomorphs: one that is simply a consonant (a fricative) and one that is that fricative followed by a close front vowel. The **ʃ-** allomorph can be added to nouns that begin with a simple consonant without any problem because the resulting cluster can be parsed by the maximal syllable template.

However, **ʃ** cannot be added to nouns that begin with consonant clusters; the resulting CCC cluster cannot be parsed (even by the minor pattern, which requires a nasal at the beginning). When the noun begins with a consonant cluster, the allomorph **ʃi-** appears, where the **i** permits the syllabification of the consonant **ʃ**, of course.

A typical analysis of these facts would be to posit a rule of i-Epenthesis, with the inserted vowel motivated by the need to rescue the stray consonant. Nevertheless, an epenthesis solution is not the only possible one nor is it especially clear that is well motivated in this language synchronically since there are so few examples of derived possessed nouns in this variety of Zapotec, unlike in some others. Furthermore, if there is epenthesis, it is an M-rule and not a P-rule, to use our terminology.

These data therefore provide evidence for analyzing the onset of the root for ‘broom’ as a consonant cluster **kp** and not as a labio-velar stop (if one were really wondering about that). It also provides evidence for analyzing the onset of the root for ‘soap’ as a consonant cluster **pj** and not as a palatalized stop. In both cases the allomorph with the vowel **i** is used. And it provides evidence for analyzing the onset of the root for ‘day ’as an affricate and *not* as a sequence t + s. See the discussion of such issues in chapters §8 and §9. Note that these facts provide clear evidence that extrametricality is not operating in Quioquitani Zapotec.

E.35 Discussion of Awara prenasalization (§25.3.1)

1. Do prenasalized stops contrast with the (aspirated) voiceless stops? (Yes; compare 5 and 12.)
2. Do prenasalized stops contrast with the nasal consonants? (Yes; compare 6 and 12.)
3. Do prenasalized stops contrast with voiced stops? (No; they are in complementary distribution.)
4. Do prenasalized stops occur intervocalically? (Yes; #8 is $\text{sa}^{\text{n}}\text{dun}$.)
5. Do prenasalized stops occur word-initially? (Yes; #17 begins with a prenasalized stop. Prenasalization is lost in absolute initial position.)
6. What does the word game do and how does it help you analyze a word like #11? (The game moves the first syllable to the end of the word. When that is done in #11, the prenasalized stop is now in absolute initial position (see third column, which is list pronunciation) and so it loses the nasalization feature in that position. This is entirely expected if the prenasalization analysis is adopted.

E.36 Discussion of Awara play language (§25.3.1)

The basic rule for the play language appears to be to take the first syllable of the word and move it to the end of the word. (The three syllable word in #2 is key evidence.) In the case of the word for 'machete', we see that the adjacent consonants reduce to a single one (the aspiration remains). We do not have any other examples of (nearly) identical consonants coming together (except when they differ in voicing, as in #20) so we do not know for sure how general this rule of degemination is in the language.

E.37 Discussion of Seri secondary labialization (at beginning of chapter §19)

The data in appendix G.5.9 show that there is contrast between k and k^{w}. Possibly the difference is not easily perceived at the end of an utterance, but it is still present there. Lip-rounding also appears when a consonant appears adjacent to a round vowel, but that rounding is only a phonetic detail—the sequence ok is pronounced differently from the sequence ok^{w}. The distinctive labialization of k^{w} also affects (at least) the uvular consonant χ when the latter immediately follows a k^{w}, as when one adds the suffix -χam, as illustrated by the data in appendix G.5.4. Therefore, to summarize, there is (a) a distinctive feature [+round] in Seri and there is also (b) non-distinctive rounding, and (c) postlexical assimilation of a back consonant (velar or uvular) to a distinctively round consonant.

E.38 Discussion of Cashinahua (§9.1.2)

The maximal syllable template appears to be $[\text{CV}]_{\text{max}}$. Because this, the sounds [ts] and [tʃ] are very appropriately hypothesized to be affricates. These are exactly the kinds of contour segments that we expect to find in languages.

E.39 Discussion of Gabri de Darbé (§9.1.3)

The maximal syllable template appears to be $[\text{CVC}]_{\text{max}}$. It might be the case that only a sonorant consonant is allowed in coda position (see #1 and #9). If this template is correct, there is no reason to posit prenasalized stops; instead, [mb] etc. can be taken as heterosyllabic clusters of nasal plus stop. This analysis therefore accounts for the lack of such sounds in word-initial position. (Only one consonant is licensed there.) On the other hand, [dʒ] must be taken as an affricate.

E.40 Discussion of Gor (§9.1.3)

The maximal syllable template appears to be $[\text{CVC}]_{\text{max}}$. It might be the case that only a sonorant consonant is allowed in coda position (see #2, #6, #11). If this template is correct, and since the sounds [nd] and [ŋg] occur word-initially, we would be justified in taking them as prenasalized stops. Likewise, [dʒ] would be taken as an affricate.

E.41 Discussion of Tainae (§18.1.2.1)

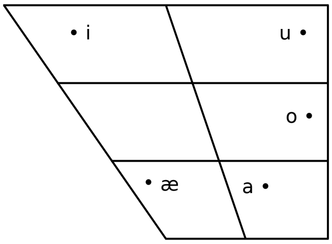
The voiceless bilabial and labiodental fricatives do not contrast. (If they did, it would be most unexpected based on what we know from inventories of sounds of the world's languages.) It looks like the sounds freely vary when they occur word-medially (by dialect? or under what conditions? we are not told). The data have only **[f]** in word-initial position. We might posit that we have a phoneme **f** that varies to bilabial **[ɸ]** when intervocalic.

E.42 Discussion of Arabela velars (§29.1.5.1)

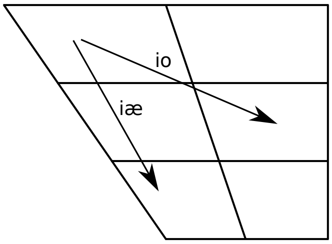
These velar consonants do not contrast. The allomorphs of the root for 'father' give evidence of what is going on. The farther away the velar is from the primary stressed syllable, the more likely it is to be pronounced as a continuant and even as a voiced continuant. We would posit the phoneme **k**.

E.43 Discussion of Jalapa de Díaz Mazatec vowels (§23.4.1)

The vowels would be charted as shown in the following figure. Note the use of a dot and a symbol for each.



The diphthongs in group 3 would be charted as shown in the following figure. Note the use of a headed arrow and a symbol for each.



F

Answers to reading questions in the indicated chapters

If you find that you had trouble answering a question easily or correctly, you should review the material in the chapter. The simple true and false questions are meant to raise certain issues. If you do not know *why* you answered the question correctly, you should review the material in the chapter.

F.1 Answers to reading questions for chapter §1

1. False
2. (a) phonetics
3. (b) phonology
4. True
5. Yes
6. All languages have sounds that they use, for which the details of pronunciation and distribution are important. Not all languages have extensive morphological operations (suffixation, prefixation, etc.) that might create allomorphs of morphemes for which M-phonology is designed to handle.
7. True
8. True
9. Phonetics deals with the production and perception of sounds—an outsider's view of those sounds. Phonology deals with how speech sounds pattern together—an insider's view of those sounds.
10. An isolating language, by having little or no morphology, will have much more to describe in P-phonology because the sounds and how they are realized are topics that must be covered. With little or no allomorphy as the result of affixation, there will be little or nothing in the area of M-phonology.
11. The allomorphy of the root is described in the M-phonology. (This may not be obvious at this point in the course, but it will be more clear later on.)
12. False. P-phonology is relevant for much more than the creation of orthographies.

F.2 Answers to reading questions for chapter §2

1. False
2. True
3. False
4. False
5. True
6. False
7. False
8. False
9. False
10. We need to know what the phonology write-up is describing and how that object (e.g., dialect or language) relates to other speech varieties that are similar.
11. False
12. False (English and Spanish are related—both are Indo-European languages—but are not in the same genus.)
13. False
14. False (They may, but that is not the criterion.)
15. False
16. False (Of course they may be in the same genus; in fact, they are.)

17. Unlikely (Obviously if it took that long to determine relatedness, the relatedness is not "easy to demonstrate.")
18. (d) There is no more inherent value in a dialect because of political, geographical or socio-economic factors. Any dialect may be of interest for a phonological write-up. Of course, there may be social value in choosing a particular dialect for a write-up (since it may be helpful to have a good description of the variety that serves the wider speech community best in the area of mass communication or in education).
19. (b) Whether two LS's are dialects of the same language or different languages depends on a variety of factors that involve political and sociological questions as well as linguistic ones. So that is not an easy decision. Whether two LS's are in the same large language family is often not an easy decision because they may be very different (like Lithuanian and Spanish) and still be in a family (like Indo-European). But whether or not two LS's are in the same genus is a relatively easy decision to make.

F.3 Answers to reading questions for chapter §3

1. False
2. False
3. (b) first part of 20th century
4. (c) second half of 20th century
5. False
6. (c) phonemes
7. True
8. False
9. False
10. nucleus
11. False
12. False
13. True
14. True
15. True
16. onset, nucleus, coda
17. True
18. (b) diphthong
19. obstruent

F.4 Answers to reading questions for chapter §4

1. False
2. False
3. True
4. False (Because ʃ is in fact a sound of English)
5. True (While the first three sounds can be parsed into a syllable that English has, the final [m] cannot be a syllable in and of itself in English.)
6. If words are made up of syllables (an idea that we have some reason to believe is true generally), then knowing the structure of possible syllables (a relatively easy task) should be very helpful in understanding what are possible words (which number into many thousands) and what are not possible words (presumably an infinite number) in the language.

F.5 Answers to reading questions for chapter §5

1. A $[CVC]_{max}$ template can easily describe a CV syllable since it is understood that the coda is never obligatory.
2. A $CVC]_{max}$ template can easily describe a VC syllable since it is understood that the onset is not obligatory unless specified.
3. False
4. (c) tri.um.fo
5. False
6. True
7. False
8. True
9. True
10. True
11. True
12. (b)
13. (a)
14. (d)
15. True
16. [CVX]
17. False. The word illustrates the syllable types CV and VC. The two vowels are in separate syllables. The type CVVC would need to be a single syllable with two vowel-like elements in it (like in the word **[void]**.
18. True. The second syllable is word-internal and has no onset.
19. False. The first syllable has no onset, but it is in word-initial position, and word-initial position is viewed as not relevant for the Obligatory Onset Parameter.
20. CV has been called the universal syllable because all languages have it, although they may also have more complex syllables and may sometimes have syllables that are smaller (e.g. only V).
21. (a) The l in this word cannot be parsed by the template and is also not handled by initial extrametricality (it's not at the beginning of the word).

F.6 Answers to reading questions for chapter §6

1. True
2. False
3. True
4. False (The final consonant could be extrametrical.)
5. (a)
6. False
7. It could be a [CVCC] plus final extrametricality.
8. The initial and final consonants could be taken as extrametrical since they are at the edge of the word.
9. False (Both edges of the word are potential problems because of the possibility of extrametricality.)

F.7 Answers to reading questions for chapter §7

1. False
2. True
3. True
4. True
5. True
6. True
7. True (they have heavy rimes)
8. (b) A branching onset does not usually contribute weight to the syllable.
9. Onset, Rime
10. Coda, Rime

F.8 Answers to reading questions for chapter §8

1. False
2. False
3. True
4. False
5. True
6. False
7. The Syllable Sequencing Constraint strongly favors the inclusion of the nasal in that word as a coda of the first syllable since it inclusion in the onset of the second syllable requires one to violate that constraint (**n** is a sonorant and **t** is an obstruent).

F.9 Answers to reading questions for chapter §9

1. True
2. False
3. False (See the discussion in §9.1.7.)
4. True
5. False
6. False (It can. The final sounds are analyzed as an affricate.)
7. True
8. True
9. True
10. (b)
11. False. (The fact that the allomorph that has the vowel—**ʃi**—is used before complex onsets tells us either that there is no Extrametricality operating in this case (you only get two consonants in the onset, so one more is not possible), or it tells us nothing about Extrametricality in this language. If we say that there is initial Extrametricality, these facts do not provide any evidence for it.
12. (a)
13. (a)

F.10 Answers to reading questions for chapter §10

1. False
2. True
3. False
4. True
5. False
6. False (But loanwords should be treated with care.)
7. False
8. (a), (b), (c), (d), (e), (f) (Answer (c) is less than ideal unless a person controls, and explains, all the details of the conjugation of the verb; unless we know how verbs are conjugated, the word by itself is not ideal evidence.)
9. Yes, they do. The contexts are completely similar. In both cases the fricative appears a flap (a voiced consonant that provides a stable contrastive context).

F.11 Answers to reading questions for chapter §11

1. True
2. True
3. True
4. False
5. False

F.12 Answers to reading questions for chapter §12

1. True
2. False
3. True
4. True
5. True
6. True
7. True
8. False
9. True
10. No. While this is clearly a minimal pair that contrasts [b] and [w], meaning that one should be sure to be able to pronounce those sounds differently, the evidence is not good for establishing b and w as phonemes since the first word is morphologically complex (and we do not know anything about the morphology of this language) and the second word may be complex as well (if cupboards are a new item in the culture).
11. True
12. False
13. False
14. True
15. Phonemic transcription requires analysis of the phonetic data, which is not likely to happen during the first day or days of fieldwork since a person is focusing on gathering good data and would not have enough data, time, or understanding to analyze it sufficiently in order to do phonemic transcription.
16. They are good evidence since we see them contrasting in a very simple context; we know what the morphological structure of the verbs is. It is possible that we may be surprised by something, but on the face of it, the evidence appears good.

F.13 Answers to reading questions for chapter §13

1. True
2. True
3. True
4. False
5. False
6. True
7. True
8. True
9. True

F.14 Answers to reading questions for chapter §14

1. False
2. False
3. False
4. False
5. False
6. True
7. True
8. True
9. True
10. False
11. True
12. True (But there may be a problem with it being valid because of the intervocalic [s]. If it were revised to be "a stop is voiced intervocalically", it would not have a problem with the [s].)
13. False
14. True
15. False
16. Plus (positive)
17. (b) This is a good context in which voicing assimilation might take place
18. The rule is less than optimal because it fails to capture a generalization. Rather than listing a group of consonants, it should attempt to capture a class (in this case, the stops). (It is probably not necessary to specify voiceless stops because the inclusion of the voiced stops would not affect the output.)
19. The rule is less than optimal because it does not include any motivation for the voicing. Rather than making reference to nasal consonants, it should mention voiced consonants, or (if necessary) voiced sonorants, unless there is reason to be less general.
20. The rule is less than optimal because it makes a short list ("stops and fricatives") rather than state something more general using a class (in this case, obstruents).

F.15 Answers to reading questions for chapter §15

1. True
2. False
3. False
4. False
5. True
6. True
7. (c) and (e)

F.16 Answers to reading questions for chapter §16

1. False
2. True
3. False
4. True
5. False
6. True
7. False
8. (c)
9. A vowel is nasalized before a tautosyllabic nasal.

F.17 Answers to reading questions for chapter §17

1. True
2. False (This is a position where neutralization of contrast between nasals commonly occurs.)
3. True
4. True
5. True
6. True
7. False (It is the Place node that is spreading.)
8. (d)
9. (b)
10. Place
11. The fact that nasal place assimilation very often results in a velar nasal when the nasal precedes a labial-velar approximant is good evidence that the approximant is most importantly a dorsal consonant.

F.18 Answers to reading questions for chapter §18

1. False
2. True
3. False
4. False
5. False
6. False
7. True
8. True
9. True
10. True
11. alveolar
12. w
13. strident
14. Coronal
15. False
16. (b)
17. The difference in the place of articulation of the sibilants could easily be due to the context. It would be natural to expect that a coronal consonant like s could be “palatalized” before a front vowel, especially a close front vowel.

F.19 Answers to reading questions for chapter §19

1. False
2. False
3. False
4. False
5. True
6. False
7. labialization
8. False
9. False
10. True

F.20 Answers to reading questions for chapter §20

1. True
2. False (Modal)
3. False (Voiced ejectives are not used in human language.)
4. True
5. True
6. False
7. False
8. True
9. (a)
10. [voice], [spread glottis], [constricted glottis]
11. [+spread glottis]

F.21 Answers to reading questions for chapter §21

1. True
2. True
3. True
4. True
5. False
6. True
7. True
8. True
9. (c) is the best answer. (b) is not good because one of the words is from a minor class and unstressed.
10. geminates
11. False
12. mora
13. true

F.22 Answers to reading questions for chapter §22

1. False
2. True
3. True
4. False
5. False
6. True
7. True
8. True
9. lenition
10. aspiration, trilling, obstruentization, prenasalization, preglottalization, affricate formation

F.23 Answers to reading questions for chapter §23

1. False
2. (f)
3. True
4. True
5. (e)

F.24 Answers to reading questions for chapter §24

1. (c)
2. (d)
3. True
4. True
5. True
6. (e) [although the truly classic case of epenthesis is choice (c)]
7. (b)

F.25 Answers to reading questions for chapter §25

1. False
2. True
3. True
4. The evidence is inadequate because the words are morphologically complex and we are not informed how they are composed. (As it turns out (from this real example, discussed in the text, the contrast is not between phonemes k and ɣ, but rather between kk (a sequence of velar stops that are concatenated during word formation) and simple k. The phonetic contrast is real, but the conclusion was erroneous.)

F.26 Answers to reading questions for chapter §26

1. True
2. (e)
3. False

F.27 Answers to reading questions for chapter §27

1. (e)
2. True
3. True
4. (e)

F.28 Answers to reading questions for chapter §28

1. True
2. False
3. (b)
4. (b)
5. False
6. False (It prohibits having the same adjacent tones.)
7. True
8. True
9. (e)
10. True
11. True

F.29 Answers to reading questions for chapter §29

1. False
2. (f)
3. True
4. True
5. False
6. True
7. False

G

Data for exercises

G.1 Data from the Tlapanecan genus

The Tlapanecan genus (Mexico) comprises several notable varieties. The following sections present data from one or more of these varieties (which might be considered very closely related languages). The data presented here include only cognates for the sake of comparison.

G.1.1 *Phonetic details in one variety.* These data are from the area of Tlacoapa (ISO 639-3 [tpl]). Impressionistic transcription.[1]

Notes: (1) ‡ Unaspirated stop in this word. (2) There are not many examples of [p] or [pʰ] to include here. Assume that this is an accidental gap. (3) All examples written with <r> could be flap [ɾ] in normal speech, or [r] in perhaps more deliberate speech. (4) Nouns and verbs that do not exist: [go], [ta], [su], [ki], etc.

1.	ʃānã́	‘vegetation’	2.	ʃã́ŋã́ʔ	‘nest’
3.	ʃàbù	‘person’	4.	ījāʔ	‘water’
5.	kʰùbàʔ ~ hùbàʔ	‘earth’	6.	ītsí	‘stone’
7.	kʰúbá ~ húbá	‘mountain’	8.	gõ̀ʔ	‘moon’
9.	ʃkwà	‘flat place’	10.	mẽ̄kʰū	‘sky’
11.	mẽ̄kʰwí	‘in the sky’	12.	wìʔhì	‘sand’
13.	mbó:	‘one (inan.)’	14.	jāhā	‘bean’
15.	ātsú	‘three (inan.)’	16.	jàhàʔ	‘louse’
17.	ɣùwàʔ ~ gùwàʔ	‘ten (inan.)’	18.	ɲũ̄:	‘rope’
19.	dũ̄:	‘hot pepper’	20.	rūʔhwā	‘rain’
21.	ɲũ̀ʔhũ̀	‘bird’	22.	rìʔhì	‘flower’
23.	ìgì (*ìɣì)	‘fox’	24.	āgūʔ	‘fire’
25.	īdā	‘palm’	26.	ã̀ʔŋũ̀ũ̄	‘iguana’
27.	ɣàʔhū ~ gàʔhū	‘spider’	28.	rã̄.ũ̄	‘mouth’
29.	ɣũ̄mã̄ ~ gũ̄mã̄	‘tortilla’	30.	hwã̄	‘seven’
31.	mbā:ʔ	‘plot of land’	32.	nã̀kwā ‡	‘shade’
33.	ɣùʔtsì ~ gùʔtsì	‘turtle’	34.	àkwã̄ (L.HM)	‘ant’
35.	āhŋgá:	‘word, language’	36.	ēʃtūʔ	‘basket’
37.	bìjú ~ βìjú	‘falcon’	38.	ã̀ŋã̀ʔ	‘deer’
39.	èhnã̀	‘box, trunk’	40.	ēgìʔ	‘fish’
41.	ɣũ̀nĩ ~ gũ̀nĩ	‘smoke’	42.	náskā	‘vegetable waste’

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[1] One set of possible instructions for using these data is given in §19.6 and §21.12. See also §15.2.2.

43.	**dʒã́ʔhã̄**	‘vulture’	44.	**kùʃtá ‡**	‘bat’
45.	**dʒwáʔhā**	‘orphan’	46.	**tsóóʔ**	‘nectar’
47.	***saa**	(no words like this)	48.	***daɣa**	(no words like this)
49.	***raa**	(no words like this)			

G.1.2 *Comparison of two varieties.* The following data are from two varieties: one set (Barranca Dulce) from the large area classified as Acatepec [tpx] and one set (Zilacayotitlán) from the large area currently classified as [tcf], but notably different from the majority variety in that group. Impressionistic transcriptions.

	Barranca Dulce [tpx]	Zilacayotitlán [tcf]	English Gloss	Spanish Gloss
1.	àdōō	àdōō	'worm (kind)'	'gusano (tipo)'
2.	béʃú	βéʃōō	'yucca'	'izote'
3.	èhnà	èhnà	'box'	'caja, baúl'
4.	ìʔdṹũ̀	èʔdṍʔ	'roadrunner'	'correcaminos'
5.	mēkū	mēkʰō	'sky'	'cielos'
6.	sìnù	tsènò	'grinding stone'	'metate'
7.	ʃēdì	ʃēdē	'head of cattle'	'res'
8.	ʃtédì	ʃtédè	'hat'	'sombrero'
9.	séhwìì	tsíɸìí	'roof tile'	'teja'
10.	ẽ̀hĩ̀	ĩ̀hĩ̀	'children'	'niños'
11.	ègìʔ	ìgìʔ	'fish'	'pez, pescado'
12.	èʃùʔ	j̃ũ̀hũ̀ ìʃù	'mosquito'	'zancudo'
13.	èhwìì	ìɸìí	'griddle'	'comal'
14.	ẽ̀ⁿdīīʔ	ĩ̀ⁿdìíʔ	'jaguar'	'jaguar'
15.	ēʔdī	ēʔdē	'blood'	'sangre'
16.	àʔkʷì	àʔkʰʷẽ̀ẽ̀	'there (medial)'	'allí (medial)'
17.	ēhʃí	īʃí	'corn'	'maíz'
18.	ēʔsí	ēʔtsẽ́	'hail'	'granizo'
19.	mẽ̄ʔpàà	βèʔpʰàà	'Me'phaa (Tlapanec)'	'me'phaa (tlapaneco)'
20.	ràhùʔ	ràhòʔ	'prickly pear cactus'	'nopal'
21.	bìjú	βìjú	'hawk'	'halcón'
22.	īdú	īdú	'salt'	'sal'
23.	īsí	ītsí	'stone'	'piedra'
24.	ījāʔ	ījāʔ	'water'	'agua'
25.	rìʔì	rìʔì	'flower'	'flor'
26.	rēʃàà	rīʃàá	'yard'	'patio'
27.	ʃāʃì	ʃāʃī	'forest'	'bosque'
28.	īdā	īdā	'palm'	'palma'
29.	āgūʔ	āgūʔ	'fire'	'lumbre'
30.	gã̀nũ̀ʔ	gã̀nũ̀ʔ	'fresh ear of corn'	'elote'
31.	gũ̄mã̄	gũ̄mã̄	'tortilla'	'tortilla'

32.	īsù	ītsū	‘bone’	‘hueso’
33.	kùbàʔ	kʰùbàʔ	‘earth’	‘tierra’
34.	rūdūʔ	rūdūʔ	‘tender’	‘tierno’
35.	rūʃī	rūʃī	‘weevil’	‘gorgojo’
36.	ādà	ādā	‘child’	‘niño’
37.	hkàʔ	àkʰàʔ	‘sun’	‘sol’
38.	àʔmã̄	àʔmã̄	‘bee, wasp’	‘abeja, avispa’
39.	mã̄tā	mã̄tʰā	‘stream’	‘riachuelo’
40.	mã̄ʃāʔ	mã̄ʃāʔ	‘green’	‘verde’

G.1.3 *Animacy marking on quantifiers in two varieties.* ISO 639-3 [tpl] and [tpx]. Impressionistic transcription (except that nasalization is probably under-transcribed on vowels and approximants preceding clear nasalization). Data from fieldwork by Stephen Marlett.[2]

	Gloss	Inanimate [tpl]	Animate [tpl]	Inanimate [tpx]	Animate [tpx]
1.	‘two’	àhmà	àhmì̃ì̃	àhmà	àhmì̃ì̃
2.	‘seven’	hwā̃	hwī̃ī̃	hwā̃	hwī̃ī̃
3.	‘ten’	gùwàʔ	gùwì̃ì̃ʔ	gùwàʔ	gùwì̃ì̃ʔ
4.	‘many’	mbāʔā	mbāʔī̃ī̃	mbāʔā	mbīʔī̃ī̃
5.	‘three’	ātsú	ātsú̃ú̃	āhsú	āhsí̃ī̃
6.	‘five’	wītsū	wītsū̃ū̃	wīsū	wīsī̃ī̃
7.	‘eight’	mīgī̃jū̃ʔ	mīgī̃jū̃ū̃ʔ	mīgī̃jū̃ʔ	mīgī̃jī̃ī̃ʔ
8.	‘twenty’	mbá skí̃jú̃ʔ	mbá skí̃jú̃ú̃ʔ	mbá skí̃jú̃ʔ	mbá skí̃jí̃ī̃ʔ
9.	‘six’	māhŋū̃	māhŋū̃ū̃	māhū̃	māhwī̃ī̃
10.	‘four’	ākʰù	ākʰù̃ū̃	àhkù	àhkwì̃ì̃
11.	‘some’	mbá tīkʰū	mbá tīkʰū̃ū̃	sīkū	sīkwī̃ī̃
12.	‘all’	ʃúgíí	ʃúgí̃í̃	ʃúgwííʔ	ʃúgwí̃í̃ʔ
13.	‘how many?’	ŋgwátʰà	ŋgwátʰì̃ì̃	ŋgwátá	ŋgwátì̃ì̃
14.	‘one’	mbóó	mbáwīī	mbóó	mbáwíí
15.	‘each’	mbámbá	mbámbáā	mámbá	mámbáā
16.	‘another’	ìmbà	ìmbàà	ìmbà	ìmbàà

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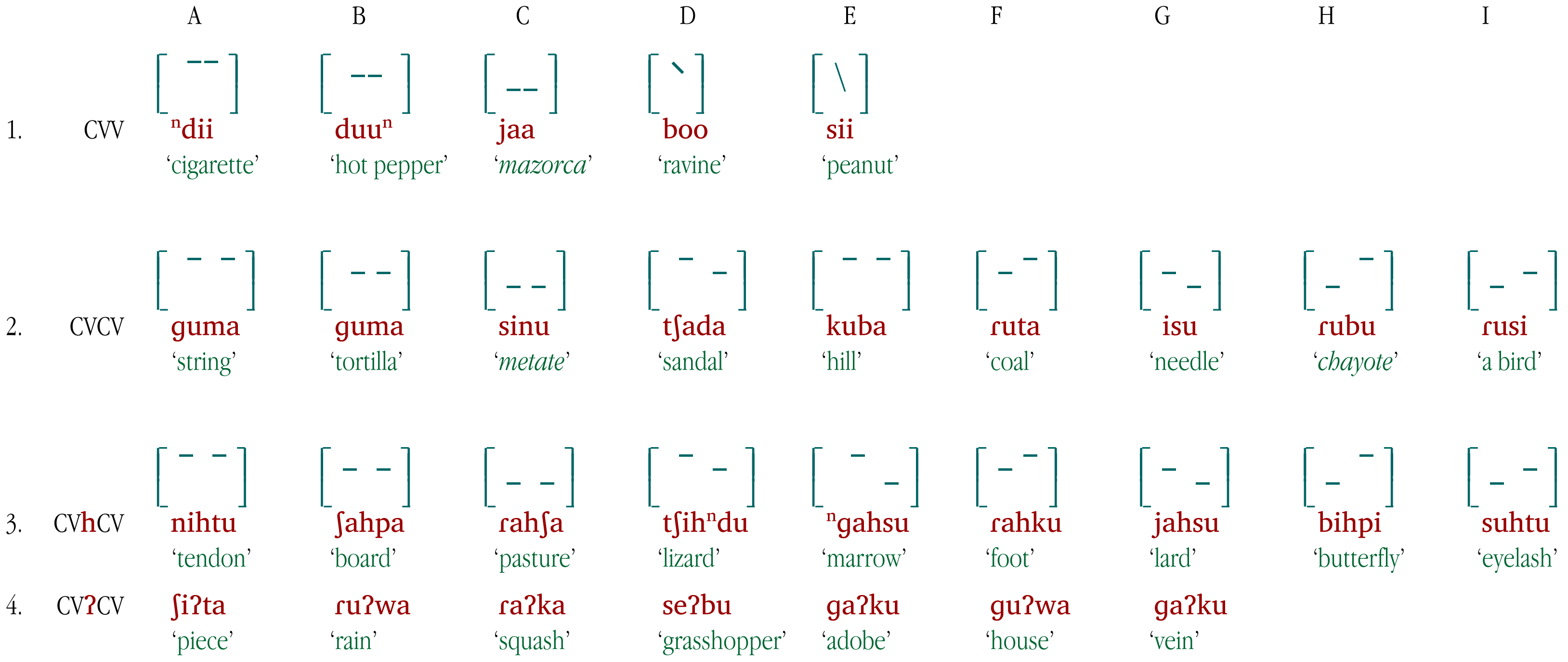
[2] One set of instructions for using these data is given in §2.7.

G.1.4 *Tone in the Acatepec variety.* ISO 639-3 [tpx]. Cline (2013). These data are in an impressionistic transcription. [However, the use of the raised final n to indicate nasalization of the morpheme is not part of the IPA tradition.] The tones in 2E are correct as shown.[3]



		A	B	C	D	E	F	G	H	I
1.	CVV	ⁿdii 'cigarette'	duuⁿ 'hot pepper'	jaa '*mazorca*'	boo 'ravine'	sii 'peanut'				
2.	CVCV	guma 'string'	guma 'tortilla'	sinu '*metate*'	tʃada 'sandal'	kuba 'hill'	ɾuta 'coal'	isu 'needle'	ɾubu '*chayote*'	ɾusi 'a bird'
3.	CVhCV	nihtu 'tendon'	ʃahpa 'board'	ɾahʃa 'pasture'	tʃihⁿdu 'lizard'	ⁿgahsu 'marrow'	ɾahku 'foot'	jahsu 'lard'	bihpi 'butterfly'	suhtu 'eyelash'
4.	CVʔCV	ʃiʔta 'piece'	ɾuʔwa 'rain'	ɾaʔka 'squash'	seʔbu 'grasshopper'	gaʔku 'adobe'	guʔwa 'house'	gaʔku 'vein'		

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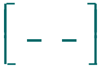
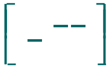
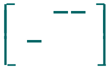
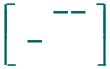
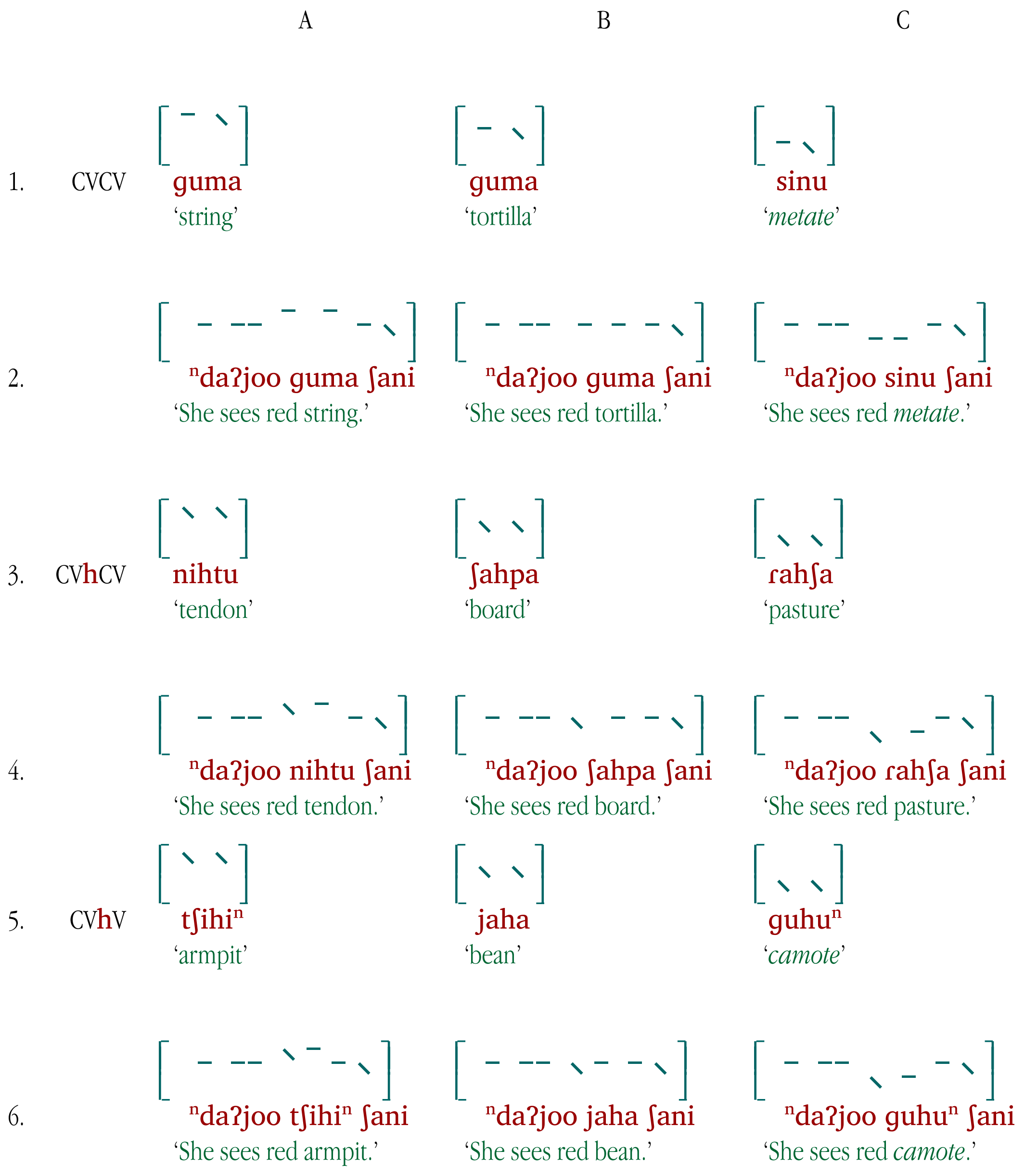
[3] One set of possible instructions for using these data is given in §28.8.

Simple forms compared with certain Possessed forms:

		A	B	C	D	E	F	G	H	I
		‘string’	‘tortilla’	‘*metate*’	‘sandal’	‘hill’	‘coal’	‘needle’	‘*chayote*’	‘a bird’
										
5.		guma	guma	sinu	tʃada	kuba	ɾuta	isu	ɾubu	ɾusi
										
6.	3.sg	gumuu	gumuu	sinuu	tʃadoo	koboo	ɾutoo	isuu	ɾubuu	ɾusjuu
										
7.	3.pl	gumuu^n	gumuu^n	sinuu^n	tʃaduu^n	kubuu^n	ɾutuu^n	isuu^n	ɾubuu^n	ɾusjuu^n

G.1.5 *Tone in the Acatepec variety (narrow transcription).* ISO 639-3 [tpx]. Cline (2013). These data are in an impressionistic transcription that is more narrow than that in appendix §1.4. [The use of the raised final n to indicate nasalization of the morpheme is not part of the IPA tradition, but is continued here for the sake of convenience.] The "free" translations only approximate the possible intended meanings; the nouns could be singular or plural, and they could be indefinite or definite.



		A	B	C
1.	CVCV	guma 'string'	guma 'tortilla'	sinu '*metate*'
2.		ⁿdaʔjoo guma ʃani 'She sees red string.'	ⁿdaʔjoo guma ʃani 'She sees red tortilla.'	ⁿdaʔjoo sinu ʃani 'She sees red *metate*.'
3.	CV**h**CV	nihtu 'tendon'	ʃahpa 'board'	ɾahʃa 'pasture'
4.		ⁿdaʔjoo nihtu ʃani 'She sees red tendon.'	ⁿdaʔjoo ʃahpa ʃani 'She sees red board.'	ⁿdaʔjoo ɾahʃa ʃani 'She sees red pasture.'
5.	CV**h**V	tʃihiⁿ 'armpit'	jaha 'bean'	guhuⁿ '*camote*'
6.		ⁿdaʔjoo tʃihiⁿ ʃani 'She sees red armpit.'	ⁿdaʔjoo jaha ʃani 'She sees red bean.'	ⁿdaʔjoo guhuⁿ ʃani 'She sees red *camote*.'

G.2 Data from the Tequistlatecan genus

The Tequistlatecan genus (Mexico) comprises three varieties that are most commonly known by the name Oaxaca Chontal.

G.2.1 *Highland Oaxaca Chontal.* ISO 639-3 code [chd]. Source: P. Turner & S. Turner (1971) and P. Turner (1967). Broad transcription.

G.2.1.1 *Part 1.* The following examples are typical examples of one syllable words in this language.[4, 5]

		English	Spanish
1.	be	‘where?’	‘dónde’
2.	tʃa	‘Let’s go! (interjection)’	‘Vamos! (interjección)’
3.	da	‘almost’	‘casi’
4.	de	‘what?’	‘qué’
5.	do	‘such as’	‘como, por ejemplo’
6.	ma	‘very’	‘muy’
7.	neʔ	‘okay (interjection)’	‘bien (interjección)’
8.	ʃom	‘sort of’	‘más o menos’

G.2.1.2 *Part 2.*

		English	Spanish
1.	ˈlane	‘the road’	‘el camino’
2.	galˈbame	‘the sweet potato’	‘el camote’
3.	ˈlabof	‘the arrow’	‘la flecha’
4.	galˈdiliʃ	‘the jaguar’	‘el jaguar’
5.	ˈɬisna	‘the drunkard’	‘el borracho’
6.	galˈdiʃmu	‘the shrimp’	‘el camarón’
7.	ˈgalmoɬ	‘the ram’	‘el carnero’
8.	galˈwoʃmiʔ	‘the moth (type)’	‘la polilla (tipo)’
9.	ˈgalʃpu	‘the bean (type)’	‘el frijo (tipo)’
10.	ˈʔonɬka	‘half’	‘la mitad’
11.	galˈlehŋga	‘the steep slope’	‘la escarpa’
12.	ˈʃpat͡s’waj	‘barefoot’	‘a descalzo’
13.	ˈʃpehŋga	‘flat and wide’	‘chato’
14.	ɬiˈnajspo	‘the scorpion’	‘el alacrán’

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[4] One set of possible instructions for using these data is given in §10.2.1.

[5] Full disclosure: We did also find the word ɬuk’ ‘smooth’ (‘liso’).

15.	ˈwansk’aj	‘a mixed group’	‘un grupo mezclado’
16.	ˈgalʃtuguˈt͡siʔ	‘an agave fruit’	‘el piñuelo’
17.	*...CCCC...		
18.	*...CC		
19.	*CCC...		

You should consider 12 as containing an ejective affricate t͡s’.

As shown in 17, no words have four consonants together. As shown in 18, no words end in two consonants. As shown in 19, no word begins with three consonants.[6]

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[6] Set of possible instructions for using these data are given in §6.10 and §17.9.

G.2.1.3 *Part 3.*

		Gloss
1.	domehˈk’ajk’ʔma	‘you will push against it!’
2.	ʔalʃkwaˈhi	‘the cooking plate (comal)’
3.	galˈʃk’wiɬ	‘the biting gnat’
4.	ʔajmigwajsˈba	‘he does not arrive’
5.	ʔuˈmehk’ajk’	‘he pushed against it’
6.	ʔiʃkwahˈmaʔ	‘it is empty’

G.2.2 *Lowland Oaxaca Chontal.* ISO 639-3: [clo]. Also known as Huamelulteco (see Waterhouse 1962:118, fn. 1). Source of data: Pike (1947:102, 153) (data originally obtained by May Morrison) and Waterhouse et al. (1992). References to third person have been expanded from 'he' to 'she', and from 'his' to 'hisher'. Impressionistic transcription. (Stress has been marked where information was available.) The description in Morrison & Waterhouse (1950:36) indicates the symbol **[ɬ]** in these data represents a sound that is frictionless, in which case the appropriate representation is **[l̥]**. [7]

		English	Spanish			English	Spanish
1.	**ˈmojɣiʔ**	'tomorrow'	'mañana'	2.	**paɣuj**	'she washes'	'ella lava'
3.	**ˈtoɣuj**	'I grow'	'crezco'	4.	**ˈgoʔ**	'heron'	'garza'
5.	**kanaˈɣa**	'bed'	'cama'	6.	**ikaɬˈʔa**	'rubber'	'goma'
7.	**liˈβiða**	'hisher grandparent'	'su abueloa'	8.	**aˈpandoʔ**	'lame'	'cojo'
9.	**ˈbiða**	'grandparent'	'abueloa'	10.	**naʔˈwa**	'tarantula'	'tarántula'
11.	**ˈfuŋguj**	'she grows fat'	'se pone gordao'	12.	**faðajʔ**	'they sow'	'siembran'
13.	**waðuj**	'she carries'	'lleva'	14.	**paŋguj**	'she lives'	'vive'
15.	**ɛntɛˈða**	'liver'	'hígado'	16.	**mbaˈmaʔ**	'ten'	'diez'
17.	**kanduj**	'she leaves'	'sale'	18.	**aˈwaːta**	'girl'	'muchacha'
19.	**toɣa**	'thick'	'grueso'	20.	**ˈtɛpʃa**	'I bit'	'mordí'
21.	**liʃjaˈne**	'incline in road'	'subida en el camino'				

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[7] One set of possible instructions for using these data is given in §17.9.

G.3 Galician

ISO 639-3: [glg], Romance genus, Spain. Narrow transcription. Source: Regueira (1999:82-85).[8]

		English	Spanish
1.	ˈθin̪θa	‘ash’	‘ceniza’
2.	ˈs̺is̺o	‘good sense’	‘seso’
3.	ˈs̺ol	‘sun’	‘sol’
4.	ˈmajs̺	‘more’	‘más’
5.	faˈθeɾɟe	‘to make him’	‘hacerle’
6.	ˈfoɾθa	‘force’	‘fuerza’
7.	ˈan̪t̪es̺	‘before’	‘antes’
8.	beˈθiɲo	‘neighbor’	‘vecino’
9.	ˈd̪eθ	‘ten’	‘diez’
10.	ˈd̪eθ̬ ˈmes̺es̺ ∼ ˈd̪eð ˈmes̺es̺ ∼ ˈd̪eθ ˈmes̺es̺	‘ten months’	‘diez meses’
11.	ˈt̪ɾes̺̬ ˈmes̺es̺ ∼ ˈt̪ɾez̺ ˈmes̺es̺ ∼ ˈt̪ɾes̺ ˈmes̺es̺	‘three months’	‘tres meses’
12.	ˈt̪ɾes̺ ˈaɟos	‘three garlics’	‘tres ajos’

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[8] One set of possible instructions for using these data is given in §14.2.1.

G.4 Brazilian Portuguese sibilants

Narrow transcription.

G.4.1 *Part 1.* Many of the following facts are certainly true for all varieties of Portuguese, but since some facts may vary between different varieties, we identify the data as being from a northern Brazilian Portuguese dialect. The data are in a somewhat narrow transcription. Some vowel allophones have not been shown.[9]

Word-initial	1.	[ˈsapu]	‘toad’	2.	[ˈzebɾa]	‘zebra’
	3.	[ˈsaku]	‘sack’	4.	[zũmˈbidu]	‘buzzing noise’
	5.	[ˈsuwku]	‘furrow’	6.	[ˈzãŋga]	‘anger’
Word-medial	7.	[ˈkasa]	‘hunt’ (n.)	8.	[ˈkaza]	‘house’
	9.	[ˈpasa]	‘raisin’	10.	[ˈpozi]	‘pose’ (n.)
	11.	[ˈposu]	‘well’ (n.)			

G.4.2 *Part 2.* We look at words in context in this exercise. Note the pronunciation of the words in three contexts below: in isolation, preceding a voiceless consonant, and preceding a voiced consonant or a vowel. (These data are all written in a moderately narrow transcription; some irrelevant phonetic details are omitted, especially regarding the quality of unstressed vowels.)[10]

	Isolation	Before voiceless	Before voiced
1.	ˈpas	ˈpas pehˈfejta *peace perfect*	ˈpaz ĩmpehˈfejta *peace imperfect*
2.	ˈkuskus	ˈkuskus kuˈzidu *couscous cooked*	ˈkuskuz ˈbɾãŋku *couscous white*
3.	ˈkuskus		ˈkuskuz ãmãˈɾelu *couscous yellow*
4.	ˈkazas	ˈkazas peˈkẽnãs *houses little*	ˈkazaz ˈboas *houses good*
5.	as .... (as in hesitation)	as ˈkazas *the houses*	az ˈgahas *the claws*
6.		as ˈpatas *the paws*	az baˈias *the bays*
7.		as ˈtasas *the cups*	az ˈdãmãs *the women*
8.			az ˈlĩŋgwas *the tongues*

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[9] One set of possible instructions for using these data is given in §14.14. © 2012, Norval Da Silva & Stephen Marlett.

[10] One set of possible instructions for using these data is given in §14.14. © 2012, Norval Da Silva & Stephen Marlett.

9.		az ˈɦuas *the streets*
10.		az ˈmãos *the hands*
11.	a saˈkolas *the bags*	a ˈzebɾas *the zebras*
12.	ũmã saˈkola *a bag*	
13.	a ʃavis *the keys*	
14.	ũmã ˈʃavi *a key*	

Some with mixed environments:

15.	as ˈtɾes ˈkãmãs *the three beds*	as ˈtɾez ˈgahas *the three claws*
16.	az ˈdes ˈkãmãs *the ten beds*	az ˈdez ˈgahas *the ten claws*

There are no words that are pronounced in isolation with final [z]. Thus, while [ˈkazas] ‘houses’ and [ˈpas] ‘peace’ are fine, there are no words like *[ˈkazaz] and *[ˈpaz] (as pronounced in isolation). Furthermore, there are no words with a sibilant in the coda that does not agree with the voicing of the following consonant. Thus [ˈdezdi] ‘since’, [ˈkasta] ‘caste’ and [ˈmezmu] ‘same’ are found, but there are no words like *[ˈkazpa] or *[ˈmasma].

G.5 Seri

ISO 639-3 [sei], Seri genus, Mexico. Sources: Marlett (1981), Marlett (2006), Marlett (2008a), and M. Moser & Marlett (2010).

G.5.1 *Seri definite article for horizontal position.* Narrow transcription.[11]

The singular definite article for items that are in a horizontal position has various allomorphs when it is written phonetically. (The language uses other articles for compact (sitting) position, erect (standing) position, flexible items (like cloth), and those in motion. See Marlett & M. Moser 1994 and M. Moser & Marlett 2010.)

Part 1:

1.	**ˈʔaχʃ koŋ ˈkiːm iʔa**	‘The dog is sleeping.’
2.	**ˈʔaχʃ kon ˈtiːm**	‘Was the dog sleeping?’
3.	**ˈʔaχʃ koɴ ˈχiːm**	‘The dog is sleeping!’
4.	**ˈʔaχʃ kom ˈpiːm ta ...**	‘When the dog is sleeping, ...’
5.	**ˈʔaχʃ kom anχʷ ˈsiːm kaʔa**	‘The dog will sleep a lot.’

Part 2:

1.	**, ... ˈʔaχʃ koŋ ‖**	‘, ... the dog.’ (one alternate pronunciation in phrase-final position for some speakers)
2.	**, ... ˈʔaχʃ kom ‖**	‘, ... the dog.’ (a pronunciation in phrase-final position that all speakers may use)

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[11] Possible instructions for using these data are given in §17.3.2 and §22.1.6.

G.5.2 *Seri nasals.* The data are presented in a fairly narrow transcription, but not all phonetic details have been included. The symbol [w̃] represents a nasalized labial-velar approximant.[12]

A. Word-initial position

1.	ˈmaːs	‘palo verde tree’	2.	ˈnaːpχa	‘turkey vulture’
3.	ˈmas	‘*Olivella dama* snail’	4.	ˈnaxk	‘crested caracara’
5.	ˈmɛ	‘you (pronoun)’	6.	ˈnop	‘bobcat’
7.	ˈmiːʃx	‘well, carefully’	8.	ˈnoːsi	‘mourning dove’
9.	ˈmokni	‘guayacán (tree)’	10.	ˈnoːχɛn	‘Cooper’s hawk’
11.	moˈxɛpɛ	‘sahuaro (cactus)’	12.	No words begin with [ŋ ɲ ɴ w̃].	

B. Intervocalic position

13.	ˈaːmo	‘far’	14.	ˈano	‘in (it)’
15.	aˈkoːmɛ	‘his younger sister’	16.	ˈsɛnɛ	‘kindling’
17.	ˈamaʃ	‘hisher father’s mother’	18.	ˈina	‘its fur, its feather’
19.	ˈʃamix	‘palm tree’	20.	ˈʔoːinax	‘dune’
21.	ˈʃɛmɛ	‘sunset’	22.	[ŋ ɲ ɴ w̃] do not appear between vowels.	

C. In the coda of a stressed syllable and before a consonant

23.	ˈamta	‘their (f.) parents’	24.	ˈkaːnx	‘Gulf grouper’
25.	iˈʔaːmn	‘to toast corn (inf.)’	26.	iˈkaːnpχ	‘to return home (inf.)’
27.	iʔaˈkoːmχ	‘to denounce (inf.)’	28.	ˈkankɬ	‘(what is) pitted, rusty’
29.	iˈtaːmt	‘hisher sandal(s)’	30.	ˈʔonk	‘sea gull’
31.	iˈkoːmɬk	‘to twist (mesquite rope to make twine) (inf.)’	32.	ˈankox	‘interiors’

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[12] One set of possible instructions for using these data is given in §22.8.

33.	ˈʔɛːmjox	‘needlefish fingerling’	34.	iʔikˈsɛːnpχ	‘to carry something big under the arm (inf.)’
35.	χoˈkomka	‘it is noisy!’			

36. [ŋ ɲ ɴ] are not found in stressed syllables in nouns and verbs except in the ˈktoːŋk ‘immature double-crested cormorant’. [ŋ] is found in the following demonstratives: ˈʔiŋkop ‘that one (standing)’, ˈʔiŋkix ‘that one (seated)’, ˈʔiŋkom ‘that one (lying down)’, and ˈʔiŋkak ‘there’.

D. In the coda of an unstressed syllable and before a consonant

37.	koŋˈkaiː	‘old woman’	38.	imˈpos	‘six-weeks threeawn (a plant)’
39.	koŋˈkaːk	‘Seri people’	40.	inˈʃɛt	‘hisher heel’
41.	ʔaŋˈkaːχat	‘smoke’	42.	anˈjaːk	‘his older brother’
43.	ʔaŋˈkiːɸɛ	‘small burning coal’	44.	kanˈtaχaɬim	‘who gets angry easily’
45.	χoɴˈχɛʃiʃ	‘ocotillo’			
46.	poˈmaɸp	‘if she doesn’t arrive’	cf.	ˈtaɸp	‘as she was arriving’
				ˈtpanʃχ	‘as she ran’
47.	pomˈpanʃχ	‘if she doesn’t run’	cf.	poˈpanʃχ	‘if she runs’
				ˈttoːxox	‘as they grow together’
48.	ponˈtoːxox	‘if they don’t grow together’	cf.	poˈtoːxox	‘if they grow together’
				ˈtʃimpχa	‘since it was rotten’
49.	poɲ ˈʃimpχa	‘if it isn’t rotten’	cf.	poˈʃimpχa	‘if it is rotten’
				ˈtkapχɬ	‘since it was sour’
50.	poŋˈkapχɬ	‘if it is not sour’	cf.	poˈkapχɬ	‘if it is sour’
	ˈsiːʃkamaʔa	‘they will arrive’		ˈsiːʃkampoʔo	‘maybe they will arrive’
51.	ˈsiːʃkaŋkaʔa[13]	‘they will arrive’	cf.	ˈsiːʃkanta	‘they were going to arrive’

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[13] These are two ways of expression a future idea. They are different in important ways, including the kind of enclitic morphemes than can follow the basic verb, as shown here. The same is true for the next verb, of course.

	ˈsiːskanaʔa	‘it will be hard’		ˈsiːskanpoʔo	‘maybe it will be hard’
52.	ˈsiːskankaʔa	‘it will be hard’	cf.	ˈsiːskanta	‘it was going to be hard’

53. The morphemes that end in **n** do not show alternations with other nasals, while those that end in **m** do show such alternations. When there is alternation, the nasals in this position are homorganic with the consonant that follows, except in some special cases which include compound words that we presume have secondary stress, such as **ˌktomˈɬiːspox** ‘a species of rooster fish’ (compare with **ˈktoːmɬ** ‘a species of rooster fish)’, and **iˌʔamsiˈsiːn** ‘to pity, love (inf.)’.

E. In phrase-final position in the coda of a stressed syllable

54.	ˈam	‘her father’	55.	ˈan	‘its interior’
56.	atkw̃ãˈxɛːm	‘her younger sister’s husband’	57.	ˈkaːn	‘(what is) slightly curved on vertical surface’
58.	iˈʔaːm	‘to exude (inf.)’	59.	ikaˈkon	‘to stink (inf.)’
60.	iˈkaːom	‘to ask for a gift (inf.)’	61.	ikapˈnin	‘to be blindfolded (inf.)’
62.	iʔaˈkam	‘to let live (inf.)’			
63.	iˈkiːm	‘to sleep (inf.)’			

64. **[ɲ, ŋ ɴ w̃]** do not appear in stressed syllables at the end of a phrase.

F. In phrase-final position in the coda of an unstressed syllable

65.	ˈakχaŋ ~ ˈakχam	‘canvasbacks (ducks)’	66.	ˈkaːiskan (no alternation)	‘(what is) hard’
67.	ikaˈkoʃiŋ ~ ikaˈkoʃim	‘to be hot weather (inf.)’	68.	ˈknopin (no alternation)	‘(what is) convex’
69.	iˈkasiŋ ~ iˈkasim	‘to laugh (inf.)’	70.	ˈʔɛsɛn (no alternation)	‘dry ironwood’
71.	ˈʔɛpɛŋ ~ ʔɛpɛm	‘white-tailed deer’	72.	ˈmoːχon (no alternation)	‘scorpionfish’

73. **[ɲ, ɴ w̃]** do not appear in stressed syllables at the end of a phrase.

G. After a consonant in the onset of a stressed syllable

74.	ˈkw̃ĩːkɛ	‘Seri person’	75.	ˈpnaːkox	‘mangrove’
76.	ˈkw̃ãːm	‘woman’			
77.	ˈkw̃ãːχ	‘now’			
				poˈmam	‘if it will be ripe’
78.	ˈkw̃ãm	‘(what is) ripe, cooked’	cf.	ˈsmam	‘it will be ripe’
				poˈmɛkɛ	‘if it will be warm’
79.	ˈkw̃ɛ̃kɛ	‘(what is) warm’	cf.	ˈsmɛkɛ	‘it will be warm’
				poˈmasoɬ	‘if it will be yellow’
80.	ˈkw̃ãsoɬ	‘(what is) yellow’	cf.	ˈtmasoɬ	‘when it was yellow’
				poˈnoːsk	‘if it will be rough’
81.	ˈknoːsk	‘(what is) rough’	cf.	ˈtnoːsk	‘when it was rough’
				poˈnoːʔkʷ	‘if it will be concave’
82.	ˈknoːʔkʷ	‘(what is) concave’	cf.	ˈsnoːʔkʷ	‘it will be concave’

83. [w̃] is found only after a tautosyllabic k or kʷ (the latter is not illustrated in these data), while [m] is never found there in the speech of present-day Seris. The nasalized vowels appear only after this nasalized approximant.

G.5.3 *Seri irrealis forms.* The data are presented in a fairly narrow transcription but not all of the phonetic details have been included. In the case of the parenthesized sounds, it is just not clear whether one can really hear them.[14]

The data continue on a second page.

	(all in third person subject)	Irrealis (finite) - speaker A	Irrealis (finite) - speaker B	Irrealis (finite, + 'perhaps') (all speakers)	Irrealis (nominalized) (all speakers)
1.	‘run’	ˈspanʃχ aʔa	ˈspanʃχ aʔa	ˈspanʃχ poʔo	ˈspanʃχ kaʔa
2.	‘eat it’	iˈsiiʔit aʔa	iˈsiiʔit aʔa	iˈsiiʔit poʔo	ˈsiiʔit kaʔa
3.	‘eat (unspec. object, repet.)’	ˈsooʔitim aʔa	ˈsooʔitim aʔa	ˈsooʔitim poʔo	ˈsooʔitiŋ kaʔa
4.	‘see ithimher’	iˈsiiʔo ʔa	iˈsiiʔo aʔa	iˈsiiʔo poʔo	ˈsiiʔo kaʔa
5.	‘arrive’	ˈsiiɸp aʔa	ˈsiiɸp aʔa	ˈsiiɸp (p)oʔo	ˈsiiɸp kaʔa
6.	‘kill ithimher’	iˈsiikʷ aʔa	iˈsiikʷ aʔa	iˈsiikʷ kʷoʔo ~ poʔo	ˈsiikʷ kʷaʔa
7.	‘die (animal)’	ˈsoχi ʔa	ˈsoχi aʔa	ˈsoχi poʔo	ˈsoχi kaʔa
8.	‘sit down’	ʔant ˈsiix aʔa	ʔant ˈsiix aʔa	ʔant ˈsiix poʔo	ʔant ˈsiix kaʔa
9.	‘sneeze’	siˈɸoʔʃχ aʔa	siˈɸoʔʃχ aʔa	siˈɸoʔʃχ poʔo	siˈɸoʔʃχ kaʔa
10.	‘be depleted’	ˈsiimɛ ʔa	ˈsiimɛ aʔa	ˈsiimɛ poʔo	ˈsiimɛ kaʔa
11.	‘sing’	ˈsoos aʔa	ˈsoos aʔa	ˈsoos poʔo	ˈsoos kaʔa
12.	‘drink it’	iˈsiisi ʔa	iˈsiisi aʔa	iˈsiisi poʔo	ˈsiisi kaʔa
13.	‘say’	ˈtɛɛsɛ ʔa	ˈtɛɛsɛ aʔa	ˈtɛɛsɛ poʔo	ˈtɛɛsɛ kaʔa
14.	‘look for it’	iˈskaa ʔa	iˈskaa (a)ʔa	iˈskaa poʔo	ˈskaa kaʔa
15.	‘hear it’	iˈsii ʔa	iˈsii aʔa	iˈsii poʔo	ˈsii kaʔa
16.	‘feel it’	iˈssii ʔa	iˈssii aʔa	iˈssii poʔo	ˈssii kaʔa

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[14] One set of possible instructions for using these data is given in §19.6.

17.	‘go toward it (place)’	iˈsjaai ʔa	iˈsjaai aʔa	iˈsjaai poʔo	ˈsjaai kaʔa
18.	‘dig it up’	iˈsχap aʔa	iˈsχap aʔa	iˈsχap (p)oʔo	ˈsχap kaʔa
19.	‘pass by it (place)’	iˈsaao ʔa	iˈsaao aʔa	iˈsaao poʔo	ˈsaao kaʔa

G.5.4 *Seri labial fricatives.* The data are presented in a fairly narrow transcription, but not all phonetic details have been shown.[15]

	Speaker A	Speaker B	English
1.	ˈkaɸʃχ	ˈkafʃχ	‘what is lightweight’
2.	ˈkɸain	ˈkfain	‘who ties it’
3.	ˈi:ɸ	ˈi:f	‘hisherits nose’
4.	iʔaˈɸiʃ	iʔaˈfiʃ	‘knot’
5.	ˈiɸɬk	ˈifɬk	‘hisher knee’
6.	ˈko:ɸ	ˈko:f	‘who hisses’
7.	ˈɸɛ:ɬ	ˈfɛ:ɬ	‘mallard (*Anas platyrhynchos*)’
8.	ˈi:ɸa	ˈi:fa	‘peninsula’
9.	ˈkoɸtx	ˈkoftx	‘western coral snake (*Micruroides euryxanthus*)’
10.	ˈkoɸ	ˈkof	‘San Juanico (tree, *Jacquinia macrocarpa* subsp. *pungens*)’

G.5.5 *Seri phrases.* The data are presented in a fairly narrow transcription but not all of the phonetic details have been included.[16]

	Words in isolation	English		Words in phrases	English
1.	kipkʷ	‘thick; dune’			
2.	ko:spox	‘spotted’	3.	kipkʷ kʷo:spox	‘Spotted Dune (place name)’
4.	anχʷ	‘much’			
5.	ka:spox	‘one who writes’	6.	anχʷ kʷa:spox	‘one who writes a lot’
7.	ta:spox	‘did she write?’	8.	anχʷ ta:spox	‘did she write a lot?’
9.	ja:spox	‘she wrote’	10.	anχʷ ja:spox	‘she wrote a lot’
11.	pa:spox	‘she will write’	12.	anχʷ pa:spox	‘she will write a lot’
13.	χa:spox	‘she writes!’	14.	anχʷ χʷa:spox	‘she writes a lot’

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[15] One set of possible instructions for using these data is given in §18.6.

[16] One set of possible instructions for using these data is given in §19.2.1.

G.5.6 *Seri length.* The data are presented in a quite narrow transcription. The half-length symbol after a consonant is used here to indicate a stronger articulation that may or may not be perceived as length. The full-length symbol after a consonant or vowel represents a greater duration of that segment.[17]

		English	Spanish
1.	ˈinːoːɬ	‘hisher finger’	‘su dedo’
2.	ˈinˑɬ	‘hisher fingers’	‘sus dedos’
3.	iˈtːaːmˑ	‘did she harvest it (eelgrass)?’	‘¿lo cosechó (trigo de mar)?’
4.	ˈktaːmˑ	‘who harvests it (eelgrass)’	‘quien lo cosecha (trigo de mar)’
5.	ˈktaːmː iʔa	‘she is harvesting it (eelgrass)’	‘lo está cosechando (trigo de mar)’
6.	ˈʔopːaːtx	‘wave’	‘ola’
7.	ˈtakːaːt	‘is it bitter?’	‘¿esestá agrio?’
8.	ˈkakːaːt	‘bitter, what is bitter’	‘agrio, lo que esestá agrio’
9.	ˈtkamˑ	‘is it alive?’	‘está vivo?’
10.	ˈkːamˑ	‘alive, that which is alive’	‘vivo, lo que está vivo’
11.	ˈkoːpːoːɬ	‘black, that which is black’	‘negro, lo que es negro’
12.	ˈtoːpːoːɬ	‘is it black?’	‘¿es negro?’
13.	ˈmonˑtax	‘shrimp’	‘camarón’
14.	ˈsapˑtim	‘a kind of large basket’	‘un tipo de canasta’
15.	ˈjaʔˑxix	‘hisher trachea’	‘su tráquea’
16.	ˈiːsˑx	‘its operculum’	‘su opérculo’
17.	ˈisˑtx	‘its leaf’	‘su hoja’
18.	ˈkosˑ	‘a shrub (*Maytenus phyllanthoides*)’	‘mangle dulce’
19.	ˈkosː iʔa	‘it is *Maytenus phyllanthoides*’	‘es mangle dulce’
20.	ˈktamˑ	‘man’	‘hombre’
21.	ˈktamː iʔa	‘it is a man’	‘es un hombre’
22.	ˈtaːnˑpχ	‘did she run?’	‘¿corrió?’
23.	iˈmaːnˑpχ iʔa	‘she didn’t run’	‘no corrió’
24.	ˈkaːnˑpχ	‘who runs’	‘quien corre’
25.	ˈtaɸˑp	‘did she arrive?’	‘¿llegó?’
26.	iˈmaɸˑp iʔa	‘she didn’t arrive’	‘no llegó’
27.	ˈtoːsˑ	‘is she singing? did she sing?’	‘¿canta? ¿cantó?’
28.	iˈmoːsː iʔa	‘she didn’t sing’	‘no cantó’
29.	ˈkoːsˑ	‘who sings’	‘quien canta’
30.	ˈkoːsː iʔa	‘she is singing’	‘está cantando’

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[17] One set of possible instructions for using these data is given in §21.12.

31.	ˈtmamˑ	‘is it ripecooked?’	‘¿está madurococido?’
32.	iˈmːamː iʔa	‘it is not ripecooked’	‘no está madurococido’
33.	ˈtːoːʃːiː	‘is it tough?’	‘¿es resistente?’
34.	inˈtoːʃːiː ʔa	‘it is not tough’	‘no es resistente’
35.	ˈktoːʃːiː	‘tough, what is tough’	‘resistente, lo que es resistente’
36.	ˈtpasːiː	‘is it wrinkled?’	‘¿está arrugado?’
37.	imˈpasːiː ʔa	‘it is not wrinkled’	‘no está arrugado’
38.	ˈtkamˑ	‘is it full?’	‘¿está lleno?’
39.	iŋˈkamː iʔa	‘it is not full’	‘no está lleno’
40.	ˈkːamˑ	‘full, what is full’	‘lleno, lo que está lleno’
41.	ˈkːamː iʔa	‘it is full’	‘está lleno’

G.5.7 *Seri stress. Broad* transcription. These data are appropriate for the analysis of syllable structure and stress.

		English	Spanish			English	Spanish
1.	takaˈʃaka	‘inchworm’	‘geómetra’	2.	saˈpatχ	‘sweetbush’	‘*Bebbia juncea* (arbusto)’
3.	kaskaˈmama	‘a stinkbug’	‘un chinche’	4.	moˈxεptχ^{w}	‘curve-bill thrasher’	‘cuitlacoche pico curvo’
5.	koʃiˈʔaːmax	‘a small insect’	‘un pequeño insecto’	6.	ʔaˈmisx	‘ashy limberbush’	‘sangrengrado’
7.	koˈnixox	‘Craveri’s murrelet’	‘mérgulo de Craveri’	8.	ʔanʃaˈxipx	‘plate’	‘plato’
9.	χpaˈsipip	‘dragonfly’	‘libélula’	10.	ʔasaʔˈkapx^{w}	‘sinita (cactus)’	‘sinita (cacto)’
11.	χomˈχεːʃiʃ	‘ocotillo (bush)’	‘ocotillo’	12.	koˈnamx	‘a large grasshopper’	‘un chapulín grande’
13.	ʔaˈmiːmε	‘sky’	‘cielo’	14.	komˈkaːk	‘Seri persons’	‘personas seris’
15.	moˈχima	‘yesterday’	‘ayer’	16.	paˈxiː	‘obsidian’	‘obsidiana’
17.	ˈkama	‘big skate’	‘una raya’	18.	maˈχaː	‘sand snake’	‘culebrita arenera’
19.	ˈʔεʔε	‘plant’	‘planta’	20.	χomkaˈʔiːɸt	‘oregano’	‘orégano’
21.	ˈsεːtεn	‘pen shell’	‘callo de hacha’	22.	χomkaˈʔai	‘a small flounder’	‘un lenguado pequeño’
23.	ˈpaːʃa	‘Gila monster’	‘escorpión pintada’	24.	ˈʔap	‘mule deer’	‘venado bura’
25.	ˈkosi	‘thorn’	‘espina’	26.	ˈʃaːʔ	‘sun’	‘sol’
27.	ˈʔapax	‘octopus’	‘pulpo’	28.	ˈʔaːp	‘wild tepary (bean)’	‘tépari del monte’
29.	ˈmoxεt	‘bighorn sheep’	‘borrego cimarrón’	30.	ˈstakx	‘a rock oyster’	‘un ostión’
31.	ˈkototax	‘boojum tree’	‘cirio’	32.	ˈkoːsot	‘narrow’	‘angosto’
33.	ˈkaːmopχa	‘a sphinx moth’	‘polilla esfinge’	34.	ˈkoːsotox	‘narrow (Plural)’	‘angosto (Plural)’
35.	kaˈtapora	‘robber fly’	‘mosca cazadora’	36.	kaskaˈmama	‘stinkbug’	‘chinche’
				37.	kaskaˈmamatax	‘stinkbugs’	‘chinches’
				38.	koˈmitin	‘ironwood tree’	‘palo fierro (árbol)’

				39.	koˈmitixa	‘ironwood trees’	‘palos fierro’
				40.	ˈkops	‘lightning bug’	‘luciérnaga’
				41.	ˈkopasox	‘lightning bugs’	‘luciérnagas’
				42.	koˈjoko	‘white-winged dove’	‘paloma ala blanca’
				43.	koˈjokoɬk	‘white-winged doves’	‘palomas ala blanca’
				44.	koˈʃiːχox	‘western banded gecko’	‘un geco (especie)’
				45.	koˈʃiːχoɬkox	‘western banded geckos’	‘gecos’
46.	iˈtaʔo	‘she saw himherit...’	‘lola vio...’	47.	ˈpamtx	‘mule deer tendon’	‘tendón del venado bura’
48.	maʔjoˈmaʔo	‘I didn’t see you’	‘no te vi’	49.	ˈpamtaɬka	‘mule deer tendons’	‘tendones del venado bura’
50.	ʔajoˈmaʔt	‘we didn’t see himherit’	‘no lola vimos’	51.	ˈpɛːn	‘carrying pole’	‘palanca’
				52.	ˈpɛːnɛkoɬ	‘carrying poles’	‘palancas’

G.5.8 *Seri verb paradigm (partial).* These data are in broad transcription in most respects. The place of articulation of the nasals is in narrow transcription, however.

Intransitive verbs; a few representative conjugated forms with third person singular subject. The data continue on the following page.

	A Dependent Irrealis	B Negative Dependent Irrealis	C Y-Realis	D Emphatic Realis	E Independent Irrealis	F Negative Independent Irrealis	G M-Realis	H Dependent Realis	I Negative Dependent Realis	Gloss
1.	ˈpoːp	poˈmap	ˈjoːp	ˈχoːp	ˈsiːp	ˈsmap	ˈmiːp	ˈtap	ˈtmap	‘stand’
2.	ˈpaːs	poˈmaːs	ˈjaːs	ˈχaːs	ˈsaːs	ˈsmaːs	ˈmaːs	ˈtaːs	ˈtmaːs	‘deflate’
3.	ˈpoːmɛ	poˈmɛmɛ	ˈjoːmɛ	ˈχoːmɛ	ˈsiːmɛ	ˈsmɛmɛ	ˈmiːmɛ	ˈtɛmɛ	ˈtmɛmɛ	‘be depleted’
4.	ˈpɛːmn	poˈmɛːmn	ˈjɛːmn	ˈχɛːmn	ˈsɛːmn	ˈsmɛːmn	ˈmɛːmn	ˈtɛːmn	ˈtmɛːmn	‘curve downwards’
5.	ˈpis	poˈmis	ˈjis	ˈχis	ˈsis	ˈsmis	ˈmis	ˈtis	ˈtmis	‘be raw’
6.	ˈpiːx	poˈmiːx	ˈjiːx	ˈχiːx	ˈsiːx	ˈsmiːx	ˈmiːx	ˈtiːx	ˈtmiːx	‘sit’
7.	ˈpatx	poˈmotx	ˈjatx	ˈχʷatx	ˈsotx	ˈsmotx	ˈmotx	ˈtotx	ˈtmotx	‘arise’
8.	ˈpas	poˈmoːs	ˈjas	ˈχʷas	ˈsoːs	ˈsmoːs	ˈmoːs	ˈtoːs	ˈtmoːs	‘sing’
9.	poˈpanʃχ	pomˈpanʃχ	joˈpanʃχ	χoˈpanʃχ	ˈspanʃχ	somˈpanʃχ	imˈpanʃχ	ˈtpanʃχ	tomˈpanʃχ	‘run’
10.	poˈtapxʷ	ponˈtapxʷ	joˈtapxʷ	χoˈtapxʷ	ˈstapxʷ	sonˈtapxʷ	inˈtapxʷ	ˈttapxʷ	tonˈtapxʷ	‘disintegrate’
11.	poˈkoxp	poŋˈkoxp	joˈkoxp	χoˈkoxp	ˈskoxp	soŋˈkoxp	iŋˈkoxp	ˈtkoxp	toŋˈkoxp	‘hop’

12.	poˈʔak	poʔˈmak	joˈʔak	χoˈʔak	ˈsʔak	soʔˈmak	iʔˈmak	ˈtʔak	toʔˈmak	‘be blind’
13.	poˈmam	pomˈmam	joˈmam	χoˈmam	ˈsmam	somˈmam	imˈmam	ˈtmam	tomˈmam	‘be ripe’
14.	poˈnopin	ponˈnopin	joˈnopin	χoˈnopin	ˈsnopin	sonˈnopin	inˈnopin	ˈtnopin	tonˈnopin	‘be bent, jagged’
15.	poˈɸit	pomˈɸit	joˈɸit	χoˈɸit	ˈsɸit	somˈɸit	imˈɸit	ˈtɸit	tomˈɸit	‘stand up’
16.	poˈsimta	ponˈsimta	joˈsimta	χoˈsimta	ˈssimta	sonˈsimta	inˈsimta	ˈtsimta	tonˈsimta	‘be itchy’
17.	poˈʃimpχa	poɲˈʃimpχa	joˈʃimpχa	χoˈʃimpχa	ˈʃʃimpχa	soɲˈʃimpχa	iɲˈʃimpχa	ˈtʃimpχa	toɲˈʃimpχa	‘be rotten’
18.	poˈxiʃi	poŋˈxiʃi	joˈxiʃi	χoˈxiʃi	ˈsxiʃi	soŋˈxiʃi	iŋˈxiʃi	ˈtxiʃi	toŋˈxiʃi	‘ache’
19.	poˈχana	poɴˈχana	joˈχana	χoˈχana	ˈsχana	soɴˈχana	iɴˈχana	ˈtχana	toɴˈχana	‘be insipid’
20.	poˈjaːi	poɲˈjaːi	joˈjaːi	χoˈjaːi	ˈsjaːi	soɲˈjaːi	iɲˈjaːi	ˈtjaːi	toɲˈjaːi	‘be expensive’
21.	poˈamx^{w}	pomˈmamx^{w}	joˈamx^{w}	χoˈamx^{w}	ˈssamx^{w}	somˈmamx^{w}	imˈmamx^{w}	ˈttamx^{w}	tomˈmamx^{w}	‘be shiny’

G.5.9 *Some Seri consonants.* Impressionistic transcripción (with some irrelevant details omitted).[18]

	(in isolation, as in a list)*	Typical gloss			Typical gloss
1.	ˈʔokʷ	‘wood’	2.	ˈʔokʷɪʔa	‘It is wood.’
3.	ˈɾo:kʷ	‘crazy’	4.	ˈɾo:kʷɪʔa	‘She is crazy.’
5.	ˈkʃokᵚ	‘what is cut to pieces’	6.	ˈkʃokɪʔa	‘She is cutting it into pieces.’
7.	inˈsokᵚ	‘black skipjack tuna’ *(Euthynnus lineatus)*	8.	inˈsokɪʔa	‘It is a black skipjack tuna.’
9.	maˈjo:kʷ	‘Yellow-crowned Night Heron’ *(Nyctanassa violacea)*	10.	maˈjo:kʷɪʔa	‘It is a Yellow-crowned Night Heron.’
11.	ˈkpokᵚ	‘what falls’	12.	ˈkpokɪʔa	‘It is falling.’
13.	ˈko:kʷ	‘what barks’	14.	ˈko:kʷɪʔa	‘It is barking.’
15.	ˈɾo:kʷχʷam	‘who are crazy’	16.	ˈɾo:kʷχʷamɪʔa	‘They are crazy.’
17.	ˈkʃokʷχam	‘who cut it to pieces’	18.	ˈkʃokʷχamɪʔa	‘They are cutting it to pieces.’
19.	ˈak	‘canvasback (duck)’ *(Aythya valisineria)*	20.	ˈakɪʔa	‘It is a canvasback.’
21.	ˈakχam	‘canvasbacks’	22.	ˈakχamɪʔa	‘They are canvasbacks.’

*The last velar consonant of each word in this column is pronounced with rounded lips, although not all to the same degree. Since there is no diacritic in the IPA to indicate the detail that we wish to indicate here, we use the symbol kʷ when there is fairly obvious rounding and the symbol kᵚ (completely ad hoc since it is not an IPA convention) when there is less pronounced rounding. (These consonants also tend to be slightly aspirated in utterance-final position, and the rounding of kʷ is also perceived in that situation)

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[18] A set of possible instructions to use these data are given at the beginning of chapter §19.

G.5.10 *Seri: some word alternations.*

	After any word that ends in a consonant, as in the context kmaːχ … 'now …'; also in utterance-initial position.[19]	After any word that ends in a vowel, as in the context ʔaptko … 'already …'.[20]	
1.	iʔˈjoːʔo	ʔˈjoːʔo	'I saw it/her/him'
2.	iɲˈjoːʔo	ɲˈjoːʔo	'you saw it/her/him'
3.	iˈjoːʔo	iˈjoːʔo	'she saw it/her/him'
4.	iʔˈsiːʔo	ʔˈsiːʔo	'I will see it/her/him'
5.	inˈsiːʔo	nˈsiːʔo	'you will see it/her/him'
6.	iˈsiːʔo	iˈsiːʔo	'she will see it/her/him'
7.	iʔjoˈɸiʃo	ʔjoˈɸiʃo	'I lifted it'
8.	iɲjoˈɸiʃo	ɲjoˈɸiʃo	'you lifted it'
9.	ijoˈɸiʃo	ijoˈɸiʃo	'she lifted it'
10.	iʔˈsɸiʃo	ʔˈsɸiʃo	'I will lift it'
11.	inˈsɸiʃo	nˈsɸiʃo	'you will lift it'
12.	iˈsɸiʃo	iˈsɸiʃo	'she will lift it'
13.	iˈtɸiʃo	iˈtɸiʃo	'she lifted it ...'
14.	iʔˈɸiʃo	ʔˈɸiʃo	'Lift it!'
15.	iʔˈχinx	ʔˈχinx	'I yell at it/her/him!'
16.	iɴˈχinx	ɴˈχinx	'you yell at it/her/him!'
17.	iˈχinx	iˈχinx	'she yells a it/her/him!'
18.	ˈʔinx	ˈʔinx	'Yell at it/her/him!'
19.	joˈpanʃχ	joˈpanʃχ	'sheit ran'
20.	ˈtpanʃχ	ˈtpanʃχ	'sheit ran ...'
21.	poˈpanʃχ	poˈpanʃχ	'sheit will run ...'
22.	ˈspanʃχ	ˈspanʃχ	'sheit will run'
23.	imˈpanʃχ	mˈpanʃχ	'sheit runsran'
24.	iʔˈpanʃχ	ʔˈpanʃχ	'Run!'

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[19] Instructions for using these data are given in §24.7.

[20] A consonant written before the stress mark is pronounced with the syllable that precedes it. That is, syllabification within an utterance takes into consideration both words. The data are presented in a broad transcription with the exception of the nasal consonants.

G.5.11 *Seri long consonants.* This exercise examines a few paradigms in order to contrast two particular forms (those in shaded cells) that sound almost identical, but which native speakers insist are not identical. E. Moser & M. Moser (1965:65) noted: "An unstressed vowel nucleus of two identical vowels occurs in phonemic contrast with an unstressed nucleus consisting of a single vowel: **ʔíttox** 'my eyes', **ʔíttox** 'our mothers'. While the difference in vowels has been confirmed, there may be more to this story (and certainly more to the analysis).

The data are written in narrow transcription.

Plural forms are often ambiguous as to whether the "base" (item) is plural or the possessor is plural. Sometimes a plural possessed noun with a plural possessor has a distinct form. Sometimes this does not make immediate sense with the gloss given (how many paternal grandmothers can one person have?) but kinship terms often have extended meanings (like for aunts, in this case).

Consider also these words before you begin: **ˈχtaːsːi** 'estuary', **ˈχtaːsːiːtox** 'estuaries', **moˈxɛpːɛ** 'sahuaro cactus', **moˈxɛptox** 'saguaro cactuses'. How do they form the plurals? (Note: the language has multiple ways in which plurals are formed.)

	'paternal grand-mother'	'paternal grandmothers'	'mother'	'mothers'	'younger sister (of female)'	'younger sisters (of female)'
Absolute	**ʔaˈpɛmːɛːʃ**		**ʔaˈpɛtːɛ**		**ʔaˈpɛtkaʃ**	
1s	**ˈʔimːaːʃ**	**ˈʔimːaːɬk**	**ˈʔitːa**		**ˈʔitkʃ**	**ˈʔitkaɬ**
2s	**ˈmamːaːʃ**	**ˈmamːaːɬk**	**ˈmatːa**		**ˈmatkʃ**	**ˈmatkaɬ**
3s	**ˈamːaːʃ**	**ˈamːaːɬk**	**ˈatːa**		**ˈatkʃ**	**ˈatkaɬ**
1p		**ˈʔimːaːɬkox**		**ˈʔitːox**		**ˈʔitkaɬkox**
2p		**ˈmamːaːɬkox**		**ˈmatːox**		**ˈmatkaɬkox**
3p		**ˈamːaːɬkox**		**ˈatːox**		**ˈatkaɬkox**

	'bone'	'bones'	'eye'	'eyes'	'fist'	'fists'
Absolute	**ˈʔatːaːk**		**ˈʔatːo**		**ʔajaˈnopx**	
1s	**ˈʔitːaːk**	**ˈʔitːaːxk**	**ˈʔitːo**	**ˈʔitːoːx**	**iʔjaˈnopx**	**iʔjaˈnopɬk**
2s	**ˈmitːaːk**	**ˈmitːaːxk**	**ˈmitːo**	**ˈmitːoːx**	**iɲjaˈnopx**	**iɲjaˈnopɬk**
3s	**ˈitːaːk**	**ˈitːaːxk**	**ˈitːo**	**ˈitːoːx**	**jaˈnopx**	**jaˈnopɬk**
1p		**ˈʔitːaːxox**		**ˈʔitːoːɬka**		**ʔajaˈnopːaːɬkox**
2p		**ˈmitːaːxox**		**ˈmitːoːɬka**		**majaˈnopːaːɬkox**
3p		**ˈitːaːxox**		**ˈitːoːɬka**		**jaˈnopːaːɬkox**

G.6 Mangseng

ISO 639-3 code [mbh] (Umua dialect), Oceanic genus, Papua New Guinea.[21] The data were provided by Lloyd Milligan (p.c.), who also procured the audio files. The recordings were kindly made by Emmanuel Seuli. These data are presented in an impressionistic transcription, although three details are purposefully omitted: aspiration, stress, and the exact pronunciation of the sequences **mr** and **nr**.

The data illustrate that some nouns have more than one plural form (a topic not explored here). Sometimes plurality involves reduplication (at the beginning). Sometimes it involves a suffix as well.

		1.sg:poss	2.sg:poss	2.pl:poss	1.pl.inc:poss	1.pl.exc:poss	3.pl:poss	3.sg.poss
1.	‘mother’s brother’	keβɛk	keβɔm	keβɔmu	keβɛr	keβɛmɛm	okeβaŋa	ikeβa
2.	‘mother’s brothers’	keβɛkre	keβɔmre	keβɔmure	keβɛrːe	keβɛmɛmre	okeβaŋare	ikeβare
3.	‘in-law’	wɛk	wɛm	wɛmu	wɛr	wɛmɛm	owɛŋa	iwɛ
4.	‘in-laws’	wiwɛk	wiwɛm	wiwɛmu	wiwɛr	wiwɛmɛm	owiwɛŋa	iwiwɛ
5.	‘in-laws’	wiwɛkre	wiwɛmre	wiwɛmŭere[22]	wiwɛrːe	wiwɛmɛmre	owiwɛŋare	iwiwɛre
6.	‘grandparent, grandchild’	teβik	tɔβum	tɔβumu	tɔβur	tɔβumɛm	oteβi	iteβi
7.	‘grandparents, grandchildren’	titeβikre	titɔβumre	titɔβumu	titɔβur	titɔβumɛm	oteβiŋa	ititeβire
8.	‘same-sex sibling’	teik	teum	teumu	teir	teimɛm	otein	itein
9.	‘same-sex siblings’	titeik	titeum	titeumu	titeir	titeimɛm	otitein	ititein
10.	‘same-sex siblings’	titeikre	titeumre	titeumŭere	titeirːe	titeimɛmre	otiteinre	ititeinre
11.	‘opposite-sex sibling’	luk	lum	lulumu	lulur	lulumɛm	olun	ilun
12.	‘opposite-sex siblings’	lulukre	lulumre	lulumure	lulurːe	lulumɛmre	olulunre	ilulunre
13.	‘child’	tuk	tum	tutumu	tutur	tutumɛm	otun	itun
14.	‘children’	tutukre	tutumre	tutumŭere	tuturːe	tutumɛmre	otutunre	itutunre

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[21] One set of possible instructions for using these data is given in §21.5.2.

[22] The forms in this column that end in [ŭere] seem odd, but that is how it sounds on the recording.

G.7 Data from the Zapotecan genus

Oaxaca, Mexico.

G.7.1 *Isthmus Zapotec.* ISO 639-3 code [zai], Zapotecan genus, Mexico. The sources of these data include Pickett et al. (2007) and Pickett et al. (2010). These data are presented in narrow transcription.[23]

To save you time, morpheme breaks are shown. But the difference between an affix boundary and a clitic boundary is not indicated; both boundaries are simply written as hyphens.

The data continue on a second page.

		English	Spanish			English	Spanish
1.	**n̥nèˑzà**	‘well, good’	‘bien, bueno’	2.	**sàkːà**	‘value’	‘valor’
3.	**ɾì-tùˑbǐ**	‘turns over’	‘se revolca’	4.	**nà-mùˑʒéʔ**	‘is coward’	‘es cobarde’
5.	**lùˑdʒǐ**	‘tongue’	‘lengua’	6.	**nìsːà**	‘water’	‘agua’
7.	**nìˑzà**	‘ear of corn’	‘mazorca’	8.	**nà-kǔˑbì**	‘is new’	‘es nuevo’
9.	**ʒìˑgà**	‘gourd’	‘jícara’	10.	**djàˑgà**	‘ear’	‘oreja’
11.	**ɾ-àtʃːě**	‘is split open’	‘se troncha’	12.	**ɾì-gàˑ**	‘is cut’	‘se corta’
13.	**n-àkːǔ**	‘is wearing’	‘tiene puesto’	14.	**n-àˑgáʔ**	‘is stuck’	‘está atorado’
15.	**ɾù-sàˑbà**	‘drops’	‘deja caer’	16.	**nà-tìpːì**	‘short’	‘corto’
17.	**ɾù-sàˑbà-bě-nǐ**	‘she drops it’	‘lo deja caer’	18.	**kùˑbà**	‘corn dough’	‘masa de maíz’
19.	**ɾ-àsːì**	‘sleeps’	‘duerme’	20.	**tàpːà**	‘four’	‘cuatro’
21.	**ɾ-àsːì-bě**	‘she sleeps’	‘duerme’	22.	**gàʃːà**	‘near’	‘cerca’
23.	**bìˑgù**	‘turtle’	‘tortuga’	24.	**gìˑdì**	‘leather’	‘cuero’
25.	**bìˑgù-kǎ**	‘that turtle’	‘esa tortuga’	26.	**n-àpːǎ**	‘has’	‘tiene’
27.	**tì-bìˑgù**	‘a turtle’	‘una tortuga’	28.	**bìgǔˑ**	‘crumbs’	‘migajas’
29.	**tàbùɾětːè**	‘chair’	‘silla’	30.	**tʃùpːǎ**	‘two’	‘dos’
31.	**tàbùɾětːè-kǎ**	‘that chair’	‘esa silla’	32.	**gètːà**	‘tortilla’	‘tortilla’
33.	**tì-tàbùɾětːè**	‘a chair’	‘una silla’	34.	**ɾìˑgà**	‘rind, peel’	‘cáscara’

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[23] One set of possible instructions for using these data is given in §29.15.

35.	**nà-gáʔ**	‘is green and leafy’	‘es verde y frondoso’	36.	**sàpàndù·**[24]	‘seed (sp.)’	‘chintul’

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[24] This example represents an uncommon pattern.

G.7.2 *Quioquitani Zapotec.* ISO 639-3 [ztq]. Ward et al. (2008) and Mike Ward (p.c.).

G.7.2.1 *Quioquitani Zapotec, Part 1.* These data, written in systematic phonetic transcription, present a range of data for considering the syllable structure of this language. Some patterns shown are very uncommon; these include three-consonant onsets and two-consonant codas.[25]

The words glossed '… of' are obligatorily possessed nouns, whereas their counterparts are simple nouns that cannot be possessed. The obligatorily possessed nouns could be viewed as being derived from the simple nouns by a morphological process. (Some other nouns, such as that for 'hand', are also obligatorily possessed nouns, but they are not derived from other nouns.)

		Gloss			Gloss
1.	ˈmá	'animal'	2.	ˈmɛ̀ʷkʷʰ	'dog'
3.	ˈʃmá	'animal of'	4.	ˈtàpʰ	'four'
5.	ˈtsɛ́	'day'	6.	ˈnìs	'water'
7.	ˈʃtsɛ́	'day of'	8.	ˈtòˑb̥	'agave'
9.	ˈkpàˑj	'broom'	10.	ˈpkò̰ˑg̊	'altar'
11.	ʃìˈkpàˑj	'broom of'	12.	ˈʃpǐˑd̥	'snout'
13.	ˈpjà	'soap'	14.	ˈŋgǐˑd̥ʲ	'hen'
15.	ʃìˈpjà	'soap of'	16.	ˈŋkʷʃǎˑndʒ	'grasshopper'
17.	ˈŋgbìˑz̥ʲ	'rattlesnake'	18.	ˈlíˑd̥z̥ʲ	'home'
19.	ˈwǐˑɲ	'little (anim.)'	20.	ˈmsíˑɲ	'mouse'
21.	ˈnḛ̀ˑg̊	'yesterday'	22.	ˈlòˑn	'bed'
23.	ˈŋkʷtʃětsʲ	'iguana'	24.	ˈmètʲʰ	'skunk'
25.	ˈmtʃàˑʷg̊ʷ	'acorn'	26.	ˈpětʃ	'vulture'
27.	ˈtsìtʰ	'egg'	28.	ˈkìts	'hair'
29.	ˈmlà̰	'termite'	30.	ˈɲǎ	'hand'
31.	ˈnlěˑŋkʷʰ	'crooked'	32.	ˈŋgbìˑd̥z̥	'sun'
33.	ˈtǎˑm	'owl'	34.	ˈjà̰ˑn	'corncob'

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[25] Possible instructions for using these data is given in §8.2.1, §24.2.3.2 and §6.10 and §22.8.

G.7.2.2 *Quioquitani Zapotec, Part 2.* This set of data should be examined without reference to other data in order for it to be meaningful and not confusing. The transcription is very narrow.[26] What is transcribed as [z̥] could have just as easily and correctly been transcribed as [s], and likewise for other consonants.[27]

Important additional information: this language clearly contrasts voiced stops and fricatives in syllable-initial position.

	Before pause	Before any vowel	Before any consonant	Gloss			Gloss
1.	ˈníˑz̥	ˈníˑz	ˈníˑz̥	‘ear of corn’			
2.	ˈnìs	ˈnìs	ˈnìs	‘water’			
3.	ˈʧòpʰ	ˈʧòp	ˈʧòpʰ	‘two’	4.	ˈʧòpʰ ˈʦìtʰ	‘two eggs’
5.	ˈtòˑb̥	ˈtòˑb	ˈtòˑb̥	‘agave (century plant)’			
6.	ˈʦìtʰ	ˈʦìt	ˈʦìtʰ	‘egg’	7.	ˈʃʦǐt à̰	‘my egg’
8.	ˈmɛ̀kʷʰ	ˈmɛ̀kʷ	ˈmɛ̀kʷʰ	‘dog’			
9.	ˈlíˑʥ̥ʲ	ˈlíˑʥʲ	ˈlíˑʥ̥ʲ	‘home’			
10.	ˈʃpǐˑd̥	ˈʃpǐˑd	ˈʃpǐˑd̥	‘snout’	11.	ˈʃpǐˑd̥ má	‘its snout’
12.	ˈʃìˑg̊	ˈʃìˑg	ˈʃìˑg̊	‘gourd container’	13.	ˈʃìˑg̊ ɾé	‘this gourd container’
14.	ˈmtʃàˑg̊ʷ	ˈmtʃàˑgʷ	ˈmtʃàˑg̊ʷ	‘acorn’			

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[26] An even narrower transcription might indicate an additional fact: a slight prelabialization before the rounded velars.

[27] One set of instructions for using these data is given in §22.1.7.

G.8 Arara of Pará

ISO 639-3 code [aap], Cariban genus, Brazil. The data are from I. Souza (2010) and S. Souza (2010). The transcription is moderately narrow.

G.8.1 *Arara of Pará, Part 1.* Words 1-10 are given as they would be in a word list.[28]

		English	Spanish
1.	abianãʔ	‘peccary’	‘jabalí’
2.	pɔnɛ̃ʔ	‘piranha’	‘piraña’
3.	ɔɾɛmĩʔ	‘a species of fish’	‘una especie de pez’
4.	tɔɾɔmɔ̃ʔ	‘Brazil nut’	
5.	imũʔ	‘its egg’	‘su huevo’
6.	kaɾiamɯ̃ʔ	‘a species of deer’	‘una especie de venado’
7.	mãũʔ	‘cat’	‘gato’
8.	ikpaʔ	‘mud’	‘lodo’
9.	ɯpɯʔ	‘yam’	‘camote’
10.	jɔɾuʔ	‘tortoise’	‘tortuga’
11.	abianã βɔk	‘on the peccary’	‘en el jabalí’
12.	pɔnɛ̃ βɔk	‘on the piranha’	‘en la piraña’
13.	oɾɛmĩ βɔk	‘on the fish (sp.)’	‘en el pez (esp.)’
14.	tɔɾɔmɔ̃ βɔk	‘on the Brazil nut’	
15.	imũ βɔk	‘on its egg’	‘en su huevo’
16.	kaɾiamɯ̃ βɔk	‘on the deer (sp.)’	‘en el venado (esp.)’
17.	mãũ βɔk	‘on the cat’	‘en el gato’
18.	ikpa βɔk	‘on the mud’	‘en el lodo’
19.	ɯpɯ βɔk	‘on the yam’	‘en el camote’
20.	jɔɾu βɔk	‘on the tortoise’	‘en la tortuga’

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[28] One set of possible instructions for using these data is given in §24.7.

G.8.2 *Arara of Pará, Part 2.* Note: The voicing of the final consonant of the words presented so far is not in view here; alternations are not shown until the last group of forms.

	Unpossessed, in isolation or following an obstruent-final word	Unpossessed, preceded by vowel- final or sonorant consonant-final word	‘hisherits ...’	Preceded by vowel-final word as possessor	‘our (dual) ...’	
1.	kambɔt	gambɔt	ikambɔɾɯ[29]	tatʃi gambɔɾɯ	ugukambɔɾɯ	‘firewood’
2.	tapɛda	dapɛda	itapɛdan	akitu dapɛdan	uktapɛdan	‘paper’
3.	pɯlɛptɛ	bɯlɛptɛ	ibɯlɛptɛn	akitu bɯlɛptɛn	ukpɯlɛptɛn	‘knife’
4.	pɔɾidɔ	bɔɾidɔ	ibɔɾidɔn	... bɔɾidɔn	ukpɔɾidɔn	‘basket’
5.	mɔbu	mɔbu	imɔbun	... mɔbun	uɲmɔbun	‘canoe’
6.	tʃigu	tʃigu	itʃiguɾu	... tʃiguɾu	ugutʃiguɾu	‘urine’
7.			iwaɲduŋ		ugwanduŋ	‘large intestine’
8.	kambiluɲɔ	kambiluɲɔ	igambilu	... gambilu	ugugambilu	‘wound’
9.	latʃiɲɔ	latʃiɲɔ	ilatʃi	... latʃi	ugulatʃi	‘mouth’
10.	piluɲɔ		ipilun	kaɾina bilun		‘tail’
11.	panaɲɔ		ibanan		ukpanan	‘ear’
12.	tembuluɲɔ		idembulu	... dembulu	uktembulu	‘throat’
13.			ibet		ukpet	‘thigh’
14.	puguɲɔ	buguɲɔ	ipun[30]	... bugun	ugupun	‘foot’
15.	mumdʒiɲɔ		imumdʒi[31]		uɲmumdʒi	‘head’
16.			ɛɾɛn		ugɛɾɛn	‘liver’
17.			aɾɔ	... aɾɔ	ugaɾɔ	‘lung’

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[29] Words that pattern like this (with voiceless stop after a prefix vowel) are extremely few. But they should be considered.

[30] A couple of forms of this lexeme are irregular compared to general patterns in the language.

[31] [dʒ] is found only following a sonorant consonant (which seems to only be a nasal) in the language.

18.	ɾuŋɔ	ɾuŋɔ	iɾu	… ɾu	uguɾu	‘older brother’
19.	panbak					‘ball’
20.				panbaŋ mapɔ ‘ball’s place’		‘place’

	Noun stem*	Derived adjective**			Noun stem	Derived adjective	
1.	(ɛŋ)	tɔŋɛɾɛ	‘liver’	2.	(ig)	tɯgɛɾɛ	‘liquid’
3.	(tag)	tɯtagɛɾɛ	‘drop’	4.	(wɔkpa)	tɔwɔkpaɾɛ	‘burp’
5.	(ptʃig)	tɯptʃigɛɾɛ	‘diarrhea’	6.	(amɯt)	tamɯdɛ	‘pet’
7.	(ɛŋnab)	tɔŋnabɛɾɛ	‘snoring’	8.	(ɛb)	tɯɛbɛɾɛ	‘smile’
9.	(dagin)	tɯdaginɛ	‘whistle’	10.	(wɔɾɔnd)	towɔɾɔndɛ	‘word’
11.	(mul)	tɯmulɛ	‘cough’				

12.	mɯtʃaŋ	‘skin ulcer’	13.	kutɔ	‘a toad (sp.)’
14.	mɯta	‘monkey’	15.	adɔ	‘a fish (sp.)’
16.	tʃaga	‘food cooked in palm leaves’	17.	wakat	‘alligator’
18.	tʃanɔ	‘a poison’	19.	ɔgɔm	‘blind snake’
20.	tagi	‘cricket’			

*Note: The noun stem given here is based on comparison with other forms and presented “bare” to make the analysis a bit easier to do. The focus here is on the suffix that appears in these derived adjectives.

**Note: The prefix that occurs in the derived adjective column would require much more data to be presented before you can analyze it.

	Before obstruent in next word	Before sonorant in next word	
1.	wakat	wakad	‘alligator’
2.	panbak	panbag	‘fall’
3.	kambɔt, gambɔt[32]	kambɔd, gambɔd	‘firewood’
4.	ukpet	ukped	‘our thighs’

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[32] The voicing of the first consonant depends on the preceding context, as shown above. Those facts are omitted here.

G.9 Awara

ISO 639-3 code [awx], Finisterre-Huon genus, Papua New Guinea. Source: Quigley (2003). (The source had [gumsʌ], which is presented above as #11 [gumsa] (play language). There is some phonetic overlap reported for the vowels in question.)[33]

The data are given in impressionistic transcription. The "play language" takes the forms of the real language and does something simple to them to produce a novel output.

	Real language list pronunciation	Real language after another word	Play language list pronunciation	English
1.	kʰahat	kʰahat	hatkʰa	'betelnut'
2.	kʰajamut	kʰajamut	jamutkʰa	'cucumber'
3.	kʰupʰan	kʰupʰan		'smoke'
4.	tʰawik	tʰawik	wiktʰa	'clothing'
5.	pʰajip	pʰajip	jipʰa	'machete'
6.	musuk	musuk		'knife'
7.	notna	notna	nanot	'my friend'
8.	sandun	sandun	dunsa	'axe'
9.	suŋgum	suŋgum	gumsu	'sweet potato'
10.	simbut	simbut	butsi	'taro cake'
11.	saŋgum	saŋgum	gumsa	'corn'
12.	bʌŋgwat	ᵐbʌŋgwat		'bald head'
13.	apʰʌk	apʰʌk		'tongs'
14.	jakʰʌp	jakʰʌp		'moon'
15.	tʰokŋʌ	tʰokŋʌ		'pain'
16.	jepmʌk	jepmʌk		'son-in-law'
17.	batʰʌŋʌ	ᵐbatʰʌŋʌ		'pepper tree'
18.	d....	ⁿd...		
19.	g....	ᵑg....		
20.	gʌpbat ∼ gʌpm̩bat	ᵑgʌpbat ∼ ᵑgʌpm̩bat		'ledge'

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[33] Possible instructions for using these data are given in §16.1.1, §20.3.1.1 and §25.3.1.

G.10 Albanian

ISO 639-3 code [als], Albanian genus, Albania. Sources: Drizari (1954), Newmark (1957) (the latter for details about pronunciation). Impressionistic transcription. The sounds [l] and [lˠ] are alveolar.

G.10.1 *Part 1.* —[34]

		Gloss			Gloss
1.	ˈmana	‘mulberries’	2.	ˈŋgas	‘I drive’
3.	maˈnaɾ	‘pet’	4.	ˈkamə	‘dagger’
5.	ˈkuŋgulˠ	‘squash’	6.	ˈmiɾə	‘good’
7.	ˈmalˠ	‘property’	8.	ˈmizə	‘fly (n.)’
9.	ˈfi̯eɾ	‘fern’	10.	ˈlɜŋk	‘broth’
11.	ˈmik	‘friend’	12.	ˈgi̯ak	‘blood’
13.	ˈmasə	‘measure’	14.	saˈpun	‘soap’
15.	ˈnapə	‘veil’	16.	ɲeˈɾi ? ni̯eˈɾi ?	‘person’
17.	tiˈgan	‘frying pan’	18.	ˈɲom ? ˈni̯om ?	‘I wet’
19.	ˈnip	‘nephew’	20.	ɲeˈɾiθ ? ni̯eˈɾiθ ?	‘uvula’
21.	ˈnot	‘swim (n.)’	22.	ˈzam	‘glue’
23.	ˈpunə	‘work (n.)’	24.	ˈkum	‘sand’
25.	ˈflamə	‘fowl disease’	26.	ˈhan	‘inn’
27.	ˈðamə	‘we gave’	28.	ˈnatə	‘night’
29.	ˈðanə	‘they gave’	30.	ˈbaɲə ? ˈbani̯ə ?	‘bath’
31.	ˈbami̯ə	‘okra’			

Note: the intention of examples 16, 18, 20 and 30 is to indicate that the listener is uncertain about what is being heard and uncertain how to transcribe it.

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[34] Sets of possible instructions for using these data are given in §15.9 and §17.9. See also §23.1.1.

G.10.2 *Part 2.* —[35]

		Gloss			Gloss
1.	ʊ̝ˈlˠɪ̝	‘olive’	2.	ˈlʊ̝gə	‘spoon’
3.	ˈvɔ̝lˠa	‘I vomited’	4.	ˈjaʋə	‘week’
5.	ˈmjaltə	‘honey’	6.	ˈlahɛ̝m	‘I wash myself’
7.	ˈkalə	‘horse’	8.	ˈplak	‘old man’
9.	ˈkalɪ̝	‘the horse’	10.	ˈplakʊ̝	‘the old man’
11.	ˈdjalˠ	‘devil’	12.	ˈlaɾk	‘far’
13.	ˈðɛ̝	‘earth’	14.	ˈdɔ̝ɾə	‘hand’
15.	ˈmblɛ̝θ	‘I collect’	16.	ˈdɔ̝ɾa	‘the hand’
17.	kʊ̝ˈnað̝ɛ̝	‘marten’	18.	ˈkɔ̝d	‘legal code’
19.	ˈkɔ̝lˠə	‘cough’	20.	ˈrað̝ə	‘row’
21.	ˈlʊ̝mə	‘river’	22.	ɪ̝ ˈbaɾðə	‘white’
23.	ˈlʊ̝mɪ̝	‘the river’	24.	ˈvʊ̝lə	‘stamp, seal’
25.	ˈrɜndə	‘heavy’	26.	mɪ̝ˈdɪ̝s	‘between’
27.	ˈvdɛ̝kjɛ̝	‘death’	28.	ˈðalˠə	‘buttermilk’
29.	ˈvras	‘I kill’	30.	ˈsiɛ̝lˠ	‘I bring’
31.	laˈhʊ̝ɾ	‘headshawl’	32.	ˈkʊ̝ɾv	‘prostitute’
33.	ˈdjalə	‘boy’	34.	ˈmblɔ̝ð̝a	‘I collected’
35.	ˈbalt	‘mud’	36.	ˈsklɛ̝p	‘rheum’
37.	ˈlɔ̝pa	‘the cow’	38.	ˈkalts	‘stocking’
39.	ˈsklˠav	‘slave’	40.	ˈylˠɪ̝	‘the star’
41.	vəˈlˠaj	‘the brother’	42.	ˈylˠ	‘star’
43.	ˈblɛ̝ʋa	‘I bought’	44.	ˈθɛ̝s	‘sack’
45.	fɪ̝ˈlˠɔ̝j	‘he began’	46.	ˈjaʋən	‘the week’
47.	lˠaˈfɔ̝sɛ̝n	‘they converse’	48.	ˈkʊ̝ɾθ	‘snare’
49.	lˠaˈpʊ̝ʃ	‘animal with flapping ears’	50.	ˈplˠak	‘phonograph record’
51.	ˈlˠɔ̝ʃ	‘garbage’	52.	ˈlˠɔ̝ʒɪ̝	‘the garbage’
53.	ɪ̝ʋəˈlˠaj	‘his hertheir brother’	54.	mɪ̝ɾə sɛ̝ ʋɪ̝nɪ̝	‘You are welcome.’
55.	ˈvɔ̝la	‘I gathered grapes’	56.	ˈc͡çɛ̝θɛ̝m	‘I get a haircut’

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[35] One set of possible instructions for using these data is given in §19.6.

G.11 Cashinahua

ISO 639-3 code [cbs], Panoan genus, Peru & Brazil. Source: Kensinger (1963). Impressionistic transcription.[36]

		English	Spanish			English	Spanish
1.	taβa	‘washboard’	‘tabla de lavar’	2.	paka	‘bamboo’	‘bambú’
3.	taka	‘liver’	‘hígado’	4.	bɜɾu	‘eye’	‘ojo’
5.	kaka	‘a kind of basket’	‘clase de canasta’	6.	baɾi	‘sun’	‘sol’
7.	bɜtu	‘stained face’	‘cara manchada’	8.	ba	‘friend’	‘amigo’
9.	baka	‘fish’	‘pescado’	10.	naβu	‘people’	‘gente’
11.	daɾɜ	‘a plant’	‘una planta’	12.	daka	‘to rest’	‘descansar’
13.	sɜpi	‘weaving design’	‘diseño de tejido’	14.	tapa	‘floor’	‘piso’
15.	naka	‘to chew’	‘masticar’	16.	dasi	‘all’	‘todo’
17.	hɜpɜ	‘a palm’	‘una palma’	18.	tama	‘peanut’	‘maní’
19.	maka	‘rat’	‘rata’	20.	kuʃa	‘to hit’	‘pegar’
21.	tsaka	‘to kill’	‘matar’	22.	tʃaka	‘trash’	‘basura’
23.	kuʂa	‘cedar’	‘cedro’	24.	mɜʃu	‘black’	‘negro’
25.	isu	‘spider monkey’	‘un mono’	26.	mɜʂu	‘to creep, crawl’	‘gatear’
27.	tawa	‘sugar cane’	‘caña de azúcar’	28.	dani	‘body hair’	‘vello’

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[36] Sets of possible instructions for using these data are given in §9.1.2 and §15.9.

G.12 Data from the Semitic genus

G.12.1 *Egyptian Arabic.* ISO 639-3 code [arz], Egypt. Source: Olmsted Gary & Gamal-Eldin (1982). Narrow transcription except for the vowels ("a" is often something more like [æ]).[37]

[s] and [z] are said to be apico-dental in this variety of Arabic.
[χ] and [ʁ] are both said to be "fricative or trilled in free variation" (the symbols here are those of the fricatives). By this we understand that each of them may vary between a fricative or trilled pronunciation, not that the voiceless fricative varies to voiced fricative. This is important to understand.

		Gloss			Gloss
1.	sit	'woman'	2.	jizuʔ	'push (v.)'
3.	daːfi (*daːvi)	'warm'	4.	samak	'fish'
5.	lisaːn	'tongue'	6.	jifdi ∼ jivdi	'he sacrifices'
7.	sana	'year'	8.	wisiχ	'dirty'
9.	sinːa	'tooth'	10.	zahra	'flower'
11.	sama	'sky'	12.	goːz	'husband'
13.	ʔusajːar	'short'	14.	goːza	'hookah'
15.	faʔr	'poverty'	16.	safa (*sava)	'bone'
17.	kuwajːis	'good'	18.	seːf (*seːv)	'sword'
19.	ʔazka	'smarter'	20.	kuːsa	'squash'
21.	dars	'lesson'	22.	ʔiŋkasar	'it was broken'
23.	jiχaːf (*jiχaːv)	'fear'	24.	χamsa	'five'
25.	ʁeːr	'other'	26.	tiχiːn	'thick'
27.	jiʁanːi	'sing'	28.	manaχiːr	'nose'

The symbol ∼ above is meant to indicate that the word may be pronounced either as the form preceding the ∼ or as the form following it.

The parenthesized and asterisked forms are meant to indicate that they are not possible pronunciations of such words, just in case you were wondering (given that in other places [f] and [v] alternate).

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[37] One set of possible instructions for using these data is given in §14.14.

G.12.2 *Hejazi Arabic.* 639-3 [acw], Saudi Arabia. Impressionistic transcription. Al-Mohanna (Fa1429H).[38]

		Gloss
1.	ʃadʒaɾi	‘my trees’
2.	maktub	‘a letter’
3.	kaasaat	‘glasses’
4.	bint	‘a girl’
5.	ʔakalt	‘I ate’
6.	faanuus	‘a lantern’
7.	galbi	‘my heart’
8.	galbak	‘your heart’
9.	katabt	‘Iyou wrote’
10.	tiin	‘figs’

The following “words” are not possible:

11. * skata
12. * taasdan
13. * pisdaabt
14. * si.at
15. * bilt.ka

These data are carefully selected and are representative of the language generally despite being few.

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[38] One set of instructions for using these data is given in §6.10.

G.13 Tucano

ISO 639-3 code [tuo], Tucanoan genus, Colombia & Brazil. Source: West & Welch (1967).[39] Note: Some phonetic detail is not included.

(The words written with final voiceless vowels would probably be transcribed impressionistically as a vowel followed by [h].)

The data continue on a second page.

	As pronounced in a list	As pronounced phrase-initially with another word following it	As pronounced phrase-medially	As pronounced phrase-finally with another word preceding it	Gloss
1.	$^{\text{m}}$biʔii̥	$^{\text{m}}$biʔi	biʔi	biʔii̥	‘mouse’
2.	pagaḁ	paga	paga	pagaḁ	‘stomach’
3.	$^{\text{m}}$buʔuu̥	$^{\text{m}}$buʔu	buʔu	buʔuu̥	‘a fish’
4.	$^{\text{m}}$buʔɛdaḁ	$^{\text{m}}$buʔɛda	buʔɛda	buʔɛdaḁ	‘rainbow’
5.	$^{\text{m}}$buʔbɛsɛɛ̥	$^{\text{m}}$buʔbɛsɛ	buʔbɛsɛ	buʔbɛsɛɛ̥	‘infection’
6.	etagɯɯ̥	etagɯ	etagɯ	etagɯɯ̥	‘who arrives’
7.	$^{\text{n}}$diaḁ	$^{\text{n}}$dia	dia	diaḁ	‘river’
8.	$^{\text{n}}$diajii̥	$^{\text{n}}$diaji	diaji	diajii̥	‘dog’
9.	$^{\text{m}}$bɛʔɾoo̥	$^{\text{m}}$bɛʔɾo	bɛʔɾo	bɛʔɾoo̥	‘later’
10.	$^{\text{n}}$dasɛɛ̥	$^{\text{n}}$dasɛ	dasɛ	dasɛɛ̥	‘toucan’
11.	$^{\text{n}}$diʔtaḁ	$^{\text{n}}$diʔta	diʔta	diʔtaḁ	‘earth’
12.	$^{\text{m}}$bãhãḁ̃	$^{\text{m}}$bãhã	bãhã	bãhãḁ̃	‘macaw’
13.	$^{\text{n}}$dii̥	$^{\text{n}}$di	di	dii̥	‘blood’

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[39] One set of possible instructions for using these data is given in §22.2.7.

14.	kaʔbii̥	kaʔbi	kaʔbi	kaʔbii̥	‘soft’
15.	ʔohoo̥	ʔoho	ʔoho	ʔohoo̥	‘banana’
16.	taḁ	ta	ta	taḁ	‘grass’

G.14 Daga

ISO 639-3 [dgz], Dagan genus, Papua New Guinea. Narrow transcription. J. Murane & E. Murane (1972), E. Murane (1974).[40]

The data presented here do not include the recent loanwords from English or neighboring languages. The verbs given as infinitives are incomplete verb forms and not really words in isolation at all. Apparently (reportedly) there *are* words that begin with [ɾ], but none with [l].

		Gloss			Gloss
1.	asi	'to grunt'	2.	uɾasɛ ~ ulasɛ	'hole'
3.	sɛnao	'to shout'	4.	waɾap ~ walap	'I take'
5.	sinao	'drum'	6.	siuɾan ~ siulan	'salt'
7.	otu	'small'	8.	simuɾa ~ simula	'to whisper'
9.	wagat	'holiday'	10.	taβɛ ~ tavɛ	'old'
11.	topɛn	'to hit'	12.	waɾiŋgapɛn ~ waliŋgapɛn	'I should get'
13.	usɛ	'there'	14.	dɛɾɛ ~ dɛlɛ	'two'
15.	nɛsip	'steps'	16.	jaβiβin ~ javivin	'I am seeing'
17.	taba	'food'	18.	jamosiβin ~ jamosivin	'I am licking'
19.	sisi	'bitter'	20.	waɾan ~ walan	'they got'
21.	tuian ??	'I kill'	22.	mɛɾip ~ mɛlip	'to vomit'
23.	watap	'I open'	24.	iɾavi ~ ilavi ~ iɾaβi ~ ilaβi	'all'
25.	daiton	'one'	26.	oɾup otua ~ *etc.*	'boys'
27.	dendɛni	'red'	28.	waɾia ~ walia	'she takes'
29.	da	'one'	30.	anɛt	'we should leave'
31.	jawan	'they saw'	32.	gamat	'facepaint'
33.	wat	'get (it)!'	34.	sinasin	'cockatoo'
35.	jao̯	'see!'	36.	bogasi	'immediately'
37.	jamot	'lick!'	38.	gutut	'story'

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[40] Sets of possible instructions for using these data are given in §15.9 and §18.6.

G.15 Madija

ISO 639-3 [cul], Arauan genus, Brazil and Peru. Adams & Marlett (1990), Adams & Marlett (1987), and Patsy Liclán (personal communication).

G.15.1 *Part 1.* —[41]

		English	Spanish
1.	poɾe	‘pierced’	‘agujerado’
2.	oɾi	‘paddle’	‘remo’
3.	oɾa	‘a tree’	‘un árbol’
4.	dzeɾo	‘grass’	‘hierba’
5.	teɾibo	‘your ear’	‘tu oreja’
6.	atsʰiɾe	‘his body’	‘su cuerpo (de él)’
7.	eɾibo	‘our ears’	‘nuestras orejas’
8.	hiɾeʔe	‘to lack’	‘faltar’
9.	hili	‘to sing’	‘cantar’
10.	β̞ilidi	‘grandfather’	‘abuelo’
11.	temoɾi	‘your foot’	‘tu pie’
12.	amoɾini	‘her foot’	‘su pie (de ella)’
13.	ɾobo	‘iguana’	‘iguana’
14.	tsili	‘lame’	‘cojo’

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[41] One set of instructions for using these data is given in §15.9.

G.15.2 *Part 2.* Note: No words are marked with stress since reportedly there is no discernible stress prominence.[42]

The use of ‘his’ in the glosses is deliberate; the possessor must be a noun from the masculine class when these words are used. (For a feminine possessor, the suffix **-ni** is added, but there is more to the story than just that.)

The words that are glossed as infinitives are verbs that require an accompanying “light” verb that carries the verbal morphology.

		Gloss			Gloss
1.	wati	‘his liver’	2.	wapi	‘his skin’
3.	watini	‘her liver’	4.	owatija	‘I fainted’
5.	owati	‘my liver’	6.	aβ̞i	‘tapir’
7.	ipo	‘his lower lip’	8.	powa	‘he’
9.	oβ̞ipo	‘my lower lip’	10.	pʰoβ̞i	‘hammock’
11.	ene	‘his nose’	12.	enede	‘his chin’
13.	oβ̞ene	‘my nose’	14.	anadani	‘her chin’
15.	epe	‘his navel’	16.	ebetʰe	‘his cheek’
17.	oβ̞epe	‘my navel’	18.	atsʰiɾe	‘his body’
19.	waɾibo	‘his ear’	20.	epʰe	‘its leaf’
21.	owaɾibo	‘my ear’	22.	pitsʰi	‘pichico monkey’
23.	atʰi	‘his word’	24.	bani	‘animal’
25.	owatʰi	‘my word’	26.	boba	‘arrow’
27.	bedi	‘his son’	28.	dapʰi	‘to swallow’
29.	tati	‘his head’	30.	kaɾo	‘rubber’
31.	aba	‘fish’	32.	wapʰa	‘a monkey’
33.	dzipa	‘clay pot’	34.	tʰatʰa	‘a plant’
35.	dahoni	‘canoe’	36.	tsili	‘lame’
37.	etʰe	‘dog’	38.	ɾobo	‘iguana’
39.	bobo	‘an owl’	40.	ede	‘tree trunk’
41.	eɾo	‘cockroach’	42.	pʰoɾo	‘to swat’
43.	ehete	‘fiesta’	44.	apa	‘to eat’

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[42] One set of instructions for using these data is given in §18.6 and §20.7.

45.	tsoda	‘flea’

G.16 Data from the Quechuan genus

G.16.1 *Corongo Quechua.* ISO 639-3 [qwa], Peru. Hintz (1990). Narrow transcription. These data exclude words that have been borrowed from Spanish.[43]

		English	Spanish
1.	tuʒuŋ	‘hisherits bone’	‘su hueso’
2.	tuʒuŋkuna	‘hisherits bones’	‘sus huesos’
3.	piʃtaʃumpaχ	‘so that we may kill himherit’	‘para que lola matemos’
4.	ejwaʃuŋmi	‘we will go toward’	‘iremos hacia’
5.	tʃ ’akɾamaŋ	‘in the field’	‘en la chacra’
6.	aŋkat	‘completely’	‘completamente’
7.	iɾkakuna	‘mountains’	‘montañas’
8.	χeʒej	‘money’	‘dinero’
9.	wasimaŋ	‘to the house’	‘a la casa’
10.	waskikimaŋ	‘to your house’	‘a tu casa’
11.	tsejpikχa	‘from there (topicalized)’	‘de allí (topicalizado)’

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[43] One set of instructions for using these data is given in §8.9.

G.16.2 *Napo Lowland Quechua.* ISO 639-3: [qvo]. Ecuador, Peru & Colombia. Orr (1962) and Orr & Wrisley (1965). Narrow transcription.

What is presented as a bilabial approximant here is presented as a fricative in the source.

The alternate pronunciation in each case when one is presented is the word as it would be pronounced at the end of an utterance, including (of course) as it would be pronounced in isolation, as in a word list.

		Gloss			Gloss
1.	ˈkaɾu	‘far’	2.	ˈɲaβ̞i	‘eye,face’
3.	ˈɾaku	‘thick’	4.	ˈtsaka	‘rough’
5.	ˈɲaɲa	‘sister (of female)’	6.	ˈmati	‘gourd dish’
7.	ˈmaŋga	‘pot’	8.	ˈxuktu	‘hole’
9.	ˈkuɾi	‘gold’	10.	tʃawˈsina	‘to shake’
11.	ˈtikta	‘trap’	12.	ˈɾasu	‘snow’
13.	ˈɾumi	‘stone’	14.	ˈkiŋgi	‘twisted’
15.	ˈtasin ∼ ˈtasiŋ	‘nest’	16.	ˈtsindzu	‘thin child’
17.	ˈnaŋgi	‘bird trap’	18.	ˈpani	‘sister (of male)’
19.	ˈkadzun ∼ ˈkadzuŋ	‘brother-in-law’	20.	ˈtuɾi	‘brother (of female)’
21.	ˈtuta	‘night’	22.	ˈsaŋka	‘hilly’
23.	ˈʎantu	‘shadow’	24.	ˈʃuŋgu	‘heart’
25.	ˈtanda	‘bread’	26.	ˈtʃagɾa	‘field’
27.	ˈpindu	‘wild cane’	28.	ˈβ̞iksa	‘stomach’
29.	ˈʎanda	‘muddy’	30.	ˈβ̞iki	‘sap’
31.	ˈwawa	‘baby’	32.	ˈawka	‘savage’
33.	ˈindi	‘sun’	34.	ˈsisa	‘flower’
35.	ˈtsuntsu	‘ragged’	36.	ˈpatsak	‘hundred’
37.	ˈaŋsa	‘dark’	38.	ˈmaŋɾa	‘red dye’
39.	ˈkaŋwa	‘with you’	40.	ˈkimsa	‘three’
41.	tʃunˈtina	‘to put sticks into the fire’	42.	ˈtʃuŋʎa	‘quietly’

G.16.3 *Salasaca Quichua.* ISO 639-3: [qxl], Ecuador. Sources: Chango Masaquiza & Marlett (2008), Waskosky (1990), Waskosky (1992). Impressionistic transcription.

G.16.3.1 *Part 1.* Basic data.[44]

		English	Spanish
1.	ˈpuŋgu	‘door’	‘puerta’
2.	ˈsipu	‘wrinkle’	‘arruga’
3.	ˈuɾpi	‘dove’	‘tórtola’
4.	ˈmapa	‘dirty’	‘sucio’
5.	ˈsukta	‘six’	‘seis’
6.	ˈtajta	‘father’	‘padre’
7.	ˈtawna	‘staff’	‘bastón’
8.	ˈkawsi	‘life’	‘vida’
9.	ˈwaɣɾa	‘cattle’	‘ganado’
10.	ˈtuta	‘night’	‘noche’
11.	ˈriŋriŋ	‘ear’	‘oreja’
12.	ˈtanda	‘bread’	‘pan’
13.	kaˈwitu	‘bed’	‘cama’
14.	ˈjaku	‘water’	‘agua’
15.	ˈwasi	‘house’	‘casa’
16.	ˈwajku	‘grassy spot’	‘lugar donde se corta hierba’
17.	miˈxiku	‘an agave’	‘cabuya (agave)’
18.	ɣuˈluŋ	‘thunder’	‘trueno’
19.	ˈmiʒpi	‘swallow!’	‘¡traga!’
20.	ˈkaŋjuŋ	‘with you’	‘contigo’
21.	ˈkiʒa	‘month’	‘mes’

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[44] One set of possible instructions for using these data is given in §5.13.

G.16.3.2 *Part 2.* Data with some interesting sounds or sequences.[45]

		English	Spanish
1.	ˈtsala	‘thin’	‘flaco’
2.	ˈatʃpa	‘earth’	‘tierra’
3.	ˈpʰaki	‘broken’	‘pedazo’
4.	ˈtʃawβi	‘half’	‘mitad’
5.	ˈtʃumbi	‘sash’	‘faja’
6.	ˈkantʃis	‘seven’	‘siete’
7.	ˈtʃuja	‘clean’	‘limpio’
8.	uˈkutʃa	‘mouse’	‘ratón’
9.	ˈtʰuktu	‘cornflower’	‘flor de maíz’
10.	ˈkʰata	‘blanket’	‘cobija’
11.	ˈpatsuk	‘hundred’	‘cien’
12.	ˈkandʒa	‘outside’	‘afuera’
13.	ˈtʃaki	‘foot’	‘pie’
14.	ˈkʰuru	‘earthworm’	‘gusano’

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[45] One set of possible instructions for using these data is given in §9.2.2.

G.16.3.3 *Part 3.* These words contain some more interesting sequences or sounds (some of which are much less common than those presented above) to consider.[46]

		English	Spanish
1.	ˈtʰjuka	‘saliva’	‘saliva’
2.	ˈkwitʃi	‘rainbow’	‘arco iris’
3.	ˈkwiŋka	‘intestinal worm’	‘lombriz intestinal’
4.	ˈkʰwiʒa	‘beautiful’	‘hermoso’

G.16.3.4 *Part 4.* Another word that is interesting.

		English	Spanish
1.	ˈzimbɾaŋ	‘trembles’	‘tiembla’

G.16.3.5 *Part 5.* Compare these morphologically complex words with those above.

		English	Spanish
1.	tʃaˈkin	‘with the foot’	‘con el pie’
2.	waˈsiβi	‘in the house’	‘en la casa’

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[46] One set of possible instructions for using these data is given in §19.1.2.1.

G.17 Marinahua dialect of Sharanahua

ISO 639-3 [mcd], Panoan genus, Peru. Impressionistic transcription, quite narrow with respect to the tones. Eunice Pike & Scott (1962), Eunice Pike & Scott (1975). The tones are transcribed here using the system explained in (7) and also in the non-IPA system that uses numbers (here with 5 for the highest, 1 for the lowest).[47]

		English	Spanish			English	Spanish
1.	**tsò (2)**	‘chigger’	‘nigua’	2.	**tʃī (3)**	‘fire’	‘fuego’
3.	**ìmȉ (2 1)**	‘ blood’	‘sangre’	4.	**fàȉ (2 1)**	‘field’	‘campo’
5.	**i̋ʃmȉ (5 1)**	‘vulture’	‘buitre’	6.	**tonã**	‘blue’	‘azul’
7.	**māpō (3 3)**	‘head’	‘cabeza’	8.	**fāī (3 3)**	‘path’	‘sendero’
9.	**ka̋fìtȉ (5 2 1)**	‘arrow’	‘flecha’	10.	**kōʃā (3 3)**	‘to hit’	‘golpear’
11.	**tsìspȁ (2 1)**	‘back of a canoe’	‘.. de una canoa’	12.	**fa̋ȉ (5 1)**	‘rise in river’	‘creciente en el río’
13.	**wa̋ȁ (5 1)**	‘to put’	‘colocar’	14.	**māstātī (3 3 3)**	‘hammer’	‘martillo’
15.	**pōtáȍ (3 4 1)**	‘throw out’	‘botar, tirar’	16.	**tàkȁrȁ (2 1 1)**	‘chicken’	‘pollo’

These data are carefully selected and are representative of the language generally despite being few.

We understand from the source that words like #12 are pronounced as two syllables. (Otherwise we would have transcribed #12 as **[faj]**.)

Additional information: the only consonants in apparent codas are **[s]**, **[ʂ]** and **[ʃ]**.

Additional information: no words like **[skata]** are ever found and no words like **[pistfa]** are ever found.

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[47] Some instructions for using these data are given in §5.5.1 and §9.11.

G.18 Korean

Genus: Korean (isolate). Narrow transcription. ISO 639-3: [kor]. Parts 1 and 2 are based on Cho (1967).

[t], [d] and [l] are reported to be dental, and [ɾ] is alveolar.

G.18.1 *Part 1.* Narrow transcription.[48]

		Gloss			Gloss
1.	pul	‘fire’	2.	tal	‘moon’
3.	pi	‘rain’	4.	toːl	‘stone’
5.	pap	‘cooked rice-meal’	6.	əpta	‘carry on back’
7.	nambi	‘saucepan’	8.	kilda	‘be long’
9.	nabi	‘butterfly’	10.	nalgæ	‘a wing’
11.	abədzi	‘father’	12.	pada	‘sea’
13.	pam	‘night’	14.	kanda	‘go’
15.	tsip	‘house’	16.	kandaɾi	‘a mussel’
17.	tsapta	‘catch’	18.	mogi	‘a mosquito’
19.	mək	‘ink’	20.	pəŋgæ	‘lightning’
21.	salsaɾi	‘a cunning knave’			

G.18.2 *Part 2.* Narrow transcription.[49]

		Gloss			Gloss
1.	naɾa	‘state’	2.	paɾe	‘at one’s foot’
3.	puɾə	‘on purpose’	4.	pal	‘foot’
5.	mal	‘horse’	6.	salgu	‘apricot’
7.	kalbi	‘ribs’	8.	nal	‘the day’
9.	sal	‘flesh’	10.	salsaɾi	‘a cunning knave’
11.	kilda	‘be long’			

Additional data: While no words are given that begin with either [l] or [ɾ], loanwords from English that in English begin with [ɹ] (such as *radio*, for example) are pronounced with [l].

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[48] One set of instructions for using these data is given in §14.14.

[49] One set of instructions for using these data is given in §15.9.

G.18.3 *Part 3.* The data in this part are in a somewhat more narrow transcription than those in Parts 1 and 2.[50]

		Gloss			Gloss
1.	son	'hand'	2.	ʃihap	'game'
3.	som	'bag'	4.	ʃilsu	'error'
5.	sosal	'novel'	6.	ʃipsam	'thirteen'
7.	sɛk	'color'	8.	ʃinho	'signal'
9.	us	'superior'	10.	maʃi	'delicious'
11.	sogɨm	'salt'	12.	ʃi	'poetry'
13.	sal	'flesh'	14.	kaps	'price'
15.	saɾaŋ	'love'	16.	muəs	'what?'
17.	susul	'operation'	18.	san	'mountain'
19.	səŋ	'castle'	20.	soʃik	'news'
21.	sam	'three'	22.	ʃinæ	'downtown'

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[50] One set of instructions for using these data is given in §18.6.

G.19 Spanish

ISO 639-3: [spa]. Romance genus. Harris (1969) and other sources. Narrow transcription. The general facts here are based on what might be called the Mexico City dialect. Other dialects vary in several details.

G.19.1 *Part 1.*

		Gloss			Gloss
1.	ˈsapo	‘frog’	2.	ˈfaɾo	‘headlamp’
3.	ˈsejo	‘seal’	4.	ˈfeo	‘ugly’
5.	ˈsona	‘zone’	6.	ˈfino	‘fine’
7.	ˈese	‘that one’	8.	ˈgafas	‘eyeglasses’
9.	ˈɛste	‘east’	10.	ˈbufo	‘comic’
11.	ˈkasa	‘house’	12.	ɛnˈtʃufe	‘socket’
13.	ˈmizma ∼ ˈmis̬ma ∼ ˈmisma	‘same’	14.	ˈxaro	‘pitcher’
15.	ˈazno ∼ ˈas̬no ∼ ˈasno	‘ass’	16.	ˈexe	‘axis’
17.	ˈrazɣo ∼ ˈras̬ɣo ∼ ˈrasɣo	‘feature’	18.	ˈpaxa	‘straw’
19.	ˈdɛzðe ∼ ˈdɛs̬ðe ∼ ˈdɛsðe	‘since’	20.	ˈkaxa	‘box’
21.	ˈizla ∼ ˈis̬la ∼ ˈisla	‘island’	22.	aˈxeno	‘foreign’
23.	ˈpas	‘peace’	24.	ˈoxo	‘eye’
25.	ˈas	‘ace’	26.	ˈmoŋxa	‘nun’

No examples of [f] or [x] in syllable-final position are found.
Alternate pronunciations are related to dialect and speech style.
The [s̬] notation here is nonstandard for IPA transcription, here meant to indicate partial voicing (beginning voiceless and ending voiced).
There are no alternate pronunciations of the other words (at least not for anything relevant to the facts under consideration).

G.19.2 *Part 2.* There are two pages of data.

	Word-initial			Intervocalic			Intervocalic			Word-final	
1.	ˈroxo	‘red’	2.	ˈpero	‘dog’	3.	ˈpeɾo	‘but’	4.	muˈxeɾ	‘woman’
5.	ˈraja	‘ray’	6.	ˈjero	‘iron’	7.	ˈfjeɾo	‘fierce’	8.	ruˈmoɾ	‘rumor’
9.	ˈreð̞	‘net’	10.	ˈkaro	‘coach’	11.	ˈkaɾo	‘expensive’	12.	koˈreɾ	‘to run’
13.	reˈsaɾ	‘to pray’	14.	ˈburo	‘burro’	15.	ˈpuɾo	‘pure’	16.	palˈpaɾ	‘to touch’
17.	ˈriko	‘rich’	18.	ˈbara	‘bar’	19.	ˈbaɾa	‘rod’	20.	(all infinitives end in [ɾ])	
21.	ˈrima	‘rhyme’	22.	ˈsero	‘hill’	23.	ˈseɾo	‘zero’			
24.	ˈrosa	‘rose’	25.	giˈtara	‘guitar’	26.	kiˈtaɾa	‘that she remove’			
27.	ˈruta	‘route’	28.	ˈbero	‘watercress’	29.	ˈmeɾo	‘mere’			
30.	ruˈmoɾ	‘rumor’	31.	fanfaˈron	‘show-off’	32.	baˈɾon	‘young man’			
							Syllable-final before consonant[51]			Phrase-final[52]	
						33.	ˈseɾð̞o	‘pig’	34.	(same words as above)	
						35.	ˈaɾma	‘firearm’			
						36.	ˈkoɾto	‘short’			
						37.	ˈpeɾla	‘pearl’			
						38.	ˈpjeɾna	‘leg’			

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[51] The descriptions of “r” in syllable-final position vary. Harris (1969) says it is a trill here. Navarro Tomás (1965) says it is a tap. Quilis & Fernández (1971) say it is one or the other and varies by the speech style.

[52] The tap at the end of a phrase has a very variable pronunciation, that varies from a tap to a multiple trill, voiced or voiceless, with or without friction (Stockwell & Bowen 1965:50). Harris (1969:46ff) claims that it is the trill that is found in utterance-final position.

SECOND POSITION
IN THE ONSET

39.	ˈembɾa	‘female’
40.	ˈkatɾe	‘cot’
41.	ˈtɾiβ̞u	‘tribe’
42.	ˈseð̞ɾo	‘cedar’
43.	ˈkaβ̞ɾa	‘goat’

SYLLABLE-INITIAL
AFTER A CONSONANT

44.	ˈonra	‘honor’
45.	sonˈrisa	‘smile’
46.	enˈrike	‘Enrique’
47.	alreð̞eˈð̞oɾ	‘near’
48.	israˈel	‘Israel’

G.20 Swampy Cree

Algonquian genus, ISO 639-3 [csw], Ontario, Canada. Narrow transcription. Ellis (1962?), Wolfart & Carroll (1981).[53]

The following facts are presented only for the sake of completeness; they do not affect how the data are analyzed for the purposes at hand. Neither source gives a very precise description of the complex phonetics of this language, and so some interpretations of their statements have had to be made. According to Wolfart & Carroll (1981), the vowel [e] is always long. Wolfart & Carroll (1981) use the equivalent of [ts] and [dz] where the equivalent of [tʃ] and [dʒ] are used in Ellis (1962?). Wolfart & Carroll (1981) do not represent [ʃ] differently than [s]. Other details may also vary. Stress is not consistently represented in the sources and so is not included here.

		Gloss			Gloss
1.	pəʰka:n	'separately'	2.	taʰkʊne:w	'she holds himher'
3.	ni:ʃoʃa:p	'twelve'	4.	mɪʰtʃe:twə	'many times'
5.	ta:nɪspi:j	'when?'	6.	o:də	'here'
7.	ma:gə	'but'	8.	təkʊʃɪn	'she arrives'
9.	pəskɪswe:w	'she shoots it'	10.	mi:dʒɪm	'food'
11.	ni:bɪnʊʰk	'last summer'	12.	me:dəwe:w	'she plays'
13.	ʊtʃɪʰtʃij	'hisher hand'	14.	kʊtək	'another'
15.	wa:bəme:w	'she sees himher'	16.	ətɪm	'dog'
17.	na:be:w	'man, husband'	18.	a:bətən	'it is useful'
19.	a:bɪʰtaw	'half'	20.	ɪʃkʊte:w	'fire'
21.	ʃi:ʃi:p	'duck'	22.	ki:ʃɪk	'sky'
23.	ʃi:ʃi:bək	'ducks'	24.	ki:ʃɪka:w	'it is day'
25.	wi:dʒɪhe:w	'she helps himher'	26.	ʊspɪtʊn	'hisher arm'
27.	mi:dʒɪwɪn	'food'	28.	tʃi:ma:n	'canoe'
29.	kɪta:w	'she consumes it'	30.	ʊspwa:gən	'tobacco pipe'
31.	ki:lə	'you'	32.	əpiw	'she sits'
33.	məskɪsɪn	'shoe, moccasin'	34.	tʃi:gəhəm	'she chops it'
35.	məskwə	'bear'	36.	ma:do:w	'she cries'
37.	məskwək	'bears'	38.	məte:w	'she is not here'

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[53] Sets of instructions for using these data are given in §14.14, §20.7, and §23.8.

G.21 Arabela

Zaparoan genus, ISO 639-3 [arl]. Peru. Narrow transcription. Rich (1963).[54]

The source presents two primary stress marks in some words; the second of these has been transcribed here as a secondary stress mark. Other details of the transcription here have been inferred from the description given. The third person glosses have been expanded from ‘he’ to ‘she’.

The words with final [ɜʔ] and [ɜ̃ʔ] are pronounced as [a] and [ã], respectively, when not in the final position of the “phonological phrase”.

The final glottal stop in these data does *not* appear when these words are *not* the last word in a “phonological phrase.”

Words with [x] may be pronounced with [ɣ] and vice-versa (details are not entirely straightforward).

		Gloss			Gloss
1.	ˈsowaɣɜʔ	‘wall’	2.	ˈʃijoɣwɜʔ	‘grease’
3.	ˈsuwaɣɜʔ	‘a fish’	4.	ˈnõːnũʔ	‘to be pained’
5.	mõnũʔ	‘to kill’	6.	ˈtawɪʔ	‘foreigner’
7.	nĩtjænũʔ	‘carry on back’	8.	ˈnĩːɣjæːʔ	‘she is pouring’
9.	ˈmj̃æ̃nũʔ	‘to swallow’	10.	ˈnẽːɣjæːʔ	‘is lying on back’
11.	ˈɦ̃ũw̃ɜ̃ʔ	‘a yellow bird’	12.	ˈnj̃æ̃ːˌɾiʔ	‘she laid it down’
13.	ˈsʊɾoʔ	‘chorro monkey’	14.	ˈpoˌsunãˌɦ̃ɜ̃ʔ	‘short person’
15.	ˈtuɣʊɾuʔ	‘palm frond’	16.	ˈnãˌnãːʔ	‘she is bathing’
17.	ˈmãːnũʔ	‘woodpecker’	18.	ˈɦ̃j̃ũːʃˌʃænõʔ	‘where I fished’
19.	ˈnãnũʔ	‘wild’	20.	ˈkɪʔ	‘father’
21.	ˈsaːˌxoʔ	‘corn’	22.	ˈnãˌxɪʔ	‘his father’
23.	ˈnũw̃ɜ̃ʔ	‘partridge’	24.	ˈkaˌnããˌɣɪʔ	‘our (excl.) father’
25.	ˈɦ̃ĩj̃æ̃nĩʔ	‘old woman’	26.	ˈkuwɔɣoʔ	‘hole’
27.	ˈkajæʔ	‘man’	28.	ˈkaˌɦ̃ĩʔ	‘axe’
29.	ˈmãn̩tɪʔ ∼ ˈmãnãtɪʔ	‘moth’			

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[54] Sets of instructions for using these data are given in §16.10 and §24.7. See also §29.1.5.1.

G.22 Tainae

ISO 639-3: [ago], Angan genus. Papua New Guinea. Impressionistic transcription. Carlson (1988).

G.22.1 *Part 1.* Regarding the data in Column 1: “Younger speakers (age 15 and under) in particular tend to use the [w] sound in place of the [v]” (Carlson 1988:34).[55]

	Younger Speakers	Older Speakers	Gloss
1.	ˈwagɪ	ˈwagɪ	‘*aibika* (a plant)’
2.	ˈwɛmiso	ˈwɛmiso	‘centipede’
3.	ˈaɾawo	ˈaɾawo	‘cockatoo’
4.	ˈtewɪ	ˈtewɪ	‘clear skies’
5.	ˈiwo	ˈiwo	‘penis’
6.	ˈawi	ˈawi	‘morning’
7.		*v....	(none exists)
8.		*β....	(none exists)
9.	ˈhawɛ	ˈhavɛ ~ ˈhaβɛ	‘waterfall’
10.	jɪˈwi	jɪˈvi ~ jɪˈβi	‘bark cape’
11.	kojˈwo	kojˈvo ~ kojˈβo	‘a banana (kind)’
12.	ˈiwo	ˈivo ~ ˈiβo	‘a lizard’
13.	ˈawi	ˈavi ~ ˈaβi	‘jungle’

G.22.2 *Part 2.* The following data are not arranged in any particular order.[56]

		Gloss			Gloss
1.	fajˈŋgijɪ	‘a banana’	2.	ˈdæ	‘lice’
3.	ˈbdajo	‘lorikeet’	4.	ˈabagi	‘woman’
5.	ˈpɨbɨgɪ	‘knot’	6.	ˈabagɪ	‘women’
7.	piˈjano	‘pig’	8.	ˈaɸɔ ~ ˈafɔ	‘man’
9.	ˈpuno	‘a lizard’	10.	aˈɸæ ~ aˈfæ	‘men’
11.	fajˈfuʔkwa	‘ten’	12.	ˈabo	‘father’
13.	jɪˈvi ~ jɪˈβi ~ jɪˈwi	‘bark cape’	14.	ˈbgwi	‘vine’
15.	kawoʔˈkawo	‘myna bird’	16.	ˈæbwɪ	‘nettles’
17.	aˈmobwo	‘a snake’	18.	ˈhimbijo	‘a pigeon’
19.	ˈsoʔpɛ	‘tobaco’	20.	ˈtomnɪ	‘a frog’
21.	ˈfɛmbɛ	‘a small lizard’	22.	ˈaŋgafɔ	‘real man’

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[55] One set of possible instructions for using these data is given in §18.6.

[56] Possible instructions for using these data are given in §14.14 and §23.8.

23.	ˈwiɸɪ ~ ˈwifɪ	‘twine’	24.	ˈm̩na	‘rain’
25.	ˈdondo	‘grasshopper’	26.	ˈm̩gaj	‘head’
27.	ˈpegi	‘round house’	28.	ˈtæ	‘fire’
29.	ˈiŋgjo	‘bird’	30.	ˈtijo	‘dog’
31.	ˈtuŋgwi	‘white ant’	32.	ˈagi	‘house’
33.	ˈtuŋgwɪ	‘white ants’	34.	ˈagɪ	‘houses’
35.	ˈwʊdæ	‘breadfruit tree’	36.	ˈhadɪ	‘urine’
37.	ˈpubwɪ	‘sugarcane (species)’	38.	ˈhaguɾɛ	‘smoke’
39.	iˈnandɪ	‘cassowary’	40.	ˈhæ	‘stones’
41.	ˈanduwaj	‘periwinkle’	42.	ˈojo	‘boy’
43.	ˈhambijɛ	‘sweet potato’	44.	fɨˈɾɨɾɨ	‘mountain’
45.	ˈhaɸɛ ~ ˈhafɛ	‘taboo’	46.	ˈiduwɪ	‘sorcery’
47.	ˈhaβɛ ~ ˈhavɛ ~ ˈhawɛ	‘waterfall’	48.	kiˈbaje	‘hook’
49.	ˈkɛmɔ	‘parrot’	50.	ˈnagɪ	‘water’
51.	hɛˈmbajɪ	‘a leaf’	52.	ajˈgjogo	‘a lizard’
53.	kojˈβo ~ kojˈvo ~ kojˈwo	‘a banana’	54.	koˈmbijo	‘crab’
55.	ˈabegɨ	‘a palm (tree)’	56.	ˈomgɪ	‘garden’
57.	paˈndawɪ	‘flesh’	58.	*ɾ...	(no words like this)
59.	ˈsɪ	‘mammal’	60.	*...VtV...	(no words like this)
61.	sɪbaˈndawɪ	‘meat’	62.	*...VkV...	(no words like this)
63.	ˈfejo	‘skin’	64.	*...VpV...	(no words like this)
65.	ˈpaɾɪ	‘black’			
66.	fejoˈbaɾɪ	‘black person’			
67.	fejoˈɾaɾɪ	‘white person’			
68.	ˈtaɾɪ	‘red’			
69.	ˈkwæ	‘*pitpit* grass’			
70.	ˈpɨmæ	‘skin’			
71.	ˈkwabɨmæ	‘*pitpit* husk’			

G.23 Tewa

ISO 639-3: [tew], Kiowa-Tanoan genus. New Mexico, United States. Speirs (1966). Narrow transcription.[57]

		Gloss		Careful Speech	Casual Speech (if different from Careful Speech)	Gloss
1.	p’ĩŋ ˨	‘mountain’	2.	sẽŋ		‘man’
3.	ʔõŋ	‘chin’	4.	sẽŋ t’aː	sẽn t’aː	‘thin man’
5.	tũ̃w̃̃æ̃̃	‘high’	6.	sẽŋbi	sẽmbi	‘from the man’
7.	nũː	‘ash’	8.	sẽŋwi		‘the man also’
9.	waː	‘egg’	10.	sẽŋ keːʔi		‘strong man’
11.	nãŋ	‘land’	12.	ʔõŋɸo	ʔõmɸo	‘beard’
13.	ȷ̃õnõ	‘four’	14.	p’ĩŋ tũ̃w̃̃æ̃̃	p’ĩn tũ̃w̃̃æ̃̃	‘high mountain’
15.	kã̃	‘lard’	16.	p’ĩŋbeː	p’ĩmbeː	‘plum’
17.	ɲæ̃ŋ	‘nest’	18.	mũː		‘bag’
19.	ka	‘leaf’	20.	mãŋ		‘hand’
21.	pãŋ	‘prisoner’	22.	mãŋxũ̃		‘finger’
23.	nã	‘I’	24.	mãm:ũ		‘glove’
25.	pĩŋ ˦	‘heart’	26.	θaː		‘day’
27.	w̃ĩŋ	‘mouse’	28.	beː		‘fruit’
29.	hæ̃ŋ	‘tongue’	30.	ʔowe		‘over there’
31.	sõŋ	‘firewood’	32.	pũ̃w̃̃æ̃̃ʔi		‘mirror’
33.	fũ̃ȷ̃̃ũ̃	‘fly’	34.	mã:hũ̃ː		‘owl’
35.	t’æ̃̃hki	‘all’				

The double tilde in this exercise represents a stronger degree of nasalization than that shown by the single tilde. (The IPA does not provide a way to indicate this in narrow transcriptions.) The lighter nasalization varies in this language; it is presented as having two degrees in the source of the data.

Two words are given with tone marks following them, namely ‘mountain’ (low tone) and ‘heart’ (high tone). Tone has not been shown for the other words.

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[57] Sets of possible instructions for using these data are given in §16.10 and §22.8.

G.24 Nabak

ISO 639-3 code [naf]; Finisterre-Huon genus. Papua New Guinea. Data from an unpublished manuscript (Nabak Phonemic Statement, 1971) by Edmund Fabian & Grace Fabian. Impressionistic transcription (adapted to the IPA, with some slight liberties taken).

G.24.1 *Part 1.* The focus of this set of data is the consonants.[58]

		Gloss			Gloss
1.	sɛt	‘road’	2.	nup	‘yam’
3.	zut ~ dzut	‘two’	4.	nanzaŋ ~ nandzaŋ	‘stone’
5.	tʰuk	‘three’	6.	an	‘man’
7.	okʰak	‘baby’	8.	saŋgip	‘betel nut’
9.	kʰogŋaŋ	‘green’	10.	nugŋaŋ	‘heavy’
11.	bap	‘floor’	12.	kʰululuŋ ~ kʰuɾuɾuŋ	‘sky’
13.	bekʰanaŋ	‘bad’	14.	sepʰaloŋ ~ sepʰaɾoŋ	‘stairs’
15.	nabɜk	‘Nabak (language)’	16.	sali ~ saɾi	‘owl’
17.	dip	‘ginger’	18.	tʰalak ~ tʰaɾak	‘naked’
19.	goŋ	‘maggot’	20.	witʰilip ~ witʰiɾip ~ vitʰilip ~ vitʰiɾip	‘mud’
21.	aɣɜ ~ agɜ	‘bird’	22.	we ~ ve	‘spirit’
23.	tʰɔɣɔ ~ tʰɔgɔ	‘wind’	24.	wanam	‘machete’
25.	zit ~ dzit	‘animal’	26.	niwet ~ nivet	‘coconut’
27.	zawat ~ dzawat	‘sick’	28.	jek ~ ʒek	‘no’
29.	tʰozɪn ~ tʰodzɪn	‘he comes down’	30.	ju ~ ʒu	‘firstborn son’
31.	zanza ~ dzandza	‘cloud’	32.	pʰet	‘knee’
33.	zikʰɜt ~ dzikʰɜt	‘eye’	34.	bet	‘hand’
35.	sawɜkʷikʷit ~ sawɜkpikpit	‘cassowary’	36.	ampʰalak ~ ampʰaɾak	‘lima bean’
37.	nap	‘loincloth’	38.	jɜmbæ ~ ʒɜmbæ	‘beard’
39.	jeŋ ~ ʒeŋ	‘grandfather’	40.	ajoŋgɜ (*aʒoŋgɜ)	‘moon’
41.	ŋaŋ	‘banana’	42.	gɜŋ	‘you’
43.	pʰat	‘wood borer’	44.	nɜŋ	‘I’
45.	gat	wild sugar ‘cane shoot’	46.	sum	‘grave’
47.	tʰæk	‘string’	48.	sip	‘blood’
49.	sɜkʷɛp ~ sɜkpɛp	‘quickly’	50.	ambasak	‘water’
51.	gʷik ~ gbik	‘worm’	52.	tʰip	‘dung’

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[58] Instructions for using these data are given in §17.9, §18.6 and §22.8.

53.	sajoŋgʷam ~ sajoŋgbam	‘lizard’	54.	tʰunduɜ	‘lake’
55.	gʷɜsɛp ~ gbɜsɛp	‘black magic’	56.	anduk	‘last child’
57.	begʷɜt ~ begbɜt	‘Tuesday’	58.	kʰililiŋ ~ kʰiɾiɾiŋ	‘spherical’
59.	bim	‘neck’	60.	tʰu	‘water’
61.	dzawak ~ zawak	‘saliva’	62.	pʰuluk ~ pʰuɾuk	‘bamboo bark’
63.	kʷaŋ ~ kpaŋ	‘grass’	64.	pʰulut ~ pʰuɾut	‘passion fruit’
65.	sæk	‘skin’	66.	dek	‘ant’
67.	map	‘rain’	68.	bap	‘floor’
69.	didik	‘bush’	70.	bunduŋ	‘hat’
71.	butʰuk	‘sweet potato’	72.	pʰusak	‘hole’
73.	sæŋen	‘yesterday, tomorrow’	74.	sobmaŋ	‘black’
75.	kʰibmaŋ	‘hot’	76.	sɪnaŋ	‘leaf’
77.	bagŋaŋ	‘soft’	78.	okʰak	‘baby’
79.	dolagŋaŋ ~ doɾagŋaŋ	‘good’	80.	gʷat ~ gbat	‘ring finger’
81.	tʰaŋganaŋ	‘used, old’	82.	tʰam	‘dog’
83.	ambɜsæ	‘leech’	84.	ŋɜndaŋ	‘precipice’
85.	ŋɛp	‘alright’	86.	gɜlɜŋ ~ gɜɾɜŋ	‘lost’
87.	kʰɔ	‘ashes’	88.	kʰɜlɜŋ ~ kʰɜɾɜŋ	‘mountain’
89.	lum (*ɾum)	‘conch shell’	90.	ambɜjɜk (*ambɜʒɜk)	‘lightning’
91.	asoŋ	‘nut tree’	92.	namɜŋ	‘red’
93.	isigŋaŋ	‘small’	94.	luŋaŋ (*ɾuŋaŋ)	‘ditch’

G.24.2 *Part 2.* (Not yet assembled.)

G.25 Murui Huitoto

ISO 639-3: [huu]. Huitoto genus, Peru & Colombia. Burtch (1976). See also Burtch & Wise (1968).

All of the examples are in third person. The suffix [–e] is third person singular subject in these words.

The distribution of the allomorphs [–t] and [–d] (a verb suffix that may have a basic form that is more than these consonants) has not been explained or understood. But it is not the purpose of this exercise. Burtch & Wise (1968:24) say that the voiceless allomorph occurs when "a member of class II or class IV and some class III verb roots immediately precede, or ... when thematic suffix 111, 181, 241, or 261 immediately precedes," and that the voiced allomorph occurs elsewhere.

The difference between #10a [ˈθai.te] and #10c [ˈθaiːte] might easily have been transcribed differently, such as (impressionistically) #10a [ˈθaĭte] and #10c [ˈθaite]—short high vowel vs. slightly longer high vowel—or even as #10a [ˈθaj.te] and #10c [ˈθa.i.te]. This is a case where one's analysis may sharpen one's ear and suggest that good recordings of these words in context would be very interesting.[59]

	A	B	C	D	
	3sg subject Non-future	3sg subject Negative non-future	3sg subject Future	3sg subject Negative future	Gloss
1.	ˈekɔnɔte	ˈekɔnɔɲede	ˈekɔnɔite	ˈekɔnɔɲeite	'open (door)'
2.	ˈdɔtade	ˈdɔtaɲede	ˈdɔtahite	ˈdɔtaɲeite	'throw out'
3.	ˈɾɔte	ˈɾɔɲede	ˈɾɔite	ˈɾɔɲeite	'sing'
4.	ˈhɯɸanɔte	ˈhɯɸanɔɲede	ˈhɯɸanɔite	ˈhɯɸanɔɲeite	'play'
5.	ˈhɯte	ˈhɯɲede	ˈhɯite	ˈhɯɲeite[60]	'plant yucca'
6.	ˈite	ˈiɲede	ˈiːte	ˈiɲeite	'be, have, give'
7.	ˈbite	ˈbiɲede	ˈbiːte	ˈbiɲeite	'come'
8.	ˈnɔide	ˈnɔiɲede	ˈnɔite	ˈnɔiɲeite	'bathe oneself'
9.	ˈtɯɰede	ˈtɯɰeɲede	ˈtɯɰeite ∼ ˈtɯɰehite	ˈtɯɰeɲeite	'cut (tree)'
10.	ˈθai.te	ˈθai.ɲede	ˈθaiːte	ˈθai.ɲeite	'dance'

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[59] Instructions for using these data are given in §21.12 and §24.7.

[60] It is presumed that there is a typographical error in the source on page 133. The form given here is an emendation.

G.26 Tetelcingo Nahuatl

ISO 639-3 code [nhg]. Aztecan genus. State of Morelos, Mexico. Pittman (1961), Brewer & Brewer (1962), David Tuggy, personal communication. Narrow impressionistic transcription.

There are no syllables in the language of the types [wo], [wu], [β̞o], [β̞u].

These data do not include loanwords from Spanish. (Such data do not conform to the patterns shown here. In particular, the effect of adopting words with f and b from Spanish is not considered here.)

What is transcribed here as the approximant [β̞] appears in the most detailed technical source as the fricative [β], and what is transcribed here as [β̞̊] is given in that source as [f]. The friction is very light, and there is an indeterminacy in the point of articulation between bilabial and labiodental. An impressionistic transcription might just as easily have used those other symbols or others.[61]

		Gloss			Gloss
1.	ˈɪɬβ̞̊ɪtɬ	‘party’	2.	ˈβ̞iktɬa	‘day after tomorrow’
3.	ˈiwa	‘and’	4.	ɔˈwakatɬ	‘avocado’
5.	ˈsowatɬ	‘woman’	6.	ˈombets	‘she fell down’
7.	ˈβ̞ejɪ	‘large’	8.	nɪkˈβ̞̊ika	‘I carry it’
9.	ˈsɔˑwatɬ	‘sore (n.)’	10.	nɪˈkwika	‘I sing’
11.	noˈkwateʃ	‘my brains’	12.	ˈkwalːi	‘good’
13.	ˈtehw̥a	‘we’	14.	iʃteloˈlohw̥a	‘hisher eyes’
15.	ˈkwaβ̞ɪtɬ	‘tree’	16.	ˈwɔˑhkɪ	‘it is dry’
17.	ˈwɔˑwɔˑtɬ	‘a caterpillar’	18.	ajhw̥atʃˈmulɪ	‘*mole de pipián* sauce’
19.	ahˈw̥atʃtɬɪ	‘drizzle’	20.	ˈβ̞entɬɪ	‘offering’
21.	ˈahw̥atɬ	‘glochid’	22.	β̞iˈtekuk	‘lightning struck’
23.	β̞eˈʃulutɬ	‘turkey’	24.	kohβ̞̊ɪˈtɪja	‘she sends him on his way’
25.	ˈβ̞ilutɬ	‘a bird’	26.	moneɬw̥ajuˈtɪja	‘it is rooted’
27.	momaɬˈβ̞̊ɪja	‘it is saved’	28.	iˈʃɪhj̥o	‘its leafage’
29.	ɪɬˈβ̞̊ɪkak	‘sky’	30.	ˈʃɪβ̞ɪtɬ	‘leaf; year’
31.	ˈkalːi	‘house (abs.)’			

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[61] Sets of instructions for using these data are given in §18.6 and §29.15.

G.27 Gabri de Darbé

ISO 639-3 code [gab]. Chari-Logone genus (Chadic family), Chad. Data from James Roberts (personal communication). Narrow transcription. Tone has not been marked, however.[62]

		English	Français			English	Français
1.	miɾibiŋ	'a plant'	'une plante'	2.	sulɔjɛ	'to twist'	'tordre'
3.	aŋgulo	'a flying insect'	'insecte volante'	4.	kɨndaɾe	'egoism'	'égoisme'
5.	kobɨde	'to follow' (hab.)	'suivre' (hab.)	6.	giɾɨmbale	'cloud'	'nuage'
7.	bɛɾɨnɛ	'message'	'message'	8.	habɨle	'to trim'	'tailler'
9.	duɾoj	'interior'	'intérieur'	10.	gumɔdʒɨ	'shirt'	'chemise'
11.	duɾɔ	'right'	'droit'	12.	tɔŋgɨlɛ	'ankle'	'cheville'
13.	kodʒugo	'deception'	'tromperie'	14.	busɔnɛ	'to plant'	'planter'
15.	miɾegi	'on knees'	'à genoux'				

Additional information: no words begin with [mb], [nd], or [ŋg], but words do begin with [dʒ].

G.28 Gor

ISO 639-3 code: [gqr]. Sara genus, Chad. Roberts (2003). Narrow transcription.[63]

		English	Français			English	Français
1.	ndì	'rain'	'pluie'	2.	gɨ̃n	'buttock'	'fesse'
3.	sī	'stick'	'fagot'	4.	ḿ̩māsī	'a plant'	'une plante'
5.	tɨ́ɾ	'to boil'	'bouiller'	6.	tɨ̄w	'glue'	'colle, cire'
7.	ŋgàlì	'manioc'	'manioc'	8.	bí	'to turn'	'tournoyer'
9.	tí	'to swell'	'enfler'	10.	dɨ́l	'a tree'	'caïlcédrat'
11.	jɨ́ɾ	'sorrel'	'oseille'	12.	lī	'snake'	'serpent'
13.	ndɨ̄ɾ	'to cook'	'cuire'	14.	nɨ̃m̄	'rat'	'rat'
15.	ɓī	'sleep'	'sommeil'	16.	mbī	'ear'	'oreille'
17.	pɨ̄l	'hearth'	'foyer'	18.	dʒī	'hand'	'main'

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[62] Sets of instructions for using these data are given in §9.1.3 and §17.9 and §23.8.

[63] Sets of instructions for using these data are given in §9.1.4, §17.9 and §23.8.

G.29 Kotoko d'Afade

ISO 639-3 code: [aal]. Biu-Mandara genus, Cameroon and Nigeria. Data from James Roberts, personal communication. Narrow transcription.[64]

		English	Français			English	Français
1.	**suɾuŋ**	'to know'	'savoir'	2.	**ŋk'aŋ**	'fingernail'	'ongle'
3.	**kɨneɾi**	'a squirrel'	'un écureuil'	4.	**andɾa**	'a legume'	'pois d terre'
5.	**maɾone**	'comrade'	'camarade'	6.	**nej**	'hippopotamus'	'hippopotami'
7.	**eŋgɨlɨm**	'a fig tree'	'un figuier'	8.	**muɗanu**	'sorcerer'	'sorcier'
9.	**mɨskpaŋ**	'horse'	'cheval'	10.	**naɾge**	'storm'	'orage'
11.	**anɨm**	'south'	'Sud'	12.	**saŋkɨŋ**	'snake'	'serpent'

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[64] One set of instructions for using these data is given in §22.8.

G.30 Chumburung

ISO 639-3 code: [ncu]. Kwa genus, Ghana. Snider (1990) and Keith Snider, personal communication. Narrow transcription.

The symbol [ɘ] here is meant to represent the [–ATR] version of [ɨ]. (For this [-ATR] vowel, Snider (1990) uses a barred iota.) It is distinct from the vowel [ə], which is a [+ATR] vowel. Some of the syllables in the data below are noun class prefixes. The double grave accent here represents a low falling pitch; this is not standard IPA use of this diacritic.

G.30.1 *Chumburung, Part 1.* One focus of these data is the set of nasal consonants; the vowel alternations are another focus. [65]

	Phrase-final	Phrase-medial	Gloss		Phrase-final	Phrase-medial	Gloss
1.	ɔ̀ɲáɾí	ɔ̀ɲáɾɘ́	‘man’	2.	kòntó	kòntó	‘snail’
3.	kámé	kámə́	‘belly’	4.	lə̀mbʷɪ̀ʔ	lə̀mbʷɪ̀ː	‘tortoise’
5.	kíɲápʊ̂	kíɲápʊ̂	‘breast’	6.	bʊ̂ŋ	bʊ̂ŋ	‘river’
7.	kùŋúɾíʔ	kùŋúɾíː	‘knee’	8.	tʊ̀ŋkʊ́ʔ	tʊ̀ŋkʊ́ː	‘place’
9.	dʒímpúnî	dʒímpúnɨ̂	‘anus’	10.	tɪ̀kàndáʔ	tɪ̀kàndáː	‘sugarcane’
11.	kɨ́lâŋ	kɨ́lâŋ	‘hip’	12.	álâŋ	álâŋ	‘hips’
13.	kítʃínî	kítʃínɨ̂	‘vein’	14.	lə̂ŋ	lə̂ŋ	‘root’
15.	kɪ̀ɲáɾí	kɪ̀ɲáɾɘ́	‘name’	16.	ɪ̀lə́ŋ èsá	ɪ̀lə́ŋ èsá	‘three roots’
17.	kíɲá	kíɲá	‘slave’	18.	áláŋ àsá	áláŋ àsá	‘three hips’
19.	ɲàɾȉ	ɲàɾɘ̏	‘friend’	20.	áŋkòl	áŋkòl	‘parrot’
21.	náːtí	náːtɘ́	‘cow’	22.	kpáŋŋá	kpáŋŋá	‘horse’
23.	ɱ̀fɔ́	ɱ̀fɔ́	‘fat’	24.	ǹdɔ́	ǹdɔ́	‘today’
25.	ɪ̀méʔ	ɪ̀méː	‘nasal mucus’	26.	mʊ́ɾɔ́bɔ́	mʊ́ɾɔ́bɔ́	‘nose’
27.	ḿbɔ̂ŋ	ḿbɔ̂ŋ	‘brains’	28.	kùŋú	kùŋú	‘head’

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[65] One set of instructions for using these data is given in §17.9.

G.30.2 *Chumburung, Part 2: Nouns and pronouns.* The focus of these data is the set of round vowels and their distribution. Other vowels may occur in words with round vowels, but these are not presented here. These data are limited to nouns and pronouns; data from verbs are similar but are not included here.[66]

		Gloss			Gloss			Gloss
1.	**wú**	‘thorn’	2.	**kúfú**	‘fear (n.)’	3.	**m̩̀búɾúfó**	‘urine’
4.	**ɲ̩̀tʃú**	‘water’	5.	**kùsúŋ**	‘work’		***…u…ʊ**	
6.	**dùŋ**	‘heart’	7.	**kùŋú**	‘head’		***…u…ɔ**	
			8.	**kúdʒó**	‘yam’			
			9.	**kùsûŋ**	‘doorway’			
10.	**mʊ́**	‘I’	11.	**kʊ̀kʷɔ́**	‘debt’	12.	**kʊ̀kʊ́ŋkʊ́ʔ**	‘one’
13.	**fʊ́**	‘you (sg.)’	14.	**kʊ̀wʊ́**	‘snake’	15.	**kʊ̀kʊ̀tɔ̏**	‘fingernail, claw’
16.	**mʊ̀**	‘she, he’	17.	**tʊ̀ŋkʊ́ʔ**	‘place’	18.	**mʊ́ɾɔ́bɔ́**	‘nose’
19.	**dʊ̂ŋ**	‘enemy’	20.	**sʊ́sʊ̏**	‘sky’		***…ʊ…o**	
21.	**bʊ̂ŋ**	‘river’	22.	**kʊ̀lɔ́**	‘illness’		***…ʊ…u**	
			23.	**kʊ́dʊ́ʔ**	‘farm’			
			24.	**kòntó**	‘snail’	25.	**tʃòɲtʃúɾôŋ**	‘loincloth’
			26.	**dʒòːnɔ̏**	‘dog’		***…o…ʊ**	
							***…o…ɔ**	
27.	**lɔ́**	‘sore (n.)’	28.	**kʷɔ́ꜜtɔ́**	‘crab’	29.	**ɔ̀lʊ́pʊ́**	‘weaver’
30.	**bɔ́**	‘hole’	31.	**ɔ́fɔ́**	‘stranger’	32.	**ɔ́dɔ́pʊ̂**	‘farmer’
33.	**sɔ́**	‘smell (n.)’						
34.	**ǹ̩dɔ́**	‘today’					***…ɔ…o**	
35.	**ń̩sɔ́**	‘ash’					***…ɔ…u**	
36.	**ɱ̩̀fɔ́**	‘fat’						

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[66] One set of instructions for using these data is given in §23.8.

G.30.3 *Chumburung, Part 3: Noun prefix for humans.* Many (but not all) nouns referring to humans use a classifier prefix with a mid back vowel that varies in tone and the feature [ATR] (when singular) and a classifier prefix with a low vowel (when plural). The plural affix is a low vowel that varies phonetically in the feature [ATR]. (The low vowels do not contrast with each other, however.)[67]

The affixes have been separated with hyphens to make the facts more obvious.

Two words in this small set have an “irregularity”. Can you spot which ones they are?

	Singular	Plural	Gloss	
1.	ɔ̀-ɲáɾí	à-ɲáɾí	‘man’	
2.	ɔ̀-tʃíʔ	à-tʃíʔ	‘woman’	
3.	ɔ̀-lʊ́pʊ́	à-lʊ́pʊ́	‘weaver’	cf. lʊ̏ ‘(to) weave’
4.	ò-kɨ̀sɨ́pʊ́	ə̀-kɨ̀sɨ́pʊ́	‘fetish priest’	
5.	ɔ̀-tʃápʊ́	à-tʃápʊ́	‘doctor’	
6.	ɔ́-kpámpʊ̂	á-kpámpʊ̂	‘hunter’	cf. fə̀nɪ̏ ‘(to) hunt’
7.	ɔ̀-pʷɛ́ːpʊ́	à-pʷɛ́ːpʊ́	‘mud worker’	cf. pʷɛ̀ʔ ‘(to) build’
8.	ó-kpé	ə́-kpé	‘witch’	
9.	ò-jú	ə̀-jú	‘thief’	
10.	ó-wúɾê	ə́-wúɾê	‘chief’	
11.	ɔ́-fɔ́	á-fɔ́	‘stranger’	
12.	ɔ̀-jàwʊ̀dʒípʊ̂	à-jàwʊ̀dʒípʊ̂	‘trader’	

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[67] One set of instructions for using these data is given in §23.8.

G.30.4 *Chumburung, Part 4: Noun prefix allomorphs (a particular class, singular).* The words are given here as they appear in a word-list (a phrase-final context).

		Gloss			Gloss			Gloss
A — 1.	**kʊ̀-kʊ̀tɔ̏**	‘claw’	B — 2.	**kí-dʒí**	‘seed’	C — 3.	**kə́-fʊ́ɾî**	‘rock’
4.	**kʊ̀-wɔ́**	‘snake’	5.	**kí-jíʔ**	‘tree’	6.	**kə́-pʊ́**	‘forest’
7.	**kù-ɲú**	‘head’	8.	**kí-tʃínî**	‘vein’	9.	**kə̀-pàɾí**	‘pool’
10.	**kù-kùtí**	‘orange’	11.	**kì-dʒàfʊ́**	‘bark’	12.	**kɨ̀-fɐ́ɾí**	‘moon’
13.	**kù-nòkʷiʔ**	‘beard’	14.	**kì-ɲáɾí**	‘name’	15.	**kɨ̀-bú**	‘stone’
16.	**kɨ̀-téʔ**	‘feather’						
17.	**kɨ̀-kɨ̀ɾéʔ**	‘silk cotton tree’						
18.	**kə̀-kàtɔ̏**	‘eye’						
19.	**kə̀-sàʔ**	‘nest’						
20.	**kə̀-sə́bɔ́**	‘ear’						

	(allophones)		(allophones)		(allophones)		(allophones)		(allophones)					
	i	**ɨ**	**ɪ**	**ɘ**	**e**	**ə**	**ɛ**	**ɜ**	**ɐ**	**a**	**u**	**ʊ**	**o**	**ɔ**
[high]	+	+	+	+	–	–	–	–	–	–	+	+	–	–
[low]	–	–	–	–	–	–	–	–	+	+	–	–	–	–
[ATR]	+	+	–	–	+	+	–	–	+	–	+	–	+	–
[round]	–	–	–	–	–	–	–	–	–	–	+	+	+	+
[palatal]??	+	–	+	–	+	–	+	–	–	–	–	–	–	–

Table 6. The nine phonemic vowel qualities of Chumburung

(The sounds **[ə]**, **[ɜ]** and **[ɐ]** may not be distinguishable.)

G.31 Tabaru

ISO 639-3 code: [tby]. North Halmaheran genus, Indonesia. Kotynski (1988a, 1988b, 1998). Broad transcription. (Be sure to read the notes at the end of the data, perhaps on a second page.)[68]

		Gloss			Gloss
A — 1.	ˈgoa	‘buttocks’	2.	paˈɲake	‘illness’
3.	ˈmao	‘to feel’	4.	beˈleka	‘shoulder’
5.	ˈʔawe	‘thread’	6.	saˈmaka	‘watermelon’
7.	ˈʔuɾu	‘mouth’	8.	kaˈkawo	‘ash’
9.	ˈsiɾa	‘first’	10.	moˈdidi	‘two’
11.	ˈɾio	‘footprint’	12.	tʃaˈana	‘pants’
13.	ˈbiɾa	‘rice’	14.	moˈdoka	‘to marry’
15.	ˈgeɾi	‘brother-in-law’	16.	doˈwoŋi	‘sand’
B — 17.	ˈodomo	‘to eat’	18.	ˈsowoko	‘fruit’
19.	ˈʔakeɾe	‘water’	20.	ˈwekata	‘wife’
21.	ˈgogeɾe	‘to sit’	22.	ˈsauku	‘hot’
23.	ˈnaoko	‘fish’	24.	ˈobiɾi	‘night’
25.	ˈkoana	‘sultan’	26.	ˈosisi	‘to urinate’
27.	goˈsomaɲa	‘crocodile’	28.	tumuˈdiiɲi	‘seven’
29.	guˈmutuku	‘rope’	30.	boˈʔosuku	‘grave’
C — 31.	ˈkula	‘to give’	32.	kuˈlasi	‘to still give’
33.	ˈtike	‘to look for’	34.	tiˈkesi	‘to still look for’
35.	ˈʔokeɾe	‘to drink’	36.	ʔokeˈɾosi	‘to still drink’
D — 37.	ˈmake	‘to see’	38.	maˈkewa	‘to not see’
39.	tuˈʔuɾu	‘to follow’	40.	tuʔuˈɾuwa	‘to not follow’
41.	boˈdito	‘to have misfortune’	42.	bodiˈtowa	‘to not have misfortune’
43.	ˈpidili	‘to release’	44.	pidiˈluwa	‘to not release’
45.	ˈodomo	‘to eat’	46.	odoˈmuwa	‘to not eat’
47.	paˈʔasana	‘to beat’	48.	paʔasaˈnuwa	‘to not beat’
49.	ˈpunusu	‘to be full’	50.	punuˈsuwa	‘to not be full’

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[68] One set of instructions for using these data is given in §29.15.

Group A: Note the penultimate stress.

Group B: Note the antepenultimate stress. (Observation: words of this pattern always have identical vowels in the last two syllables. However, some words in Group A also have identical vowels in the last two syllables.)

Groups C and D: These examples show that if a word has a suffix (see the second column), stress always falls on the penultimate syllable.

G.32 American English (an East coast dialect)

ISO 639-3 code: [eng]. Germanic genus.

This chart lists words illustrating the monophthongs of English (excluding schwa) as presented in Ladefoged (1999), using the symbols in column (3) on page 42 of that work, but drawn from an East coast dialect.

		1	2	3	4	5	6
		ɪ	**ɛ**	**æ**	**ɑ**	**ʊ**	**ʌ**
A	**_p**	*rip*	*pep*	*cap*	*cop*		*cup*
B	**_b**	*rib*	*ebb*	*cab*	*cob*		*rub*
C	**_m**	*dim*	*gem*	*dam*	*bomb*		*rum*
D	**_mp**	*limp*	*hemp*	*ramp*	*romp*		*lump*
E	**_f**	*glyph*	*deaf*	*laugh*		*hoof*	*rough*
F	**_v**	*give*	*rev*	*have*			*love*
G	**_ft**	*lift*	*left*	*raft*			
H	**_t**	*sit*	*set*	*sat*	*cot*	*soot*	*cut*
I	**_d**	*lid*	*led*	*lad*	*rod*	*good*	*bud*
J	**_st**	*mist*	*pest*	*past*			*gust*
K	**_l**	*dill*	*tell*	*pal*		*pull*	*gull*
L	**_n**	*din*	*ten*	*can*	*swan*		*run*
M	**_nt**	*lint*	*rent*	*pant*			*runt*
N	**_nts ? _ns ?**	*rinse*	*fence*	*dance*			
O	**_nd**	*wind*	*bend*	*band*	*pond*		*fund*
P	**_s**	*kiss*	*less*	*lass*		*puss*	*fuss*
Q	**_z**	*fizz*	*fez*	*as*			*buzz*
R	**_tʃ**	*rich*	*fetch*	*match*	*notch*	*butch*	*clutch*
S	**_dʒ**	*ridge*	*ledge*	*badge*	*lodge*		*fudge*
T	**_ntʃ**	*cinch*	*bench*	*ranch*			*lunch*
U	**_ndʒ**	*singe*	*avenge*	*flange*			*lunge*
V	**_k**	*lick*	*wreck*	*rack*	*rock*	*book*	*luck*
W	**_g**	*pig*	*peg*	*rag*	*bog*		*bug*
X	**_ŋ**	*ring*		*rang*			*lung*
Y	**_ŋk**	*link*		*bank*			*punk*
Z	**_ɹ**						
AA	**_ɹk**				*lark*		
BB	**_#**						

This chart lists words for the long vowels and the diphthongs of English as presented in Ladefoged (1999), using the symbols in column (3) on page 42, drawn from an East coast dialect in which the vowel **[ɔː]** occurs (and so that vowel is also added).

		1 **aɪ**	2 **iː**	3 **eː**	4 **oː**	5 **ɔː**	6 **uː**	7 **aʊ**	8 **ɔɪ**	9 **ɚː**
A	**_p**	*ripe*	*keep*	*cape*	*cope*		*dupe*			*burp*
B	**_b**	*tribe*	*grebe*	*babe*	*robe*	*daub*	*tube*			*curb*
C	**_m**	*dime*	*deem*	*dame*	*dome*		*doom*			*berm*
D	**_mp**									
E	**_f**	*life*	*reef*	*safe*	*loaf*	*cough*	*proof*			*surf*
F	**_v**	*dive*	*grieve*	*save*	*rove*		*prove*			*serve*
G	**_ft**					*loft*				
H	**_t**	*site*	*seat*	*fate*	*coat*	*taut*	*boot*	*gout*		*curt*
I	**_d**	*ride*	*read*	*raid*	*road*	*fought*	*rude*		*void*	*bird*
J	**_st**	*heist*	*feast*	*paste*	*post*	*lost*	*roost*	*roust*	*hoist*	*burst*
K	**_l**	*pile*	*peel*	*pail*	*pole*	*tall*	*tool*	*fowl*	*coil*	*girl*
L	**_n**	*dine*	*green*	*cane*	*cone*	*lawn*	*rune*	*town*	*coin*	*burn*
M	**_nt**	*pint*		*faint*		*taunt*		*count*	*point*	
N	**_nts ? _ns ?**							*pounce*		
O	**_nd**	*kind*	*fiend*					*bound*		
P	**_s**	*rice*	*peace*	*face*	*gross*	*toss*	*loose*	*house*	*rejoice*	*purse*
Q	**_z**	*rise*	*cheese*	*phase*	*hose*	*gauze*	*lose*	*rouse*	*noise*	
R	**_tʃ**		*beach*		*coach*		*hootch*	*couch*		*birch*
S	**_dʒ**			*rage*			*huge*			*purge*
T	**_ɲtʃ**					*launch*				
U	**_ɲdʒ**							*lounge*		
V	**_k**	*like*	*beak*	*rake*	*poke*	*talk*	*fluke*			*lurk*
W	**_g**					*dog*				*iceberg*
X	**_ŋ**					*long*				
Y	**_ŋk**					*honk*				
Z	**_ɹ**	*tire*	*beer*	*bare*	*bore*		*moor*	*sour*		
AA	**_ɹk**				*pork*					
BB	**_#**	*buy*	*bee*	*bay*	*low*	*law*	*two*	*cow*	*boy*	*fir*

Questions that arise: 1) Is the analysis of **ɚ** the best one?

G.33 Tlachichilco Tepehua

ISO 639-3 code: [tpt]. Totonacan genus, Mexico; Watters (1987) and personal communication (for more explanation).[69] Words are given in impressionistic transcription *as they are pronounced in isolation* in the majority dialect unless a context is given. (Watters 1980 gives data that are very similar, but not identical, as those data are from a minority dialect of the same language.)

		Gloss			Gloss
1.	ˈʃqə̃	‘fly’	2.	ˈkmɪɬ	‘I came’
3.	ˈʃqãː	‘corn husk’	4.	ˈkniːɬ	‘I died’
5.	ˈhʊ̃ *	‘hummingbird’	6.	ˈkliːtəhʊ̃	‘I have’
7.	ˈʔũː	‘wind’	8.	ˈksaːɬ	‘I hit him’
9.	ˈʃɪɬ	‘mucus’	10.	ˈnau̯ɬ	‘she said’
11.	ˈɬmãː	‘wide’	12.	ˈkau̯	‘ten’
13.	ˈtəɬpə̥	‘cliff’	14.	ˈtãũ̯	‘one’
15.	təɬˈmãː	‘tall’	16.	ˈʔoʃ	‘good’
17.	ˈɬkəkə̥	‘spicy’	18.	ʔəˈhuːkɪ̥	‘deer’
19.	ˈslʊɬ	‘lizard’	20.	ləqˈtʃʊɬ	‘eye’
21.	ˈβiːɬ	‘she sits’	22.	təβɪˈlaːnəɬ **	‘they sit’
23.	ˈɬtətai̯	‘she sleeps’	24.	ˈskaːtə̥	‘flea’
25.	hãːntʊkpaːsˈtəkɬɪ̥	‘I didn’t think’	26.	ˈskəkətɪ̥	‘fever’
27.	təˈβaːnə̃ntʃə tˀətˀɪ̥	‘when did you come?’	28.	ˈməkɬkʊ̥	‘light’
29.	ˈpʊɬʔə̃	‘mud’	30.	ˈhuɬˈtʃə̃	‘sun’
31.	qəˈɬːʊw̥	‘a lot of plant-type’	32.	ˈɬʊw̥	‘a lot’
33.	ləkaːˈkiːs	‘five places’	34.	ˈʃqoi̯	‘leaf’
35.	ʔəqˈskiːs	‘five flat things’	36.	ˈʃə̃nti̥	‘flower’

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[69] Some instructions for using these data are given in §8.9, §9.11, and §16.10.

37.	**ˈhĩ**	‘smoke’	38.	**sneˈpəq**	‘fine, thin’
39.	**ˈʔʊʃ**	‘bee’	40.	**ˈləlәkʃ** (very unusual)	‘a kind of tree (Sp. guaje)’
41.	**ˈʃkai̯ɬ**	‘x hated y’	42.	**ˈpəʃɬɪ̥**	‘x bathed’
43.	**ʔuːnɪˈlai̯**	‘it blows’***	44.	**qəsˈməkɬɪ̥**	‘x heard’
45.	**ˈləqts’ɪɬ**	‘x saw y’	46.		
47.	**ˈləqˈts’ĩ**	‘x sees y’	48.		
49.	**kələqts’ɪˈnaːʔ**	‘x will see y’	50.		

*One subdialect consistently has the sound **[f]** in this word rather than **[h]**. Otherwise, **[f]** does not occur.

In fast speech, this is pronounced **[təβˈlaːnəɬ].

***Compare with #7.

Note: Words that are pronounced in isolation as beginning with a glottal stop are pronounced with an even more audible glottal stop when utterance-medial.

Some other facts:

1. Unattested: σ[kt σ[kp σ[kq σ[kt σ[pt σ[pk σ[qt σ[qp σ[qt
2. Unattested: geminate (viz., long) consonants
3. Unattested: p]σ t]σ but notice #28 and #36
4. Unattested: V.V (i.e., hiatus does not exist)
5. Unattested: ts]σ ʧ]σ
6. Unattested: tC unless C is s or ʃ
7. Examples like #2, #4, #6, #8 have person inflection and exemplify the only kinds of words with complex onsets that begin with a **[k]**.
8. There are no major class words of the shapes CV or CCV where the vowel is oral.

G.34 Pangutaran Sama

ISO 639-3 code: [slm]. Sama-Bajaw genus, Philippines. Source: Walton (1979). The data are given in impressionistic transcription. Corrections and clarifications have been made to the data based on personal communication with Chuck Walton (June 2015). Some vowels in the data below reflect a majority dialect (where certain vowel contrasts are maintained), unlike the data as it appears in Walton (1979), which was from a minority dialect in which two particular vowels were merging.) Verb forms given here are complete words but the glosses do not reflect their exact meanings; they are not infinitives. [70]

		Gloss			Gloss
	197				
1.	ˈdʒaga	‘guard’	2.	ˈnawa	‘to give light’
3.	ˈʔudʒʊd	‘divine recompense’	4.	paˈɲakɪt	‘leprosy’
5.	ˈlʌndʒai̯	‘a variety of rice cake’	6.	paˈnaki	‘to cause sickness’
7.	ˈɲoɲo	‘a star (name)’	8.	peˈɲatʌn	‘to squash under foot’
9.	ˈnugʊn	‘to order’	10.	peˈneʔʌn	‘to choose’
11.	ˈni.au̯	‘to ask a question’			
	199				
12.	ˈpapʌn	‘board’	13.	ˈhʌpdɯs	‘heartburn’
14.	ˈbʌksa	‘to know, to understand’	15.	ˈkibʊt	‘water jar’
16.	ˈsabʌb	‘because’	17.	ˈmupu	‘the Pleiades’
18.	ˈlami	‘recreation’	19.	ˈtʌmbʌɭ	‘medicine’
20.	ˈwʌktu	‘time’	21.	ˈpawa	‘variety of cake’
22.	ˈbʌŋkau̯	‘mangrove’	23.	ˈpʌkpʌk	‘to drop down [light item]’
24.	ˈku.it	‘skin’	25.	ˈmʌndi	‘to bathe’
26.	ˈdapu	‘possession’	27.	ˈtabu	‘market’
28.	ˈgamʊt	‘root’	29.	ˈhawʌn	‘smooth’
30.	ˈkohʌp	‘afternoon’	31.	ˈʔʊndʌm	‘basin’
32.	ˈtokɛʔ	‘gecko’	33.	ˈkatʌs	‘paper’
	200				
34.	ˈdagʌŋ	‘to sell’	35.	ˈtʌndɯg	‘to tremble’
36.	ˈtʊdlʊʔ	‘index finger’	37.	ˈpaɾagʌn	‘to run’
38.	ˈbʌdːʒa	‘plow’	39.	ˈsʌmbʊŋ	‘answer’
40.	ˈpɪsni	‘cheek’	41.	ˈnanʌʔ	‘pus’
42.	ˈʔʊndʌm	‘basin’	43.	—	
44.	ˈpaɲʌp	‘to prepare’	45.	ˈlaɾa	‘hot pepper’
46.	ˈdulau̯	‘saffron’	47.	ˈhʌɭgʌʔ	‘price’

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[70] Instructions for using these data are given in §18.6 and §17.2.2.

48.	ˈkatɯɭ	‘itchy’	49.	ˈtajʊm	‘a sea urchin’
50.	ˈʔumai̯	‘when’	51.	ˈbai̯hu	‘face’
52.	ˈtɯgnʌʔ	‘to cook’	53.	ˈdʊgsʊk	‘to stab’
54.	ˈdʒɯgdʒɯg	‘to shake’	55.	ˈsɔŋkɛt	‘to cut down fruit’
56.	ˈnɔndʌʔ	‘to troll fish’	57.	ˈlɔŋkɔi̯	‘lazy’
58.	ˈʔutʌn	‘vegetables’	59.	ˈsuɾuʔ	‘spoon, shovel’
60.	ˈpusʊk	‘banana flower’	61.	ˈŋaɲʌm	‘to weave mat’
62.	ˈbalʌt	‘west wind’	63.	ˈbajʌʔ	‘to want’

From Chuck Walton, p.c.

64.	ˈlʊnsʊɭ	‘to walk’	65.	ˈdʌlːa	‘tongue’
66.	ˈsʊɭgʌʔ	‘paradise’	67.	ˈluhɔɭ	‘afternoon prayer’
68.	ˈbʊɭha	‘eyebrow’	69.	ˈlʌlːa	‘male’
70.	mahʌɭˈtabʌt	‘honor’	71.	ˈʔʌmbɔɭ	‘jealous’
72.	ˈdʌmblɪŋ	(a name)	73.	ˈdasad	(a name)
74.	si ˈɾʌmblɪŋ	(above name in context)	75.	si ˈɾasad	(above name in context)

201

76.	lapʊtˈlapʊt	‘dust’	77.	lamɔdˈlamɔd	‘mixed’
78.	ˈlʌgtʌs	‘to free’	79.	ˈtaŋʌn	‘hand’
80.	ˈpagʌɭ	‘fence’	81.	ˈlabai̯	‘to pass by’
82.	ˈkaka	‘older sibling’	83.	ˈtʊktʊk	‘forehead’
84.	ˈgojʌk	‘wave of the sea’	85.	ˈbaga	‘hot coal’
86.	ˈbɔgbɔg	‘watery cooked rice’	87.	ˈsai̯ŋʌʔ	‘branch of tree’
88.	ˈŋʌndʌʔ	‘to look’	89.	ˈbʌŋkɛt	‘lime’
90.	ˈpisʌn	‘pineapple’	91.	ˈhinʌŋ	‘to do, make’
92.	kaˈhawa	‘coffee’	93.	ˈʔɪŋkɯt	‘to tie’
94.	ˈbuʔun	‘hair’	95.	ˈde.ɔʔ	‘below’
96.	ˈm̩pu	‘grandchild’	97.	ˈgawi	‘purpose’
98.	ˈŋagʌd	‘to wait for’	99.	ˈhapa	‘corn or rice husk’
100.	ˈʔaʔa	‘person’	101.	ˈlokai̯	‘coconut leaf’
102.	ˈlugʊs	‘areca nut’	103.	ˈlaŋau̯	‘house fly’
104.	ˈlahʌt	‘place’	105.	ˈlaʔʌt	‘bad’
106.	ˈpisʌk	‘muddy’	107.	ˈbasʌg	‘strong’
108.	ˈpɪsːʌʔ	‘cracked’			

202

109.	**ˈmamʌn**	‘ants’	110.	**ˈnanʌʔ**	‘pus’
111.	**ˈɲawa**	‘soul’	112.	**ˈŋanʌd**	‘to learn (form a)’
113.	**ˈtimʌn**	‘to throw away’	114.	**ˈʔanʌd**	‘to learn (form b)’
115.	**ˈʔaɲʌm**	‘to weave’	116.	**ˈbadʌn**	‘body’
117.	**ˈʔəndʌŋ**	‘naturally’	118.	**ˈbigi**	‘seed’
119.	**ˈlami**	‘recreation’	120.	**bɪŋˈkatʌk**	‘frog’
121.	**ˈsɪndʊŋ**	‘to take shelter from elements’	122.	**ˈleɾɔʔ**	‘to boil’
123.	**ˈhebɔk**	‘crooked’	124.	**ˈbɛŋkɔk**	‘crooked’
125.	**ˈbɛntɛn**	‘to hand carry at one's side’	126.	**ˈʔinʊm**	‘to drink’
127.	**ˈʔeŋʌs**	‘branches’	128.	**ˈko.eʔ**	‘to be well, able-bodied’
129.	**ˈbusugʌn**	‘to sprinkle with water’	130.	**ˈputu**	‘steamed cassava’
131.	**ˈbukʊt**	‘back of’	132.	**ˈbʊslʊt**	‘rotten, corroded’
133.	**ˈpotɛʔ**	‘white’	134.	**ˈkaboˈlaʔʌn**	‘place with lots of bamboo’
135.	**ˈpɔnsɔt**	‘navel’			

G.35 Jalapa de Díaz Mazatec

ISO 639-3 code: [maj]. Popolocan genus, Mexico. Source: Schram & E. Pike (1978) and Judith Schram (p.c.). See also Silverman et al. (1994). Impressionistic transcription. In the case of diphthongs, tone is only written on the dominant vowel symbol and a bottom tie bar or top tie bar is used (perhaps an unusual use of those diacritics); for many of these we might have written one of the vowels with a subscript arch to show its non-syllabicity or one of them might have been written with the symbol j. When necessary, a dot appears between two vowels to clarify that the sequence of vowels is *not* a diphthong. The vowels seem to generally have the values indicated by the symbols used, although [a] is described as "low back" (= open back in IPA), and has allophonic variation not completely described here. [71]

	Group 1	(Oral vowels)			
1.	tí	'boy'	2.	tǽ	'shoe'
3.	thò	'wind'	4.	tū	'fruit'
5.	tá	'liquid'	6.	tì	'fish'
7.	tʃá	'old'	8.	thæ̀	'seed'
	Group 2	(Nasalized vowels)			
9.	sĩ̄	'causing to sneeze'	10.	sæ̃̄	'spirit'
11.	sõ̀ (mid-low)	'song'	12.	sũ̄	'level'
13.	sã̄	'sour'			
	Group 3	(Diphthongs—partial set; more appear below)			
14.	líki͜ǽ	'vulture'	15.	líki͜ǽ.ì	'your vulture'
16.	thi͜ó	'cornhusk'	17.	thi͜ò	'fish'
	Group 4	(The vowel [y] appears)			
18.	nầti͡ý	'coconut'	19.	tsīnĩỹ̄	'your (pl.) uncle'
20.	nĩ̀ɲỳ	'tortilla'	21.	tʃỳ	'animal'
22.	jȳ	'willing'			
	Group 5	(Noun or verb without pronoun)		(Word with enclitic pronoun)	
23.	tsùkù	'foot'	24.	tsùkɯ̀͜i	'your foot'
			25.	nĩ̄ndākɯ̄͜i	'your head'
26.	tū	'fruit'	27.	tɯ̄.ì	'your fruit'

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[71] Instructions for using these data are given in §23.4.1 and §23.8 and §25.9.

	Group 6	(The vowels [e] and [ɤ] appear)			
28.	tǽ	‘shoe’	29.	tê: (high-low)	‘your shoe’
			30.	jē	‘you know’
31.	nĩ̄wákò	‘she brings’	32.	nĩ̄wákɤ̀͜e	‘you bring’
33.	tʃìnkà	‘pig’	34.	tʃìnkɤ̀.è	‘your pig’
35.	shɤ̄͜e †	‘leg’			
	Group 7	(Looking at [w] and [β])			
36.	nũ̀wò	‘nest’	37.	sùwà	‘alone’
38.	βǣ	‘she knows’	39.	*wu… *…wu	
40.	tíʔβī	‘she drinks’			
	Group 8	(Some vowel facts are special when after specifically [β], [w], [th], [tχ], [tsh], [tsχ])			
			41.	tʃhýβé	‘take it!’
			42.	tʃỳwē	‘say it!’
43.	thàʔβæ̀	‘wasp’	44.	thàʔβè:	‘your wasp’
45.	tàwà	‘dish’	46.	tàwè:	‘your dish’
	Group 9	(Looking at [th] and [tχ])			
			47.	sthẽ̄	‘your forehead’
48.	stχẽ̄	‘mushroom’			
49.	thæ̀	‘seed’	50.	thè:	‘your seed’
51.	thò	‘wind’	52.	tχè:	‘your wind’
			53.	tshè:	‘your bean (sp.)’
			54.	tsχē:	‘you like’
	Group 10	(Palatal & postalveolar consonants relevant)			
55.	nĩ̄ʔjā	‘house’	56.	nĩ̄ʔjǣ.ì	‘your house’
57.	tʃá	‘old’	58.	tʃǽ͜i	‘you are old’
59.	nã̄ɲã́	‘dog’	60.	nã̄ɲǽ.ĩ̀	‘your dog’
61.	ndànti͜à	‘boss’	62.	ndànti͜æ̀.ì	‘your boss’
63.	thi͜ò	‘fish (sp.)’	64.	thi͜æ̀.ì	‘your fish (sp.)’
	Group 11	Something systematic but very specific to the sequence [i͡y] + [ì]			

65.	**nā̀ti͡ý**	‘coconut’	66.	**nā̀tî:**	‘your coconut’
	Group 12				
			67.	**tísē**	‘you sing’
			68.	**nī̀sḕ: (low mid-low)**	‘your bird’
69.	**jáshɤ͜ē**	‘corner post’	70.	**jáshɤ͜ḕ: (high mid-low)**	‘your corner post’
			71.	**ʃùtɤ͜è:**	‘your people’
			72.	**jē**	‘you know’
			73.	**jê:**	‘your tree’
74.	**tì**	‘fish’	75.	**tì:**	‘your fish’
76.	**tsà: ‡**	‘cheek’			

† This word is unusual in a key way.

‡ This word is unusual; it is the only case of a long vowel in a monomorphemic word.

Completion of a table of features that distinguish the vowels may be helpful:

	i	**æ**	**a**	**u**	**ɯ**	**o**	**ɤ**	**y**	**e**
[back]									
[high]									
[low]									
[round]									

G.36 Fa d'Ambu

ISO 639-3 code: [fab], spoken on Annobon island, Equatorial Guinea. Source: Calderón Calderón et al. (2014) and related unpublished work. Impressionistic transcription.[72]

	Preceding affirmative pause	Preceding interrogative pause	English gloss	Spanish gloss
1.	[ˈsapʷ]	[saˈpu]		‘estropajo’
2.	[ˈbɔtʷ]	[bɔˈtɔ]	‘belt’	‘cinturón’
3.	[ˈmatʷ]	[maˈtʊ]		‘parcela’
4.	[ˈzɛjtᵊ]	[zɛjˈtɛ]	‘oil’	‘aceite’
5.	[ˈdʊdʷ]	[dʊˈdʊ]		‘mimo’
6.	[ˈidʷ]	[iˈdu]	‘louse’	‘piojo’
7.	[ˈikʷ]	[iˈku]	‘trash’	‘basura’
8.	[ˈɸʊgʷ]	[ɸʊˈgʊ]	‘fire’	‘fuego’
9.	[ˈpegʷ]	[peˈgu]	‘nail’	‘clavo’
10.	[ˈt͡ʃuᶮt͡ʃʷ]	[t͡ʃũᶮˈt͡ʃu]	‘shorebird (sp.)’	‘pájaro playero (esp.)’
11.	[ˈwat͡ʃ]	[waˈt͡ʃi]	‘group’	‘grupo’
12.	[ˈβad͡ʒ]	[βaˈd͡ʒi]	‘trip’	‘viaje’
13.	[ˈxamᵊ]	[xaˈma]	‘bed’	‘cama’
14.	[ˈjamʷ]	[jaˈmʊ]	‘yam’	‘ñame’
15.	[ˈd͡ʒanᵊ]	[d͡ʒaˈna]	‘banana’	‘banana’
16.	[ˈgeɸᵊ]	[geˈɸa]	‘fork’	‘tenedor’
17.	[guˈlaɸᵊ]	[gulaˈɸa]	‘large bottle’	‘botella grande’
18.	[ˈnɔβᵊ]	[nɔˈβa]	‘news’	‘noticias’
19.	[ˈnuβʷ]	[nuˈβu]	‘nine’	‘nueve’
20.	[ˈlɔsʷ]	[lɔˈsɔ]	‘people’	‘pueblo’
21.	[ˈxɔsʷ]	[xɔˈsɔ]	‘nut’	‘nuez’
22.	[ˈbisʷ]	[biˈsu]	‘worm’	‘gusano’
23.	[ˈlãⁿzᵊ]	[lãⁿˈza]	‘orange’	‘naranja’
24.	[ˈkʊzʷ]	[kʊˈzʊ]	‘thing’	‘cosa’
25.	[ˈɸaxᵊ]	[ɸaˈxa]	‘knife’	‘cuchillo’
26.			‘navel’	‘ombligo’
27.	[ˈtelᵊ]	[teˈla]	‘earth, country’	‘tierra, país’
28.	[baˈtɛlʷ]	[batɛˈlʊ]	‘dugout’	‘cayuco’
29.	[ˈsalʷ]	[saˈlʊ]	‘salt’	‘sal’
30.	[ˈawə]	[aˈwa]	‘water’	‘agua’
31.	[ʊˈbʊjʊ]	[ʊbʊˈjʊ]	‘crab’	‘cangrejo’

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[72] One set of instructions for using these data is given in §25.9.

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Topic index

Language index