QUESTIONS

3. Is the first sound in each of the following words voiced or voiceless?
   a) though  e) zoom  i) huge  m) when (may vary)
   b) thought  f) silk  j) choose  n) ghetto
   c) form  g) pan  k) judge  o) pneumatic
   d) view  h) boat  l) buns  p) winced

4. Using the words presented in question 3, state whether the last sound of each word is voiced or voiceless.

5. For each of the following pairs of sounds, state whether they have the same or a different place of articulation. Then identify the place of articulation for each sound.
   a) [s]:[l]
   b) [k]:[ŋ]
   c) [p]:[g]
   d) [l]:[r]
   e) [m]:[n]
   f) [d]:[f]
   g) [f]:[h]
   h) [w]:[j]
   i) [b]:[f]
   j) [t]:[d]
   k) [s]:[v]
   l) [θ]:[t]

PHONETICS: THE SOUNDS OF LANGUAGE

6. For each of the following pairs of sounds, state whether they have the same or a different manner of articulation. Then identify the manner of articulation for each sound.
   a) [s]:[θ]  e) [l]:[t]  i) [r]:[w]
   b) [k]:[ŋ]  f) [ɔ]:[v]  j) [t]:[d]
   c) [w]:[j]  g) [t]:[s]  k) [h]:[ʔ]
   d) [f]:[ʃ]  h) [m]:[ŋ]  l) [z]:[d]

7. After each of the following articulatory descriptions, write the sound described in phonetic brackets.
   a) voiceless velar stop  e) voiced velar nasal
   b) voiced labiodental fricative  f) voiceless interdental fricative
   c) voiced alveopalatal affricate  g) high back rounded lax vowel
   d) voiced palatal glide  h) low front unrounded vowel

8. Which of the following pairs of words show the same vowel sound? Mark each pair “same” or “different.” Then transcribe the vowels of each word.
   a) back  sat  h) hide  height
   b) cot  caught  i) least  heed
   c) bid  key  j) drug  cook
d) luck  flick  k)  sink  fit  
e)  ooze  deuce  l) oak  own  
f)  cot  court  m) pour  port  
g)  fell  fail  n)  mouse  cow  

9. Using descriptive terms like sibilant, fricative, and so on, provide a single phonetic characteristic that all the segments in each group share. Try to avoid over-obvious answers such as “consonant” or “vowel.”

Example:  [b d g m j] are all voiced.

| a)  | [p t k g?]           | e)  | [ʌ ʊ ə a]i)          | j)  | [t d l r n s z]          |
| b)  | [i e æ]             | f)  | [h?]                 | j)  | [t d l r n s z]          |
| c)  | [tʃ ʒ f dʒ]         | g)  | [uo]                 | j)  | [t d l r n s z]          |
| d)  | [p b m f v]          | h)  | [s z tʃ dʒ ʒ]         | j)  | [t d l r n s z]          |
PHONOLOGY:
THE FUNCTION
AND PATTERNING
OF SOUNDS

Michael Dobrovolsky
Ewa Czaykowska-Higgins

A person’s tongue is a twisty thing, there are plenty of words there of every kind, and the range of words is wide, and their variation.
—HOMER, The Iliad, 20

OBJECTIVES

In this chapter, you will learn:
• how we know which language sounds are distinctive in a particular language
• how distinctive sounds in a particular language can vary systematically according to the context in which they occur
• how we use transcription to represent distinctive sounds and systematic variations of these sounds
• how syllables are constructed and the influence of language-specific syllable structure
• how individual sounds can be broken down further, according to specific features
• how we can construct rules to explain systematic variations in the production of sounds
• how we can group, organize, and illustrate features of sounds

We saw in Chapter 2 that human beings can produce and perceive a large number of speech sounds. No human language exploits all of these phonetic possibilities. Instead, every language makes its own particular selection from the range of all possible speech sounds and organizes them into a more or less regular system. The component of grammar that determines the selection of speech sounds and governs both the sound patterns and the systematic phonetic variation found in language is known as phonology.

Speakers have (at least) some subconscious knowledge of the phonetic patterns that make up phonological systems. For example, as we saw in Chapter 1, speakers of English recognize without being taught that certain combinations of consonants are acceptable in English, even if those combinations occur in forms that are not real words, while other combinations are not acceptable; thus, srish and screpk are acceptable to English speakers, while srish and screpk are not. In fact, speakers can do more than recognize that certain forms are unnatural in their system; they can even correct unnatural forms to make them conform to the patterns that are acceptable in their own language. Without knowing exactly why, most English speakers would pronounce a form like srish as [sərɪʃ]—breaking up the unacceptable consonant combination with a vowel, rather than, say, deleting one of the consonants to form [sɪʃ] or [rɪʃ]. The task of phonologists, then, is (1) to discover and describe the systematic phonetic patterns found in individual languages and (2) to discover the general...
principles that underlie the patterning of sounds across all human languages. In doing this, phonologists hope to uncover the largely subconscious knowledge that speakers have of sound patterns.

The existence of phonological patterns in language is a result of the organization of certain basic elements or units that combine to make up these patterns. In our discussion of phonology we will examine three of the major phonological units: the feature, the segment, and the syllable.

We are already acquainted with the idea that the flow of speech can be divided into segments and that segments are characterized by specific phonetic properties. In this chapter, we will investigate the types of patterned phonetic variation that segments exhibit in individual languages and cross-linguistically. We will also learn that segments are composed of features. Features correspond to articulatory or acoustic categories such as [voice] or [strident]. They are the smallest building blocks of phonological structure, and as we will see, the types of phonological patterns found in language are directly related to the properties of the features that make up segments. Finally, we will learn about the ways in which segments combine to form syllables. Syllables consist of a syllabic element—usually a vowel—and any preceding or following segments that are associated with it. As the representation of the word segment in Figure 3.1 illustrates, features, segments, and syllables are organized into hierarchical levels, each of which is composed of units from the level beneath it. In Figure 3.1, segment is a word-level unit represented by the abbreviation Wd. This word in turn consists of two syllables, each of which is represented by the Greek letter Ω (sigma). Each syllable itself consists of several segments. Finally, each segment is composed of features. (For purposes of illustration, only a few features are provided for each segment and the internal hierarchical structure of syllables and segments is not represented; these are treated later, in Sections 4, 5.2, and 5.3, respectively.)

As units of phonological structure, syllables, segments, and features play major roles in the processes we investigated in the previous chapter and, in combination with certain general principles of phonology, produce the sound patterns of language. In the next sections we examine these sound patterns and the phonological knowledge that enables speakers to distinguish among forms and to deal with the systematic phonetic variation found in the pronunciation of speech sounds.

1 SEGMENTS IN CONTRAST

All speakers know which segments of their language contrast and which do not. Segments are said to contrast (or to be distinctive or be in opposition) in a particular language when their presence alone may distinguish forms with different meanings from each other. Thus, for instance, in the English words sip and zip, the phonetically distinct segments [s] and [z] are in contrast; similarly in hit hate, and hot, the vowels are in contrast.

In this section we will consider how to determine which segments contrast in a language. In Section 2 we will consider the systematic patterns associated with phonetically similar segments when they do not contrast.

1.1 MINIMAL PAIRS

Since knowledge of segmental contrasts is fundamental to knowing any language, the first step in an
analysis of the phonology of a language is to establish which sounds in that language are in contrast with each other. In order to establish contrasts, it is necessary to examine the distribution of sounds in words and to compare word meanings. The most straightforward way to accomplish this examination is by way of the minimal pair test.

A minimal pair consists of two forms with distinct meanings that differ by only one segment found in the same position in each form. The examples [slp] *sip* and [zip] *zip* given previously form a minimal pair and show that the sounds [s] and [z] contrast in English.

A number of minimal pairs that demonstrate consonant contrasts for English are given in Table 3.1; it is important to remember that it is on the basis of *sound* and not spelling that minimal pairs are established. In displaying contrasts, contrasting words are often placed along the horizontal axis with respect to their place of articulation, reading from left to right (labial, alveolar, and so on), and vertically with respect to their manner of articulation, in order to show which places and manners of articulation are exploited by the language in question.

### Table 3.1 Contrasts among consonants in English

<table>
<thead>
<tr>
<th>Labial</th>
<th>Interdental</th>
<th>Alveolar</th>
<th>Alveopalatal</th>
<th>Velar</th>
<th>Glottal</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Tap</em></td>
<td><em>Pat</em></td>
<td><em>Match</em></td>
<td><em>[tʃ]</em></td>
<td><em>Pick</em></td>
<td></td>
</tr>
<tr>
<td><em>Tab</em></td>
<td><em>Pad</em></td>
<td><em>Madge</em></td>
<td><em>[dʒ]</em></td>
<td><em>Pig</em></td>
<td></td>
</tr>
<tr>
<td><em>Leaf</em></td>
<td><em>Thigh</em></td>
<td><em>Sip</em></td>
<td><em>[s]</em></td>
<td><em>Mesher</em></td>
<td><em>Hip</em></td>
</tr>
<tr>
<td><em>Leave</em></td>
<td><em>Thy</em></td>
<td><em>Zip</em></td>
<td><em>[z]</em></td>
<td><em>Measure</em></td>
<td></td>
</tr>
<tr>
<td><em>Sum</em></td>
<td><em>Sun</em></td>
<td><em>Sung</em></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Liquids and glides</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Wet</em></td>
<td><em>Yet</em></td>
<td><em>Yet</em></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Leer</em></td>
<td><em>Rear</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The phonetic context in which a sound occurs is called its environment. Pairs that have segments in nearly identical environments—such as assure [aʃʊr] (= *[aʃʊr]*) / azure *[aʊʒər]* (= *[aʊʒər]*)—are called near-minimal pairs. They can be used to establish contrasts if no minimal pairs for a particular set of segments can be found.

Once you have established the existence of a minimal or near-minimal pair for a set of two segments, you may assume that those two segments contrast or are distinctive. Segments that contrast with each other in a particular language are said to belong to separate phonemes (contrastive phonological units) of that language. Thus, all the consonants in Table 3.1 belong to separate phonemes in English, since all of them are contrastive in the language.

When looking for the contrastive sounds of a language, it is in fact rare to find minimal pairs for all such sounds, since the historical evolution of every language has led to some sounds being used more frequently than others or being eliminated from some environments. For example, you will find no minimal pairs involving *[h]* and *[ŋ]* in word-initial or word-final position in English because there are no words that begin with *[ŋ]* or end in *[h]*. It is also difficult to find minimal pairs in English that have the phone *[ʒ]*, which occurs for the most part in words borrowed from French, such as *azure* and *mirage*.
Vowel contrasts in English
Vowel contrasts in English can be established with a few sets of examples. We assume in Table 3.2 that English vowel-glide sequences like [ey] and [ow] are single vowels. From this perspective, we can say that the vowels [ej] and [e] and [aw] and [ay], and so on, contrast.

Table 3.2 Vowel contrasts in American English

<table>
<thead>
<tr>
<th>English</th>
<th>Turkish</th>
</tr>
</thead>
<tbody>
<tr>
<td>[bit]</td>
<td>[biyt]</td>
</tr>
<tr>
<td>[bIt]</td>
<td>[I]</td>
</tr>
<tr>
<td>[bejt]</td>
<td>[beyt]</td>
</tr>
<tr>
<td>[bet]</td>
<td>[e]</td>
</tr>
<tr>
<td>[bæt]</td>
<td>[æ]</td>
</tr>
<tr>
<td>[b⁠u⁠d]</td>
<td>[⁠b⁠u⁠wd]</td>
</tr>
<tr>
<td>[⁠b⁠u⁠d]</td>
<td>[⁠b⁠u⁠wd]</td>
</tr>
<tr>
<td>[⁠b⁠o⁠d]</td>
<td>[⁠b⁠o⁠wd]</td>
</tr>
<tr>
<td>[⁠b⁠o⁠d]</td>
<td>[⁠b⁠o⁠wd]</td>
</tr>
<tr>
<td>[⁠b⁠o⁠d]</td>
<td>[⁠b⁠o⁠wd]</td>
</tr>
<tr>
<td>[⁠l⁠o⁠d]</td>
<td>[⁠l⁠o⁠wd]</td>
</tr>
<tr>
<td>[⁠l⁠o⁠d]</td>
<td>[⁠l⁠o⁠wd]</td>
</tr>
<tr>
<td>[⁠o⁠d]</td>
<td>[⁠o⁠wd]</td>
</tr>
<tr>
<td>[⁠o⁠d]</td>
<td>[⁠o⁠wd]</td>
</tr>
</tbody>
</table>

Table 3.2 lists seven minimal pairs, which are pairs of words that differ in only one sound. In every one of these pairs, the sound contrast is crucial to the meaning of the word. For example, in the pair [bit] : [bIt], the sound contrast between [t] and [T] is crucial to the meaning of the words. Similarly, in the pair [bejt] : [beyt], the sound contrast between [t] and [y] is crucial to the meaning of the words. The same is true for the other pairs in Table 3.2.

1.2 LANGUAGE-SPECIFIC CONTRASTS

Whether or not segments contrast with each other is determined on a language-particular basis. In other words, just because two sounds are phonetically distinct, it does not mean that they necessarily behave as phonologically distinct or contrastive. Therefore, sounds that are contrastive in one language will not necessarily be contrastive in another. For example, the difference between the two vowels [e] and [æ] is crucial to English, as we can see from minimal pairs like Ben [bɛn] and ban [bæn] (see Table 3.3). But in Turkish, this difference in pronunciation is not distinctive. A Turkish speaker may pronounce the word for ‘I’ as [bɛn] or [bæn], and it will make no difference to the meaning.

Table 3.3 Language-specific vowel contrasts: English versus Turkish

<table>
<thead>
<tr>
<th>English</th>
<th>Turkish</th>
</tr>
</thead>
<tbody>
<tr>
<td>[bɛn]</td>
<td>Ben</td>
</tr>
<tr>
<td>[bæn]</td>
<td>ban</td>
</tr>
</tbody>
</table>

Conversely, sounds that do not contrast in English, such as long and short vowels, may be distinctive in another language. There are no minimal pairs of the type [æt] : [æt:] or [us] : [us:] in English. But in Japanese and Finnish, short and long vowels contrast, as the examples in Table 3.4 show.

Establishing the contrasting segments in a language is a first step in phonological analysis. However, in every language there are many sounds that never contrast. The following section deals with this aspect of phonology.
CHAPTER THREE

Table 3.4 Short/long vowel contrasts in Japanese and Finnish

Japanese

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>[tori]</td>
<td>‘bird’</td>
</tr>
<tr>
<td>[tori:]</td>
<td>‘shrine gate’</td>
</tr>
<tr>
<td>[kibo]</td>
<td>‘scale’</td>
</tr>
<tr>
<td>[kibo:]</td>
<td>‘hope’</td>
</tr>
</tbody>
</table>

Finnish

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>[tuli]</td>
<td>‘fire’</td>
</tr>
<tr>
<td>[tu:li]</td>
<td>‘wind’</td>
</tr>
<tr>
<td>[hætæ]</td>
<td>’distress’</td>
</tr>
<tr>
<td>[hæ:tæ:]</td>
<td>‘to evict’</td>
</tr>
</tbody>
</table>

2 PHONETICALLY CONDITIONED VARIATION: PHONEMES AND ALLOPHONES

Everyday speech contains a great deal of phonetic variation that speakers pay little or no attention to. Some of this variation arises from nonlinguistic factors such as fatigue, excitement, orthodontic work, gum chewing, and the like. This kind of variation is not part of the domain of phonology. But much phonetic variation is systematic. It occurs most often among phonetically similar segments and is conditioned by the phonetic context or environment in which the segments are found. This variation occurs because segments are affected and altered by the phonetic characteristics of neighboring elements or by the larger phonological context in which they occur. We rarely notice this kind of variation unless we are trained to do so, because every speaker has the ability to factor it out in order to focus attention on only those contrasts of the language that affect meaning. In this section we will consider the patterns of variation exhibited by noncontrastive sounds, how to analyze these patterns, and the conclusions that can be drawn from them.

2.1 COMPLEMENTARY DISTRIBUTION

When first learning phonetic transcription, English speakers are often surprised that all the /l/s they pronounce are not identical. In Table 3.5, the is in column A are voiced, while those in column B are voiceless (indicated here by a subscript circle under the ‘l’). Many speakers of English are unaware that they routinely produce this difference in articulation, which can be heard clearly when the words in column B are pronounced slowly.

Table 3.5 Voiced and voiceless /l/ in English

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>blue</td>
<td>plow</td>
</tr>
<tr>
<td>gleam</td>
<td>clap</td>
</tr>
<tr>
<td>slip</td>
<td>clear</td>
</tr>
<tr>
<td>flog</td>
<td>play</td>
</tr>
<tr>
<td>leaf</td>
<td></td>
</tr>
</tbody>
</table>

In fact, as it turns out, the two is never contrast in English: there are no minimal pairs like [pley] and
[pλey] in which the phonetic difference between [l] and [l] functions to signal a difference in meaning.

Moreover, when one examines the distribution of the two is, it becomes apparent that voiced and voiceless is vary systematically: all of the voiceless [l]s occur after the class of voiceless stops in English, while the voiced [l]s never occur after voiceless stops. The voicelessness of the /l/s in column B is thus a consequence of their phonetic environment; it is also a predictable property of the phonology of English in the sense that in English, only voiceless [l]s occur after voiceless stops.

Since no voiced [l] ever occurs in the same phonetic environment as a voiceless one (and vice versa), we say that the two variants of /l/ are in complementary distribution.

In the data in Table 3.5, voiced [l] occurs in a greater number of different phonetic environments (after voiced stops, after voiceless fricatives, and in word-initial position) than does voiceless [l] and in addition those different environments for voiced [l] cannot be easily described as they do not naturally fall together as a class. Therefore, when two (or more) segments are in complementary distribution, the term elsewhere is used, as in Table 3.6, to indicate the kind of wider distribution exhibited by [l] in Table 3.5. Specifically, we find [l] after voiceless stops, and [l] elsewhere.

**Table 3.6 Complementary distribution of [l] and [l] in English**

<table>
<thead>
<tr>
<th></th>
<th>[l]</th>
<th>[l]</th>
</tr>
</thead>
<tbody>
<tr>
<td>After voiceless stops</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>Elsewhere</td>
<td>yes</td>
<td>no</td>
</tr>
</tbody>
</table>

In spite of these differences in their phonetic environments, native speakers of English consider the two is to be instances of the same segment, since they are not contrastive but are nevertheless similar phonetically (they are both types of /l/s) and since the differences between them are systematic and predictable. We can sum up the relationship that the two is bear to each other by stating that, for speakers of English, although the two is are phonetically distinct, they are phonologically the same because of the sound system of English, given their phonetic similarity, predictable distribution, and noncontrastiveness.

### 2.2 PHONEMES AND ALLOPHONES

When two (or more) segments are phonetically distinct but phonologically the same, they are referred to as allophones (predictable variants) of one phoneme (contrastive phonological unit). The ability to group phonetically distinct sounds into the phonological units known as phonemes is shared by all speakers of all languages. Phonologists represent this phonological knowledge formally by distinguishing two levels of representation: the **phonetic representation** that consists of predictable variants or allophones, and the **phonemic** (or phonological) **representation** that consists of the phonemes to which the allophones belong.
As we have seen, segments that can be considered to be allophones of one phoneme are phonetically similar and occur in phonetically predictable environments. In fact, it is frequently the case that allophones of one phoneme are in complementary distribution with each other. Consequently, we can use the fact that allophones occur in complementary distribution as a way of testing whether or not two (or more) segments should be considered to be allophones of one phoneme.

Allophonic variation is found throughout language. In fact, every speech sound we utter is an allophone of some phoneme and can be grouped together with other phonetically similar sounds into a class that is represented by a phoneme on a phonological level of representation. An important part of phonological analysis thus deals with discovering inventories of the phonemes of languages and accounting for allophonic variation.
4 ABOVE THE SEGMENT: SYLLABLES

So far we have been discussing the distributional properties of segments, and have established the existence of the segmental units of phonological analysis known as phonemes and their allophones. We have also seen that allophonic variation may be conditioned by neighboring segments. We turn now to a different unit of phonological representation, namely the syllable. We will see that syllables are composed of segments, and thus impose an organization on segments; in this sense syllables are suprasegmental (above the segment) units. We will also see that the shapes of syllables are governed by universal and language-specific constraints. Finally, we will examine examples of allophonic variation that is conditioned by syllable structure rather than by neighboring segments.

4.1 DEFINING THE SYLLABLE

As we saw in Chapter 2, vowels, glides, liquids, and nasals are sonorants (singable sounds); obstruents, in contrast, are not sonorant. Of the sonorant sounds, vowels are most sonorous, and glides, liquids, and nasals are correspondingly less sonorous. A syllable consists of a sonorous element and its associated nonsyllabic (less sonorous) segments. Since vowels are the most sonorous sounds, syllables usually have a vowel nucleus at their core; less sonorous sounds may appear on either side of a nucleus. Thus the word telegraph has three syllables because it has three vowels that serve as syllable nuclei.

Native speakers of a language demonstrate their awareness of the sonority values of segments and of the syllable as a unit of phonological structure whenever they count syllables in a word. No English speaker would hesitate to say that the words telegraph and accident have three syllables, and most speakers would feel confident that the words could be broken up into the syllables /tɛl ′ græf/ and /ək ′ sə. dənt/ (the periods mark syllable divisions informally).

Speakers also know that syllables have internal subsyllabic structure as well. A syllable consists of an onset and a rhyme; the rhyme, in turn, consists of the nucleus or syllable core, and a coda.

We will see later on in this chapter that some allophonic variation makes reference to internal subsyllabic structure such as the coda.

There are other kinds of evidence that subsyllabic structure is part of speakers’ knowledge. In English rhyming verses, for instance, it is always the rhymes of syllables that match each other (in other words, that rhyme), while onsets may vary: thus sprite and fright rhyme by virtue of having identical rhyme (nucleus and coda) constituents, but the onsets of each are different. In addition, one version of the English language game known as Pig Latin is played by displacing the onset of the first syllable of a word to the end of the word and then tacking on the rhyme ay [eɪ]: thus strong becomes ong-str-ay, and swivel become ivel-sw-ay.

Furthermore, when speakers are asked to syllabify words, they are able to do so in ways that are neither random nor variable. The word extreme /ekstrɪm/ would never be syllabified as /e. kstrɪm/ in English, for example. Instead, syllables comply with certain constraints that prohibit them from beginning with a sequence like kstr and thus result in the actual syllabification /ek.strɪm/. The examples here are all from English, but similar kinds of evidence for the existence of subsyllabic constituents can be found in many other languages as well.
QUESTIONS

Assume phonetic transcription of the data in all exercises.

Inuktitut (Eastern) (Native Canadian)

a) iglumut to a house h) pinna that one up there
b) ukiaq late fall i) ani female’s brother
c) aiviq walrus j) iglu (snow)house
d) aniguvit if you leave k) panna that place up there
e) aglu seal’s breathing hole l) aivuq she goes home
f) iglumit from a house m) ini place, spot
g) anigavit because you leave n) ukiuq winter

i) List all the minimal pairs in this data. Based on the minimal pairs you have found, list all the contrastive pairs of vowels.

ii) Using the charts in Figures 2.9 and 2.10 as your models, make a chart of Inuktitut vowel phonemes.

iii) Now consider the data again; here it is transcribed in more phonetic detail. In it, there are phonetically similar segments that are in complementary distribution. Look for them and then answer the question that follows the data.

iv) List the phonetically similar segments that are in complementary distribution. State the distribution (in words).

Hindi

[b] versus [b̥]

a) [bara] ‘large’ f) [b̥d] ‘disagreement’
b) [b̥ri] ‘heavy’ g) [bais] ‘twenty-two’
c) [bina] ‘without’ h) [b̥s] ‘buffalo’
d) [b̥ir] ‘crowd’ i) [bap] ‘father’
e) [bori] ‘sackcloth’  j) [ḥaṇ] ‘part’

Question:

In contrast distribution, that is, do these count as different sounds, i.e., different phonemes in Hindi? If they are, describe the slot(s) they contrast in.

In complementary distribution, that is, do these count as the same sound in Hindi? If they do, describe the slot that [b] occurs in and the different slot that [h] occurs in.

Mokilese:

vowel chart:

i  u
  e  o
  e  o

The voiceless and voiced vowels are in complementary distribution. Describe the slot that voiceless vowels occurs in (the vowels with circles under them) and the different slot that voiced vowels occur in.

a) [piːsan] ‘full of leaves’  g) [uduk]
   ‘flesh’

b) [tuːpʊkta] ‘bought’  h) [kaskas] ‘to throw’

c) [pʊka] ‘basket’  i) [poki] ‘to stike smthg.’

d) [kisa] ‘we (two)’  j) [pil] ‘water’

e) [suːpwo] ‘firewood’  k) [apid] ‘outtrigger support’

f) [kamwɔːkɪtʃ] ‘to move’  l) [luːdʒuk] ‘to tackle’

Plain Cree (Algonquian)

a) niska goose  l) nisto three

b) kodak another  m) tʃiːgahigan

axe
c) asaba:p thread n) a:dim
d) waskow: cloud o) mi:bit tooth
e) paskwa:w prairie p) pime: lard
f) ni:gi my house q) mide heart
g) ko:go:s pig r) o:gik these
h) tahki often s) tʃihtʃiŋ finger
i) namwa:tʃ not at all t) wa:bos rabbit
j) ospwa:gan pipe u) na:be:w man
k) midʒihtʃiŋ hand v)

i) Do [p] and [b] belong to separate phonemes or are they allophones of one phoneme? If you think they belong to separate phonemes, list data to support your case. If you think that are allophones, first state the conditioning factors in the words, and then, using features, write a rule that accounts for their distribution.

ii) Do the same for [t] and [d], [k] and [g], and [tʃ] and [dʒ].

iii) Can you make a general statement about the relationship among all the consonantal pairs whose distribution you have examined?