CHAPTER 1 INTRODUCTION

Phonology is the study of the organization of sounds in human languages. It is a subfield of linguistics concerned with understanding how languages use certain sounds and combine them to build meaningful units – essentially, words. At its core, phonology begins with the observation that each language uses its own fixed set of sounds, an inventory of consonants and vowels, and that these sounds may combine into sequences in patterned ways. We call these sounds **phonemes**: contrastive sounds of language, they are not themselves meaningful, but serve as symbols which are combinable into longer sequences, to which meaning and function are in turn associated.

phoneme: a contrastive sound or category of sounds within a language.

Our methods for detecting phonemes are indirect, and involve examining the structure and form of simple and complex words. We begin with the basic task of **segmentation**, in which we observe words of a language and detect smaller components within them. In so doing, we also identify recurrent parts, component units that are found in many different words.

segmentation: the task of dividing up words into smaller components.

For example, consider the word *love*, and in particular, focus on the way the word sounds when spoken aloud. Using two different approaches to segmentation, we can identify three smaller components within the word. First, just thinking about how the sounds of the word are created, it begins with a vocal gesture with the tongue tip touching the roof of the mouth, but with air escaping around its sides. It then moves to a more open configuration, with the jaw more open, and the sound more resonant. Last, the mouth closes again, this time with the lower teeth against the upper lip, just enough to create a small amount of turbulent hissing. While there are also transitional gestures as we move from one configuration to the next, there nevertheless are three distinct phases we can identify over the course of the word, in terms of the configuration of the mouth, and in terms of the sounds that accompany each distinct physical configuration.

Alternatively, we can think of this word in comparison to other words in the same language. For example, the word *love* begins with the same component that occurs at the beginning of words such as *laugh*, *like*, and

1

learn. Its next component is similar to the most resonant component of words such as *tub*, *bus*, and *dove*. Its last component is identical to the first component of *very* and the last component of *give*. The smaller components we find are called **segments**.

Exercise 1.1 Consider the following list of English words, and perform segmentation on each of them.

stoop, *stop*, *shop*, *shoot*, *spots*, *those*, *this*, *spit*, *soothe*, *soup*, *post*, *pose, toss*

a.   How many segments do you find in each word?
b.   How many types of segments do you find overall?

The number of segments for each word is listed as follows. Below that is a list of the types of segments, along with the words in which each segment occurs.

stoop	4
stop	4
shop	3
shoot	3
spots	5
those	3
this	3
spit	4
soothe	3
soup	3
post	4
pose	3
toss	3

s	*stoop, stop, spots, spit, soothe, soup, post, toss*
t	*stoop, stop, shoot, spots, spit, toss*
oo	*stoop, shoot, soothe, soup*
p	*stoop, stop, shop, spots, spit, soup, post, pose*
o	*stop, shop, spots, toss*
sh	*shop, shoot*
th	*those, this, soothe*
long-o	*those, post, pose*
z	*those, pose*
short-i	*this, spit*

As our data are linguistic, they are usually auditory in nature, but can be recorded visually using techniques of phonetic transcription. To return to the

2

example of *love*, we'd transcribe the first segment as [l], the second as [ʌ], and the third as [v]. The transcription task itself enacts segmentation, as it relies on the use of specific standardized symbols, where each symbol invariantly represents some type of segment. Our spelling system (like all alphabets) is a transcription system, but for historical reasons it is not suited to the task of transcribing words to the level of detail that the analyses in this textbook require. For that reason, we rely on the IPA alphabet for all transcriptions. This textbook assumes you have knowledge of the symbols of IPA, but you may find it helpful to keep a copy of the standard IPA chart nearby should you need to refer to it.

It is important to remember that segments and transcription symbols are not the same as letters. The spelling systems of languages like English sometimes use pairs of letters to represent single sounds, or allow a given letter to represent different sounds in different words, or indeed allow the same sound to be represented with different symbols in different words.

Exercise 1.2 Transcribe the words from Exercise 1.1 into IPA notation. If you are familiar with details such as diacritics that indicate aspiration and release, you can leave them out for now. Vowels may differ by accent.

stoop	[stup]
stop	[stɒp/stɑp]
shop	[ʃɒp/ʃɑp]
shoot	[ʃut]
spots	[spɒts/spɑts]
those	[ðoʊz]
this	[ðɪs]
spit	[spɪt]
soothe	[suð]
soup	[sup]
post	[poʊst]
pose	[poʊz]
toss	[tɒs/tɑs]

We can use symbolic transcription systems because each of the segments we identify occurs in a large number of words. For example, the sound represented by [l] is a segment found in many English words; the same is true of the sounds representd by [ʌ] and by [v]. The more words we observe and perform segmentation on, the more segments we detect; with sufficient observation, we would arrive at the complete set of segments for a given language. This full set comprises the surface **inventory** of the language.

inventory: the set of sounds within a language.

3

As we will see, we can use the surface inventory to make inferences about what sounds are contrastive in a language, and about the nature of mental representations of words. For example, you know that *love* and *dove* are different words, in part because they begin with different segments. The fact that they differ only by their initial segments suggests that the contrast between [l] and [d] is relevant in English. In turn, we infer that the two segments represent or "belong to" different phonemic categories.

Phonology is a distinct enterprise from the study of phonetics, which is concerned with the physical properties of sounds in human language – for example, articulatory dimensions such as tongue position and vocal cord vibration, and acoustic dimensions such as loudness and resonance. The division between these fields is blurry, however, since phonemes can be described by their phonetic properties. Indeed, phonological and phonetic generalizations often interact with each other.

When we study the phonetic properties of languages, we learn that segments can be described in terms of how they are articulated in the vocal tract. Such description includes details of place and manner of articulation, nasality, and the state of the larynx. In turn, we learn that some combinations are absent from some languages. For example, English has fricatives such as [f, v, θ, ð, s, z ʃ, ʒ], and velar consonants such as [k, g, ŋ], but no velar fricatives such as [x] or [ɣ]. This does not mean such a combination is impossible; instead, it is a fact about the inventory of English segments. Different languages have different inventories of sounds. Nevertheless, in both phonology and phonetics, we often observe enough languages to infer that some sounds are more common than others. Many languages have [t] and [m], while fewer have [θ] or [ʁ].

Your phonology is part of the knowledge you have of your language. You know which sounds are a part of a language and which are not, and you know which sounds may occur together within a word and which may not. In technical terms, you have knowledge of the phonemes that comprise the phonological inventory of your language, and you also have knowledge about which phonemes can go where in words of your language, its **phonotactics**.

phonotactics: the restrictions a language places on which sounds may occur next to each other.

There is thus much more to the study of phonology than the study of the phonemic inventory of languages. The study of phonotactics shows us that languages place restrictions on the positioning and sequencing of phonemes. For example, the Japanese consonant inventory includes the consonant [t], and the vowel [i], and in general, any consonant may precede any vowel. However, the sequence of [t] followed by [i] does not occur; there are no

4

words in which the string [. . .ti. . .] can be found. Of course, this is a fact only about Japanese phonology; some other languages may share this property, while others clearly allow the sequence [ti].

This point becomes more complex when we realize that in Japanese, as in many languages, a word may consist of more than one meaningful part. We refer to such meaningful parts as **morphemes**.

morpheme: a linguistic unit which pairs sound with meaning, and which is not composed of smaller morphemes.

The absence of [. . .ti. . .] is a basic observation about Japanese words, but also applies more specifically to Japanese morphemes. One might wonder whether this gap is a simple accident or a principled gap. In fact, if we examine words that combine more than one morpheme, we also encounter evidence which suggests that [. . .ti. . .] is actively avoided in the sound system. If you consider a **root** morpheme that ends in the consonant /t/, such as /kat/ 'win,' but try to add a **suffix** morpheme that begins with the vowel /i/, such as /-inai/ 'NEGATIVE,' you are creating a word in which the sequence [. . .ti. . .] may potentially occur.

root: a morpheme to which affixes may be attached.

affix: a morpheme attached to a root, such as a prefix or suffix.

If the combination of / kat + inai / remains intact as [. . .ti. . .], then we may conclude that the absence of [ti] among individual morphemes is indeed an accident. However, if anything changes about this sequence of sounds, we have evidence that it is truly avoided, and indeed the surface form in this case is [katʃinai]: the root's final /t/ has changed to a [tʃ].

This is an example of **alternation**, a scenario in which a morpheme has more than one surface realization, where one or more of its segments changes predictably. In this case, the root /kat/ appears as [kat-] in some contexts and [katʃ-] in others. We may say both that /t/ alternates between [t] and [tʃ], and that the morpheme /kat-/ alternates between [kat-] and [katʃ-].

alternation: a scenario in which a morpheme has more than one surface realization, depending on the linguistic context.

Within the Japanese word [katʃinai], we may still observe the form [katʃ-] as the root and [-inai] as the suffix, but since not every word built from /kat/ has [katʃ-] as its root, we refer to both [katʃ] and [kat] as *alternants* of the root. Further, while we may say that the root alternates, a more thorough examination of Japanese verbs would tell us that this is not simply a fact about morphemes such /kat-/, but about any root ending in /t/. Thus, there is a phonological alternation between [t] and [tʃ], in which they are surface realizations of the same element, but [tʃ] is the alternant that arises in a specific

5

circumstance – preceding the vowel [i] – while [t] is the alternant that arises in other circumstances. A third alternant, [ʦ], arises just if the following vowel is [u]. Again, these are generalizations about the sound system of Japanese, not just facts associated with some individual words.

Another important concept is that although there is more than one alternant of the root, in phonological analysis we often want to identify a single, abstract mental representation for any root or morpheme. This representation is often called the **underlying form**. In Japanese, for a number of reasons that will become clear as you learn more about phonology, the underlying form of 'win' is /kat-/.

underlying form or underlying representation (UR): an abstract mental representation of a linguistic unit.

Underlying representations are usually represented in text within angle brackets, as in /kat-/. Surface alternants, instead, are represented in square brackets, as in [kat-] and [kaʧ-].

A similar term for the concept of underlying form is **lexical form**, in reference to the **lexicon** – a list of morphemes which we presume a speaker of a language knows. The lexicon of any language is a list of all its morphemes, including roots and affixes, and includes information about their form as well as their meaning and function. The lexicon is analogous to an actual dictionary, in that it is a list of forms, both their sounds and functions, but is an abstract mental construct. Every speaker of every language has a lexicon comprising the morphemes of their language. In essence, the term *lexical form* implies that the underlying representation is what is stored within the lexicon of the language.

lexicon: an abstract mental list of morphemes, consisting of their form (sounds) and their functions and/or meanings.

Phonological restrictions of the kind exemplified by the absence of [ti] in Japanese are observable just by inspecting the form of individual morphemes. Nevertheless, they are often easiest to see in scenarios of alternation, wherever prefixes or suffixes attach to roots. In some cases, certain phonological generalizations are *only* observable in the context of alternation. For this reason, we will begin our study of phonology by framing it within morphology – the study of word structure.

1.1 Organization of this textbook

This textbook therefore follows a particular path through phonology. In Chapter 2, we will begin our investigation by studying alternation in more

detail: we will see many examples of phonemes taking on different forms in different phonological contexts. Chapter 3 explores alternation with zero-forms – situations where segments are deleted or inserted. We will move on in Chapter 4 to patterns of long-distance effects, where non-adjacent segments influence each other. One major example is the phenomenon of vowel harmony, a specific type of alternation seen in diverse languages around the world. We'll then focus more closely on the notion of phoneme and phonemic distribution in Chapter 5. This will prepare us to visit the notion of classes of sounds in Chapter 6, and hidden processes in Chapter 7.

We then move on to explore some other challenging types of phonological phenomena that go beyond the analysis of segments, such as syllable structure in Chapter 8, tone in Chapter 9, stress and meter in Chapter 10, and prosodic morphology in Chapter 11. Chapter 12 provides a discussion of advanced theories of phonological representation that are intended to address many of the empirical challenges along the way.

Key terms

phoneme
segment
segmentation
inventory
phonotactics
morpheme
root
affix
alternation
underlying form / underlying representation (UR)
lexicon

CHAPTER 2 ALTERNATION

Learning objectives

- Identify morphemes that have multiple alternants
- Learn the basics of morphological analysis, to identify components of complex words
- Describe the contexts in which various alternants appear
- Identify the best fit for a default alternant or underlying form
- Compose rules to derive other alternants from underlying forms

Introduction

In this chapter, we will explore how sounds may change their form because of the nature of adjacent sounds. We can see this quite clearly when morphology operates to place morphemes together – in such scenarios, sometimes a segment at the edge of a morpheme adapts to the segment at the corresponding edge of another morpheme, which provides us with concrete evidence of a default or "underlying" sound changing into something else. When the sounds of particular morphemes change like this, we infer that they **alternate** – they take one form in one context and a different form in some other context. We will begin examining the phenomenon of alternation here, and will pursue it further in the subsequent two chapters.

2.1 English plurals

For a first look at alternation, we may turn to a few basic examples from English. First, think of how nouns are made plural in English – aside from a short list of exceptions, we add a suffix spelled *-s* to a noun to make it plural. Under certain circumstances, we instead spell the suffix *-es*. Nevertheless, the phonological form of this suffix actually has three alternants; we can divide the set of all regular-pluralizing nouns into three groups, depending on which form of the suffix they take.

8

Exercise 2.1   For each group of words, describe the form of the English plural suffix. Remember to think in terms of sounds, not spelling. The orthographic and phonemic representations of each word in its singular form are provided; where UK and US pronunciations differ, both are shown.

a. *Phonemic representation*	*Gloss*	b. *Phonemic representation*	*Gloss*	c. *Phonemic representation*	*Gloss*
dɒg/dɑg	dog	ɹeɪk	rake	dʒʌdʒ	judge
wɒl/wɑl	wall	lɪp	lip	weɪdʒ	wage
kæn	can	stɹɪəp	stirrup	tʃɜtʃ/tʃɚtʃ	church
ɹɪm	rim	mast/mæst	mast	kaʊtʃ	couch
sɪmbəl	symbol	pɒt/pɑt	pot	pas/pæs	pass
stoʊv	stove	tɛmpəst	tempest	meɪz	maze
ɒlɪv/ɑlɪv	olive	task/tæsk	task	tɒs/tɑs	toss
bɒtəm/bɑɾəm	bottom	weɪf	waif	sɔːs/sɔɹs	source
fɪg	fig	klɪf	cliff		
deɪ	day	asp/æsp	asp		
bɔɪ	boy	hæft	haft		
kiː	key	tɹɪk	trick		
stjuː/stuː	stew				
hænd	hand				
fæŋ	fang				
stænd	stand				
kɹɪb	crib				
aʊə/aʊɹ	hour				
fɜː/fɚ	fur				
bɛː/bɛɹ	bear				

The form of the suffix for the roots in (a) is [z]; for the roots in (b) it is [s], while for the roots in (c) it is [əz].

Each noun has exactly one plural form, and everyone who speaks the language agrees on the nature of the plural form. One of way of trying to explain this knowledge is to presume that we all have acquired a lexicon which lists a pair of forms for each noun – one member of each pair is the singular, and the other is the plural. For example, we remember that the singular of *cat* is [kæt] and that *cats* [kæts] is its plural.

However, there are two facts that are unexplained by this approach: first, membership in one of the three groups above is not random, and second, people pluralize new words in consistent ways. To discover the non-randomness of the three groups, we look for something that the words in each group have in common with each other, to the exclusion of the other groups.

9