

Phonology

Phonology is the study of the sound system of language. It is the study of the wide variety of sounds in all languages, of the basic units of sound in a particular language, and of the regularities and rules that govern pronunciation of speech.

Some observations about the sounds of language:

1. the sounds of words are made by blowing air through the throat, mouth, and/or nose
2. speech is a continuous stream, but we hear separate speech sounds
3. the same sound recurs in different words (though often spelled differently)
4. the sounds of speech can be analyzed into smaller units
5. the sounds of speech will vary from one context to another

What linguists infer from these observations:

- Phonologists pay attention to the structure of the **vocal tract**, and the **articulation** of sounds by the vocal apparatus.
- They try to identify the basic sounds of a language—its **phonemes**.
- Phonemes can be further analyzed into their **distinctive features**.
- Systematic changes in the phonemes (**allophones**) when they are combined into longer sounds are described in terms of **phonological rules**.

Elements of The Vocal Tract

The production of speech involves the skillful manipulation of all the components of the vocal tract:

lips (1 in diagram below)

teeth

tongue

alveolar ridge (4): the bony ridge behind the upper teeth

hard palate (7): the bony dome constituting the roof of the mouth

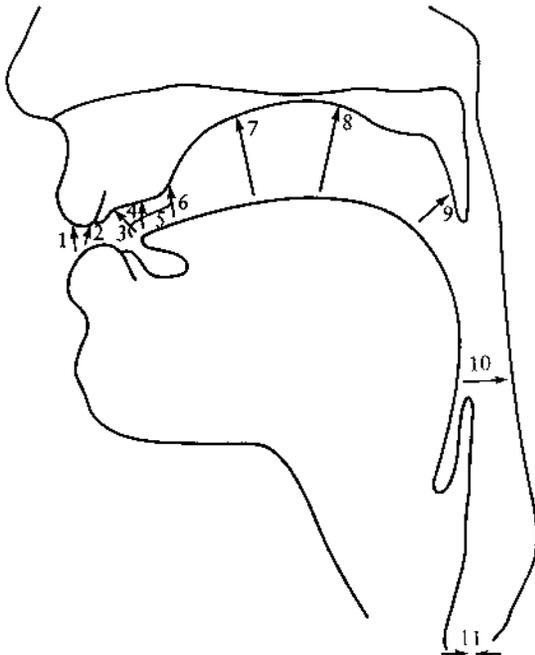
velum, or soft palate (8): the soft tissue immediately behind the tongue; when raised, it forces all air through the mouth; lowered, it allows air through the nose

uvula (9): the soft appendage hanging from the velum

pharynx (10): the back wall of the throat behind the tongue

larynx (11): containing the vocal cords

trachea: the tube going to the lungs



Phonemes: Segments of Sound

How to represent the sounds of speech? Written forms often provide little guide to actual pronunciation, in English at least.

One approach has been to develop a specialized notation to represent the sounds of any language. The International Phonetic Alphabet is the best known of these.

[b] as in *bird*, [d] as in *dog*; [ü] as in XX; [é] as in ...; [İ] as in ...

The IPA is a system of **phonetic** transcription. It is generally considered to provide a universal, language-independent, description. A **phonetic** or **phonological** transcription encloses elements in brackets: [].

The IPA can be used to describe the wide variety of sounds used in all the world's languages. However, each language uses a relatively small number of sounds. These basic sounds are called the **phonemes** of the language.

On average a language has around 35 phonemes. British English has 44, on one analysis.

A **phonemic** transcription encloses elements in slashes: //

Theoretically, the symbols used in a phonemic transcription have no special significance: one could use /1/, /2/ instead of /p/ and /b/. In practice, of course, this would make a transcription almost impossible to read.

A phoneme is the smallest segment of sound which can distinguish two words. The words *pit* and *bit* differ only in their initial sound: /p/ in one case, /b/ in the other. Words that differ by only one sound are known as **minimal pairs**, and one way to look for the sounds of a language is to search for such pairs.

The English accent known as Received Pronunciation has 24 consonant phonemes and 20 vowel phonemes, of which 12 are pure vowels (as in *bit*, *bet*, *bat*, *but*) and 8 are diphthongs or gliding vowels (as in *boat*, *buy*, *bay*).

The Phonemes of English

Consonants		Vowels	Diphthongs
/p/ <u>peep</u>	/v/ <u>veal</u>	/i/ <u>beet</u>	/aj/ <u>buy</u>
/b/ <u>bib</u>	/s/ <u>sun</u>	/ɪ/ <u>bit</u>	/aʊ/ <u>bow</u>
/m/ <u>my</u>	/z/ <u>zone</u>	/e/ <u>say</u>	/ɔj/ <u>boy</u>
/t/ <u>toot</u>	/ʃ/ <u>shoe</u>	/ɛ/ <u>set</u>	
/d/ <u>deed</u>	/tʃ/ <u>chop</u>	/æ/ <u>sat</u>	
/n/ <u>noon</u>	/ʒ/ <u>azure</u>	/ɑ/ <u>far</u>	
/k/ <u>sook</u>	/ʃ/ <u>judge</u>	/ʊ/ <u>up</u>	
/g/ <u>gig</u>	/r/ <u>rear</u>	/u/ <u>mood</u>	
/ŋ/ <u>singer</u>	/l/ <u>lull</u>	/ʊ/ <u>pull</u>	
/θ/ <u>ether</u>	/h/ <u>hail</u>	/ɔ/ <u>obey</u>	
/ð/ <u>either</u>	/w/ <u>wail</u>	/ɔ/ <u>fall</u>	
/f/ <u>fife</u>	/y/ <u>you</u>	/ə-/ <u>burr</u>	

How Real are Phonemes?

Linguists generally have agreed that when we hear speech we perceive these phonemes as sound segments. The phoneme has seemed to be, both intuitively and analytically, the ultimate unit of speech. However, some linguists have recently declared "the death of the phoneme": they claim that the phoneme is "an illusion" (Kaye, 1989, p. 149).

An indication of the problematic status of the phoneme can be seen in *Linguistics for Non-linguists*: on two facing pages phonemes are described as “percepts—psychological units,” as “abstract entities postulated to account for the fact that speakers of English perceive... vowels... as different,” and finally that “when we talk, we utter a physical speech signal which we *interpret* as containing phonemes” (p. 106-107, original emphasis). (And on page 110 we’re told “phonemes... are theoretical constructs within a theory of phonology.”) Percepts, interpretations, or abstract theoretical constructs?

But because the news that the phoneme is dead is not widely shared, we’ll proceed here in terms of the standard phonological story.

Shared Properties of Phonemes

The phonemes of a language are not totally separate entities; they share common features. Any feature that distinguishes some phonemes from others is called a **distinctive feature**.

For example:

/b/, /d/, /m/, /n/ are all voiced: they are pronounced with vibration of the vocal cords.

/p/, /b/, and /m/ are all pronounced with the lips.

When /m/ and /n/ are spoken, air is expelled through the nose.

There are several different ways of analyzing phonemes into their distinctive features. A standard way is to describe **vowels** in terms of the features of [high], [low], [back], [round] and [tense]:

[**high**] = height of tongue in the mouth (/i/ is high, /e/ is mid, /a/ is low).

[**front**] = position of tongue: towards the lips (/i/), or towards the velum (/u/).

[**round**] = degree of rounding of the lips (/u/ is round, /e/ is spread).

[**tense**] = state of vocal muscles (/u/ is tense, /a/ is lax).

For a very good animated demonstration of the anatomy of vowel production, point your browser to: <http://www.departments.bucknell.edu/linguistics/ln105/vowel/index.html>
Point and click to hear each vowel sound and see tongue position (n. b. this animation requires that your browser has the Shockwave plug-in).

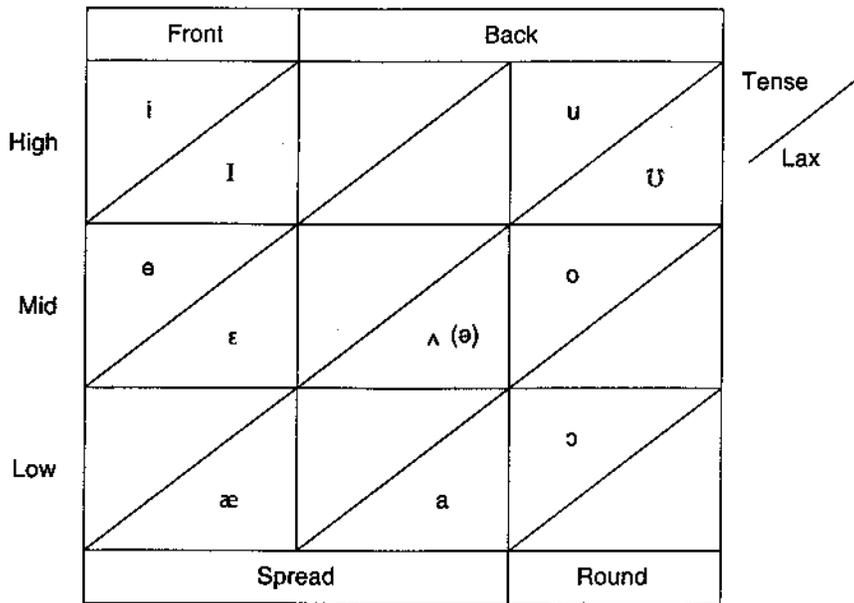
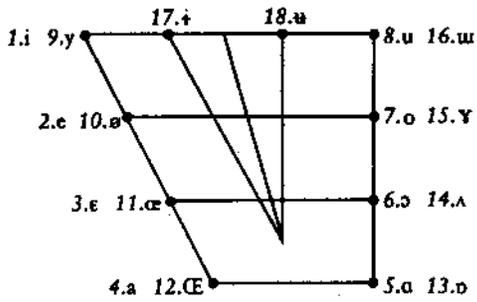


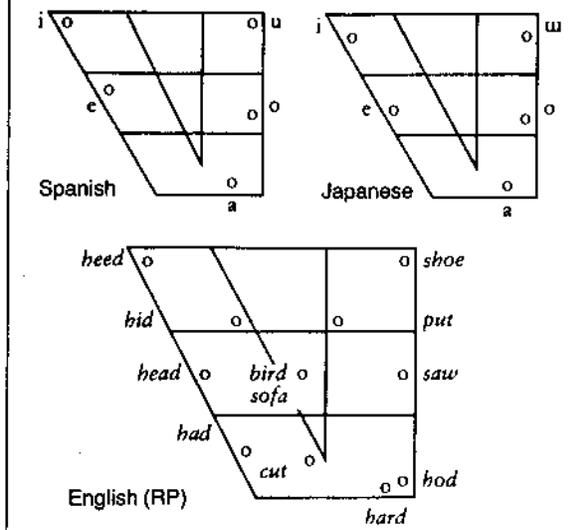
FIGURE 6.2 Vowel Phonemes of English



Using the Cardinal Vowel diagram

Once the cardinal vowel values have been learned (a matter of auditory practice), it is possible to place the vowels of a speaker of any language onto the chart in a fairly precise way – if necessary, confirming the auditory judgments by acoustic measurements. In this way, typical articulations in different languages can be compared – the five-vowel system (p. 167) of Spanish, alongside that of Japanese, for example. The two systems are very similar, but most of the Japanese vowels are articulated in slightly more open positions than the Spanish; the close back vowel also shows a difference in lip rounding. (It is standard practice to use the nearest (rounded or unrounded) cardinal vowel symbols, when locating 'real' vowels on the chart.)

English has a more complex vowel system, as can be seen from the following chart (the accent represented is 'received pronunciation', p. 39).



Consonants can be similarly described, in terms of the features of [place], [manner], and [voice]:

[place] = the location of the constriction in the vocal tract:

bilabial (/p, b, m, w/), labiodental (/f, v/), interdental (/θ, ð/), alveolar (/t, d, s/), palatal (/r, y/), velar (/k, g/), and glottal (/h/).

PLACE OF ARTICULATION

Two reference points are involved in defining consonantal places of articulation: the part of the vocal tract that moves (the 'active' articulator) and the part with which it makes contact (the 'passive' arti-

culator) (p. 130). Eleven possible places are used in speech, as indicated in the figure. (A full list of phonetic symbols is given on p. 159 and in Appendix II.)

1. Bilabial. Both lips are involved in the articulation, e.g. [p], [b], [m].

2. Labio-dental. The lower lip articulates with the upper teeth, e.g. [f], [v].

3. Dental. The tongue tip and rims articulate with the upper teeth, e.g. [θ], [ð], as in *thin* and *this* respectively.

4. Alveolar. The blade (and sometimes the tip) of the tongue articulates with the alveolar ridge (p. 130), e.g. [t], [s]. Sounds articulated at the rear of this ridge (e.g. [ɹ],

as in some pronunciations of *red*) are sometimes classified separately as *post-alveolar*.

5. Retroflex. The tip of the tongue is curled back to articulate with the area between the rear of the alveolar ridge and the front of the hard palate, e.g. [ɻ], [ɻ̌], as heard in many Indian English accents.

6. Palato-alveolar. The blade (and sometimes the tip) of the tongue articulates with the alveolar ridge, with a simultaneous raising of the

front of the tongue towards the hard palate, e.g. [ʃ], [ʒ], as in *shoe* and French *je*.

7. Palatal. The front of the tongue articulates with the hard palate, e.g. [ç], [j], as in German *ich* and *ja* respectively.

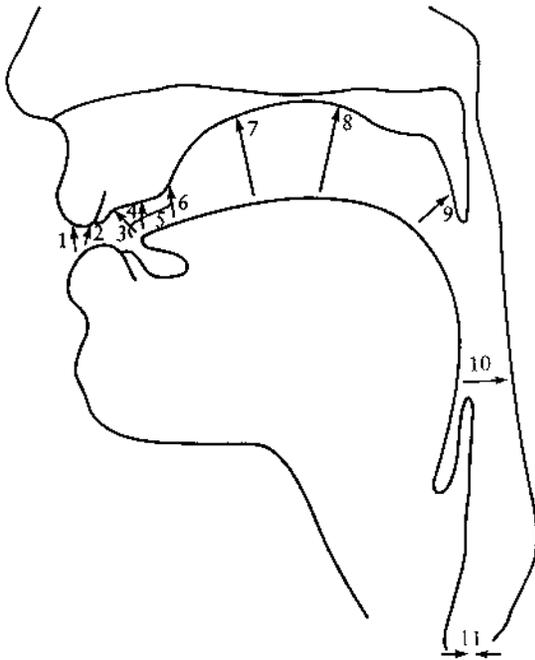
8. Velar. The back of the tongue articulates with the soft palate, e.g. [k], [g].

9. Uvular. The back of the tongue articulates with the uvula, e.g. [ʀ], as in French *vue* (certain accents).

10. Pharyngeal. The front wall of the pharynx (in the region of the epiglottis) articulates with the back wall, e.g. [ħ], [ʕ], both common in Arabic.

11. Glottal. The vocal folds come together to cause a closure or friction, e.g. [h], [ʔ] (the glottal stop, p. 128) – a rather different method of articulation from any of the other consonants.

Other ways of describing articulation, in the context of phonology, are discussed in §28.



[**manner**] = the manner of the constriction:

stops (/p, b/): the flow of air is completely blocked

fricatives (/f, v, ɸ/): air flow is impeded but not completely blocked

affricatives (/XX/): begin like a stop and end like a fricative

nasals (/m, n/): air flows through the nose, is blocked through the mouth

liquids (/l, r/): between true consonants and vowels: *l*-like and *r*-like sounds

and glides (/w, y/): between true consonants and vowels: vocal tract is constructed, but not enough to block or impede the airflow

Stops, fricatives and affricatives are sometimes called **obstructives**, while nasals, glides and liquids are called **sonorants**.

[voice] = whether or not the vocal cords are vibrating:

voiced (/b, d, g, m, n.../), unvoiced (/p, t, k, h.../).

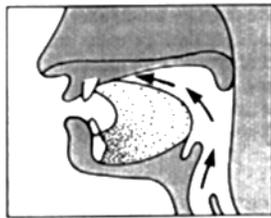
For a demonstration of the articulation of consonants, go to:

<http://www.departments.bucknell.edu/linguistics/ln105/cons/index.html>

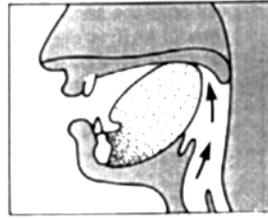
Some consonant places of articulation



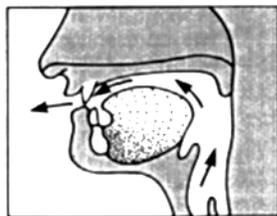
Bilabial [p] and [b]



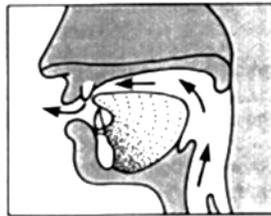
Alveolar [t] and [d]



Velar [k] and [g], when followed by an [i] vowel



Labio-dental [f] and [v]



Dental [θ] and [ð]



Alveolar [s] and [z]

Note that stops, fricatives and affricatives always come in voiced and voiceless **pairs** (except for /h/). Nasals, liquids and glides are all voiced. All vowels are voiced.

Every phoneme, then, can be described in terms of these distinctive features. For example:

/p/ = [+bilabial, +stop, -voice] /r/ = [+palatal, +liquid, +voice]

It will be evident that phonological analysis is based (somewhat indirectly) on the physiology of the vocal tract. The distinctive features of a phoneme correspond to the form of articulation of the vocal tract when that phoneme is uttered.

However, one complication is the fact that the phonemic representation of the words in a language is not identical for every speaker. English has a variety of **dialects**, each of which is spoken in ways that differ somewhat from person to person: these individual differences are called **ideolects**.

Another complication is that every language has **non-segmental** aspects to the way it sounds.

Non-Segmental Phonemes

A language like Chinese has words that are distinguished by differences in the rise and fall of tone.

<i>ma</i> (level tone) = mother	<i>ma</i> (rising tone) = hemp
<i>ma</i> (dipping tone) = horse	<i>ma</i> (falling tone) = scold

Metrical Phonology

English doesn't have tones, but it does have important non-segmental features. In particular, each word and phrase has a rhythm, a pattern of stressed and unstressed syllables. Phonologists have recently begun to study these properties.

There seems to be an internal structure to rhythm, or alternating strong (S) and weak (W) portions. For example:

r	e	f	o	r	m	a	t	i	o	n
S	W		S	W						
	W			S						

And stress plays a part in the indication of meaning, as we shall see later.

Combining Phonemes: Phonological Processes

We've seen that in most analyses—phonemes are the units of language on the level of its sounds. Linguists also look for **rules** that specify the organization of these units, to explain phenomena like the following:

the is pronounced *th[ɪ]* when the following word begins with a consonant, and *th[i]* when it begins with a vowel. Compare *the duck* and *the owl*.

The phoneme /t/ is pronounced differently in different contexts: *Tim*, *stem*, *hit*, *hit me*, *Betty*. In *Tim* the /t/ is aspirated; in *stem* it is released but not aspirated; in *hit* it can be

released or unreleased; in *hit me* it may be unreleased or may be a glottal stop; in *Betty* it is an alveolar flap (in U.S. English, though not in British English, which is why a British *Martin* is hard for Americans to recognize).

These are **allophones**, and they are predictable. A careful description of phenomena such as these will link the **phonemic** level and the **phonetic** level of speech.

Phonological rules address additional phenomena, such as:

aspiration: /p/ becomes /p^h/ when it both begins a syllable and is followed by a stressed vowel. E.g., *peanut* versus *napkin*. This regularity can be expressed more technically:

$$/p/ \rightarrow [p^h] / \$ _ V [+stress]$$

Where \rightarrow indicates “becomes,” / means “in the following environment,” \$ indicates a syllable boundary.

It turns out that /t/ and /k/ behave the same as /p/, so we can write the rule more broadly, as:

$$[+stop, -voice] \rightarrow [+aspirated] / \$ _ V [+stress]$$

[Notice that here you can actually see the phoneme dying! That’s to say, the phoneme ceases to become a necessary part of the analysis.]

Other phonological phenomena include: **vowel lengthening**, **vowel nasalization**, **flapping** (and more broadly **neutralization**), and **nasal deletion**.

Each of these is a phenomenon that occurs when speech sounds are articulated in combination.

Notice that the analysis of language at the level of sound, into phonemes, distinctive features, and phonological rules, appears to make no mention of **meaning**. It is often said that the phonological level of language doesn’t involve meaning. But remember that identifying the phonemes of a language requires comparing minimal pairs of words (such as *put* and *pit*), and words are **semantic** units—that’s to say, words are identified by virtue of having meaning. If [pĭt] were a word along with [put] and [pot], then ĭ would be a phoneme of English, rather than just an allophone. So decisions about the identity of phonemes are influenced by semantic judgments.

Exercises

Problems facing the Child

How to control lips, tongue, glottis, etc., to articulate different sounds? (production)

How to discriminate subtle differences in audible sound? (reception)

(Actually, how *not* to discriminate?)

Which differences are meaningful (phonemic), and which are not (allophonic)?

How to articulate strings of phonemes?

Phonological development book

How are intonation and stress used?

Exercises