

## LANGUAGE SOUNDS: PHONETICS

In these lectures we will study...

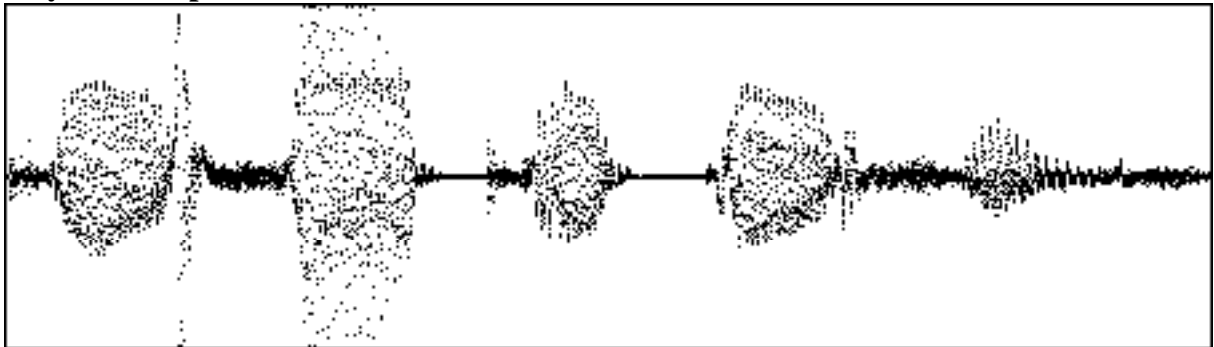
- ✓ evidence that producing and processing language sounds is biologically built in ability.
- ✓ the ways that linguists describe speech sounds.
- ✓ the difference between speech sounds and their written representation (“orthography” or “spelling”).

### PERCEIVING AND PRODUCING SPEECH SOUNDS

**Phoneme:** In Chapter 6 of *The Language Instinct*, Pinker frequently refers to *phonemes*. For our purposes, a *phoneme* is what a speaker of a language perceives as a single speech sound. I will generally just refer to “(speech) sounds” rather than “phonemes”.

- Speech is a continuous signal
- Acoustic *wave form*

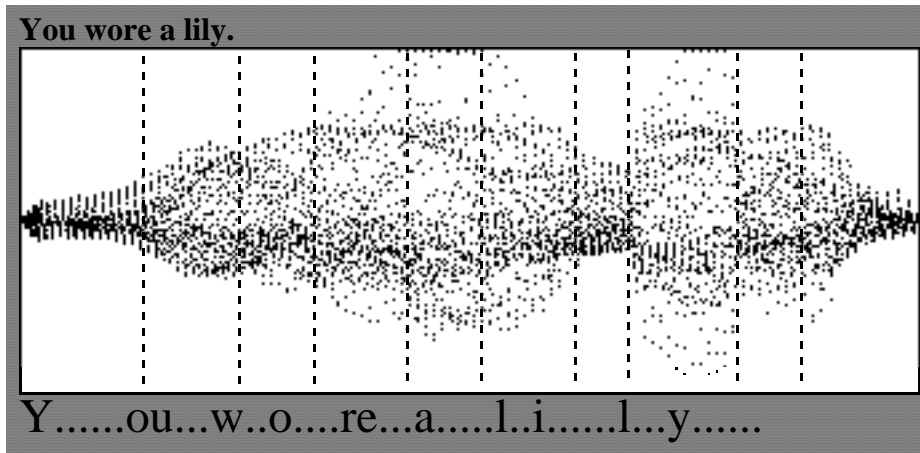
**Kay saw two pieces.**



K..ay....s.....aw...t.....wo...p.....ie....c.....e....s.....

Wave form: actual picture of sound wave

Identifying individual sounds: This example suggests that there are individual sounds (11 sounds)



10 sounds, but wave form does not show clear demarcations.  
(cf. *Why are you weary?* from film, 1st week)

To a HUMAN ear, the sounds are equally distinct as with “Kay say two pieces”

- *Oronyms*

Ithinkitsaparent.      { I think it's a parent. }  
   { I think it's apparent. }

Letuspray                      { Let us pray. }  
   { Let us spray. }

(Examples from R. Jackendoff, *Patterns in the Mind*, BasicBooks, 1994)

THERE ARE NO WORD BREAKS IN THE SPEECH STREAM!

**SUMMARY: From a continuous stream, we hear individual sounds in a language we know and we group those sounds.**

**WORDS and SENTENCES are not audible as separate units either.**

- The “same sounds” are not the “same” in the continuous stream of speech, yet we manage to compensate for differences and hear different sounds as “the same”

lean	kneel	Are the <i>l</i> 's the same?
Pam	Spam	Are the <i>p</i> 's the same?
kit	cot	Are the “ <i>k</i> ” sounds at the beginning of each word the same?
cat	can	Are the “ <i>a</i> ’s” in these words the same sound?
I miss you.	I miss her.	Are the <i>s</i> 's as the end of <i>miss</i> the same in both sentences?

- Speech is fast—10-15 phonemes/second in casual speech, 20-30 in fast speech
- Articulatory phonetics

**Articulatory phonetics:** The description of speech sounds in terms of the way they are produced by the vocal organs. The articulatory organs can be grouped as follows:

Air passages: The mouth (*oral* sounds) or the nasal passage (*nasal* sounds)

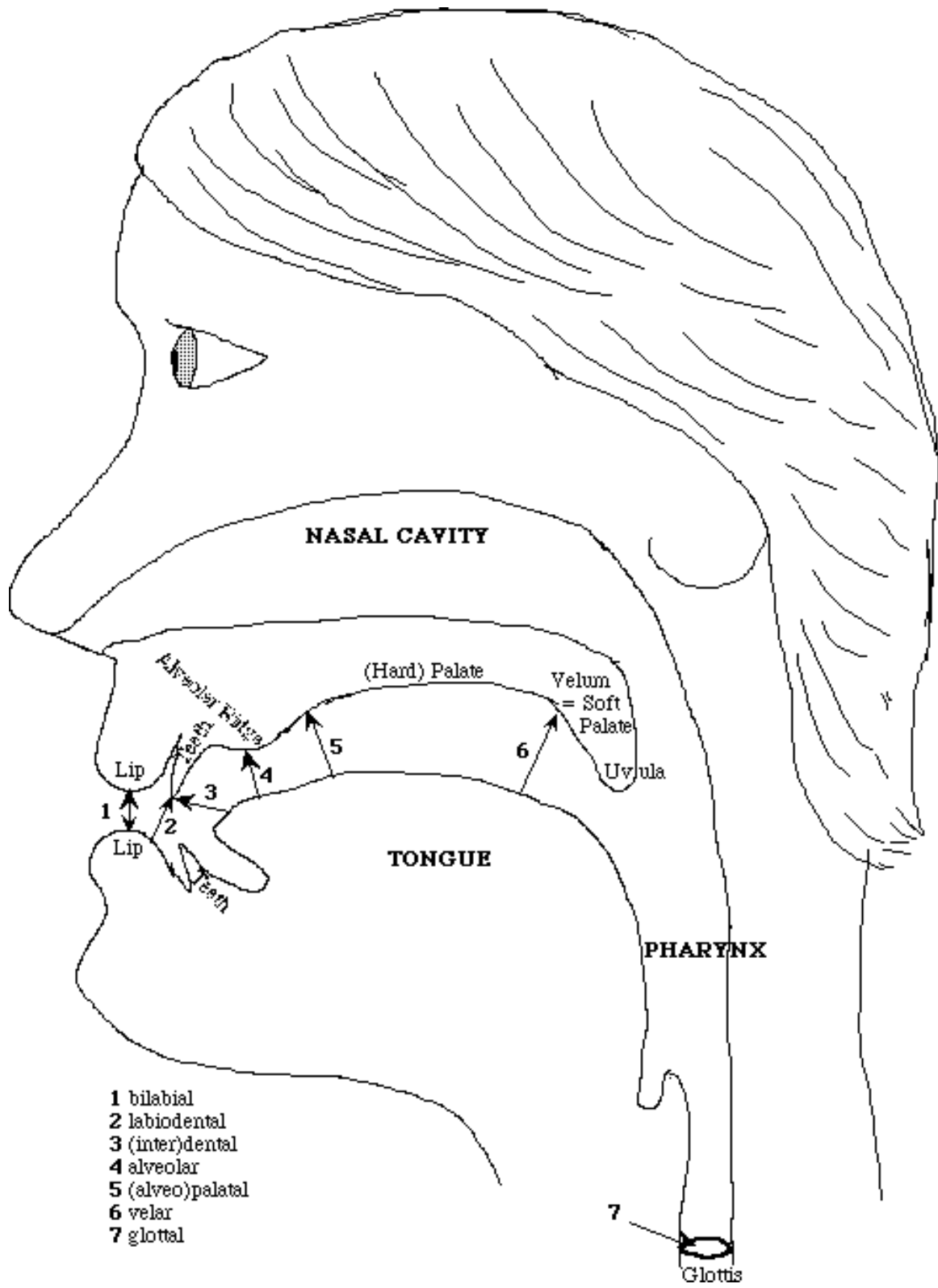
Articulators: Flexible organs which can be moved; these are the lips (*labial* sounds) and the tongue. (The PART of the tongue which is the main articulator can be named, e.g. *apical* for the tip of the tongue, *dorsal* for the back of the tongue, but it is normally sufficient to simply name the area touched by the tongue, not the part of the tongue itself.)

Places or Points of articulation: The areas where the articulators create the most constriction; these may be the lips (*labial* sounds), the teeth (*dental* sounds), the alveolar ridge behind the teeth (*alveolar* sounds), the roof of the mouth or hard palate (*palatal* sounds), the velum or soft palate (*velar* sounds), or the vocal cords or glottis (*glottal* sounds).

Complementary to articulatory phonetics is ...

**Acoustic phonetics:** The description of speech sounds in terms of the physical properties of the sounds themselves. Acoustic phonetics requires the use of instruments which can record and measure such aspects of speech sounds as pitch and noise frequency, amplitude, and formant (“overtone”) structure. An example of one type of instrumentally produced data is seen in the wave forms on page 49.

We will not study acoustic phonetics in Linguistics 1. However, note that acoustic phonetics is essential for all work involving both machine speech recognition systems and speech synthesis systems. Why?



- Consonants

Consonants are distinguished by ...

1. **State of glottis:** Is the glottis vibrating (*voiced*) or not (*voiceless*)?
2. **Place of articulation:** Where is the main air constriction in the vocal tract?
3. **Manner of articulation:** Is the air *stopped*, is there local *friction*, does air go through the nose (*nasal*)?

### THE CONSONANTS OF ENGLISH

(In boxes with 2 consonants, the left-hand one is **voiceless**, the right-hand one is **voiced**.)

	<b>Bilabial</b>	<b>Labiodental</b>	<b>(Inter)dental</b>	<b>Alveolar</b>	<b>(Alveo)palatal</b>	<b>Velar</b>	<b>Glottal</b>
<b>Stops</b>	p b			t d		k g	ʔ
<b>Fricatives</b>		f v	θ ð	s z	ʃ ʒ		h
<b>Affricates</b>					tʃ dʒ		
<b>Nasals</b>	m			n		ŋ	
<b>Liquids</b>				l r			
<b>Glides</b>	w*				y	w*	

\*[w] has both the *bilabial* element of lip-rounding and the *velar* element of the back of the tongue approaching the velum.

#### Examples:

<b>Bilabial</b>	<b>Labiodental</b>	<b>(Inter)dent.</b>	<b>Alveolar</b>	<b>Palatal</b>	<b>Velar</b>	<b>Glottal</b>
[p]ie [b]uy			[t]ie [d]ie		[k]ite [g]uy	(oh[ʔ]oh)
	[f]ie [v]ie	[θ]igh [ð]y	[s]igh [z]ion	[ʃ]y mea[ʒ]ure		[h]igh
				[tʃ]ime [dʒ]iant		
[m]y			[n]igh		si[ŋ]	

			[l]ie [r]ye			
[w]ide				[y]ou		

- Vowels

- Vowels differ from consonants in that the air stream flows freely for vowels. The differences between vowels are created by shaping the oral cavity to create different acoustic effects, similar to the way a harmonica player can shape the sound of the harmonica by opening or closing a hand around the instrument.

- Vowels are distinguished from each other by ...

1. **Height of tongue in the mouth:** What part of the tongue is relatively *high* or *low* in the mouth?
2. **Frontness or backness of tongue in the mouth:** Is the active part of the tongue toward the *front* or the *back* of the oral cavity?
3. **Position of lips:** Are the lips relatively *rounded* or not?

### THE VOWELS OF ENGLISH

Among languages of the world, English has an unusually large number of vowel sounds. In **high** and **mid** vowel areas, there are two sets of vowels. If necessary, we will refer to these as the *upper high* and *lower high* versions of the high vowels and *upper mid* and *lower mid* versions of the mid vowels.

	Front (& unrounded)	Central (& unrounded)	Back (& rounded)
<b>High</b>	i [bit] 'beat'		u [but] 'boot'
	ɪ [bɪt] 'bit'		ʊ [pʊt] 'put'
<b>Mid</b>	e [bet] 'bait'	ə [sofə] 'sofa'	o [bot] 'boat'
	ɛ [bɛt] 'bet'	ʌ [bʌt] 'but'	ɔ [bɔt] 'bought'*
<b>Low</b>	æ [bæt] 'bat'		a [bat] 'bot'*

\*Many speakers of American English have identical pronunciation for 'bought' and 'bot' (a type of fly or the name of the person who invented 'Bott's dots' which mark freeway lanes). If these words, or other pairs like 'caught' and 'cot', 'hawk' and 'hock', sound the same for you, then you do not have the back, rounded [ɔ] as one of the sounds (*phonemes*) in your English dialect.

Practice some words

## SPEECH AND WRITING

### • Speech vs. spelling

“LANGUAGE IS AN INSTINCT, WRITTEN LANGUAGE IS NOT” (Pinker 186)

- Evidence that writing is *not* an “instinct” ...
  - Throughout history, most languages have never had a written form
  - Writing has been independently invented a number of times: Mesopotamian, Egyptian, Chinese, Mayan at least, and probably some others
  - People have to be *taught* writing; moreover, there are no known examples of children elaborating a rudimentary writing system parallel to children creating grammatical creole languages based on rudimentary pidgins
  - Some people never succeed in mastering written language: *illiteracy* from poor teaching or lack of desire and *dyslexia* are two such cases
  - Types of writing systems: although bases of spoken language are universal, bases of writing are not—see next section

### • Types of writing systems

- Word writing (*logographic*)

**English**  
(if it had a word writing system)



Lizards



swallow



beetles.

**Chinese**



iN



ʔi!



ʔØ!

‘Eagles swallow snakes.’

- Syllable writing

**English**  
(if it had a syllable writing system)



Liz-



ards



swal-



low



bee-



tles.

**Japanese** (mixes native Japanese *syllabic signs* with Chinese characters, which are word signs—the portions represented as Chinese characters are shown with small capitals in the transcription)

トカゲガ	カブト 虫 ヲ	飲ミ込ム
to- ka- ge- ga mu	ka- bu- to- MUSHI- o	NU- mi- KO-
Tokage-ga lizard-NOM	kabutomushi-o beetle-ACC	numikomu. drink-suck in
‘Lizards swallow beetles.’		

- Phoneme writing

**English** [lɪzrdz swəloʊ bi:tlz] ‘Lizards swallow beetles.’  
(if it had a true phoneme writing system)

There are probably no writing systems which meet the phoneme writing system ideal of *one and only one symbol per sound*. A few, like Spanish and Russian, come fairly close. Most languages for which a writing system has been created in only recent times, such as the languages of Africa, also come close, but even there, typographic and other considerations have usually made it necessary to omit certain distinctions or to use symbol groups to represent one sound, such as English *ch* and *sh*, which represent the sounds [tʃ] and [ʃ] respectively.

- English spelling

- In principle, English has a *phoneme writing system*, but ...

ONE LETTER OR LETTER COMBINATION MAY REPRESENT DIFFERING SOUNDS

<u>f</u> ame	[ e ]	<u>f</u> lute	[ u ]	<u>s</u> un	[ s ]	<u>g</u> irl	[ g ]
<u>f</u> ad	[ æ ]	<u>p</u> t	[ ʊ ]	<u>s</u> ugar	[ ʃ ]	<u>g</u> iant	[ dʒ ]
<u>f</u> ather	[ a ]	<u>b</u> t	[ ʌ ]	<u>e</u> asy	[ z ]		
				<u>m</u> ea <u>s</u> ure	[ ʒ ]		
<u>ch</u> ip	[ tʃ ]	<u>ei</u> ther	[ ð ]	<u>m</u> eat	[ i ]		
<u>ma</u> chine	[ ʃ ]	<u>e</u> ther	[ θ ]	<u>gr</u> eat	[ e ]		
<u>ch</u> aracter	[ k ]	<u>Th</u> omas	[ t ]	<u>thr</u> eat	[ ε ]		

ONE SOUND IS REPRESENTED BY MORE THAN ONE LETTER OR LETTER COMBINATION

	[ i ]		[ u ]		[ f ]		[ ʃ ]
<u>h</u> e	<u>C</u> aesar	<u>t</u> o	<u>thr</u> ough	<u>f</u> ill	<u>sh</u> t		
<u>s</u> ea	<u>f</u> oetus	<u>t</u> oo	<u>bl</u> ue	<u>c</u> uff	<u>s</u> ugar		



<u>see</u>	ma <u>ch</u> ine	<u>two</u>	<u>crew</u>	<u>ph</u> ysics	fas <u>ci</u> st
de <u>ce</u> ive	ke <u>y</u>	fl <u>u</u> te	<u>cou</u> p	rou <u>gh</u>	na <u>ti</u> on
<u>se</u> ize	sil <u>l</u> y	sh <u>o</u> e			ma <u>ch</u> ine
					<u>sch</u> ism

SOME LETTERS OR COMBINATIONS ARE “SILENT”

res <u>ig</u> n	lan <u>e</u>
bo <u>mb</u>	<u>mn</u> emonic
ps <u>ych</u> ology	aut <u>um</u> n
<u>kn</u> ow	<u>pt</u> omaine
<u>nigh</u> t	ind <u>ic</u> t

SOME SOUNDS ARE NOT WRITTEN

colonel	(pronounced “ker...”)
cute	(pronounced “ky ...”)

- Would a *phonetic* spelling system for English be preferable to English *orthography*

An orthography is a *practical* way to represent a language in written form, not necessarily a technically correct representation of pronunciation. Would a phonetic spelling system be practical as an everyday way to write English? Consider the following ...

- Orthography preserves morpheme identity

“s” plural  $\left\{ \begin{array}{l} \text{ropes [rops]} \\ \text{robes [robz]} \\ \text{Romes [romz]} \\ \text{roses [roz@z]} \end{array} \right\}$

“ed” past tense  $\left\{ \begin{array}{l} \text{backed [bækt]} \\ \text{bagged [bægd]} \\ \text{banned [bænd]} \\ \text{batted [bæt@d]} \end{array} \right\}$

sane/sanity, divine/divinity, obscene/obscenity

sign/signal, hymn/hymnal, bomb/bombard

- Differentiation of homonyms (a functional aspect of several spellings, one sound)  
reed/read, break/brake, bred/bread, made/maid, site/cite/sight, need/knead, rite/right/write, bite/byte, etc.
- One writing system for different dialects; here are some entries from a little book called *How to Speak Southern* (Bantam, 1976)

**Ah:** The things you see with, and the personal pronoun denoting individuality. “Ah think Ah’ve got somethin’ in mah ah.”

**Flares:** The colorful, sweet-smelling part of a plant. “If yo wife’s mad at you, it’s smart to take her some flares.”

**Prolly:** Likely to. “Ah’ll proolly go to Etlanna this weekend.”

- And ... if you learned only a phonetic representation of English, how would you ever read all those books that are already in the library??!

- In fact, English spelling isn't all that irregular. Though it is not *phonetic*, the written forms of about 84% of the words in English follow regular spelling conventions.

- **English Diphthongs**

[ay] 'eye'  
[aw] 'out'  
[oy] 'boy'

- **How do we distinguish between vowels with the same height, backness and rounding?**

tense vs. lax- tense vowels have greater vocal tract constriction

English tense vowels:

[i], [e], [u], [o]