

LINGUISTICS COURSE

Phonetics and the IPA

How speech sounds are made, described and written down with the International Phonetic Alphabet.

10 Chapters

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PHONETICS AND THE IPA

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Phonetics and the IPA

Course 1 · Chapter 1 · Why Sounds Need a Notation

Introduction to Linguistics gave a first look at how speech sounds are made and organised. This course goes further: it teaches you to describe any speech sound exactly, and to write it down in a way that another person can read. The tool for that is the **International Phonetic Alphabet**, the IPA. This first chapter explains why we need it, what it is, and the few conventions that you will see in every chapter after this.

> **THE IDEA IN A BOX**
>
> Spelling records words; the IPA records sounds. Ordinary spelling gives one sound many spellings and one spelling many sounds, so a separate alphabet is needed in which each symbol stands for one sound, in every language.

Spelling Is Not a Record of Sound

English spelling is a famous example of the problem. Here are six words that all contain the letters *ough*, with a transcription of how each is said in Received Pronunciation (RP), a standard southern English accent. Do not worry about the symbols yet; just notice how many different sounds hide behind four letters.

```
# spelling    RP transcription
through     [θɹuː]
though      [ðəʊ]
tough       [tʌf]
cough       [kɒf]
bough       [baʊ]
thorough    [ˈθʌɹə]
```

The reverse happens too: the same sound is spelt in many ways. The vowel [iː] is written differently in *see*, *sea*, *be*, *key*, *field* and *receive*. Spelling is a record of history and convention, not of sound.

> **WATCH OUT: LETTERS ARE NOT SOUNDS**

> A letter is a written symbol; a sound is something a person produces. This course keeps them apart. Letters and words in ordinary spelling are in *italics*; sounds are in **[square brackets]** or **/slashes/**. The letter *c* is [k] in *cat* and [s] in *city*.

Some spellings are closer to the sound

Not every language is as irregular as English. Hungarian and Esperanto were both given spelling systems that come close to one letter or digraph per sound. Even there, the letters do not always match what an English reader expects, which is exactly why a neutral notation is useful.

SPELLING	LANGUAGE	SOUND	EXAMPLE
s	Hungarian	[ʃ]	*só* [ʃoː] "salt"
sz	Hungarian	[s]	*szó* [soː] "word"
zs	Hungarian	[ʒ]	*zseb* [ʒɛb] "pocket"
cs	Hungarian	[t͡ʃ]	*csak* [t͡ʃɒk] "only"
gy	Hungarian	[ɟ]	*gyár* [ɟaːr] "factory"
ĉ	Esperanto	[t͡ʃ]	*ĉapelo* "hat"
ŝ	Esperanto	[ʃ]	*ŝipo* "ship"
ĝ	Esperanto	[d͡ʒ]	*ĝardeno* "garden"
c	Esperanto	[t͡s]	*celo* "aim"

Notice that Hungarian *s* is the sound English writes *sh*, and Hungarian *sz* is the sound English writes *s*. The Hungarian pair *só* and *szó* differ in one sound, a minimal pair of the kind met in Introduction to Linguistics 3. The tie bars (*t͡ʃ*) show that two symbols make one sound, an affricate.

What the IPA Is

The **International Phonetic Alphabet** is a set of symbols with a fixed meaning for each: one symbol for one sound, whatever the language. It is maintained by the **International Phonetic Association**, also called the IPA.

POINT	WHAT THE SOURCES SAY
Origin	Founded in 1886 by a group of French and English language teachers; named the International Phonetic Association from 1897. Paul Passy led the group, with Otto Jespersen and Daniel Jones among the figures involved.
First uniform alphabet	The values of the letters were made uniform across languages in 1888.
Size	107 letters for consonants and vowels, 31 diacritics and 17 suprasegmental signs, according to Wikipedia.
Latest revisions	The Association says its latest substantive changes were in 2015 (wording and layout) and 2005 (the labiodental flap); later years' charts repeat that design with an updated copyright year. Wikipedia describes the official chart as revised in 2020, so the year you see depends on the source.
Licence	The chart and its sub-charts are published under a Creative Commons Attribution-ShareAlike 4.0 licence, so you may copy and adapt them with attribution.
Use	Many British dictionaries, including the *Oxford English Dictionary*, give pronunciations in the IPA; most American dictionaries use their own respelling systems instead.

USE THE REAL CHART

The Association's website lists the full chart (a PDF and image files), sub-charts for consonants, vowels, diacritics and tones, an interactive chart, and recordings of the sounds. A written course cannot play audio, so open the interactive chart next to this one and click the sounds as you read.

Brackets and Slashes

You met two kinds of brackets in Introduction to Linguistics 3. They are worth fixing now.

BRACKETS	MEANS	EXAMPLE
[ ] square brackets	a phonetic transcription: the sounds as they are physically made	[pʰɪn]
/ / slashes	a phonemic transcription: the sounds as units of one language's system	/pɪn/
italics	ordinary spelling	*pin*

Broad and Narrow

A **narrow** transcription records fine detail; a **broad** one records only the main sounds. Both are usually written in square brackets. Compare two transcriptions of the same English word:

```
# word   broad     narrow
pin      [pɪn]     [pʰɪn]    # narrow shows the puff of air after the p
spin     [spɪn]    [spɪn]    # no puff here, so both are the same
```

How much detail to record depends on the purpose. A dictionary needs a broad transcription; a study of a new accent needs a narrow one. This course gives you both and states which one it is using.

How This Course Works

1. **The accent is always stated.** A transcription of English belongs to a particular accent; the same word differs between RP, General American and Scottish English (Chapter 7).
2. **Examples come from languages you know.** English, German, Hungarian, Japanese and Esperanto are the working languages, with a few others when they show a sound best.
3. **Everything is checked.** Symbols and values are checked against the IPA chart and a reference such as Wikipedia's phonology articles; anything I could not confirm is marked as unverified.
4. **Use your own voice.** Each exercise can be done with the interactive chart and by saying the sounds aloud.

Try It Yourself

EXERCISE 1

Say these English words aloud (in your own accent) and decide how many different vowel sounds the letters *ea* stand for: *bead, bread, break, heart, earth*. Then give one more word with each vowel sound you found.

View solution

EXERCISE 2

Using the table of Esperanto and Hungarian letters, write a broad transcription (in square brackets) of Hungarian *sör, nyár, cél* (using *ny* = [ɲ], *c* = [t͡s] and *ö* = [ø]) and Esperanto *ŝipo, ĉapelo, ĝardeno*. Mark the stress in the Esperanto words (stress falls on the second-to-last syllable).

View solution

EXERCISE 3

Say which brackets (square brackets, slashes or italics) each needs: (a) the word as spelt in a book; (b) the puffed-out [pʰ] of *pin*; (c) the phoneme that English speakers hear as the first sound of *pin*; (d) the transcription you would put in a dictionary entry.

View solution

CHAPTER 1 QUICK REFERENCE

- Spelling is not a record of sound: one spelling, many sounds (*ough*); one sound, many spellings ([iː])
- The **IPA**: one symbol per sound in every language; founded 1886, uniform letter values from 1888
- Chart: free, Creative Commons licence; use the Association's interactive chart for audio
- **[ ]** phonetic, **/ /** phonemic, *italics* spelling
- **Broad** transcription: main sounds; **narrow**: fine detail
- State the accent for English transcriptions
- Hungarian *s* = [ʃ], *sz* = [s]; Esperanto *ĉ* = [t͡ʃ], *ŝ* = [ʃ], *ĝ* = [d͡ʒ]

COMING NEXT

Phonetics and the IPA 2 shows how speech is made: the airstream, the larynx and voicing, the vocal tract, and the articulators that every consonant symbol refers to.

Phonetics and the IPA

Course 1 · Chapter 2 · How Speech Is Made

Every symbol in the IPA stands for a particular way of using the body. To read the chart, you first need to know what the body is doing. This chapter walks through the machinery from the lungs to the lips, and gives you a short set of experiments to try on yourself.

> **THE IDEA IN A BOX**
>
> A speech sound is made in three steps: **air is set moving** (initiation), the **larynx** either vibrates or does not (voicing), and the **tongue and lips** shape the air in the mouth (articulation). The IPA describes each sound by what happens in these steps.

Step 1: The Airstream

Almost all speech is powered by the lungs pushing air outwards. Wikipedia's article on articulatory phonetics describes three "pistons" that can move air: the lungs (a **pulmonic** airstream, used in all human languages), the larynx (**glottalic**), and the body of the tongue (**velaric**, used for clicks). The last two appear in a few languages and in some sounds of a few more; Chapter 4 introduces them. For now, take the lungs as the default.

Step 2: The Larynx and Voicing

The air passes up the windpipe into the **larynx**, which holds the **vocal folds**. The opening between them is the **glottis**.

GLOTTIS	WHAT HAPPENS	RESULT
Folds close together	Air passing through makes them vibrate	**voiced**: all normal vowels, and consonants such as [z] and [b]
Folds apart	Air passes through without vibration	**voiceless**: consonants such as [s] and [p]

Try it

Put your fingers on your Adam's apple (the front of the throat) and say [z], then [s]. You feel a buzz in [z] and none in [s]. The two sounds are made in the same place and the same way; the only difference is voicing.

VOICELESS	VOICED	WORD PAIR
[p]	[b]	*pin / bin*
[t]	[d]	*ten / den*
[k]	[g]	*coat / goat*
[f]	[v]	*fan / van*
[s]	[z]	*sip / zip*

WATCH OUT: TWO MEANINGS OF "VOICED"

In phonetics, *voiced* means the vocal folds are vibrating. In phonology the same word is a label for a class of phonemes, and a sound with that label need not always be voiced in every position. This course uses the phonetic sense unless it says otherwise. Voicing comes in more than one type: Wikipedia also lists *breathy* and *creaky* voice alongside ordinary voice (Chapter 6).

Step 3: The Vocal Tract

Above the glottis the air enters the **pharynx** (the throat), then the **oral cavity** (the mouth) or the **nasal cavity** (the nose), and leaves. The shape of this passage decides which sound you hear.

Oral and nasal

The **velum**, or soft palate, works like a valve. When it is raised, air goes through the mouth only: **oral** sounds. When it is lowered, air also escapes through the nose: **nasal** sounds, such as [m] and [n], and nasalised vowels. Try it: hold your nose and say [m], then [s]. The [m] stops (the air has nowhere to go); the [s] is unaffected.

Active and passive articulators

A consonant is made by narrowing or closing the airway at some point. The part that moves is the **active articulator**; the part it approaches or touches is the **passive articulator**.

ACTIVE (MOVES)	PASSIVE (STAYS)
lower lip	upper lip, upper teeth
front of the tongue (tip, blade)	alveolar ridge (the bump behind the upper teeth), the area just behind it
body of the tongue	hard palate, soft palate (velum), uvula
root of the tongue	back wall of the pharynx, epiglottis
glottis (the folds themselves)	(none)

Run your tongue tip from the back of your top teeth backwards: you meet the ridge, then the hard bony roof, then a soft area. That order is exactly the order of the places of articulation on the chart.

A Map of the Places of Articulation

The place of articulation names where the constriction is made. Going from front to back, with the chart symbol that Wikipedia gives as the example for each:

GROUP	PLACE	SYMBOL	ACTIVE + PASSIVE
Labial	bilabial	[p]	both lips
	labiodental	[f]	lower lip + upper teeth
Coronal	dental	[θ]	tongue tip or blade + teeth
	alveolar	[t]	tongue tip or blade + alveolar ridge
	postalveolar	[ʃ]	tongue blade + area behind the ridge
	retroflex	[ʈ]	tongue tip curled back
Dorsal	palatal	[c]	tongue body + hard palate
	velar	[k]	tongue body + soft palate
	uvular	[q]	tongue body + uvula
Radical	pharyngeal	[ħ]	tongue root + pharynx wall
Glottal	glottal	[ʔ]	the glottis itself

You already use many of these. English has bilabial [p], labiodental [f], dental [θ], alveolar [t], postalveolar [ʃ] and velar [k]. Hungarian *ty* in *tyúk* "hen" is the palatal [c]. The glottal stop [ʔ] is the brief closing of the glottis in the catch in the middle of English "uh-oh". Chapter 3 gives full chart rows for these places.

NOTE ON SOURCES

The airstream, voicing, vocal-tract and place-of-articulation facts come from Wikipedia's articles on articulatory phonetics, voice and place of articulation. Wikipedia does not present the airstream, larynx and mouth as "three steps"; that framing is a teaching device of this course. The "uh-oh" example is mine.

Try It Yourself

EXERCISE 1

Using the finger-on-throat test, sort these English sounds into voiced and voiceless: [s], [z], [f], [v], [ʃ], [ʒ], [θ], [ð]. Check each pair against a word (*thin* / *this*, *vision* / *mission*).

View solution

EXERCISE 2

Name the place of articulation of the first sound in each word: *pin, fan, thin, ten, ship, key*. Say each slowly and notice which parts touch.

View solution

EXERCISE 3

Pinch your nose shut and say *mama*, then *baba*, then *sasa*. Which of the three is changed, and what does that tell you about the velum?

View solution

CHAPTER 2 QUICK REFERENCE

- Airstream: **pulmonic** (lungs) is the default; **glottalic** and **velaric** (clicks) are rarer
- **Voiced** = vocal folds vibrate; **voiceless** = they do not; all normal vowels are voiced
- Test: fingers on the Adam's apple, [z] buzzes and [s] does not
- **Oral** sounds: velum raised; **nasal** sounds: velum lowered
- Active articulators move (lips, tongue); passive ones stay (teeth, ridge, palate, velum, uvula, pharynx)
- Places, front to back: bilabial, labiodental, dental, alveolar, postalveolar, retroflex, palatal, velar, uvular, pharyngeal, glottal

COMING NEXT

Phonetics and the IPA 3 starts the consonant chart: place across the top, manner down the side, and the stops, nasals and fricatives of English to read it with.

Phonetics and the IPA

Course 1 · Chapter 3 · Consonants: Place and Manner

Chapter 2 gave you the machinery. Now you can use it to name any consonant. A consonant is described by three facts, always in the same order: **voicing**, **place**, **manner**. This is how the IPA consonant chart is organised: place runs across the top, manner runs down the side, and voicing is shown by which of two neighbouring symbols you pick.

> **THE IDEA IN A BOX**
>
> [t] is a **voiceless alveolar stop**. [z] is a **voiced alveolar fricative**. Each label is a short recipe: whether the vocal folds vibrate, where the airway is narrowed, and how the air is let through.

Manner of Articulation

Place (Chapter 2) says *where* the airway is narrowed. **Manner** says *how*: completely blocked, squeezed so that the air hisses, or only slightly narrowed. The definitions below follow Wikipedia's article on manner of articulation.

MANNER	WHAT HAPPENS	ENGLISH EXAMPLES
Stop (plosive)	The oral tract is blocked and no air escapes through the nose	[p t k] voiceless, [b d g] voiced
Nasal	The mouth is blocked but air passes through the nose	[m n ŋ]
Fricative	Continuous turbulent airflow at the place of articulation	[f s] voiceless, [v z] voiced
Affricate	Starts like a stop, releases into a fricative	[t͡ʃ] *church*, [d͡ʒ] *judge*
Approximant	Very little obstruction	[w], [ɹ], [j], [l]
Tap or flap	A momentary closure of the oral cavity	the *tt* of *utter* in North American and Australian English: [ɾ]
Trill	The articulator, usually the tongue tip, is held in place and vibrates in the airstream	Spanish double *r*, as in *perro* (not standard in English)

MANNER	WHAT HAPPENS	ENGLISH EXAMPLES
Lateral fricative	Friction on one or both sides of the tongue	Welsh *ll* [ɬ], Zulu *hl*

Subtypes worth knowing

- **Sibilant**: a fricative with a high-pitched, distinctive sound, such as [s] and [z].
- **Semivowel (glide)**: an approximant pronounced like a vowel but with more stricture: [w] and [j].
- **Lateral approximant**: air flows through the sides of the tongue: [l].
- **Liquids**: lateral approximants and rhotics (r-sounds) together.

> **WATCH OUT: IPA [J] IS NOT ENGLISH "J"**
>
> The IPA symbol [j] is the sound of English *y* in *yes*. The English *j* of *judge* is [d͡ʒ]. Likewise the IPA symbol [ɹ] is the English r-sound; the plain letter [r] is a trill. This is why Chapter 1 insisted on reading the symbols, not the spelling.

Putting Place and Manner Together

Combine the two and the English consonants fall into a grid. In each cell, the voiceless symbol comes first and the voiced one second. The symbols and example words come from Wikipedia's English-dialect consonant chart; the arrangement into place and manner is mine. Accent differences are noted below the table.

MANNER	BILABIAL	LABIODENTAL	DENTAL	ALVEOLAR	POSTALVEOLAR	PALATAL	VELAR
Stop	p b			t d			k g
Nasal	m			n			ŋ
Fricative		f v	θ ð	s z	ʃ ʒ		
Affricate					t͡ʃ d͡ʒ		
Approximant	w			ɹ, l		j	

Example words (Wikipedia's chart): *pin*, *but*; *ring* [ŋ]; *thing* [θ] and *this* [ð]; *she* [ʃ] and *pleasure* [ʒ]; *ham* [h]; *yes* [j]; *we* [w].

Two placements are my own simplifications, so treat them as teaching approximations: [w] is made with the lips and also the back of the tongue (it is "labial-velar"), and [ɹ] is placed at the alveolar ridge here, but the source does not assign it to one place for every accent.

Accent differences the source mentions

- **/t/ and /d/**: a flap [ɾ] occurs in some positions in American and Australian English (*better*, *daddy*); a glottal stop [ʔ] occurs in some positions in Scottish Standard English, English English, American and Australian English.
- **/r/**: an alveolar trill occurs only in some varieties of Scottish, Welsh, Indian and South African English; taps occur in some Scottish, Irish, Indian, Welsh, Northern English and South African varieties.
- **/l/**: RP has clear [l] in onsets and dark [ɬ] in rimes; clear [l] does not occur in Australian, New Zealand, Scottish Standard or American English.
- **[ʍ]**: Scottish, Irish, and many southern US and New England dialects keep *which* distinct from *witch*.
- **[x]**: marginal in most accents (*loch*).

Obstruents and Sonorants

Phoneticians often sort manners into two big classes. **Obstruents** (stops, fricatives, affricates) involve substantial obstruction of the airflow and are prototypically voiceless, though voiced ones are very common. **Sonorants** (nasals, liquids, approximants, and vowels) lack that obstruction and are nearly always voiced; voiceless sonorants are uncommon. This is why the table above has pairs in the obstruent rows and single symbols in the nasal and approximant rows.

The same article describes a cline of stricture from greatest to least: stops, fricatives, approximants, tense vowels, lax vowels. Sounds can drift along it over time (towards less stricture, called lenition, or more, called fortition).

Reading a Label Backwards

```
// Voicing + place + manner
[b]    voiced + bilabial + stop
[ŋ]    voiced + velar + nasal
[θ]    voiceless + dental + fricative
[t͡ʃ]   voiceless + postalveolar + affricate
[j]    voiced + palatal + approximant
```

NOTE ON SOURCES

Manners, subtypes, obstruent/sonorant, the cline of stricture and the accent notes come from Wikipedia's articles on manner of articulation and the English-dialect IPA chart (the chart page was read only up to its first 100,000 characters). The grid layout, the [w] and [ɹ] caveat and the label recipes are mine.

Try It Yourself

EXERCISE 1

Write the full label (voicing, place, manner) for each: [d], [m], [v], [ʃ], [k], [d͡ʒ].

View solution

EXERCISE 2

Give the symbol for each description: voiceless labiodental fricative; voiced velar stop; voiced alveolar nasal; voiceless postalveolar affricate; voiced palatal approximant.

View solution

EXERCISE 3

[p] and [m] share a place. What do they share and what differs? Then do the same for [s] and [t]. Use the velum and the airflow from Chapter 2.

View solution

CHAPTER 3 QUICK REFERENCE

- A consonant label has three parts: **voicing + place + manner**
- Manners: stop, nasal, fricative (sibilant), affricate, approximant (semivowel, lateral), tap, trill
- IPA [j] = English *y*; [d͡ʒ] = English *j*; [ɹ] = English r-sound
- **Obstruents** (stops, fricatives, affricates) come in voiceless/voiced pairs; **sonorants** are nearly always voiced
- Accents differ: flap or glottal stop for /t/, trilled or tapped /r/, clear and dark /l/, [ʍ]

COMING NEXT

Phonetics and the IPA 4 goes past English: the rest of the consonant chart, including sounds that English lacks.

Phonetics and the IPA

Course 1 · Chapter 4 · More Consonants

Chapter 3 covered the consonants of English. The IPA chart is much bigger, because the world's languages use places and airstreams that English never touches. This chapter does not ask you to memorise them all; it shows you how to *read* them using the same voicing, place and manner recipe.

> **THE IDEA IN A BOX**
>
> Every new consonant is a new combination of the same ingredients. A retroflex stop is just a stop with the tongue curled back. A click or an ejective changes the *airstream* (Chapter 2, step 1) instead of the place.

New Places, Same Recipe

Chapter 2 listed all the places from front to back with one example symbol each. Several of them are absent from English consonants but familiar from other languages.

PLACE	EXAMPLE SYMBOL	NOTES
Retroflex	[ʈ]	tongue tip curled back; its ejective version is [ʈʼ]
Palatal	[c]	Hungarian *ty* in *tyúk* "hen"; the voiced stop is [ɟ], Hungarian *gy* in *gyár*
Uvular	[q]	tongue body against the uvula
Pharyngeal	[ħ]	tongue root against the pharynx wall
Glottal	[ʔ]	the glottal stop

The Hungarian palatal examples are the ones you met in Chapter 1: *gy* = [ɟ] is from Wikipedia's Hungarian phonology article, and *ty* = [c] follows the same pattern.

Changing the Airstream

Chapter 2 named three airstream "pistons". Pulmonic (lungs) covers everything so far. The other two give three families of **non-pulmonic** consonants.

Ejectives: glottalic egressive

An ejective is "usually voiceless", made with a glottalic egressive airstream. The glottis closes and rises (the hyoid bone is lifted by the stylohyoid and digastric muscles), the mouth is closed, so pressure builds in the mouth, and when the articulators separate there is a burst of air. Ejectives are often weak, and can be hard to tell apart from ordinary voiceless or voiced stops.

Notation: a modifier apostrophe [ʼ] after the symbol. Examples from Wikipedia: stops [pʼ tʼ kʼ qʼ], affricates [tsʼ tʃʼ], fricatives [sʼ ʃʼ], lateral [tɬʼ]. Languages with ejectives include Georgian, Chechen, Quechua, Hausa, Zulu, Tlingit and Amharic.

> **WATCH OUT: THE APOSTROPHE MEANS DIFFERENT THINGS**
>
> In the IPA, [ʼ] marks an ejective. The same page notes that Americanist notation uses the apostrophe for weak ejection (and "!" for strong ejection), and Russian romanisation uses it for palatalisation. Check which tradition you are reading.

Implosives: glottalic ingressive

In an implosive the glottis moves *down* during the stop, which rarefies the air in the mouth, while air is also pushed up from the lungs. Most implosives are voiced; the page notes that many involve no real inward rush of air, so they are phonetically sonorants. Voiceless implosives use a purely glottalic ingressive airstream with the glottis closed.

SYMBOL	LABEL
[ɓ]	voiced bilabial implosive
[ɗ]	voiced alveolar implosive
[ᶑ]	voiced retroflex implosive
[ʄ]	voiced palatal implosive
[ɠ]	voiced velar implosive
[ʛ]	voiced uvular implosive

Each is a voiced stop with a rightward-facing hook. Sindhi and Saraiki contrast [ɓ ɗ ʄ ɠ]; in Swahili implosives are non-contrastive allophones of voiced stops. Voiceless implosives are written with a voiceless diacritic ([ɓ̥]); in 1993 the IPA withdrew its separate letters for them, and some authors still use the old ones.

Clicks: lingual ingressive

Clicks use a lingual ingressive airstream: the tongue sucks air into a pocket between two closures, one at the front and one at the back, and the front closure is then released. Clicks occur in many Southern African languages and in three East African languages: Sandawe, Hadza and Dahalo.

SYMBOL	TYPE	SOUND
[ʘ]	bilabial	a lip-smacking sound
[ǀ]	dental	a sharp sound made by sucking the front teeth
[ǃ]	alveolar	an abrupt "pop" made by pulling the tongue tip down
[ǂ]	palatal	a sharp crack made by pulling a flat tongue backward
[ǁ]	lateral	a squeaky sound made by sucking the molars

Zulu and Xhosa write clicks with the letters *c*, *q* and *x*. Hadza and Sandawe have three click types: [ǀ], [ǁ] and [ǃ]. You already make something like clicks: the "tut-tut" or "tsk tsk" of disapproval is a dental click, and the "tchick" used to spur on a horse is a lateral click. Wikipedia adds that these English sounds are not full click consonants, because they lack the back release needed to combine with vowels.

NOTE ON SOURCES

The ejective, implosive and click descriptions come from Wikipedia's articles on those consonants (each page was read only up to its first 100,000 characters). The pages give no example words for ejectives or implosives, so this chapter gives none. The "recipe" framing is mine.

Try It Yourself

EXERCISE 1

Name the airstream and the family (ejective, implosive or click) for each: [kʼ], [ɓ], [!], [tsʼ], [ɠ], [ǀ].

View solution

EXERCISE 2

Say "tsk tsk" and then the "tchick" used for a horse. Which click type is each, and how do you know from where the tongue moves?

View solution

EXERCISE 3

Decode this: a Hungarian word begins with *gy*. Give its IPA symbol and full label, and say what airstream it uses.

View solution

CHAPTER 4 QUICK REFERENCE

- New places reuse the recipe: retroflex [ʈ], palatal [c ɟ], uvular [q], pharyngeal [ħ], glottal [ʔ]
- **Ejective**: glottalic egressive, marked [ʼ] (*kʼ, tsʼ*)
- **Implosive**: glottalic ingressive plus lung air, hooked letters (*ɓ ɗ ɠ*)
- **Click**: lingual ingressive airstream: [ʘ ǀ ! ǂ ǁ]
- English "tsk tsk" is a dental click, but not a full click consonant

COMING NEXT

Phonetics and the IPA 5 turns from consonants to vowels, which have no touching or friction and so need a different kind of map.

Phonetics and the IPA

Course 1 · Chapter 5 · Vowels

Consonants are described by where the airway is blocked or squeezed. Vowels have little or no obstruction, so there is no "where it touches" to name. Instead we describe the *shape* of the open space in the mouth, using three questions: how high is the tongue, how far forward, and are the lips rounded?

> **THE IDEA IN A BOX**
>
> A vowel label is **height + backness + rounding**. [i] is a close front unrounded vowel; [u] is a close back rounded vowel. Together they sit at the two top corners of the vowel chart.

The Three Dimensions

According to Wikipedia's article on vowels, a vowel is produced with little or no obstruction of the vocal tract, whereas a consonant has a constriction or closure somewhere along it. Phonologically, a vowel is the sound that forms the peak of a syllable.

DIMENSION	WHAT CHANGES	SCALE
Height	Close (high) vowels like [i] and [u] have the tongue near the palate; open (low) vowels like [a] have the jaw open and the tongue low	close, near-close, close-mid, mid, open-mid, near-open, open
Backness	Front vowels have the tongue further forward, back vowels further back	front, near-front, central, near-back, back
Rounding	Whether the lips are rounded	unrounded or rounded

Rounding usually reinforces back vowels, but some languages, such as French and German, have front rounded vowels. In English, the usual pairing holds: [i] is front and unrounded, [u] is back and rounded.

Try it

Say [i] (as in *see*) then [ɑ] (as in *ah*) slowly. Your jaw drops: that is height. Now say [i] then [u] (as in *you*) and watch your lips: they round for [u]. Your tongue also moves back, which you can feel

if you keep your fingertip on your chin. (This exercise is mine; the labels are the source's.)

The Vowel Chart

The IPA plots height against backness on a trapezoid-shaped chart, with unrounded vowels to the left of rounded ones in each cell. Here are the main vowels from Wikipedia's chart (unrounded / rounded):

HEIGHT	FRONT	CENTRAL	BACK
Close	i / y	ɨ / ʉ	ɯ / u
Close-mid	e / ø	ɘ / ɵ	ɤ / o
Open-mid	ɛ / œ	ɜ / ɞ	ʌ / ɔ

I have left out the open row. The summary of the chart I worked from was ambiguous there (it lists [a], [œ], [ä] and [ɑ], [ɒ]), and I would rather leave it to the Chapter 6 chart than guess.

> **WATCH OUT: THE SYMBOL IS NOT THE SAME SOUND IN EVERY LANGUAGE**
>
> The symbols are positions on a grid. English [i], French [i] and Hungarian [i] are close in quality but are not guaranteed identical. For a precise comparison you need a fixed reference, which is what cardinal vowels are for.

Cardinal Vowels

Daniel Jones devised the cardinal vowel system in the early 20th century, building on earlier work by Alexander John Ellis and Alexander Melville Bell. There are eight primary cardinal vowels and 22 in total (9-22 are secondary). They are not the vowels of any language but a fixed measuring scale.

#	SYMBOL	DESCRIPTION
1	[i]	high, front, unrounded
2	[e]	upper-middle, front, unrounded
3	[ɛ]	lower-middle, front, unrounded

#	SYMBOL	DESCRIPTION
4	[a]	low, front, unrounded
5	[ɑ]	low, back, unrounded
6	[ɔ]	lower-middle, back, rounded
7	[o]	upper-middle, back, rounded
8	[u]	high, back, rounded

- Four corner vowels ([i], [a], [ɑ], [u]) are defined by articulation; the others are set at auditorily equal intervals between them.
- Jones held that using the system well needs training, with an expert or with recordings of each vowel.
- Ladefoged's experiments found trained phoneticians agreed closely near the cardinal values but diverged widely farther away. The system is usually taken to support about 16 primary and secondary vowels plus some central ones.

Different Kinds of Vowel

- **Monophthong**: the quality stays the same throughout, as in *hit* [ɪ].
- **Diphthong**: glides from one quality to another, as in *boy* [ɔɪ]. A triphthong glides through three. Whether a sequence counts as a diphthong or triphthong depends on whether it is analysed as one phoneme or several.
- **Nasalised vowels**: oral vowels that pick up nasality from a neighbouring nasal consonant, as in English *hand*. **Nasal vowels** are phonemically distinct, as in French /ɑ/ versus /ɑ̃/ (the velum of Chapter 2 at work).
- **Long vowels** contrast phonemically in languages such as Japanese, Finnish, Hungarian, Arabic and Latin. Vowels also lengthen non-distinctively when stressed or spoken slowly.

Wikipedia's other examples: *ah* /ɑː/, *oh* /oʊ/, and the tense-versus-lax pair *mate* and *mat*. The vowels of real English accents are the subject of Chapter 7.

```
// Height + backness + rounding
[i]   close + front + unrounded
[u]   close + back + rounded
```

```
[y]   close + front + rounded     (French/German type)
[ɛ]   open-mid + front + unrounded
[ɔ]   open-mid + back + rounded
```

NOTE ON SOURCES

The three dimensions, the chart rows, the cardinal-vowel details and the vowel types come from Wikipedia's articles on vowels and cardinal vowels (the vowel page was read only up to its first 100,000 characters). The jaw, lips and fingertip experiment is mine.

Try It Yourself

EXERCISE 1

Write the full label (height, backness, rounding) for [i], [u], [y], [ɔ] and [ɛ].

View solution

EXERCISE 2

Give the symbol for each: close back rounded; close-mid front unrounded; open-mid back rounded; close front rounded. Which of these four is a primary cardinal vowel?

View solution

EXERCISE 3

Classify each as monophthong or diphthong, from the examples in this chapter: *hit*, *boy*, *oh*. Explain what would count as evidence for each.

View solution

CHAPTER 5 QUICK REFERENCE

- Vowel label: **height + backness + rounding**

- Corners of the chart: [i] close front, [u] close back, [ɑ] open back, [a] open front
- Front rounded vowels: [y] [ø] [œ] (French, German)
- Cardinal vowels (Daniel Jones): 8 primary, 22 total, a measuring scale and not a language
- Monophthong (steady), diphthong (glide); nasalised vs nasal; long vowels can contrast

COMING NEXT

Phonetics and the IPA 6 puts consonants and vowels together on the full IPA chart, with its diacritics and the non-segmental marks (stress, length, tone).

Phonetics and the IPA

Course 1 · Chapter 6 · Reading the IPA Chart

You now know the ingredients: voicing, place, manner, airstream, and the three vowel dimensions. This chapter shows how they are laid out on the real chart, and introduces the marks that go *on* and *between* the letters: diacritics, length, stress, breaks and tone.

> **THE IDEA IN A BOX**
>
> The chart is a lookup table in three blocks of letters (pulmonic consonants, non-pulmonic consonants, vowels), plus a block of small marks that modify the letters. Learn the layout once and you can find any sound by its recipe.

The Layout

Wikipedia's article on the IPA says the letters fall into three categories, and the counts of letters and marks are 107 letters, 31 diacritics and 17 additional signs.

BLOCK	COLUMNS	ROWS
Pulmonic consonants	place of articulation, labial on the left to glottal on the right	manner, from full closure (nasals and plosives) at the top to minimal closure (approximants) at the bottom
Non-pulmonic consonants	clicks, implosives, ejectives (Chapter 4)	(grouped by airstream)
Vowels	front on the left to back on the right	close at the top to open at the bottom

Rules for reading the cells

- Where letters appear in pairs, the letter on the **right is voiced** and the one on the left is voiceless. (Wikipedia notes the breathy-voiced [ɦ] as an exception.)
- Where a cell holds a single letter, that letter represents a **voiced** consonant.
- **Shaded cells** are articulations judged impossible or not distinctive.
- In the vowel trapezoid, **unrounded** vowels sit to the left of rounded ones in each pair (Chapter 5).

The open vowels (the gap left in Chapter 5)

From the vowel chart on Wikipedia's vowel article: open front is [a] (unrounded) and [œ] (rounded), and open back is [ɑ] (unrounded) and [ɒ] (rounded). Cardinal vowels 4 and 5 are [a] and [ɑ]. I did not manage to confirm the open central cell ([ä]) from the source text, so it is left out.

Diacritics

A diacritic modifies a letter. The table follows Wikipedia's list (the ◌ shows where the base letter goes).

MARK	MEANING	EXAMPLE
◌ʰ	aspirated	tʰ
◌̥	voiceless	n̥, d̥
◌̬	voiced	s̬, t̬
◌̤	breathy voiced	b̤, a̤
◌̰	creaky voiced	b̰, a̰
◌̩	syllabic	ɹ̩, n̩
◌̯	non-syllabic	i̯, u̯
◌̪	dental	t̪, d̪
◌̃	nasalised	ẽ, z̃
◌ʷ	labialised	tʷ, dʷ
◌ʲ	palatalised	tʲ, dʲ
◌ˠ	velarised	tˠ, dˠ
◌ˤ	pharyngealised	tˤ, aˤ

Two of these finish business from earlier chapters. **Aspiration** is the [pʰ] of English *pin* from Chapter 1. **Breathy** and **creaky** voice are the extra phonation types promised in Chapter 2. On Wikipedia's page on voice, breathy voice ("murmur") and creaky voice sit on a scale of

phonation types between breath and the restricted end; "voiced aspirate" consonants normally have breathy voice, as in Ju|'hoansi and Taa. That page gives no IPA diacritics for them; the diacritics above come from the IPA article.

> **WATCH OUT: DIACRITICS SIT ABOVE, BELOW OR AFTER**
>
> Some marks go over a letter, some under, and the raised ones ([ʰ ʷ ʲ ˠ ˤ]) after it. If your font puts a mark in the wrong place, the sound has not changed; only the typography has.

Length, Stress and Breaks

MARK	MEANING	EXAMPLE
ˈ	primary stress, placed before the stressed syllable	ˈke
ˌ	secondary stress, placed before the stressed syllable	ˌke
ː	long	eː, kː
ˑ	half-long	eˑ
◌̆	extra-short (also used for a flap)	ă, ğ
.	syllable break	ek.ste, eks.te
‿	linking, no boundary (a phonological word)	es‿e
|	minor break (foot break)	
||	major break (intonation break)	

Chapter 1 told you that in Esperanto the stress falls on the second-to-last vowel. In IPA the stress mark goes *before* the stressed syllable, so Esperanto *lingvo* "language" would be written [ˈliŋgvo] (my own transcription, not from the source). Length marks matter in languages such as Hungarian, where Chapter 5 noted that long vowels contrast.

Tone

Tone is written either with pitch diacritics over the vowel or with Chao tone letters. Wikipedia lists:

TONE	DIACRITIC	TONE LETTER
High	é	˥e
Mid	ē	
Low	è	˩e
Rising	ě	˧e
Falling	ê	˥˩e

Upstep and downstep are [ꜛ] and [ꜜ] (ꜛke, ꜜke). The tone material is in the article's final sections, which I read, but I did not read the last 25,875 characters of the page.

```
// Reading marks, left to right
[ˈliŋgvo]   ˈ = stress on the next syllable
[pʰɪn]      ʰ = aspirated
[eː]        ː = long vowel
[n̩]        ̩ = syllabic consonant
[tʲ]        ʲ = palatalised
```

NOTE ON SOURCES

Layout, cell rules, diacritics, suprasegmentals and tone come from Wikipedia's IPA article (read in two parts: 0-200,000 characters) and the article on voice (phonetics). The open vowels come from the vowel article's chart. The [ˈliŋgvo] transcription is mine. I left out diacritics whose meaning the source summaries gave inconsistently (tongue root, advanced/retracted).

Try It Yourself

EXERCISE 1

In a pair of consonant letters in the same cell, which is voiced? What does a lone letter in a cell mean? What does a shaded cell mean?

View solution

EXERCISE 2

Say what each of these means: [kʰ], [m̥], [t̪], [aː], [ˈke], [ẽ].

View solution

EXERCISE 3

Write the diacritic you would add to show: a voiceless [n]; a nasalised [z]; a syllabic [n]. Then say which earlier chapter introduced the idea behind each.

View solution

CHAPTER 6 QUICK REFERENCE

- Consonant chart: place across (labial to glottal), manner down (closure to approximant)
- Pair in a cell: left voiceless, right voiced; lone letter: voiced; shaded: impossible or not distinctive
- Common diacritics: ʰ aspirated, ◌̥ voiceless, ◌̬ voiced, ◌̃ nasalised, ◌̩ syllabic, ʷ ʲ ˠ ˤ secondary articulation
- ˈ primary stress, ˌ secondary stress, ː long, ˑ half-long, . syllable break
- Tone: pitch diacritics (é è ě ê ē) or Chao tone letters (˥ ˩)

COMING NEXT

Phonetics and the IPA 7 uses everything so far to transcribe English, in Received Pronunciation, General American and Scottish English.

Phonetics and the IPA

Course 1 · Chapter 7 · Transcribing English

"Transcribe English" has no single answer, because English is many accents. This course's convention (Chapter 1) is to name the accent every time. This chapter compares three: **Received Pronunciation (RP)**, **General American (GA)** and **Scottish English**. It leans on the "lexical sets": a keyword such as KIT or FLEECE that stands for a whole class of words, so that accents can be compared vowel by vowel.

> **THE IDEA IN A BOX**
>
> To transcribe a word, first decide the accent, then find which lexical set the stressed vowel belongs to, then use that accent's symbol for the set. Consonants need checking too: rhoticity, flapping, [ʍ] and [x] differ by accent.

Vowels by Lexical Set

The table uses Wikipedia's articles on RP, General American and Scottish English. RP and GA symbols are phonemic (the slashes of Chapter 1); Scottish values are phonetic ranges from the page's table. Where a cell says "same as TRAP", the page says there is no distinction.

SET	RP	GENERAL AMERICAN	SCOTTISH ENGLISH
KIT	/ɪ/	/ɪ/	[ɪ~e̝]
DRESS	/e/	/ɛ/	[ɛ~e̞]
TRAP	/æ/	/æ/	[ä]
BATH	/ɑː/ (BATH words with /æ/ are disputed)	/æ/	same as TRAP
LOT	/ɒ/	/ɑ/ (merged with father; see below)	[ɔ]
STRUT	/ʌ/	/ʌ/	[ʌ]
FOOT	/ʊ/	/ʊ/	[ʉ~u~ʏ]
FLEECE	/iː/	/i/	[i]

SET	RP	GENERAL AMERICAN	SCOTTISH ENGLISH
GOOSE	/uː/	/u/	not given on the page
FACE	/eɪ/	/eɪ/	[e]
GOAT	/əʊ/	/oʊ/	[o~oʊ]
PRICE	/aɪ/	/aɪ/	[ʌi, ai]
MOUTH	/aʊ/	/aʊ/	[ʌʉ]
CHOICE	/ɔɪ/	/ɔɪ/	[ɔe~oe~ɔi~ɔɪ~ɒɪ]
THOUGHT	/ɔː/	/ɔ/ for some; merged with LOT for many	[ɔ, ɒ]

WATCH OUT: LEXICAL-SET LABELS ARE NOT WORDS YOU MUST SAY

KIT, TRAP and the rest are just labels. The point is that the words in a set share one vowel in a given accent. When an accent merges two sets (as Scottish English does with TRAP and BATH), you simply use one symbol for both.

Consonants by Accent

FEATURE	RP	GENERAL AMERICAN	SCOTTISH ENGLISH
/r/ in the coda	non-rhotic: /r/ occurs only before a vowel	rhotic: pronounced in all spelled-r positions, as in *pearl*, *car*, *fort*	typically pronounced in the coda; some non-rhotic varieties in Edinburgh and Glasgow
/r/ sound	postalveolar approximant [ɹ]	[ɹ] or retroflex [ɻ]	approximant [ɹ], traditionally a flap [ɾ], rarely a trill [r]
/t/ and /d/	/t/ may take a preceding glottal stop syllable-finally; may be replaced by [ʔ] before a syllabic nasal (*bitten*)	flapped [ɾ] between a vowel and an unstressed vowel or syllabic consonant: *ladder* and *latter* sound the same	in colloquial speech [ʔ] may be an allophone of /t/ after a vowel

FEATURE	RP	GENERAL AMERICAN	SCOTTISH ENGLISH
/l/	dark [ɬ] in the syllable rhyme; some speakers vocalise it	(not covered in this chapter's source summary)	usually velarised, except in borrowings like *glen*
which / witch	no [ʍ] mentioned	wine–whine merger in most speakers	distinguished: [ʍ] vs [w]
/j/ after /n, t, d/	most no longer keep /j/ after /n/ (*news*)	yod-dropped in stressed syllables: *new* /nu/, *duke* /duk/	(not covered)
/x/ (*loch*)	marginal	marginal	common in Gaelic and Scots borrowings

Mergers worth knowing

- **Cot–caught** (GA): LOT and THOUGHT merge for many speakers, especially in the West; others keep them apart, especially in parts of the South and Great Lakes region.
- **Father–bother** (GA): the source lists LOT words with the same vowel as *father*.
- **TRAP–BATH** (Scottish): the page says there is no TRAP/BATH (or PALM) distinction in most varieties.
- **FOOT–GOOSE** (some Scottish speakers): *pull* and *pool* are homophones.

Worked Examples

Using only the rules above, here are broad (phonemic) forms. These are my own applications of the rules, not forms quoted from a dictionary, so treat them as practice rather than reference.

```
// car
RP        /kɑː/        non-rhotic: no /r/ before silence
GA        /kɑɹ/        rhotic: r is pronounced
Scottish  /kar/        (r kept; the page treats it as [ɹ], [ɾ] or rarely [r])

// goat
RP        /gəʊt/
GA        /goʊt/

// ladder vs latter in GA
ladder    /ˈlæɾə/      flap
latter    /ˈlæɾə/      same flap: they sound the same
```

NOTE ON SOURCES

The vowel and consonant data come from Wikipedia's articles on Received Pronunciation, General American English and Scottish English; each page was read only up to its first 100,000 characters. The three-column layout and the worked examples are mine, as are the choice of Scottish /kar/ and the use of [ɚ] in *ladder* and *latter* (GA has an r-coloured schwa; the page lists [ɚ] for the NURSE vowel).

Try It Yourself

EXERCISE 1

For the GOAT set, give the RP, General American and Scottish values from the table. Then say what the three have in common and where they differ.

View solution

EXERCISE 2

Explain why *pearl* and *car* differ between RP and General American, using the rhoticity rule. Which accent keeps the /r/?

View solution

EXERCISE 3

In which accent are *ladder* and *latter* homophones, and why? Name another pair that merges in one of the three accents.

View solution

CHAPTER 7 QUICK REFERENCE

- Always name the accent; use lexical sets to compare vowels
- RP is non-rhotic; General American and Scottish English keep /r/ in the coda
- GA flaps /t, d/ between vowels (*ladder* = *latter*); Scottish keeps [ʍ] in *which*

- Merging sets: GA cot–caught (variable), Scottish TRAP–BATH, some Scottish FOOT–GOOSE

COMING NEXT

Phonetics and the IPA 8 moves from single words to connected speech, where sounds change at word boundaries.

Phonetics and the IPA

Course 1 · Chapter 8 · Connected Speech

So far every sound has been treated as a separate item, as if each word were said slowly on its own. Real speech is not like that. Sounds lean on their neighbours, some disappear, and small words shrink. This chapter covers the three processes you most need to recognise before you transcribe anything spoken at normal speed.

> **THE IDEA IN A BOX**
>
> A dictionary form is a **citation form**: the word said carefully on its own. In connected speech sounds **assimilate** (become more like their neighbours), **elide** (drop out), and small grammatical words shift to **weak forms**. A transcription of real speech shows what was actually said, not the dictionary form.

Assimilation

Wikipedia defines assimilation as a sound change in which phonemes (typically consonants or vowels) become more similar to nearby sounds. It occurs within a word or between words. The page distinguishes several kinds:

DIMENSION	TYPE	MEANING
Direction	regressive (anticipatory)	a sound changes to match the sound that follows
	progressive (perseverative)	a sound changes to match the sound that precedes
Distance	adjacent (contact)	neighbouring sounds; far more frequent
	distant (long-distance)	sounds separated by others
Extent	complete	the sound becomes identical to its trigger
	partial	some features shared, others differ, such as place
Coalescence	fusion	two adjacent sounds merge into one sharing features of both

English examples, from the source

```
// Plural -s: voicing follows the previous consonant
pots   /pɒts/       pods   /pɒdz/

// Place assimilation
handbag      /ˈhændbæg/  →  [ˈhæmbæg]   ([d] elided, [n] becomes [m])
handkerchief             →  [hæŋkətʃif]  (nasal takes the place of the stop)

// Coalescence across a word boundary
don't you    /dəʊnt ju/  →  [dəʊntʃu]   (/t/ + /j/ fuse into [tʃ])
would you    /wʊd ju/    →  [wʊdʒu]     (/d/ + /j/ fuse into [dʒ])
```

The page also gives *imprecise*, pronounced with [m] (from *in-* + *precise*) and spelled with *m*. It notes that *it is* [ɪtɪz] becomes *it's* [ɪts], where the vowel is elided and the final consonant devoices after a voiceless sound.

> **WATCH OUT: ASSIMILATION IS NOT ALWAYS SPELLED**
>
> Spelling rarely shows assimilation. *Handbag* keeps its *d* and *n* on the page, so only a transcription reveals that you said [m]. Wikipedia says assimilation is described using terms (regressive, progressive) that "confuse many people", so check the direction by asking "which sound changed, and which one caused it?"

Elision

Elision (also called deletion) is the omission of one or more sounds, such as a vowel, a consonant or a whole syllable, in a word or phrase. In its narrower sense it covers two words run together by dropping a final sound. Examples from Wikipedia:

CITATION FORM	WITH ELISION	WHAT IS LOST
first light	*firs' light*	final /t/ before a consonant
natural	/ˈnætʃrəl/ (from /ˈnætʃərəl/)	a vowel
family	/ˈfæmli/ (from /ˈfæmɪli/)	a vowel
fifth	/ˈfɪfθ/ → /ˈfɪθ/	a consonant
him	/hɪm/ → /ɪm/	initial /h/

CITATION FORM	WITH ELISION	WHAT IS LOST
going to	*gonna*	whole segments
it is, I have, is not	*it's, I've, isn't*	contractions

Weak and Strong Forms

Many small grammatical words have two pronunciations: a **strong form** used when the word is stressed, isolated, or at the end of a phrase, and a **weak form** used otherwise. Wikipedia lists:

WORD	WEAK FORM	STRONG FORM	STRONG USED WHEN
and	[ən], [n̩] or [ŋ̍] (before a velar)	not given	listed as "always reduced"
to	[tə] (*to Cambridge*)	[tu] (*to Oxford*)	stressed at the end of a phrase
the	[ði] before a vowel, [ðə] before a consonant	not given	when definiteness is emphasised
a	reduced vowel	[eɪ]	when indefiniteness is emphasised
can	/kən/	/kæn/	when stressed, phrase-final or cited in isolation
them	[əm]	not given	listed as "always reduced"
you	/ʊ/ or [u]	not given	listed as "always reduced"

The same page classifies English as **stress-timed**: speakers tend to space stressed syllables at roughly equal intervals, and the weak forms are clitics, forming "a rhythmic pattern with an adjacent word". That is why *cat and dog* sounds like *cat'n dog*.

NOTE ON SOURCES

Assimilation, elision and the weak-form list come from Wikipedia's articles on assimilation, elision and weak and strong forms in English. The pages did not include some classic textbook examples (*input*, *that person*, *ten bags*, *next door*, *Wednesday*), and the weak-forms page does not mention linking or intrusive /r/, so this chapter leaves them out. The *cat'n dog* spelling is my illustration of the [n̩] form.

Try It Yourself

EXERCISE 1

Classify each as assimilation, elision or a weak form: *handbag* → [ˈhæmbæg]; *him* → [ɪm]; *to Cambridge* with [tə]; *would you* → [wʊdʒu].

View solution

EXERCISE 2

In *pots* and *pods*, which sound is the suffix, what is its voicing, and what causes the difference? Is this regressive or progressive assimilation?

View solution

EXERCISE 3

Write the weak and strong forms of *can* and say when each is used. Then use them: say "I can swim" normally and "Yes, I can" emphatically.

View solution

CHAPTER 8 QUICK REFERENCE

- **Assimilation**: sounds become more like neighbours (regressive, progressive; complete, partial; coalescence)
- **Elision**: sounds drop out (*firs*' *light*, *family* /ˈfæmli/, *gonna*)
- **Weak forms**: unstressed grammar words reduce (*can* /kən/); strong forms when stressed or phrase-final
- English is **stress-timed**; weak forms are clitics
- A transcription of speech records what was said, not the dictionary form

COMING NEXT

Phonetics and the IPA 9 turns from articulation to the sound itself: how waves, frequency and formants describe speech, using the free program Praat.

Phonetics and the IPA

Course 1 · Chapter 9 · Acoustic Phonetics

Chapters 2 to 5 described speech from the speaker's side: where the tongue is, what the larynx does. This chapter describes it from the sound's side. A listener, a microphone or a program has no access to the tongue; it has only the sound wave. Acoustic phonetics measures that wave and links what it finds back to articulation.

> **THE IDEA IN A BOX**
>
> Every articulatory description from earlier chapters leaves a trace in the signal. Voicing shows up as regular vibration, vowel height and backness as **formants**, and aspiration as a measurable delay called **voice onset time**.

What Acoustic Phonetics Studies

Wikipedia describes acoustic phonetics as the subfield that studies the acoustic properties of speech sounds. It looks at waveforms in the time domain (such as duration, amplitude and fundamental frequency), in the frequency domain, or both together, and links these to articulatory and auditory phonetics and to abstract units such as phonemes.

PROPERTY	MEANING	RELATED TO
Duration	how long a sound lasts	length marks (Chapter 6), long vowels (Chapter 5)
Amplitude	the size of the wave	loudness
Fundamental frequency	rate of vocal-fold vibration	pitch, tone (Chapter 6)
Spectrum	which frequencies are present	formants, vowel quality

The links in the third column are my own bridging to earlier chapters. The Wikipedia page for acoustic phonetics itself names duration, amplitude and fundamental frequency but explains little more, so the later sections rely on its pages for formants, voice onset time and Praat.

Formants

A **formant** is a broad peak in the spectrum of a sound, produced by acoustic resonance of the human vocal tract. Formants shape the sound of the voice but are not sound sources themselves. The first two, F1 and F2, mainly determine vowel quality:

- **F1** is higher for open (low) vowels like [a] and lower for close (high) vowels like [i] and [u]. So F1 tracks *height* (Chapter 5).
- **F2** is higher for front vowels like [i] and lower for back vowels like [u]. So F2 tracks *backness*.
- Lip rounding tends to lower F1 and F2 in back vowels.

Typical values

Wikipedia gives these averages for a male voice, in hertz:

VOWEL	F1 (HZ)	F2 (HZ)	CHAPTER 5 LABEL
[i]	240	2400	close front unrounded
[a]	850	1610	open front unrounded
[u]	250	595	close back rounded

Read the numbers against the rule. [i] and [u] are both close, so both have a low F1 (240 and 250). [a] is open, so its F1 is much higher (850). [i] is front, so its F2 is high (2400); [u] is back and rounded, so its F2 is low (595). Formants are estimated from a spectrogram or spectrum analyser, or by linear predictive coding (LPC), which estimates the vocal tract's resonances from a recording.

> **WATCH OUT: AVERAGES ARE NOT TARGETS**
>
> Those are averages for male voices. Formant values vary with the size of the vocal tract and with the speaker, so a female or child voice will show higher values for the same vowel. The shape of the pattern (low F1 for close vowels, high F2 for front vowels) is what carries over.

Voice Onset Time

Voice onset time (VOT) is "the length of time that passes between the release of a stop consonant and the onset of voicing." It is the acoustic measure behind the aspiration diacritic of Chapter 6.

VOT	WHAT HAPPENS	KIND OF STOP
Positive	voicing begins well after the release, leaving a puff of breath	aspirated, e.g. English initial /p t k/ with [ʰ]
Zero	voicing starts at or near the release	unaspirated voiceless ("tenuis")
Negative	vocal-fold vibration starts before the release	voiced stops

- Longer VOT means stronger aspiration. Navajo [kʰ] is about 160 ms, about twice English [kʰ] at about 80 ms; Navajo unaspirated [k] is about 45 ms.
- For velar stops, about 20-30 ms is unaspirated, 50-60 ms weakly aspirated, 80-90 ms moderately aspirated, and over 100 ms strongly aspirated.
- English initial /b d g/ are partially voiced; initial /p t k/ are aspirated with positive VOT. In the page's figure, /t/ in *tie* has a VOT of 95 ms and /d/ in *die* 25 ms.

Praat

Praat is free, open-source software for analysing and synthesising speech, created by Paul Boersma and David Weenink at the University of Amsterdam and first released in 1992. It is licensed under GPL-3.0-or-later and runs on Windows, Linux, macOS, FreeBSD and Solaris. It is downloaded from praat.org (the source is on GitHub at github.com/praat/praat). It can:

- extract vowel formants and prosodic details such as pitch and intonation;
- display spectrograms and waveforms, which show voicing and whether a given segment is present;
- manipulate, synthesise and annotate sounds;
- run scripts through a built-in GUI scripting language.

A first session (my suggested workflow)

```
// Suggested steps, not taken from the sources
1. Download Praat from praat.org and open it.
2. Record yourself saying [i], [a], [u], each held for a second.
3. Open each recording in an editor window.
4. Show the spectrogram and the formants.
5. Compare F1 and F2 for the three vowels with the table above.
```

NOTE ON SOURCES

The formant rules and values, VOT definitions and numbers, and the Praat facts come from Wikipedia's articles on formant, voice onset time and Praat (Wikipedia's Praat article does not mention TextGrids, so they are left out). The "Chapter 5 label" column, the Related-to column, the remark about female and child voices, and the first Praat session are mine. I have not run Praat for this chapter, so menu names are deliberately not given.

Try It Yourself

EXERCISE 1

From the table, predict which of [i], [a], [u] has the lowest F1 and which has the highest F2. Explain using height and backness.

View solution

EXERCISE 2

A velar stop has a VOT of 55 ms. How would the page's scale classify it, and would a listener hear aspiration? Then classify 25 ms and 110 ms.

View solution

EXERCISE 3

If you install Praat, record [i], [a] and [u] and compare your F1 and F2 with the averages. Which of your values differ most from the table, and why might they?

View solution

CHAPTER 9 QUICK REFERENCE

- Acoustic phonetics measures duration, amplitude and fundamental frequency in the signal
- **F1** tracks height (higher for open vowels); **F2** tracks backness (higher for front vowels)

- Average male values: [i] 240/2400, [a] 850/1610, [u] 250/595 Hz
- **VOT**: positive = aspirated, zero = tenuis, negative = voiced
- Praat: free, open-source, from praat.org; spectrograms, formants, pitch, scripting

COMING NEXT

Phonetics and the IPA 10 is the last chapter: putting the IPA to work, with a summary of the course and pointers to Historical Linguistics.

Phonetics and the IPA

Course 1 · Chapter 10 · Putting It to Work

You have the whole toolkit: a notation (Chapter 1), the machinery of speech (2), consonants and vowels (3 to 5), the chart (6), English in three accents (7), running speech (8) and the sound itself (9). This last chapter ties them into one working routine and says honestly where the IPA stops.

> **THE IDEA IN A BOX**
>
> Wikipedia says phonetics is "traditionally divided into three sub-disciplines": articulatory, acoustic and auditory. This course covered the first two in depth (Chapters 2 to 5 and Chapter 9) and touched the third only in passing. Auditory phonetics, the study of how listeners perceive speech, is a natural next topic.

The Course in One Table

CHAPTER	CORE IDEA
1 Why Sounds Need a Notation	spelling is not sound; [brackets] versus /slashes/; broad versus narrow
2 How Speech Is Made	airstream, voicing, oral versus nasal, active and passive articulators, places
3 Consonants: Place and Manner	label = voicing + place + manner
4 More Consonants	new places; ejectives, implosives, clicks
5 Vowels	label = height + backness + rounding; cardinal vowels
6 Reading the IPA Chart	layout, diacritics, length, stress, tone
7 Transcribing English	lexical sets; RP, General American, Scottish English
8 Connected Speech	assimilation, elision, weak and strong forms
9 Acoustic Phonetics	formants, VOT, Praat

A Transcription Routine

When you transcribe anything, work through the same questions in the same order. This routine is my summary of the course, not a standard from a source.

```
// Transcription routine
1. Name the accent (RP, General American, Scottish English ...).
2. Decide the level: broad /slashes/ or narrow [brackets].
3. For each vowel: find its lexical set, then use the accent's symbol.
4. For each consonant: voicing + place + manner, then the symbol.
5. Check the accent's consonant rules: rhoticity, flapping, [ʍ], [x].
6. Add stress (ˈ), length (ː) and any needed diacritics.
7. If the speech is connected, ask: assimilation? elision? weak form?
```

Worked example

Take *handbag* from Chapter 8 in careful RP-style speech and then in running speech. Wikipedia gives both forms:

```
// handbag (forms from Wikipedia, Assimilation)
/ˈhændbæg/       citation form
[ˈhæmbæg]        rapid speech: [d] elided, [n] becomes [m]
```

Step 7 is what separates the two lines: elision removes [d], and place assimilation turns [n] into [m] before the bilabial [b]. The accent is not stated by the source, so this course does not claim one.

Where the IPA Stops

- **It is a notation, not a measurement.** Chapter 9's formants and VOT are numbers; IPA symbols are categories. Two speakers of [i] can have different formants.
- **Phonetic symbols are positions, not guarantees.** Chapter 5 warned that "the same" vowel symbol is not identical across languages. The cardinal-vowel system needs training to use well, and trained phoneticians agree less the further a vowel is from a cardinal value (Chapter 5, citing Ladefoged).
- **Transcription is a choice.** Broad or narrow, one accent or another: the same speech can be written several defensible ways.

- **The chart is revised.** Chapter 1 recorded that the latest substantive revisions date from 2015 and 2005 according to the Association, against "revised 2020" in Wikipedia.

WATCH OUT: DO NOT TRUST A TRANSCRIPTION YOU CANNOT NAME

A transcription with no named accent and no stated level (broad or narrow) cannot be checked. When you read someone else's, look for those two things first. When you write your own, always put them in.

Where to Go Next

DIRECTION	WHY
Historical Linguistics	sound change (the drift along the cline of stricture in Chapter 3, assimilation and elision in Chapter 8) is how languages change over centuries. A Historical Linguistics course is planned on this site, not yet written.
Auditory phonetics	the third branch of phonetics, perception, which this course only touched
A real recording	record yourself with Praat (Chapter 9) and transcribe it with the routine above
The Handbook and chart	the full IPA chart, free from the International Phonetic Association, is the best next reference

NOTE ON SOURCES

The three-branches statement comes from Wikipedia's Phonetics article (read to its first 100,000 characters; the part on applications was not reached, so this chapter makes no claims about speech technology, forensics or teaching). The handbag forms come from the Assimilation article. The recap table, routine and "where to go next" are mine.

Try It Yourself

EXERCISE 1

Run the routine on *car* in General American, from Chapter 7. Say which step handles the /r/ and what the result is.

View solution

EXERCISE 2

Take *would you* from Chapter 8. Give the citation form, the running-speech form and name the process.

View solution

EXERCISE 3

Choose your own accent and one short sentence. Transcribe it using the routine, saying which steps you used and what you are unsure of.

View solution

CHAPTER 10 QUICK REFERENCE

- Phonetics has three sub-disciplines: articulatory, acoustic, auditory
- Routine: accent, level, vowels by lexical set, consonants by recipe, accent rules, marks, connected-speech check
- Transcription is a notation, not a measurement, and always a choice
- Always state the accent and the level

COURSE COMPLETE

Phonetics and the IPA is finished. You can name any sound by its recipe, read the IPA chart, transcribe English in three accents, spot connected-speech processes and read a formant. A Historical Linguistics course is the planned next step.