So much for English orthography as a precise representation of pronunciation. (It is worth noting that although English orthography does not always directly reflect pronunciation, that does not necessarily make it a bad or inefficient writing system. We will discuss this question more when we look at morphology (Chapters 4&5) and etymology (Chapter XX)).

orthography, *n*. From Greek via French and Latin, *orth-* "right, correct," related to Sanskrit *urdhva*, "high, upright", and Greek *-graph*, "scratch, write" [English *carve* is derived from this word]. A writing or spelling system.

In order to consider the phonological structure of words properly, we need a writing system which will allow us to represent English pronunciation accurately. We will use the International Phonetic Alphabet (IPA) to represent the individual sounds which make up English words. The IPA is a symbol system developed by linguists for representing the pronunciation of any human language. (We will only consider the symbols that represent the sounds of American English in this chapter; other languages and other dialects of English make use of different IPA symbols for sounds that are not present in American English).

I'll introduce this new alphabet in groups of sounds according to the parts of the vocal tract involved in producing them, and the way in which they are produced. This will be useful in our discussions later, because it turns out that, over time, as the sounds of a language change, they change in groups picked out by a particular pronunciation characteristic that they share. Similarly, it is families of sounds, not individual sounds, that are affected by the sound rules of a language.

2.2 The voice box

Before we get to the actual sounds and symbols, however, let's briefly consider the instrument that produces the actual sound that constitutes an individual's unique voice: the *larynx*, also called the voice box. The larynx is a triangular structure of cartilage situated at the exit of

the windpipe (trachea), separating the windpipe from the oral cavity. (The triangle points forward, the tip making a small bump on the front of the neck of some men — the Adam's apple). Its crucial features are two flat, thin strips of tissue that are stretched across it like rubber bands, from front to back (see fig 1), the vocal cords, or "vocal folds". At the back are muscles that can act to tighten or relax the vocal cords. When you're not speaking, your vocal folds are spread apart, as in fig. 1a, allowing air to pass freely back and forth as you inhale and exhale. When you're speaking, however, the folds are tensed and brought together, as in fig 1b, —but not too tightly. Air coming up from your lungs pushes on the closed vocal folds, and when a certain pressure is built up, they flap open. The air rushes out, causing a suuden pressure decrease, upon which they flap closed again, then the pressure builds up, they flap open, and so on, approximately 100 times per second.[4] The vibrations caused by the opening and closing of the vocal folds create the sound of your voice. This works in exactly the same way that your lips quickly flap open and closed when you're making a raspberry, and the same way that air escaping from the neck of a rubber balloon creates a buzzing noise. You can stretch the neck of the balloon to change the pitch of the buzz — this increases the frequency of the flapping rubber, which increases the frequency of the vibrations it creates. A higher frequency corresponds to a higher pitch. In the same way, you change the pitch of your voice by moving a part of your voice box so that the vocal cords are stretched thinner and tighter, and flap faster. (Since men's voice boxes are somewhat bigger and their vocal cords somewhat thicker than women's, the cords flap more slowly, so the pitch of a typical man's voice is lower than the pitch of a typical woman's, just as a cello makes lower notes than a violin.)

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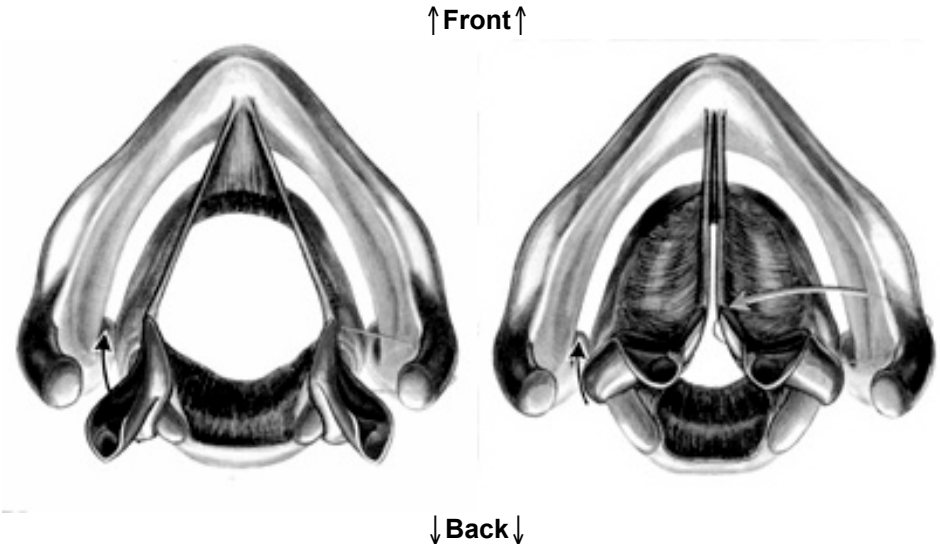
[4] The drop in air pressure associated with movement in a gas or liquid is called the *Bernoulli effect*, and it's responsible for the lift that holds an airplane up, the way your shower curtain swings inward when you turn the water on, and the rapidity with which your vocal cords snap shut after being blown open.

Fig. 1a Fig. 1b

Larynx and vocal cords, top view[5]



If you touch your fingers to your Adam's apple — the point of the triangle in the figures above — and say *aaa…aaaa…aaaa*, you will feel the vibration produced by your vocal cords starting and stopping. This vibration is called *voicing*, and during speech you manipulate it to produce different kinds of consonants. (Try changing the pitch of your voice, too. In order to stretch the cords to make a higher noise, you move the front of your voice box upwards. Sing a scale and feel it move.).[6]

Now we are ready to see what the vocal tract does with that buzzing to turn it into the sounds of speech—the *phonemes* of English.

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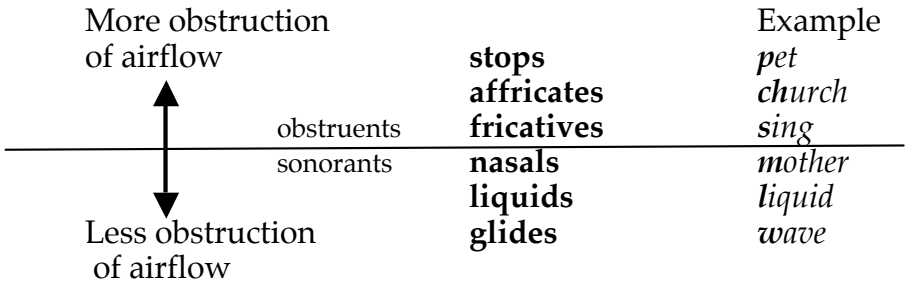
[5] These images taken from The Voice Center: Anatomy of the Larynx, Eastern Virgina Medical School, http://www.voice-center.com/larynx.html. XXpermissionsXX

[6] When you were a child, you might have sometimes talked in a funny, strained voice, not quite a whisper, that can sound a little scary—I've heard it used to imitate the way a ghost's voice might sound. That voice, called *creaky voice*, is produced by manipulating your vocal cord muscles so that they're half-closed and half-open, giving a sort of strange, staccato voicing vibration.

2.3 The building blocks of words I: Consonants in the IPA

Consonants are produced when the airflow through the mouth is partially or completely obsructed. Some mobile part of your mouth moves to a certain position and blocks the airflow. Partial obstruction results in sustainable sounds, since airflow can be maintained, although it's restricted. These sustainable consonants are named *fricatives* (like the *s* sound in 'sing'), *liquids* (like the *l* sound in 'liquid'), and *glides* (like the *w* sound in 'wave'), after the way they sound. Complete obstruction of the oral cavity produces *stop* consonants (like the *p* sound in 'pet'), which are generally not sustainable sounds, since the oral cavity is, momentarily, completely blocked off. The exception is when air is allowed to flow through the nose, even though the mouth is obstructed; this produces the sustainable *nasal* stops (like *m* in 'mother'). There are also a couple of combination stop/fricative consonants, called *affricates* (like the *ch* sound in 'church'). Stop, affricate and fricative consonants involve a greater degree of obstruction of the oral cavity than liquids or glides; they are consequently called *obstruents*. The six groups of consonants are illustated in XX below. We'll look at each of them in turn in a moment.

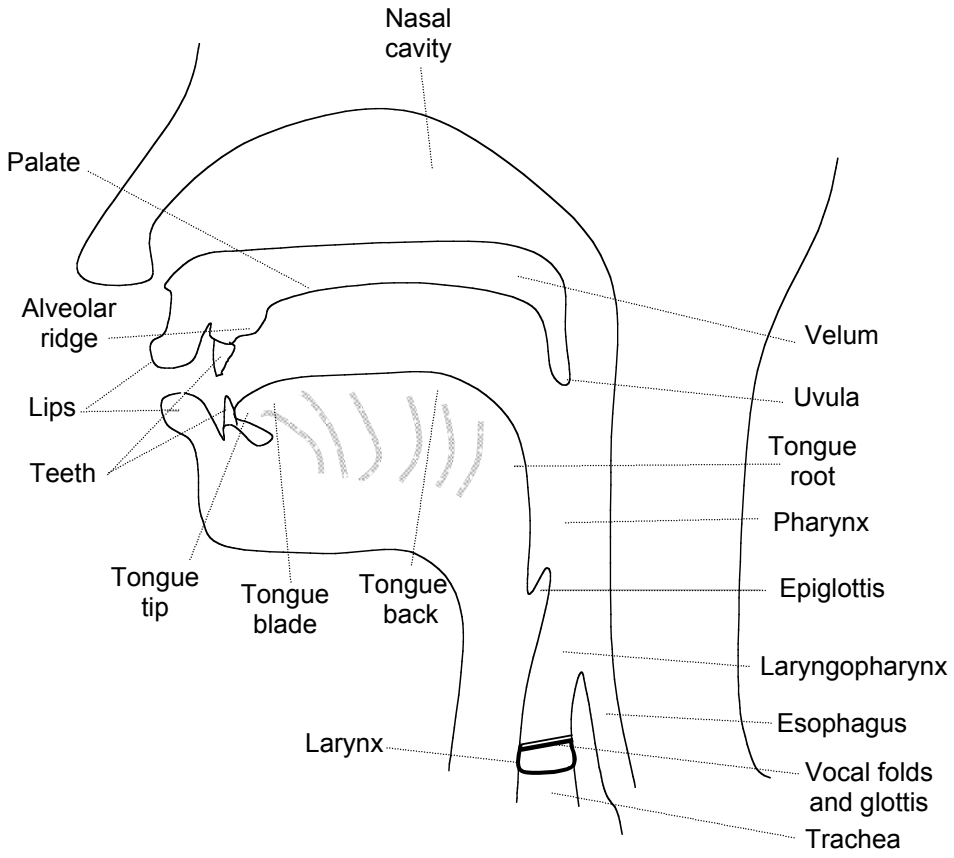
(13) *Types of English consonants*



The mobile parts which create the crucial obstructions are the lips and different parts of the tongue. The lips and tongue are the *articulators*, and the different spots in the mouth at which they can create an obstruction are called *places of articulation*. Each distinct place of articulation creates a different consonant sound. Look at the diagram in Fig 2 and identify each of the following parts. In English, obstructions can

be created at the lips (*labial* consonants, like *b* in *boy*), at the teeth (*dental* consonants, like *th* in 'thing'), just behind the teeth (*alveolar* consonants, like *d* in 'dog'), or, farther back in the mouth, against the palate (*palatal* consonants, like *sh* in 'shin') and velum (*velar* consonants, like *g* in 'goat'). The velum can also be lowered to allow air to pass through the nasal cavity and out the nose; this is how *nasal* consonants (and vowels) are produced. We'll consider each of these mechanisms in turn.

Fig. 2: The vocal tract



consonant, *n*. From Latin, via French, *con-* 'together' + *sonāre* 'to sound'. An alphabetic or phonetic element other than a vowel. [Note also its adjectival meaning, 'harmonious, in accord with'.]

Consonants, then, are made up of several distinct features. They have a *manner* of articulation—the type of obstruction produced: fricative, liquid, glide or stop. They have a *place* of articulation—labial, dental, alveolar, palatal, and velar. Further, they can be produced while the vocal cords are buzzing, in which case they are *voiced*, or they can be produced without buzzing, simply using the airflow, in which case they are *voiceless*. Let's see how all this fits together to make the different consonant sounds of English.

2.3.1 Fricative consonants

Fricative consonants are the sounds created when airflow is restricted a great deal but not stopped completely. Air is escaping only through a small opening, and the resulting friction produces turbulence that gives these consonants a sort of hissing quality, hence their name. The table below gives the IPA symbol and the combination of articulators and voicing used to produce each of the fricatives of English, along with three example words in which the sound occurs.[7]

To hear the difference voicing makes, make a long *sssssssssssss* noise. Without stopping, change to a *zzzzzzz* sound. Go back and forth, *sssszsssssszzzzsssszzz*. Notice that nothing changes in the position of your lips teeth and tongue: the only difference is in whether the vocal cords are vibrating or not—put your finger on your Adam's apple and check it out.

[7] The IPA symbols are enclosed between slashes, /…/, here and throughout the text, to differentiate them from normal English orthography.

Table 1: Fricative Consonants of English

Place, Articulator, *Name*	IPA symbols	Voicing	Example: word-initial	Example: word-medial	Example: word-final
Upper teeth, Lower lip, *Labiodental*	/v/	voiced	**v**ine	ra**v**el	o**f**
	/f/	voiceless	**f**ine	ra**ff**le	rou**gh**
Upper teeth, Tongue tip, *Interdental*	/ð/[8]	voiced	**th**en	ei**th**er	brea**th**e
	/θ/[9]	voiceless	**th**in	e**th**er	brea**th**
Alveolar ridge, Tongue tip, *Alveolar*	/z/	voiced	**z**it	rai**s**in	a**s**
	/s/	voiceless	**s**it	ra**c**ing	a**ss**
Behind ridge, Tongue tip, lip rounding, *Palatal*	/ʒ/	voiced	--[10]	trea**s**ure	mira**g**e
	/ʃ/[11]	voiceless	**sh**uffle	ra**ti**on	bu**sh**
Glottis,[12] *Glottal*	/h/	voiceless	**h**alf	be**h**ave	--

[8] This symbol is named "eth", or "edh" — the name of the symbol, of course, contains the voiced interdental fricative, not the voiceless one.
[9] This symbol is named "theta".
[10] This sound can occur at the beginnings of words in some other languages — English has even borrowed a couple of such words: *Dr. **Zh**ivago, **g**endarme* — but no words that begin with /ʒ/ are native to English.
[11] This symbol is named "esh"
[12] The *glottis* is the name for the space between the vocal folds. The sound /h/ is produced without any restriction anywhere in the mouth except a small constriction of the vocal folds, giving it its breathy sound.

The palatal fricatives are two of the six English consonants that are produced with an additional articulation—they're pronounced with a distinct rounding of the lips. Try saying *shin* to yourself, lingering over the initial voiceless palatal fricative, like a librarian shushing somene. Your lips are pushed forward and slightly rounded, right?

2.3.2 Stop consonants (oral)

In this group of sounds, the IPA symbols and the English spelling conventions match up almost one-to-one. Stops[13] are formed when the passage of air from the lungs out through the mouth is completely blocked off at some point.

Table 2: Stop Consonants of English

Place, Articulator, *Name*	IPA symbols	Voicing	Example: word-initial	Example: word-medial	Example: word-final
Upper and lower lips, *Labial*	/b/	voiced	**b**ile	ra**b**id	mo**b**
	/p/	voiceless	**p**ile	ra**p**id	mo**p**
Alveolar ridge, Tongue tip, *Alveolar*	/d/	voiced	**d**en	a**d**ore	ma**d**e
	/t/	voiceless	**t**en	a**tt**ach	ma**t**e
Velum, Tongue back, *Velar*	/g/	voiced	**g**um	ba**gg**ing	du**g**
	/k/	voiceless	**c**ome	ba**ck**ing	du**ck**

There's also a stop made with the vocal cords, just by shutting them off in the middle of a vowel sound. It doesn't occur too often in my dialect of standard American English, but it does show up now and

[13] Stops are also called *plosives*.

then—in the middle of the exclamation *uh-oh*, for instance. It's written as /ʔ/ in IPA, and it is much more widely used in other dialects of English, as we'll see.

2.3.3 Nasal stop consonants

These are all produced in exactly the same way as the voiced oral stops, above, but with the velum lowered, allowing air to escape out the nose. With the vocal cords vibrating, a sort of humming noise is produced. (There are no voiceless nasal consonants; with no resistance to produce a sound, a voiceless airflow out the nose sounds the same no matter what the place of articulation is. Try it and see: make an *mmmmm* sound, then stop the voicing and just let the air hiss out your nose—then do the same with an ŋŋŋŋŋŋŋ sound, like the last consonant in *si**ng***.) Nasal stops often lend a nasal quality to neighboring vowels, as the velum gets into the open position a little before the consonant is produced, and takes a moment to get closed again after the consonant is finished. (In Old French, the vowels became so nasalized in front of nasal consonants that the difference in pronunciation persisted even after word-final consonants ceased to be pronounced. If you know French, compare the sound of French *beau* 'beautiful', with the sound of *bon*, 'good'.)

The nasal stops are the consonants that sound funny when you have a cold and your nose is stuffed up—airflow through the nose is blocked no matter what you do with your velum. Consequently, you can't say something like *Lend me your pen* properly because all the nasals come out sounding like regular stops; you end up saying *Led be your ped*.

.

Table 3: Nasal Consonants of English

Place, Articulator, *Name*	IPA symbol	Voicing	Example: word-initial	Example: word-medial	Example: word-final
Upper and lower lips, *Labial*	/m/	voiced, nasal	**m**ow	re**m**ain	to**mb**

Alveolar ridge, Tongue tip, *Alveolar*	/n/	voiced, nasal	**kn**ow	i**n**ane	tu**n**e
Velum, Tongue back, *Velar*	/ŋ/[14]	voiced, nasal	-- [15]	si**ng**able	to**ng**ue

One thing that's important to understand about the velar nasal /ŋ/, as in *sing*, is that it's a single sound, like /m/ or /n/. The spelling system of English is confusing on this point, since it invariably represents the /ŋ/ sound with two letters, 'ng'. There is no 'g' sound in *sing*, in most dialects of English.

2.3.4 Affricates

In English, there are two consonants that are formed by combining a stop and a fricative, with the same place of articulation. These are called *affricates*. These sounds are produced by first pressing your tongue against the alveolar ridge, producing the /t/ portion of the affricate, and then sliding the tongue back to the palate and producing the /ʃ/ portion. Try pronoucing the voiceless affricate, usually spelled "ch", as in *church*, really slowly, and you'll hear these two parts.

The affricates are two of the other six consonants that are produced with lip-rounding—when you pronounce them, you push your lips forward into a slightly rounded position. This is because the palatal fricative part—the /ʃ/ and /ʒ/ part—is produced with lip-rounding. The other two consonants in English with some rounding are the "r" sound in words like

[14] Called 'eng'.
[15] Again, in English no words begin with this sound, but in some languages it is possible — a common Vietnamese name, for example, is Nguyen, pronounced /ŋwin/.

red, and of course the "w" sound in words like *wet*—see the next section on liquids and glides).

Table 4: Affricate Consonants of English

Place, Articulator, *Name*	IPA symbol	Voicing	Example: word-initial	Example: word-medial	Example: word-final
Behind ridge, Tongue tip (lip rounding), *Palatal*	/d͡ʒ/	voiced	**j**ump	ri**g**id	lo**dg**e
	/t͡ʃ/	voiceless	**ch**ump	wre**tch**ed	la**tch**

The affricate consonants are written with a curved line on top, joining the two symbols together, to distinguish them from transcriptions in which the two consonants which make them up occur separately. For example, there are words where /t/ and /ʃ/ occur next to each other, but are not part of the same consonant, as in the word *nutshell*. Contrast that with the word *cello*, where the initial consonant is the single affricate /t͡ʃ/. We'd transcribe *nutshell* like this, without the linking line: /nʌtʃɛl/, and *cello* like this, using the line: /t͡ʃɛlow/

2.3.5 *Liquids and Glides*

Liquids and glides are consonants that are almost like vowels: /l/ as in *lateral* and /ɹ/ as in *ripper* are liquids, and the 'y' and 'w' sounds in *yell* and *water* are glides. Liquids involve considerably less airflow obstruction in the mouth than other consonants, and so these, like nasals, are nearly always voiced, since there wouldn't be enough turbulence to distinguish voiceless liquids.[16] Liquids are so named no doubt because they reminded

[16] Some languages, like Welsh, do have a voiceless 'l'; that's the sound that's spelled with a double 'l' as in the name *Lloyd*.

someone of the sound of flowing water. Glides involve a small movement of the relevant articulator: the articulator (lips or tongue) starts out in one position which, if you held it, would produce a vowel sound, but then quickly *glides* into another. The vowel position is released so quickly that the resulting sound has consonantal qualities. Because of their close relationship to vowels, glides are sometimes called *semivowels*. (Remember "*A, e, i , o, u* and sometimes *y* and *w*?")

The American English liquid "r" in words like *bird, word, report*, etc., is a comparatively rare sound cross-linguistically — a Spanish-style trilled "r" is much more common. English "r" has a secondary articulation as well: the lips are rounded, as with /ʃ/ and /ʒ/.

Table 5: Liquids and Glides of English

IPA symbol	Place, Articulator, *Name*	Manner, Voicing	Example: word-initial	Example: word-medial	Example: word-final
/l/	Alveolar ridge, Tongue blade *Lateral Alveolar*	liquid, voiced	**l**ake	be**ll**y	poo**l**
/ɹ/	Tongue blade (lip rounding) *Retroflex Alveolar*	liquid, voiced	**r**ake	be**rr**y	poo**r**
/j/	-- Tongue blade, *Palatal*	glide, voiced	**y**et	mill**i**on	--
/w/	-- Lips *Labial*	glide, voiced	**w**et	po**w**er	--

(One of the most confusing things about the IPA for Engilsh-speaking beginners is that the IPA symbol for the initial sound in 'you' (/j/) is the same as the English symbol for the initial sound in 'jump'. The

initial sound in 'jump'—a voiced palatal affricate—is written /d͡ʒ/ in IPA. Be careful not to get them mixed up! The 'y' symbol stands for a particular kind of vowel in the IPA,[17] but it's a vowel that isn't used in English at all—so there should never be a 'y' in any of the transcriptions you do in this book.)

The /l/ sound is called 'lateral' because air is allowed to escape around the *sides* of the tongue—say a long /lllllllllllllll/ to yourself and you'll see that it's so. The /ɹ/ is called 'retroflex' because the tip of the tongue is flexed slightly towards the back of the mouth—again, say a long /ɹɹɹɹɹɹɹɹɹɹ/ to yourself to feel this.

A table containing the all the symbols for the consonants of English organized by manner and place of articulation is at the end of this chapter, for quick reference.

2.4 Building blocks II: Vowels and the IPA

The oral tract is much more open for vowels than for any consonant. Consequently, voiceless vowels are practically non-existent: there's not enough obstruction in the mouth to make different sounds distinguishable just by using the airstream, as with voiceless consonants. Vowels are more like a vibrating volume of air in a container—a resonating chamber. Changing the shape of the container changes the sound produced by the vibrations, just the way a slide trombone player changes the sound of her instrument by pulling the slide in and out—the slide makes the vibrating volume of air in the trombone bigger or smaller, and consequently changes the pitch. Unlike the trombonist, though, we are able to change not just the size of our resonating chamber, but also its shape, by moving our jaw, tongue and lips into different positions. It is the different shapes of airspace that creates the different vowels.[18]

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[17] It's the vowel heard in French in words like *sucre*, or in German in words like *Tür*.

[18] The primary way we change the airspace shape is by using our large, muscular tongue—a more mobile and precise one than most tongues in the animal kingdom. The fact that we stand upright, with our heads set squarely on our necks, rather than forward of our bodies, has an important role to play as well: it means that our oral tract is a tube

You may recall that your grade-school English teacher taught you to distinguish between "short" and "long" vowels of English. You might have learned that the "a" in *tack* was "short" and the "a" in *take* was "long". Similarly, the "e" in *pet* is "short", and the "e" in *Pete* is "long". English spelling is misleading on this point, however, because there are other, very significant differences between the vowels in *tack* and *take*, and *tech* and *teak*, besides the difference in "length".

Exercise 2: Pronounce *tack, take, tech* and *teak* to yourself several times, and then just the four vowels by themselves. Try to describe, in words, the distinct way you position the various parts of your mouth to produce each isolated vowel.

You may have noticed that your tongue is a little closer to the roof of your mouth for *take* than for *tack*, and a lot closer to the roof of your mouth for *teak* than for *tack*. Once crucial way that vowels can differ is in how *high* the body of the tongue is in the mouth. The vowel in *teak* is a high vowel, while the vowel in *tack* is a low vowel.

Now try it again with *goose* and *geese*, as well as *rote* and *rate*.

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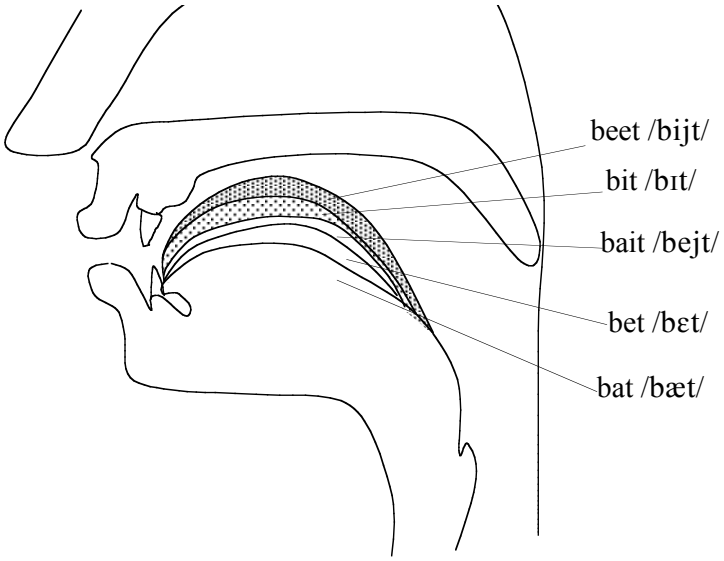
with an approximately 90° bend in it, which gives it unique acoustical properties. Animals with a shallower curve to their throats, and lacking the crucial moldable, mobile tongue, cannot even try to make the variety of sounds available to us, which is one reason why it is impossible to teach chimpanzees or dogs to use spoken human language. Chimps can do better with sign languages, as their hands are almost as mobile and precise as our own. Some animals, like parrots, can make a variety of sounds comparable to ours, and they can be taught to produce good imitations of English words. Whether they can understand and use such sound patterns the way we do is, of course, a separate question.

Exercise 3: Pronounce *goose, geese, rote* and *rate* to yourself several times, and then just the four vowels by themselves. Try to describe, in words, the distinct way you position the various parts of your mouth to produce each vowel.

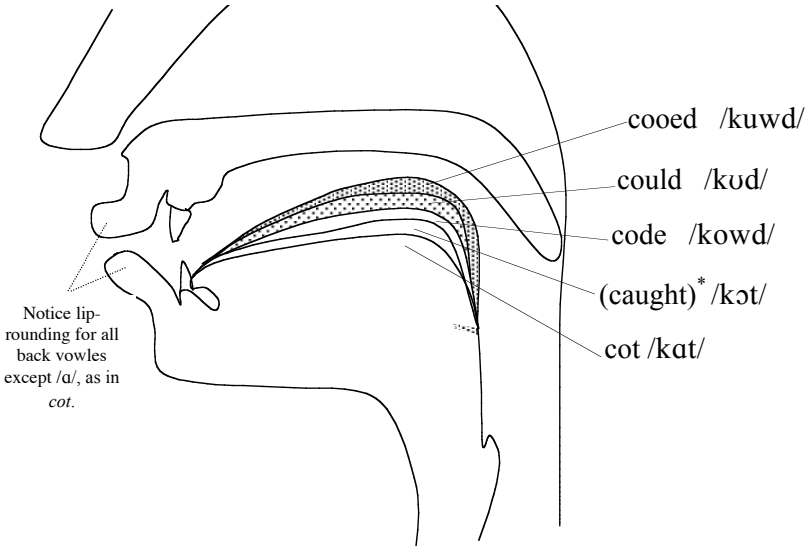
One thing that you probably will notice is that for *goose* and *rote*, your lips are rounded, while for *geese* and *rate* they are not. That's not the only thing that's different, however. Try leaving your lips in an unrounded position (as for *rate*), and pronounce *rote* like that. Switch back and forth between *rote* (with unrounded lips) and *rate*.

Fig. 3a. The front vowels of English



The other thing that's changing in your mouth is how far forward the main body of your tongue is. Besides *height*, and *rounding*, vowels can differ in how far *front* or *back* they are. The vowel in *rate* is a front vowel, while the vowel in *rote* is a back vowel. Figs. 3a and 3b illustrate the positions of the tongue for the front and back vowels of English.

Fig 3b. The back vowels of English



*This is a low, back rounded vowel. In the U.S., many northeastern dialects use it by itself, but some others don't. To decide if you have it, see if you pronounce 'cot' and 'caught' differently. (Most dialects of English do use it as part of the diphthong in the word *boy*, even if they don't use it by itself..

Some English vowels are made up of two different vowel sounds pronounced in quick succession. The vowel in the word *kite* is like this. Say *kite* very slowly to yourself, lingering over the vowel. You'll find that you start off with your tongue in one place, making a sound rather like the "a" in *father*, and end up with your tongue in another place, making a sound rather like the "i" in *pit* or possibly like the "ee" in *geese*. These "two-vowel" vowels are called *diphthongs*. In fact, nearly all English 'long' vowels end with a little "off-glide" — the sound in *way* is not a single pure vowel, but ends in a little /j/ sound, just as it's spelled. English long vowels are essentially *all* diphthongs, although for some of them (e.g. the vowel in "free") the off-glide is so minimal that it is difficult to detect. The ubiquitous off-glide in English long vowels can make it difficult for English speakers to accurately produce the vowel sounds in languages like French or Spanish, which have vowels that sound *almost* like our long

vowels, but without the off-glide—their vowels are "pure". For instance, the French word *aller*, 'to go', which sounds almost like the English word *allay*, is pronounced without a /j/ ('y'-sound) at the end. Pronouncing such vowels with an off-glide is one of the characteristics of an "English accent" in French.

diphthong, *n.* /dɪfθɑŋ/ Two vowels pronounced in succession within one syllable. From Greek via Latin and French: *di-* 'twice' and *-phthong-*, 'voice, sound'.

There's another important type of vowel in English, which your English teacher probably did not mention. These are the *reduced* vowels, which occur only in unstressed syllables. They are shorter even than short vowels, and they are not particularly high, low, back or front—the tongue is in a very neutral position when they are pronounced. We don't have a special symbol in the English alphabet for these, and just about every possible letter is used to represent a reduced vowel in the spelling of some word. For example, in *b**a**n**a**n**a***, the first and third "a"s are reduced—they're not pronounced like the "a" in *rat*, nor like the "a" in *rate*, nor like the "a" in *father*. In *chick**e**n*, the "e" is reduced; it is not pronounced like the "e" in *pet* or *Pete*. In *t**o**mato*, the first "o" is reduced: it's not pronounced like the "o" in *pot* or *lope*—and so on. Vowel reduction and stress assignment in English words are important topics in the next chapter, when we look at how English suffixes and prefixes affect pronunciation, and in the study of the history of English, in which vowel reduction plays a very big role. To an English speaker, it seems very natural to pronounce unstressed vowels as a kind of quiet "uh" sound, but in many languages, unstressed vowels do not get reduced. French is such a language. Taking our example from above, the first syllable of the French verb *aller,* 'to go', is unstressed, and hence quieter and lower in pitch than the second syllable. Nonetheless, the vowel is pronounced with its full value, a sound like the "a" in *cat*. In the English word *allay*, however, the first vowel is both unstressed and reduced, so that it doesn't sound like the vowel in *cat* but more like that quiet "uh".

The precise transcription of English vowel sounds is a surprisingly complicated task. In the alphabet that we use to write English, there are only five different vowel symbols, "a", "e", "i", "o", and "u". But in my dialect of American English, there are no less than *fifteen* distinct vowels (including diphthongs), each of which must be transcribed differently in a pronunciation-based system like IPA. Further, vowels are the most mutable sounds in a language. They are pronounced quite differently in different dialects of English. They're one of the primary components of the "accent" that distinguishes one particular dialect from another. The vowels of Southern American English, for instance, are famously different from those of people with a Midwestern-ish dialect; similarly the vowels of New Jersey English are different from those of California or Canada. Even more radical differences can be heard when comparing North American English speakers to Australian English speakers, or British English to South African English… and so on. The vowel symbols I present here are those needed to transcribe my own dialect of Standard American English, and can be used to do a broad transcription of most North American English dialects; you may find that you need to adapt them somewhat if your pronunciation differs significantly. See the official website of the IPA at the University of Glasgow for a complete discussion: http://www.arts.gla.ac.uk/IPA/ipa.html, and for information on distinctive North American dialects, see the Atlas of North American English at the University of Pennsylvania:
http://www.ling.upenn.edu/phono_atlas/home.html.

I have divided the vowels into three tables, according to whether the tongue starts out positioned in the front, center or back of the mouth. One final note: the distinction that your English teacher used to refer to with the terms "short" and "long" —the 'short' vowels being those in *bid, bed, but, bought*, and the 'long' ones in *bead, bade,* and *boat*—also differ in the muscular tension in the pharynx during their pronunciation. Consequently, linguists refer to *lax* ('short') and *tense* ('long') vowels, instead, and that is the distinction encoded in the tables below. Since the tense vowels all have off-glides at the end, they do also take a bit longer to pronounce than the lax vowels. The short/long distinction has played a very important role in the history of English; see chapter XX for more discussion.

Table 7: Front Vowels of American English

IPA symbol	Tongue height	Front/back, rounding	Lax or Tense	Examples
/ɪ/	high	front, unrounded	Lax	p**i**t, b**i**d, compet**i**tion
/ɛ/	mid			p**e**t, b**e**d, tr**ea**d
/æ/	low			p**a**t, b**a**d, inter**a**ct
/ij/	high		Tense	P**e**te, b**ea**d, th**ei**f, fr**ee**d, magaz**i**ne, bull**y**
/ej/	mid →high			m**a**te, b**ay**ed, gr**ea**t, m**ai**d participation, w**ei**gh
/aj/	low → high	central → front, unrounded		m**i**ght, **t**ide, b**y**, g**uy**, l**ie**, goodb**ye**

We will using the symbols for the glides /j/ and /w/ to represent the off-glides in the diphthongs and tense vowels of English, as in the vowel /aj/ in the table above, or /ow/ in the table below.

Table 9: Back vowels of American English

IPA symbol	Tongue height	Front/back rounding	Lax or Tense	Examples
/ʊ/	high	back, rounded	Lax	put, good, should
/ɑ/	low	back, unrounded		pot, body, father, talk, auction, raw, cough
/uw/	high	back, rounded	Tense	toot, booed, rune, flute, lewd, flue, through
/ow/	mid			coat, bode, home, flow, so, sew, though, OK
/aw/	low → high	central, unrounded →back, rounded		p**ou**t, b**ow**ed, b**ou**gh, fl**au**tist
/ɔj/	mid →high	back, rounded → front, unrounded		b**oy**, **oi**l

Unstressed vowels are *central*: the tongue body is neither forward nor back, but in a relaxed, neutral position. The primary unstressed vowel of English, /ə/, is called *schwa*. Sometimes, however, an unstressed vowel is pronounced with the tongue body a little bit higher than the central location of schwa, in which case it's transcribed as a 'barred I': /ɨ/. When an unstressed syllable ends with a liquid or nasal consonant like /l/, or /n/, the vowel can disappear entirely—the consonant itself becomes the nucleus of the syllable. When this happens, it is transcribed with a small vertical stroke underneath it, to indicate that the consonant forms its own syllable. The word *written*, for instance, could be transcribed /ɹɪtn̩/, and the word *little* could be transcribed /lɪtl̩/.

The only stressed, central vowel in American English is almost indistinguishable from schwa; in general, however, it's a little bit lower, and we use a different symbol, /ʌ/, to transcribe it.

Table 8: Central Vowels of American English

IPA symbol	Tongue height	Front/back rounding	Lax or Tense	Examples
/ʌ/	mid-low	central, unrounded	Lax, stressed	p**u**tt, b**u**d, fl**oo**d, wh**a**t
/ə/	mid		Lax, unstressed	**c**o**m**plete, b**a**nan**a**, **a**rrest
/**i**/	mid-high			**i**nvade, chick**e**n, woma**n**

One final note: the /ɹ/ sound at the end of a syllable can strongly affect the vowels which precede it, enough so that they can be entirely distinct from other vowels. Even when they are not distinct they are sometimes hard to identify; the tense/lax (short/long) distinction is essentially neutralized before /ɹ/. Is the vowel in *care* more like the /ej/ in *wait*, the /ɛ/ in *wet*, or the /æ/ in *wham*? Table 10 gives the usual transcription of some easily confused vowels before /ɹ/ and in diphthongs in my dialect of American English.[19] The syllable-final /ɹ/ sound is fairly rare in the languages of the world, and has been lost in several dialects of English, including standard British English, where it has been replaced by either schwa (/ə/) or lengthening the previous vowel, and Boston English, where it has been replaced by lengthening.

[19] Some of you may make a distinction between a mid front vowel before "r" and a low front vowel before "r". To decide, see if you pronounce *marry* and *merry* the same way. If they sound different, you retain a distinction between /æ/ and /ɛ/ before /ɹ/.

Table 10: Mid and low vowels before "r"

IPA symbol	Tongue height	Front/back, rounding	Examples
/aɹ/	low	central, unrounded	c**ar**t, sn**ar**l
/ɔɹ/	mid	back, rounded	c**or**e, fl**oo**r
/ʌɹ/	mid	central, unrounded	f**ur**, w**ere**
/ɛɹ/	mid	front, unrounded	c**ar**e, fl**air**,
/ɪɹ/	high	front, unrounded	**ear**, sh**eer**
/ʊɹ/	high	back, rounded	t**our**, b**oor**

Exercise 4: To practice using the IPA, transcribe the underlined words in the following sentences:

(14) a. We must <u>polish</u> the <u>Polish</u> furniture.
/wij mʌst pɑlɪʃ θə powlɪʃ fʌɹnɨt͡ʃʌɹ/

b. He could <u>lead</u> if he would get the <u>lead</u> out.
c. The farm used to <u>produce</u> <u>produce</u>.
d. The dump was so full that it had to <u>refuse</u> more <u>refuse</u>.
e. The soldier decided to <u>desert</u> in the <u>desert</u>.
f. This was a good time to <u>present</u> the <u>present</u>.
g. A <u>bass</u> was painted on the head of the <u>bass</u> drum.
h. When shot at, the <u>dove</u> <u>dove</u> into the bushes.
i. I did not <u>object</u> to the <u>object</u>.
j. The insurance was <u>invalid</u> for the <u>invalid</u>.

Exercise 5: To practice reading the IPA, read these IPA transcriptions aloud, and write them down.

(15) a. /ðə bændəd͡ʒ wəz wawnd ərawnd ðə wuwnd/
"The bandage was wound around the wound."
b. /ðɛɹ wəz ə ɹaw əmʌŋ ðə ɔrzmən əbawt haw tə row/
c. /ðej wəɹ tuw klows tə ðə dɔɹ tə klowz ɪt/
d. /ðə bʌk dʌz fʌnij θɪŋz wɛn ðə dowz aɹ prɛzənt/
e. /ðej sɛnt ə sowəɹ dawn tə st͡ʃɪt ðə tɛɹ ɨn ðə suwəɹ laɪn/
f. /tə hɛlp wɪθ plæntɪŋ, ðə faɹməɹ tɑt hɪz saw tə sow/
g. /ðə wɪnd wəz tuw strɑŋ tə wajnd ðə sejl/
h. /æftəɹ ə nʌmbəɹ əv ɨnd͡ʒɛkʃn̩z maj d͡ʒɑ gɑt nʌməɹ/
i. /əpɑn sijɪŋ ðə tɛɹ ɨn maj klowðz aj ʃɛd ə tijɹ/
j. /aj hæd tuw səbd͡ʒɛkt ðə sʌbd͡ʒɛkt tuw ə sijɹijz əv tɛsts/
k. /haw kæn aj ɪntɪmejt ðɪs tuw maj mowst ɪntɪmɨt frɛnd/

Exercise 6: Try saying these tongue twisters five times (or more) fast:
"She sells sea shells by the seashore"
"The sixth's sheik's sixth sheep is sick"
"Toy boat"
Transcribe them in IPA. Which sounds get confused? Which articulators are being used in the places where your pronunciation breaks down? Can you design your own tongue twister?

2.5 Families of sounds: a case in point

The primary reason that all the preceding complicated information is important is that English, like all languages, has consistent patterns of organization and pronunciation that apply to *families* of sounds, not just to individual sounds. In order to understand the changes that English has undergone since the year 1000 AD, for instance, it is crucially important to know that vowels come in low, mid, and high varieties, as well as short (lax) and long (tense).

In modern English, the sounds /p/, /t/, and /k/ are pronounced in a special way when they occur by themselves at the beginning of a stressed syllable: they come with a little extra puff of air. (Put your hand about an inch in front of your lips and say *pat, spat, tat, stat, cat, scat*. Feel the difference in each case?) It's not a coincidence that this special pronunciation—called *aspiration*—happens to /p/, /t/, and /k/ but not to any other consonants of English. The extra-puff-of-air pronunciation applies to all (and only) the *voiceless stops* of English in that position. This kind of quirk of pronunciation is the sort of thing that could lead to more significant language change. In another five hundred years, it is possible that syllable-initial /p/, /t/, and /k/ in English will have become fricatives, turning into /f/, /θ/, and /x/,[20] since the extra puff of air is one step towards a more fricative-like quality. If that happened, we'd be pronouncing the word *pat* as /fæt/, *tat* as /sæt/ and *cat* as /xæt/, while still retaining the present-day pronunciation of *spat, stat* and *scat*. (We might still *spell* the words the same way, in this hypothetical future, since spelling is very conservative; in that case, future learners of English would be wondering why the letter "p" sometimes stands for /f/ but other times stands for /p/.)

In fact, this is a type of sound change that has already happened once in the long-ago history of English. This very set of sound changes happened to the ancestral language spoken by the Germanic tribes of Europe, before that ancient language split up into German, Swedish,

[20] The IPA symbol /x/ represents a sound like that in the German name *Bach*, or the Scottish word *loch*, a velar fricative.

Dutch, English and so on. This sound change was one step on the way to the differentiation of the Germanic languages from the languages spoken by related peoples in Europe.

There was once a single language spoken by a group of people living somewhere in Central Europe. This language was the ancestor of nearly all the modern European languages, including English, and it was also the ancestor of Hindi and other related languages on the Indian subcontinent. Linguists have named this now-extinct language *Proto-Indo-European*. This tribe split up into several groups, some of which migrated eastwards (spreading their language all the way to India), some northwest (bringing their language to Spain, Italy, and France), and some to the far north (the group which came to speak the modern-day Germanic and Scandinavian languages). Northeast, another group went to Eastern Europe and Russia. XXinsert map here.

When two groups of people, originally sharing a common language, are separated for generations, their languages will begin to drift apart, creating, at first, mutually intelligible dialects, but eventually diverging so far that speakers from the different groups can no longer understand each other. This drift is not simple random alteration of a sound here or there: it occurs quite generally to whole families of sounds and patterns within a language. Consider the pairs of Latin and English words in (5) below:

(16)

Latin	English
pater	father
pedem	foot
penna	feather
tri-	three
tu	thee
cordis	heart
octo-	eight
quis	who
deca-	ten
dent-	tooth
labia	lip
genu-	knee
genus	kin
granum	corn

fundus	bottom
foro	bore
frag-	break
hædus	goat

These words are *cognates* of each other, that is, each pair represents the end product of sound changes that different groups of speakers applied to the same source word. Pairs of cognate words are like two animals of different species which are both descended from a single ancestor species. These words have preserved their core meaning over time, since they are commonly used words which stand for concepts that have remained stable and current over the centuries.

Consider the list carefully. Are there any correspondences between the pronunciation of the consonants in the Latin and English words? It may help you to know that in Latin, the letter "c" was pronounced /k/, and so was the letter "q".

Exercise 7: Look at the consonants in the pairs of Latin/English words in (5). Can you detect any regular correspondences between the consonants in the Latin words and the consonants in the English words? State any regularities you see first in terms of individual sounds, and then try to state them in terms of *manner* and *voicing*.

In fact, these correspondences are part of a very general and complete sound change that happened in the ancestral Germanic language, after that group of people had moved away from the group which eventually came to speak Latin. The sound change did not happen in Latin or its descendants, so in this respect, Latin remained more similar to the

original language that is the ancestor of both Latin and English, Proto-Indo-European.[21] The change involved stops and fricatives.

In the list, wherever there is a /p/ in a Latin word, there is an /f/ in the corresponding English word. You can see this in ***p**ater/**f**ather*, ***p**edem/**f**oot,* and ***p**enna/**f**eather*. In most places, where there is a /t/ in a Latin word, there is a /θ/ in the corresponding English word: ***t**ri/**th**ree*, ***t**u/**th**ee*, *pa**t**er/fa**th**er*, and *den**t**-/too**th***. (This isn't true in *oc**t**o-/eigh**t***, but it is the only exception in the list.) Wherever there is a /k/ (spelled "c") in the Latin word, there is a /h/ in the corresponding English word: ***c**ent-/**h**undred*, ***c**ordis/**h**eart*, and ***q**uis*/***wh**o*. Even in *oc**t**o/ei**gh**t*, although an /h/ isn't pronounced in the English word, it's present in the spelling. The only case where this correspondence doesn't hold is in *de**c**a-/te**n***, but this is because the two-syllable pronunciation with an /h/ in the middle was gradually lost in the English branch of Germanic; the old Gothic word for "ten" was *tai**h**un*. So far, we see that Latin /p/ corresponds to English /f/, Latin /t/ corresponds to English /θ/, and Latin /k/ corresponds to English /h/.

Elsewhere, we see that wherever there is a /d/ in a Latin word, there is a corresponding /t/ in the English word: ***d**ent-/**t**ooth*, ***d**eca-/**t**en,* *pe**d**em/foo**t***, *cor**d**is/hear**t***, *fun**d**us/bo**tt**om,* and *hae**d**us/goa**t***. Latin /g/ corresponds to English /k/ in ***g**enus/**k**in*, ***g**ranum/**c**orn,* and *fra**g**-/brea**k***; in ***g**enu-/**k**nee* there is a spelled "k" in the English word that is not pronounced. Again, this is a more recent change in English; well into the 15th century, *knee* was pronounced with an initial *k* sound in English. So Latin /g/ corresponds to English /k/, and Latin /d/ corresponds to English /t/.

Finally, Latin /f/*,* corresponds to English /b/, in ***f**undus/**b**ottom,* ***f**rag-/**b**reak,* and ***f**oro/**b**ore*, while Latin /h/ corresponds to English */g/* in ***h**aedus/**g**oat*. The nasals and liquids of Latin words generally seem to be preserved in their English counterparts; there's no obvious pattern of

[21] It's important to understand that *Latin* is not an ancestor language of English. Latin and English are more like cousins in the family tree of Indo-European. They are both descended from the same ancestor language, however.

change—and the vowels are all over the place. But let's see what we've got among the stops and fricatives:

(17)	Latin	English
a)	p, t, k	f, θ, h
b)	d, g	t, k
c)	f, h	b, g

What is immediately apparent is that, at least for the first two groups in this list, the correspondences are not an accident. In group (a), /p/ , /t/, and /k/ are all voiceless stops, and /f/, /θ/, and /h/ are the corresponding voiceless fricatives, produced at pretty much the same place of articulation. In group (b), /d/ and /g/ are voiced stops, and /t/ and /k/ are the corresponding voiceless stops produced at the same place of articulation. In the third group, we can again see a generalization in terms of place of articulation, although they're very different sounds in other regards. /f/ is a voiceless fricative and /b/ is a voiced stop, but they do have the same labial place of articulation. Similarly, /h/ is a voiceless fricative and /g/ is a voiced stop; nonetheless they do share approximately the same place of articulation in the back of the mouth. In Germanic, it appears, stops and fricatives changed their manner of articulation and/or their voicing in a consistent way, but retained their place of articulation, or at least as close an approximation of it as possible. We can summarize what we have found in terms of place, manner and voicing as follows:

(18) a. Voiceless stops → Voiceless fricatives
b. Voiced stops → Voiceless stops (/b/: unknown)
c. Voiceless fricatives→Voiced stops (/θ/: unknown)

At a first glance, it looks like the consonants of the Germanic branch of Proto-Indo-European played musical chairs with voicing and manner:

voiced stops became voiceless, voiceless stops became fricatives, voiceless fricatives became voiced stops.[22]

Of course, we don't have enough evidence in our list to confirm the complete generality of our correspondences in (b) and especially (c). When looked at in detail, there's an important missing piece of the puzzle: another series of consonants in the ancestral Proto-Indo-European that underwent changes in *both* Latin and English. Nonetheless, the overall picture is correct, confirmed by hundreds of cognate words in the various Indo-European languages. This collection of sound changes, part of the development of Germanic as a separate subfamily of Indo-European, is known as *Grimm's Law*, (the same Grimm as in *Grimm's Fairy Tales*), after the linguistic anthropologist who pointed out its importance (and recorded the fairy tales).[23] This work, part of the larger project to reconstruct Proto-Indo-European, constituted a breakthrough in the development of linguistics as a science, and crucially depended on an understanding of the families of sounds we have just learned about. This kind of reconstruction of change through comparison is used by linguists all over the world to investigate the relationships between different languages and language families, and can provide strong evidence about the migration patterns of various groups of people over periods of thousands of years.

More relevant for our immediate concerns, this kind of example makes it clear that knowing about families of sounds is essential if we want to understand the history of English words.

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[22] Note that this all had to have happened more or less at the same time. If, for example, the voiced stops had turned into voiceless stops before the voiceless stops became voiceless fricatives, we would expect to see the word *dent-* end up corresponding to an English word *thooth*, since the /d/ would have become /t/, and then that new /t/ would have become /θ/ later, when all the other /t/s did.

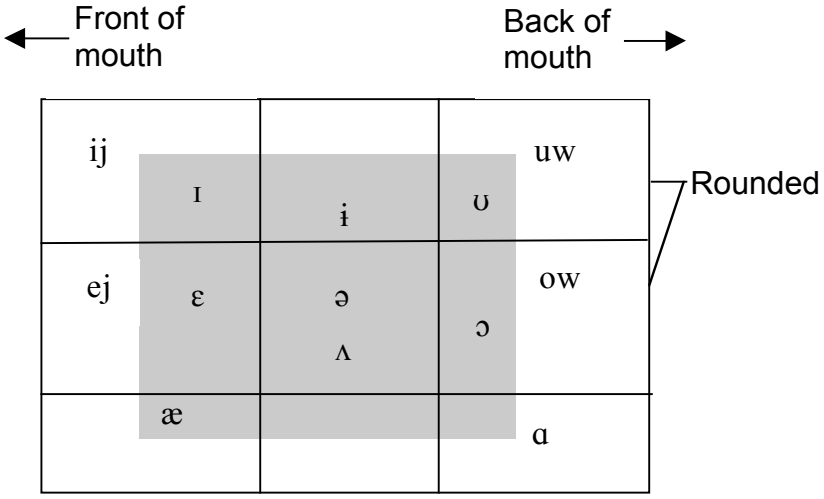
[23] Grimm's law was actually discovered by a Danish scholar, Rasmus Rask

IPA Summary Tables

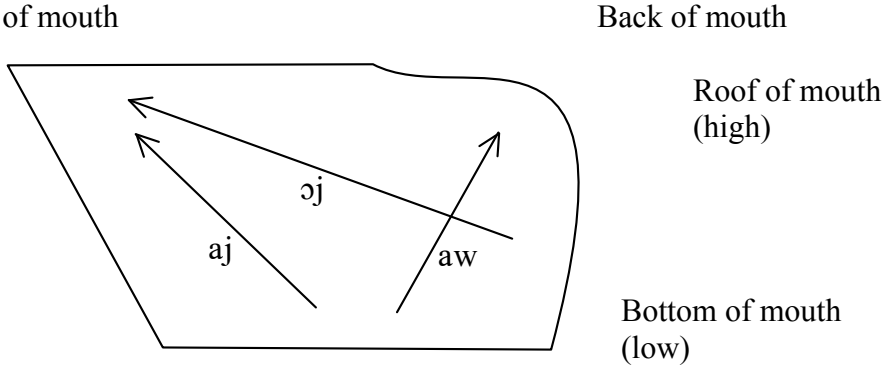
Consonants of English — voiceless — voiced

place / manner	labial		labio-dental		inter-dental		alveolar		palatal		velar		glottal	
stops	p	b					t	d			k	g		
fricative			f	v	θ	ð	s	z	ʃ	ʒ			h	
affricates									t͡ʃ	d͡ʒ				
nasal		m						n				ŋ		
liquids (lateral) (non-lateral)								l ɹ						
glides		w								j				

Vowels of English: — tense — lax



Diphthongs of English: Arrow =movement of tongue



XXto come: problem sets, further readingsXX