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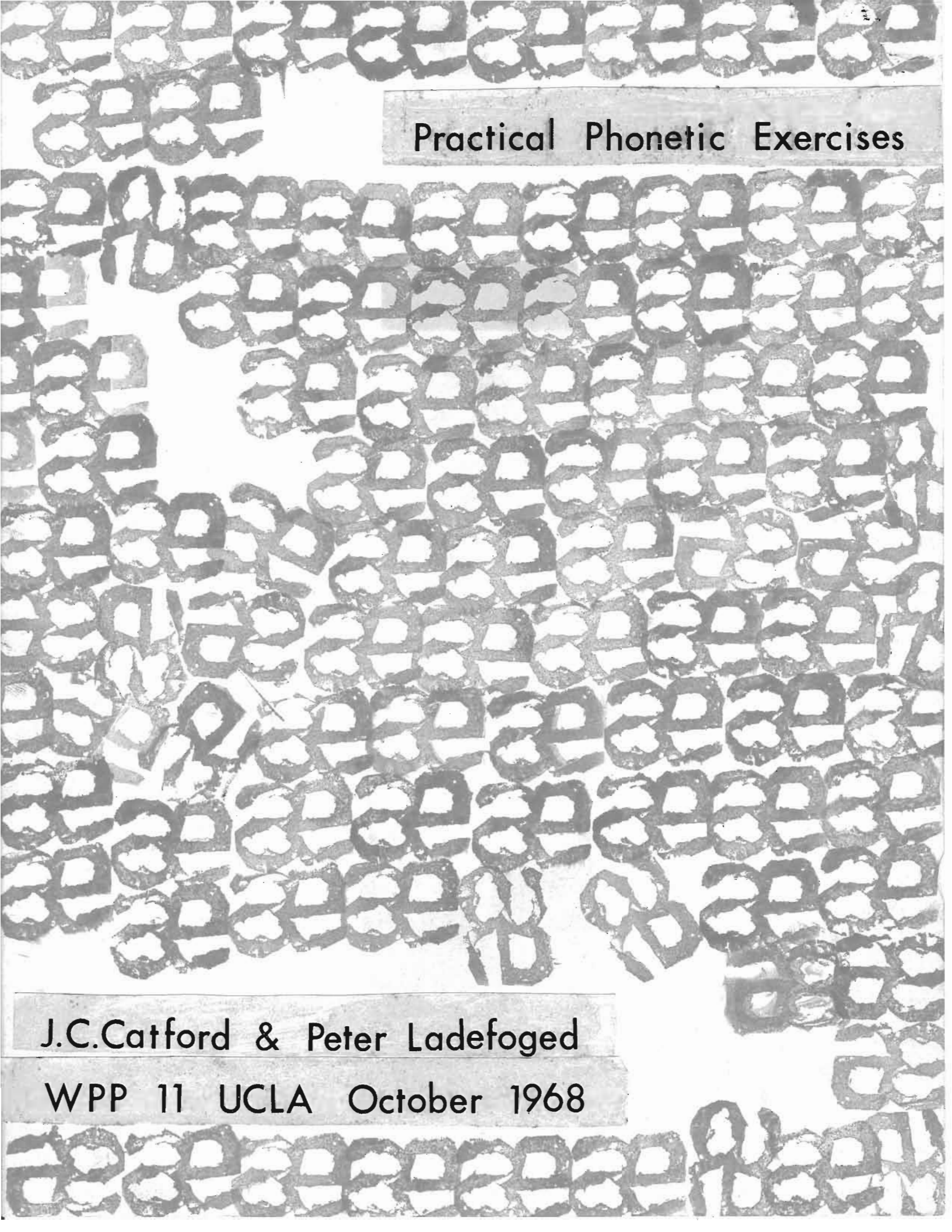
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Practical Phonetic Exercises

Nobody can hope to get very far in the study of linguistics without some knowledge of phonetics; and any such knowledge cannot be entirely theoretical, but must involve a practical component. A linguist should be able to produce the sounds he describes; and he should be able to reproduce sounds described by others. He should also have a familiar knowledge of all the terms used in taxonomic phonetics. It is hoped that this set of practical exercises will help him achieve all these aims.

The phonetic symbols used are those of the International Phonetic Association, except for the deficiencies of our typewriter (an IBM Selectric with a Camwil element, P/W 113-M), and except for the deficiencies of the IPA system, such as the lack of a diacritic for laryngealization. In presenting the main set of exercises the symbols have been introduced in a logical order; but in the illustrations of contrasts in actual languages we have sometimes had to use symbols which have not been previously presented. We suggest that these exercises, which are marked by a prefixed L, should be attempted in their correct sequence (provided there is an instructor who can be imitated) and then reviewed again later.

The exercises collected here are a development of a set originally prepared by us for use in the Phonetics Department of the University of Edinburgh. Undoubtedly the influence of David Abercrombie, the Head of that Department, and Elizabeth Uldall, who taught with us, is apparent throughout. We would also like to thank all the teaching assistants who have worked with us, especially Mona Lindau.

Pulmonic air-stream mechanism

- 1.1 Say a long [ffff]. Observe the two components of this sound:
 - (i) pulmonic egressive *initiation* (or air-stream mechanism), and
 - (ii) contact between lower lip and upper teeth — *articulation*.
- 1.2 Practice a pulmonic *ingressive* air-stream (i.e. inhaling) a long [ffff].
- 1.3 Alternate pulmonic egressive and ingressive air-stream, with various articulations, e.g. [aaaa, ssss, ttt].
- 1.4 Try talking with a pulmonic ingressive air-stream, saying a wide variety of different sentences. Can you count as far on one breath in this way? What words are particularly difficult to say?

States of the glottis

2.1 Voiced - voiceless

Say [fff] then [vvv]. Let [fff] run into [vvv] without a break. Note that articulation and initiation remain the same. In passing from [f] to [v] the state of the glottis alters in that the vocal cords start vibrating.

- 2.2 Produce a sustained pulmonic egressive air-stream, plus a sustained labio-dental articulation, i.e. the position for [f]. While doing this, alternately add and subtract voice, i.e. say [ffvffvff]. Repeat with [s] and [z] articulations, e.g. [sszzsszz] etc.
- 2.3 Tests for *voice*
 - (i) Place thumb and forefinger on the sides of the larynx, and say [ffvffv]. Note that during [vv] the vibration of the vocal cords can be slightly felt by the thumb and finger.
 - (ii) Close the ears. While keeping them closed say [ffvffv]. Note that during [ff] only a faint hiss can be heard. During [vv] the head seems to be filled with a loud buzzing sound. Repeat with [sszzsszz], [θθððθθðð] and [ʃʃʒʒʃʃʒʒ].
 - (iii) Note that a voiced sound can be sung on different pitches.
 - (iv) There are also several instrumental tests for voice.
- 2.4 Practice subtracting *voice* from other sounds, keeping them otherwise unchanged: (The sign [̥] underneath a symbol indicates that the corresponding sound is voiceless.)

Produce [nnn] then [n̥n̥n̥]; alternate [nn̥nn̥nn̥nn̥]. Repeat this exercise with [m] and [m̥], [l] and [l̥] and [r] and [r̥].

L.1 Note the following contrasts in Burmese: --

mà	healthy	nà	pain	ŋa	fish
ṃà	order	ṇà	nostril	ṅá	rent
		lá	moon		
		ǰá	beautiful		

Voiced, voiceless unaspirated and aspirated plosives

- 2.5 Say a sequence of the form [aba], which is voiced throughout. Now try to prolong the b closure, while making sure that you still maintain the voicing all through the sequence.
- 2.6 Produce an initial fully voiced [b] followed by a vowel.
- 2.7 Make a series of bilabial plosives followed by vowels, starting with a fully voiced [b], then gradually reducing the voicing during the closure till you make a voiceless unaspirated plosive followed by a vowel; continue the series gradually increasing the duration of the aspiration. (The terms *voiced* - *voiceless* are used to describe the state of the glottis during a closure; and the terms *aspirated* - *unaspirated* are used to describe the absence - presence of vocal cord vibration during the release of the closure.)
- 2.8 Repeat exercises 2.5 to 2.7 with alveolar and velar articulations.
- 2.9 Practice these exercises until you are sure that you can produce three clearly differentiated plosives (1) voiced, (2) voiceless unaspirated, (3) aspirated, at each point of articulation.

L.2 Note the following contrasts in Sindhi (an Indian language): --

ḃəni	curse	bənu	forest	pənu	leaf	phəṇu	snake	ḃəṇəṇu	lamentation
		ḃəru	door	təru	bottom	thəru	district	ḃəru	trunk of body
							name		
səḡi	braid	bəḡi	buggy	ǰəki	suspi- cious	səkhī	girl	səḡi	healthy
	tail						friend		

- 2.10 Learn to produce a period of voicelessness during phase I of a voiceless stop (plosive) consonant, e.g. say [ahp, aht, ahk]. Stops of this kind are called *preaspirated*. The preaspiration may coincide with a consonant articulation as well as a vowel. (E.g. [aḡt, aḡt̚, aḡt̚].) Sounds of this kind occur in Gaelic.

2.11 Whisper

Produce any vowel sound (represented in these exercises by capital [V]), then whisper this, and finally pass to the voiceless sound

[v̥v̥v̥]. Practice this sequence: [VVV - whisper - v̥v̥v̥] several times, and the reverse sequence [v̥v̥v̥ - whisper - VVV].

- 2.12 Note that in phonetics 'whisper' is used as a technical term describing a particular state of the glottis. What is the state of the glottis during the first sound in the word "fin" when, in popular usage, this word is whispered?

2.13 Glottal closure

Practice closing the glottis. This state of the glottis is symbolized by [ʔ]. To get the sensation of closed glottis, simply 'hold the breath' -- imagine you are exerting a sustained pressure on something with your arms (e.g. trying to lift a heavy weight).

- 2.14 To test whether the glottis is open or closed: open the mouth fairly wide, making sure that there is no contact between the tongue and the roof of the mouth (i.e. imagine you are saying a vowel). Flick a finger against the neck, a little below the angle of the jaw. If the glottis is open, the resultant sound is a rather dull thump. If the glottis is closed, a louder and clearer click is produced, the pitch of which can be varied by changing the shape of the mouth (e.g. by rounding the lips).

- 2.15 Alternate various states of the glottis. E.g. produce the sequence [VVV ? v̥v̥v̥] and the reverse sequence [v̥v̥v̥ ? VVV].

- L.3 Note the following contrasts in Tagalog (a Phillipine language): --

?a:naj	termite	ha:naj	row
ka?o:n	fetch	kaho:n	box
ba:ta?	child	ba:tah	bathrobe
mag?alis	to remove	magalis	full of sores

2.16 Breathy voice or murmur

Produce a vowel-like voiced sound letting a large quantity of breath escape at the same time: 'speaking while sighing' may help to suggest the desired effect. This state of the glottis often occurs during the release of some stop consonants in Indian languages.

- 2.17 Alternate ordinary vowels and murmured vowels (shown here by a subscript [..]). Say [aa_{..}aa_{..}aa_{..}].

- L.4 Note the following contrast in Gujerati (a language spoken in India): --

ba _{..} r	burden	ba _{..} r	outside	ba _{..} r	twelve
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Note also the examples in L.2 on page 4.

2.18 Creaky voice or laryngealization

This involves a particular set of the vocal cords, but can be learned by singing the lowest note you can, then trying to go still lower, so that the relatively slow vibration of the vocal cords is heard as a set of discrete taps, like a stick being drawn along a railing.

2.19 Alternate ordinary vowels and laryngealized vowels (shown here by a subscript [̣]). Say [aạaaaạ].

2.20 Now try superimposing laryngealization on consonants: starting with sounds such as [w] and [m]. Practice sequences such as [ạẉa], [ạṃa], [ạẓa], [ạḅa] etc.

L.5 Note the following contrasts in Margi (a Nigerian language): --

bábá	open place	bàbà	hard
bwá	ball	ḅẉàḅẉà	cooked
dà mə	big axe	ḍàḍàḥo	bitter
káwà	sorry	ẉáẉí	adornment
jà	give birth	̣jà	thigh

Glottalic airstream mechanism

3.1 Practice raising and lowering the larynx. Place a finger on the larynx so that its movements can be felt. Say a vowel on the lowest note you can produce, then on the highest note you can produce. Produce these two notes again in very rapid succession. In passing from low to high you should notice a quick upward movement of the larynx. Now do the same thing in reverse -- i.e. high - low -- and observe the downward movement of the larynx. Alternate these rapid pitch changes -- up, down, up, down -- several times, noting the kinaesthetic sensations of larynx raising and lowering.

3.2 Repeat exercise 3.1 silently, merely imagining the pitch changes, but actually producing only upward and downward larynx movements.

3.3 Produce glottalic egressive stops (*ejectives*, symbolized by p', t', k').

(i) Close the glottis (i.e. 'hold your breath') for a few seconds.

(ii) While keeping the glottis closed, open and close the lips several times. If the lips are opened and closed smartly, a hollow sound should be produced.

(iii) Now, while holding the lips together, and while still keeping the glottis closed, try to raise the larynx so as to build up sufficient glottalic pressure to produce an explosive sound when the lip closure is released.

- 3.4 Repeat exercise 3.3 with other articulatory closures.
- 3.5 Produce an ejective followed by a vowel, e.g. [p'e] or [t'i]. Remember the sequence: close glottis - form stop articulation - build up glottalic pressure - release stop - release glottal closure into a vowel. Try to make the vowel follow immediately after the explosion.
- L.6 Note the following contrasts in Amharic (an Ethiopian language): --

t'iil	quarrel	tii	warm	dii	victory
k'ir	stay away	kirr	thread	gerr	innocent
mɛtʃ'	one who comes	mɛtʃ	when	mɛdʒ	grinding stone
s'ɛgga	grace	sɛgga	to worry	zɛgga	to close

Velaric airstream mechanism

- 4.1 Say the clicking sound commonly written 'tut tut' or 'tck tck'. The phonetic symbol for this sound is [ɔ]. Note that you can say a series of clicks while breathing in and out through the nose, or humming. This proves that the click is produced independently of the pulmonic (or glottalic) airstream.
- 4.2 How many clicks with different articulations can you produce?
- 4.3 Produce clicks before and after vowels; try not to have any pause between the click and the vowel.
- 4.4 Produce clicks with the velum up and with it down, i.e. non-nasally and nasally, with vowels before and after.
- L.7 Note the following contrasts in Zulu (all these items are imperative forms of verbs, all with the tone pattern low - high): --

	(laminal) dental		(apical) alveolar		alveolar lateral
aspirated	ɬaɬha	be evident	ʈaʈha	rip open	ɬhɔɬha stab, jab
voiceless unaspirated	ɬaɬa	climb	ʈaʈa	explain	ɬɔɬa narrate
voiced	ɡɬaɡɬa	dance at wedding	ɡʈoɡa	dress up	ɡɬɔɬa pound

murmured						
nasal	ṅṅaṅṅa	gather unripe	ṅṅaṅṅa	tie tightly	ṅṅaṅṅa	coax
	corn	
voiced						
nasal	ṅṅaṅṅa	act quickly	ṅṅaṅṅa	resound*	ṅṅaṅṅa	slope

Combinations of two airstream mechanisms

5.1 Voiced implosives (symbols [ɓ, ɗ, ɠ])

Alternate voiceless glottalic stops -- egressive, ingressive, egressive, ingressive. Try to add voice on the ingressive ones -- i.e. try to combine a fully-voiced stop with the glottalic ingressive airstream mechanism.

5.2 Say a fully-voiced [b]. Try to produce the voicing for this, but not the explosion -- i.e. try to pronounce an unreleased [b] several times. Now try to do this while pulling the larynx down -- i.e. combining it with a glottalic ingressive airstream mechanism,

5.3 Some people find it easiest to learn to make implosive sounds by trying to imitate a frog by using a velar articulation in combination with a rapid downward movement of the larynx.

5.4 When you can pronounce [ɓ, ɗ, ɠ] try to pronounce a vowel before and after them.

Note the examples in Sindhi in L.2 on page 4.

Fricatives and affricates

6.1 Say the word "eats" [i:ts] slowly. Notice the relation between the last two sounds: pressure is built up behind the tongue during the [t]; then the tongue is withdrawn slightly so that the air is released through a narrow channel forming a fricative [s] at the same place of articulation. A combination of a stop plus a homorganic fricative is called an *affricate*.

6.2 Build up pressure behind a k - closure, and then withdraw the tongue slightly so that a fricative [x] is formed with the same place of articulation.

6.3 Learn to produce [x] before and after vowels.

6.4 Produce [x] and add voice to it, so forming [ɣ]; alternate [xɣxɣxɣ].

6.5 Learn to produce [ɣ] before and after vowels.

L.8 Note the following contrasts in Spanish: --

'ixɔ	son	'axɔ	garlic
'iyɔ	fig	'ayɔ	do

6.6 Make the voiced and voiceless affricates [gɣ] and [kx].

6.7 Repeat exercises 6.1 - 6.5 using a p - closure and forming a voiceless bilabial fricative [ɸ] and its voiced equivalent [β].

6.8 Compare [ɸ] and [f], and [β] and [v]. Say all these sounds in combination with various vowels. Practice sequences such as [faɸa, βava] etc.

L.9 Note the following contrasts in Ewe (a West African language): --

ɛβɛ	the Ewe language	ɛvɛ	two
ɛɸá	he polished	ɛfá	he was cold
ɛβlɔ	mushroom	ɛvlɔ	he is evil

Fricatives and approximants

7.1 Try making a fricative version of [j]. In this section we will use the diacritic [^] to mean a more close and therefore fricative articulation. Learn to contrast [aja] and [aj^a].

7.2 Practice voiced palatal fricatives before and between other vowels i.e. say sequences such as [ej^e, j^o, etc.].

7.3 Now produce a labial velar fricative [w^]. Make sure you get friction at both places of articulation. Learn to contrast [awa] and [aw^a].

7.4 Practice voiced and voiceless labial velar fricatives in other sequences. (Although both voiceless labial velar fricatives and approximants can be found in different languages, as far as we know no language uses the contrast between these two sounds.)

L.10 Note the following contrasts in Margi (a West African language): --

jà	give birth	j^àj^àqò	picked up	káwà	sorry	w^á	reach inside
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Velic control

8.1 Learn to control velic movements. Say [bmbbm] with no break between the [b] and the [m]. The lips should be closed, and the vocal cords should remain vibrating throughout this sequence. The only movement is the formation and release of the velic closure.

- 8.2 Make the similar but entirely voiceless sequence [p̥mp̥mp̥]. Try to become conscious of the velic movements.
- 8.3 Practice the sequences [dndndn], [t̥ɪt̥ɪt̥ɪ], [gngngɲ] and [k̥ŋk̥ŋk̥ŋ].
- 8.4 Try saying English words such as "open, hidden, bitten, bacon" with and without nasal plosion.
- 8.5 Practice releasing nasal plosion, i.e. say sequences such as [bma, p̥ma, dna, t̥na, g̥na, k̥na].

L.11 Note the following contrasts in Russian: --

dno	bottom	no	but
dna	bottom (gen)	na	here, take it (interjection)
dnu	bottom (dative or instrumental)	nu	well! (interjection)

- 8.6 Say combinations of nasal and plosive initially without an intervening vowel; i.e. learn to say sequences such as [mba, mpa, nda, nta, nga, ŋka]. Try to make a compound consonant, not a syllabic nasal followed by a plosive in another syllable.

L.12 Note the following contrasts in Tiv (a West African language): --

áa mbé	she suckled	á bëndè	he touched	á mènà	he swallowed
á ndèrà	he began	á dé	he left alone	á nèndà	he is backward in growth
á ndzùùr	he muddled	á dzèndà	he prohibited	á nàndè	he urinated
á ndzòyòì	he spoke quickly	á dzíngé	he searched		
á ngòhòr	he received	á gèrà	he turned round		
á ŋmgbahom	he approached	á gbèr	he slashed		

- 8.7 Compare all these sequences with [ma, ma, ma] etc. The mark [,] underneath a symbol indicates that the sound is syllabic.

L.13 Note the following phrase in Igbo (a West African language): --

ḿ má ḿmá I'm beautiful

Fricative laterals

- 9.1 Produce a voiceless alveolar lateral before and after vowels -- e.g. [i̥i̥i̥], [ḁḁḁ], [u̥u̥u̥]. Now introduce local friction between the sides of the tongue and the teeth. This is a *voiceless alveolar fricative lateral* (symbol [ɬ]). Produce this also between vowels -- [i̥ɬi̥], [ḁɬḁ], [u̥ɬu̥].

9.2 Produce the voiced counterpart of this sound (symbol [k̤]). Practice this also between vowels -- [i̤i], [ak̤a], [uk̤u].

L.14 Note the following contrasts in Welsh: --

ʧan	church	soʧt	shilling
'kəʧɛʧ	knife	ʧa'neʧi	Llanelly
'kevaiʧ	friend		

9.3 Note the following contrasts in Zulu: --

lòndá	preserve	ʒùká	roam loose
ʧòʧá	prod	cá'ecá'a	tattoo

Trills, taps and flaps

10.1 Make a lingual alveolar *trill* [r]. Put the tongue loosely behind the alveolar ridge and try to set it vibrating with a pulmonic egressive airstream. Make voiced and voiceless trills.

10.2 Make dental trills, voiced and voiceless, before and after vowels.

10.3 Learn to control a trill so that there is only a single touch of the tongue. This is an alveolar *tap* [ɾ].

L.17 Note the distinction between a tap and a trill in Spanish: --

pero	but	pero	dog
por'ke	why?	buro	donkey
se'ɲor	Senor	rei	king

10.4 In making a *flap* [ɾ] the body of the tongue is drawn back, the tip is extended up towards the hard palate and then brought down so that it flaps, usually against the post-alveolar ridge, on the way. Practice this sound before and after vowels.

L.18 Note the difference between a tap (which may be a trill) and a flap in Hausa:

báɽà:	servant	bàrà:	begging
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10.5 Consider the extent to which it is possible to make labial and uvular trills, taps and flaps.

Secondary articulation

11.1 Practice *palatalized* sounds. Form a frictionless palatal articulation simultaneously with the primary articulation. Say, e.g. [v], [z], [m], [n], [l], producing a vowel of i-type at the same time. Add an open vowel, e.g. [a], and note the j-like off-glide. Practice other palatalized sounds: e.g. palatalized [p], [b], [t], [d], [k], [g], [f], [θ], [ð], [s], [x], [v], [r].

11.2 Practice *velarized* sounds. Form a frictionless velar articulation simultaneously with the primary articulation -- i.e. produce a vowel of [u]-type at the same time as the primary articulation.

Say velarized [v], [z], [m], [n], [l], [p], [b], [t], [d], [f], [θ], [ð], [s], [r] before and after vowels.

11.3 Moderately palatalized and moderately velarized sounds are sometimes called *clear* and *dark* respectively. Practice clear and dark [l]s, and discover which type you normally use in each of these words: *leaf, late, lock, look, feel, tail, call, cool, little*.

Say all these words first with a very clear [l], then with a very dark [l].

L.19 Note the following contrasts in Russian: --

brat	brother	bratʲ	to take
krɔf	roof	krɔfʲ	blood
stal	he has become	stalʲ	steel
zar	beat	zarʲ	cook

11.4 Practice *labialized* sounds. Round the lips, without producing labial friction, simultaneously with the primary articulation. Note that labialized consonants are often accompanied by velarizations and hence may be indicated by a superscript [ʷ].

Say [sʷ], [ʃʷ], [xʷ], [ɣʷ] etc. before and after vowels.

L.20 Note the following contrasts in Twi (a West African language): --

càcà	straw mattress	ócʷá	he cuts
óʃé	he wears	óʃʷé	he looks at

11.5 In some languages labialization is accompanied by palatalization, and may be marked by a superscript [ʷ].

Say [sʷ], [ʃʷ] before and after [a].

L.21 Note the following contrasts in Gã (a West African language): --

étfò	it is ablaze	étfɔ̀	he struck
édzà	it is right	édzɔ̀	it is broken

Nasalization

12.1 Remember that *nasalization* is not, in our terminology, a secondary articulation but a separate process; but it is convenient to practice it at this point. Alternate non-nasalized and nasalized vowels saying [aaã, eeẽ, ooõ, iĩ, uuũ].

12.2 Learn to produce nasalized approximants such as [j̃, w̃] and fricatives such as [ʒ̃, ṽ].

L.22 Note the following contrasts in Yoruba (a West African language): --

fi	use	òbó	monkey	su	scatter seed
ijafí	wife	ìbò	gun	sù	push
ìjẹ	that	wó	they	méfí	four

Vowels

13.1 *Vertical axis.* Say a series of four different front vowel qualities from close to open. These will be approximately close, half close, half open and open (symbols [i, e, ε, a]). Try to feel the degree of raising of the tongue. Say these sounds with the mouth as wide open as possible, watching the tongue in a mirror. Now repeat silently, paying attention to the kinesthetic and any tactile sensations you notice.

13.2 *Horizontal axis.* Say [i] again and then say a close back rounded vowel [u]. Alternate [i - u - i - u]. Try to note the movement of the tongue from front to back in the mouth. Repeat silently again, noting the kinesthetic and tactile sensations.

13.3 *Lip position.* Say [i - u - i - u] again. This time note the fact that the lip position changes as you go from one vowel to the other -- spread for [i], rounded for [u]. Repeat silently, again noting kinesthetic sensations. Then produce a set of four back rounded vowels from close to open, starting with [u], (symbols [u, o, ɔ, ɔ̃]).

13.4 Add lip rounding to [i, e, ε] ([a] is omitted for the time being), producing three front rounded vowels (symbols [y, ø, œ]). Now alternate these with back rounded vowels, noting the tongue movement, which is now the only factor differentiating the sounds (i.e. say [y - u, ø - o, œ - ɔ]).

- 13.5 *Slurring*. Start at [i] and slur to [a], i.e. lower the tongue (and/or the jaw) at a uniform rate, thus passing through all the front unrounded vowel positions from close to open. Do this in the reverse position and repeat silently.
- 13.6 Do the same from [y] to [œ] and back from [œ] to [y], repeating silently again, and then do the same from [u] to [ɑ] and [ɑ] to [u].
- 13.7 Interrupt the slur at intermediate points (e.g. slur from [i] to [a] stopping at [e] or [ɛ] etc.), and then try to interrupt between two vowel types (e.g. between [i] and [e] or [o] and [ɔ] etc.).
- 13.8 *Bracketing*. Say [i], then [ɛ] several times, and then try to produce a vowel half way between them. This will be of the [e] type. Repeat this with other pairs of front and back vowels. (E.g. [y], [œ]; [a], [ɔ] etc.).
- 13.9 *Back unrounded vowels*. Say the sequence of back rounded vowels again [u, o, ɔ, ɑ]. Now try to say a similar sequence with the lips unrounded, keeping the same tongue positions. These are back unrounded vowels (symbols [ɯ, ʏ, ʌ, ɑ]). Try slurring these, noting the sensations of their production, and alternate them with the front unrounded vowels (i.e. say [ɯ - i, ʏ - e, ʌ - ɛ, ɑ - a]).

The Cardinal Vowels

(The quotations in this section are all from D. Jones, *An Outline of English Phonetics* 8th Ed., 1956.)

"The values of the cardinal vowels cannot be learned from written descriptions; they should be learned by oral instruction from a teacher who knows them."

- 14.1 Learn to make CV 1 [i]. In this sound "the raising of the tongue is as far forward as possible and as high as possible consistently with its being a vowel, the lips being spread." The teeth are close together, almost touching.
- 14.2 Learn to make CV 5 [ɑ]. This is a sound "in which the back of the tongue is lowered as far as possible and retracted as far as possible consistently with the sound being a vowel, and in which the lips are not rounded." Note that the jaw is fully open and pulled back.
- 14.3 Imitate the pronunciation of CV's 2, 3, and 4 [e, ɛ, a], forming a series of auditorially equidistant steps between CV's 1 and 5. Note that in pronouncing [e, ɛ, a] the jaw is held in a forward position, and is progressively lowered.

- 14.4 Imitate the pronunciation of CV's 6, 7, 8 [ɔ, o, u]. These vowels form a series of similar auditorially equidistant steps. Note that the lip rounding increases steadily.
- 14.5 Practice slurring from one vowel to another, e.g. from [i] to [e], [ɔ] to [u] etc. Also try slurring from [i] to [u], [e] to [o] etc.
- 14.6 Try to produce vowels half way between two cardinal vowels, e.g. between [i] and [e], [e] and [ɛ] etc.; and between [i] and [u], [e] and [o] etc. You can do this either by saying the two vowels and then trying to produce a sound half way between them; or by slurring between the two vowels once or twice, and then trying to stop half way.

Secondary Cardinal Vowels

- 15.1 Prolong CV 1 [i], and add close lip-rounding taking care to keep exactly the same tongue position. This forms the secondary cardinal [y].
- 15.2 Practice saying [iyiyiy].
- 15.3 Compare also [y] and [u]; say [yuyuyu], and note the sensation of moving the tongue backwards and forwards. The rounded vowel half way between [y] and [u] is [ɥ].
- 15.4 In a similar way learn to make the secondary cardinal [ø] by adding close lip-rounding to the tongue position of [e]; and the secondary cardinal [œ] by adding open lip-rounding to the tongue position of [ɛ].
- 15.5 Compare both these sounds with a central vowel [ə]; say [ə] then [ø] several times, and also [ə] then [œ] several times.
- 15.6 Learn to say the secondary cardinal vowel [ɯ] by combining the tongue position of [u] with spread lips. Practice the sequence [uɯuɯuɯ].
- 15.7 Move from [ɯ] to [i], and note that the tongue movement is the reverse of that in exercise 15.3. The unrounded vowel half way between [i] and [ɯ] is [ɨ].
- L.23 Note the following Swedish words with rounded and unrounded front vowels: --

ny:	new	ni:	you	hœst	autumn
nœ:	now			hest	horse
nø:t	nut	ve:t	know		
næt	worn	vet	mind		

Diphthongs

- 16.1 Practice diphthongs. Say the first element (e.g. [a]) then the second (e.g. [e]) then slur rapidly from the first to the second. In all diphthong practice at this stage use 'decrecendo' stress, i.e. start with considerable breath-force and allow this to die away during the slur. Diphthongs of this kind are called *falling* diphthongs.
- 16.2 Produce diphthongs starting from CV 2 and moving to each of the other cardinal vowels which you have learned, i.e. say [eɪ, eɛ, ea, eo, eɔ, eu, ey, eʊ, eə, ew]
- 16.3 Repeat exercise 16.2 with each of the other cardinal vowels as a starting point.

Semi-vowels

- 17.1 Diphthongs with increasing stress are known as *rising diphthongs*. Such sounds are often said to consist of a semi-vowel followed by a vowel. The semi-vowel corresponding to [i] (i.e. the first element in a rising diphthong beginning with [i]) is [j]; that corresponding to [u] is [w]; and that corresponding to [y] is [ɥ]).
- 17.2 Note the following contrasts in French: --

mʃɛt	crumb	mɥɛt	mute	mʷɛt	sea gull
lʃe	tied	lɥi	him	lwi	Louis
		ɥit	eight	wi	yes

Palatals

- 18.1 Say [x] and while still producing fricative noise move the articulation further forward until the front of the tongue is articulating with the hard palate. You should now be forming a voiceless *palatal* fricative (symbol [ç]).
- 18.2 Slide the tongue backwards and forwards from [x] to [ç], noting how the pitch of the hiss changes, being higher when the tongue is forward, lower when it is back.
- 18.3 Produce [ç] again and then the voiced counterpart of this sound (a voiced palatal fricative -- symbol [j]). Alternate [çjçjçj].

L.25 Note the following German words: --

'vɔxə	week	ʃlɛçt	bad
'axʃɔŋ	attention	iç	I
maxt	power	mi ç	milk

- 18.4 Make a complete closure at the same place as you have been articulating [ç, j]. The symbols for the voiceless and voiced palatal stops are [ç, j]. Pronounce these before, after and between vowels, saying [ca, ci, ja, ji, aca, ici, aja, iji] etc.
- 18.5 Make a complete closure with the front of the tongue against the hard palate as for [ç, j] above, but this time lower the velum. Initiate a voiced pulmonic egressive air-stream to produce a *voiced palatal nasal* (symbol [ɲ]). Learn to produce this before and after vowels -- [aɲa], [iɲi] etc.
- 18.6 Produce the voiceless counterpart of this sound (symbol [ɲ̥]). Alternate [ɲ̥ɲ̥ɲ̥] and compare once again with [j] and [ç]. Also produce [ɲ̥] before and after vowels.
- 18.7 Make a closure at the hard palate once more (as for [j]) and then try to lower one or both sides of the tongue. Initiate a voiced pulmonic egressive air-stream to produce a *voiced palatal lateral* (symbol [ɮ]). Learn to produce this before and after vowels.
- 18.8 Produce the voiceless counterpart of this sound (symbol [ɮ̥]). Alternate [ɮ̥ɮ̥ɮ̥] and again compare with [j, ç] and [ɲ, ɲ̥]. Produce [ɮ̥] before and after vowels.

L.26 Note the following Italian words: --

mas'kaɲɲi	Mascagni	fa'miʎʎa	family
'dziʎʎi	lilies	'fiʎʎo	son
di'zɛɲɲo	drawing	'ɔɲɲi	every

Uvulars

- 19.1 Say [x] once more and move the articulation back until the extreme back of the tongue is articulating with the uvular and end of the soft palate. This is a voiceless *uvular* fricative. (Symbol [χ]).
- 19.2 Slide the tongue backwards and forwards again from [x] to [χ] (and forward to [ç]) noting how the pitch of the hiss becomes lower still as you go further back from the velar position.

19.3 Produce [χ] again and then try the voiced counterpart of this sound (a voiced uvular fricative -- symbol [ʁ]). This is the French "r". Try alternating [χʁχʁ].

L.27 Note the following French words: --

buʁo	bull	kaʁχ	four
byʁo	office	lɛʁχ	letter
buʁ	road	o:ʁχ	other

19.4 Make a complete closure at the same place as you have been articulating [χ]. The symbols for the voiceless and voiced uvular stops are [q, ɢ]. Say these sounds before, after, and between vowels, saying [qa, qi, ga, gi, aqa, lqi, aqa, lei] etc. Try varying the amount of voicing and aspiration.

19.5 Now, with lowered velum produce *voiceless* and *voiced uvular nasals* (symbols [ŋ, ɳ]). Make these before and after vowels -- [ana], [ini], [aŋa], [iɳi].

L.28 Note the beginning of the fable of "The North Wind and the Sun" in Eskimo: --

[qaʔtəχ'sa:nne so'le asse'ʁo:nne'ʁoʔto'ne tsi'meme'not nen'noppa:]

Dentals and alveolars

20.1 Dentals and alveolars may be made with either the tip of the tongue (*apical*), or the blade (*laminal*). Which is your normal pronunciation of the initial sounds in "tie, die, nigh"?

20.2 Are the final sounds in "oat, ode, own" made in the same place?

20.3 Learn to produce all these sounds with the opposite (laminal or apical) articulation.

20.4 Both dentals and alveolars may be pronounced in both ways. Laminal dentals usually have articulatory contact on both the teeth and the front part of the teeth ridge; they may therefore be called denti-alveolars. In these exercises the following symbols will be used; descriptive terms in parentheses may be considered redundant:

	(apical) dental	(laminal) denti-alveolar	apical alveolar	laminal alveolar
	<u>d</u>	<u>ɖ</u>	d	ɖ
Learn to say:	a <u>d</u> a	a <u>ɖ</u> a	ada	aɖa
	a <u>t</u> a	a <u>ɖ</u> a	ata	aɖa
	a <u>n</u> a	a <u>ɖ</u> a	ana	aɖa

Repeat with other vowels.

L.29 Note the following contrasts in Temne (a West African language): --

ɬor	descend	ɬor	farms
ɬéɬè	soon	ɬàkó	fowl

(The [ɬ] is both more aspirated and affricated.)

L.30 Note the following contrasts in Isoko (a West African language): --

òtú	louse	òtú	gang
údù	farm	údù	chest
ìdì	drums	ìdì	drinks

20.5 Differences in alveolar and dental fricatives [s, z] also occur. Learn to make these sounds in both ways.

Retroflex, post-alveolar and palato-alveolar sounds

21.1 An apical articulation with the back part of the alveolar ridge and the tip of the tongue curled upwards is called *retroflex*. An apical or laminal articulation in the same place but with the front of the tongue raised is called *palato-alveolar*. (The term *post-alveolar* may be used when a less specific label is required.)

21.2 Produce retroflex stops before, after, and between vowels; say [ɬa, ɬi, aɬ, aɬa, iɬi, ɬa, ɬi, aɬ, iɬ, aɬa, iɬi].

21.3 Make voiced retroflex nasals in similar contexts [ŋa, ŋi] etc.

L.31 Note the following contrasts in Malayalam (a language spoken in India): --

Bilabial	Dental	Alveolar	Post-alveolar	Palatal	Velar
	mɪɪu pearl	muttu density	muttu knee		
	kɪɪi stabbed	kutti peg	kutti child		
kɪmmi shortage		kanni Virgo	kɪɪɪ link in chain	kɪɪɪ boiled rice and water	kɪɪɪ crushed
	ɛɪɪɪ named	ɛɪɪɪ me	ɛɪɪɪ oil	te:ɪɪɪ worn out	te:ɪɪɪ cocoanut

- 21.4 Learn to produce retroflex fricatives [ʂ, ʐ] before, after and between vowels. Say [ʂa, ʂi, aʂa, iʂi] etc.
- 21.5 Post-alveolar fricatives may be made with the front of the tongue raised, but with the fricative articulation being made either by the tip or by the blade of the tongue. If a distinction is required, an apical articulation may be symbolized [ʃ, ʒ] and called palato-alveolar; and a laminal articulation may be symbolized [ç, ʝ] and called alveolo-palatal.

L.32 Note the following contrasts in Telugu (a language spoken in India): --

alveolar	post-alveolar	retroflex
maasaw month	aaʃa ambition	kaʂaaʃaw decoction
haasjaʋ̃ sarcasm	druʃjam scenery	baasjaʋ̃ commentary

21.6 Consider your own consonants in words such as "she, show". How can they be described in terms of the categories in these exercises?

21.7 What are your consonants in "raw, oar" etc.?

L.33 Note the following contrasts in Fante (a West African language): --

óʔcè	he catches	óʔcʋè	he cuts
ódzà	he leaves	ódzʋè	he calms
òcí	*caterpillar	òcʋè	he looks at

Review

22.1 Produce intervocalic voiceless plosives at as many places of articulation as possible; note:

p, t, ṭ, t̤, t̥, ț, c, k, q, ?

22.2 Repeat exercise 22.1 with voiced stops and nasals. Note the symbols here:

22.3 Produce as many voiceless fricatives as possible; note:

ɸ, f, θ, ɸ̥, s, ʃ, ç, ç̥, x, χ, ɸ̥, ɸ̥

22.4 Repeat exercise 22.3 with voiced fricatives. Note the symbols here:

22.5 Review the trills, taps, flaps, and apical and uvular approximants; note:

ʀ, ɽ, ɾ, ɺ, R, B

22.6 Review the voiced laterals; note:

ɭ, ɮ, ɢ, ɣ, ʎ

22.7 Produce the corresponding voiceless sounds. Note the symbols here:

22.8 What pulmonic egressive consonants have been omitted in this review? Note them here:

22.9 Produce consonants of the type summarized in the chart below:

Airstream Mechanisms

	Pulmonic	Glottalic	Velaric
Egressive	k, f, m	(Ejective) p', t', ts'	
Ingressive		(Implosive) ɓ, ɗ, ɠ	(Click) ɰ, ɱ, ɮ

22.10 Review consonants with secondary articulations (labialization, palatalization, velarization, pharyngalization); added nasalization; different degrees of aspiration and voicing; laryngealization; and breathy voice.

22.11 Make sure that you can produce all the vowels noted below.

i	ɨ	u	ɤ	ɯ	ɰ
e		o	ø		ɤ
ɛ		ɔ	œ		
a		ɑ			

- 22.12 Read the following approximate specifications; produce each of the sounds (or groups of sounds) indicated before, between and after vowels; and write the appropriate symbol (or symbols) in the right-hand column.

<u>Initiator Voicing</u>			<u>Articulators</u>	<u>Stricture</u>	<u>Symbol</u>
<u>Air-stream</u>					
1.	Pul.	egr. v.	bilabial	fricative	
2.	Glott.	egr. vl.	velar	stop	
3.	Pul.	ingr. vl.	dental	stop	
4.	Pul.	egr. vl.	alveolar	lateral fricative	
5.	Vel.	ingr. v.	alveolar	stop	
6.	Pul.	egr. v.	velar	stop	
				with nasal plosion	
7.	Pul.	egr. vl.	palatal	stop	
8.	Pul.	egr. vl.	alveolar	stop	
				with lateral plosion	
9.	Pul.	egr. v.	palatal	lateral frictionless	
10.	Pul.	egr. v.	alveolar	flap	
11.	Glott.	egr. vl.	retroflex	stop	
12.	Pul.	egr. vl.	palatal	fricative	
13.	Pul.	egr. v.	retroflex	fricative	
14.	Pul.	egr. v.	labiodental	frictionless	
15.	Pul.	egr. vl.	bilabial	stop	
				with nasal plosion	
16.	Pul.	egr. -	glottal	stop	
17.	Pul.	egr. vl.	palatal	nasal	
18.	Glott.	ingr. v.	bilabial	stop	
19.	Pul.	egr. vl.	uvular	fricative	
20.	Vel.	ingr. vl.	alveolar	stop	
				with lateral plosion	
21.	Pul.	egr. v.	retroflex	nasal	
22.	Pul.	egr. v.	uvular	trill	
23.	Pul.	egr. v.	bilabial	lateral frictionless	
24.	Glott.	egr. vl.	uvular	stop	
25.	Pul.	egr. vl.	velar	nasal	

C O N S O N A N T C H A R T

	<i>Bilabial</i>	<i>Labio-dental</i>	<i>Dental & Alveolar</i>	<i>Retroflex</i>	<i>Palato-Alveolar</i>	<i>Palatal</i>	<i>Velar</i>	<i>Labio-velar</i>	<i>Uvular</i>	<i>Pharyngeal</i>	<i>Glottal</i>
<i>Nasal</i>	m		n	ṅ		ɲ	ŋ		ɴ		
<i>Plosives</i>	p b		t d	ṭ ḍ		c ɟ	k ɡ		q ɢ		ʔ
<i>Implosives</i>	ɓ		ɗ				ɡ̱				
<i>Ejectives</i>	pʰ		tʰ				kʰ				
<i>(Central) Fricative</i>	ɸ β	f v	s z	ʂ ʐ	ʃ ʒ	ç ʝ	x ɣ		χ ʁ	ħ ʕ	h ɦ
<i>Lateral Fricative</i>			ɬ ɮ								
<i>(Central) Approximant</i>			ɹ			j		w			
<i>Lateral (Approximant)</i>			l	ɭ		ʎ					
<i>Trill</i>			r						ʀ		
<i>Tap</i>			ɾ								
<i>Flap</i>				ɽ							

When there are two symbols together the one on the left represents a voiceless consonant.

D I A C R I T I C S

voiceless	◌̥	e.g. p̥	nasalized	◌̃	e.g. ñ ẽ
aspirated	◌ʰ	tʰ	labialized	◌ʷ (or) ◌ʱ	tʷ (or) tʰʷ
murmured	◌̤	b̤	palatalized	◌ʲ (or) ◌ʝ	tʲ (or) tʲʝ
laryngealized	◌̚	b̚	long	◌ː	nː
raised	◌˥ (or) ◌˦	w˥ (or) w˦	half long	◌ˑ	nˑ
lowered	◌˧ (or) ◌˨	θ˧ (or) θ˨	velarized or	} ◌̠	s̠ ʔ̠
retracted	◌̠ (or) ◌̡	t̠ (or) t̡	pharyngealized		
advanced	◌̡ (or) ◌̢	t̡ (or) t̢	syllabic	◌̩	ŋ̩
dental	◌̪	t̪			