

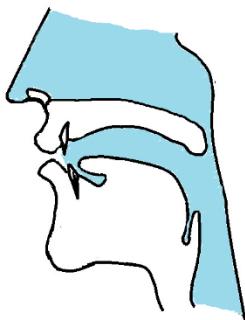


# Phonetic diversity in the world's languages

## Lecture 1

The entire unit is based on

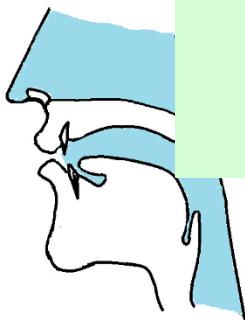
Ladefoged, Peter and Maddieson Ian (1996) The Sounds of the World's Languages. Blackwell





# Languages in the world

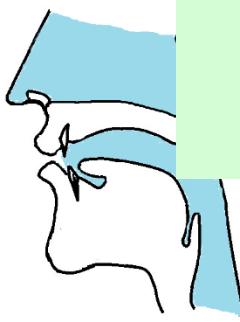
- About 6000 - 7000 languages
- Most languages are spoken by fewer than 10,000
- A quarter spoken by under 1000 people
- A language is a dialect with an army and a navy – Max Weinreich
- Mutual intelligibility





# Languages in the world

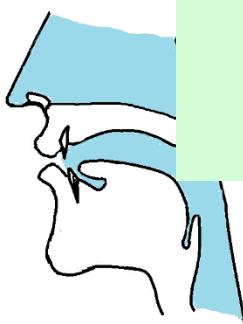
- Next century we will be left with 1000 – 3000 languages
- Endangered languages
- When the next generation of young people speak other, socio-economically powerful languages
- About half of the world speak one of the 10 largest languages

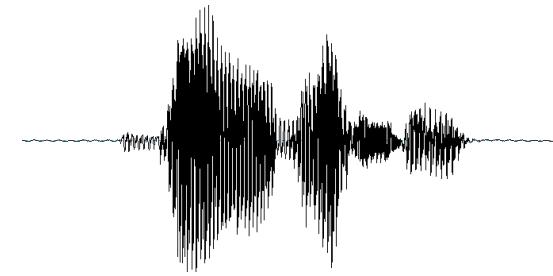




# Languages in the world

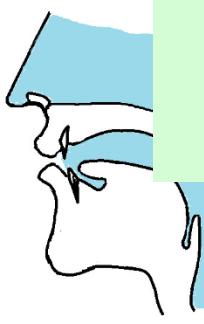
- Just as plant geneticists will suffer from a loss of biodiversity in their understanding of possible plant genes,
- cognitive scientists will cognitive structure of human languages when the diversity of human languages available for study is severely limited
- what is a possible human language depends on our knowledge of existing human languages



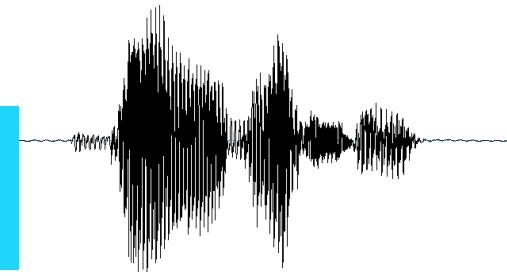


# Place of Articulation

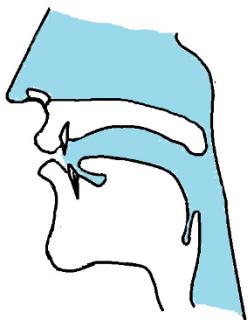
- Browman and Goldstein (1986,1992) Articulatory Phonology model.
- Articulatory Phonology - central role is assigned movements
- described in terms of abstract gestural prototypes. These have
- coordinated with other gestures for different degrees of temporal overlap.
- We use the term gesture to refer to a generalized pattern of movement for a family of linguistically equivalent articulations.



# Place of articulation



- Range of different locations of articulation
- Five major parts of the vocal tract
- Movable parts – active articulators
- Lips, tip and blade of the tongue
- Tip of the tongue – apical
- Centre part of the tongue – Laminar
- The body of the tongue is behind the blade
- Articulations made with this surface are called Dorsal



# Places of articulation

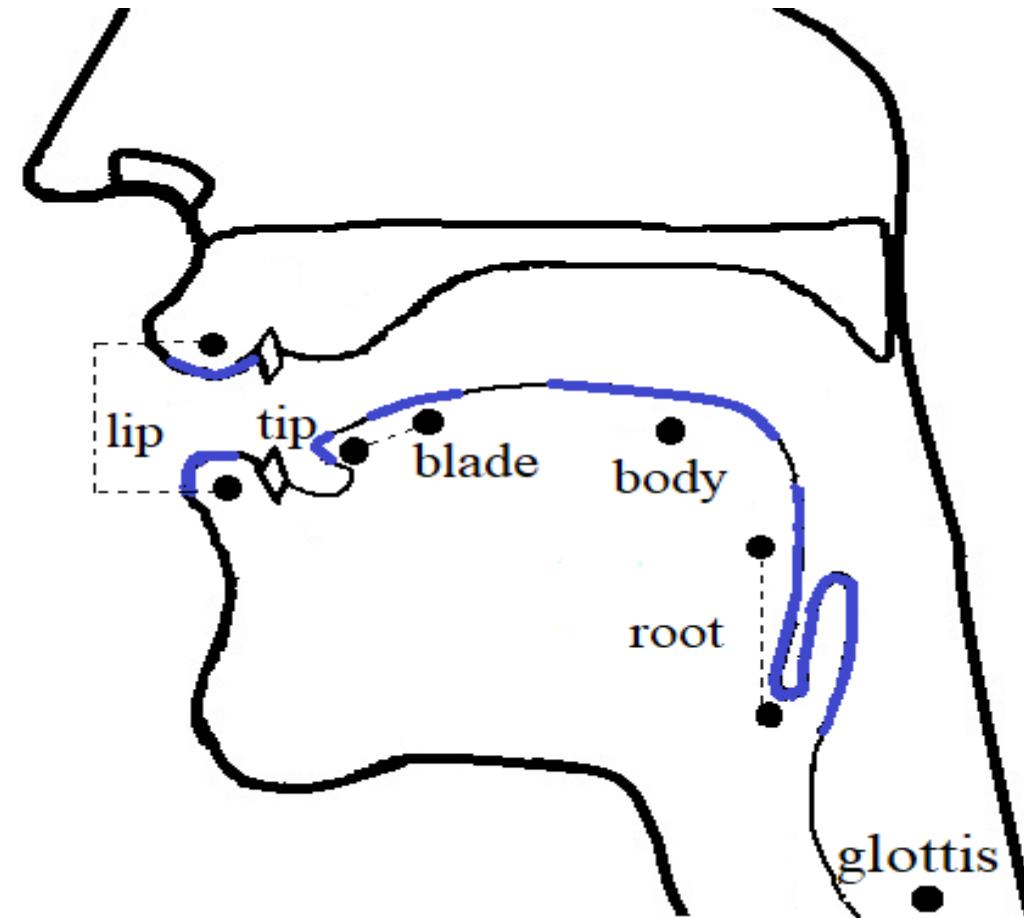
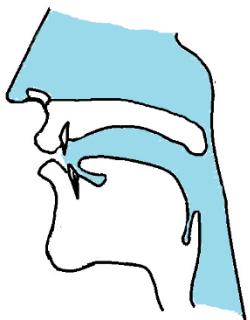


Fig. 1. The five groups of moveable structures forming the active articulators in the vocal tract.



# Places of articulation

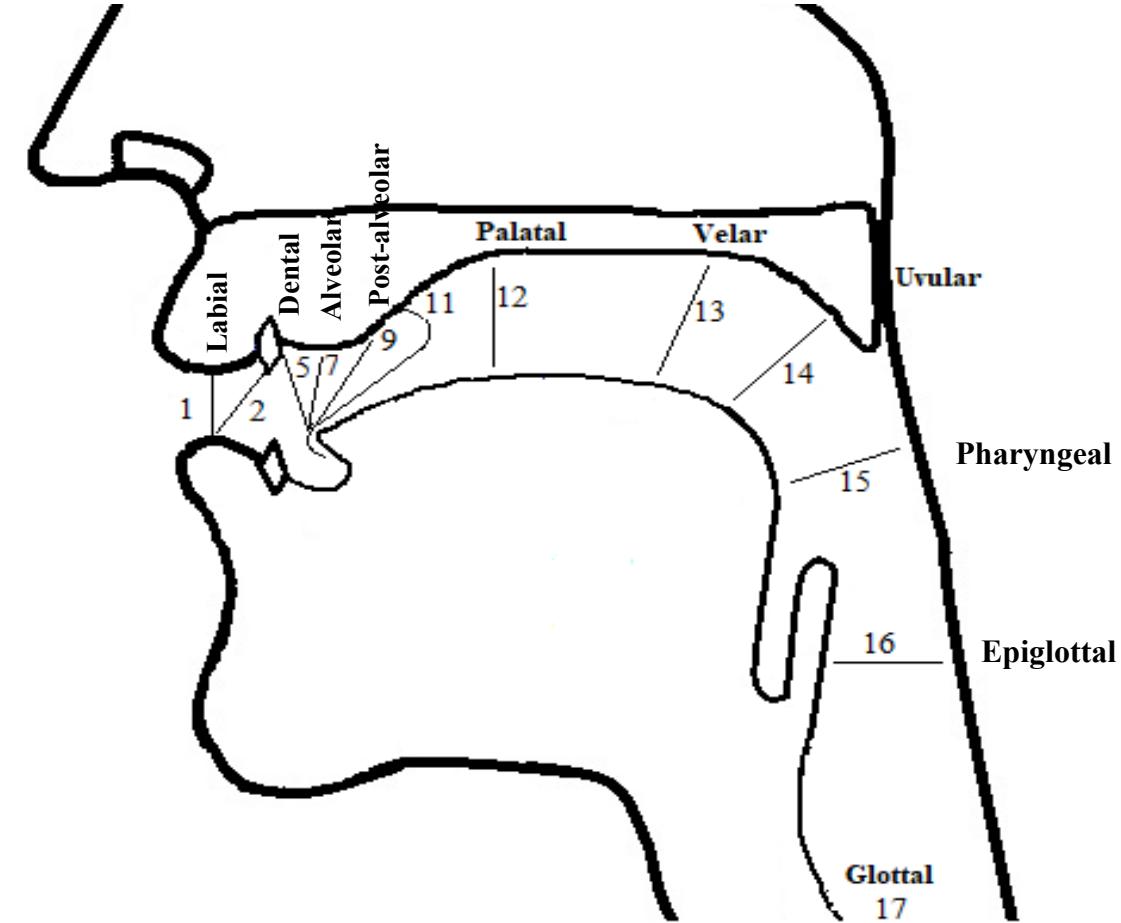
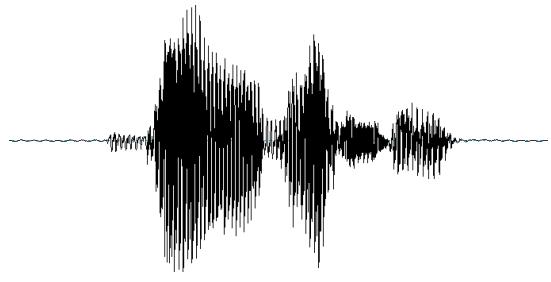
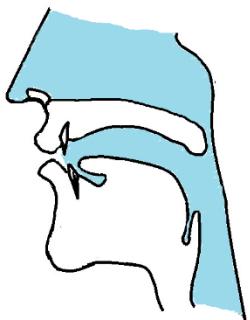


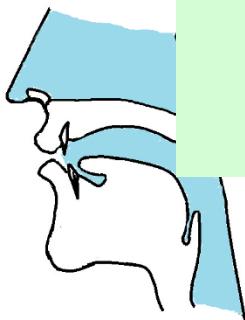
Fig. 2. The nine regions of the vocal tract that can be considered as target areas for the moveable articulators. The numbered lines show some of the 17 named articulatory gestures, including those in the glottal region. Some additional gestures are shown in the more detailed diagrams of the anterior part of the vocal tract in Figure 3.



# Place of articulation a la targets



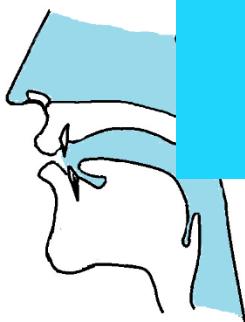
- Fig 1 and 2 show movable structures forming active articulators
- Targets and what moves towards them are shown in Figure 2
- There are nine target regions





# Place of Articulation

- Alveolar
- Pairings between active articulator and targets in figures 3 and 4
- Traditional descriptions imply both the active articulator and target
- Not always a complete specification



# Places of articulation

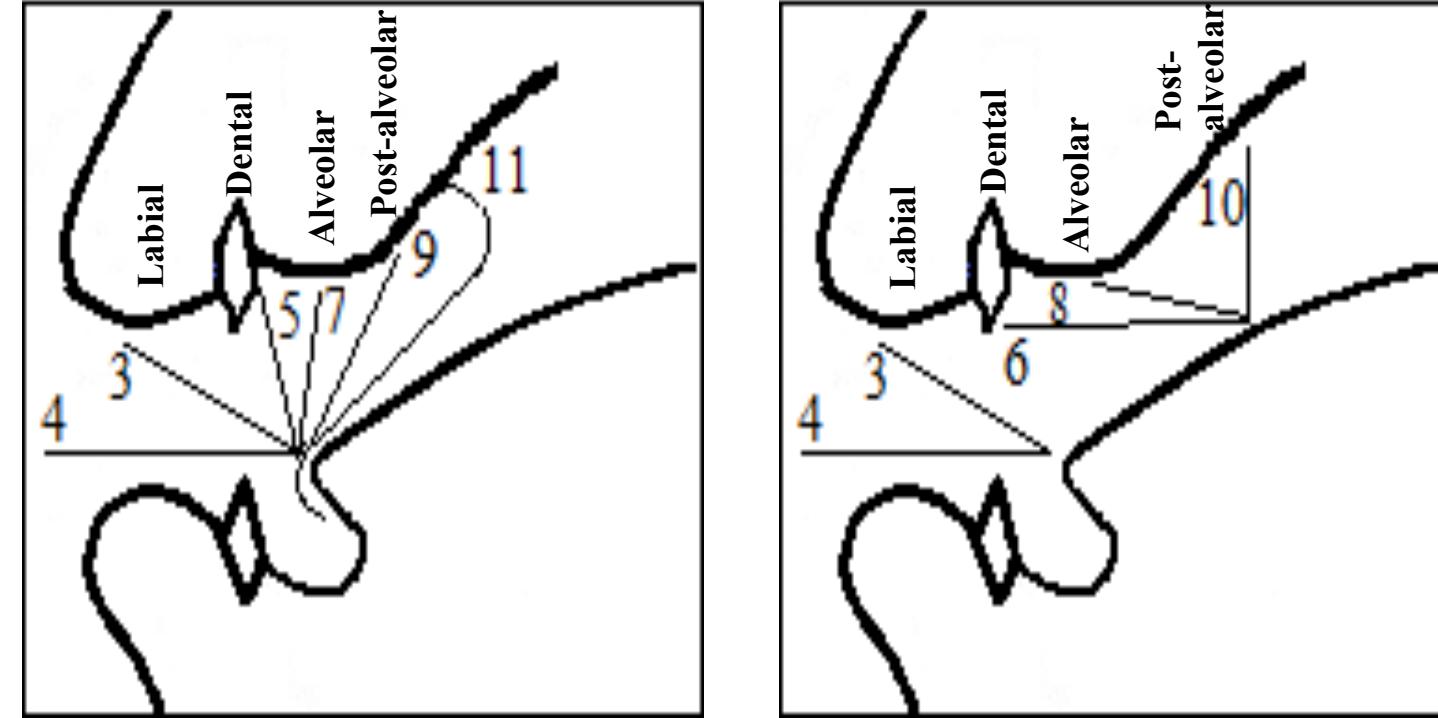
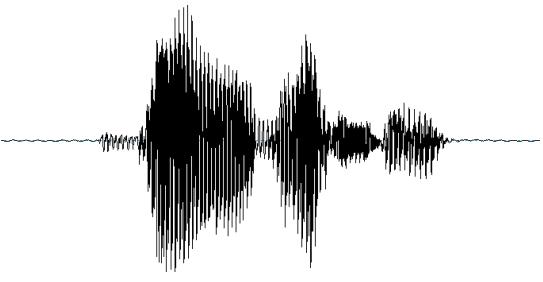
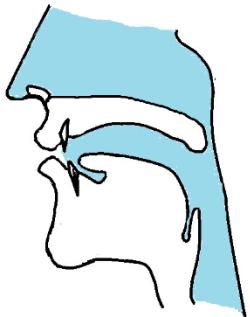


Fig. 3. More detailed diagrams of the anterior part of the vocal tract in figure 2.2, showing articulations involving the tongue tip and blade.

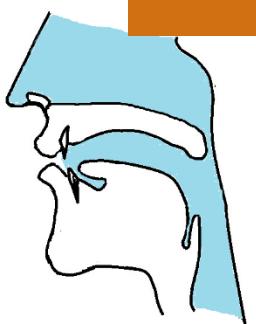


# Coronal



- Apical
- Laminal

- Dental
- Alveolar
- Postalveolar

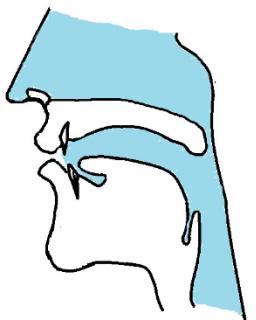
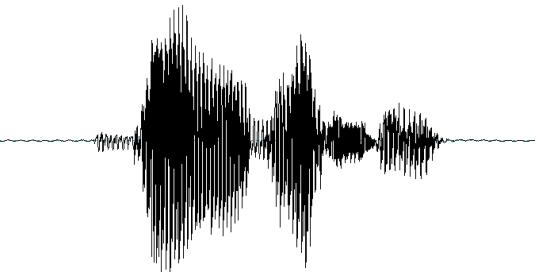


dental

alveolar

postalveolar

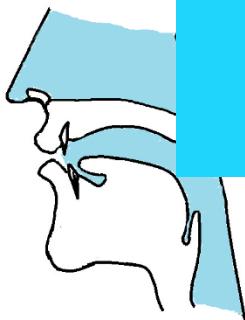
# Coronals





# Place of Articulation - Labials

- Typical movement pattern for a bilabial gesture
- Bilabials, more than other stops are more likely to have incomplete gestures
- More likely to have fricativized allophones
- Ladiodental stops
- Labiodental nasals
- Linguo-labial

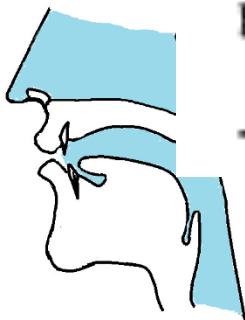




# Labials

Table 2.2 Words illustrating some of the labial consonants of the Xinkuna dialect of Tsonga (from Baumbach 1974, 1987)

	BILABIAL PLOSIVE	BILABIAL FRICATIVE	LABIODENTAL AFFRICATE	LABIODENTAL FRICATIVE
VOICELESS	papa	ɸu	timɸfuβu	mfutsu
UNASPIRATED	'cloud'	'finished'	'hippos'	'tortoise'
VOICELESS ASPIRATED	pʰapʰatani		mɸfʰuka	
	'butterfly'		'distance'	
VOICED	kuba	kuβaβa	filedvu	kuvumba
	'to hit'	'to be painful'	'chin'	'to guess'
BREATHY VOICED	jimbʱo		mdbvʱuβu	kuvʱeṭa
	'ostrich'		'tree (sp.)'	'to scratch'



# Linguo-labials

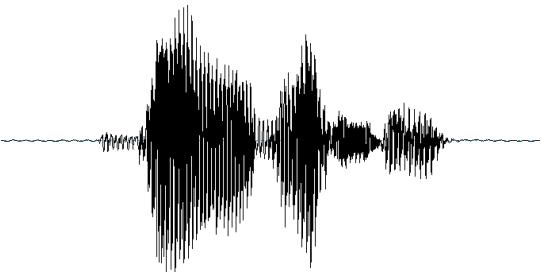


Figure 2.5 Three frames from a videotape showing the tongue and lip contact in the production of the word *nandak* 'bow' by a speaker of Vao.

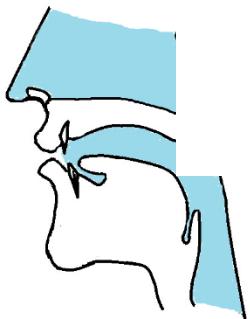


Table 2.3 Words illustrating bilabial, linguo-labial and alveolar places of articulation in Tangoa (from

# Linguo-labial in Tonga

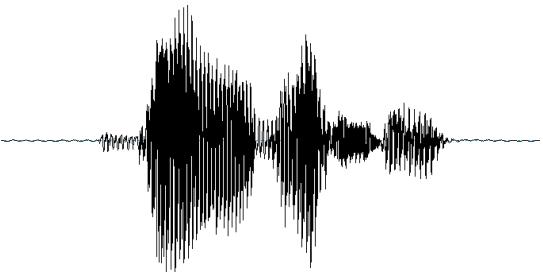
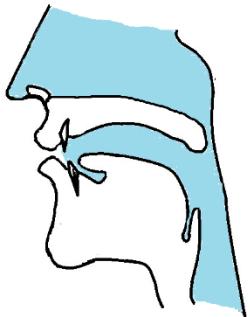


Table 2.3 Words illustrating bilabial, linguo-labial and alveolar places of articulation in Tangoa (from Maddieson 1989, Camden 1979)

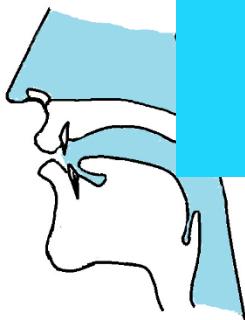
	BILABIAL		LINGUO-LABIAL		ALVEOLAR	
PLOSIVE	peta	'taro'	t <sub>e</sub> t <sub>e</sub>	'butterfly'	t <sub>a</sub> n <sub>a</sub>	'father'
NASAL	mata	'snake'	n <sub>a</sub> t <sub>a</sub>	'eye'	nunua	'messenger spirit'
FRICATIVE	βiliu	'dog'	ð <sub>a</sub> t <sub>u</sub>	'stone'	sasati	'bad'

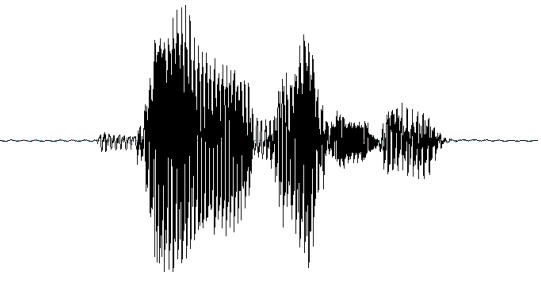




# Place of Articulation

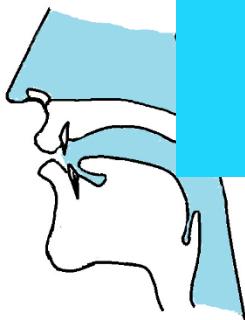
- Table 2.1 presents the terminology used for labeling the place of articulatory gestures
- 2.1 indicates the major movements
- Of an articulator from a neutral position towards the target
- 





# Places of Articulation

- Dental
- Labiodental
- Interdental and dental – English varieties
- Apical dental and Interdental - Malayalam



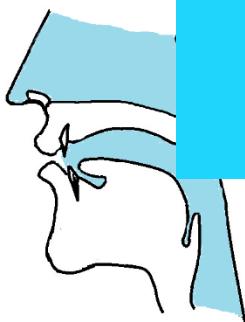


# Place of Articulation

- Many languages are known to contrast dental and alveolar stops
- Accompanied by a difference in laminality.
- Apical dental, laminal dental, apical alveolar, and laminal alveolar occur
- Malayalam

Dental stop – laminal

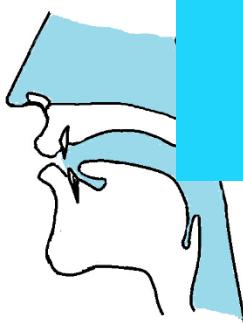
Alveolar stop - apical



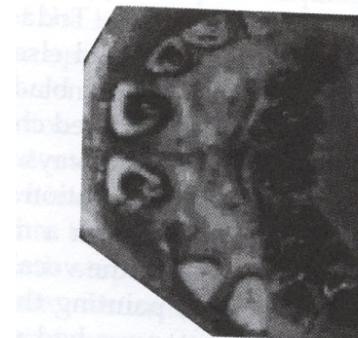
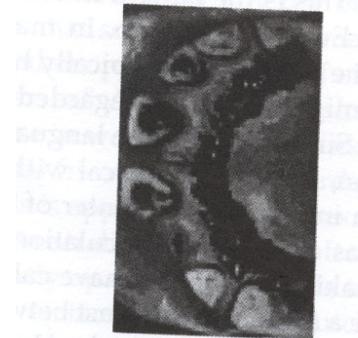
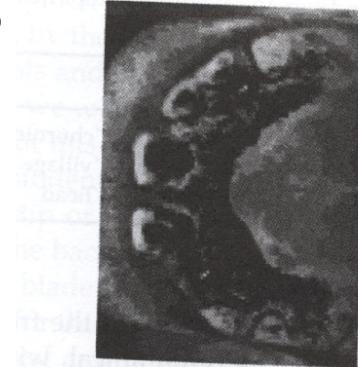
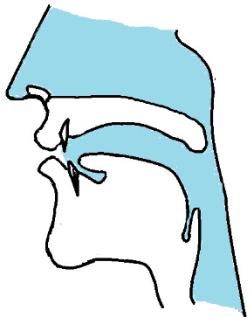


# Places of articulation

- Toda (Dravidian, spoken in India) – Palatogram & Linguogram
- Involves painting the tongue tip, blade and front with edible oil and charcoal.
- A video camera and mirror placed in the mouth showed the places in the upper part of the vocal tract contacted.
- Dental stops – tip and blade of the tongue contact with the upper front teeth and alveolar ridge – laminal denti- alveolar stops



# Palatograms

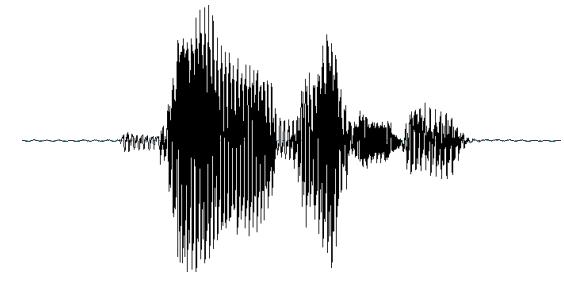


Toda

Dental - Apical

Alveolar - Laminal

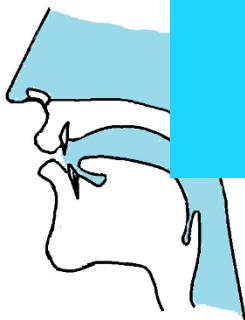
Retroflex



# Places of Articulation



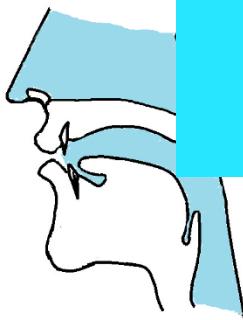
- Alveolar – apical alveolar
- Retroflex – sub apical
- If a language has a dental and an alveolar stop then the stop will be laminal if dental and apical if alveolar
- Very few languages have dental stops which are apical
- The difference between plain stops and palatalized stops in Bulgarian is that the former are produced with an apical gesture and the latter are produced with an apical gesture

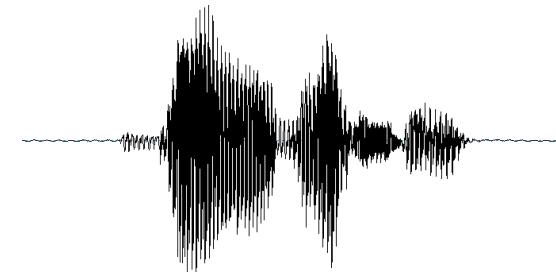


# Retroflex



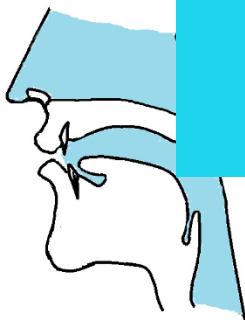
- Ladefoged and Bhaskararao (1983) have shown that languages can differ in the kind of retroflexion that they employ.
- Figure 2.11 shows typical tongue positions for the retroflex consonants in Tamil and Telugu, two Dravidian languages, and Hindi, an Indo-Aryan language.
- The Dravidian languages typically have sub-apical consonants in which the underside of the tongue contacts the anterior part of the hard palate, whereas Hindi speakers do not usually have the tongue tip curled so far back and therefore the contact is on the apical



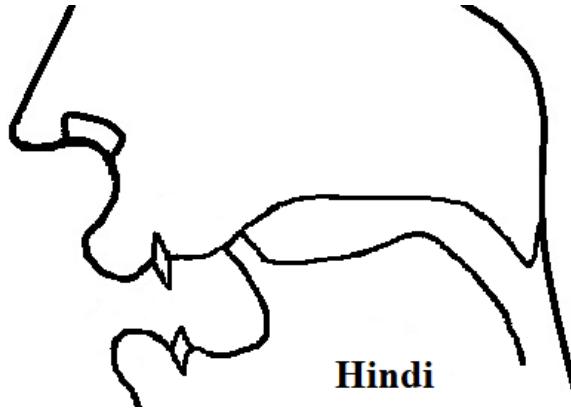


# Retroflex

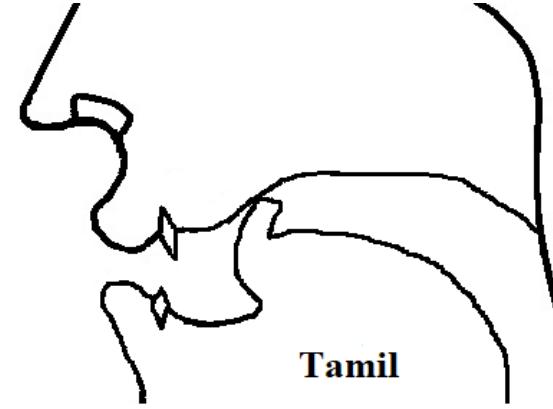
- The Dravidian languages are the best known languages that have sub-apical retroflex stops
- Stevens and Blumstein (1975) remark that "the overall acoustic pattern is characterized by a clustering of F2, F3 and F4 in a relatively narrow frequency region"
- much greater formant transitions from a vowel into a retroflex consonant than into a following vowel.



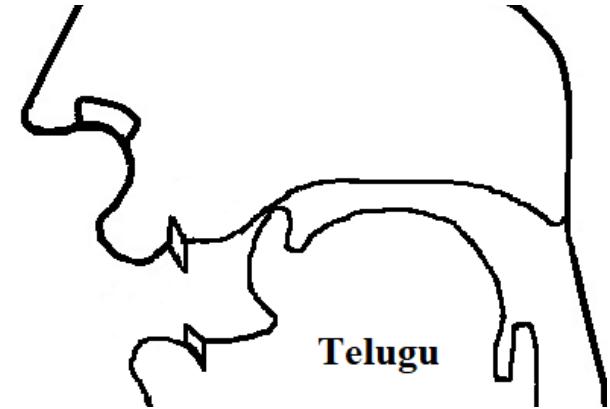
# Sounds of the world's languages: Consonants around the world



Hindi

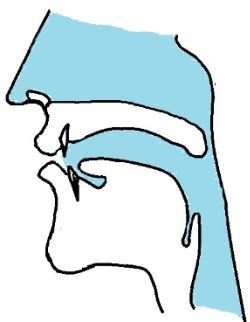


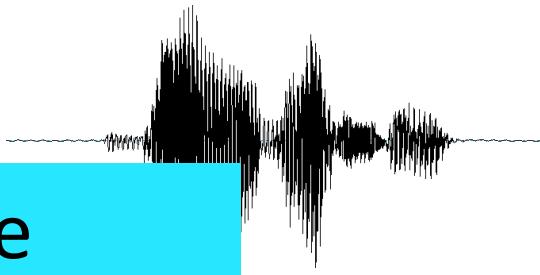
Tamil



Telugu

Fig. 1. The apical retroflex  $\ddot{d}$  in Hindi and the sub-apical retroflex  $\ddot{d}$  in Tamil and Telugu (after Ladefoged and Bhaskararao 1983)



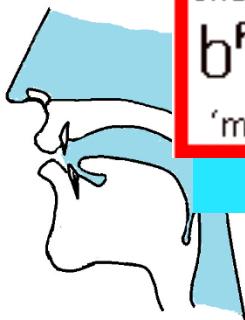
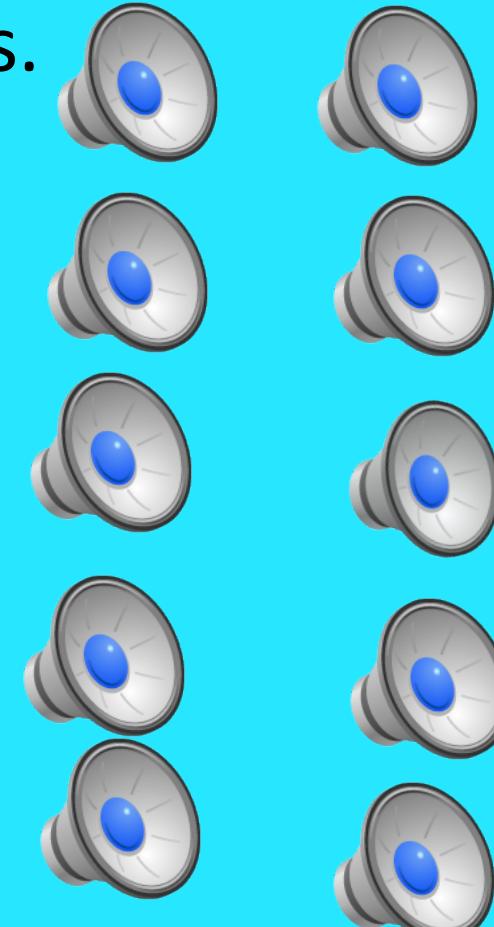


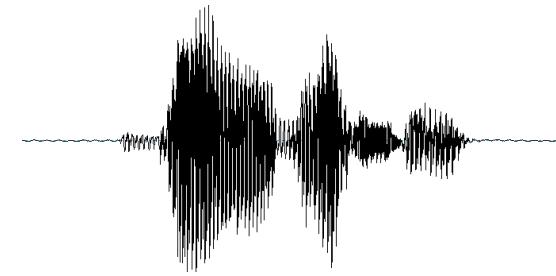
Retroflex Stops • Retroflex stops are produced in the post-alveolar region, by curling the tip of the tongue back.

- Common in south Asian languages.

Sindhi place contrasts

bani		ɖinu	fatu	g'anu
'field'		'festival'	'illiterate'	'handle'
banu	daru	ɖɔru	ʈatu	guṇu
'forest'	'door'	'you run'	'illiterate' [variant]	'quality'
panu	taru	ʈanu	catu	kanu
'leaf'	'bottom'	'ton'	'to destroy'	'ear'
pʰanu	tʰaru	tʰag'u	cʰat̪u	kʰanu
'snake hood'	(district name)	'thug, cheat'	'crown'	'you lift'
bʱanu	dʱaru	ɖʱag'u	ʈʱat̪u	gʱanu
'manure'	'trunk'	'bull'	'a grab'	'excess'

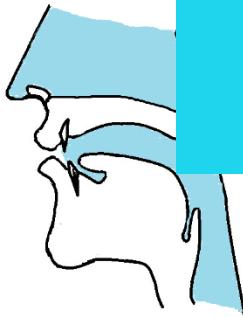


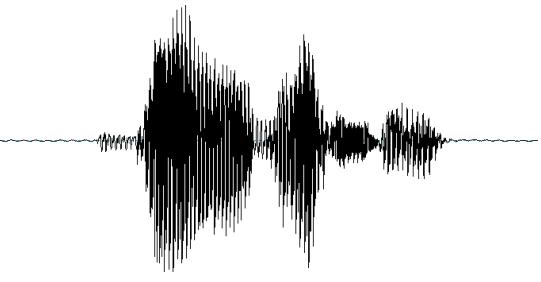


# Bilabials

	Bilabial	Labiodental
Plosive	p b	
Nasal	m	mj
Fricative	ɸ β	f v

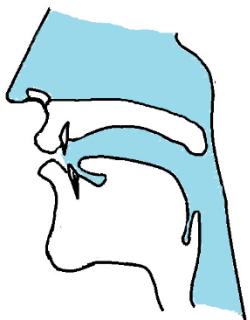
Linguo-labials - tongue + lip

	Linguolabial	t	d
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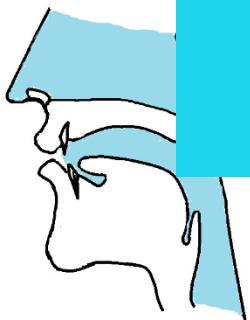
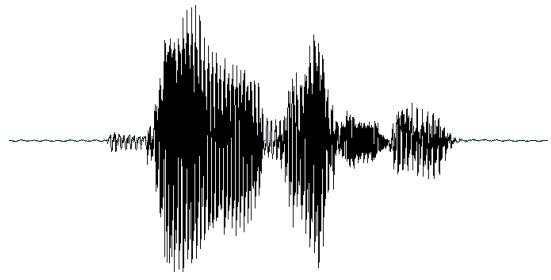
# Labials

Bilabial	Labiodental
p b	
m	m̪
B	
	v̪
ɸ β	f v
	v̪



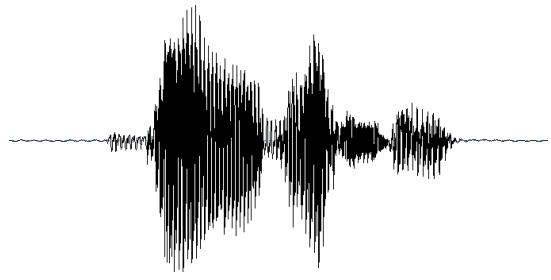
CORONAL

# Interdental/Dental

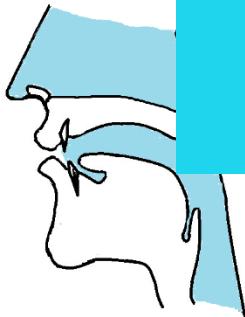


CORONAL

# Alveolar

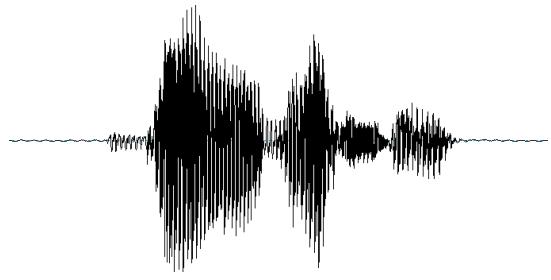


Alveolar	
Plosive	t d
Nasal	n
Fricative	s z

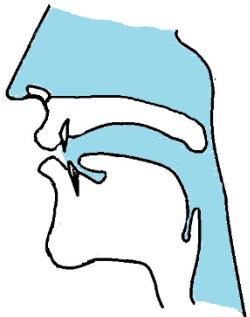


CORONAL

# Retroflex



Retroflex - tongue tip curled,  
articulation with the surface  
beneath the tongue



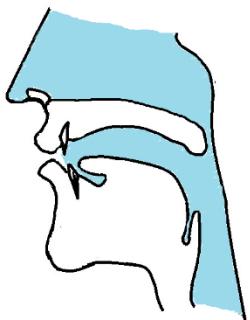
	Retroflex
Plosive	t d
Nasal	n
Fricative	s z



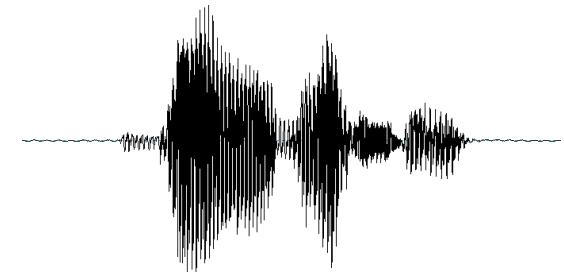
# Part of Tongue Used

- Apical - Tongue Tip
- Laminal - Tongue Blade
- Dorsal - Back of Tongue

t	d	Apical
t	d	Laminal

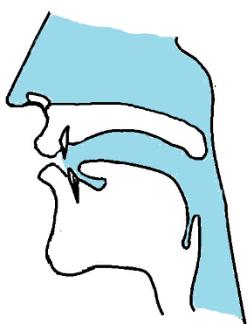


# Sounds of the world's languages: Consonants around the world



**Table 1. the relationship between the major place features and individual places of articulation**

<b>Labial</b>	1. Bilabial 2. Labiodental
	1. Laminal 3. lingo-labial 4. Interdental 5. Laminal dental 6. Laminal alveolar 7. Laminal post-alveolar (palato-alveolar)
<b>Coronal</b>	2. Apical 8. Apical dental 9. Apical alveolar 10. Apical post-alveolar
	3. Sub-apical 11. sub-apical palatal (retroflex)
<b>Dorsal</b>	12. Palatal 13. Velar 14. Uvular
<b>Radical</b>	15. Pharyngeal 16. Epiglottal
<b>Laryngeal</b>	17. Glottal

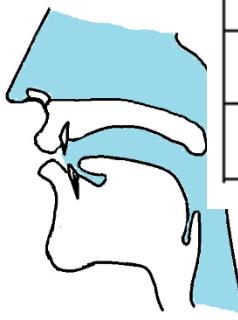




# Diacritics

**DIACRITICS** Diacritics may be placed above a symbol with a descender, e.g.  $\overset{\circ}{l}$

○ Voiceless	$\overset{\circ}{n}$ $\overset{\circ}{d}$	.. Breathy voiced	$\overset{\circ}{b}$ $\overset{\circ}{a}$	□ Dental	$\overset{\circ}{t}$ $\overset{\circ}{d}$
✗ Voiced	$\overset{\circ}{s}$ $\overset{\circ}{t}$	~ Creaky voiced	$\overset{\circ}{b}$ $\overset{\circ}{a}$	□ Apical	$\overset{\circ}{t}$ $\overset{\circ}{d}$
h Aspirated	$t^h$ $d^h$	~ Linguolabial	$\overset{\circ}{t}$ $\overset{\circ}{d}$	□ Laminar	$\overset{\circ}{t}$ $\overset{\circ}{d}$
, More rounded	$\overset{\circ}{ɔ}$	ʷ Labialized	$t^w$ $d^w$	~ Nasalized	$\overset{\circ}{e}$
, Less rounded	$\overset{\circ}{o}$	j Palatalized	$t^j$ $d^j$	n Nasal release	$d^n$
+ Advanced	$\overset{\circ}{u}$	ʸ Velarized	$t^y$ $d^y$	l Lateral release	$d^l$
- Retracted	$\overset{\circ}{e}$	ᵑ Pharyngealized	$t^{ᵑ}$ $d^{ᵑ}$	ᵑ No audible release	$d^{ᵑ}$
'' Centralized	$\overset{\circ}{ē}$	~ Velarized or pharyngealized	$\overset{\circ}{t̄}$		
✗ Mid-centralized	$\overset{\circ}{ē}$	↑ Raised	$\overset{\circ}{e}$	( $\overset{\circ}{J}$ = voiced alveolar fricative)	
↓ Syllabic	$\overset{\circ}{n}$	↓ Lowered	$\overset{\circ}{e}$	( $\overset{\circ}{β}$ = voiced bilabial approximant)	
~ Non-syllabic	$\overset{\circ}{e}$	↓ Advanced Tongue Root	$\overset{\circ}{e}$		
~ Rhoticity	$\overset{\circ}{θ̄}$ $\overset{\circ}{ā}$	↓ Retracted Tongue Root	$\overset{\circ}{e}$		



# Place of Articulation



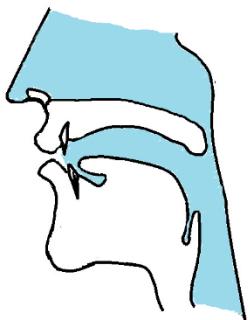
Bilabial, Alveolar, Velar

UPSID Database (in Maddieson's Patterns of Sounds, 1984) surveys 317 languages

314 have bilabial stops

316 have alveolar/dental stops

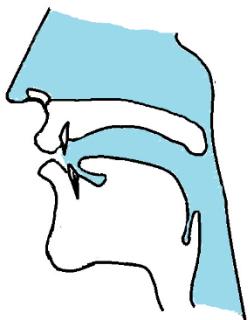
315 have velar stops



# Palatals

- Plosives, Nasals, Fricatives and approximants
- Root of tongue to wall of palatal region

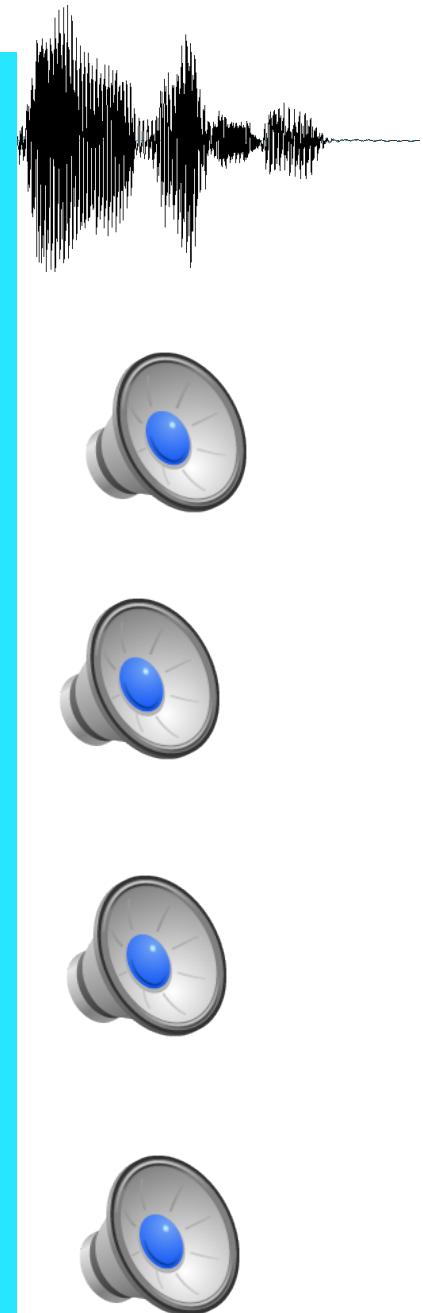
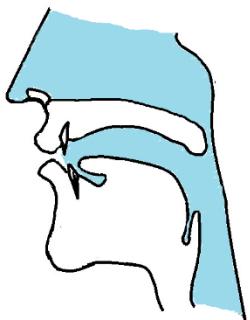
Palatal
c   j
ɟ   ɿ
ç   ɿ̪
j   ɿ̪̪



## Palatals

- Palatal Stops
- 59 languages in UPSID database have palatal stops
- Palatals vs. Velars in Ngwo (spoken in Cameroon)

Ngwo			
Laminal dental/velar	Laminal palatoalveolar	Palatal	Velar
èdzè	dʒé	éfɛ	ēgɛ
(dance)	(fruit)	'postpone'	'grass' [pl.]



# Sounds of the world's languages: Consonants around the world

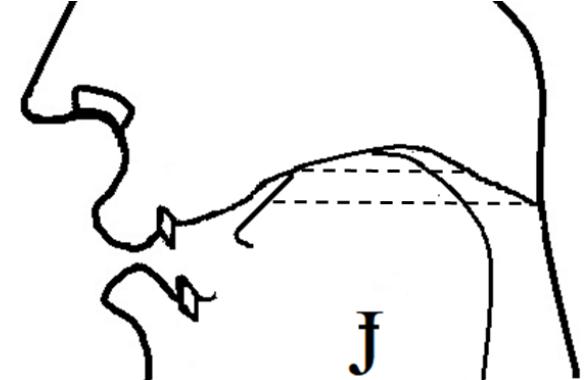
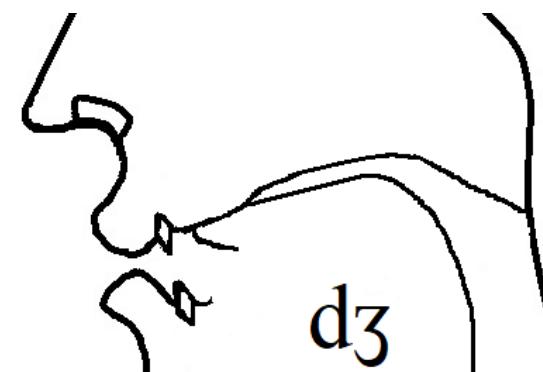
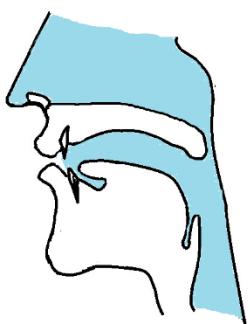


Fig. 4. palatograms articulatory positions of laminal denti-alveolar, laminal palato-alveolar, and palatal stops in Ngwo.

The contact area on the roof of the mouth is the area fro, which the marking medium has been wiped away.

— — — The dotted lines on the palatal sagittal section correspond to the (solid) contour lines superimposed on the palatograms.



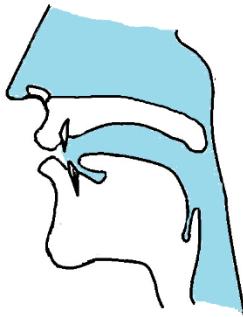


## Also: Palatal Nasals

### Examples from Hungarian



	VOICELESS STOP	VOICED STOP	NASAL
INITIAL	tyúk <b>c</b> uk 'hen'	gyújt <b>g</b> uit 'he ignites'	nyújt <b>n</b> uit 'he reaches'
BETWEEN VOWELS	atya <b>c</b> c 'gather'	agya <b>c</b> f 'his brain'	anya <b>c</b> u 'mother'





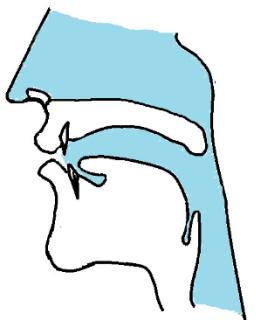
## Uvulars

47 languages in UPSID database have uvular stops

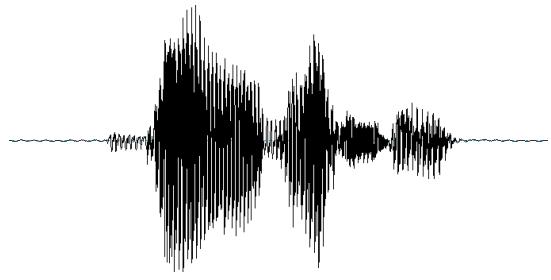
Uvular nasal: Japanese



mi 'fruit, nut'	mu 'nothing'
me 'eye'	mo 'algae'
ma 'interval'	

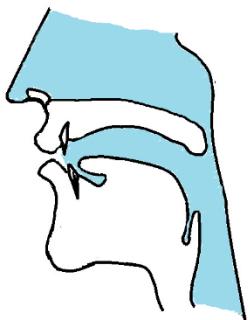


# SyrA Emphatics

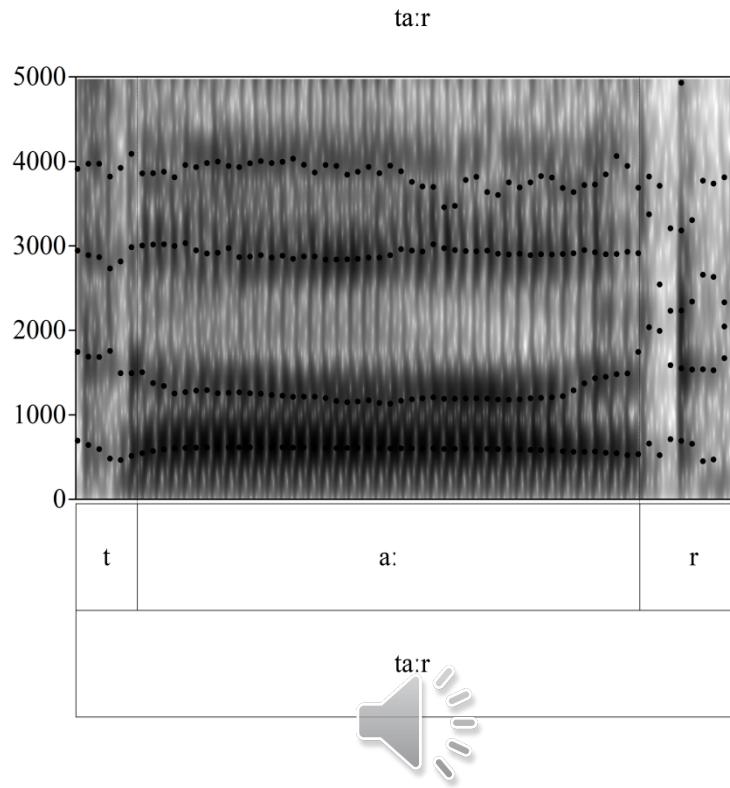


		Plosive		Fricative	
		plain	Emphatic	Plain	Emphatic
Alveolar	Voiceless	<b>t̪a:r</b> 'revenge'	<b>t̪ʃa:r</b> 'flew'	<b>s̪e:f</b> 'sword'	<b>s̪ʃe:f</b> 'summer'
	Voiced	<b>d̪arb</b> 'path'	<b>d̪ʃarb</b> 'hitting'	<b>z̪əl</b> 'Humiliation'	<b>z̪ʃəl</b> 'shadow'

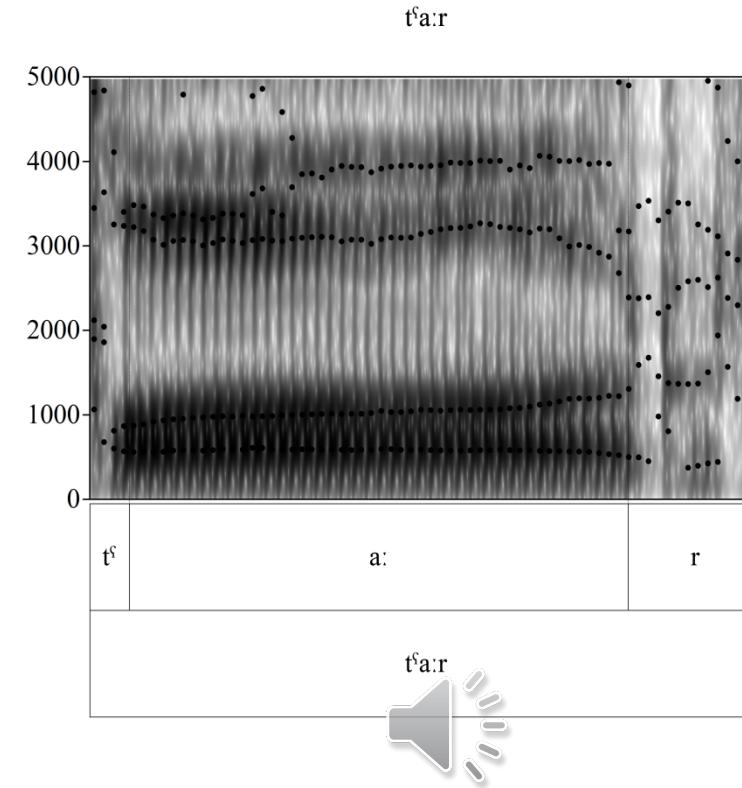
Table 1. Emphatics in Syrian Arabic



# SyrA Emphatics



Plain



Emphatic

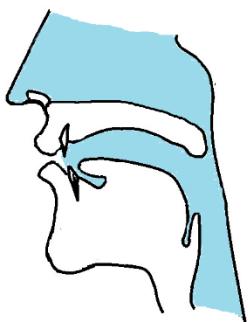
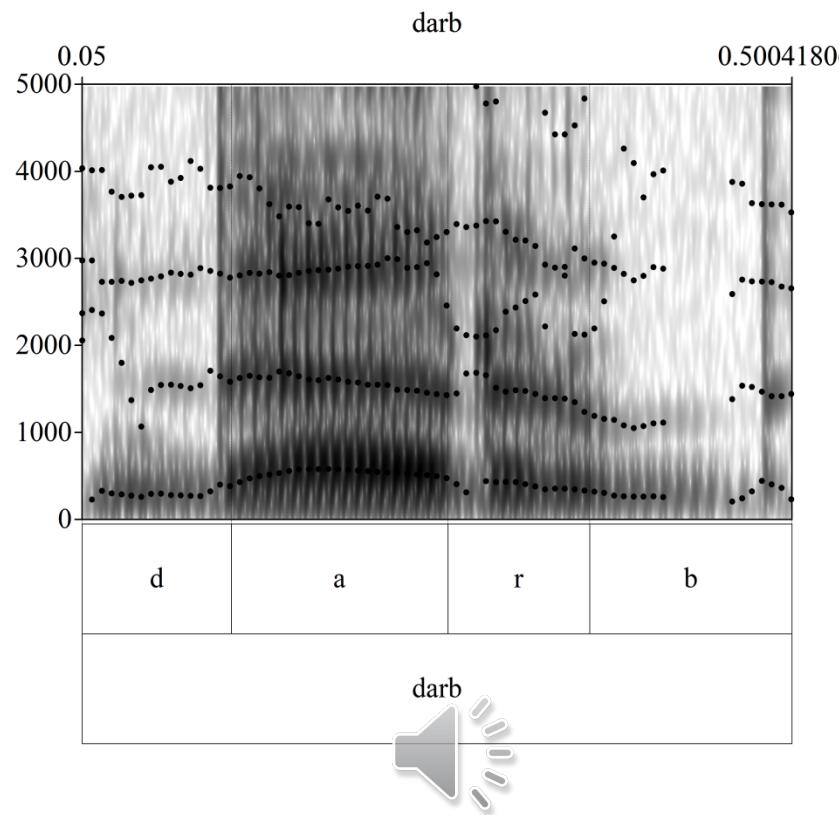


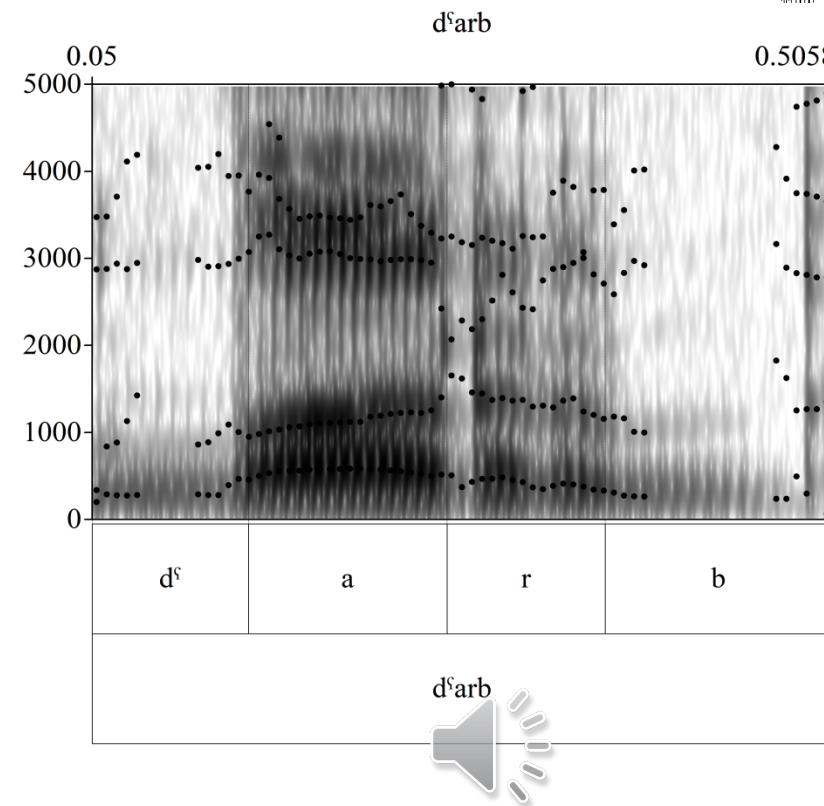
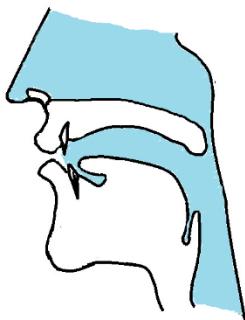
Fig. 1. Voiceless alveolar plosive



# SyrA Emphatics



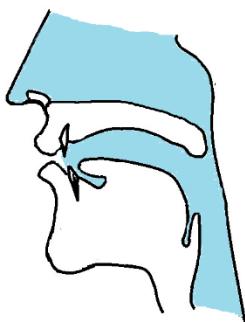
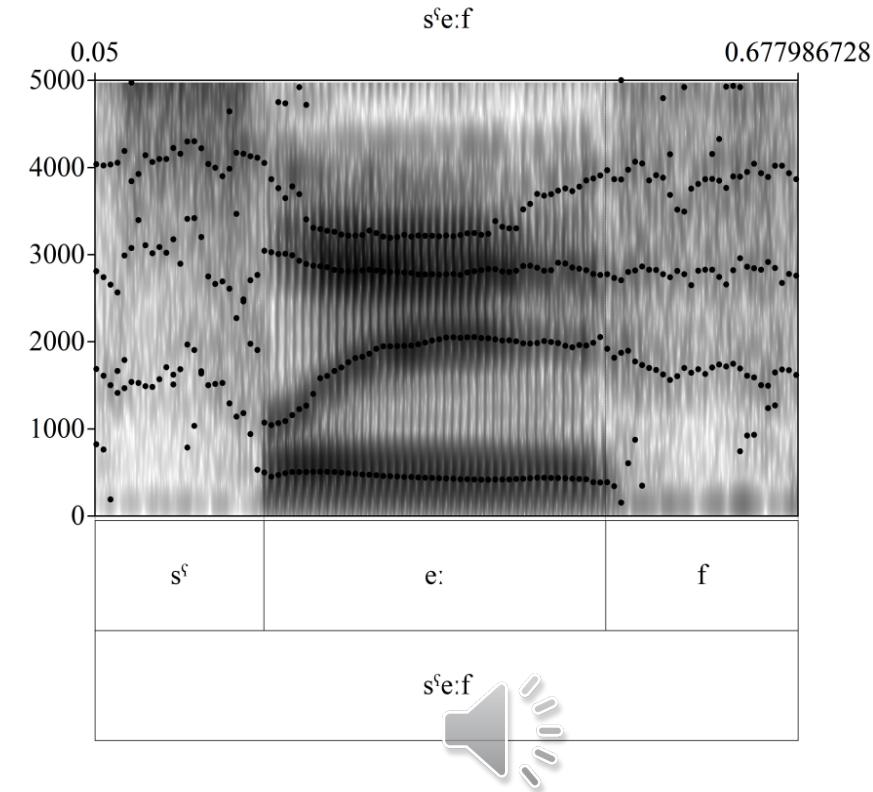
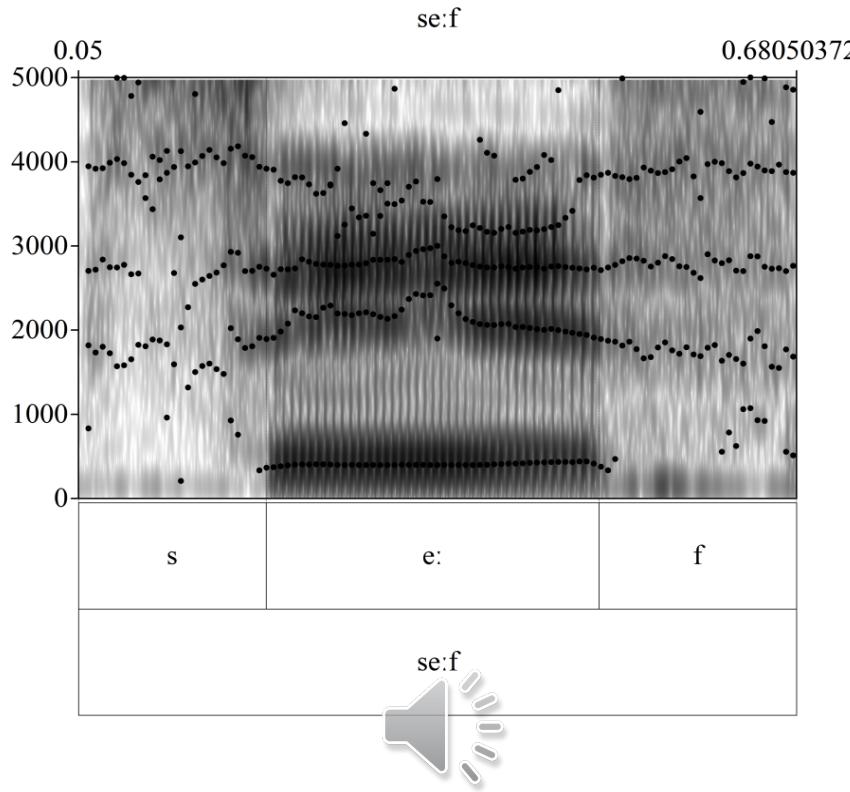
Plain



## Emphatic

Fig. 2. Voiced alveolar plosive

# SyrA Emphatics



Plain

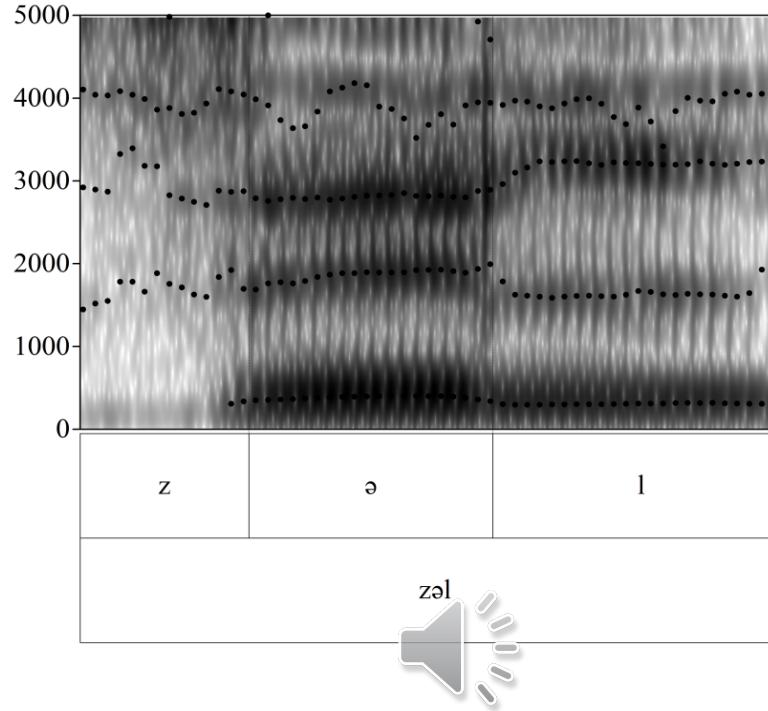
Emphatic

Fig. 3. Voiceless alveolar fricative

# SyrA Emphatics

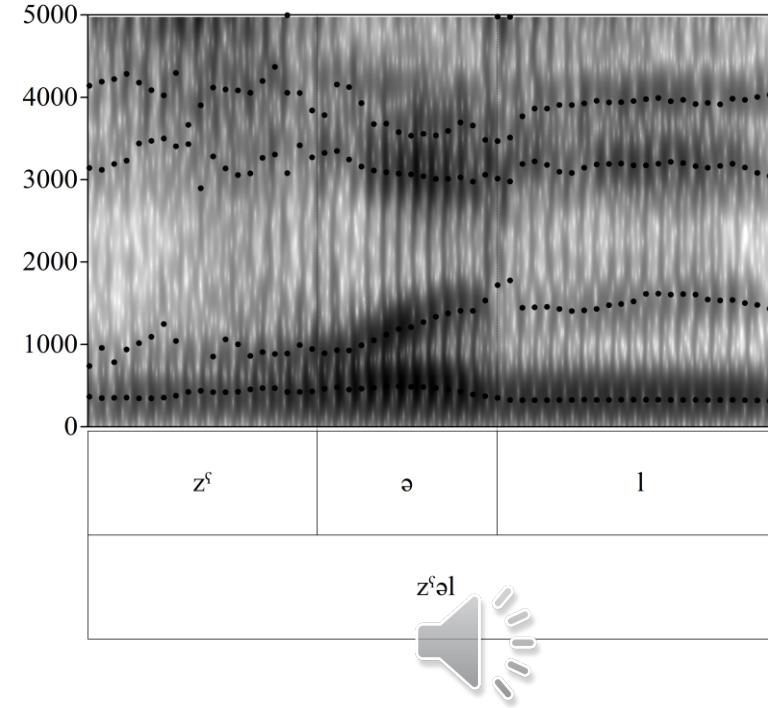


$zəl$



Plain

$z^{\circ}əl$



Emphatic

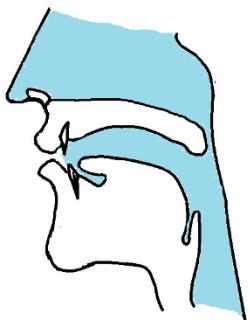


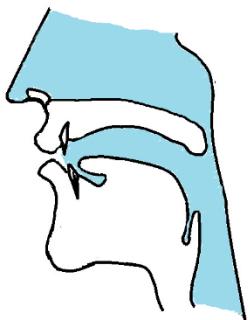
Fig. 4. Voiced alveolar fricative

# SyrA Uvulars

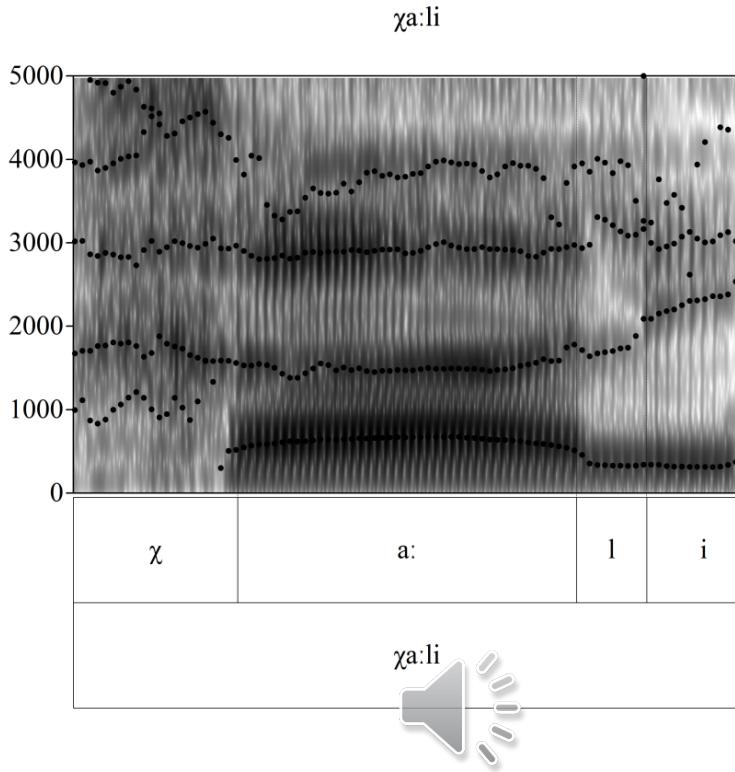


	Uvular	Pharyngeal	Glottal	
Plosive		qa:si 'hard'	ɬamal 'hope'	
Fricative	χa:li 'my uncle'	ʁa:li 'expensive'	ħa:li 'my condition'	fɑ:li 'high'

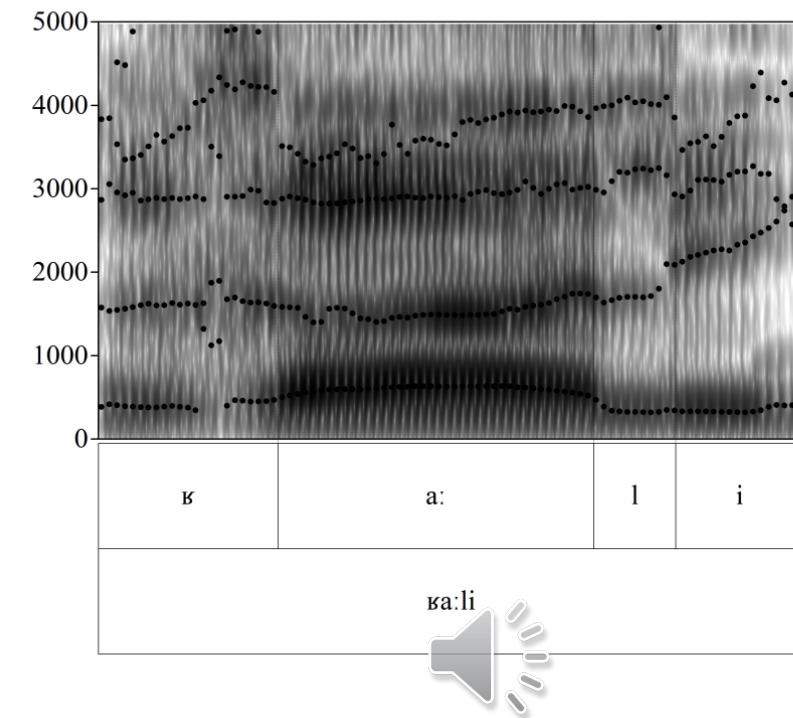
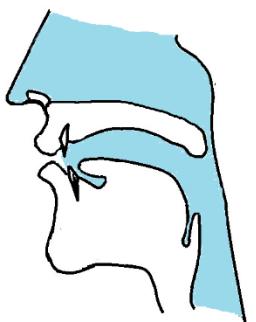
Table 2. uvular, pharyngeal & glottal sounds in Syrian Arabic



# SyrA Uvulars



Voiceless uvular fricative



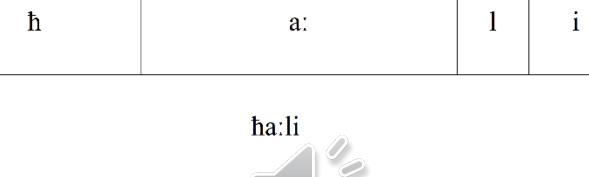
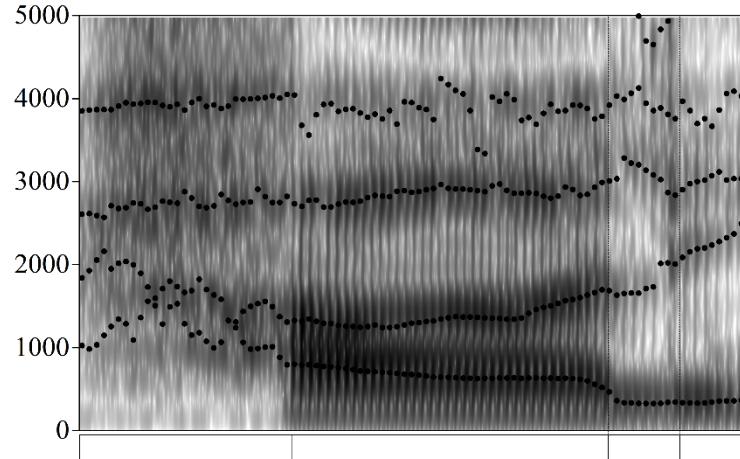
Voiced uvular fricative

Fig. 5. Uvular fricatives

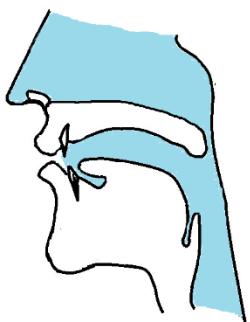
# SyrA Uvulars



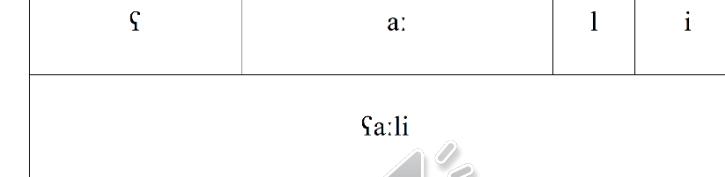
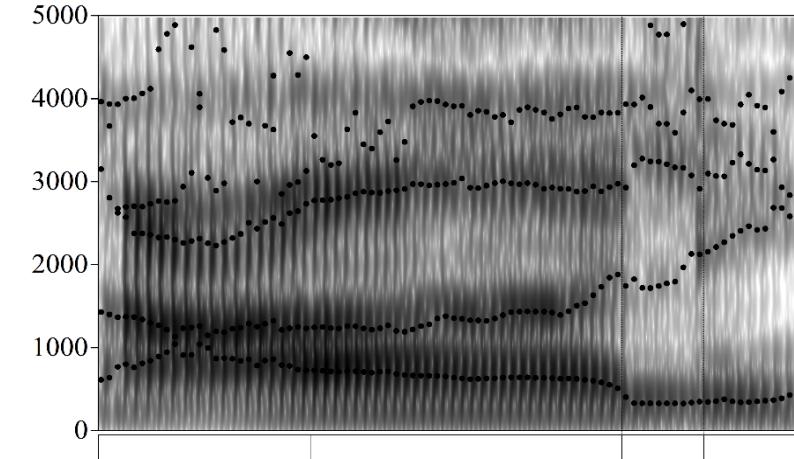
ha:li



Voiceless pharyngeal fricative



fa:li



Voiced pharyngeal fricative

Fig. 6. Pharyngeal fricatives

# SyrA Uvulars

qa:si

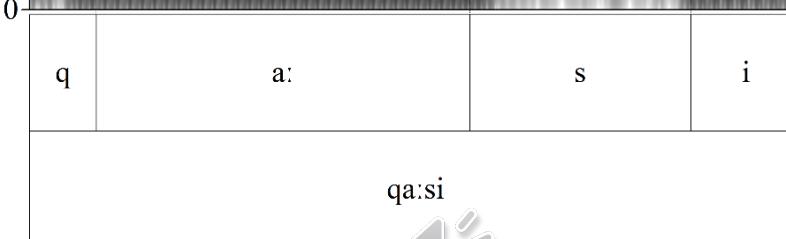
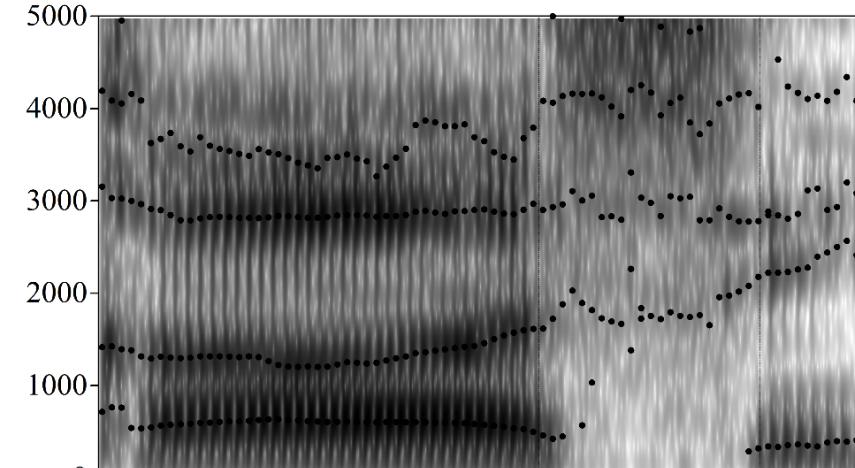
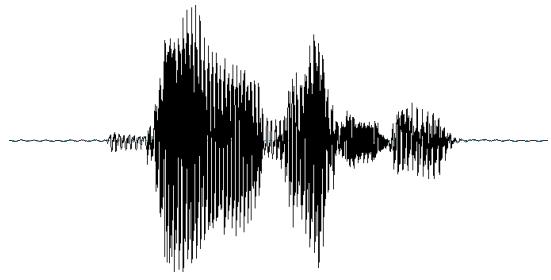
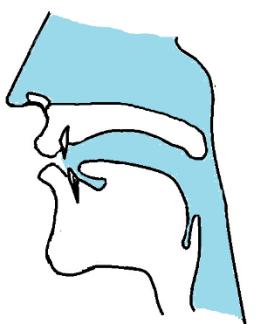


Fig. 7. Voiceless pharyngeal plosive



# SyrA Uvulars

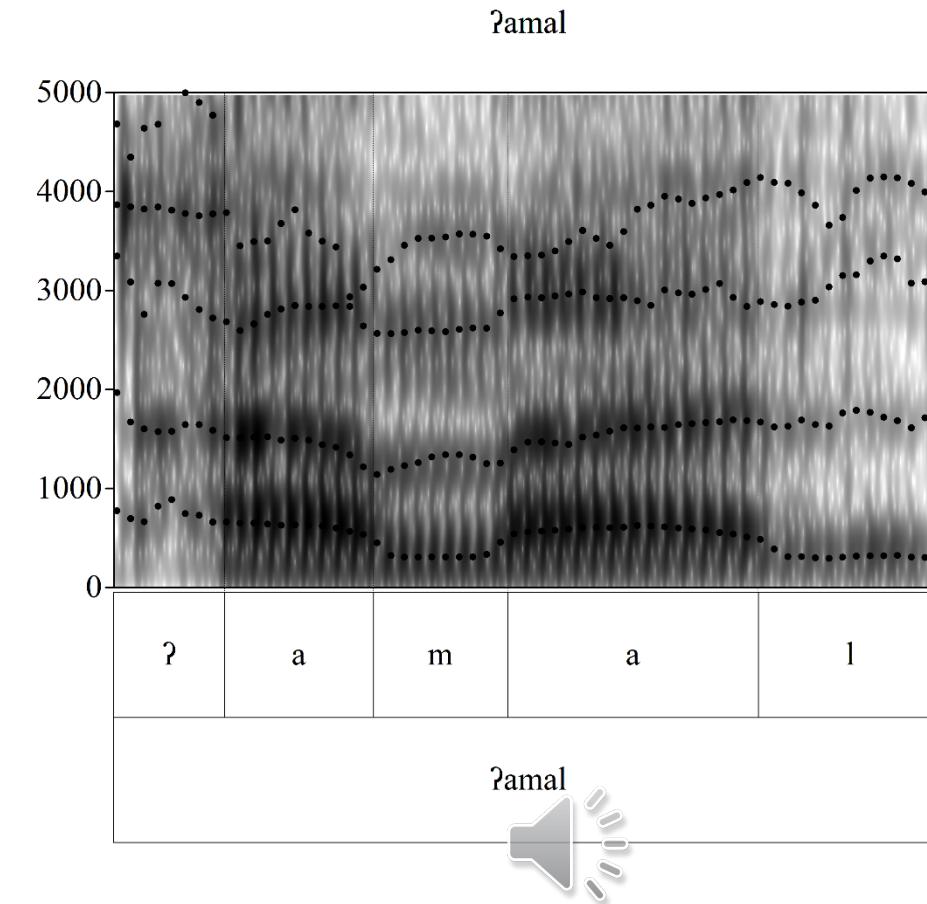
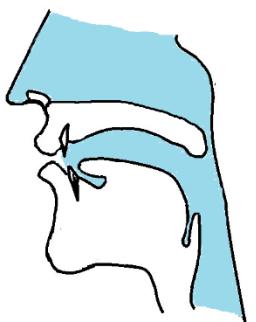


Fig. 8. Voiceless glottal plosive



# Other Places of Articulation

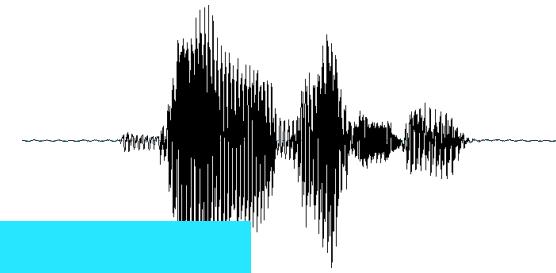


- One dialect of Hebrew has uvular and pharyngeal fricatives

## Hebrew (Oriental dialect)

	Uvular	Pharyngeal	Glottal	
<b>Initial</b>	χimia 'chemistry'	ḥor 'hole' gor 'skin'	hem ʔor	'them' 'light'
<b>Medial</b>	maxar 'he sold'	naḥar 'snored' naṣar 'made a donkey, noise'	nahar saʔon	'river' 'noise'
<b>Final</b>	laχ 'for you' [fem.]	laḥ 'humid' naṣ	lah	'for her'





## Quechua Contrasts •

Quechua is spoken primarily in Bolivia and Peru.



tʃaka

'bridge'

kujuj

'to move'

qaχu

'tongue'

tʃʰaka

'large ant'

kʰujuj

'to whistle'

qʰaχu

'shawl'

tʃ'aka

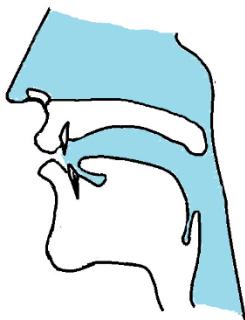
'hoarse'

k'ujuj

'to twist'

q'aχu

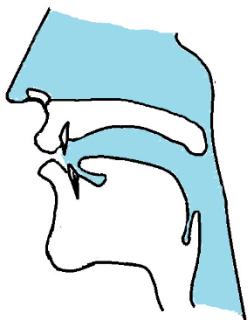
'tomato sauce'



# Epiglottals



- Epiglottis to back wall of pharynx
- Rare in Fricatives
- Phonemic contrast between pharyngeal & epiglottal place extremely rare.





## Epiglottals in Agul • Agul is spoken in Dagestan, near the Caspian Sea, in Russia

### Agul (Burkixan Dialect)

**Voiced pharyngeal  
fricative**

muʕ<sup>ø</sup>  
'bridge'

muʕar  
'bridges'

**Voiceless pharyngeal  
fricative**

muħ  
'barn'

muħar  
'barns'

**Voiceless epiglottal  
fricative**

mɛħ  
'whey'

mɛħer  
'wheys'

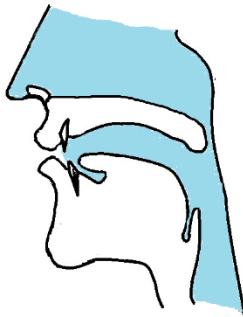
**Voiceless epiglottal  
stop**

jaʔ  
'center'

sɛʔ  
'measure'

jaʔar  
'centers'

sɛʔer  
'measures'

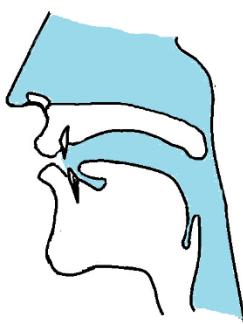
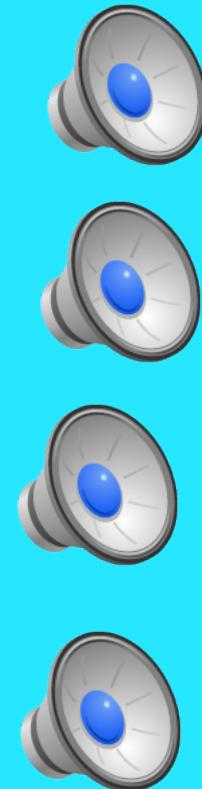




## Labial-velar stops

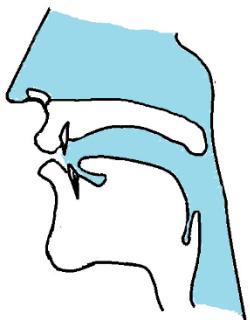
Examples from Idoma (spoken in Nigeria):

Idoma			
	Labial	àpà 'lizard'	àbà 'palm nut'
	Labial-velar	àkpà 'bridge'	àgbà 'jaw'
	Velar	àka 'wheel'	ɔŋáji 'Western rainbow'
	Labialized	òkʷò (tree)	àgʷa 'swimming'
			àŋʷà 'fortune-telling instrument'

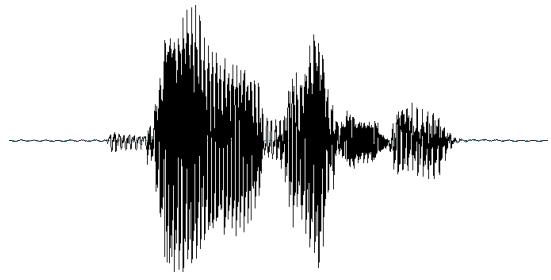


# Velar

Stops, nasals,  
fricatives, and  
approximants



Velar
k g
tʃ
x γ
w
l

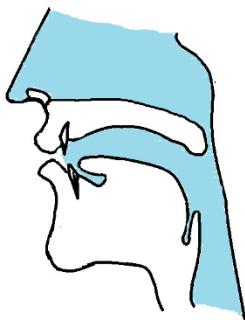
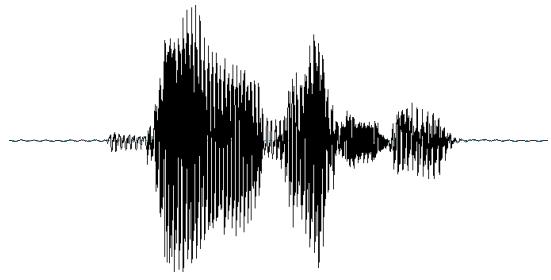


## Linguolabials

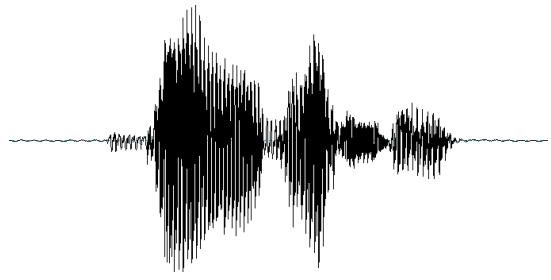
- Linguolabials are formed by touching the blade of the tongue to the upper lip.
- Examples from V'enen Taut, a language spoken in Vanuatu (the South Pacific):



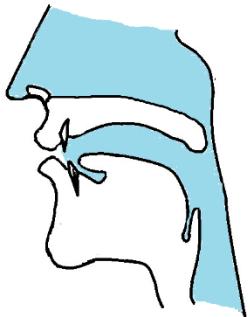
Bilabial	Linguo-labial	Alveolar
pətək 'my head'	tətei 'breadfruit'	
nəmək 'my spirit'	nənək 'my tongue'	ðanu 'island'
naβal 'songfest'	naðət 'stone'	

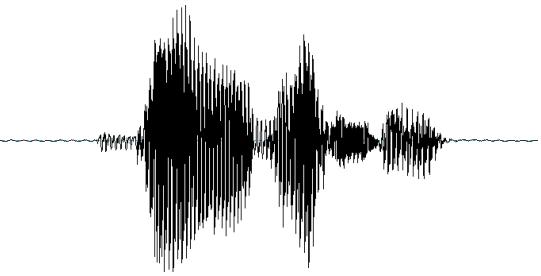


# Coronal



- Yanyuwa Coronal Contrast
- Yanyuwa is spoken in the Northern Territory of Australia
- Yanyuwa has 7 stop place contrasts

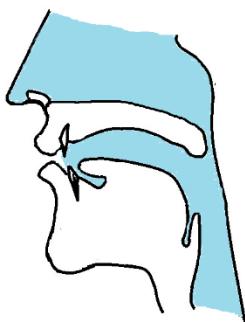
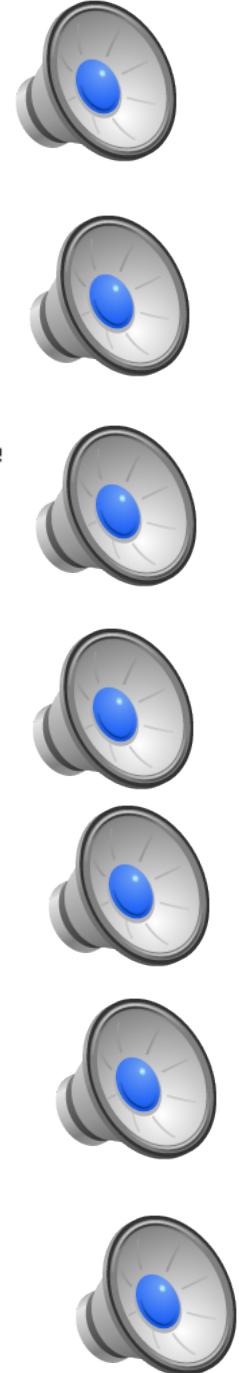




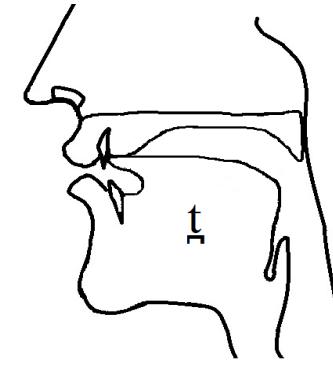
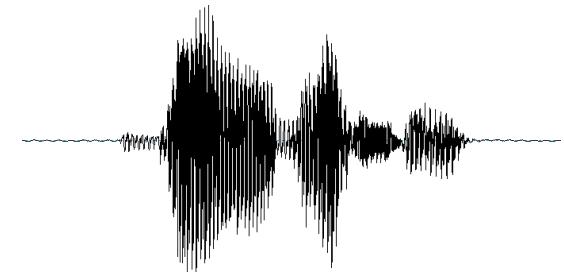
## Yanyuwa

Oral stops

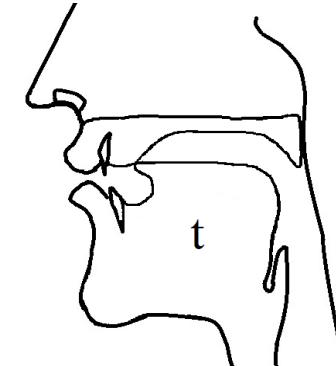
<b>Bilabial</b>	<b>wubuwingu</b>	'for a small female one'
<b>Laminal dental</b>	<b>wudurumaya</b>	'laugh!'
<b>Apical alveolar</b>	<b>wuduru</b>	'full of food'
<b>Apical retroflex</b>	<b>wudu<u>la</u></b>	'in the stomach'
<b>Palatoalveolar</b>	<b>wudu<u>la</u></b>	'into the grass'
<b>Front velar</b>	<b>gugulu</b>	'sacred'
<b>Back velar</b>	<b>wugugu</b>	'grandparent'



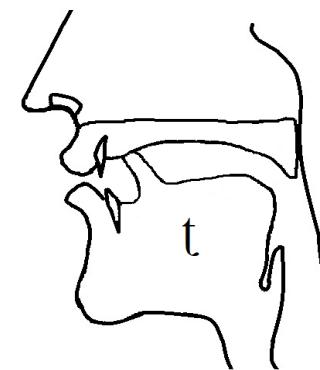
# Sounds of the world's languages: Consonants around the world



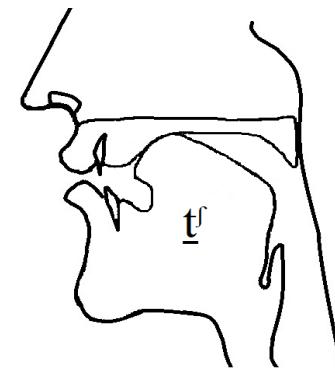
Dental t̪



Alveolar t

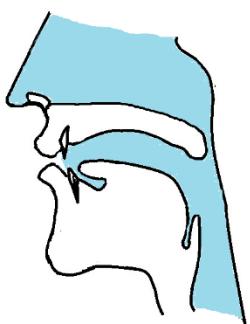


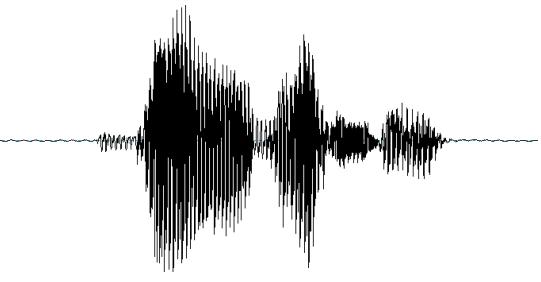
Retroflex t̪



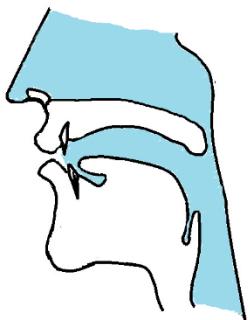
Palatoalveolar t̪

Fig. 3. Positions of the tongue during the stop closures in the four Nunggubuyu words

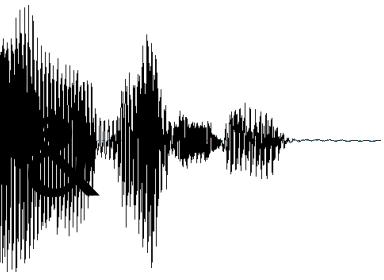




- dental/alveolar • velar •
- palatal or uvular
- retroflex
- sometimes labial-velar

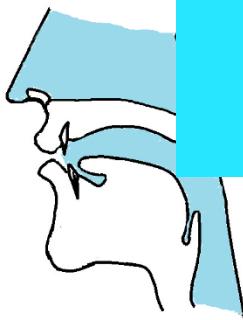


# Lateral vs. Central / Approximants (liquids glides)



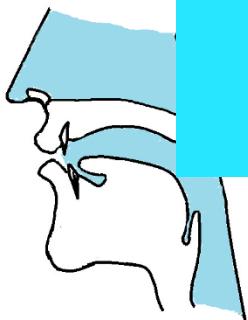
- Lateral
  - Air passes out of the sides
- Central
  - Air passes out centrally

Lateral fricative			ʃ ʒ							
Approximant		v	r	l	j	m				
Lateral approximant			l	ɫ	ʎ	ɫ				





1. Airstream Mechanism/direction
2. Glottal state
3. Part of Tongue
4. Primary Place of Articulation
5. Manner of Articulation
6. Centrality
7. Nasality

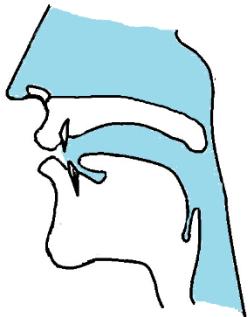


# Voiceless Nasals

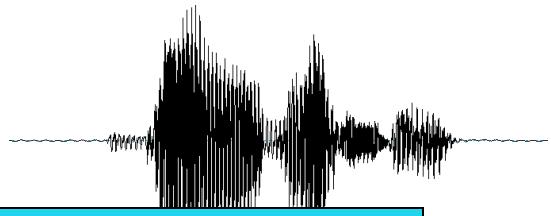


- Nasalization and fricatives are not compatible
- The existence of nasal fricatives is very often disputed
- voiceless nasals in **Burmese**

NASALS	BILABIAL	DENTAL	PALATAL	VELAR
VOICELESS	m̥ā  'om'	n̥ă:  'nasal'	j̥ă:  'co <u>siderate</u> '	ŋ̥ā  'row'
VOICED	mā  't up'	nă:  'ain'	jă:  'ight'	ŋā  'ish'

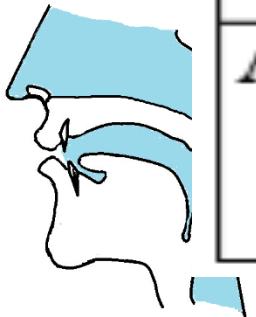


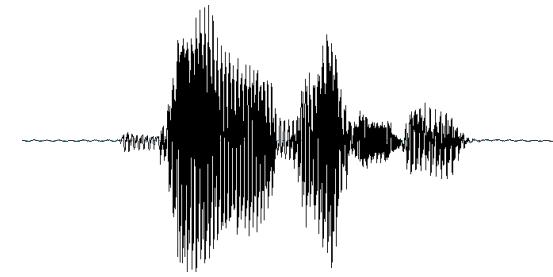
# Another Manner: Trills



- **Trills** - two articulators open and close against each other vigorously
- Kele has both bilabial and alveolar trills.
- Kele is spoken on the island of Manus, which is north of New Guinea.

KELE		
BILABIAL	m <b>buεŋkei?</b> ‘fruit’ (species)	m <b>bulim</b> ‘face’
ALVEOLAR	n <b>r<u>u</u>wiñ</b> ‘bone’	n <b>rikei</b> ‘leg’

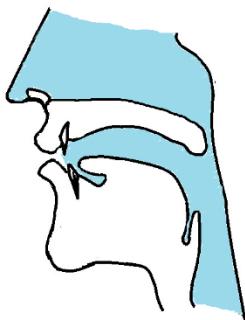




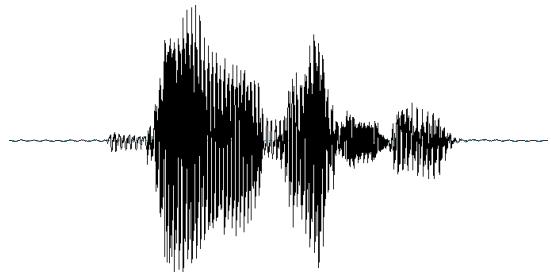
# Another Manner: Laterals

Kaititj			
	Initial	Medial	
Laminal dental	l <u>inp</u> 'armpit'	a <u>lun</u> 'burrow'	i <u>lbal</u> 'smoke'
Apical alveolar	l <u>ubi</u> ɺ 'thigh'	a <u>lungk</u> 'chase'	i <u>rmal</u> 'fire saw'
Apical post-alveolar		<u>kalat</u> 'sacred board'	<u>aldimal</u> 'west'
Laminal post-alveolar		<u>alilk</u> 'smooth'	<u>kural</u> 'star'

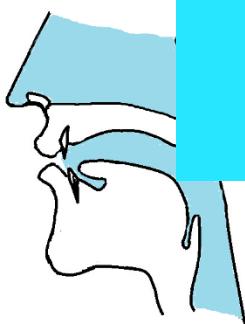
Kaititj is an Australian language (Arandic group of the Pama-Nyungan branch) spoken in the Northern territory.



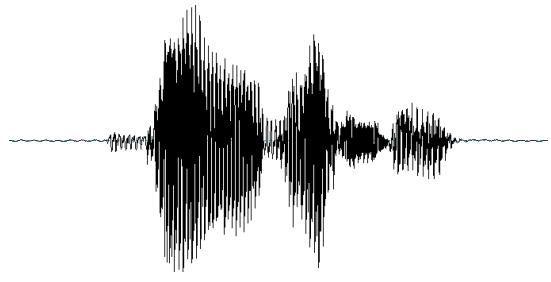
# Airstream Mechanism



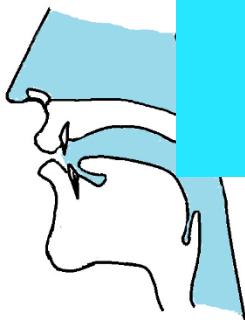
1. Pulmonic
2. Glottalic
3. Velaric



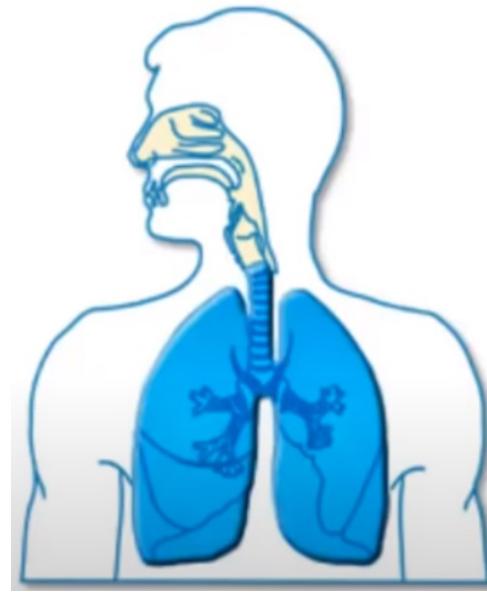
# Airstream Direction



1. Egressive
2. Ingressive



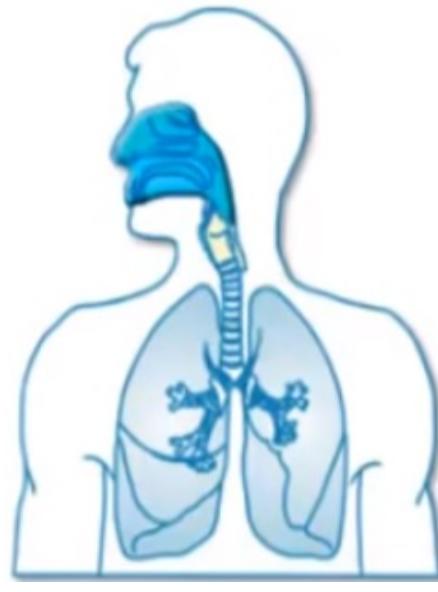
# Articulation: Airstream Mechanism



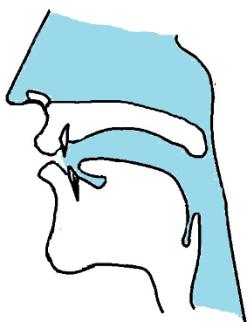
Pulmonic



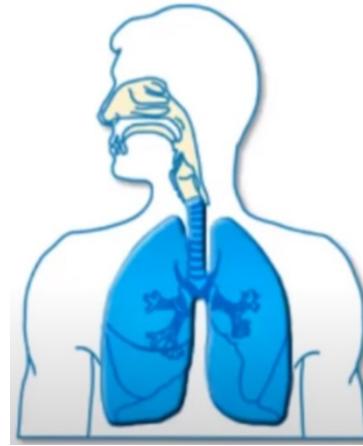
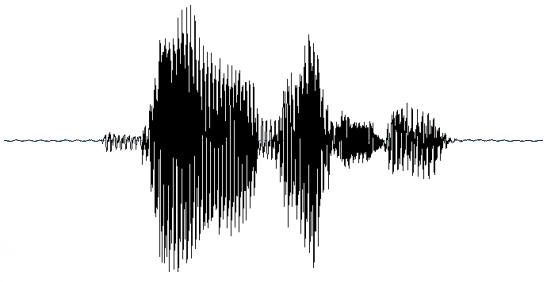
Glottalic



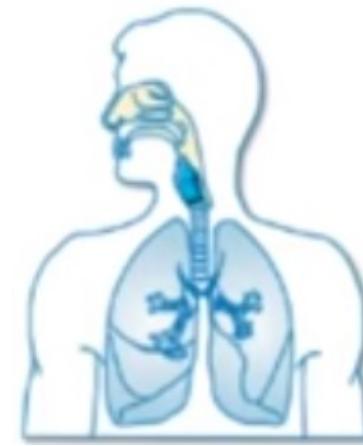
Velaric



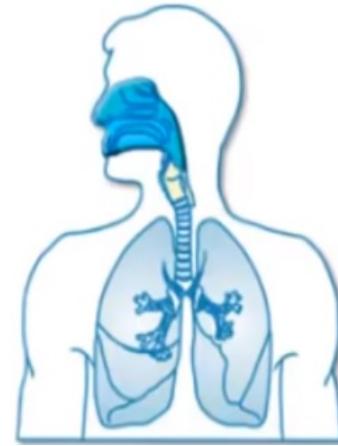
# Airstream Mechanism



Pulmonic



Glottalic



Velaric

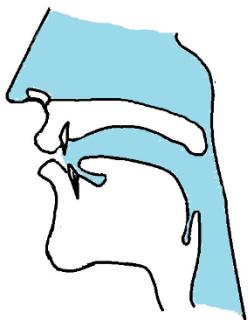
- Air direction: egressive
- Stop consonants: plosives
- E.g. [p t k] [b d g]
- Voicing: voiceless / voiced

Airstream mechanism

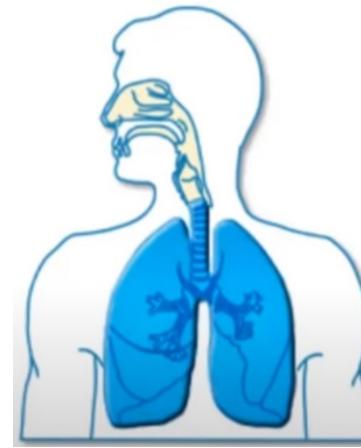
Pulmonic

Glottalic

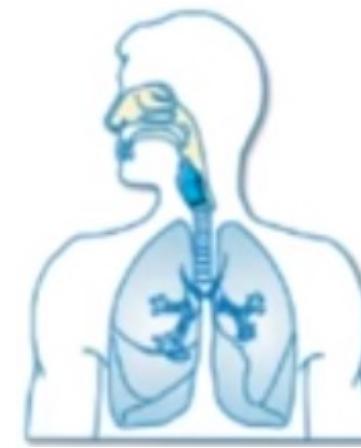
Velaric



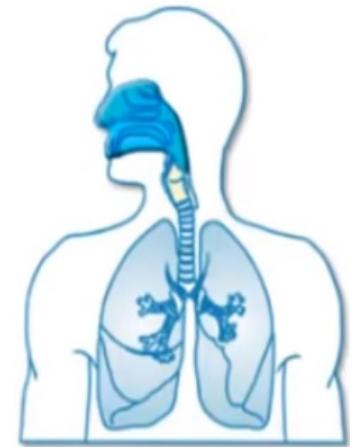
# Airstream Mechanism



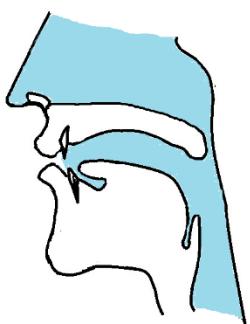
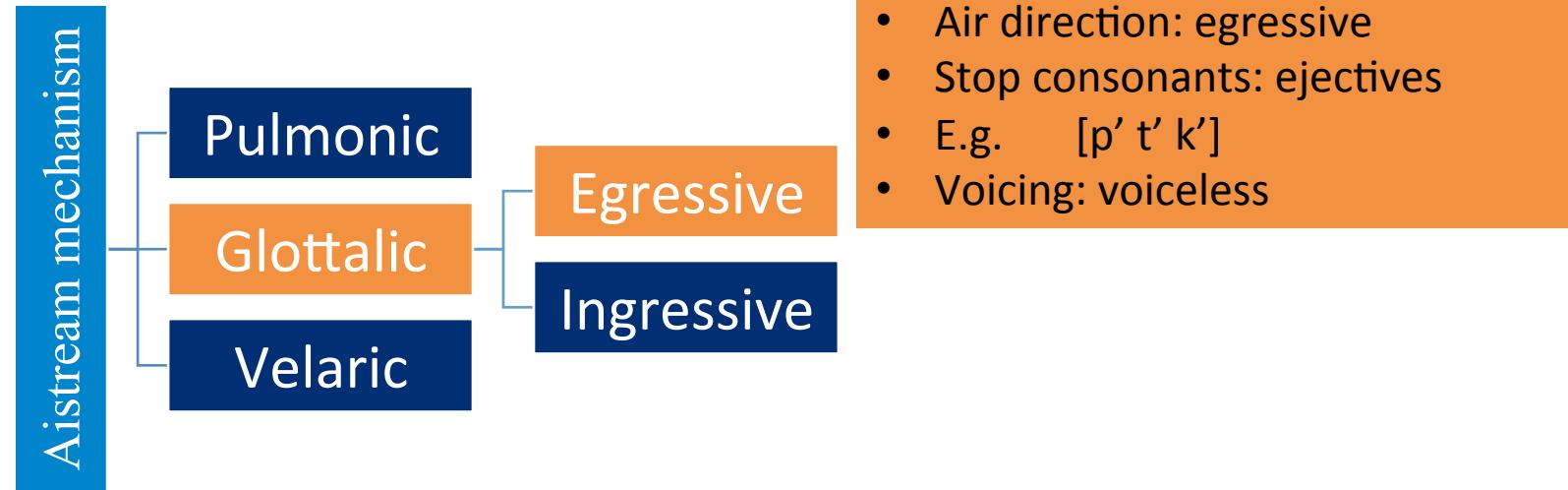
Pulmonic



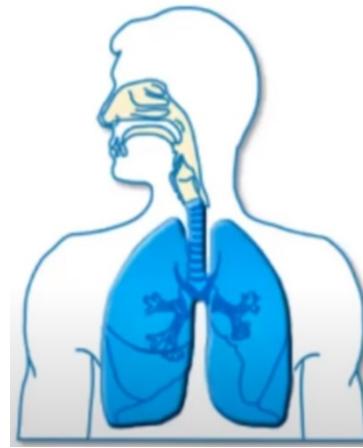
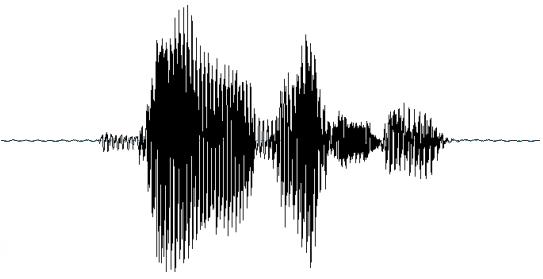
Glottalic



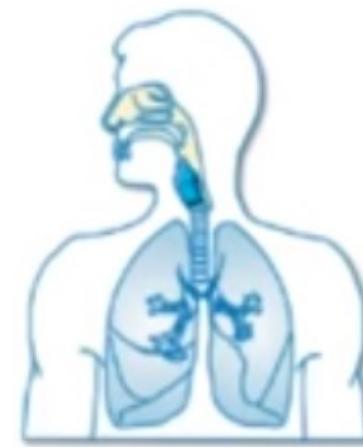
Velaric



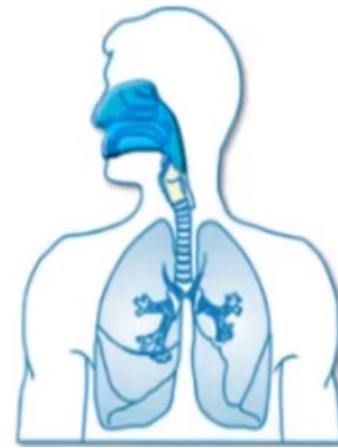
# Airstream Mechanism



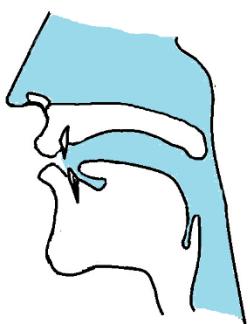
Pulmonic



Glottalic



Velaric



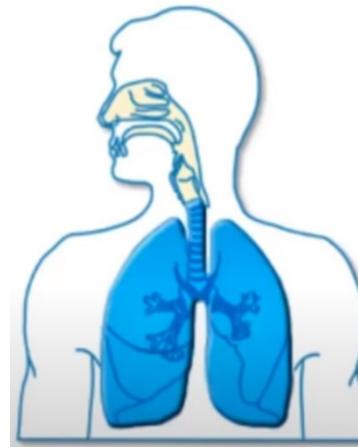
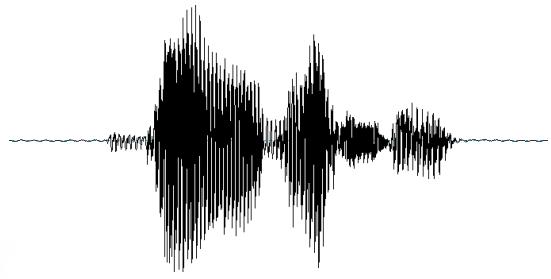
## Airstream mechanism

Pulmonic  
Glottalic  
Velaric

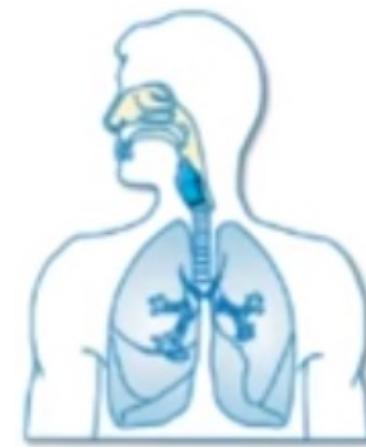
Egressive  
Ingressive

- Air direction: ingressive
- Stop consonants: implosives
- E.g. [b d g]
- Voicing: voiced

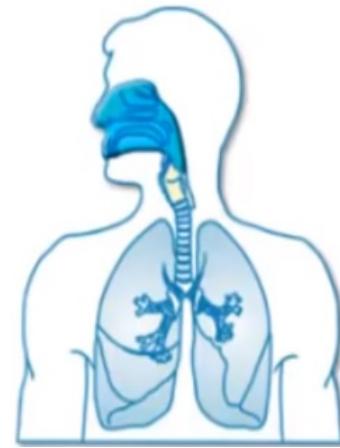
# Airstream Mechanism



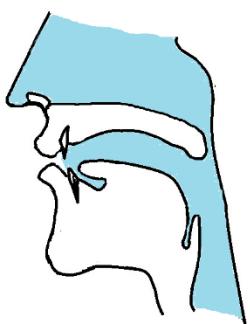
Pulmonic



Glottalic



Velaric



## Airstream mechanism

Pulmonic

Glottalic

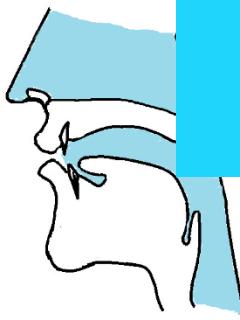
Velaric

- Air direction: ingressive
- Stop consonants: clicks
- E.g. [ʘ | ! ||]
- Voicing: voiceless / voiced

# Contrast and parameters



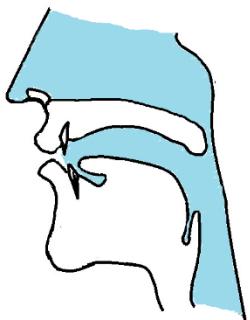
- Making speech sounds
- Airstream mechanism
- Moving air by exhaling from lungs - pulmonic egressive airstream
- Glottalic egressive airstream – ejective sounds
- Closures in the vocal tract and the vocal folds
- Compressed air released with high pressure from oral closure





# Other Airstream Mechanisms

- Some sounds are made without air flowing out of the lungs.
- Sounds produced with closed glottis - ejectives.
  - They are symbolized with a ‘ after a stop: [p’ ], [t’ ], [k’ ]

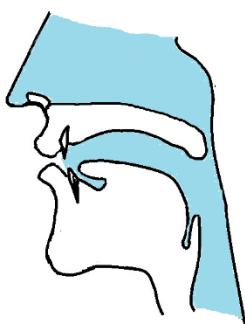


# Ejectives

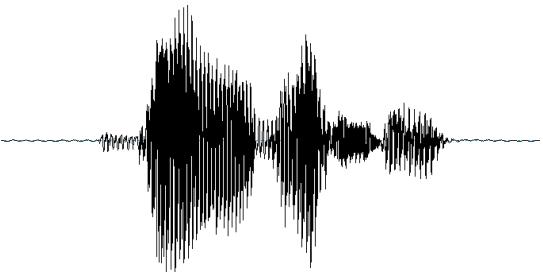


- Sounds made with a glottalic egressive airstream mechanism are also known as **ejectives**.
- Ejectives are symbolized with a ['] following a symbol for a stop.

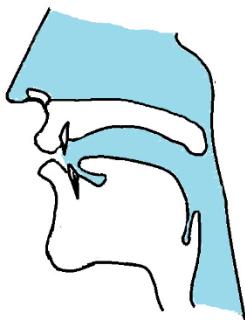
- [ap' a]              [at' a]              [ak' a]



# Quechua Ejectives



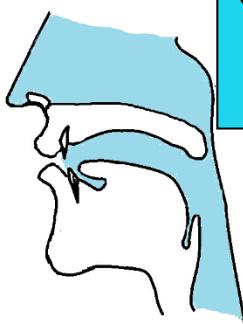
	PALATO- ALVEOLAR	VELAR	UVULAR
VOICELESS	<b>tʃaka</b> 'bridge'	<b>kujui</b> 'to move'	<b>qaʎau</b> 'tongue'
EJECTIVE	<b>tʃ'aka</b> 'hoarse'	<b>k'uju</b> 'to twist'	<b>q'aʎau</b> 'tomato sauce'



# Glottalic Egressives



1. Close the glottis (glottal stop)
  2. Make a stop closure
  3. Raise the glottis - compresses the air in the supraglottal cavity
  4. Release the stop - Air rushes out of the vocal tract - high pressure to low pressure
  5. Release the glottal closure - Air rushes out of the lungs - Making a glottal stop
- Sounds which are made in this way use a **glottalic egressive** airstream mechanism.



# Implosives



- Sounds can also be made when air comes into the mouth.
- dropping the closed glottis and an obstruction for the stop
- Sounds made in this way are called **implosives**.
- Examples from Sindhi (spoken in India):



bani  
'field'



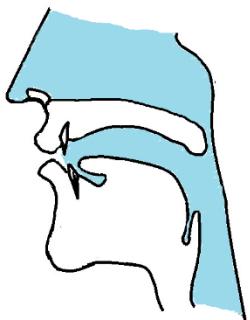
g'anu  
'handle'



banu  
'forest'



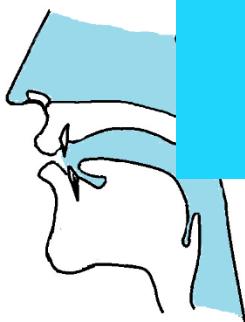
gunu  
'quality'



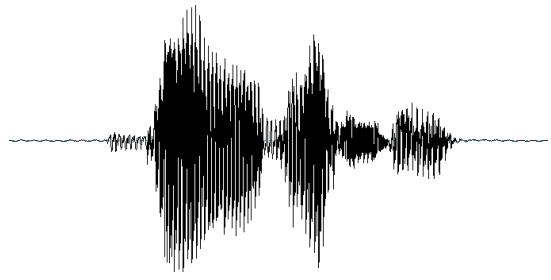


# Ingressives

- Glottalic Ingressive airstream
- Implosives
- Air forced into the mouth
- Closure in mouth and at the vocal folds
- Downward movement of the larynx
- Lowered pressure
- Expansion of the vocal tract - . Strong voicing vibrations during closure



# Velaric Ingressive Sounds

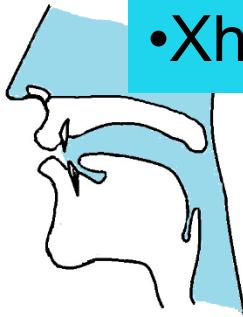


- Sounds with two closures
- Clicks

	Dental	Alveolopalatal	Alveolar lateral
<b>Voiceless unaspirated velar plosive</b>	<b>ukúk ola</b> 'to grind fine'	<b>ukúk!oɓa</b> 'to break stones'	<b>úk  olo</b> 'peace'



- Xhosa, - southwestern Africa.



# Sounds of the world's languages: Clicks

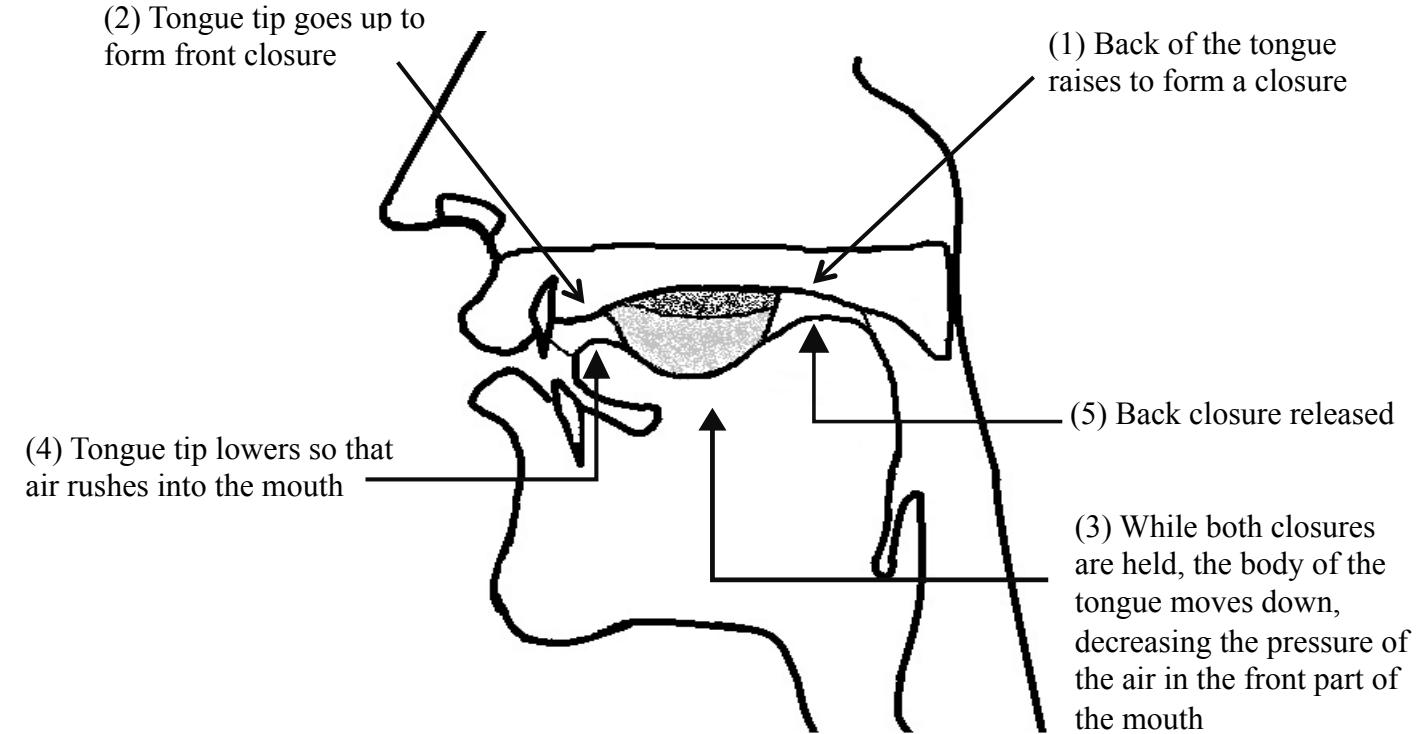
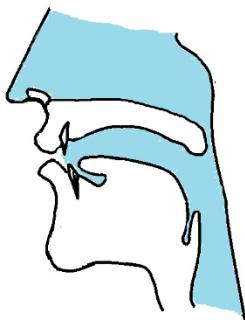


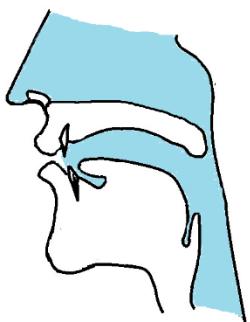
Fig. 5. the movement involved in making a click

- The dark shaded area shows the cavity enclosed when the closures are formed.
- The light shaded area shows the cavity just before the release of the front closure.
- ＼ The dashed lines show the lowered tongue positions corresponding to step 4 & 5.

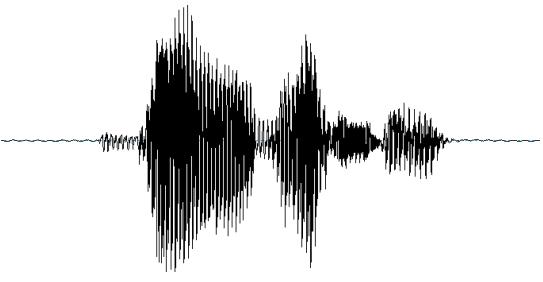




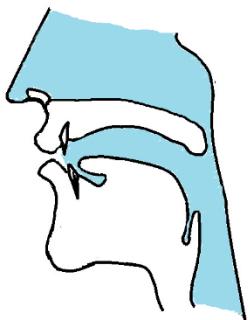
Conventional  
click



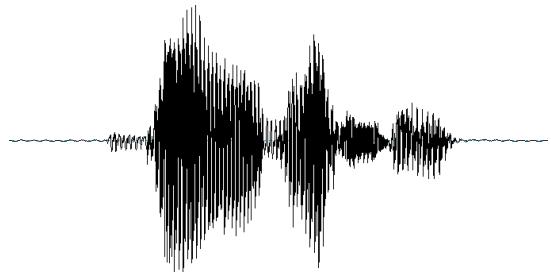
# Click



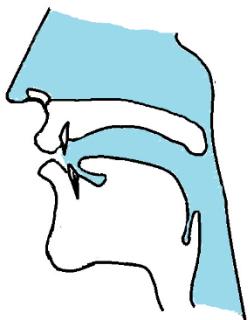
- Anterior and posterior closure (against the soft palate)
- Pocket of air created
- When the front closure is released air rushes into the mouth
- The negative pressure and rapid inflow creates a loud sound



# Alveolar click



- Steps in producing an alveolar click
- Make two oral closures
- Air rarefaction: tongue pulled down. Decrease in air pressure of the air cavity
- The front oral closure is released. Air rushes in to equalize pressure
- The back oral closure is released

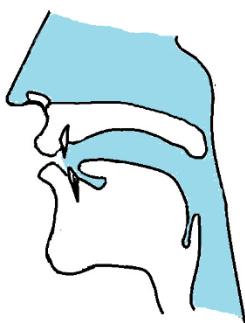


# Clicks in Zulu



	Dental	Alveopalatal	Alveolar lateral
Voiceless unaspirated velar plosive	k a:ŋza	k!a:k!a	k  a:ga
Voiceless aspirated velar plosive	k h:a:ga	k!h:a:k!h:a	k  h:a:ga
Voiced velar plosive	g o:ba	g!o:ba	g  o:ba
Voiced velar nasal	isi:ŋ e	isi:ŋ!e	isi:ŋ  e:le

Table 1. Zulu clicks (Ladefoged 2006).



# Clicks in Zulu

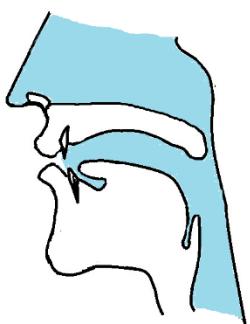
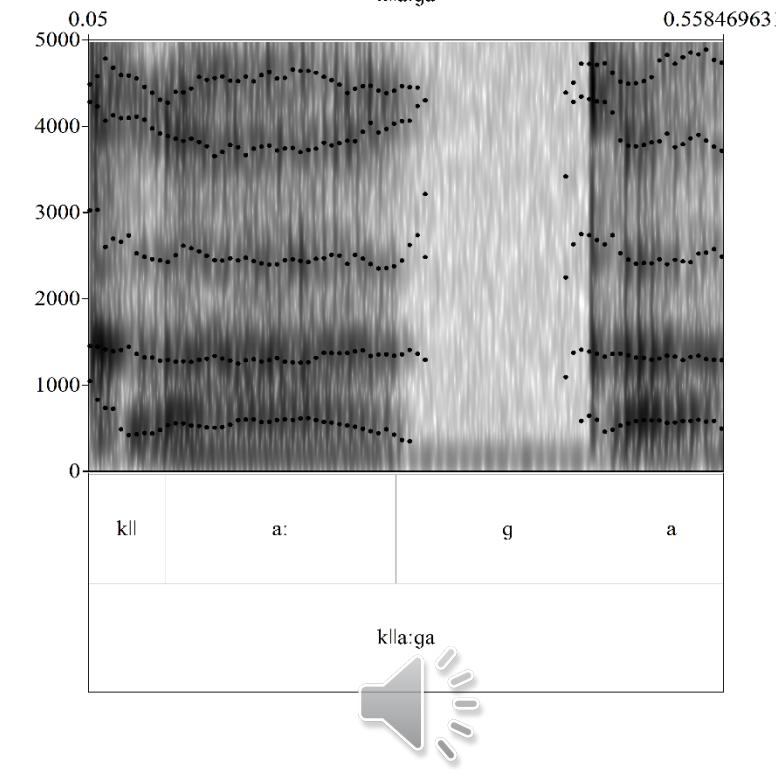
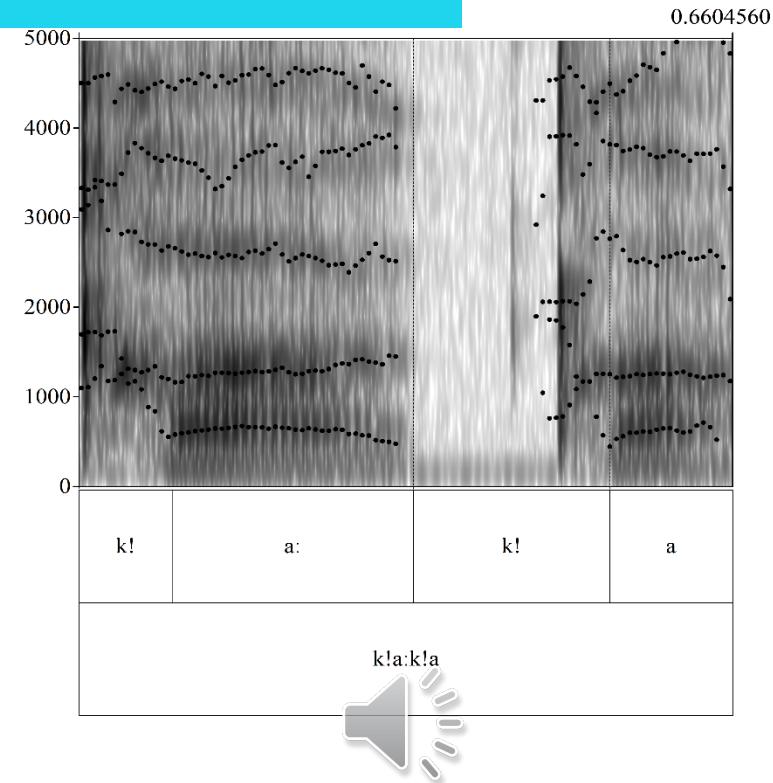
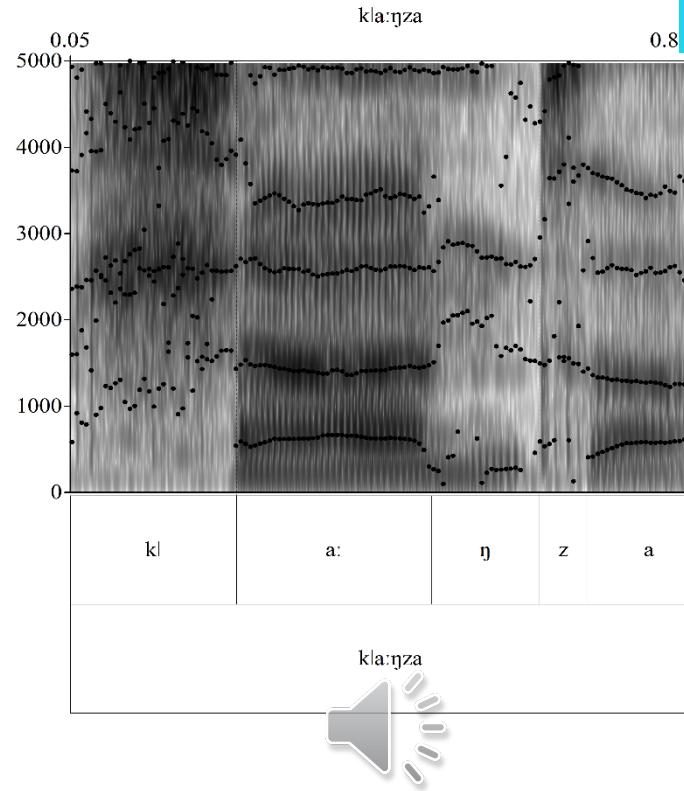
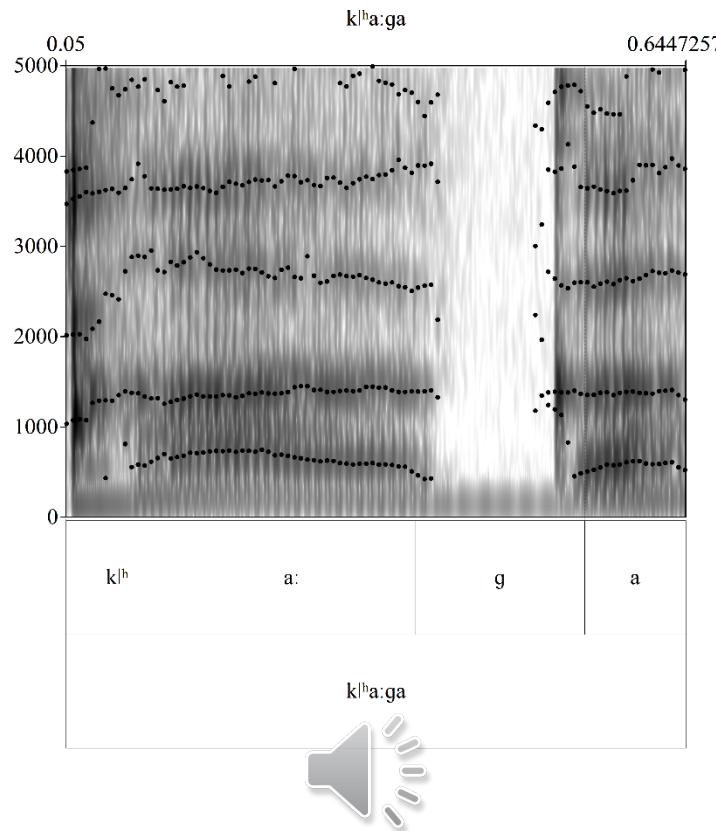
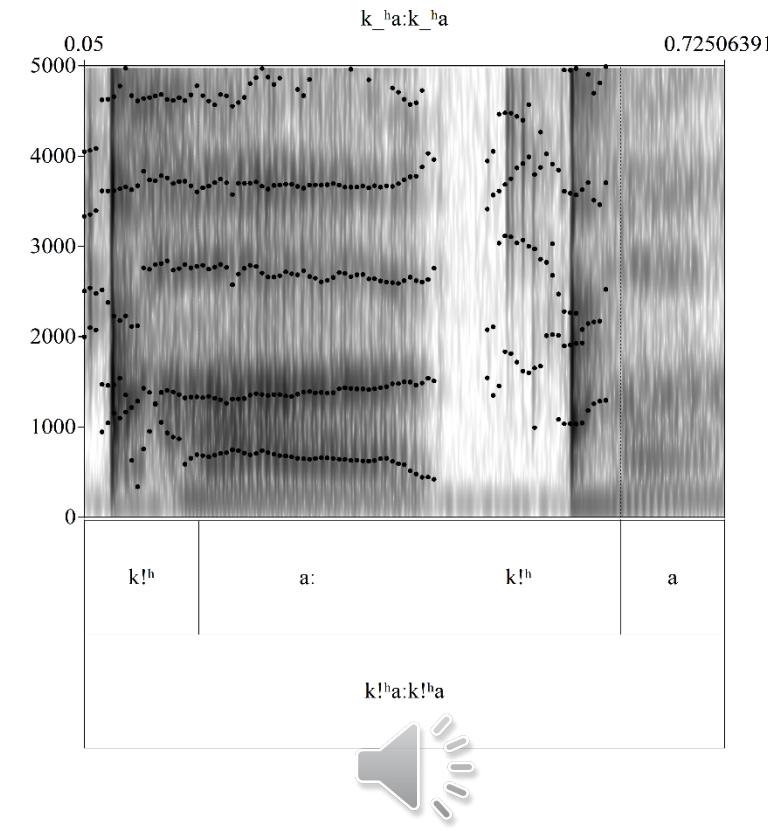


Fig. 1. Voiceless unaspirated velar plosive

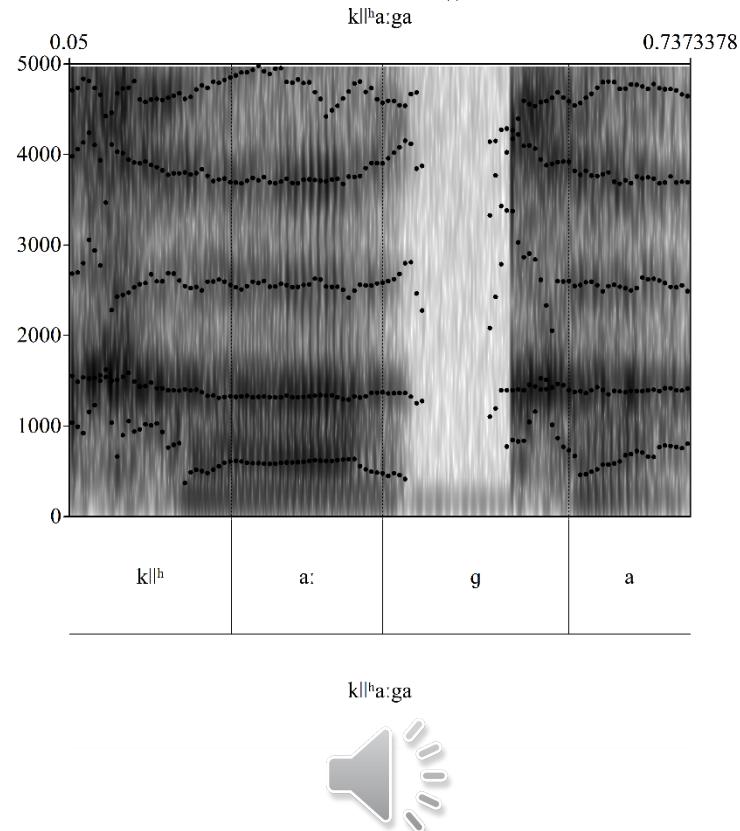
# Clicks in Zulu



Dental

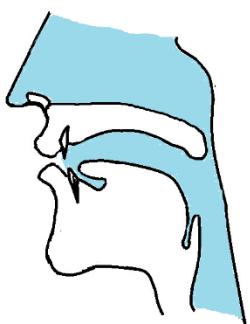


Alveopalatal

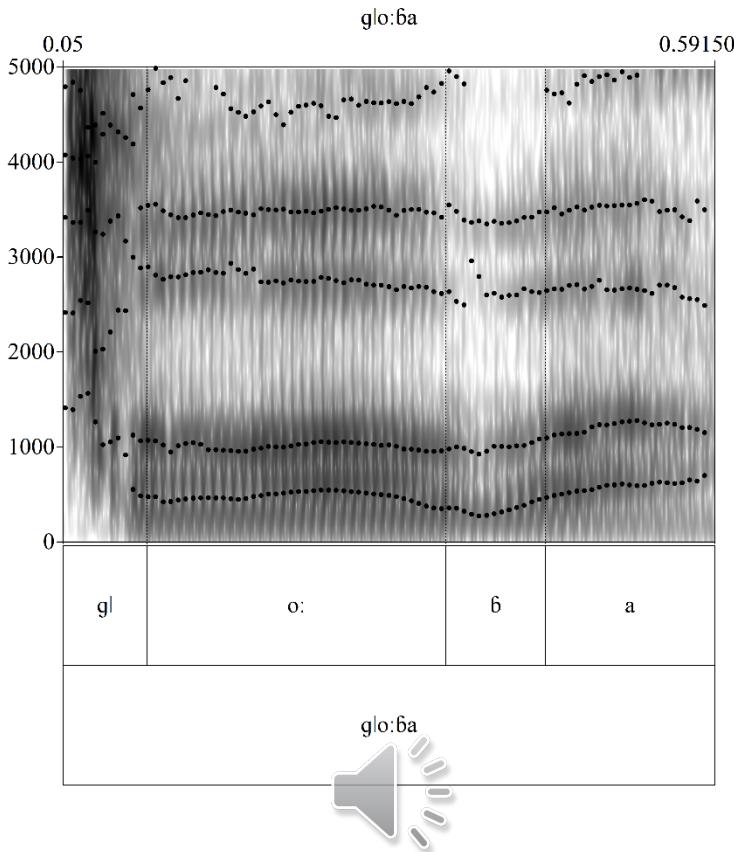


Alveolar lateral

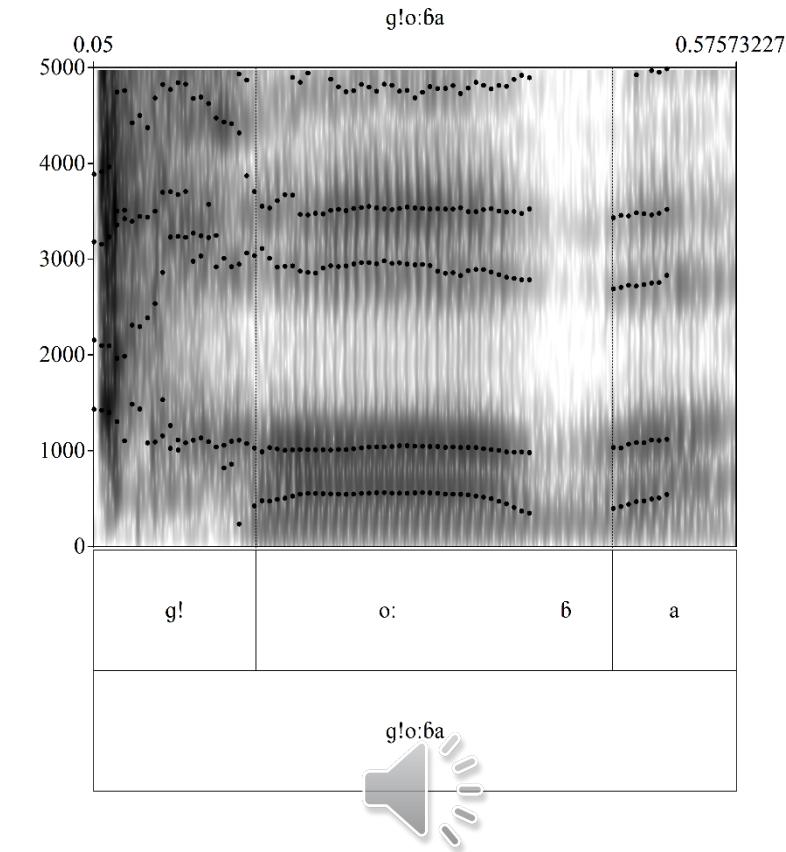
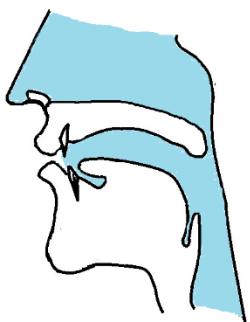
Fig. 2. Voiceless aspirated velar plosive



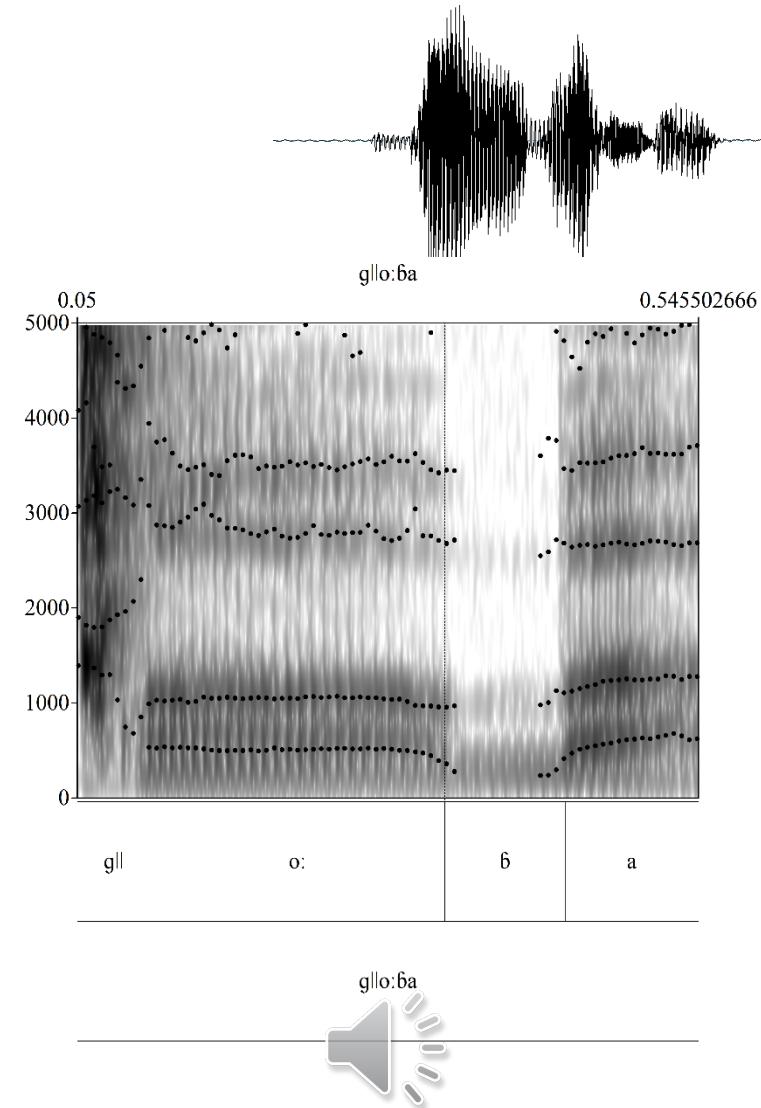
# Clicks in Zulu



Dental



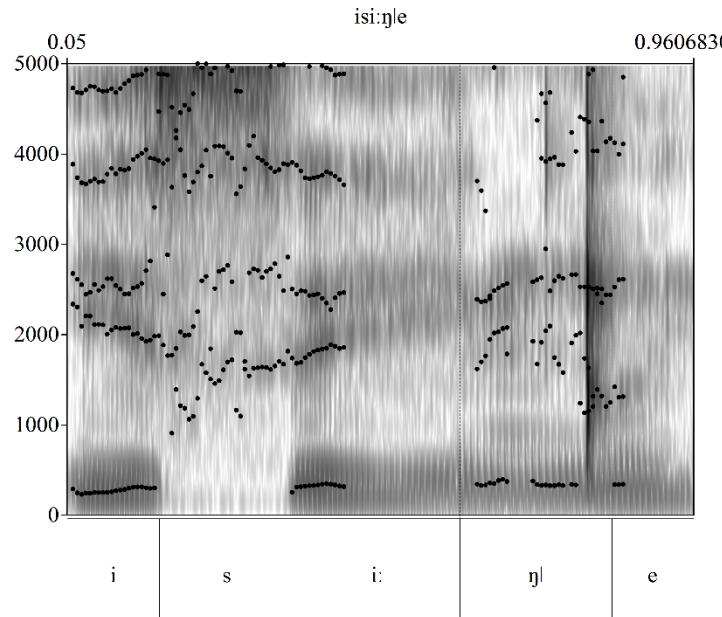
Alveopalatal



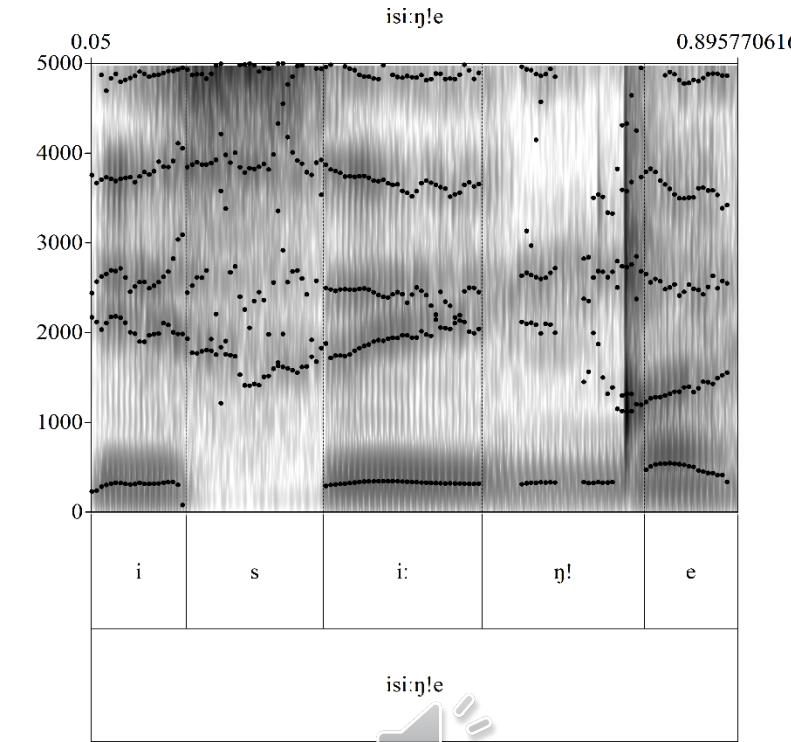
Alveolar lateral

Fig. 3. Voiced velar plosive

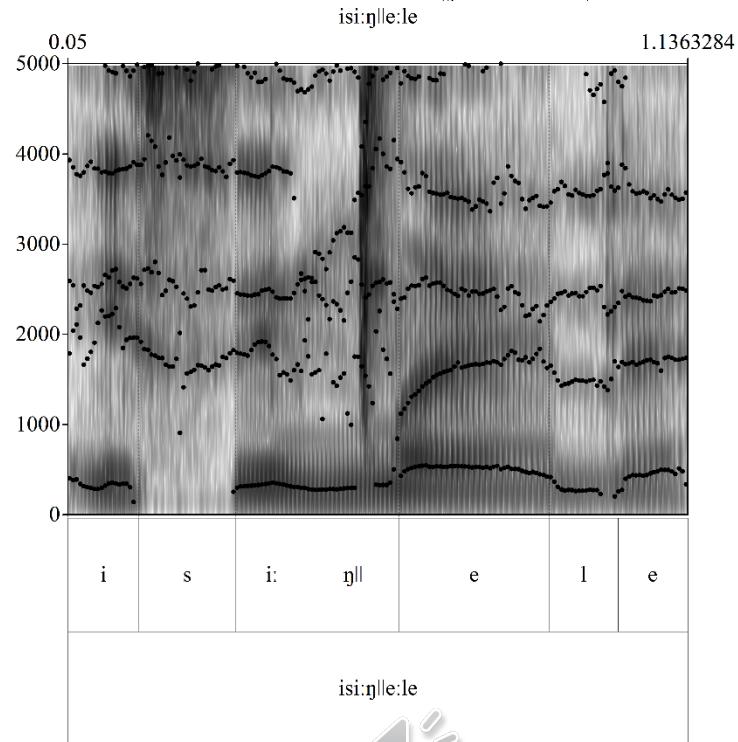
# Clicks in Zulu



Dental



Alveopalatal



Alveolar lateral

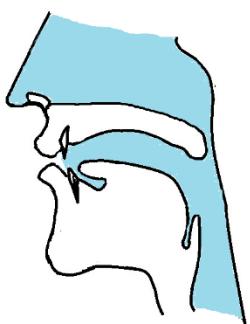
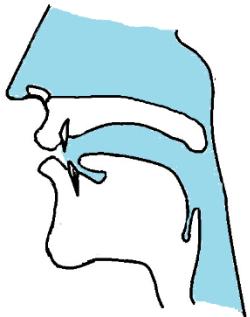
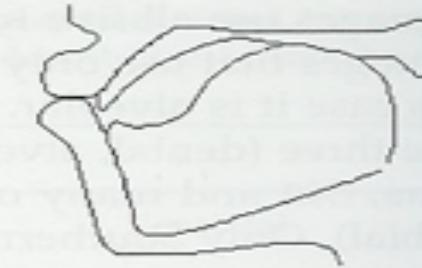
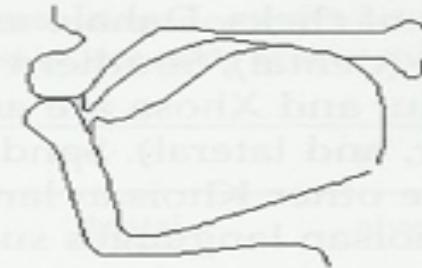


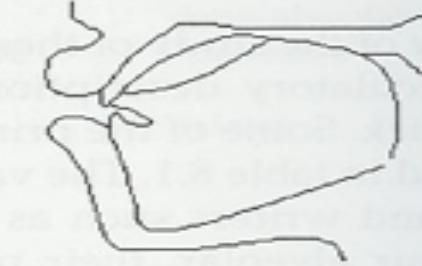
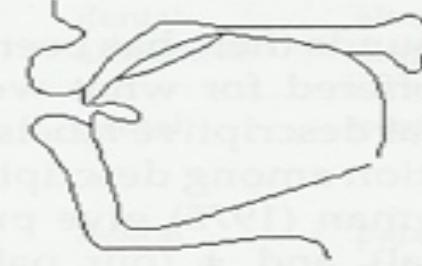
Fig. 1. Voiced velar nasal



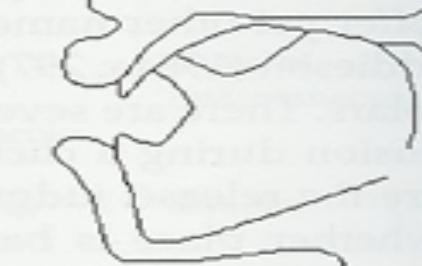
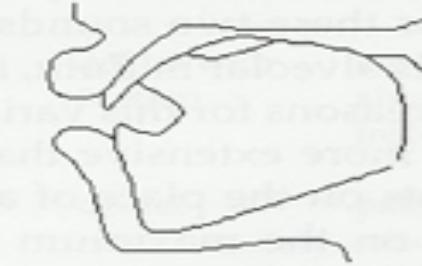
Bilabial



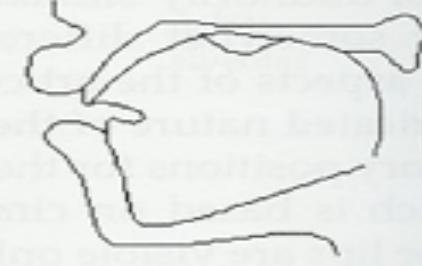
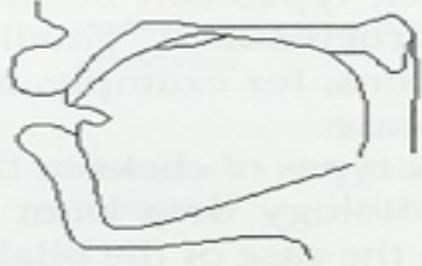
Dental



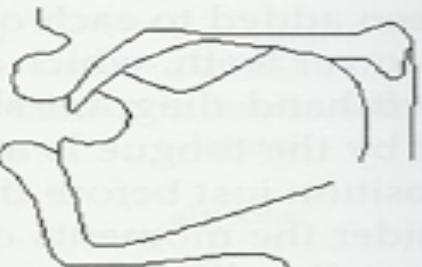
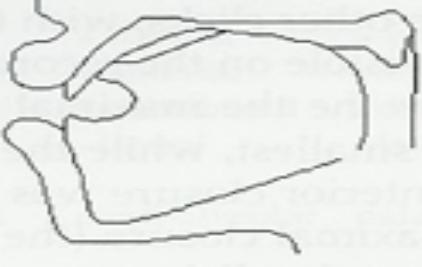
Alveolar



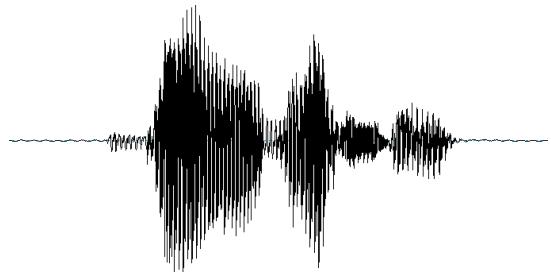
Palatal



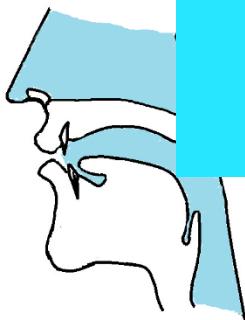
Lateral



# Glottis State



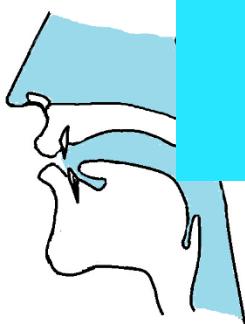
1. Voiced
2. Voiceless
3. Murmured
4. Laryngealized
5. Closed





# Part of Tongue Involved

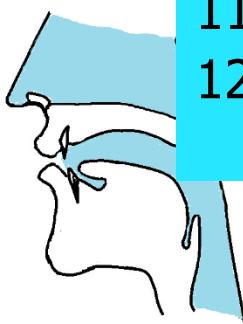
1. Apical
2. Laminal
3. Neither



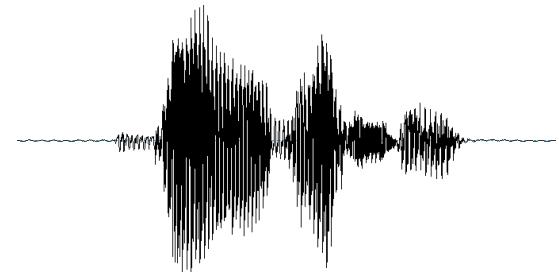
# Primary Place of Articulation



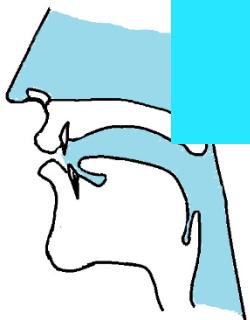
1. Bilabial
2. Labiodental
3. Dental
4. Alveolar
5. Retroflex
6. Alveopalatal
7. Palato-alveolar
8. Palatal
9. Velar
10. Uvular
11. Pharyngeal
12. (Labial-Velar)



# Manner of Articulation



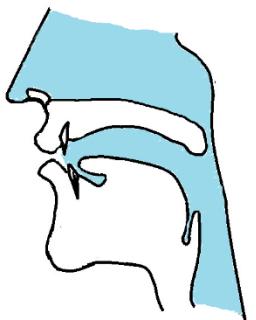
1. Stop
2. Fricative
3. Approximant
4. Trill
5. Flap
6. Tap
7. Affricate



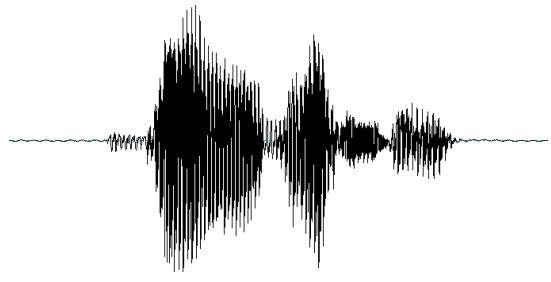
# Centrality



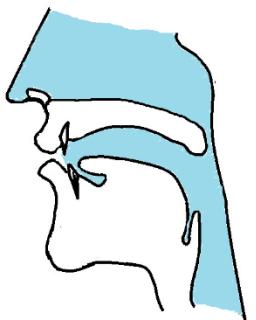
1. Central
2. Lateral

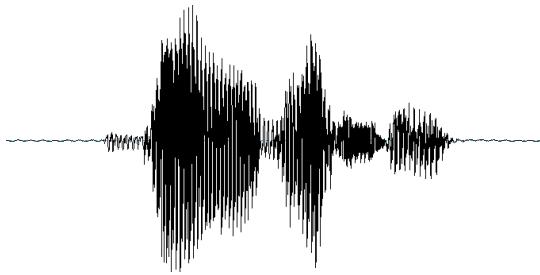


# Nasality



1. Oral
2. Nasal

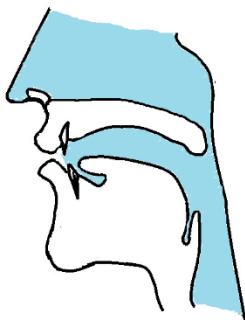




# Stops

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1. voiced	b
2. voiceless unaspirated	p
3. aspirated	p <sup>h</sup>
4. murmured (breathy)	b̪
5. implosive	b̚
6. laryngealized (creaky)	b̫
7. ejective	k'
8. nasal release	dn
9. prenasalized	nd
10. lateral release	tɬ
11. ejective lateral release	tɬ'
12. affricate	ts



# Nasals, stops and Fricatives



	bilabial	labiodental	dental	alveolar	retroflex	palato-alveolar	palatal	velar	uvular	pharyngeal	labial velar
<b>nasal</b>	m	nj	ŋ	n	ɳ	jn	ɳj	n			ɳm
<b>stop</b>	p b		t d	t d	t d̪	c j	k g	q G		k p g b	
<b>fricative</b>	ɸ β	f v	θ ð	s z	ʂ ʐ	ç ɬ	x ɣ	χ ʁ	ħ ʕ		





## CONSONANTS (PULMONIC)



© 2005 IPA

	Bilabial	Labiodental	Dental	Alveolar	Postalveolar	Retroflex	Palatal	Velar	Uvular	Pharyngeal	Glottal
Plosive	p b			t d		t d̪	c ɟ	k g	q ɢ		ʔ
Nasal	m	m̪		n		n̪	n̪̥	ŋ	N		
Trill	B			r					R		
Tap or Flap		v̪		f		t̪					
Fricative	ɸ β	f v̪	θ ð	s z	ʃ ʒ	s̪ z̪	ç ɟ	x ɣ	χ ʁ	h ʕ	h̪ f̪
Lateral fricative			ɬ ɭ								
Approximant		v̪		r̪		ɬ̪	j̪	w̪			
Lateral approximant			l̪			ɬ̪	ɻ̪	L̪			

Where symbols appear in pairs, the one to the right represents a voiced consonant. Shaded areas denote articulations judged impossible.

## CONSONANTS (NON-PULMONIC)

Clicks	Voiced implosives	Ejectives
ʘ Bilabial	b̪ Bilabial	’ Examples:
ǀ Dental	d̪ Dental/alveolar	p’ Bilabial
ǃ (Post)alveolar	f̪ Palatal	t’ Dental/alveolar
ǂ Palatoalveolar	g̪ Velar	k’ Velar
ǁ Alveolar lateral	G̪ Uvular	s’ Alveolar fricative

## OTHER SYMBOLS

ʍ Voiceless labial-velar fricative

w̪ Voiced labial-velar approximant

ɥ Voiced labial-palatal approximant