



Speech Science WiSe 2024/2025

Exercise 1: Classification of speech sounds

Oct 28, 2024

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Organizational matters



- Course homepage (slides and information):
 https://www.coli.uni-saarland.de/courses/speech-science/2024 WS/speech-science.html
- Do you want a Team on MSTeams for communication?

Organizational matters

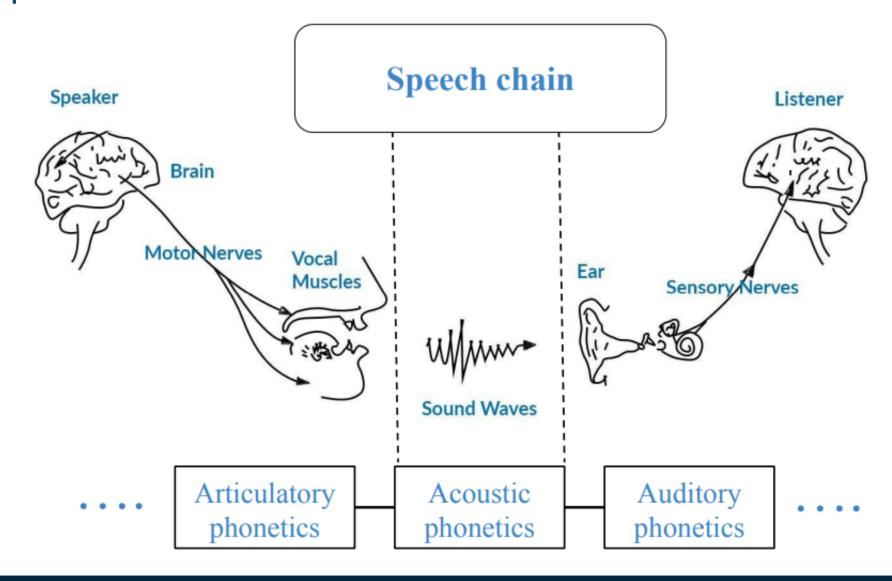


What are we here for?

- Repeat contents of lecture
- Complemented and deepened by some in-class exercises
- Time to ask questions
- Time to discuss
- Some assignments to do at home

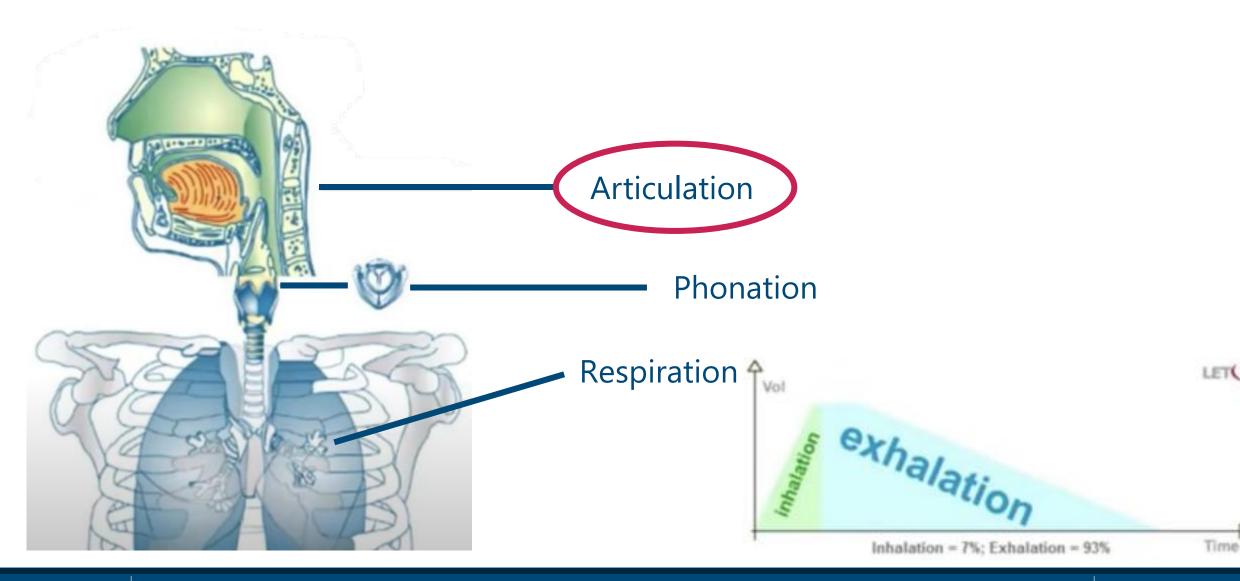
Recap: Speech science





Recap: Speech production organs





Exercise 1: Speech production organs



Match the organs with their function:

diaphragm, teeth, lungs, nasal cavity, hard palate, velum, larynx, jaw, tongue, vocal folds

Articulation

Phonation

Respiration



Exercise 1: Speech production organs



Match the organs with their function:

diaphragm, teeth, lungs, nasal cavity, hard palate, velum, larynx, jaw, tongue, vocal folds

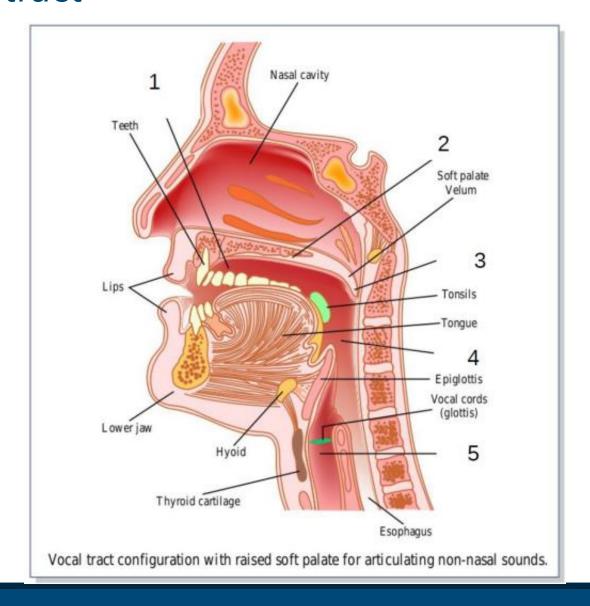
Articulation teeth, nasal cavity, hard palate, velum, jaw, tongue

Phonation vocal folds, larynx

Respiration diaphragm, lungs, nasal cavity

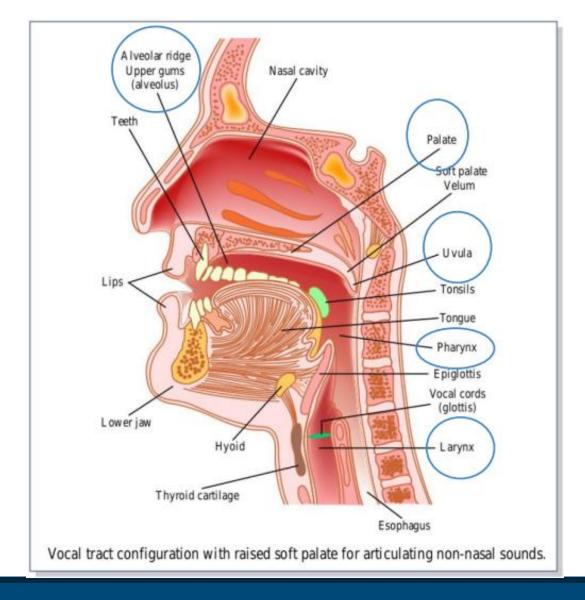
Exercise 2: Vocal tract





Exercise 2: Vocal tract

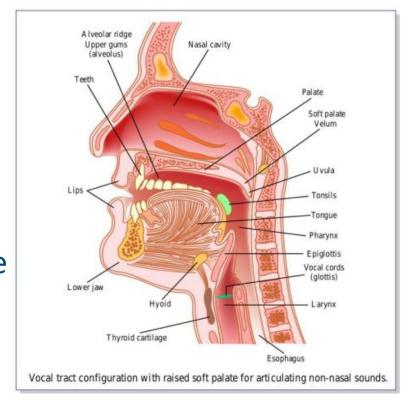




Active vs. passive articulators

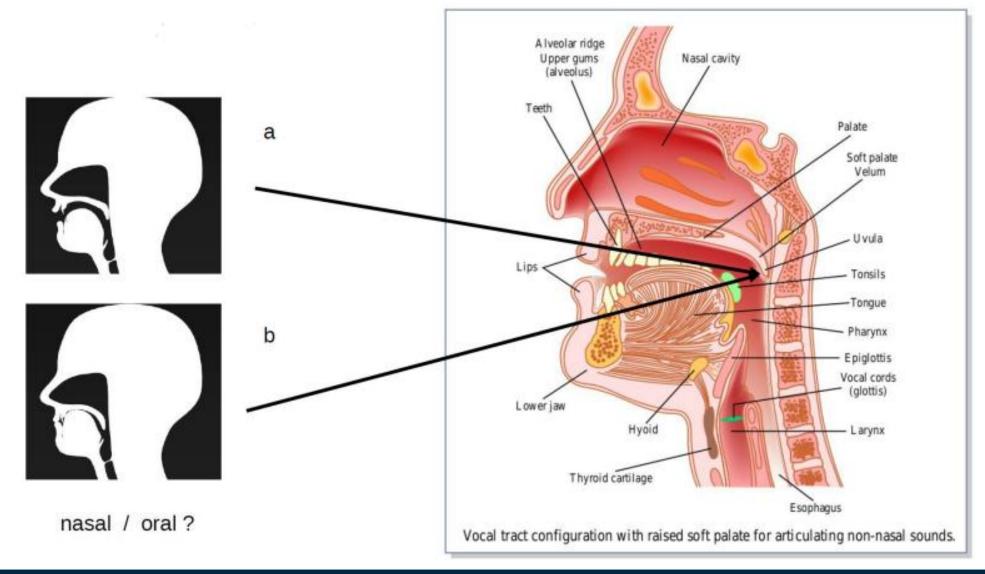


- Constriction between active articulator and passive articulator
- Active articulators: organ of your vocal tract that actively moves towards a passive articulator: lower lip and the tongue
- Passive articulators: remains stationary,
 place of articulation (i.e. velum)



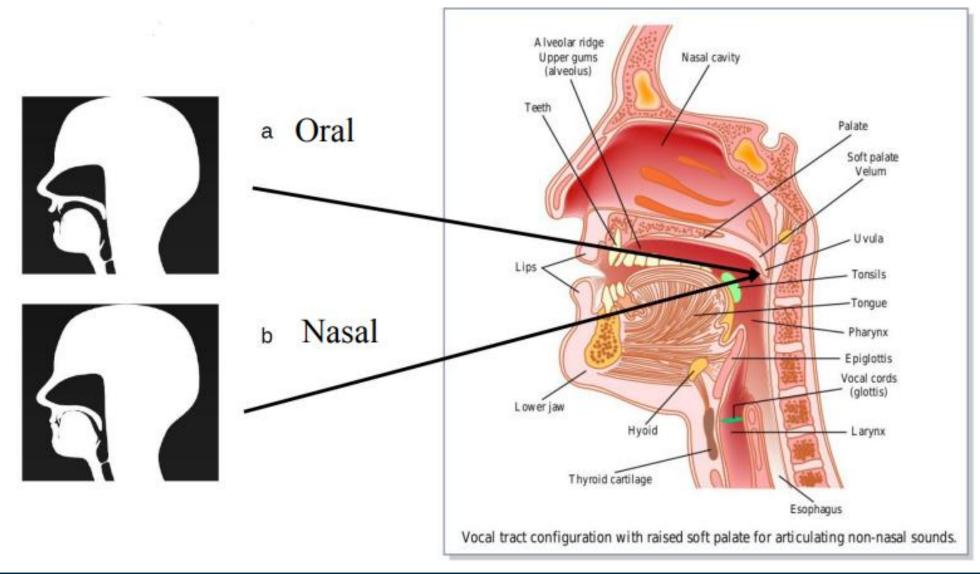
Exercise 3: Vocal tract





Exercise 3: Vocal tract





30.10.2024 Fußzeile 12



Classification of speech sounds

Types of speech sounds



Consonants

Vowels



- IPA = International Phonetic Association
- Established 1886 in Paris
- Aim: universal classification system for all speech sounds
- Aim: universal phonetic alphabet, to describe all speech sounds of all languages
- most recent revision: alphabet: 2020



www.internationalphoneticassociation.org

L Alphabet

L, Full IPA Chart L, IPA Kiel (2015)

THE INTERNATIONAL PHONETIC ALPHABET (revised to 2015)

CONSONANT	S (PULM	ONIC)													0	2015	IP.A
	Bilabial	Labiodental	Dental	Alveolar	Postalveolar	Retr	oflex	Pal	atal	Ve	lar	Uv	ular	Phary	mgeal	Ole	ottal
Plotive	рb			t d		t	þ	С	J	k	g	q	G			3	
Naval	m	m		n			η		ŋ		ŋ		N				
Trill	В			r									\mathbf{R}				
Tap or Flap		V		ſ			t										
Fricative	φβ	f v	θð	s z	∫ 3	ş	Z,	ç	j	Х	Y	χ	R	ħ	ſ	h	ĥ
Lateral fricative				1 k	•												
Approximant		υ		I			ŀ		j		щ						
Lateral approximant				1			l		Á		L						

ateral pproximant				1			l	T	Á		L	,					
Sy	mbols to th	e right in a	cell are voi	ed, to t	he left	are voi	iceless. Sh	ade	d areas	deno	ote arti	oul	ations judg	ed imp	ossibl	е.	
ONSONANT	S (NON-PU	JLMONIC)					vo	WE	LS								
Clicks	V	oiced implo	ivea	Eject	iveo					ont			Centro				Baok
Bilabial	6	Bilabial	,	Examp	les:		Cle	ope	1•	Vy-		_	— + • મ	ı —		ш	† ^u
Dental	ď	Dental/alveo	lar p'	Bilabia	1					/	1 1	(\		υ		
. (Post)alveol	ar f	Palatal	ť'	Dental/	alveolar		Cle	000-1	mid	6	0	_	—-9	•е-		-γ	O
Palatoalveol	ar g	Velar	k'	Velar								\		ခု			
Alveolar late	eral G	Uvular	s'	Alveol	ar fricati	ive	Op	en-n	nid			6)	$^{\circ}$	3∤3	_	-Λ	† O
THE	2010												æ	g			
THER SYME			_				Op	en					a • c	E —		- a	Ð
N Voiceless la		,	Z Alveolo								When to the	e sy	mbols app ht represer	ear in p	aire, fi inded	he on vowe	î.
Voiced labia			Voiced		r								•				
Voiced labia	al-palatal app	roximant Ŋ	Simulta	neous	and	X					S		RASEOMI		3		
H Voiceless eg	piglottal fricat	tive Af	fricates and	louble a	rticulatio	ons	_					•	Primary of	reco	for	mə ^l t	ıslıı
Voiced epig	lottal fricativ		n be represen				ts k	p				ı	Secondary	atress			
P Epiglottal pl	losive	joi	ned by a tie	oar if ne	cessary.							I	Long	e:			
onimico									ñ			•	Half-long	e'			
NACRITICS				_				e.g.		\neg		•	Extra-shor	ŧĕ			
Voiceless	0	5	athy voiced	b	a		ental		ţ d	4			Minor (fo	ot) grou	P		
Voiced	§ !	v ~	aky voiced	Ď	a		otcal		ţ d	_			Major (int	onation) grou	ip.	
h Aspirated	th (~	guolabial	ţ	ĝ	n La	minal		ţ d	_			Syllable b	reak	лi.a	ekt	
More rounds	ed 🤉	W Lab	ialized	tw	dw	~ Na	isalized		ẽ	╛		J	Linking (a	bsence	of a b	reak))
Less rounde	d 🤉	J Pak	stalized	tj	\mathbf{d}^{j}	n _{Na}	isal release		d	_		Т	ONES AN	D WO	ED A	CCEN	NTS
Advanced	ų	Y Vel	arized	tΥ	\mathbf{d}^{Y}	l La	teral releas	е	d				LEVEL		cc	ONTO	UR
Retracted	<u>e</u>	Υ Pha	ryngealized	ť٩	$\mathbf{d}_{\mathbb{S}}$	No.	audible re	lease	d	1		ế	or 7 Extr	a i	ě or	∕l B	Rising
Centralized	ë	~ Vel	arized or pha	ryngeali	zed	ł						é	Hig		ê		alling
Mid-centrali	ized Ě	Rai	sed	ę	(<u>I</u> = ;	voiced a	lveolar fric	ative	:)			ē è	Mid		ĕ		ligh ising ow
Syllabic	ņ	Lov	vered	ę	<u>(β</u> = ·	voiced b	oilabial appr	roxir	nant)			e 2	Low		è è	A F	ising Rising-
Non-syllabic	ę	Adv	anced Tongs	e Root	ę							ļ	→ low Downstep		e ZGI		alling ise
Rhoticity	ar i	a∿ Ret	racted Tongu	e Root	e					╗		†	Linsten		S GI	obal fi	all





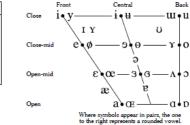
	Bilabial	Labiodental	Dental	Alveolar	Postalveolar	Retr	oflex	Palatal	Velar	Uvular	Pharyn	geal	Olo	ttal
Plosive	рb			t d		t	þ	СЭ	k g	q G			3	
Naval	m	m		n			η	ŋ	ŋ	N				
Trill	В			r						R				
Tap or Flap		V		r			t							
Fricative	φβ	f v	θð	s z	∫ 3	ş	Z,	çj	ху	χк	ħ	r	h	ĥ
Lateral fricative				ł										
Approximant		υ		I			ŀ	j	щ					
Lateral approximant				1			l	Ý	L					

Symbols to the right in a cell are voiced, to the left are voiceless. Shaded areas denote articulations judged impossible.

VOWELS

CONSONANTS (NON-PULMONIC)

Clieku	Voiced implosives	Ejectives
O Bilabial	6 Bilabial	Examples:
Dental	d Dental/alveolar	p' Bilabial
(Post)alveolar	f Palatal	t' Dental/alveolar
‡ Palatoalveolar	g Velar	k' Velar
Alveolar lateral	G Uvular	S' Alveolar fricative



OTHER SYMBOLS

M Voiceless labial-velar fricative	ÇZ	Alveolo-palatal	fricatives
W Voiced labial-velar approximant	Ţ	Voiced alveolar	lateral fl
U Voiced labial-palatal approximant	ĥ	Simultaneous	and 2

H Voiceless epiglottal fricative

th dh

ə∘a•

Voiced epiglottal fricative

Voiced

Aspirated .

More rounded

Less rounded Advanced

Retracted

Centralized Mid-centralized Č

Syllabic

Non-syllabic

Affricates and double articulations can be represented by two symbols ts kp joined by a tie bar if necessary. 2 Epiglottal plosive

DIACRITICS Some discritics may be placed above a symbol with a descender, e.g. 1]

Creaky voiced

Y Pharyngealized t Y d Y

~ Velarized or pharyngealized

Advanced Tongue Root | e

Retracted Tongue Root e

Linguolabial

W Labialized

j Palatalized

Lowered



Laminal

n Nasal release

SUPRASEOMENTALS

-	Primary of	reas	founs tr[sn
	Secondary	stress	reeste ajen
•	Lone	e:	

' Half-long C'

. Syllable break .ri.ækt

Linking (absence of a break)

TONES AND W	ORD ACCENTS
LEVEL	CONTOUR
ể or 7 Extra	ě or ∕ Rising
é ∃ High	ê V Falling
ē ⊢ Mid	ĕ 1 High rising
è 1 Low	è ⊿ Low rising
ề ⊿ Extra	ề ↑ Rising-
↓ Downstep	Global rise
† _{Upstep}	

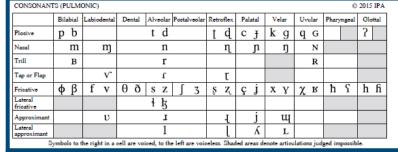
e (I = voiced alveolar fricative)

 $e (\underline{\beta} = \text{voiced bilabial approximant})$

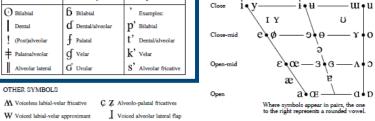


Consonants

THE INTERNATIONAL PHONETIC ALPHABET (revised to 2015)



CONSONANTS (NO	N-PULMONIC)	
Clieku	Voiced implosives	Ejectives
O Bilabial	6 Bilabial	, Examples:
Dental	d Dental/alveolar	p' Bilabial
(Post)alveolar	f Palatal	t' Dental/alveolar
+ Palatoalveolar	g Velar	k' Velar
Alveolar lateral	G Uvular	S' Alveolar fricative



VOWELS

W Voiced labial-velar approxima	ant Voiced alveolar lateral flap
U Voiced labial-palatal approxim	nant $\hat{\mathbf{h}}$ Simultaneous \mathbf{h} and \mathbf{x}
H Voiceless epiglottal fricative	Affricates and double articulations
Voiced epiglottal fricative	can be represented by two symbols
2	joined by a tie bar if necessary.

P Epiglottal plosive



DIACRITICS Some discritics may be placed above a symbol with a descender, e.g. $\tilde{\Pi}$

	Voiceless	ņ	d	Breathy voi	ced b	a	Dental t	d
Ų	Voiced	ş	ţ	Creaky voic	ed b	a	Apical L	d
h	Aspirated	ťh	d^{h}	Linguolabia	ı ţ	ģ	Laminal t	d
,	More rounded	ş		W Labialized	tw	\mathbf{d}^{w}	Nasalized	ẽ
,	Less rounded	ş		j Palatalized	t ^j	\mathbf{d}^{j}	n Nasal release	d^{n}
	Advanced	ų		Y Velarized	t ^y	\mathbf{d}^{Y}	l Lateral release	d^{l}
_	Retracted	<u>e</u>		S Pharyngeal	ized t^{ς}	d٩	No audible release	ď
••	Centralized	ë		~ Velarized o	r pharyngealiz	red	ł	
×	Mid-centralized	ě		Raised	ę	<u> </u>	voiced alveolar fricative)	
,	Syllabic	ņ		Lowered	ę (<u>β</u> =	voiced bilabial approxima	nt)
_	Non-syllabic	ĕ		Advanced 7	Tongue Root	ę	·	
r	Rhoticity	æ	a	Retracted T	ongue Root	ę		



founa tr[an Long

Minor (foot) group Major (intonation) group

. Syllable break .ri.ækt Linking (absence of a break)

TONES AND WORD ACCENTS



Non-pulmonic:

- Ingressive or
 egressive airstream
 originating in
 velum, glottis
- 18% of languages*

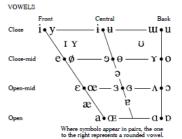
Symbols t	to the right in a cell are	voiced, to the left are voi	De.
CONSONANTS (NON	N-PULMONIC)		1
Clicks	Voiced implosives	Ejectives	
O Bilabial	6 Bilabial	, Examples:	
Dental	d Dental/alveolar	p' Bilabial	
! (Post)alveolar	f Palatal	t' Dental/alveolar	
+ Palatoalveolar	g Velar	k' velar	
Alveolar lateral	G Uvular	S' Alveolar fricative	
OTHER SYMBOLS			
M Voiceless labial-vela	r fricative Ç Z Al-	veolo-palatal fricatives	
W Voiced labial-velar a	pproximant I vo	oiced alveolar lateral flap	
U Voiced labial-palatal	approximant f Sir	multaneous \int and X	

H Voiceless epiglottal fricative

2 Epiglottal plosive

0	Voiceless	ņ	ģ		Breathy voiced	þ	a	Dental t d	l
	Voiced	ş	ţ	~	Creaky voiced	ģ	a	Apical t d	ļ
h	Aspirated	th	d^{h}	_	Linguolabial	ţ	ģ	Laminal t d	1
,	More rounded	Ş		w	Labialized	tw	dw	~ Nasalized ~ ~ ~	Ś
	Less rounded	ç		j	Palatalized	tj	\mathbf{d}^{j}	n Nasal release	ŀ
	Advanced	ų		¥	Velarized	tY	d^{γ}	l Lateral release d	-
_	Retracted	e		٢	Pharyngealized	t٩	d٩	No audible release	ľ
••	Centralized	ë		~	Velarized or phar	yngeali	zed	ł	
×	Mid-centralized	ě			Raised	ę	(<u>I</u> =	voiced alveolar fricative)	
,	Syllabic	ņ		_	Lowered	ę	<u>(β</u> =	voiced bilabial approximant)	
_	Non-syllabic	ě		4	Advanced Tongu	e Root	ę	·	
r	Rhoticity	ð	a		Retracted Tongue	Root	e		

Affricates and double articulations can be represented by two symbols joined by a tie bar if necessary.



SUPRASEOMENTALS

Primary stress	founə tı [ən
Secondary stre	
! Long	ei
' Half-long (e'
Extra-short (ĕ
Minor (foot) g	roup
Major (intonat	ion) group
. Syllable break	.ri.ækt
_ Linking (above	ce of a break)
TONES AND W	ORD ACCENTS
LEVEL	CONTOUR
ể or ☐ Extra	ě or / Rising
é ∃ High	ê √ Falling
ē ⊢ Mid	ĕ 1 High rising
è ⊣ Low	e A Low rising
ề ⊿ Extra	ề ↑ Rising- falling
↓ Downstep	→ Global rise
† Unsten	Clobal fall Cloba

Typetaces: Doulos Sil. (metatext); Doulos Sil., IPA Kiel, IPA LS Uni (symt



Pulmonic:

Egressive airstream originating in lungs

*https://wals.info

Classification of speech sounds: Consonants



What are the main characteristics of consonants?

- The airstream is blocked by an "obstacle" in the vocal tract
- A consonant (usually) does not appear in the nucleus of a syllable

How to characterize consonants?



3 main categories:

- 1. Place of articulation
- 2. Manner of articulation
- 3. Voicing

How to characterize consonants?

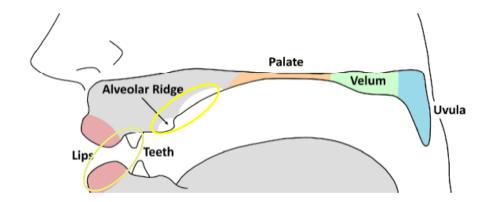






Consonants





THE INTERNATIONAL PHONETIC ALPHABET (revised to 2015)

CONSONANTS (PULMONIC)

© 2015 IPA

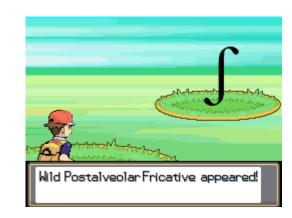
	Bilabial	Labiodental	Dental	Alveolar Postalveolar	Retroflex	Palatal	Velar	Uvular	Pharyngeal	Glottal
Plosive	p b			t d	t d	С Ј	k g	q G		3
Nasal	m	m		n	η	ŋ	ŋ	N	·	
Trill	В			r				R		
Tap or Flap		V		ſ	t					
Fricative	φβ	f v	θδ	s z ∫ 3	Ş Z	çj	хγ	χк	ħΥ	h fi
Lateral fricative				1 b						
Approximant		υ		Ţ	ŀ	j	щ			
Lateral approximant				1	l	λ	L			

Gotta catch 'em all! (Consonants!)



Can we collect all consonants (of Standard American English) by transcribing our names?





	Bilabial	Labiodental	Dental	Alveolar	Postalveolar	Retroflex	Palatal	Velar	Uvular	Pharyngeal	Glottal
Plosive	p b			t d				k g			
Nasal	m			n				ŋ			
Trill				r							
Tap or Flap											
Fricative		f v	θδ	S Z	∫ 3						h
Lateral fricative											
Approximant				Ţ			j	w			
Lateral approximant				1							

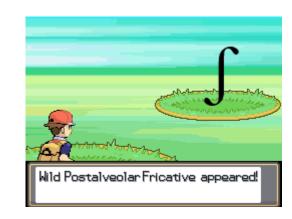
24

Gotta catch 'em all! (Consonants!)



Can we collect all consonants
(of Standard American English)
by transcribing our names?





	Bilabial	Labiodental	Dental	Alveolar	Postalveolar	Retroflex	Palatal	Velar	Uvular	Pharyngeal	Glottal
Plosive											
Nasal											
Trill											
Tap or Flap											
Fricative											
Lateral fricative											
Approximant											
Lateral approximant											



								_													
	Bila	abial	Labio	dental	Der	ntal	Alveola	г	Postalveolar	Retr	oflex	Pal	atal	Ve	lar	Uv	ular	Phary	mgeal	Olo	ttal
Plosive	p	b					t d			t	þ	С	Ŧ	k	g	q	G			3	
Naval		m		m			n				η		ŋ		ŋ		N				
Trill		В					r										\mathbf{R}				
Tap or Flap				V			ſ				τ										
Fricative	ф	β	f	v	θ	ð	s z	I	∫ 3	ş	Z,	ç	j	х	Y	χ	R	ħ	ſ	h	ĥ
Lateral fricative							łţ														
Approximant				υ			1				ŀ		j		щ						
Lateral approximant							1				l		λ		L						

Symbols to the right in a cell are voiced, to the left are voiceless. Shaded areas denote articulations judged impossible.

CONSONANTS (NON-PULMONIC)

CONSONANTS (PULMONIC)

Clieku	Voiced implosives	Ejectives
O Bilabial	6 Bilabial	Examples:
Dental	d Dental/alveolar	p' Bilabial
. (Post)alveolar	f Palatal	t' Dental/alveolar
+ Palatoalveolar	g Velar	k' Velar
Alveolar lateral	G Uvular	S' Alveolar fricative

C+A-8/8-0/3

VOWELS

OTHER SYMBOLS

M Voiceless labial-velar fricative C Z Alveolo-palatal fricatives U Voiced labial-palatal approximant f Simultaneous and X

H Voiceless epiglottal fricative

Voiced epiglottal fricative PEpiglottal plosive

Affricates and double articulations can be represented by two symbols ts kp joined by a tie bar if necessary.

DIACRITICS Some discritics may be placed above a symbol with a descender, e.g. $\tilde{\Pi}$

0	Voiceless	ņ d	Breathy voiced b a Dental t	ď
~	Voiced	şţ	_ Creaky voiced b a Apical t	d
h	Aspirated	th dh	Linguolabial t d Laminal t	d
,	More rounded	ş	w Labialized tw dw ~ Nasalized	ẽ
	Less rounded	ę	j Palatalized tj dj n Nasal release	d^{n}
	Advanced	ų	Y Velarized t Y d Y 1 Lateral release	d^{l}
_	Retracted	<u>e</u>	Pharyngealized t d No audible release	ď
	Centralized	ë	~ Velarized or pharyngealized 1	
×	Mid-centralized	ě	Raised Q (I = voiced alveolar fricative)	
-	Syllabic	ņ	Lowered $e (\beta = \text{voiced bilabial approximan})$	nt)
	Non-syllabic	ě	Advanced Tongue Root &	
r	Rhoticity	ъa	Retracted Tongue Root P	

Vowels

© 2015 IPA

— **ш** • u υ

foune tr[en

Where symbols appear in pairs, the one to the right represents a rounded vowel.

SUPRASEOMENTALS Primary stress

Extra-short Č Minor (foot) group Major (intonation) group . Syllable break .ri.ækt Linking (absence of a break) TONES AND WORD ACCENTS

Long ' Half-long C'

UNIVERSITÄT

Classification of speech sounds: Vowels



What are the main characteristics of vowels?

- The airstream is **not** blocked in the vocal tract
- The vocal folds are vibrating during the production of vowels =
 phonation
- A vowel (usually) appears as the nucleus of a syllable

How to characterize vowels?

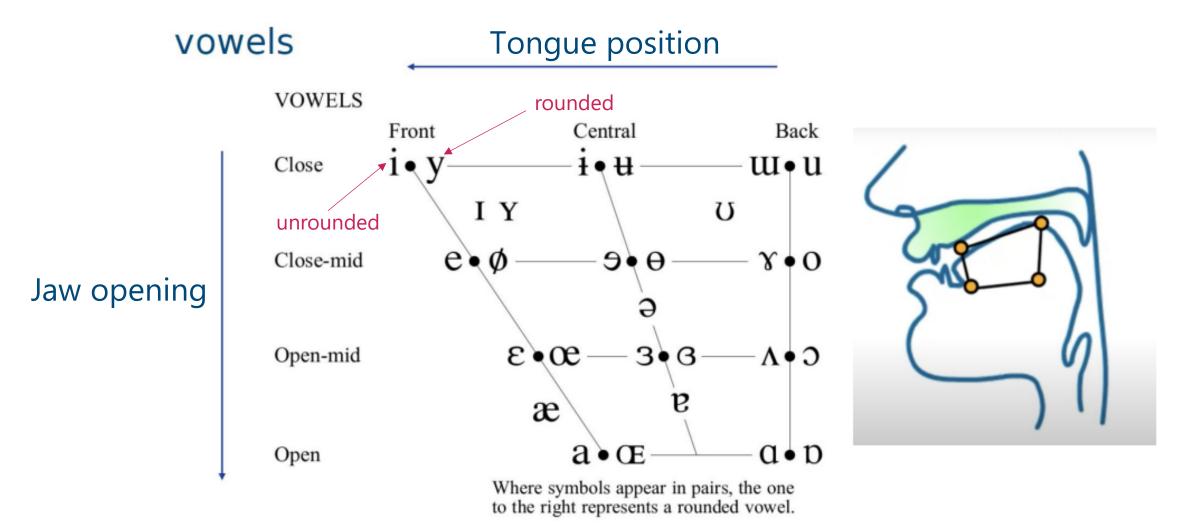


3 main categories:

- 1. Tongue position (front vs. back)
- 2. Jaw opening (open vs. closed)
- 3. Lip rounding (rounded vs. unrounded)

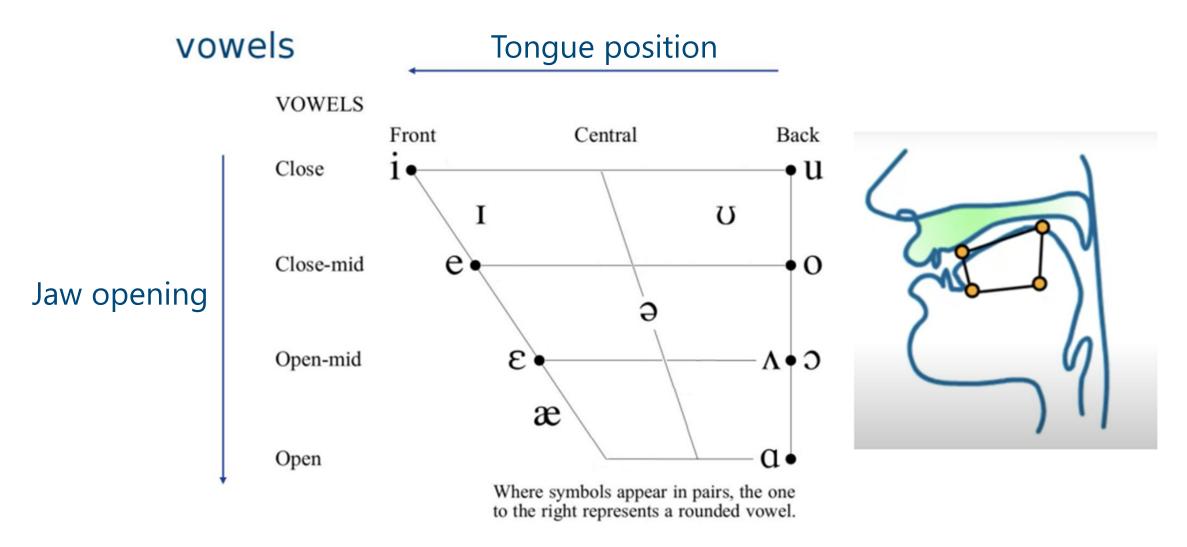
IPA: Vowels





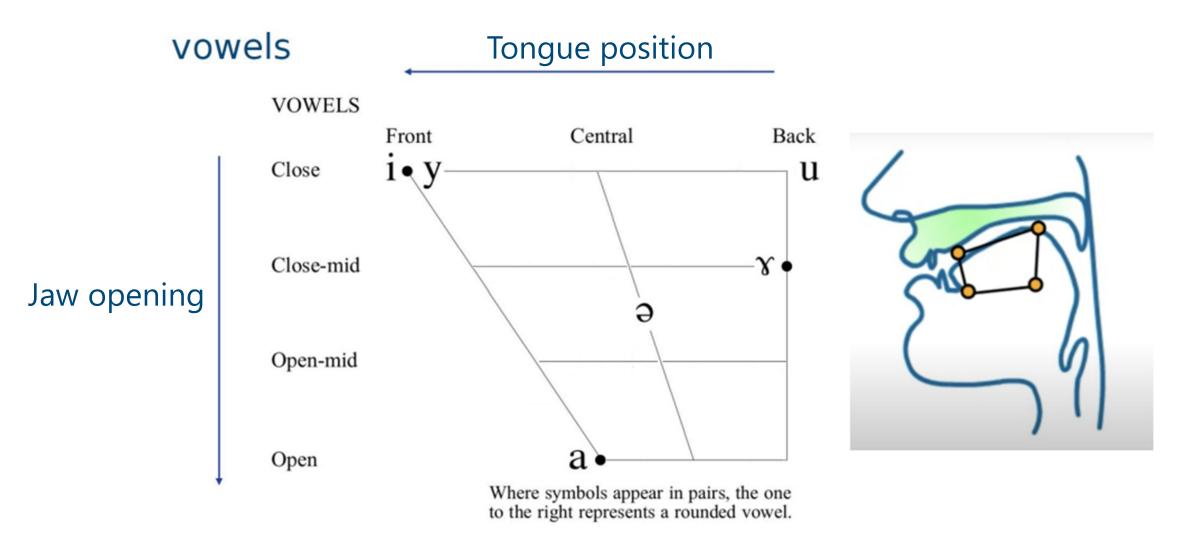
IPA: Vowels in Standard American English





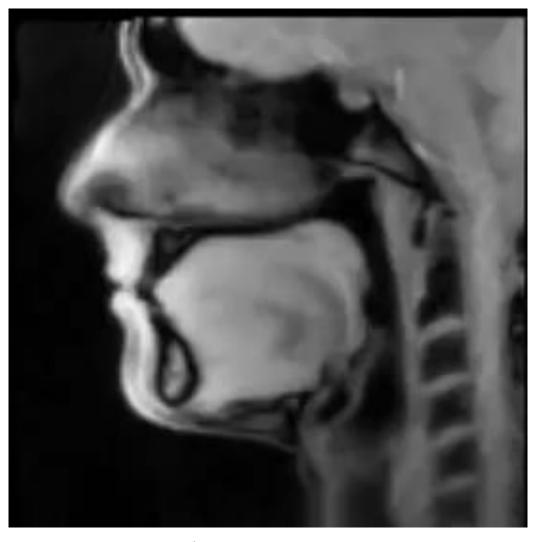
IPA: Vowels in Mandarin





Real time MRI video: Speaking



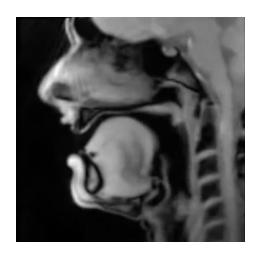


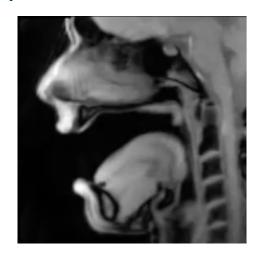
www.youtube.com/watch?v=6dAEE7FYQfc&t=31s

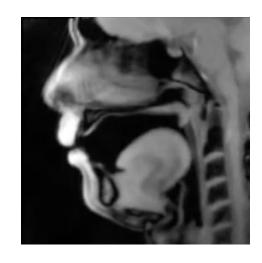
Exercise: Vowels

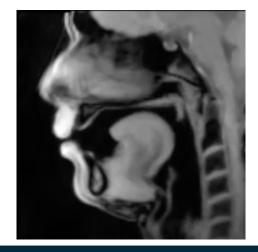


Which vowels are being produced here?





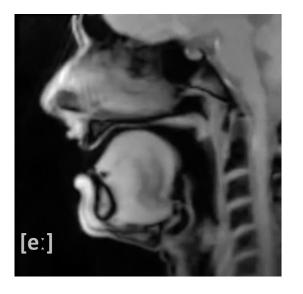


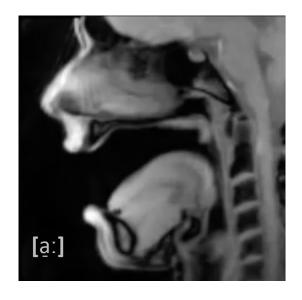


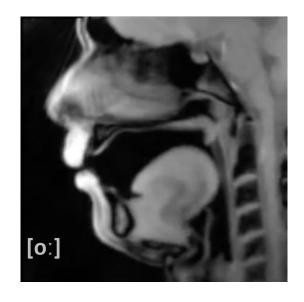


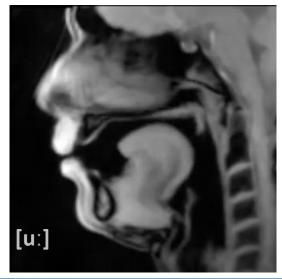
Exercise: Vowels

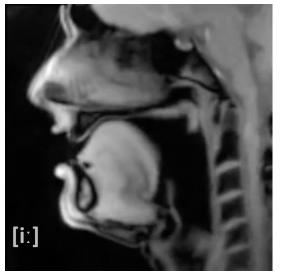












SUPRASEGMENTALS

Primary stress

founə tı∫ən

Secondary stress

Long

Half-long

Extra-short

Minor (foot) group

Major (intonation) group

.ii.ækt Syllable break

Linking (absence of a break)

THE INTERNATIONAL PHONETIC ALPHABET (revised to 2015)

CONSONANTS (PULMONIC)



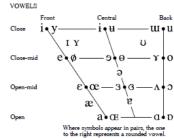


	Bilabial	Labiodental	Dental	Alveolar	Postalveolar	Retro	flex	Palatal	Velar	Uvular	Phary	ngeal	Olo	ttal
Plosive	рb			t d		t	þ	СЭ	k g	q G			3	
Nasal	m	m		n			η	ŋ	ŋ	N				
Trill	В			r						R				
Tap or Flap		V		ſ			t							
Fricative	φβ	f v	θð	s z	∫ 3	ş	Z,	çj	ху	χв	ħ	ſ	h	ĥ
Lateral fricative				ł <u> </u>										
Approximant		υ		1			-Į	j	щ					
Lateral approximant				1			l	ý	L					

Symbols to the right in a cell are voiced, to the left are voiceless. Shaded areas denote articulations judged impossible.

CONSONANTS (NON-PULMONIC)

Clicks	Voiced implosives	Ejectives
O Bilabial	6 Bilabial	Examples:
Dental	d Dental/alveolar	p' Bilabial
(Post)alveolar	f Palatal	t' Dental/alveolar
# Palatoalveolar	g Velar	k' Velar
Alveolar lateral	G Uvular	S' Alveolar fricative



OTHER SYMBOLS

OTHER STRIBOLS		Open
M Voiceless labial-velar fricative	Ç Z Alveolo-palatal fricatives	
W Voiced labial-velar approximant	Voiced alveolar lateral flap	
U Voiced labial-palatal approximant	f) Simultaneous ∫ and X	
H Voiceless epiglottal fricative	Affricates and double articulations	_
Voiced epiglottal fricative Voiced epigl	can be represented by two symbols 1S	kp
P Epiglottal plosive	joined by a tie bar if necessary.	-

SUPRASEOMENTALS
Primary stress foune tifen
Secondary stress
: Long e:
' Half-long C'
Extra-short Č
Minor (foot) group
Major (intonation) group
. Syllable break .11.ækt

DIACRITICS Some discrition may be placed above a symbol with a descender, e.g. 1)

Noticeless n d Breathy voiced b a p Dental f d Voiced § t Creaky voiced b a _ Aprical t d h Aspirated t d _ Linguolabial t d _ Laminal t d , More rounded γ W Labialized t W d Nasalized € , Less rounded γ j Palatalized t j d n Nasalizelase d , Advanced μ γ V velarized t d 1 Lateral release d
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$
Advanced μ Y Velarized t^{Y} d^{Y} 1 Lateral release d^{1}
1 1
Retractede S Pharyngealized t S d S No audible release No audible release No audible release
Centralized e ~ Velarized or pharyngealized †
Mid-centralized Č Raised Ç (I = voiced alveolar fricative)
Syllabic n Lowered e (β = voiced bilabial approximant)
Non-syllabic e Advanced Tongue Root e
~ Rhoticity ∂ a Retracted Tongue Root €

Linking (absence of a break)

TONES	AND W	VORD	ACCE	NTS
LEVE	L		CONT	DUR
ể ज∃	Extra high	ě	or /	Rising
éТ	High	ê		Fallin
ē⊣	Mid	ĕ	1	High rising
èч	Low	è	7	Low rising
Ľŝ	Extra low	ê	4	Rising
↓ Down	step	1	Global	rise
↑ Upster	,	>	Global	fall

DIACRITICS

0	Voiceless	ņ ģ	Breathy voiced b a Dental t
_	Voiced	ş ţ	Creaky voiced b a Apical t
h	Aspirated	th d	Linguolabial t d Laminal t
,	More rounded	ş	w Labialized tw dw ~ Nasalized
c	Less rounded	Ş	j Palatalized tj dj n Nasal release
+	Advanced	ų	Y Velarized t Y d Y l Lateral release
_	Retracted	e	$^{\Gamma}$ Pharyngealized t^{Γ} d^{Γ} $^{\gamma}$ No audible release
••	Centralized	ë	∼ Velarized or pharyngealized 1
×	Mid-centralized	ě	Raised Q (I = voiced alveolar fricative)
,	Syllabic	ņ	Lowered $e (\beta = \text{voiced bilabial approximant})$
^	Non-syllabic	ĕ	Advanced Tongue Root e
2	Rhoticity	a a	Retracted Tongue Root &

Some diacritics may be placed above a symbol with a descender, e.g. $\check{\mathbf{\eta}}$

THE INTERNATIONAL PHONETIC ALPHABET (revised to 2015)

CONSONANTS (PULMONIC) © 2015 IPA Bilabial Labiodental Dental Alveolar Postalveolar Retroflex Palatal Velar Uvular Pharyngeal Olottal d c j k g q G t d n \mathbf{B} Tap or Flap φβ| f v | θ δ | s z | [3 | s z | c j | x y | χ κ | μ ς | μ μ Fricative Lateral fricative Approximant Lateral λ L

Symbols to the right in a cell are voiced, to the left are voiceless. Shaded areas denote articulations judged impossible.

CONSONANTS (NON-PULMONIC)

Clicks	Voiced implosives	Ejectives					
O Bilabial	6 Bilabial	, Examples:					
Dental	d Dental/alveolar	p' Bilabial					
(Post)alveolar	f Palatal	t' Dental/alveolar					
+ Palatoalveolar	g Velar	k' Velar					
Alveolar lateral	G Uvular	S' Alveolar fricative					

OTHER SYMBOLS

M Voiceless labial-velar fricative	Ç Z Alveolo-palatal fricatives
W Voiced labial-velar approximant	J Voiced alveolar lateral flap
U Voiced labial-palatal approximant	f_j Simultaneous \int and X

H Voiceless epiglottal fricative

Affricates and double articulations Yoiced epiglottal fricative can be represented by two symbols joined by a tie bar if necessary.

th dh

ë

ņ

e

ə∙ a•

DIACRITICS Some discritics may be placed above a symbol with a descender, e.g. ¶ Breathy voiced

Creaky voiced

Linguolabial

Y Pharyngealized

Lowered

Velarized or pharyngealized

Advanced Tongue Root e

Retracted Tongue Root e

W Labialized

J Palatalized

P Epiglottal plosive

Voiced

h Aspirated

More rounded

Less rounded

Advanced

Retracted

Centralized

Syllabic

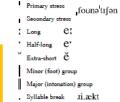
Non-syllabic

Mid-centralized \hat{e}

VOWELS Central -w•u Open-mid C+A-8+8-3+3

Where symbols appear in pairs, the one to the right represents a rounded vowel.

SUPRASEOMENTALS



Linking (absence of a break) TONES AND WORD ACCENTS

CONTOUR LEVEL ě or / Rising

Low ề ↑ Rising ↓ Downstep Global rise

↑ Upstep

e (I = voiced alveolar fricative)

 $e (\underline{\beta} = \text{voiced bilabial approximant})$

Dental

Apical

Laminal

Nasalized

n Nasal release

No audible release

a

a

tw dw

t^j d

ţ d



TONES AND WORD ACCENTS

LEVEL CONTOUR Rising Falling rising Extra Global rise Downstep Global fall

THE INTERNATIONAL PHONETIC ALPHABET (revised to 2015)

CONSONANTS (PULMONIC) © 2015 IPA

	Bilabial	Labiodental	Dental	Alveolar	Postalveolar	Retn	oflex	Palat	al	Ve	lar	Uvi	ular	Phary	ngeal	Olo	ttal
Plosive	рb			t d		t	þ	С	Ŧ	k	g	q	G			3	
Nasal	m	m		n			η		n		ŋ		N				
Trill	В			r									\mathbf{R}				
Tap or Flap		V		ſ			t										
Fricative	φβ	f v	θð	s z	∫ 3	ş	Z,	ç	j	х	Y	χ	R	ħ	ſ	h	ĥ
Lateral fricative				1 k													
Approximant		υ		Ţ			ŀ		j		щ						
Lateral approximant				1			l		λ		L						

Symbols to the right in a cell are voiced, to the left are voiceless. Shaded areas denote articulations judged impossible.

CONSONANTS (NON-PULMONIC)

	Clicks	Voiced implosives	Ejectives
0) Bilabial	6 Bilabial	Examples:
	Dental	d Dental/alveolar	p' Bilabial
!	(Post)alveolar	f Palatal	t' Dental/alveolar
#	Palatoalveolar	g Velar	k' velar
	Alveolar lateral	G Uvular	S' Alveolar fricative

OTHER SYMBOLS

	C Z Alveolo-palatal fricatives
/11 Volceless labial-velar iricalive	Aiveolo-palatai meatives
W Voiced labial-velar approximant	J Voiced alveolar lateral flap
U Voiced labial-palatal approximant	f_j Simultaneous \int and X
H Voiceless epiglottal fricative	Affricates and double articulations

 Voiced epiglottal fricative
 Voiced epiglottal fr can be represented by two symbols

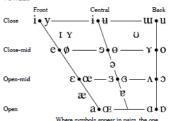
oined by a tie bar if necessary. P Epiglottal plosive

DIACRITICS Some discritics may be placed above a symbol with a descender, e.g. $\tilde{\Pi}$

	Voiceless	ņ	ģ		Breathy voiced	ģ	a	2	Dental	ţ	ď
	Voiced	ş	ţ	~	Creaky voiced	ģ	a	2	Apical	ţ	d
h	Aspirated	th	d^{h}		Linguolabial	ţ	đ		Laminal	ţ	d
,	More rounded	ş		w	Labialized	t^{w}	d^{w}	~	Nasalized		ẽ
	Less rounded	ç		j	Palatalized	tj	\mathbf{d}^{j}	n	Nasal release		d^{n}
	Advanced	ų		Y	Velarized	tY	d^{γ}	1	Lateral release		d^{l}
_	Retracted	e		٤	Pharyngealized	t٢	d۶	7	No audible releas	se	ď
	Centralized	ë		~	Velarized or phary	mgeali	zed	ł			
×	Mid-centralized	ě			Raised	ę	(<u>I</u> =	voio	ed alveolar fricativ	re)	
	Syllabic	ņ		_	Lowered	ę	<u>β=</u>	voio	ed bilabial approxi	iman	t)
_	Non-syllabic	ĕ		4	Advanced Tongue	Root	ę				
r	Rhoticity	ð	æ	۲	Retracted Tongue	Root	ę				

VOWELS

Open



Where symbols appear in pairs, the one to the right represents a rounded vowel.

SUPRASEOMENTALS

•	Primary stree	10	founə tı ʃən
- 1	Secondary st	reco	reesse ajes
I	Long	e	
•	Half-long	e'	
~	Extra-chort	ĕ	
Ī	Minor (foot)	grou	P

Major (intonation) group

. Syllable break .ri.ækt

Linking (absence of a break)

0	,
LEVEL ế or ┐ Extra é ┐ High	ORD ACCENTS CONTOUR Č or / Rising Ĉ V Falling
	ĕ 1 High
è ⊣ Low	e / rising
ề ⊿ Extra	è
↓ Downstep	Global rise
↑ _{Upstep}	



Affricates and double articulations can be represented by two symbols joined by a tie bar if necessary.





Affricate = plosive + fricative

THE INTERNATIONAL PHONETIC ALPHABET (revised to 2015)

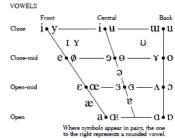
CONSONANTS (PULMONIC) © 2015 IPA

	Bilabial	Labiodental	Dental	Alveolar	Postalveolar	Retr	oflex	Pal	atal	Ve	lar	Uv	ular	Phary	ngeal	Olo	ottal
Plosive	рb			t d		t	þ	С	Ŧ	k	g	q	G			3	
Naval	m	m		n			η		ŋ		ŋ		N				
Trill	В			r									\mathbf{R}				
Tap or Flap		V		ſ			τ										
Fricative	φβ	f v	θð	s z	∫ 3	ş	Z,	ç	j	х	Y	χ	R	ħ	ſ	h	ĥ
Lateral fricative				łţ													
Approximant		υ		I			ŀ		j		щ						
Lateral approximant				1			l		λ		L						

Symbols to the right in a cell are voiced, to the left are voiceless. Shaded areas denote articulations judged impossible.

CONSONANTS (NON-PULMONIC)

Clicks	Voiced implosives	Ejectives						
O Bilabial	6 Bilabial	Examples:						
Dental	d Dental/alveolar	p' Bilabial						
(Post)alveolar	f Palatal	t' Dental/alveolar						
+ Palatoalveolar	g Velar	k' Velar						
Alveolar lateral	G Uvular	S' Alveolar fricative						



OTHER SYMBOLS



P Epiglottal plosive joined by a tie bar if necessary.

٥	Voiceless	ņ	ģ		Breathy voiced	þ	a		Dental	ţ	ď
	Voiced	ş	ţ	~	Creaky voiced	ģ	a		Apical	ţ	d
h	Aspirated	th	d^h		Linguolabial	ţ	ģ		Laminal	ţ	d
,	More rounded	ş		w	Labialized	tw	\mathbf{d}^{w}	~	Nasalized		ẽ
ç	Less rounded	ç		j	Palatalized	t ^j	\mathbf{d}^{j}	n	Nasal release		d
	Advanced	ų		Y	Velarized	tY	\mathbf{d}^{Y}	1	Lateral release		d
_	Retracted	e		٤	Pharyngealized	t٢	d٩	٦	No audible releas	se	d
••	Centralized	ë		~ Velarized or pharyngealized 1							
×	Mid-centralized	ě		Raised Q (I = voiced alveolar fricative)							
,	Syllabic	ņ		Lowered e (= voiced bilabial approximant)							
_	Non-syllabic	ě		Advanced Tongue Root &							
r	Rhoticity	ð	a		Retracted Tongue	Root	ę				

SUPRASEOMENTALS

Long	e:										
* Half-long	e'										
Extra-short	ĕ										
Minor (foot)	Minor (foot) group										
Major (inton	Major (intonation) group										
. Syllable brea	k ni.ækt										
Linking (absence of a break)											
TONES AND WORD ACCENTS											
LEVEL	CONTOUR										
ể or 7 Extra	ě or ∕ Rising										
é ∃ High	ê √ Falling										
ē ∃ Mid	ĕ 1 High										

foune trien

Typefaces: Doulos SIL (metatext); Doulos SIL, IPA Kiel, IPA LS Uni (symbo



UNIVERSITÄT

IPA Chart – Audio samples



- Click and play:
 - https://www.internationalphoneticalphabet.org/ipa-sounds/ipa-chart-with-sounds/#ipachartstart
- With MRI recordings: http://sail.usc.edu/span/rtmri_ipa/index.html
- IPA keyboard:
 https://westonruter.github.io/ipa-chart/keyboard/
- Useful website (in German but might still be useful): https://www.coli.uni-saarland.de/elaut/index.html

Assignment 1



Find the IPA symbol and an example word for the sounds described below.

- 1) bilabial nasal
- 2) voiceless labiodental fricative
- 3) velar nasal
- 4) voiced alveolar fricative
- 5) voiceless velar plosive

- 6) palatal approximant
- 7) voiced postalveolar fricative
- 8) voiced bilabial plosive
- 9) voiceless postalveolar fricative
- 10) voiceless dental fricative

Assignment 1



Find the IPA symbol and an example word for the sounds described below.

- 11) unrounded open back vowel
- 12) rounded close-mid back vowel
- 13) unrounded close-mid front vowel
- 14) unrounded open-mid front vowel
- 15) rounded near-close back vowel

Thank you for your attention!



30.10.2024