

BBN-ANG-141 Foundations of phonology

Phonetics 1: Consonants

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outline

branches of phonetics

some anatomy: the vocal tract

articulatory properties of consonants

- place of articulation

- manner of articulation

- phonation type

- airstream mechanism

multiple articulatory gestures

IPA symbol charts

sample exam questions

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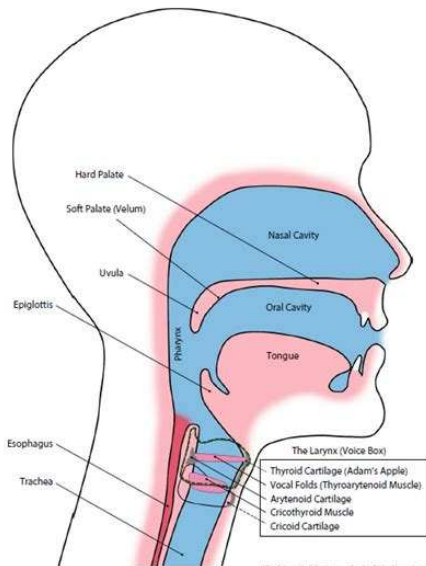
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- ▶ articulatory (what to put where and how to get the given sound)
- ▶ acoustic (the properties of the sound waves of the given sound)
- ▶ auditory (how the brain processes the acoustic signals the ear receives)

THE VOCAL TRACT



articulatory properties of consonants

place of articulation (POA)

the location within the vocal tract where the most significant constriction occurs

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the initiator and the direction of the airstream

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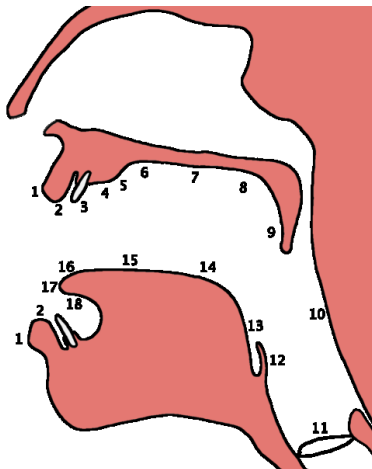
articulators

passive

- 2 lips/labial
- 3 teeth/dental
- 4 upper alveolar ridge/alveolar
- 5 —/post-alveolar
- 6 —/pre-palatal
- 7 palate/palatal
- 8 soft palate or velum/velar
- 9 uvula/uvular
- 10 pharynx/pharyngeal

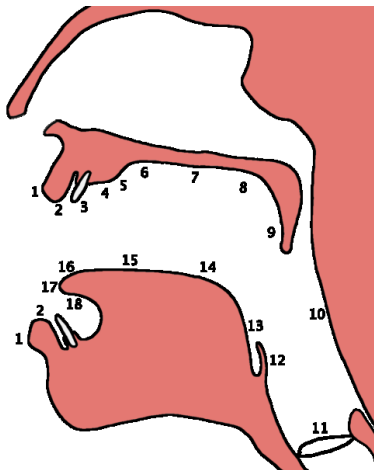
active

- 11 glottis/glottal
- 12 epiglottis/epiglottal
- 13 tongue root/radical
- 14 back of tongue body/postero-dorsal
- 15 front of tongue body/antero-dorsal
- 16 tongue blade/laminal
- 17 tongue tip/apical
- 18 —/sub-apical



places of articulation

- 2▶2 bilabial (p)
- 2▶3 labiodental (f)
- 16▶2 linguo-labial
- 16▶3 interdental (AmE *th* θ)
- 17▶3 apical dental (BrE *th* θ)
- 16▶3/4 (laminal) denti-alveolar
- 17▶4 apical alveolar (t)
- 16▶4 laminal alveolar
- 17▶5 apical retroflex
- 16▶5 (laminal) palato-alveolar
- 18▶6/7 sub-apical (retroflex)
- 15▶6/7 palatal (j, Hung. *ty* c)
- 14▶8 velar (k)
- 14▶9 uvular (q)
- 13▶10 pharyngeal
- 12▶10 epiglottal
- 11 glottal (?)



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- ▶ none: **vowel** (which we will look at next week)

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- ▶ **lateral**: more constriction in the central area, more air escapes at the sides (fricative: **ʃ** **ʒ**; approximant: **l**)
- ▶ **rhotic** (r-sounds): **trill** (**r**), **tap/flap** (**r**), approximant rhotic (**ɹ** **ɻ**), fricative rhotic (**ʁ**)

manner of articulation

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- ▶ **lateral**: more constriction in the central area, more air escapes at the sides (fricative: f ɬ ; approximant: l)
- ▶ **rhotic** (r-sounds): **trill** (r), **tap/flap** (r), approximant rhotic (ɹ ɻ), fricative rhotic (ʀ)
- ▶ **nasal**: velum is lowered, allowing air to flow through the nasal tract (as well) (stop: m n ɲ ŋ ; vowel: ã)

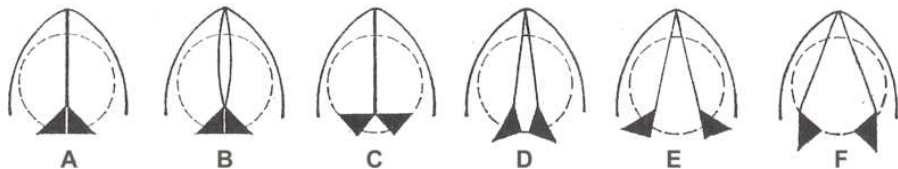
manner of articulation

two major manner categories:

consonant vs vowel, obstruent vs sonorant

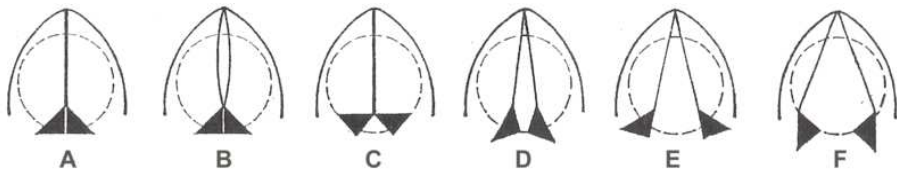
consonant	p t tʃ k b d dʒ g	plosive	obstruent
	f θ s ʃ v ð z ʒ	fricative	
	m n ŋ	nasal	sonorant
	r l j w	approximant	
vowel	i u e ə o a		

phonation type



states of the glottis

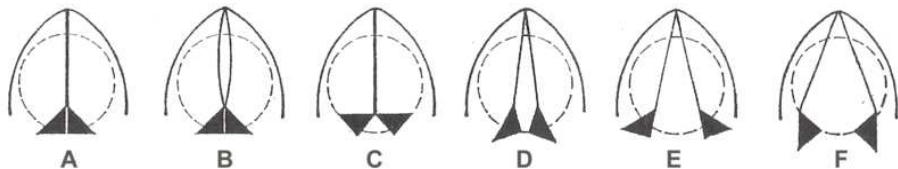
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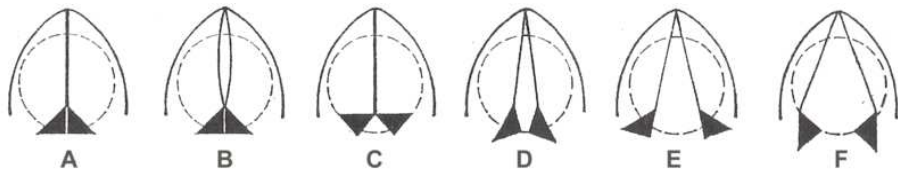
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- A glottal stop:** vocal folds held together (?)
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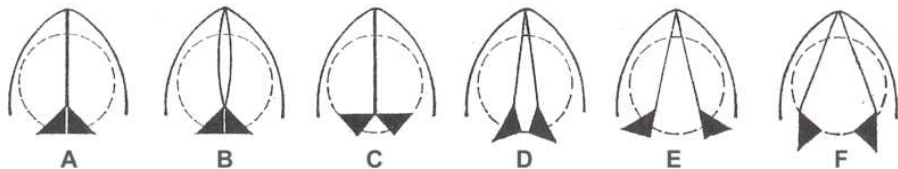
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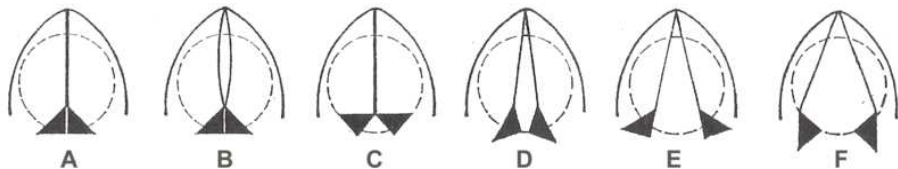
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- D breathy voice/murmur:** arytenoids apart, vocal folds vibrate without contact, high rate of airflow (b/b^h g)

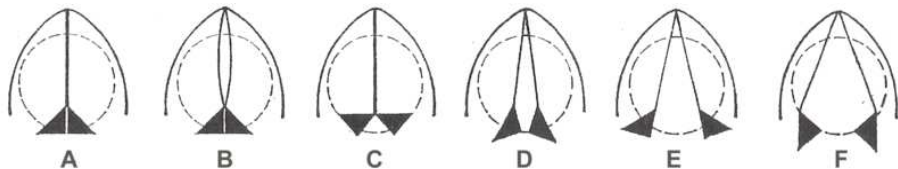
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- E voiceless:** vocal folds do not vibrate, arytenoids apart (p m ɑ)

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- E voiceless:** vocal folds do not vibrate, arytenoids apart (p m g)
- F aspirated:** arytenoids pulling vocal folds apart even more (p^h h)

airstream mechanism

pulmonic airstream

only egressive (lung air pushed out under the control of the respiratory muscles): **(ex)plosive** (p t k b d g)

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velaric airstream

only ingressive (mouth air rarefied by the backward and downward movement of the tongue pressed to the velum): **click** (ǀ ǃ)

multiple articulatory gestures

double closures (two places of articulation)

labio-velar stop: $k^{\wedge}p$ $g^{\wedge}b$ $\eta^{\wedge}m$, approximant: w

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secondary articulations

labialization: k^w g^w , palatalization: p^j b^j , velarization: m^{v} t (cf. English dark l), pharyngealization: s^{f} (=Arabic emphatics)

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stop+fricative: ts cz $tʃ$ $ɟʒ$

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- ▶ they are commonly sibilants (like the above)
- ▶ they are in fact not doubly articulated, but slowly released plosives

main consonant chart

THE INTERNATIONAL PHONETIC ALPHABET (2005)

CONSONANTS (PULMONIC)

	Bilabial	Labio-dental	Dental	Alveolar	Post-alveolar	Retroflex	Palatal	Velar	Uvular	Pharyngeal	Epi-glottal	Glottal
Nasal	m	ɱ	n			ɳ	ɲ	ŋ	ɴ			
Plosive	p b	ɸ β	t d			ʈ ɖ	c ɟ	k ɡ	q ɢ			
Fricative	ɸ β	f v	θ ð	s z	ʃ ʒ	ʂ ʐ	ç ʝ	x ɣ	χ ʁ	ħ ʕ	ħ ʕ	h ɦ
Approximant		ʋ	ɹ			ɻ	j	ɰ				
Trill	ʙ		r						ʀ		ʀ	
Tap, Flap		ⱱ	ɾ			ɽ						
Lateral fricative			ɬ ɮ			ɭ	ʎ	ɥ				
Lateral approximant			l			ɭ	ʎ	ɥ				
Lateral flap			ɭ			ɭ						

Where symbols appear in pairs, the one to the right represents a modally voiced consonant, except for murmured *h*. Shaded areas denote articulations judged to be impossible. Light grey letters are unofficial extensions of the IPA.

diacritics, non-pulmonics, co-articulated

DIACRITICS Diacritics may be placed above a symbol with a descender, as *ɟ̥*. Other IPA symbols may appear as diacritics to represent phonetic detail: *t̚* (fricative release), *b^h* (breathy voice), *ʔ̚* (glottal onset), *ə̯* (epenthetic schwa), *o̯* (diphthongization).

SYLLABICITY & RELEASES		PHONATION		PRIMARY ARTICULATION		SECONDARY ARTICULATION			
<i>ŋ̥ ɹ̥</i>	Syllabic	<i>ŋ̥̚ ɹ̥̚</i>	Voiceless or Slack voice	<i>t̚ ɸ̚</i>	Dental	<i>tʷ dʷ</i>	Labialized	<i>ɔ̞ ɤ̞</i>	More rounded
<i>ɛ̥ ʊ̥</i>	Non-syllabic	<i>ɛ̥̚ ʊ̥̚</i>	Modal voice or Stiff voice	<i>t̚ ɹ̚</i>	Apical	<i>tʲ dʲ</i>	Palatalized	<i>ɔ̞ ɤ̞^w</i>	Less rounded
<i>t^h ht</i>	(Pre)aspirated	<i>ṅ̚ ṅ̚</i>	Breathy voice	<i>t̚ ɹ̚</i>	Laminal	<i>tʷ dʷ</i>	Velarized	<i>ẽ ẽ̃</i>	Nasalized
<i>dⁿ</i>	Nasal release	<i>ṅ̚ ṅ̚</i>	Creaky voice	<i>ɹ̚ t̚</i>	Advanced	<i>t̚ d̚</i>	Pharyngealized	<i>ɤ̞ ɤ̞̠</i>	Rhoticity
<i>d^l</i>	Lateral release	<i>ṅ̚ ṅ̚</i>	Strident	<i>ɹ̚ t̚</i>	Retracted	<i>ɹ̚ z̚</i>	Velarized or pharyngealized	<i>ɛ̞ ɔ̞</i>	Advanced tongue root
<i>t̚</i>	No audible release	<i>ṅ̚̚ ɹ̚̚</i>	Linguolabial	<i>ä̞ j̞</i>	Centralized	<i>ũ̞</i>	Mid-centralized	<i>ɛ̞ ɔ̞</i>	Retracted tongue root
<i>ɛ̞ β̞</i>	Lowered (<i>β̞</i> is a bilabial approximant)			<i>ɛ̞ ɹ̞</i>	Raised (<i>ɹ̞</i> is a voiced alveolar non-sibilant fricative)				

CONSONANTS (NON-PULMONIC)

Anterior click releases (require posterior stops)	Voiced implosives	Ejectives
<i>ɔ̞</i> Bilabial fricated	<i>ɓ</i> Bilabial	<i>ʔ</i> Examples:
<i>ɮ</i> Laminal alveolar fricated ("dental")	<i>ɗ</i> Dental or alveolar	<i>p̚</i> Bilabial
<i>ɮ̠</i> Apical (post)alveolar abrupt ("retroflex")	<i>ɟ</i> Palatal	<i>t̚</i> Dental or alveolar
<i>ɮ̠̠</i> Laminal postalveolar abrupt ("palatal")	<i>ɠ</i> Velar	<i>k̚</i> Velar
<i>ɮ̠̠̠</i> Lateral alveolar fricated ("lateral")	<i>ɠ̠</i> Uvular	<i>s̚</i> Alveolar fricative

CONSONANTS (CO-ARTICULATED)

- M* Voiceless labialized velar approximant
- W* Voiced labialized velar approximant
- ɥ* Voiced labialized palatal approximant
- ɕ* Voiceless palatalized postalveolar (alveolo-palatal) fricative
- ʑ* Voiced palatalized postalveolar (alveolo-palatal) fricative
- ɧ* Simultaneous *x* and *f* (disputed)
- k̟ t̟* Affricates and double articulations may be joined by a tie bar

sample exam questions

which is an obstruent?

1. a
2. ɹ
3. k
4. m

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which is not a POA?

1. lateral
2. palatal
3. bilabial
4. velar

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