

Phonological Features and the IPA

Major Class Features

[syllabic]

All vowels are [+syllabic]. By default, consonants are [-syllabic]; [+syllabic] consonants are marked with the [̥] diacritic. Glides are always [-syllabic]; the [+syllabic] counterpart of a glide is a vowel.

p			t		t̥	c	k	q	ʔ
b			d		d̥	ɟ	g	ɢ	
β			ɖ		ɖ̥	f	ɣ	ɕ	
ɸ	f	θ	s	ʃ	ʃ̥	ç	x	ç	ħ h
β	v	ð	z	ʒ	ʒ̥	j	ɣ	ʁ	ɦ
			ʈ						
			ɕ						
pf̥			ts	tʃ					
			ɖʒ̥						
m	ɱ		n		ɳ	ɲ	ŋ	ɴ	
			l		ɭ	ʎ	ʟ		
			ɭ						
w	v					j	ɥ		

i	y		ɯ/i	u
ɪ	ʏ		ʊ	
e	ø		ɤ	o
ɛ	œ	ʌ/ə	ɔ	
æ	æ	a/ɑ	ɑ	

[vocalic]

Vowels and glides are [+vocalic]; all other segments are [-vocalic].

p			t		t̥	c	k	q	ʔ
b			d		d̥	ɟ	g	ɢ	
β			ɖ		ɖ̥	f	ɣ	ɕ	
ɸ	f	θ	s	ʃ	ʃ̥	ç	x	ç	ħ h
β	v	ð	z	ʒ	ʒ̥	j	ɣ	ʁ	ɦ
			ʈ						
			ɕ						
pf̥			ts	tʃ					
			ɖʒ̥						
m	ɱ		n		ɳ	ɲ	ŋ	ɴ	
			l		ɭ	ʎ	ʟ		
			ɭ						
w	v					j	ɥ		

i	y		ɯ/i	u
ɪ	ʏ		ʊ	
e	ø		ɤ	o
ɛ	œ	ʌ/ə	ɔ	
æ	æ	a/ɑ	ɑ	

[continuant]

The feature [continuant] refers to oral airflow: segments that are [+continuant] have continuous oral airflow; segments that are [-continuant] involve an interruption in oral airflow. Vowels, glides, liquids, and fricatives are [+continuant]; stops, affricates, and nasals are [-continuant].

p	t	t̥	c	k	q	ʔ
b	d	d̥	ɟ	g	ɣ	
β	ɖ	ɖ̥	f	ɣ̟	ɣ̟	
ɸ	f	θ	s	ʃ	ʂ	ç
β	v	ð	z	ʒ	ʒ̥	ʝ
			ʃ̥			
			ʂ̥			
pf	ts	tʃ				
	ɖʒ	ɖʃ				
m	ɱ	n	ɲ	ɳ	ŋ	ɴ
		l	ɭ	ʎ	ʟ	
		ɭ	ʎ			
w	v			j	ɥ	

i	y	ɥ/i	u
ɪ	ʏ		ʊ
e	ø	ɤ	o
ɛ	œ	ʌ/ə	ɔ
æ	æ	a/ɑ	ɒ

[lateral]

Lateral fricatives and approximants are [+lateral]; all other segments are [-lateral].

p	t	t̥	c	k	q	ʔ
b	d	d̥	ɟ	g	ɣ	
β	ɖ	ɖ̥	f	ɣ̟	ɣ̟	
ɸ	f	θ	s	ʃ	ʂ	ç
β	v	ð	z	ʒ	ʒ̥	ʝ
			ʃ̥			
			ʂ̥			
pf	ts	tʃ				
	ɖʒ	ɖʃ				
m	ɱ	n	ɲ	ɳ	ŋ	ɴ
		l	ɭ	ʎ	ʟ	
		ɭ	ʎ			
w	v			j	ɥ	

i	y	ɥ/i	u
ɪ	ʏ		ʊ
e	ø	ɤ	o
ɛ	œ	ʌ/ə	ɔ
æ	æ	a/ɑ	ɒ

[nasal]

Nasal consonants are [+nasal]. All other segments are [-nasal] by default; nasal vowels and other nasalized segments are marked with the [̃] diacritic.

p			t		t̥	c	k	q		ʔ									
b			d		d̥	ɟ	g	ɣ											
β			ḍ		ḍ̥	f	ɣ̣	ɣ̣̥											
ɸ	f	θ	s		ʃ	ʂ	x	χ	ħ	h									
β̃	v	ð	z		ʒ	ʐ	j	y	ɸ	ɦ		i	y		ɯ/i			u	
			ɬ									ɪ	ʏ					ʊ	
			ɮ								e		ø		ɤ				o
			ɮ̥		ɮ̥̥							ɛ		œ	ʌ/ə			ɔ	
pf̃			ɬ		ɬ̥							æ		œ	a/ɑ			ɒ	
			ɬ̣		ɬ̣̥														
m	ɱ		n		ɲ	ɳ	ŋ	ɴ											
			l		ɭ	ʎ	ʟ												
			ɽ		ɿ														
w	ʋ					j	ɥ												

[strident]

The feature [strident] refers to high-frequency aperiodic noise during a segment: segments that are [+strident] have this noise; segments that are [-strident] do not. All affricates are [+strident]; in addition, fricatives at certain places of articulation are [+strident]: labiodentals, alveolars, palato-alveolars, retroflexes, and uvulars. All other segments are [-strident].

p			t		t̥	c	k	q		ʔ									
b			d		d̥	ɟ	g	ɣ											
β			ḍ		ḍ̥	f	ɣ̣	ɣ̣̥											
ɸ	f	θ	s		ʃ	ʂ	x	χ	ħ	h									
β̃	v	ð	z		ʒ	ʐ	j	y	ɸ	ɦ		i	y		ɯ/i			u	
			ɬ									ɪ	ʏ					ʊ	
			ɮ								e		ø		ɤ				o
			ɮ̥		ɮ̥̥							ɛ		œ	ʌ/ə			ɔ	
pf̃			ɬ		ɬ̥							æ		œ	a/ɑ			ɒ	
			ɬ̣		ɬ̣̥														
m	ɱ		n		ɲ	ɳ	ŋ	ɴ											
			l		ɭ	ʎ	ʟ												
			ɽ		ɿ														
w	ʋ					j	ɥ												

Place Features

[labial]

Among consonants, the feature [labial] distinguishes between labial and non-labial segments. Rounding in vowels and glides is specified with [round], which is a dependent feature of [labial]; therefore, all vowels and glides are [+labial]. Thus, bilabials, labiodentals, and all vowels and glides are [+labial]; all other segments are [-labial]. In addition, if a language has a pair of segments that contrast in rounding, both segments are [+labial] (see below).

p b β ϕ f β v (pf) m m̥ w v	t d ḍ θ s ð z ṭ ʃ ʒ ts dʒ ʔ ʃ ẓ j n l ɾ	ʈ c ɖ k ɟ ʒ ç x j y ŋ ɲ ʎ ʟ ʟ̥ ṭ 	q g g̣ χ ʁ ɰ ɲ ɳ ɹ 	? ɦ h ɦ fi j ɰ
--	--	---	--	--

<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding: 2px;">i</td> <td style="padding: 2px;">y</td> <td style="padding: 2px;">ɰ/i</td> <td style="padding: 2px;">u</td> </tr> <tr> <td style="padding: 2px;">ɪ</td> <td style="padding: 2px;">ʏ</td> <td style="padding: 2px;"></td> <td style="padding: 2px;">ʊ</td> </tr> <tr> <td style="padding: 2px;">e</td> <td style="padding: 2px;">ø</td> <td style="padding: 2px;">ɤ</td> <td style="padding: 2px;">o</td> </tr> <tr> <td style="padding: 2px;">ɛ</td> <td style="padding: 2px;">œ</td> <td style="padding: 2px;">ʌ/ə</td> <td style="padding: 2px;">ɔ</td> </tr> <tr> <td style="padding: 2px;">æ</td> <td style="padding: 2px;">œ</td> <td style="padding: 2px;">a/ɑ</td> <td style="padding: 2px;">ɒ</td> </tr> </table>	i	y	ɰ/i	u	ɪ	ʏ		ʊ	e	ø	ɤ	o	ɛ	œ	ʌ/ə	ɔ	æ	œ	a/ɑ	ɒ
i	y	ɰ/i	u																	
ɪ	ʏ		ʊ																	
e	ø	ɤ	o																	
ɛ	œ	ʌ/ə	ɔ																	
æ	œ	a/ɑ	ɒ																	

[round]

The feature [round] is dependent on the feature [labial]; it refers to rounding of the lips independent of labial place of articulation. Round vowels and glides are [+round]; unrounded vowels and glides and labial consonants are [-round]. Rounding on other segments is indicated with the [w] superscript; thus, adding [w] to a segment makes that segment [+round] (and [+labial] if it is not labial already). The non-rounded counterpart of that segment (if any) is [+labial, -round].

p b β ϕ f β v 	i ɪ e ɛ æ	<table border="1" style="border-collapse: collapse;"> <tr><td>y</td><td>ʏ</td></tr> <tr><td>ø</td><td>œ</td></tr> <tr><td>œ</td><td>ʌ/ə</td></tr> <tr><td>æ</td><td>a/ɑ</td></tr> </table>	y	ʏ	ø	œ	œ	ʌ/ə	æ	a/ɑ	<table border="1" style="border-collapse: collapse;"> <tr><td>ɰ/i</td><td>u</td></tr> <tr><td>ʊ</td><td>o</td></tr> <tr><td>ɔ</td><td>ɒ</td></tr> </table>	ɰ/i	u	ʊ	o	ɔ	ɒ
y	ʏ																
ø	œ																
œ	ʌ/ə																
æ	a/ɑ																
ɰ/i	u																
ʊ	o																
ɔ	ɒ																
m m̥ <div style="border: 1px solid black; display: inline-block; padding: 2px;">w v</div>	j ɰ																

[coronal]

The feature [coronal] refers to the involvement of the front half of the tongue body in the articulation of the segment. Interdental, alveolar, palato-alveolar, retroflex, and palatal consonants (except glides) are [+coronal]; labial, velar, uvular, pharyngeal, and glottal consonants and all vowels are [-coronal]. The dependent features of [coronal] are [anterior] and [distributed].

p		t	ʈ	c	k	q	ʔ					
b		d	ɖ	ɟ	g	ɢ						
β		ɗ	ɟ̥	f	ɣ	ɣ̥						
ɸ	f	θ	ʃ	ʂ	x	χ	ħ	h				
β̣	v	ð	z	ʒ	ʝ	ʥ	ɦ	ɦ̥				
		ʈ̥							i	y	ɯ/i	u
		ɖ̥							ɪ	ʏ		ʊ
pf̥		ʈ̥							e	ø	ɣ	o
		ɟ̥	ʃ̥						ɛ	œ	ʌ/ə	ɔ
		ɟ̥̈	ʂ̥						æ	œ	a/ɑ	ɒ
m	ɱ	n		ɳ	ɲ	ɳ	ɴ					
		l		ɭ	ʎ	ʎ						
w	ɥ	ɹ		ɻ								
					j		ɥ					

[anterior]

The feature [anterior] is dependent on the feature [coronal]; it refers to whether the primary constriction is in the frontmost part of the mouth (at or before the alveolar ridge). Interdentals and alveolars are [+anterior]; palato-alveolars, retroflexes, and palatals are [-anterior].

t		ʈ	c
d		ɖ	ɟ
ɗ		ɟ̥	f
θ	s	ʃ	ʂ
ð	z	ʒ	ʝ
	ʈ̥		
	ɟ̥		
	ʃ̥		
	ʂ̥		
	n	ɳ	ɲ
	l	ɭ	ʎ
	ɹ	ɻ	

[distributed]

The feature [distributed] is a dependent feature of [coronal]; it refers to whether the primary constriction is made with the tip or the blade of the tongue. Segments that are [+distributed] are articulated with the blade of the tongue; segments that are [-distributed] are articulated with the tip. Interdentals, palato-alveolars, and palatals are [+distributed]; alveolars and retroflexes are [-distributed].

	t		t̪	c
	d		d̪	ʃ
	dʃ		dʃ̺	f
θ	s	ʃ	s̺	ç
ð	z	ʒ	z̺	j
	ʃ̺			
	ʃ̺	ʃ̺		
	ʃ̺	ʃ̺		
	ʃ̺	ʃ̺		
	n		ɳ	ɲ
	l		ɭ	ʎ
	ɹ		ɻ	

[dorsal]

The feature [dorsal] refers to the involvement of the back half of the tongue body in the articulation of the segment. Palato-alveolar, palatal, velar, uvular, and pharyngeal consonants and all vowels and glides are [+dorsal]; labials, interdentals, alveolars, retroflexes, and glottals are [-dorsal]. The dependent features of [dorsal] are [high], [low], and [back].

p		t	t̪	c	k	q	ʔ
b		d	d̪	ʃ	g	ɢ	
ɸ	f	dʃ	dʃ̺	f	gʲ	ɢʲ	
β	v	θ	s	ç	x	χ	ħ
		ð	z	j	y	ʁ	ʕ
			ʃ̺	ʒ			
			ʃ̺				
			ʃ̺				
			ʃ̺				
			n	ɳ	ŋ	ɴ	
			l	ɭ	ʎ		
			ɹ	ɻ			
				j	ɥ		

i	y	ɯ/i	u
ɪ	ʏ		ʊ
e	ø	ɤ	o
ɛ	œ	ʌ/ə	ɔ
æ	æ	a/ɑ	ɒ

[high]

The feature [high] is dependent on the feature [dorsal]; it refers to the height of the tongue body. Alveopalatal, palatal, and velar consonants, all glides, and high vowels are [+high]; uvular and pharyngeal consonants and mid and low vowels are [-high].

		c	k	q					
		ʃ	g	ɟ					
		f	ɣ	ʕ					
		ʃ	ç	x	χ	ħ			
		ʒ	j	ɥ	ʁ	ʕ			
		tʃ							
		ʤ							
			ɲ	ŋ	N				
			ʎ	ʟ					
w	v		j	ɥ					

i	y	ɯ/i	u
ɪ	ʏ		ʊ
e	ø	ɤ	o
ɛ	œ	ʌ/ə	ɔ
æ	ɶ	a/ɑ	ɒ

[low]

The feature [low] is dependent on the feature [dorsal]; it refers to the height of the tongue body. Pharyngeal consonants and low vowels are [+low]; palato-alveolar, palatal, velar, and uvular consonants, all glides, and high and mid vowels are [-low].

		c	k	q					
		ʃ	g	ɟ					
		f	ɣ	ʕ					
		ʃ	ç	x	χ	ħ			
		ʒ	j	ɥ	ʁ	ʕ			
		tʃ							
		ʤ							
			ɲ	ŋ	N				
			ʎ	ʟ					
w	v		j	ɥ					

i	y	ɯ/i	u
ɪ	ʏ		ʊ
e	ø	ɤ	o
ɛ	œ	ʌ/ə	ɔ
æ	ɶ	a/ɑ	ɒ

[back]

The feature [back] is dependent on the feature [dorsal]; it refers to the horizontal position of the tongue body. Velar, uvular, and pharyngeal consonants and central and back vowels and glides are [+back]; palato-alveolar and palatal consonants and front vowels and glides are [-back].

	c	k	q				
	ʃ	g	ŋ				
	f	ɣ	ç				
	ʒ	x	χ	ħ			
	ʒ	y	ɤ	ʕ			
	ʧ						
	ʣ						
		ŋ	ɴ				
	ʎ	ʟ					
w	ʋ	j	ɥ				

		y	ɥ		ɯ/ɯ̯	u
i	ɪ		ʏ			ʊ
e		ø	œ	ɤ		o
	ɛ		œ	ɤ	ɔ	
	æ		œ	ɤ	a/ɑ	ɒ

[pharyngeal]

Pharyngeal consonants and vowels in a language with a contrast between tense and lax vowels are [+pharyngeal]; all other segments are [-pharyngeal]. The dependent feature of [pharyngeal] is [ATR].

	p	t	t̤	c	k	q	ʔ
	b	d	d̤	ɟ	g	ŋ	
	β	f	f̤	ɣ	ç	ç̥	
	φ	θ	s	ʃ	x	χ	ħ
	β	ð	z	ʒ	y	ɤ	ʕ
		ʧ					
		ʣ					
		ʧ					
		ʣ					
m	ɱ	n	ɲ	ɲ	ɳ	ɴ	
		l	ʎ	ʟ	ʟ		
		ɾ	ɾ				
w	ʋ			j	ɥ		

		y	ɥ		ɯ/ɯ̯	u
i	ɪ		ʏ			ʊ
e		ø	œ	ɤ		o
	ɛ		œ	ɤ	ɔ	
	æ		œ	ɤ	a/ɑ	ɒ

[ATR]

The feature [ATR] (short for 'advanced tongue root') corresponds to the distinction between tense and lax vowel. Tense vowels are [+ATR]; lax vowels and pharyngeal consonants are [-ATR].

	i	y	ɯ/i	u
	ɪ	ʏ		ʊ
h	e	ø	ɤ	o
ʕ	ɛ	œ	ʌ/ə	ɔ
	æ	ɶ	a/ɑ	ɒ

Laryngeal Features

[voiced]

Voiced consonants and all vowels are [+voiced]; voiceless consonants are [-voice].

p	t	t̥	c	k	q	ʔ
b	d	d̥	ɟ	g	ɢ	
ɸ	f	f̥	ç	x	χ	ħ
β	v	v̥	ʝ	ɣ	ʁ	ɦ
	ɸ					
	ɸ̥					
		ts	tʃ			
		dz	dʒ			
m	ɱ	n	ɳ	ɲ	ŋ	ɴ
		l	ɭ	ʎ	ʟ	
		ɹ	ɽ			
w	ʋ			j	ɥ	

i	y	ɯ/i	u
ɪ	ʏ		ʊ
e	ø	ɤ	o
ɛ	œ	ʌ/ə	ɔ
æ	ɶ	a/ɑ	ɒ

[aspirated]

Voiceless fricatives and [h] are [+aspirated]; all other consonants and all vowels are [-aspirated] by default. The feature [+aspirated] is also applied to aspirated stops (marked with the [ʰ] diacritic), voiceless sonorants (marked with the [̥] diacritic), and vowels with breathy voice (marked with the [̤] diacritic).

p		t		t̥	c	k	q		ʔ											
b		d		d̥	ɟ	g	ɣ													
β		ɖ		ɖ̥	f	ɣ	ɣ̥													
ɸ	f	θ	s	ʃ	ʂ	ç	x	χ	ħ	h										
β̥	v	ð	z	ʒ	ʒ̥	j	ɣ	ɣ̥	ʃ	h̥										
			ɬ																	
			ɮ																	
pf̥			ts	tʃ																
			ɬɬ	ɬʃ																
m	ɱ		n		ɳ	ɲ	ŋ	ɴ												
			l		ɭ	ʎ	ʟ													
			ɭ		ʟ															
w	ʋ					j	ɥ													

i		y		ɯ/i	u
	ɪ	ʏ			ʊ
e		ø		ɤ	o
	ɛ	œ	ʌ/ə		ɔ
	æ	æ	a/ɑ		ɒ

[glottalized]

Implosive consonants and the glottal stop are [+glottalized]; all other consonants and all vowels are [-glottalized] by default. The feature [+glottalized] is also applied to ejectives (marked with the [ʼ] diacritic) and vowels with creaky voice (marked with the [̰] diacritic).

p		t		t̰	c	k	q		ʔ											
b		d		d̰	ɟ	g	ɣ													
β̰		ɖ̰		ɖ̰̰	f	ɣ	ɣ̰													
ɸ̰	f	θ̰	s	ʃ̰	ʂ̰	ç̰	x̰	χ̰	ħ̰	h̰										
β̰̥	v	ð̰	z	ʒ̰	ʒ̰̥	j	ɣ	ɣ̰̥	ʃ̰	h̰̥										
			ɬ̰																	
			ɮ̰																	
pf̰̥			ts̰	tʃ̰																
			ɬ̰ɬ̰	ɬ̰ʃ̰																
m	ɱ		n		ɳ̰	ɲ̰	ŋ̰	ɴ̰												
			l		ɭ̰	ʎ̰	ʟ̰													
			ɭ̰		ʟ̰															
w	ʋ					j	ɥ													

i		y		ɯ/i	u
	ɪ	ʏ			ʊ
e		ø		ɤ	o
	ɛ	œ	ʌ/ə		ɔ
	æ	æ	a/ɑ		ɒ

Diacritics

Table 1: IPA diacritics

Diacritic	Example	Meaning	Feature
ˈ	pˈ	ejective	[+glottalized]
◌̥	ŋ̥	voiceless	[-voiced, +aspirated]
◌̤	ŋ̤	voiced	[+voiced]
◌ʰ	tʰ	aspirated	[+aspirated]
◌̩	ɹ̩	syllabic	[+syllabic]
◌̯	e̯	non-syllabic	[-syllabic]
◌̤̥	ã	breathy voiced	[+aspirated]
◌̤̥̥	ḁ̥̥̃	creaky voiced	[+glottalized]
◌ʷ	tʷ	labialized	[+labial, +round]
◌ʲ	tʲ	palatalized	[+dorsal, +high, -back]
◌ʷ	tʷ	velarized	[+dorsal, +high, +back]
◌̠	t̠	pharyngealized	[+pharyngeal]
◌̟	t̟	dental	[+coronal, +anterior, +distributed]
◌̠̟	t̠̟	apical	[+coronal, -distributed]
◌̥̟	t̥̟	laminal	[+coronal, +distributed]
◌̃	ẽ	nasalized	[+nasal]