LING 2010Q – Spring 2017

3 - Phonology, or:

the science of sounds – level of abstractness: 1 – ∞

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Contents

1 Some basic definitions - recap

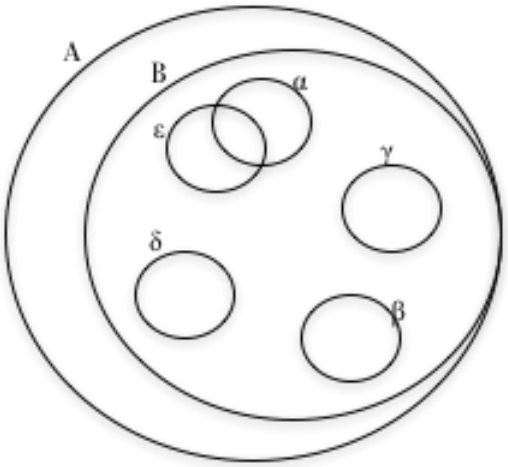
(1) **Phonetics** studies every linguistic sound that humans can possibly produce with the vocal tract, from a purely articulatory point of view. This is superset A.

a. **Articulatory phonetics** studies the physiology of how speech sounds/signs are produced.

b. **Acoustic phonetics** studies the physical properties of speech sounds.

c. **Auditory phonetics** deals with how speech sounds are perceived.

(2) In the set B of *all possible linguistic sounds*, a subset of A, **phonology** studies the subset of linguistic sounds β chosen by a specific language to form words; languages may or may not share some sounds. Phonology also concerns with how sounds are put together to form syllables and words. We will deal with phonology in the next module.



2 Abstractness level 1 – *features* and *natural classes*

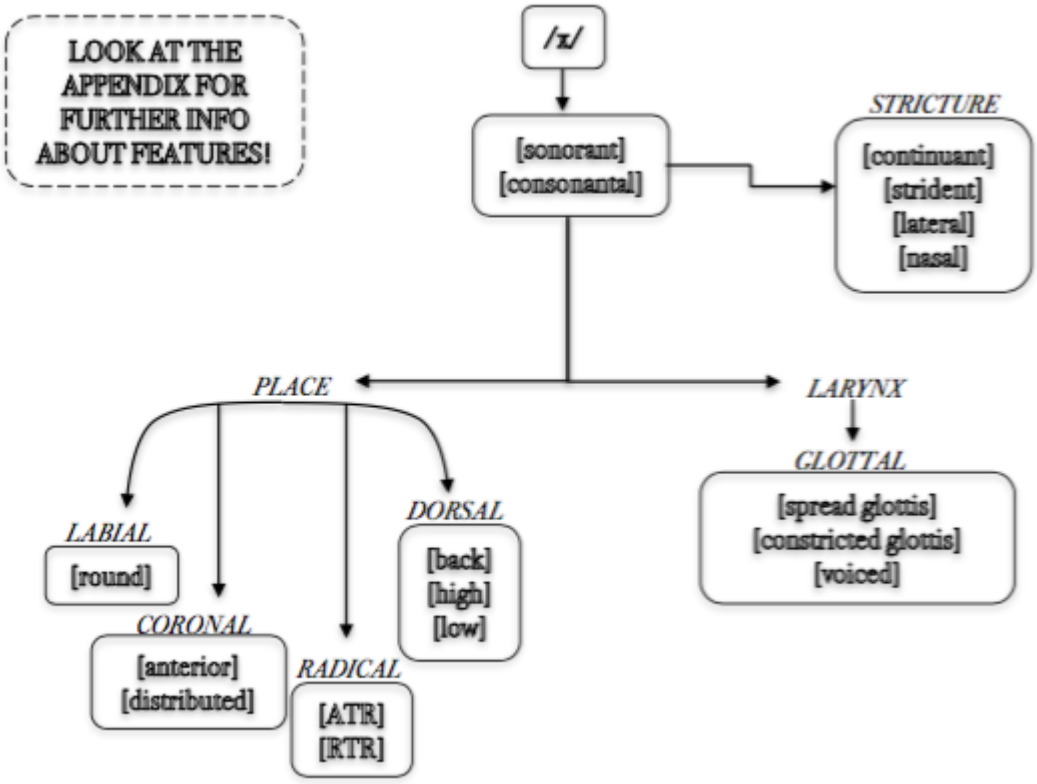
(3) **Features** can be thought of as:

a. articulatory instructions sent by the brain to the vocal tract;

b. acoustic information used by the brain to decode the incoming signal.
They are usually binary: a specific articulatory instruction may be present or not, and this is signaled by + and −, respectively. (Jakobson & Halle 1956)

[a]	:	[+sonorant], [-consonantal], [+low], [-high], [-back], [-round]
[i]	:	[+sonorant], [-consonantal], [-low], [-back], [-round]
[u]	:	[+sonorant], [-consonantal], [+high], [-low], [+back], [+round]
[k]	:	[-sonorant], [+consonantal], [-continuant], [+high], [+back], [-voiced]
[f]	:	[-sonorant], [+consonantal], [+continuant], [-anterior], [+labial], [-voiced]
[d]	:	[-sonorant], [+consonantal], [-continuant], [+anterior], [-labial], [+voiced]

Any sound can be therefore described as a ***bundle of features***.



(4) A **natural class** is a grouping of sounds sharing one or more feature values.

[i, u]: [-consonantal, +sonorant, +high]

[p, b, f, v, m]: [-consonantal, +round]

[t, d, r, l, s, z, ʔ, ð]: [+consonantal, -sonorant, +anterior]

As we will see, identifying natural classes is important in phonology, since it leads to generalizing sound changes.

2.1 Activity 1: Natural classes

Each list below contains sounds all but one of which share some phonological property. Let?s find exactly one feature — just one! — that all the phones except one have and name the phone that is left out.

1. [i, e, u, k]: /k/ is not a vowel (i.e., it is [+cons, -son])
2. [t, d, g, b]:
3. [m, n, l, r]:
4. [β, ɾ̃ǎ, z, ɣ]:

2.2 Activity 2: British English vs American English

British and American speakers pronounce the following words in a slightly different way. Help me put the correct American pronunciation in the right-hand column of the table below.

	word	British English	American English
a.	pure	[pjuːə]	
b.	cute	[kjuːt]	
c.	tune	[tjuːn]	
d.	abuse	[əbjuːs]	
e.	dues	[djuːz]	
f.	argue	[ɑːgjuː]	
g.	muse	[mjuːz]	
h.	new	[njuː]	
i.	lewd	[ljuːd]	
j.	few	[fjuː]	
k.	view	[vjuː]	
l.	enthuse	[ɪnθjuːz]	
m.	suit	[sjuːt]	
n,	hue	[hjuː]	

As you may yet have noticed, BE [ju] *is sometimes replaced by* [u] *in AE — but when? Let's list the context(s) in which this happens, and then try to group them in one natural class.*

Your answer:

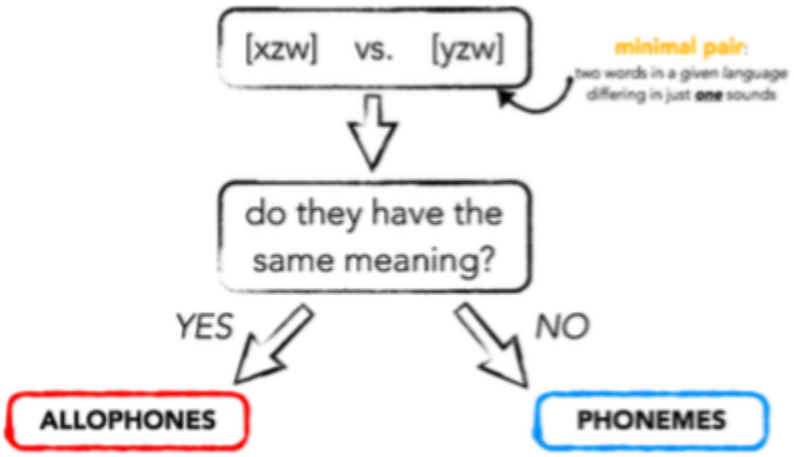
3 Abstractness level 2 – fundamental notions

(5) A **phone** is any speech sound.

(6) A **phoneme** is a phone used in a given language to form *minimally contrastive* words. Two sounds are two distinct phonemes when they occur in the same environment, hence their occurrence cannot be predicted any.

→ Think of *diamonds*. When comparing the quality of two diamonds, they are typically compared with a black surface behind them. This is because the black surface provides a neutral background to highlight the contrast of the diamonds. In the same way, shared environments in words allow us to see more clearly that the two segments in question contrast with each other. Allophones are variants of the same phoneme.

(7) The **minimal pair test** is the only safe way to uncover the nature of sounds in a given language, since it helps us assess whether a pair of sounds are two different phonemes or allophones of the same phoneme in that language.



3.1 Activity 3: Finding English phonemes

For each of the following pair of sounds, find out whether or not they are phonemes.

Pair	**Words**	Phonemes? (Y/N)
[b] ∼ [p]	buy ∼ pie	
[f] ∼ [v]		
[e] ∼ [ɛ]		
[i] ∼ [ɪ]		
[p] ∼ [p^h]		

(8) Allophones may occur:

a. in **free distribution**, when they may appear in the same environment without a change in meaning and without being considered incorrect by speakers; or,

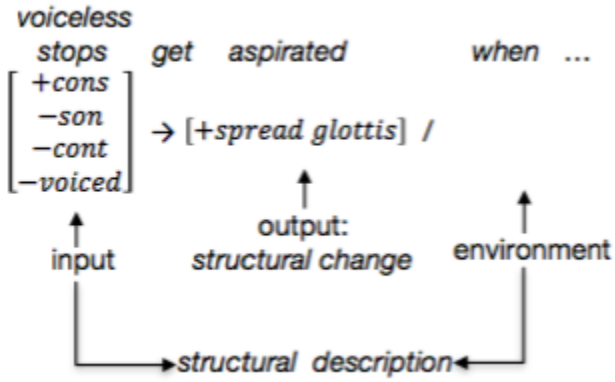
b. in **complementary (or contextual) distribution**, when they appear in two different phonological contexts; this means that their occurrence is predictable.

→ Think of superheroes — let's say my favorite, *Daredevil*. In reality, Daredevil and Matt Murdock are the same person. However, depending on the environment, you're going to see only one representation of Bruce Wayne — you'll never see Daredevil and Matt Murdock hanging out in the same place at once.

3.2 Activity 4: English aspirated stops

Analyze the English words in the table below: some stops show aspiration, some others do not. Can we identify the context in which each of them occurs? Complete the phonological rule *below.*

Aspirated	**IPA**	**Unaspirated**	**IPA**
pot	[p^hɑt]	spot	[spɑt]
top	[t^hɑp]	stop	[stɑp]
cot	[k^hɑt]	Scot	[skɑt]
cat	[k^hɑt]	guest	[gɛst]
tame	[k^heɪm]	drain	[dreɪm]
kite	[k^heɪt]	lucky	[lʌki]



3.3 Major phonological operations

(9) A sound may **assimilate** to a neighboring sound with respect to some phonetic property (i.e., voicing, place of articulation and/or manner of articulation).

3.3.1 Activity 5a: Assimilation (I)

In the following word chunks, consider the sound in bold. What sound do you actually produce?

1. I ca**n** ask [...]
2. I ca**n** bake [...]
3. I ca**n** go [...]
4. ha**t** trick [...]
5. hi**t** batsman [...]
6. nigh**t** class [...]
7. ba**d** dream [...]
8. hea**d** band [...]
9. ba**d** guy [...]

3.3.2 Activity 5b: Assimilation (II)

Consider the following forms of the English past tense. Do you always produce the same sound for the morpheme –ed*?*

abridged	[əbrɪʤd]	flagged	[flægd]
asked	[æskt]	claimed	[kleɪmd]
jumped	[ʤʌmpt]	typed	[taɪpt]
rubbed	[rʌbd]	expressed	[ɛkspɾɛst]

(10) A sound may **dissimilate** — i.e. lose some phonetic property shared with an adjacent sound. For example, in the Latin adjectival suffix *-alis*, [l] dissimilates to [r] if another [l] is present nearby:

nav-a**l**is	'naval'	episcop-a**l**is	'episcopal'
so**l**-a**r**is	'solar'	mi**l**it-a**r**is	'military'
lupan-a**r**is	'whorish'	ocu**l**-a**r**is	'ocular'

(11) A sound may be **inserted** in a specific phonetic context. For example, consider the following words and expressions in Italian.

[princ*e*tonn*e*]	'Princeton'	[appl*e*]	'apple'
[njujork*e*]	'New York'	[in *i*spaɲɲa]	'in Spain'

(12) A sound may be **deleted** in a specific phonetic context. For example, in Italian [n] drops when followed by a consonantal cluster [sC]:

/i<u>n</u>*st*allare/	→	[i_stallare]	'to install'
/i<u>n</u>*st*ruttsjone/	→	[i_struttsjone]	'education'
/co<u>n</u>*st*ruttsjone/	→	[co_struttsjone]	'construction'

(13) Sounds may re-arrange in a specific context (**metathesis**). For example, consider the following mispronunciations of English words.

cavalry	[kælvəri]	foliage	[fɔılıʤ]
comfortable	[kʌmftərbəl]	relevant	[rɛvələnt]
asterisk	[æstərıks]	prescription	[pərskrıpʃən]

(14) A segment may be produced more prominently in specific contexts (**fortition**). Go back to the Activity in sec. 3.2 and review the data in the light of this new notion.

(15) A segment may be produced less prominently in specific contexts (**lenition**). The activity in sec 4.2 below will be an example — please hold on for the moment.

3.4 Morphology 101

(16) A **morpheme** is the smallest meaningful morphological unit of a given language.

a. **root**: the part of a word carrying the core meaning: e.g., <u>table</u>-s; <u>link</u>-ing

b. **bound morphemes**: parts of a word that cannot occur alone, rather need to be attached to a root.

(i) prefixes, occurring before a root: *im-*possible; *re-*iterate

(ii) infixes, occurring inside a root: wel-*diddly-*elcome (Ned Flanders)

(iii) suffixes, occurring after a root: talk-*ing*; driv-*er*

(17) **Allomorphs** are (contextual) variants of the same morpheme.

3.4.1 Activity 6a: English plurals (I)

Look at the following list of English nouns; specifically, focus on the corresponding transcriptions of the plural forms. How many allomorphs conveying plurality can you identify? List them below, together with the context in which each of them occurs respectively.

singular	**IPA**	**plural**	**IPA**
cat	[kæt]	cat-s	[kæts]
deed	[diːd]	deed-s	[diːdz]
tag	[tæg]	tag-s	[tægz]
neck	[nɛk]	neck-s	[nɛks]
soap	[soʊp]	soap-s	[soʊps]
pub	[pɑb]	pub-s	[pɑbz]
wreath	[riθ]	wreath-s	[riθs]
ball	[bɔl]	ball-s	[bɔlz]
computer	[kʌmpjiuɾər]	computer-s	[kʌmpjiuɾərz]
boy	[bɔɪ]	boy-s	[bɔɪz]
proof	[pruf]	proof-s	[prufs]
clam	[klæm]	clam-s	[klæmz]
can	[kæn]	can-s	[kænz]
myth	[mɪθ]	myth-s	[mɪθs]
fly	[flaɪ]	fli-es	[flaɪz]
veto	[viɾoʊ]	veto-es	[viɾoʊz
glass	[glæs]	glass-es	[glæsəz]
wish	[wɪʃ]	wish-es	[wɪʃəz]
bus	[bɑs]	bus-es	[bɑsəz]

Allomorphs for the English plural:

1.

2.

3.

4 Abstractness level 3: beyond the veil of Maya

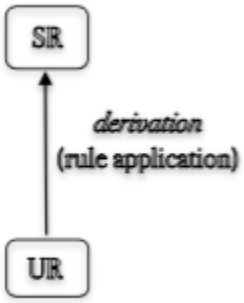
(18) In phonology, the **underlying representation** (UR) of a word or morpheme is the abstract form that a word or a morpheme is assumed to have before any (morpho-)phonological rules have applied to it. Accordingly, it is the form stored in the lexicon.

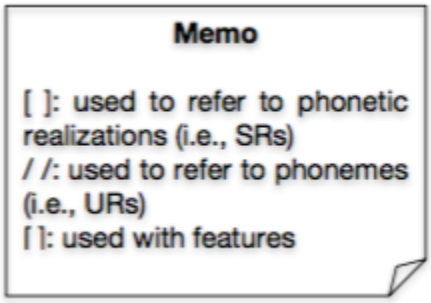
(19) Conversely, the **surface representation** (SR) is the phonetic realization of a given word or morpheme.

→ Hence: URs are made up of phonemes, SRs of (allo-)phones.

(20) The **derivation** is the road taken by an UR to come to surface; along this way, it may undergo some (morpho-)phonological change(s), governed by **rules**. They usually need be applied in a specific *ordering* to get the desired surface form.

→ Let's think of Daredevil again. Matt (Murdock) would be the underlying representation, whereas Daredevil the surface representation after the 'masking rule' applies.





The long road beyond the veil of Maya
how to identify what lies behind the surface

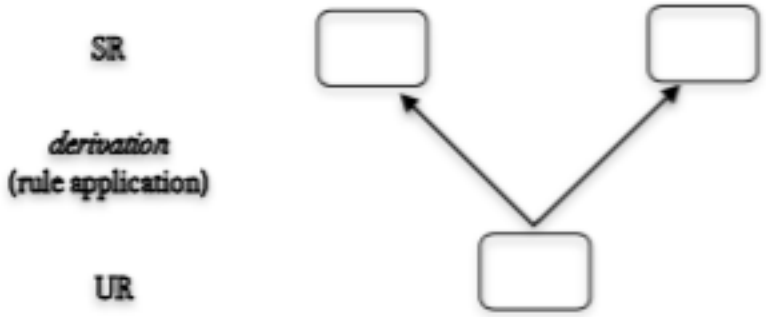
1. Identify the sound variation: what are the alternating phones?
2. List the environment where each alternant occur: what sounds surrounds them? Some formalisms:
   (a) word-initially: #_
   (b) word-finally: _#
   (c) between two vowels (any): V_V
   (d) between two consonants (any): C_C
   The space _ is where the sound you are analyzing occurs.
3. Do (some of) the sounds occur in the same exact environment?
   (a) If so, and the two corresponding words have two different meanings, it means that the two sounds are in a *contrastive distribution*, i.e. they are phonemes;
   (b) If so, and the two corresponding words have the same meaning, it means that the two sounds are allophones in *free variation*;
   (c) If not, the two sounds are *allophones distributing complementarily* depending on the phonological context.

   Now you have identified the kind of relationship between them, you can focus on the next step. In case of contrastive or free allophonic distribution, your job is done: there is no predictability power in such cases. In case of complementary distribution, you need to classify the environments in which each allophone occurs.
4. Once you have found the context in which each alternating sound occurs, you can work on stating the rule.
   → This is the **trick**: in cases of complementary allophonic distributions, usually just one of the (two or more) alternants typically occurs in an environment that cannot be easily grouped in a *natural class* — this hints that sound is likely to be the underlying representation!
5. Once you stated the rule, test your hypothesis by applying your rule(s) to the alleged UR. If you have detected more than one rule, you also want to check whether or not their application needs to be *ordered* in a specific way in order to get the desired surface representation.

4.1 Activity 6b: English plurals (II)

Look again at data in table in Activity 4a above. Since plurality is just one piece of morphological information, in (morpho-)phonology we usually assume that it must be underlyingly present in just one form. Let's try to detect it, by using the box in the previous page.

1. Alternating allomorphs:
   (a)
   (b)
   (c)
2. Occurring environments:
   (a)
   (b)
   (c)
3. What kind of alternation is that?
   (a) contrastive distribution
   (b) free allophonic distribution
   (c) complementary allophonic distribution
4. Phonological analysis:
   (a) By looking at the environment in which each allomorph occurs, which one do you is more likely to be the underlying form for the plural?



(b) Finally, let's check rule ordering: does it matter? Complete the derivation in the table below. The goal is to apply all the rules we have just assumed in the same order for any word you possibly think of — and still get the desired SR.

UR	[kæt-__]	[tæg-__]	[wiʃ-__]
SR	[kæt-s]	[tægz]	[wiʃəz]

4.2 Activity 7: English flapping

In table below alveolar stops /t, d/ *become the alveolar flap* [ɾ] *in a specific context: what is that? State it below.*

word	**IPA**	**word**	**IPA**
ladder	[ˈlæɾər]	latter	[ˈlæɾər]
soda	[ˈsoʊɾə]	cider	[ˈsaɪɾər]
hitter	[ˈhɪɾər]	etiquette	[ˈɛɾəˌkɛt]
stack	[ˈstæk]	table	[ˈtʰbəl]

Now let's look at the additional data below. Do they contradict our first guess? If so, try to hone the rule you just stated. Hint: Look at the stress! Where does it fall?

word	**IPA**	**word**	**IPA**
proton	[proʊ”tʰɑn]	rattle	[ˈræɾəl]
rider	[ˈaɪɾər]	radar	[ˈreɪdɑr]
retain	[rəˈʰeɪn]	material	[mətʰɪrjəl]
atom	[ˈærəm]	atomic	[æˈtʰɑmɪk]

Complete the following rule:

$$\begin{bmatrix} +\text{cons} \\ +\text{anterior} \\ \text{-distributed} \end{bmatrix} \rightarrow [\ +\text{sonorant}\ ] \ / \ \underline{\qquad\qquad}$$

The data in the table above shows that in English alveolar flapping interacts with another phenomenon that we have just seen in one of the activities above: what is that? In which order do they have to apply? Remember that such order must be fixed, and account for all relevant data presented above. Complete the table below.

UR	[ˈætəm]	[æˈtʰɑmɪk]
SR	[ˈærəm]	[æˈtʰɑmɪk]

4.3 Activity 8: Indonesian prefixes

Analyze the following Indonesian words into their constituent morphemes, and work out an underlying representation for each morpheme and each word.

	gloss	**simple form**	**prefixed form**
a.	'throw'	lempar	ləlempar
b.	'feel'	rasa	mərasa
c.	'represent'	wakil	məwakili
d.	'convince'	yakin	məyakin
e.	'cook'	masak	məmasak
f.	'marry'	nikah	mənikah
g.	'chat'	ŋaco	məŋaco
h.	'sing'	ɲaɲi	məɲa ɲi
i.	'count'	hituŋ	məŋhituŋ
j.	'draw'	gambar	məŋgambar
k.	'send'	kirim	məŋirim
l.	'hear'	dəŋar	məndəŋar
m.	'write'	tulis	məntulis
n.	'help'	bantu	məmbantu
o.	'hit'	pukul	məmpukul
p.	'sew'	ʒahit	məɲʒahit
q.	'note down'	ʧatat	məɲʧatat
r.	'take'	ambil	məŋambil
s.	'fill up'	isi	məŋisi
t.	'invite'	undaŋ	məŋundaŋ

1. *What is the underlying form of the prefix? Why?*

2. *List the underlying representations of any other alternating morphemes (hint: look at changes in the roots!).*

3. *Let's try to list all the rules we need to assume, given the corpus above; do they need to be ordered somehow? Complete the derivations in the table below.*

UR	[___-ambil]	[___-bantu]	[___-lempar]	[___-tulis]
SR	[məŋambil]	[məmbantu]	[məlempar]	[mən-tulis]

5 Recap

(21) *Phonology* studies the linguistic sounds a given language makes use of, to make up words. Phonology also looks at sound changes occurring in specific phonological and morphological contexts.

(22) To explain such changes, phonologists use *features*, i.e. specific articulatory configurations; they are usually assumed to have binary values: [+] indicates the presence of a specific articulatory movement, [-] indicates its absence. Changes are explained as phenomena occurring exclusively in sounds that can be grouped together as sharing at least one feature value (*natural classes*).

(23) *Minimal pair testing* is the only way to figure out whether two phones are used *contrastively* in a given language. Only if a minimally different pair of words conveys two different meanings, the two different sounds are to be considered as phonemes in that language; otherwise, one is an allophone of the other.

(24) Phonological operations include: *assimilation, dissimilation, insertion, deletion, metathesis, fortition, lenition.*

(25) Occurrence of phonological operations implies the presence of an abstract level of representation of sounds (*underlying representation*), which may undergo specific (morpho-)phonological operations leading to a phonetic representation (*surface representation*). *Ordering of rules* is sometimes crucial, in order for the underlying representation to surface as expected.

A Little Handbook of phonological features

— Root Tier —

[consonantal] constriction in the vocal tract. [+consonantal] are obstruents, nasals, liquids, and trills; vowels are [-consonantal].

[sonorant] type of oral constriction that can occur in the vocal tract. [+son] designates the vowels and sonorant consonants (namely glides, liquids, and nasals), which are produced so that the air pressure in the vocal tract is the same as the external air pressure; [-son] alternatively describes obstruents, characterized by an imbalance of air pressure in the vocal tract.

— Stricture Tier —

[continuant] passage of air through the vocal tract. [+cont] are mainly fricative sounds; stops are typically [-cont].

[strident] a type of friction that is noisier than usual. This is caused by high energy white noise.

[lateral] the shape and positioning of the tongue with respect to the oral tract. In [+lat] sounds the constriction occurs in the central area of the vocal trace, but the sides of the tongues are lowered so that air can pass through.

[nasal] the position (lowered/raised) of the velum. [+nasal] sounds are produced with a lowering of the soft palate, so that air can flow through the nasal cavity; in [-nas] sounds the velum is raised.

— Laryngeal Tier —

[spread gl.] openness of the glottis. [+spr gl] sonorant sounds are characterized by a breathy voice, non-sonorant [+spr gl] sounds are aspirated.

[constricted gl.] degree of closure of the glottis. [+constr gl] sonorant sounds are characterized by a creaky voice, non-sonorant [+constr gl] sounds are glottalized.

[voice] vibration of the vocal folds: voiced/unvoiced segments.

— Place Tier —

[round] [+round] sounds are produced with lip rounding, in [-round] sounds there is no such constriction.

[anterior] anterior segments are articulated with the tip or blade of the tongue at or in front of the alveolar ridge.

[distributed] for [+dist] segments the restriction is extended to an extended area on the median longitudinal axis of the vocal tract.

[high] [+high] segments raise the tongue body close to the palate, [-high] segments do not.

[low] [+low] segments bunch the tongue body to a position low in the mouth.

[back] [+back] segments are produced with the tongue body bunched and retracted slightly to the back of the mouth; [-back] segments are bunched and extended slightly forward.

[ATR] advanced position of the root of the tongue. For anatomical reasons, [+ATR] sounds usually are [+high] too.

[RTR] retracted position of the root of the tongue towards pharynx; uvular and pharyngeal sounds are [+RTR].

B Chart of phonological features