Unit 2 Distinctive Feature Theory

YANGCHEN ROY
LNG 201 PHONOLOGY
DECCAN COLLEGE POST-GRADUATE AND RESEARCH INSTITUTE
WINTER 2022

SEMINAL LITERATURE

Trubetzkoy (1939/1969) - *Principles of Phonology*
Jakobson, Fant & Halle (1952) – *Preliminaries to Speech Analysis: The distinctive features and their correlates*
Chomsky & Halle (1962) – *The Sound Pattern of English*

TEXTBOOK

Gussenhoven & Jacobs (2017) – *Understanding phonology,*
Odden – *Introducing Phonology,* “Feature Theory”, p. 129 – p. 135

EXTRA RESOURCES:

VLC DISTINCTIVE FEATURES I : HTTPS://YOUTU.BE/8PA0PM8A_DY

VLC DISTINCTIVE FEATURES II: HTTPS://YOUTU.BE/GXRL5KNNXWG

E-PG PATHASALA RESOURCES ON GDRIVE -

HTTPS://DRIVE.GOOGLE.COM/DRIVE/FOLDERS/1NCVSA53SWZ1RPTWSWWKMAGAC3KDKQQFM?USP=SHARING

On phonological distinctive opposition

- From Trubetzkoy's *Principles of Phonology* (1939/1969, p. 31)

The concept of distinctiveness presupposes the concept of *opposition*. One thing can be distinguished only from another thing: it can be distinguished only insofar as it is contrasted with or opposed to something else, that is, insofar as a relationship of contrast or opposition exists between the two. A phonic property can therefore only be distinctive in function insofar as it is opposed to another phonic property, that is, insofar as it is a member of an opposition of sound. Oppositions of sound capable of differentiating the lexical meaning of two words in a particular language are *phonological* or *phonologically distinctive* or *distinctive oppositions*.[1] In contrast, those oppositions of sound that do not have this property are *phonologically irrelevant* or *nondistinctive*. In German the opposition *o-i*, as in "so"/"sie" (thus, so/she, they), "Rose"/"Riese" (rose/giant) is phonological (distinctive). The opposition alveolar *r* and uvular *r*, on the other hand, is nondistinctive since in German there does not exist a single word pair that is differentiated by this opposition.

The Prague School: A brief history

- It all begins with the Moscow Linguistic Circle (founded in 1915). This circle had Nikolai Trubetzkoy, Roman Jakobson. This circle dealt with language and linguistics, poetics, literature analysis a.o. Influenced by de Saussure and Baudouin.
- By the 1920s, the terms 'phoneme' and 'phonology', both attribyted to T and J are well known to European linguistics.
- The Prague circle emerges in 1926 in the wake of the Russian revolution. The legacy of structuralism left by de Saussure greatly influenced linguistics.
- Jakobson – feature, binary opposition, markedness, redundancy, universals.
- Trubetzkoy – distinction between phonetics and phonology, distinctive opposition, minimalist pairs, neutralization, archiphoneme
- Together, J and T initiated the distinctive feature theory

The Prague Circle Manifesto

a. To identify the characteristics of particular phonological system, in terms of the language particular range of significant differences among “acoustico-motor images”

b. To specify the types of differences that can be found in general, and in characterize multiple pairs of elements (e.g., voicing separates *p* from *b)*

c. To formulate general laws governing the relations of these correlations to one another within particular phonological systems

d. To account for historical change in terms of the phonological system (rather than the individual sound) which undergoes it, and to construe such changes as teleologically governed by considerations of the system

e. To found phonetic studies on an acoustic rather than an articulatory basis, since it is the production of sound that is the goal of linguistic phonetic events and that gives them their social character.

Source: http://www.ling.fju.edu.tw/phono/prague.htm

Distinctive features

Any minimal distinction carried by the message confronts the listener with a two-choice situation. Within a given language each of these oppositions has a specific property which differentiates it from all the others. The listener is obliged to choose either between two polar qualities of the same category, such as grave vs. acute, compact vs. diffuse, or between the presence and absence of a certain quality, such as voiced vs. unvoiced, nasalized vs. non-nasalized, sharpened vs. non-sharpened (plain). The choice between the two opposites may be termed distinctive feature. The distinctive features are the ultimate distinctive entities of language since no one of them can be broken down into smaller linguistic units. The distinctive features combined into one simultaneous or, as Twaddell aptly suggests, concurrent bundle form a phoneme.

- A phoneme/segment is the minimal unit of sound in a language system. It **can be auditorily realised** i.e. it can have (via allophones if required), actual realisation.
- Distinctive features are a **more basic building block** of phonological analysis than phonemes.
- For example, consonants fall into two major classes, those that are voiced and those that are not. So we posit a **binary** distinctive feature [± voice], such that the voiced consonants are defined by the [+voice] feature while the voiceless ones are defined by the [-voice] feature.

Turkish vowels

Turkish vowels are defined by three independent binary features [±high], [±back] and [±round].

	–back		+back	
	–round	+round	–round	+round
+high	i	ü	ɨ	u
–high	e	ö	ɑ	o

Q

Is {i, e and u} a natural class?

Is {e, ɑ, o} a natural class?

Jensen (2004)

Why do we need them?

- The phonological behaviour of phonemes is largely determined by the phonetic features which they are made up of. English /r/ undergoes partial devoicing when immediately preceded by voiceless stops but not when preceded by voiced ones.

pray	[p̥ɾeɪ]	brain	[breɪn]
train	[t̥ɾeɪn]	drain	[dreɪn]
crane	[k̥ɾeɪn]	grain	[greɪn]

-We get a unique set of feature values for each distinctive sound unit of human languages.
-We have a natural way of identifying **classes of sounds** that function together in phonological operations (rules).

Katamba (1989, p. 36)

Q36

1 Which consonants are aspirated syllable-initially in English?
2 If we ignore the ordinal suffix [θ], as occurring in *sixth*, which consonants can form a word-final complex coda in a position after [s] in English?
3 Which consonants can occur between [s] and [r] in the syllable onset of English words?
4 What is the significance of the fact that the preceding three questions have the same answer?

DAY 2

Distinctive feature theory in Jakobson, Fant and Halle (1952) - Features for English

Fundamental Source Features	Secondary Consonantal Features	Resonance Features
Vocalic vs Non-vocalic	Envelope Features – (Interrupted vs Continuant), (Checked vs Unchecked)	Compact vs Diffuse
Consonantal vs Non-Consonantal	Strident vs Mellow	Tonality Features – (Grave vs Acute), (Flat vs plain), (Sharp vs Plain)
	Voiced vs Unvoiced	Tense vs Lax
		Nasal vs Oral

Vocalic/Non-Vocalic

- “Phonemes possessing the vocalic feature have a single periodic (“voice”) source whose onset is not abrupt. (JFH, p. 18)
- “Vocalic sounds are produced with an oral cavity in which the most radical constriction does not exceed that found in the high vowels [i] and [u] and with vocal cords that are positioned so as to allow spontaneous voicing; in producing non-vocalic sounds one or both of these conditions are not satisfied.” (SPE, p. 302)
- Vocalic sounds - voiced vowels (/a, o, u/) and liquids (/l, r/)
- Non-vocalic sounds – glides (/w, y/), nasal consonants (/m, n, ŋ, ɳ/), obstruents i.e. plosives, fricatives and affricates (/p, f, dʒ/), voiceless vowels and liquids (/l̥, ḁ, r̥/)

Consonantal/Non-Consonantal

- “Phonemes possessing the consonantal feature are acoustically characterized by the presence of zeros that affect the entire spectrum.” (JFH, p. 19)
- “Consonantal sounds are produced with a radical obstruction in the midsagittal region of the vocal tract; non-consonantal sounds are produced without such an obstruction.” (SPE, p. 302)
- Consonantal – liquids, nasal consonants, non-nasal consonants
- Non-consonantal – voiced vowels, voiceless vowels, glides

Interrupted vs Continuant

- The abrupt onset distinguishes the interrupted consonants (stops) from the continuant consonants constrictives) . The onset of constrictives is gradual. The main characteristic of stops, on the contrary, is a sharp wave front preceded by a period of complete silence, for which, under certain conditions, a mere vibration of the vocal bands may be substituted. The spectrograms show here a sharp vertical line preceded either by a period of silence or a "voice bar" (JFH)
- In the production of continuant sounds, the primary constriction in the vowel tract is not narrowed to the point where the air flow past the constriction is blocked; in stops the air low through the mouth is effectively blocked. Among the stops are the plosives (nasal as well as oral), the affricates, and the glottal stops, as well as various types of sounds with closure not only at the point of primary constriction but also at supplementary constrictions, including clicks, other doubly articulated plosives (labiovelars), and implosive and ejective stops. (SPE)
- Interrupted – stops (/p, b, t, d/)
- Continuant – everything else (/f, v, m, r/)

Checked vs Unchecked

- An abrupt decay is the opposite of a smooth one. In spectrograms, checked phonemes are marked by a sharper termination, but this is ordinarily less prominent than an abrupt onset

2.3123 Occurrence. Certain varieties of checked stops, called glottalized, are found in many native languages of America, Africa, the Far East and the Caucasus; e.g. the spectrograms of the Navaho and Circassian glotallized stops (for the latter see Fig. 1) disclose a striking similarity of structure.

Examples: checked vs. unchecked stops: Circassian /tʾa/ "dig!" - /ta/ "we"; /cʾa/ "name" - /ca/ "tooth"; /pʾa/ "place" - /pa/ "be out of breath!". Less clear and most uncommon is the glottalization of constrictives (7) observed in Tlingit (Northwestern America) and Kabardian (N. Caucasus).

Strident vs Mellow

- Sounds that have irregular waveforms are called strident . In the spectrogram such sounds are represented by a random distribution of black areas. They are opposed to sounds with more regular waveforms. The latter are called mellow and have spectrograms in which the black areas may form horizontal or vertical striations. (JFH)
- Differentiates between plosives (nonstrident stops) and affricates (strident stops). What about nonstrident affricates, like those found in Chippewyan (an American Indian language). It has contrasting dental strident and nonstrident affricates. (SPE)

Voiced vs Unvoiced

- The voiced or "buzz" phonemes as /d b z v/ vs. the voiceless or "hiss" phonemes are characterized by the superposition of a harmonic sound source upon the noise source of the latter (10). For the voiced consonants this means a joint presence of two sound sources. The spectrum of voiced consonants includes formants which are due to the harmonic source. The most striking manifestation of "voicing" is the appearance of a strong low component which is represented by the voice bar along the base line of the spectrogram ...Voiced phonemes are emitted with periodic vibrations of the vocal bands and voiceless phonemes without such vibrations. (JFH)
- In order for the vocal cords to vibrate, it is necessary that air flow through them. If the air flow is of sufficient magnitude, voicing will set in, provided only that the vocal cords not be held as widely apart as they are in breathing or in whispering. (SPE)

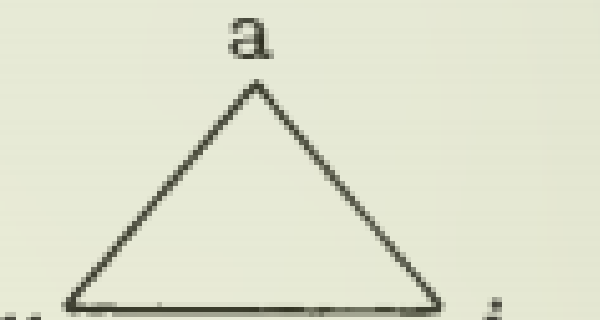
Compact/Diffuse & Grave/Acute

- Compact phonemes are characterized by the relative predominance of one centrally located formant region (or formant). They are opposed to diffuse phonemes in which one or more non-central formants or formant regions predominate. (JFH)
- Acoustically this feature means the predominance of one side of the significant part of the spectrum over the other. When the lower side of the spectrum predominates, the phoneme is labeled grave; when the upper side predominates, we term the phoneme acute.
- Both to do with describing the articulatory configurations of vowels and consonants (SPE)
- Revised in SPE

Arabic

Compact

Diffuse



Grave Acute

The revisions proposed in the last few pages have the following main effects:

(1) Features specifying the position of the body of the tongue are now the same for vowels and consonants.

(2) In the characterization of vowel articulations, the features "high," "low," "back" correspond to the earlier "diffuse," "compact," and "grave," respectively. In consonants, the same three revised features correspond to palatalization, velarization, and pharyngealization in the manner discussed above.

(3) The feature "anterior" mirrors precisely the feature "diffuse" in consonants.

(4) The feature "coronal" corresponds most closely to the feature "grave" in consonants but with opposite value. Except for the palatals ([k_1], etc.), consonants that were classified as nongrave in the earlier framework are coronal in the revised framework, whereas those that were classified as grave are noncoronal. The palatals, which in the earlier framework were nongrave, are noncoronal.

We recall that in the earlier framework the feature "diffuse" was used to characterize both the distinction between high and nonhigh vowels and that between what we have called anterior and nonanterior consonants. As a result the articulatory and acoustical characterization of the feature became quite complex and rather implausible. (See, for example, the discussion of diffuseness in Halle (1964).)

SPE
p. 306-307

Flat/Plain

- Flattening manifests itself by a downward shift of a set of formants or even of all the formants in the spectrum ... Flattening is chiefly generated by a reduction of the lip orifice (rounding) with a concomitant increase in the length of the lip constriction. Hence the opposition flat vs. plain has been genetically termed "orifice variation", and the opposition grave vs. acute "cavity variation"

Flat vs. plain vowels: Turkish /kus/ - /kɨs/, /kys/ - /kis/; /on/ - /an/; /ɸn/ - /en/ (See Fig. 4). We employ a conventional musical term for labeling this feature, and in phonemic transcription we may correspondingly use a subscript or superscript musical flat "♭" to denote the flat consonants. Examples from Rutulian, a North Caucasian language: /iak♭/ "light" - /iak/ "flesh", /χ♭ar/ "more" - /χar/ "hail". (See Fig. 6).

Sharp/Plain

- This feature manifests itself in a slight rise of the second formant and, to some degree, also of the higher formants … To effect this feature, the oral cavity is reduced by raising a part of the tongue against the palate. (JFH)

Examples: Russian /m'at/ "to rumple" - /m'at/ "rumpled" - /m'at/ "mother" - /m'at/ "checkmate", /kr'of/ "blood" - /kr'of/ "shelter" (see Fig. 9).

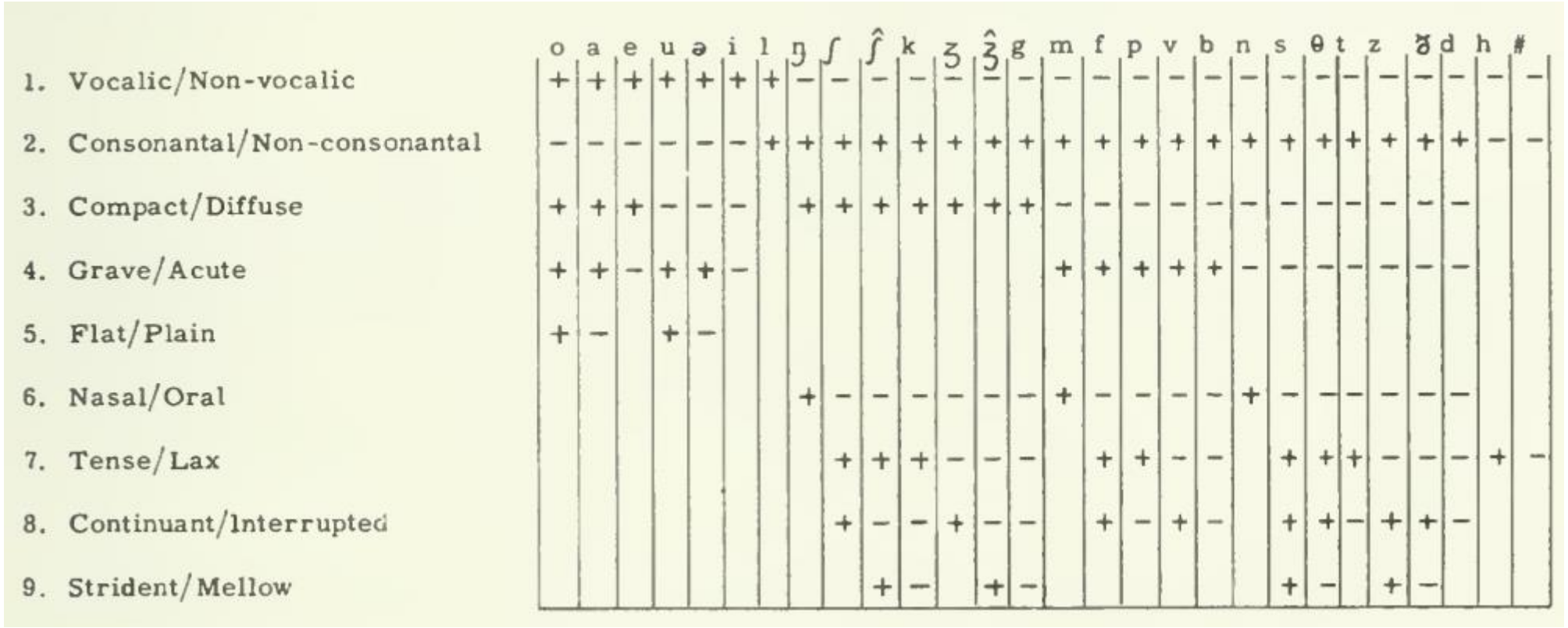
Tense/Lax

- In contradistinction to the lax phonemes the corresponding tense phonemes display a longer sound interval and a larger energy. In contradistinction to the lax phonemes the corresponding tense phonemes display a longer sound interval and a larger energy. (JFH)
- The feature" tenseness" specifies the manner in which the entire articulatory gesture of a given sound is executed by the supraglottal musculature-.Tense sounds are produced with a deliberate, accurate, maximally distinct gesture that involves considerable muscular effort; nontense sounds are produced rapidly and somewhat indistinctly. In tense sounds, both vowels and consonants, the period during which the articulatory organs maintain the appropriate configuration is relatively long, while in nontense sounds the entire gesture is executed in a somewhat superficial manner. (SPE)

Nasal/Oral

- The oral (or more exactly, the non-nasalized) phonemes are formed by the air stream which escapes from the larynx through the mouth cavity only. The nasal (or more exactly, nasalized) phonemes are, on the contrary, produced with a lowering of the soft palate, so that the air stream is bifurcated and the mouth resonator is supplemented by the nasal cavity. (JFH)
- Nasal sounds are produced with a lowered velum which allows the air to escape through the nose; nonnasal sounds are produced with a raised velum so that the air from the lungs can escape only through the mouth. (SPE)

Distinctive feature theory in Jakobson, Fant and Halle (1952) - Features for English



	o	a	e	u	ə	i	l	ŋ	ʃ	ʧ	k	ʒ	ʤ	g	m	f	p	v	b	n	s	θ	t	z	ð	d	h	#
1. Vocalic/Non-vocalic	+	+	+	+	+	+	+	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−
2. Consonantal/Non-consonantal	−	−	−	−	−	−	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	−	−
3. Compact/Diffuse	+	+	+	−	−	−		+	+	+	+	+	+	+	−	−	−	−	−	−	−	−	−	−	−	−		
4. Grave/Acute	+	+	−	+	+	−									+	+	+	+	+	−	−	−	−	−	−	−		
5. Flat/Plain	+	−		+	−																							
6. Nasal/Oral								+	−	−	−	−	−	−	+	−	−	−	−	+	−	−	−	−	−	−		
7. Tense/Lax									+	+	+	−	−	−		+	+	−	−		+	+	+	−	−	−	+	−
8. Continuant/Interrupted									+	−	−	+	−	−		+	−	+	−		+	+	−	+	+	−		
9. Strident/Mellow										+	−		+	−							+	−		+	−			

(p. 43)

Check pages 47-52 of JFH for spectrogram descriptions of the feature binaries

Distinctive features in *The Sound Pattern of English*

Major class features	Cavity features	Manner of articulation features	Source features	Prosodic features
sonorant	Coronal	**Continuant**	Heightened subglottal pressure	Stress
consonantal	Anterior	Release features – instantaneous and delayed	**Voice**	Pitch – High, Low, Elevated, Rising, Falling, Concave
vocalic	Tongue-body features – High, Low, Back	Supplementary movements – Suction (Velaric suction, implosion), Pressure – Velaric pressure, Ejectives	**Strident**	Length
	Round	**Tense**		
	Distributed			
	Covered			
	Glottal constrictions			
	Secondary apertures – **Nasal**, Lateral			

Sonorant vs Obstruent

- Sonorants are sounds produced with a vocal tract cavity configuration in which spontaneous voicing is possible; obstruents are produced with a cavity configuration that makes spontaneous voicing impossible. As we noted above, spontaneous voicing may be suppressed by narrowing the air passage to a point where the rate of flow is reduced below the critical value needed for the Bernoulli effect to take place. Constrictions more radical than those found in the glides [y] and [w]will have this result. Hence sounds formed with more radical. constrictions than the glides, i.e., stops, fricatives, and affricates, are non-sonorant, whereas vowels, glides, nasal consonants, and liquids are sonorant.

Coronal vs Non-Coronal

- Coronal sounds are produced with the blade of the tongue raised from its neutral position; non-coronal sounds are produced with the blade of the tongue in the neutral position.
- The so-called dental, alveolar, and palato-alveolar consonants are coronal, as are the liquids articulated with the blade of the tongue.
- The uvular [R] and the consonants articulated with the lips or with the body of the tongue are non-coronal. The glides [y]and [w]are non-coronal.
- The so-called retroflex vowels which are found in some languages of India-e.g., Badaga (H. L. Gleason, personal communication)-as well as in many English dialects in the position before [r]are coronal.
- Nonretroflex vowels are, of course, non-coronal.

In the neutral position the body of the tongue is assumed to be raised and fronted, approximating the configuration found in the vowel [e] in English bed.

Anterior vs Non-Anterior

- Anterior sounds are produced with an obstruction that is located in front of the palatoalveolar region of the mouth; nonanterior sounds are produced without such an obstruction. The palato-alveolar region is that where the ordinary English [ʃ] is produced.
- It follows from the proposed characterization that vowels, which are formed without constrictions in the oral cavity, are always nonanterior.
- Consonants and liquids are anterior when they are formed with an obstruction that is located farther forward than the obstruction for [ʃ]. The consonants that in traditional terminology are described as palato-alveolar, retroflex, palatal, velar, uvular, or pharyngeal are therefore non anterior, whereas labials, dentals, and alveolars are anterior.

FEATURES RELATING TO THE BODY OF THE TONGUE: HIGH-NONHIGH, LOW-NONLOW, BACK-NONBACK

- The three features "high," "low," "back" characterize the placement of the body of the tongue.
- In characterizing these three features, we shall be concerned with the various displacements of the tongue body from the neutral position.

In the neutral position the body of the tongue is assumed to be raised and fronted, approximating the configuration found in the vowel [e] in English bed.

High vs Non-High

- High sounds are produced by raising the body of the tongue above the level that it occupies in the neutral position
- Non-high sounds are produced without such a raising of the tongue body

Low vs Non-low

- Low sounds are produced by lowering the body of the tongue below the level that it occupies in the neutral position; nonlow sounds are produced without such a lowering of the body of the tongue.

Back vs Non-back

- Back sounds are produced by retracting the body of the tongue from the neutral position; non-back sounds are produced without such a retraction from the neutral position.

Why do we need both HIGH and LOW?

TABLE 2.

	palatals	velars	uvulars	pharyngeals
high	+	+	−	−
low	−	−	−	+
back	−	+	+	+

Round

- Rounded sounds are produced with a narrowing of the lip orifice; nonrounded sounds are produced without such a narrowing.
- All classes of sounds may manifest rounding. In glides and non-low vowels, rounding is commonly correlated with the feature" back": sounds that are back are also round, those that are non-back are non-round. This association is not obligatory, however, and there are many instances where the features "round" and "back" combine freely. Turkish, for example, has all of the four possible feature combinations contrasting among its high vowels

TABLE 4. *Turkish high vowels*

	i	ɨ	ü	u
back	−	+	−	+
round	−	−	+	+

Distributed vs Non-distributed

HOMEWORK

Covered vs Uncovered (Tentative)

- We shall assume that covered sounds are produced with a pharynx in which the walls are narrowed and tensed and the larynx raised; uncovered sounds are produced without a special narrowing and tensing in the pharynx
- “In many West African languages there is vowel harmony in terms of a feature that has been variously described as "tenseness" (Ladefoged,1964) “heightening"(Welmers, 1946), "brightness" (Sapir, 1931). The X-ray tracings published by Ladefoged (1964, p. 38) clearly show that in one set of these vowels the pharynx is more constricted than in the other and that the constriction in the pharynx is accompanied by a noticeable elevation of the larynx. We venture to suggest that this difference corresponds to the difference between the vocal tract positions in open and covered singing. The particular dull quality associated with covered voice production appears not to be present in all cases. Sapir (1931) observed it in Gweabo, and Berry (1957) mentions it for Twi, but other observers, including Ladefoged (1964), have failed to notice it. In view of the uncertain status of our data, the proposed description of this feature must be taken as tentative.”

Glottal constrictions

- Glottal constrictions are formed by narrowing the glottal aperture beyond its neutral position. Such constrictions may accompany many different types of supraglottal articulatory configurations. Included among the sounds with glottal constriction are both the implosives and the ejectives, as well as certain types of clicks.

“Several African and Caucasian languages exhibit the so-called laryngealized or "creaky" voice (Knarrstimme), which seems to be an instance of glottal constriction.”

Lateral

- This feature is restricted to coronal consonantal sounds. Lateral sounds are produced by lowering the mid section of the tongue at both sides or at only one side, thereby allowing the air to flow out of the mouth in the vicinity of the molar teeth; in non-lateral sounds no such side passage is open. Laterality is compatible both with vocalic (liquid) and non-vocalic sounds, the difference being that in the vocalic lateral (liquid) the passage is wider and less obstructed than in the non-vocalic lateral. Among the lateral non-vocalic sounds we have continuants opposed to affricates, whereas there does not seem to be any such subdivision among the vocalic laterals.

Delayed release vs Instantaneous release

- These features affect only sounds produced with closure in the vocal tract. There are basically two ways in which a closure in the vocal tract may be released, either instantaneously.as in the plosives or with a delay as in the affricates. During the delayed release, turbulence is generated in the vocal tract so that the release phase of affricates is acoustically quite similar to the cognate fricative. The Instantaneous release is normally accompanied by much less or no turbulence.

- **See SPE for more on types of delayed release**

Velaric suction and implosion

- Since suction is produced by a downward movement of velar or glottal closures, it is necessary from a phonetic point of view to postulate two distinct suction features, one (the" click " feature) is associated with velar closure and the other (the "implosion" feature) with glottal closure.

Velaric pressure and Ejectives

- Like suction motions, pressure motions can be executed by the velar or by the glottal closure. We must therefore postulate two pressure features, a" velar pressure" feature and a "glottal pressure" feature. We shall refer to the latter by its traditional name" ejection,“ in view of its greater familiarity.
- VELAR PRESSURE. The existence of velaric pressure stops, which is occasionally mentioned in the literature (see Heffner, 1950), could not be substantiated.
- EJECTION. Ejection is produced by an upward movement of the glottal closure.

Features we will work with (From your textbook)

Major-Class features	Laryngeal features	Manner features	Place features (Univalent)
[±consonantal]	[±voice]	[±continuant]	[LABIAL] – [±round]
[±sonorant]	[±spread glottis]	[±nasal]	[CORONAL] – [±anterior], [±distributed]
[±approximant]	[±constricted glottis]	[±strident]	[DORSAL] – [±high], [±low], [±back], [±tense]
		[±lateral]	[RADICAL]
		[± delayed release]	

The three requirements we must impose on a distinctive feature system

1. They should be capable of characterizing natural segment classes.

2. They should be capable of describing all segmental contrasts in the world's languages.

3. They should be definable in phonetic terms.

[±consonantal]

- [+cons] segments have a constriction **somewhere along the centre line in the vocal tract**
- [–cons] segments lack such a constriction.
- Thus, [+cons] are plosives, affricates, fricatives, nasals, laterals and [r].
- [–cons] are vowels, glides like [j ɥ w], and, because their stricture is in the larynx rather than the vocal tract, [h ɦ ʔ].

[±sonorant]

- [+son] segments are produced with a **constriction in the vocal tract which allows the air pressure behind it and in front of it to be relatively equal.** This is not the case for [–son] segments.
- That is, either [–son] segments have an oral constriction which causes a significant increase in the air pressure behind it (e.g. [s], [d]), or there is no constriction in the vocal tract. Since the vocal tract does not include the larynx, [h] and [ʔ] are [–son].
- So [+son] are all vowels, glides like [ʊ w j], liquids and nasals,
- [–son] are plosives, fricatives, affricates and laryngeal segments.

[±approximant]

- [+approx] are those segments which have a constriction in the vocal tract which allows a free (frictionless) escape of air, while for [–approx] segments this is not the case.
- Vowels and non-nasal sonorants, like [ɪ ɹ ʌ], are [+approx] segments.

Vowels	Glides	Liquids	Nasals	Obstruents
[+syllabic]	[–syllabic]			
[–consonantal]		[+consonantal]		
[+approximant]			[–approximant]	
[+sonorant]				[–sonorant]

Hayes (2009), p. 76

Q39 **In the variety of Spanish spoken in the state of Cordoba in Colombia, the first of two adjacent consonants was assimilated to the second, creating a geminate consonant (Charette 1989). For example, the word for 'door', which is** [pwerta] **in Peninsular Spanish, is** [pwetta]

in the Cordoba variety. The process did not always apply. Characterize the class of consonants that underwent the process.

Earlier form	*Later form*	
serdo	seddo	'pork'
awto	awto	'car'
talko	takko	'talc'
doktor	dottor	'doctor'
algo	aggo	'something'
neptuno	nettuno	'Neptune'
fohforo	fohforo	'match'
magdalena	maddalena	'Madeleine'
ojgo	ojgo	'onion'
arma	amma	'weapon'
ahno	ahno	'donkey'

[d, k, g, t, m]

[+consonantal]

Q40 **In Dutch, sequences of identical segments, which arise when the last segment of one morpheme is the same as the first of the next, are degeminated. Characterize the class of sounds that is subject to the rule in terms of distinctive features.**

Input	*Output*	
χeːl lɑmpjə	χeː lɑmpjə	'yellow lamp'
fis sɑpjə	fi sɑpjə	'nasty drink'
leːχ χaːtjə	leː χaːtjə	'empty hole'
fraːj jɑχt	fraːj jɑχt	'beautiful yacht'
løːk kɪnt	løː kɪnt	'nice child'
slɪm mɛiʃjə	slɪ mɛiʃjə	'clever girl'
ryʋ ʋeːr	ryʋ ʋeːr	'stormy weather'
doːf fɛntjə	doː fɛntjə	'deaf fellow'
χutkoːp pɑk	χutkoː pɑk	'cheap suit'
fɛin nøːʃjə	fɛi nøːʃjə	'fine nose'
niʋ ʋɔntjə	niʋ ʋɔntjə	'new wound'
fiːr raːmən	fiː raːmən	'four windows'

[+consonantal]

Q42 In English, certain segments may appear after [sp st sk] **in the same syllable. Characterize them with the help of a single distinctive feature on the basis of the following data.**

skɪp	spreɪ	stju:	əˈspaɪə
stɔp	skju:d	skləˈrəʊsɪs	skræp
skwɒd	spreɪn	spju:	streɪt
stæk	strɔ:	ˈsplɛndɪd	skʌl

[+sonorant]

Q38 **In Dutch, there is a rule that places a [ə] between the noun stem and the diminutive ending [tjə], as when [bɑl] 'ball' is affixed with [tjə] and becomes [ˈbɑlətjə]. On the basis of the following data, characterize the group of segments after which this [ə] is inserted.**

bɑl	bɑlətjə	'ball'	dɪŋki tɔj	dɪŋki tɔjtjə	'Dinky Toy'
kɔm	kɔmətjə	'bowl'	kɑp	kɑpjə	'hood'
lɑχ	lɑχjə	'laugh'	bɛs	bɛʃə	'berry'
kɑn	kɑnətjə	'jug'	rɔk	rɔkjə	'skirt'
kɑr	kɑrətjə	'cart'	dɪŋ	dɪŋətjə	'thing'
pɛt	pɛtjə	'cap'	sɔk	sɔkjə	'sock'

Segments after which schwa is inserted during diminutive ending attachment – [l m n r ŋ] – [[+consonantal] [+sonorant]]
Segments after which schwa is NOT inserted during diminutive ending attachment – [X, t j p ʃ k]

Q42 In English, certain segments may appear after [sp st sk] in the same syllable. Characterize them with the help of a single distinctive feature on the basis of the following data.

skɪp	spreɪ	stju:	əˈspaɪə
stɔp	skju:d	skləˈrəʊsɪs	skræp
skwɒd	spreɪn	spju:	streɪt
stæk	strɔ:	ˈsplɛndɪd	skʌl

[ɪ ɔ w æ r j l a ʌ]
Therefore all [+son]

[±voice]

- [+voice] are segments for which the vocal folds are close enough together to allow vibration, while for [–voice] this is not the case.
- [+voice] are vowels (e.g. [i ʌ ɛ ã ɪ]), sonorant consonants (e.g. [m ɲ l r ʀ w]) and voiced obstruents (e.g. [b z ɣ dʒ] and [ɦ]
- [–voice] are voiceless obstruents (e.g. [p θ ʃ ts h]).

[±spread glottis]

- [+spread] segments have a vocal fold configuration that produces audible friction in the glottis
- [–spread] segments lack such a configuration.
- Thus, aspirated segments like [p^h k^{wh}] and [h ɦ] are [+spread]
- Other segments are [–spread].

[±constricted glottis]

- For [+constr] segments the vocal folds are tense and drawn together, while for [–constr] segments this is not the case.
- Thus, [ʔ], laryngealized vowels (e.g. [ṵ]) and laryngealized sonorant consonants (e.g. [mʔ]), glottalized obstruents (e.g. preglottalized [ˀp] or ejective [p’]) are [+constr]. So are implosives ([ɓ ɗ ɠ]).
- Other segments are [–constr].

Q43

1 American English [p t k] are accompanied by a glottal closure when appearing in the syllable coda, as in *sit*, *atlas*, *popcorn*, *duckpond*. What feature specification do these plosives acquire in this context?

2 In Southern Oromo, a rule of i-EPENTHESIS inserts [i] between the ejectives [t' tʃ'] and a following [t n], as shown in (a). However, [ʔ ɗ t] do not trigger the rule but undergo other changes that are not relevant here, as shown in (b,c,d) (Lloret 1995). What combination of features distinguishes the [t'] from the three consonants that do not trigger i-EPENTHESIS?

a	fit'-na	fit'ina	'we finish'
b	aʔ-na	a:na	'we push'
c	fe:ɗ-ta	fe:t:a	'you want'
d	bit-ta	bit:a	'you buy'

1. [+constricted glottis]
2. The features that distinguish [ʔ ɗ t] i.e. a voiceless glottal plosive, a voiced implosive and a voiceless alveolar plosive: [[-sonorant] [-voice] [+constr]]

[±continuant]

- [+cont] segments lack a central occlusion i.e. a full closure, in the oral portion of the vocal tract, while [–cont] segments are produced with such an occlusion.
- Thus, plosives (e.g. [p d g]), nasal consonants (e.g. [m ŋ]), affricates (e.g. [tʃ]) and the glottal stop [ʔ] are [–cont]
- other segments i.e. fricatives, liquids, glides and vowels are [+cont].

[± delayed release]

- Sounds that are [+delayed release] are produced with a slow release of air, like fricatives and affricates
- Sounds produced with a sudden release are [-delayed release], like plosives

Stops	Affricates	Fricatives
[–continuant]		[+continuant]
[–delayed release]	[+delayed release]	

Hayes (2009), p. 79

[±nasal]

- [+nas] segments (e.g. [m n ŋ]) are produced with the velum ('soft palate') lowered, and [–nas] segments have the velum in its closed (raised) position.
- Nasal consonants and nasalized vowels are [+nas]; other segments are [–nas]

[±strident]

- [±strident] is relevant for obstruents only and refers to a type of friction.
- [+strident] segments cause a noisier kind of friction than [–strident] segments.
- Used to distinguish plosives from affricates, both of which are [-son, -cont].
- Coronal fricatives and affricates can be [+strident]
- it is at least suggestive that affricates typically have strident friction after the release of the closure, as in [pf ts tʃ kχ] rather than [pɸ tθ cç kx]

Q44 In Scottish English, [i e a o u ʌ ʌi] are pronounced as long [i: e: a: o: u: ʌ: ae] in open syllables. The long vowels (including [ae]) also appear before certain consonants. How can this class of consonants be characterized? This regularity, described by Aitken (1981, 1984), is known as Aitken's Law.

raeð	*writhe*	mʌil	*mile*
nʌin	*nine*	be:ʒ	*beige*
ti:z	*tease*	rod	*road*
lʌ:v	*love*	ka:r	*car*
liθ	*Leith*	hom	*home*
lʌif	*life*	pis	*peace*
mel	*mail*	raʃ	*rash*

Consonants before which the long vowels occur – [ð, z, v, ʒ, r]
Consonants before which the long vowel DOES NOT occur – [n, θ, f, l, d, m, s, ʃ]
Therefore, the class of consonants before which the long vowels occur are voiced fricatives and rhotics. This class is characterized by the feature bundle [[+voice] [+cont] [-lateral]]

Q45 In Turkish, obstruents are voiceless in the syllable coda, as shown in (1) (after Kim 1997).

(1)

Underlying	*Objective*	*Plural*	
ip	ipi	ipler	'rope'
dib	dibi	dipler	'bottom'
at	atɯ	atlar	'horse'
ad	adɯ	atlar	'name'
køk	køki	køkler	'root'
gøg	døgi	døkler	'sky'
diʃ	diʃi	diʃler	'tooth'
kɯz	kɯzɯ	kɯzlar	'daughter'
deniz	denizi	denizler	'sea'
satʃ	satʃɯ	satʃlar	'hair'
a:dʒ	a:dʒɯ	a:tʃlar	'tree'

1 Which obstruents are devoiced?
2 Can this group of obstruents be characterized as a natural class?

1. The obstruents that are devoiced when in syllable coda position:
[b d g dʒ] – voiced plosives and affricates
2. Yes, [[-son] [-cont.] [+voice]]

Assume a language with the following segmental inventory:

p t tˢ č c k φ f θ s š x b d dᶻ ǰ ɟ m n ŋ l i e o u a ü ö w y

(In this case, <c> represents a palatal stop, assumed to be featurally identical to a palatalized *k*.) In each of the following groups, one of the segments is not a member of the natural class which the other sounds belong to. Identify that sound, and state what features characterize the remaining class of segments.

k x ŋ o u a w y

[y] [-back]

Q46 In Dutch, certain consonants must be voiceless at the end of a syllable. Characterize that class of consonants with the help of distinctive features.

Singular	*Plural*		*Singular*	*Plural*	
li:r	li:rən	'pulley'	ka:rt	ka:rtən	'card'
mɛp	mɛpən	'slap'	rɑnt	rɑndən	'edge'
spɛlt	spɛldən	'pin'	bɑl	bɑlən	'ball'
kɑnt	kɑntən	'side'	ʒi'rɑf	ʒi'rɑfən	'giraffe'
rɛis	rɛizən	'journey'	vɛp	vɛbən	'web'
dœyf	dœyvən	'pigeon'	pa:rt	pa:rdən	'horse'
vɑŋ	vɑŋən	'cheek'	sxun	sxunən	'shoe'
kʌus	kʌusən	'sock'	le:v	le:vən	'lion'

Consonants that are voiceless at the end of a syllable : [b, d, ʒ, v] – [+cons] [-son] [+voice]

[±lateral]

- [+lat] segments have a central tongue contact in the oral cavity with one or both sides of the tongue being held away from the roof of the mouth, allowing the air to escape there, like alveolar [l] and prepalatal [ʎ].
- Other sounds are [–lat].
- A lateral escape of the air is also possible for obstruents, like the lateral fricatives [ɬ] (voiceless) and [ɮ] (voiced) and the lateral affricates [tɬ] and [dɮ].

[CORONAL] segments are articulated with a raised crown of the tongue, i.e. a raised tip and/or blade, ranging from dental [θ] to prepalatal [j].
[CORONAL] segments are further specified for the features [±anterior] and [±distributed], and in the case of coronal fricatives
and affricates also for [±strident]

1 [±anterior]. For [+ant] segments, the crown articulates with the alveolar ridge or somewhere further forward, while for [–ant] segments, the crown articulates with a point behind the alveolar ridge. Thus, [t d s z θ ð n l] are [+ant], while prepalatal or postalveolar and retroflex consonants (e.g. [c ɟ ʃ ʒ ɲ] and [ʈ ɖ ʂ ʐ ɳ ɭ ɽ]) are [–ant].

2 [±distributed]. Segments that are [+distr] are produced with a constriction that extends for a relatively great distance along the vocal tract, while for [–distr] segments this is not the case. Thus, consonants produced with the tip of the tongue (**apical** consonants like British English [t d n]) are [–distr], as are [s z] (Clements 1985). Blade-articulated (laminal) consonants like [ʃ tʃ ʒ] are [+distr]. Dental consonants like [θ ð t̪ l̪] are also [+distr], because even where it is only the tip that touches the front teeth, the blade is close to the alveolar ridge and in fact contributes to the acoustic effect. Retroflex consonants are [–distr]: the tip articulates with the part of the palate immediately behind the alveolar ridge. Australian languages frequently have a four-way opposition, utilizing the four possibilities given by these features (Butcher 2006). Four coronal stops and nasals contrast in Kayardild, for instance, as shown in (1) (Evans 1995).[1]

	(Lamino-) dental	(Apico-) alveolar	(Lamino-) prepalatal	Retroflex
	t̪ n̪	t n	c ɲ	ʈ ɳ
Ant	+	+	–	–
Distr	+	–	+	–

Dorsal

- [±high]. Segments that are [+high] raise the dorsum to a position close to the roof of the mouth, while [–high] segments do not. Thus, [+high] segments are [i ɪ y ʏ u ʊ ɯ], as well as [ç], and [k g x ɣ ŋ], while [χ e o a] are [–high], for instance [±low]. [+low] segments have the bunched dorsum low in the mouth, while [–low] segments do not. Thus, [+low] segments are [a ɛː ɔː], for instance.
- [±back]. [+back] segments have the bunch of the tongue positioned in the centre or further back, while [–back] segments have the bunch in the front. Thus, [+back] segments are velar and uvular consonants (e.g. [k ɣ χ]) and vowels like [u ə o ʌ ɑ], while [–back] segments are fronted velars like [k̟] and [ç], and vowels like [i y ø ɛ].
- [±tense]. [+tense] vowels like [i e a o u] are produced with a more peripheral and somewhat closer tongue position than their [–tense] counterparts [ɪ ɛ ɑ ɔ ʊ]. The feature is relevant only if the language has vocalic oppositions like [i – ɪ], [y – ʏ], [u – ʊ], etc. It is commonly used in Germanic languages, which have contrasts like English [suːt] suit – [sʊt] soot and German [ˈmiːtə] ‘rental fee’ – [ˈmɪtə] ‘middle’. The features [±Advanced Tongue Root; ATR], as used, for instance, in the description of the West African language Akan (Lindau 1978), and [±Retracted Tongue Root; RTR], used, for instance, in the description of the Tungusic languages of Siberia (Li 1996), may be seen as phonetic variants of this phonological feature.

[RADICAL]

- [radical] (also [pharyngeal]) sounds are articulated with the root of the tongue. A voiceless fricative [ħ] occurs in many varieties of Arabic, as does a pharyngeal approximant [ʕ]. See Ladefoged and Maddieson (1996) for more information.

Q48 In Bengali, there is an optional rule which deletes [r] before certain consonants, allowing the consonant to geminate. Characterize the class of consonants that trigger r-DELETION on the basis of the following data (Hayes and Lahiri 1991).

Input	*Output*	
barʃa	baʃʃa	'rainy season'
miʈʰu-r ʃari	miʈʰu-ʃʃari	'Mithu's sari'
ram-er bari	ram-er bari	'Ram's house'
ram-er ʈaka	ram-eʈ ʈaka	'Ram's money'
fon-korbo	fon-korbo	'will telephone'
ʃundor dɔrdʒʒa	ʃundod dɔddʒa	'beautiful door'
bɔrdi	bɔddi	'elder sister'
bɦorti	bɦotti	'full'
kor-lo	kol-lo	'do-3SG, FUT'
kor-t̪o	kot̪-t̪o	'do-3SG.PAST'
matʃʰ-er nɑ:k	matʃʰ-en nɑ:k	'fish's nose'
matʃʰ-er matʰa	maʈʃ-er matʰa	'fish head'

[t d ʈ ʃ dʒ n l] – [coronal]

Ambiguity

- Languages may vary in the feature specification of [continuant] for [l]. In Scottish English, for example, [l] is [-cont]. In other languages it may be [+cont].
- In Frisian, vowels are nasalized before [n] in the same syllable, provided a [+cont] consonant follows.
- the group of consonants that does not allow the change to go through is [p t k g n], while the consonants that do allow it are [s f j ʋ r l]

in-pɑkə	impɑkə	‘to wrap up’
oən-trɛkə	oəntrɛkə	‘to take to heart’
oən-komə	oəŋkomə	‘to arrive’
in-gɪən	iŋgɪən	‘to enter’
oən-nɪmə	oənnɪmə	‘to accept’
oən-stiən	oə̃stiən	‘to please’
in-fɔlə	ĩfɔlə	‘to fall in’
in-jɑ:n	ĩjɑ:n	‘to give in’
in-ʋɛ̃jə	ĩʋɛ̃jə	‘to live with one’s parents’
oən-ropə	oə̃ropə	‘to call’
in-lɪzə	ĩlɪzə	‘to preserve’

Redundancy (from Kenstowicz, 1994, p.57) & Underspecification of features

- The point-of-articulation features like Labial ([p]), Coronal ([t])and Dorsal ([k]) are distinctive for stop consonants in English.
- The laryngeal features of the English stop system are as follows:

(1)

[−voiced, −spread gl]	p t k
[−voiced, +spread gl]	p^h t^h k^h
[+voiced, −spread gl]	b d g

(2)

initial		medial		final	
[p^h]in	[b]in	ra[p]id	ra[b]id	la[p]	la[b]
[t^h]ot	[d]ot	a[t]om	A[d]am	ma[t]	ma[d]
[k^h]ap	[g]ap	jac[k]et	jag[g]ed	pic[k]	pi[g]

- If we study (2) carefully, we find that the feature specifications for voicing (i.e. [+voiced] and [-voiced]) have free distribution: they each appear initially, medially and finally.
- But the [+spread glottis] does not appear in **free distribution**.
- The distribution of the [+spread glottis] feature is severely limited.
- It only appears on voiceless stops. [p^h, t^h, k^h]
- It only appears when the voiceless stop is in the syllable initial position. Eg.: [k^hæn] 'can'. In fact unaspirated voiceless stops are never found in syllable initial position.
- Thus [p^h, t^h, k^h] and [p, t, k] are in **complementary distribution**.
- Therefore, aspiration is a feature that is **redundant**, unlike place of articulation and voicing.

For any given English sound, we may predict its [+ spread gl] value by determining whether it is a voiceless stop and if so whether it occurs in syllable initial position. If the sound is not voiceless it is automatically [-spread glottis]

READ PAGE 82 OF YOUR TEXTBOOK FOR MORE ON REDUNDANCY

- Leaving out redundant features i.e features that are predictable or non-contrastive, is called Underspecification.
- Underspecification builds simplicity and economy into the theory of distinctive features.
- There are two kinds of underspecification propagated by two different schools of thought:

Radical underspecification – predictable features are underspecified

Contrastive/Restricted underspecification – Non-contrastive features are underspecified. Eg: [t] vs [d] opposition is a [-voiced] vs [+voiced] distinction in the lexicon. The default rules assign only the redundant, predictable features in a given system – features that never distinguish a pair of otherwise identicle segments: [+voiced] in sonorants and ?

stops	p,b	t,d		k,g
affricates		t^s	č	
fricatives	f,v	s,z	š,ž	x
nasals	m	n		
liquids		l,r		

Check out page 12 of the E-PGPathashala Unit called Distinctive features-II for more on the Underspecification of features. Also Page 508 of Kenstowicz(1994)