Distinctive Feature Theory: Materials (ish)

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1 Motivating Features

Jakobson (1939): Original argument for features, from Turkish vowel harmony. How do vowel harmony facts divide up the set of vowel phonemes?

(1)   Turkish vowel system

i e y ø ɨ ɑ u o

(2)   Turkish Harmony, Type 1:

nom. sg.	nom. pl.	dat. sg.	gloss
isim	isimler	isme	'name'
dere	dereler	dereye	'river'
tyrk	tyrkler	tyrke	'Turk'
ɟøl	ɟøller	ɟøle	'sea'
kɨz	kɨzlɑr	kɨzɑ	'girl'
ut	utlɑr	utɑ	'lute'
ɑt	ɑtlɑr	ɑtɑ	'horse'
ok	oklɑr	okɑ	'arrow'

First feature: triggering harmony with [e] vs. triggering harmony with [ɑ]

(3)   Turkish Harmony, Type 2:

nom. sg.	gen. sg.	acc. sg.	gloss
ip	ipin	ipi	'string'
ev	evin	eve	'house'
tyrk	tyrkyn	tyrky	'Turk'
gøz	gøzyn	gøzy	'eye'
kɨz	kɨzɨn	kɨzɨ	'girl'
hɑlk	hɑlkɨn	hɑlkɨ	'people'
burun	burnun	burnu	'nose'
kol	kolun	kolu	'arm'

Second feature: subdividing the two harmonic sets (first feature) further

Third feature: the set of harmonic vowels in Type 2

Exercise for you: Fill in the feature matrix below!

(4)   Feature specification in Turkish. Take one.

	[i]	[e]	[y]	[ø]	[ɨ]	[ɑ]	[u]	[o]
[F1]								
[F2]								
[F3]								

First finding: All segments are contrastively specified – our three features allow us to distinguish between all segments.
Question: Do F1, F2, F3 define arbitrary classes, or do these features have a phonetic correlate?

Additional question: If they have a phonetic correlate, could you think of additional features? Are these features necessary?

A summary:

- Features have a **classificatory** function: they group individual sounds into classes of sounds, characterised by identical phonological behaviour. For example, all phonologically [+voice] segments may undergo final devoicing in a number of languages.

- They also have a **contrastive** function, describing the contrasts found within a language but also, qua their universality, delimiting the number of possible contrasts in the world's languages. For example, the existence of a binary feature [±voice] predicts possible contrast between voiced and voiceless sounds but no phonological contrast between voiced, voiceless, and partially voiced sounds.

- Finally, features have a **descriptive** function: They describe the phonetic (articulatory but possibly also acoustic) properties of a sound. Thus, [+voice] sounds are characterised by vocal fold vibration, [−voice] sounds by the absence of vocal fold vibration.

2 Features: a survey

Note: For using features in SPE-style rules, see Odden's class notes.

2.1 Feature list: quick and dirty

(Mind the abbreviation conventions in the short explanation!)

- **[±consonantal]**   Consonants are [+cons], vowels aren't.

- **[±sonorant]** Vowels, liquids, nasals are   [+son], obstruents aren't.

- **[±continuant]**   [+cont] sounds are produced with a continuous oral airstream. i.e. vowels, liquids and fricatives but not plosives (stops) and nasals.

- **[±voice]**   Voiced sounds are [+voi], voiceless sounds aren't.

- **[±spread glottis]**   [+s.g.] sounds are aspirated.

- **[±constricted glottis]**   Glottalised, ejective and implosive sounds are [+c.g.].

- **[±nasal]**   Nasals and nasalised vowels are [+nas].

- **[±lateral]**   L-sounds are [+lat].

- **[±strident]**   Sibilants and other noisy fricatives/affricates are [+strid].

- **[labial]**   [lab] sounds are produced with the lips.

- **[coronal]**   [cor] sounds are produced with the blade of the tongue.

- **[dorsal]**   [dor] sounds are produced with the back of the tongue.

- **[±anterior]**   Front coronals like alveolar and dental sounds are [+ant], back coronals like postalveolar and retroflex sounds are [–ant].

- **[±distributed]**   Basically, laminal coronals are [+dist] while apical ones are [–dist].

- **[±round]**   [+rd] vowels have lip-rounding.

- **[±back]**   [+bk], vowels are back. Velar and uvular consonants are also [+bk].

- **[±high]**   [+hi] vowels are high/close. Palatal and velar consonants are also [+hi].

- **[±low]**   Low vowels and pharyngeal/glottal consonants are [+lo].

2.2 Classes of sounds and their specifications

- **Consonants** are [+consonantal]

- **Vowels** are [–consonantal]

- **Obstruents** are [+consonantal, –sonorant]

- **Sonorants** are [+consonantal, +sonorant]

- **Stops** are [+consonantal, –sonorant, –continuant]

- **Fricatives** are [+consonantal, –sonorant, +continuant]

- **Liquids** are [+consonantal, +sonorant, +continuant]

- **Sibilants** are [+consonantal, coronal, +strident]

- **Dentals** are [coronal, +anterior, –distributed]

- **Alveolars** are [coronal, +anterior, +distributed]

- **Postalveolars** are [coronal, –anterior, +distributed]

- **Retroflexes** are [coronal, –anterior, –distributed]

- **Palatals** are [dorsal, –back, +high] (perhaps [coronal])

- **Velars** are [dorsal, +back, +high]

- **Uvulars** are [dorsal, +back, –high]

- **High vowels** are [–consonantal, +high, –low]

- **Mid vowels** are [–consonantal, –high, –low]

- **Low vowels** are [–consonantal, –high, +low]

- **Front vowels** are [–consonantal, –back]

- **Back vowels** are [–consonantal, +back]

- **Tense vowels** are [–consonantal, +ATR]

- **Lax vowels** are [–consonantal, –ATR]

- anything else . . . ?

2.3   Some feature matrices

(5)   Major classes of sounds:

	[+consonantal]	[–consonantal]
[+sonorant]	liquids, nasals	vowels, glides
[–sonorant]	obstruents	—

(6)   Classes of consonants

	[+continuant]	[–continuant]
[+sonorant]	liquids	nasals
[–sonorant]	fricatives	plosives

(7)   Manners of articulation (summary):

	plosives	fricatives	nasals	laterals	rhotics	vowels
[consonantal]	+	+	+	+	+	–
[sonorant]	–	–	+	+	+	+
[continuant]	–	+	–	+	+	+
[nasal]	–	–	+	–	–	–
[lateral]	–	–	–	+	–	–

(8)   Places of articulation:

	labial	labio-dental	inter-dental	alveolar	post-alveolar	palatal	velar	uvular
[labial]	+	+	–	–	–	–	–	–
[coronal]	–	–	+	+	+	–	–	–
[anterior]	+	+	+	+	–	–	–	–
[strident]	–	+	–	+	+	–	–	+
[back]	–	–	–	–	–	–	+	+
[high]	–	–	–	–	+	+	+	–

(9)   Laryngeal feature combinations

	[p]	[b]	[pʰ]	[bʱ]	[p']	[ɓ]
[voice]	–	+	–	+	–	+
[spread glottis]	–	–	+	+	–	–
[constr. glottis]	–	–	–	–	+	+

(10)   Vowel specifications:

			[−back]		[+back]	
			[−rd]	[+rd]	[−rd]	[+rd]
[−low]	[+high]	[+ATR]	i	y	ɨ, ɯ	u
		[−ATR]	ɪ	ʏ	ɵ	ʊ
	[−high]	[+ATR]	e	ø	ɤ	o
		[−ATR]	ɛ	œ	ʌ	ɔ
[+low]		[−ATR]	a, æ	ɶ	ɑ	ɒ

(11)   Consonant Specifications (simplified)

			[+labial]	[+coronal]				[+hi]		[−hi]
				[+ant]		[−ant]		[−bk]	[+bk]	
				[−dis]	[+dis]	[+dis]	[−dis]			
[−son]	[−cont]	[−voi]	p	t			ʈ	c	k	q
		[+voi]	b	d			ɖ	ɟ	g	ɢ
	[+cont]	[−voi]	f	θ	s	ʃ	ʂ	ç	x	χ
		[+voi]	v	ð	z	ʒ	ʐ	ʝ	ɣ	ʁ
[+son]	[−cont]	[+nas]	m	n			ɳ	ɲ	ŋ	ɴ

2.4 Some exercises

(12)   Classify the following natural classes of sounds! Which features do we
need to (a) distintiguish the two classes and (b) to delimit the whole
set of sounds?

p, t, k, f, s, ʃ, x	*vs.*	b, d, g, v, z, ʒ, ɣ, m, n, ŋ, l, r, a, i, u
p, t, k, f, s, ʃ, x, b, d, g, v, z, ʒ, ɣ	*vs.*	m, n, ŋ, l, r, a, i, u
p, t, k, f, s, ʃ, x, b, d, g, v, z, ʒ, m, n, r, l	*vs.*	a, i, u
p, t, k, b, d, g, m, n, ŋ	*vs.*	f, s, ʃ, x, v, z, ʒ, ɣ, r, l, a, i, u
p, t, k	*vs.*	b, d, g
p, t, k, b, d, g	*vs.*	f, s, ʃ, v, z, ʒ
m, n, ŋ	*vs.*	p, t, k, f, s, ʃ, x, b, d, g, v, z, ʒ, ɣ, l, r
t, d, θ, ð, s, z	*vs.*	ʈ, ɖ, ʃ, ʒ, ʂ, ʐ
i, y, u	*vs.*	e, ø, o, a
i, e, ɛ, æ, y, ø, œ	*vs.*	u, o, ɔ, ɑ, ɯ, ɒ
i, y, u, e, ø, o	*vs.*	ɪ, ʏ, ʊ, ɛ, œ, ɔ
i, ɯ	*vs.*	u, y
s, z, ʃ, ʒ, tʃ, dʒ	*vs.*	t, d, θ, ð

(13)   What do these rules express? 'Translate' into plain English!

a. $\begin{bmatrix} +\text{voice} \\ -\text{sonorant} \end{bmatrix} \rightarrow [-\text{voice}] \ / \ \underline{\hspace{1cm}} \ \#\#$

b. $[\alpha\text{voice}] \rightarrow [-\alpha\text{voice}] \ / \ \underline{\hspace{1cm}} \ [-\alpha\text{voice}]$

c. $\begin{bmatrix} +\text{voice} \\ -\text{sonorant} \\ -\text{continuant} \end{bmatrix} \rightarrow [+\text{continuant}] \ / \ [\text{--cons}] \ \underline{\hspace{1cm}} \ [\text{--cons}]$

d. $\begin{bmatrix} +\text{cons} \\ -\text{son} \\ -\text{cont} \\ +\text{back} \end{bmatrix} \rightarrow -[\text{back}] \ / \ \begin{bmatrix} -\text{cons} \\ -\text{round} \\ +\text{high} \\ -\text{back} \end{bmatrix} \underline{\hspace{1cm}}$

e. $\emptyset \rightarrow \begin{bmatrix} -\text{cons} \\ +\text{high} \\ -\text{back} \\ -\text{round} \\ -\text{ATR} \end{bmatrix} \ / \ \begin{bmatrix} +\text{cons} \\ +\text{cont} \\ +\text{cor} \\ +\text{strid} \end{bmatrix} \underline{\hspace{1cm}} \begin{bmatrix} +\text{cons} \\ +\text{cont} \\ +\text{cor} \\ +\text{strid} \end{bmatrix}$

3 Interlude: the functions of features; conflict

Some background assumptions in standard feature theory, as seen so far:

- Features are universal: All languages use the same feature pool.

- Features have phonetic correlates – they correspond to articulatory gestures (and possibly also acoustic cues).

  - Thus, I should be able to determine the feature specifications of a segment from its surface phonetic properties – feature specifications are deterministic.

  - Thus, the same feature combination should result in pretty much the same surface segment, across languages.

- The different functions of the feature are not in conflict.

  - Thus, phonological classes are phonetically natural classes. Sounds that act as a class phonologically (e.g. as triggers or targets of a process) share a phonetic trait.

How well do the different functions of distinctive features align, especially the classificatory/phonological function and the descriptive/phonetic function? A little exercise: **umlaut** in German, with a focus on the Northern variety of Standard High German.

(14)   Background info: Northern German vowels

iː	yː		uː		ɪ	ʏ		ʊ
eː	øː		oː		ɛ	œ		ɔ
			ɑː					ɑ

How would you classify German vowels featurally? What features do we need? How is each vowel specified?

(15)   German umlaut—the straightforward alternations

Stem	Diminutive	Gloss
H[uː]t	H[yː]tchen	'(little) hat'
D[ʊ]tt	D[ʏ]ttchen	'(little) hair bun'
H[oː]se	H[øː]schen	'trousers/panties'
Kn[ɔ]pf	Kn[œ]pfchen	'(little) button'

What feature changes? Provide a rule!

(16)   German umlaut and low vowels

Stem	Diminutive	Gloss
H[ɑ]nd	H[ɛ]ndchen	'hand/knack'
Bl[ɑ]tt	Bl[ɛ]ttchen	'(little) leaf'
R[ɑ:]d	R[e:]dchen	'(little) wheel'
Z[ɑ:]hn	Z[e:]hnchen	'(little) tooth'

Does your rule account for this alternation? What could you do to make it work? Think of creative solutions!

(17)   German umlaut and diphthongs

Stem	Diminutive	Gloss
H[ɑʊ]s	H[ɔɪ]schen	'(little) house'
Pf[ɑʊ]	Pf[ɔɪ]chen	'(little) peacock'
T[ɑʊ]be	T[ɔɪ]bchen	'(little) dove'

How are you going to deal with this?

Some alternative claims (to be looked at more closely in the second half of this course):

1. The same feature may have different phonetic correlates in different environments.

2. There is no clear one-to-one relation between features and articulatory parameters/gestures.

3. What is phonologically the 'same' may be articulatorily diverse.

A question to ponder: Should features have fixed phonetic correlates? Should we even dump the phonetic function of the feature, reducing features to indices of phonological classhood? Can you think of some consequences of such a move? What would you predict? Does it make sense to you?

4 Underspecification

Basic observation: feature values can be redundant, i.e they are predictable from other feature values.

- Universal redundancy relations, to do with the (phonetic) definition of features: Can you think of any?

- Language-specific redundancy relations, resulting from the system of (phonemic) contrasts in a language.

(18)   5-vowel system, full specifications

	[i]	[e]	[a]	[o]	[u]
[consonantal]	−	−	−	−	−
[high]	+	−	−	−	+
[low]	−	−	+	−	−
[back]	−	−	+	+	+
[round]	−	−	−	+	+
[ATR]	+	+	−	+	+
[nasal]	−	−	−	−	−

What is redundant here? Try to 'clean up' the system as much as you can and formulate redundancy rules.

(19)   5-vowel system, cleaned up by you

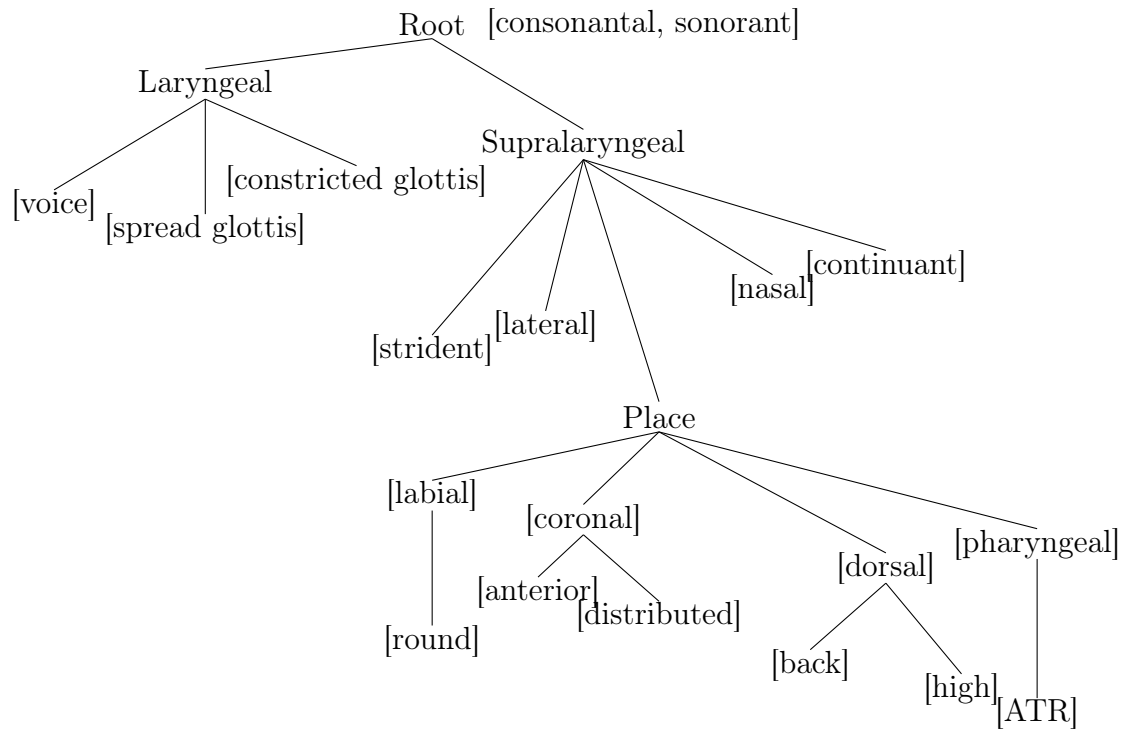|	[i]	[e]	[a]	[o]	[u]
[consonantal]					
[high]					
[low]					
[back]					
[round]					
[ATR]					
[nasal]					

The big question: Are segments underspecified? Why? At what level? Is there evidence? Some pointers:

- Representational economy and markedness

- Phonological activity

- Bonus question: Are all segments fully specified at the surface?

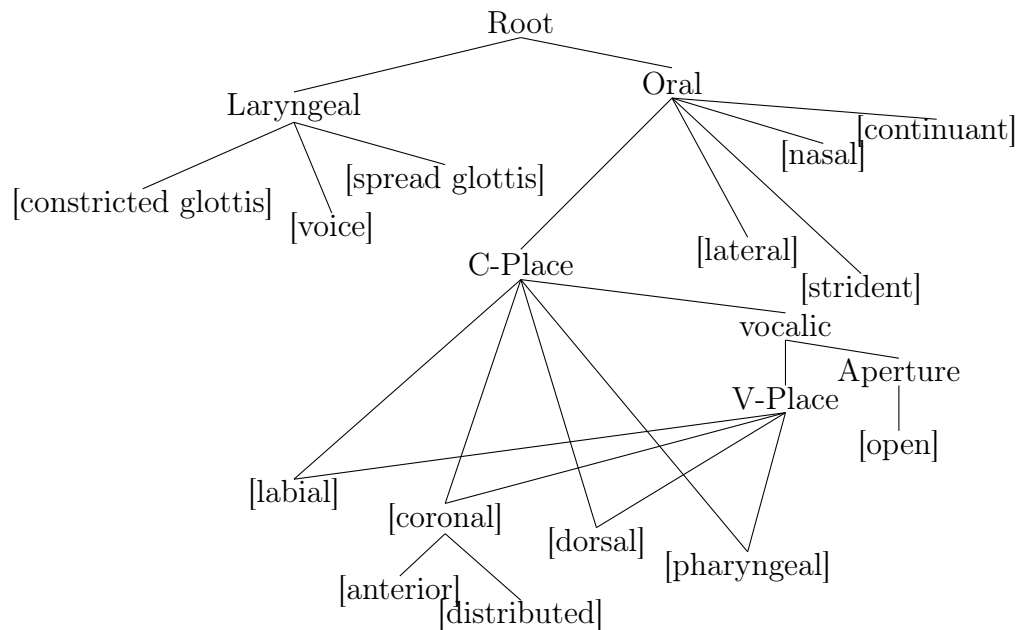- Subtractive vs. additive underspecification

5   Autosegments and Feature Geometry

For the autosegmental view of the feature, also see Odden's class notes.

(20)   Articulator Theory (the Sagey/Halle model)

Root [consonantal, sonorant]
- Laryngeal
  - [voice]
  - [spread glottis]
  - [constricted glottis]
- Supralaryngeal
  - [strident]
  - [lateral]
  - [nasal]
  - [continuant]
  - Place
    - [labial]
      - [round]
    - [coronal]
      - [anterior]
      - [distributed]
    - [dorsal]
      - [back]
      - [high]
    - [pharyngeal]
      - [ATR]

(21)   Unified Feature Theory (the Clements/Hume model)

Root
- Laryngeal
  - [constricted glottis]
  - [voice]
  - [spread glottis]
- Oral
  - [nasal]
  - [continuant]
  - [lateral]
  - [strident]
  - C-Place
    - [labial]
    - [coronal]
      - [anterior]
      - [distributed]
    - [dorsal]
    - [pharyngeal]
    - vocalic
      - V-Place
        - [labial]
        - [coronal]
        - [dorsal]
        - [pharyngeal]
      - Aperture
        - [open]

(22)   Look at the following alternations in Northern High German and try
        to account for them in Feature Geometric terms:

/hɑpn/	[hɑʔm]	'bite (n.)'
/hɑtn/	[hɑʔn]	'had (pl.)'
/hɑkn/	[hɑʔŋ]	'to hack'
/kɪpn/	[kɪʔm]	'to pour'
/kɪtn/	[kɪʔn]	'to mend'
/kɪkn/	[kɪʔŋ]	'to kick'