3차시: Distinctive Features and Natural Classes

1. Distinctive Features

- An important finding with regard to phonemes is that they are not further indivisible units but are themselves composites of features which recur in speech sounds.

- A distinctive feature is a feature that serves to distinguish between two phonemes, for example, the distinctive feature of voicing, which distinguishes /b/ from /p/ in English, or nasality, which distinguishes /m/ from /b/.

- Distinctive features are grouped into categories according to the *natural classes of sounds they describe: major class features, laryngeal features, manner features, and place features.

* Natural classes are sets of sounds in a language that are characterized by a small number of features to the exclusion of all other sounds in that language, as will be discussed below.

Distinctive Features of English Phonemes
(Halle & Clements, 1983, pp. 6~8)

Features	Descriptions
Syllabic/ Nonsyllabic	• Syllabic sounds are those that constitute syllable peaks; [+syllabic]: vowels, syllabic consonants • Nonsyllabic sounds are those that do not; [-syllabic]: glides, nonsyllabic consonants
Consonantal/ Nonconsonantal	• Consonantal sounds are characterized by a partial or complete obstruction of the flow of air through the speech organs; [+consonantal]: stops, affricates, fricatives (excluding [h]), nasals, liquids • Nonconsonantal sounds are produced without such an obstruction; [-consonantal]: vowels, semivowels, [h]
Sonorant/ Obstruent	• Sonorant sounds are characterized with a vocal tract configuration sufficiently open, allowing relatively free airflow through the vocal tract; [+sonorant]: vowels, glides, liquids, nasals

	• The opposite of sonorants are obstruents, which constrict the flow of air more severely; [-sonorant]: stops, affricates, fricatives
Continuant/ Noncontinuant	• Continuant sounds are produced with the unblocked flow of the air at any point in the articulation of the sounds. They include all the sounds other than (oral and nasal) stops and affricates; [+continuant]: vowels, glides, liquids, fricatives • Noncontinuant sounds are made with the blocked airflow at some point in the articulation of the sounds; [-continuant]: stops, nasals, affricates
Nasal/ Oral	• Nasal sounds are produced by lowering the velum and allowing the air to pass outward through the nose; [+nasal]: nasal stops, nasalized consonants, vowels and glides • Oral sounds are produced with the velum raised to prevent the passage of air through the nose; [-nasal]: all other sounds
Lateral/ Central	• Lateral sounds are produced by lowering the tongue sides, allowing the air to pass over the tongue sides; [+lateral]: lateral sonorants, fricatives and affricates • Central sounds do not involve such a constriction; [-lateral]: all other sounds
Sibilant/ Nonsibilant	• Sibilant sounds are produced with a “hissing” effect by forcing the air through a narrow opening formed using the middle of the tongue; [+sibilant]: [s, z, ʃ, ʒ, ʧ, ʤ] • Nonsibilant sounds are produced with such an effect; [-sibilant]: all other sounds
Voiced/ Voiceless	• Voiced sounds are produced with the vibrating vocal cords; [+voiced]: vowels, sonorants, and voiced stops, fricatives and affricates • Voiceless sounds are made without vocal cord vibration; [-voiceless]: voiceless stops, fricatives and affricates
Labial/ Nonlabial	• Labial sounds are articulated by an obstruction at the lips; [+labial]: p, b, m, f, v • Nonlabial sounds are produced without such a gesture; [-labial]: all other sounds
Anterior/ Posterior	• Anterior sounds are produced by an obstruction in the front part of the oral cavity, from the alveolar ridge forward.

	[+anterior]: labials, interdentals, alveolars (but not alveolopalatals) • Posterior sounds are produced without such a gesture. [-anterior]: alveopalatals, palatals, velars
Coronal/ Noncoronal	• Coronal sounds are made by raising the front (or blade) of the tongue from a neutral position. [+coronal]: interdentals, alveolars, alveolopalatals, palatals • Noncoronal sounds are produced without such a gesture. [-coronal]: labials, velars
Delayed release/ Nondelayed release	• Delayed release sounds are those that are produced with an oral passage so narrow that airflow through it is turbulant; [+delayed release]: fricatives, affricates • Nondelayed release sounds are those without such an air turbulance; [-delayed release]: all other sounds
High/ Nonhigh	• High sounds are produced by raising the body of the tongue toward the palate. [+high]: palatals, velars, palatalized and velarized consonants, high vowels and glides • Nonhigh sounds are produced without such a gesture. [-high]: all other sounds
Back/ Nonback	• Back sounds are produced with the tongue body relatively retracted; [+back]: velars, velarized consonants, back vowels, [w] • Nonback sounds are produced with the tongue body relatively advanced; [-back]: all other vowels
Low/ Nonlow	• Low sounds are produced with the jaw slightly open to allow the body of the tongue to draw lower; [+low]: low vowels • Nonlow sounds are made without such a jaw lowering; [-low]: all other sounds. • Note that vowels that are neither high nor low (i.e., [-high, -low]) are mid vowels.
Tense/ Lax	• Tense sounds are produced with a tongue body configuration involving a greater degree of constriction than that found in their lax counterparts; [+tense]: tense vowels [iy, ey, uw, ow], diphthongs [ɑy, ɑw, ɔy] • Lax sounds are produced with relatively relaxed muscles; [-tense]: lax vowels [ɪ, ɛ, æ, ɔ, ɑ, ʊ]
Rounded/	• Rounded sounds produced with a rounding of the lips;

Unround	[+round]: round vowels [uw, ʊ, ow, ɔ], labio-velar glide [w] • Unrounded sounds are produced without protrusion of the lips; [-round]: all other sounds
Spread/ Nonspread glottis	• Spread and aspirated sounds are produced with the vocal cords drawn apart, producing nonperiodic noise; [+spread]: aspirated consonants, voiceless vowels and glides • Nonspread sounds are produced without such a gesture; [-spread]: all other sounds

Distinctive Feature Specification for English Consonants

	b	p	t	d	k	g	f	v	ɵ	ð	s	z
Consonantal	+	+	+	+	+	+	+	+	+	+	+	+
Syllabic	-	-	-	-	-	-	-	-	-	-	-	-
Continuant	-	-	-	-	-	-	+	+	+	+	+	+
Sonorant	-	-	-	-	-	-	-	-	-	-	-	-
Sibilant	-	-	-	-	-	-	-	-	-	-	+	+
Delayed release	-	-	-	-	-	-	+	+	+	+	+	+
Voiced	+	-	-	+	-	+	-	+	-	+	-	+
Anterior	+	+	+	+	-	-	+	+	+	+	+	+
Coronal	-	-	+	+	-	-	-	-	+	+	+	+
Nasal	-	-	-	-	-	-	-	-	-	-	-	-

	ʃ	ʒ	h	ʧ	ʤ	m	n	ŋ	l	r	w	y
Consonantal	+	+	+	+	+	+	+	+	+	+	-	-
Syllabic	-	-	-	-	-	-	-	-	-	-	-	-
Continuant	+	+	+	-	-	-	-	-	+	+	+	+
Sonorant	-	-	-	-	-	+	+	+	+	+	+	+
Sibilant	+	+	-	+	+	-	-	-	-	-	-	-
Delayed release	+	+	+	+	+	-	-	-	-	-	-	-
Voiced	-	+	-	-	+	+	+	+	+	+	+	+
Anterior	-	-	-	-	-	+	+	-	+	-	+	-
Coronal	+	+	-	+	+	-	+	-	+	+	-	+
Nasal	-	-	-	-	-	+	+	+	-	-	-	-

Distinctive Feature Specification for English Vowels

	iy	ɪ	ey	ɛ	æ	ʌ	uw	ʊ	ow	ɔ	ɑ
Consonantal	-	-	-	-	-	-	-	-	-	-	-
Syllabic	+	+	+	+	+	+	+	+	+	+	+
High	+	+	-	-	-	-	+	+	-	-	-
Low	-	-	-	-	+	-	-	-	-	-	+
Back	-	-	-	-	-	-	+	+	+	+	+
Round	-	-	-	-	-	-	+	+	+	+	-
Tense	+	-	+	-	-	-	+	-	+	-	-

2. Natural Classes of Sounds

• A natural class is a set of sounds in a language that are characterized by a small number of features to the exclusion of all other sounds in that language, as mentioned above.

• Natural classes can be defined by + and − feature values, as shown below.

Natural Classes	Distinctive Features
vowels	[+syllabic, -consonantal]
glides	[-syllabic, -consonantal]
consonants other than glides	[-syllabic, +consonantal]
voiced consonants	[+voiced, +consonantal]
nasal sounds	[+nasal]
stops	[-continuant, -sonorant, -delayed release]
voiceless stops	[-voiced, -continuant, -delayed release]
liquids and glides	[+sonorant, -nasal]

• A natural class is one in which the number of features that must be specified to define that class is *smaller* than the number of features required to distinguish any one of its members.

Natural class	Distinctive features
/p, t, k/	[-voiced, -continuant]
Member	**Distinctive features**
/t/	[-voiced, -continuant, +coronal, +anterior]

• Phonological rules apply not to random sets of phonemes but to sets that share some features in common, or natural classes. In other words, natural classes play a role in phonological rules and constraints.

• **Example 1**

The sounds /p, t, k/ are said with a special puff of air, or aspiration, when they occur at the beginning of a stressed syllable as in words such as *peak*, *take*, and *Kate*. The voiceless stop aspiration can be stated as follows:

voiceless stops ➜ aspirated / '$_____
'$ = at the beginning of a stressed syllable

The set of the sounds /p, t, k/ has the features [-voice, -continuant, -delayed release] in common. That is, the sounds form a natural class. This rule can be depicted in distinctive features as follow:

[-voiced, -continuant, -del rel] ➜ [+spread glottis] / '$_____
'$ = at the beginning of a stressed syllable

On the other hand, /p, t, k/ is deaspirated when they occur in a phonetic environment of immediately after /s/ as in *speak*, *stake*, and *skate*. The voiceless stop deaspiration rule can be stated as follows:

voiceless stops ➜ unaspirated / [s] _____

The deaspiration rule can be depicted in distinctive features as follow:

[-voiced, -continuant, -del rel] ➜ [-spread glottis] / [+sibilant, +ant, +cor, -voiced] _____

• **Example 2**

The sounds /l, r, w, y/ are devoiced when they occur immediately after aspirated voiceless stops /p, t, k/ as in words such as *play*, *pray*, *pew*, *tray*, *twin*, *clay*, *crazy*, and *cue*. This rule can be stated as follows.

/l, r, w, y/ → voiceless / aspirated voiceless stops _____
/l, r, w, y/ → voiced / elsewhere

This rule can be depicted in distinctive features as follow:

[+sonorant, -nasal] → [-voiced] / [-voice, -delayed release, +spread glottis] _____
[+sonorant, -nasal] → [+voiced] / elsewhere