# Appendix C

# Distinctive Features

Distinctive features are an alternative system to the one described in this book. But this is not to say that distinctive features are incompatible with, or in opposition to, the phonetic system we have developed in this text. In fact, many of the general principles we have discussed could be described using distinctive features. First, we will examine what a distinctive feature is, and then we will show how distinctive features relate to the phonetic system of this book.

To illustrate the concept of distinctive features, we will start with a nonphonetic example. Imagine that we have a group of people of both sexes and different ages and our task is to group them into men, women, boys, and girls. To form the groups, we could ask people to stand in a single line and then separate them on the basis of two questions: Is the sex of this person male or female? Is this person an adult (for example, using a cutoff age of 18 years) or a child? We can cast these questions into the form of a coding tree as follows.
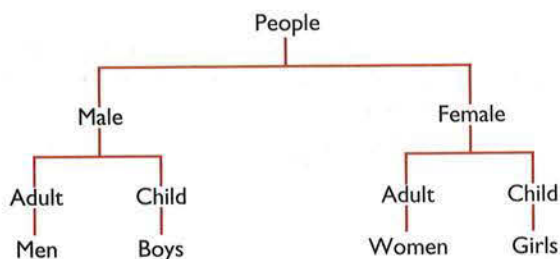


The first decision line, or branch, of this tree divides the people into two groups—male and female. The second branch divides each sex group into two age groups—adults and children. The final line gives us the desired final grouping into the classes of men (MALE + ADULT), boys (MALE + CHILD), women (FEMALE + ADULT), and girls (FEMALE + CHILD).

Because MALE versus FEMALE, and ADULT versus CHILD, are dichotomous, or divided into mutually exclusive groups, we could cast the coding tree into the form shown in the following figure. That is, each person is either male (+MALE) or female (–MALE) and either adult (+ADULT) or child (–ADULT). The terms we use to form each "plus" and "minus" group are arbitrary. The division into gender groups could just as well be made by changing the first
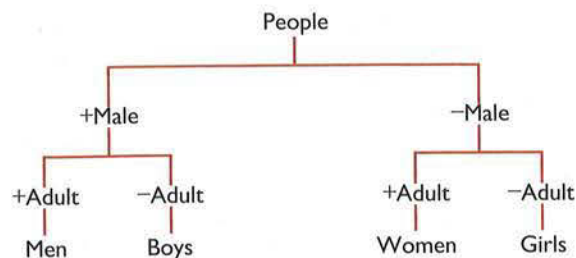


branch to –FEMALE versus +FEMALE. The essential point is that we form our groups by making binary (two-way) decisions at each branch of the coding tree. If we make correct binary decisions at each branch, we end up with the desired classes of men, boys, women, and girls. The branch names MALE (+MALE or –MALE) and ADULT (+ADULT or –ADULT) can be regarded as distinctive features for the classification of the people.

Distinctive features used in linguistic phonetics also are usually binary, although one could develop a system involving decisions that are three-way, four-way, and so on. Binary features often are preferred because of convenience in coding and a belief that the pertinent classes of sounds really can be formed of dichotomous groups. Binary features are best suited and most easily applied to attributes having opposing traits. For example, it is fairly easy to conceive of sounds as being either nasal (+NASAL) or nonnasal (–NASAL). Consonants described as +NASAL would be /m n ŋ /; other consonants would be –NASAL. Other attributes of sounds, such as place of articulation, might not be as inherently binary.

Ideally, distinctive features should fulfill three functions:

1. They should be capable of describing the systematic phonetics (a phonetic function).

2. They should serve to differentiate lexical items (a phonemic function).

3. They should define natural classes of sounds, that is, segments that as a group undergo similar phonological processes.

In addition, distinctive features are particularly advantageous for a linguistic purpose if a given set of features can be applied to all languages of the world. Although this criterion

is not of primary importance to clinical phonetics, the speech-language clinician does have a similar concern, namely, that the features be widely applicable to patterns of developing and disordered speech. Whether or not distinctive features described in the literature are satisfactory for this purpose is perhaps controversial, but the authors would argue for the negative. Nonetheless, distinctive features have a general relevance to the study of phonetics and phonology and also offer significant advantages for some kinds of phonetic analysis. Therefore, speech-language clinicians should be familiar with them.

What is a distinctive feature? Some definitions or descriptions found in the literature are quoted as follows.

(a) *"A distinctive feature is any property that separates a subset of elements from a group"* (Blache, 1978, p. 56).

(b) *"Distinctive features are those indispensable attributes of a phoneme that are required to differentiate one phoneme from another in a language"* (Singh and Singh, 1976, p. 177).

(c) *"Distinctive features are really distinctive categories or classes within a linguistic system but just like in accepted analysis it is required that they are consistent with the phonetic facts and these phonetic facts on various levels [articulatory, acoustic, perceptual, or linguistic] have lent their names to the features"* (Fant, 1973, p. 152).

(d) *"It should be appreciated that distinctive features in the sense utilized by Jakobson, Fant and Halle (1952) primarily constitute a system for subdividing phonemes and other components of the message ensemble. A distinctive feature has certain correlates on each stage of the speech communication chain and these correlates are described in terms of various parameters and cues. . . . A distinctive feature is thus a unit of the message ensemble rather than a property of the signal ensemble. The term 'distinction' or 'minimal category' would have been more appropriate and might have led to less confusion concerning their nature and use"* (Fant, 1973, p. 162).

(e) *"A theory of distinctive features constructs category systems for phonemes; the categories are intended to cover all languages. Each feature category is derived by joint consideration of three levels of linguistic analysis: the perceptual level, the acoustic level, and the articulatory level. Thus the purpose of distinctive feature theory is to provide a single consistent framework for specifying the phonology, i.e., the communicative sound structure, of any language."* (Picket, 1980, p. 103).

(f) *"In recent years, phonological theory has moved to a system of distinctive feature classification based upon articulatory contrasts among phonetic seg-*

*ments. Here the aim has been to identify a system which differentiates every sound segment from every other segment by a phonetic or distinctive feature. Relative to phonological theory, it is intended that this system be universal to the languages of the world. It is most important to note that distinctive features systems are not intended as refinements in the descriptions of articulation already available from research in acoustic and physiological phonetics. Instead they are intended as the most economical description of phonemic (rather than phonetic) contrasts, and as such, may differ in some cases from the details of the phonetician's description of articulation"* (Williams, 1972, pp. 34–35).

From this sampling of remarks, it should be clear that distinctive features are pertinent to phonemic and not phonetic contrasts and that the names assigned to individual features do not always come from the same level of analysis or observation (articulatory, acoustic, perceptual, or linguistic). Partly because of the abstract nature of distinctive features and partly because of the inadequacy of definitions of their articulatory correlates, some of the early writings, especially those of Chomsky and Halle, have been criticized (for example, see Ladefoged, 1971, and Pak, 1971). Furthermore, some clinical applications of distinctive feature theory have been seriously questioned (Walsh, 1974; Parker, 1976). We point out these problems because we believe that the speech-language clinician should be aware that distinctive feature theory should be applied cautiously to the actual phonetic behavior of their clients.

The distinctive features described in this appendix are largely those proposed by Chomsky and Halle (1968) in their book *The Sound Patterns of English*. Departures from the Chomsky and Halle system are taken from Fant (1973) and Hyman (1975).

## THE MAJOR CLASS FEATURES (TABLE C-1)

The major class features of syllabic, consonantal, and sonorant define the five major sound classes of vowels, syllabic nasals and liquids, nonsyllabic nasals and liquids, obstruents, and glides or semivowels. (Hyman also used nasal as a class feature to distinguish the liquids and nasals.) Definitions of the major class features are as follows.

### Syllabic–Nonsyllabic

Syllabic characterizes the role that a segment plays in the structure of a syllable. A +syllabic sound serves as a nucleus or peak of a syllable; a –syllabic (nonsyllabic) sound does not. Vowels are +syllabic, whereas most, but not all, consonants are –syllabic. Some consonants, the liquids and nasals, can serve as syllable nuclei in words like *battle* /b æ t l̩/ and *button* /b ʌ t n̩/.

**TABLE C-1**
Distinctive Features for Major Sound Classes

| Feature | Oral Cavity Obstruents | Nasals and Liquids | Syllabic Nasals and Liquids | Glides | Vowels |
|---|---|---|---|---|---|
| Syllabic | − | − | + | − | + |
| Sonorant | − | + | + | + | + |
| Consonantal | + | + | + | − | − |

### Sonorant–Nonsonorant

This feature refers to the resonant quality of most sounds produced with a relatively open vocal tract. Vowels, nasals, liquids, and semivowels (glides) are +sonorant. The obstruents are –sonorant.

### Consonantal–Nonconsonantal

Consonantal sounds have a narrowed constriction in the oral cavity—either total occlusion or a narrowing sufficient to create frication. Stops, fricatives, affricates, nasals, and liquids are +consonantal. Vowels and semivowels are –consonantal.

The three major class features can be used in a coding tree to define the major sound classes as follows. Note that each branch of the tree is associated with one of the three features and that the left and right directions at each branch are labeled with the + and − feature values.
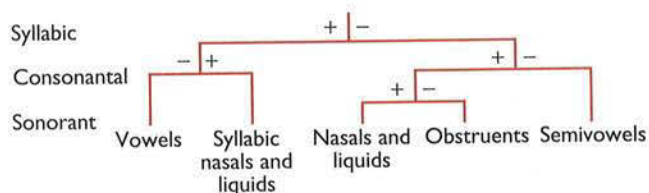


The same information can be represented in table form as shown in Table C-1. The table shows which values (+ or −) of each feature are associated with a given sound class. For example, vowels can be identified in bracket convention as

$$\begin{bmatrix} + \text{ syllabic} \\ + \text{ sonorant} \\ - \text{ consonantal} \end{bmatrix}$$

The enclosure of all three features within brackets indicates that they are taken together to define the sound or sounds in question.

## MANNER OF ARTICULATION FEATURES (TABLE C-2)

Additional classes of sounds are determined by features having generally to do with manner of articulation. The following features fall into this group.

### Nasal–Nonnasal

Nasal sounds are produced with an open velopharynx so that air can escape through the nose. Nonnasal sounds are produced with a closed velopharynx so that air pushed out from the lungs can escape only through the mouth. The only nasal consonants in English are /m n ŋ /.

### Continuant–Noncontinuant

For continuant sounds, the primary constriction in the vocal tract does not completely block the flow of air. But for noncontinuants, or stops, the flow of air is completely blocked for some period of time. The stops /p t k b d g / and affricates /tʃ dʒ / are the noncontinuants in English.

### Instantaneous Release–Delayed Release

With an instantaneous or abrupt release of the primary closure in the vocal tract, little or no turbulence is generated as the constriction widens. But with a delayed release, significant turbulence is generated upon release, causing an acoustic similarity to a fricative produced at the same point. The stops /b d g p t k / are produced with instantaneous release; the affricates /dʒ tʃ / are produced with delayed release.

### Strident–Nonstrident

Strident sounds are produced with a greater intensity of noise than nonstrident. The noise intensity is determined by characteristics of the constriction, including roughness of the articulatory surface, rate of airflow over it, and angle of incidence between the articulatory surfaces. The strident sounds are / s z ʃ ʒ tʃ dʒ /.

### Lateral–Nonlateral

This feature is restricted to coronal consonantal sounds. Lateral sounds are produced by lowering the midsection of the tongue at both sides or at only one side, so that air flows around the midline closure. Nonlateral sounds do not have such a side passage. The only lateral in English is /l/.

## TABLE C-2
### Distinctive Features of Selected Consonants[a]

|  | m | b | p | h | d | t | ŋ | g | k | z | s | ʃ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nasal | + | − | − | + | − | − | + | − | − | − | − | − |
| Low |  |  |  | − | − | − | − | − | − | − | − | − |
| High |  |  |  | − | − | − | + | + | + | − | − | + |
| Back |  |  |  | − | − | − | + | + | + | − | − | − |
| Anterior | + | + | + | + | + | + | − | − | − | + | + | − |
| Coronal | − | − | − | + | + | + | − | − | − | + | + | + |
| Continuant | − | − | − | − | − | − | − | − | − | + | + | + |
| Strident |  |  |  |  |  |  |  |  |  | + | + | + |
| Delayed Release |  | − | − |  | − | − |  | − | − |  |  |  |
| Voiced | + | + | − | + | + | − | + | + | − | + | − | − |

[a]An empty cell means that the feature is either not relevant to the sound classification or is redundant with other features for that sound. For example, the features "Low," "High," and "Back" are unspecified for /m/, because tongue position of /m/ varies with context. The feature "Strident" is unspecified for /ʍ/, because nasals cannot be strident.

## CAVITY (PLACE OF ARTICULATION) FEATURES (TABLE C-2)

The following features describe cavity configuration, or place or articulation. Some of them are defined relative to a neutral position of the tongue, which is essentially the position for [ɛ] in *bed*.

### Coronal–Noncoronal

Coronal sounds are produced with the blade of the tongue raised from its neutral position; noncoronal sounds are produced with the blade of the tongue in the neutral position. For example, /t d n l θ/ are coronals; /p f k g / are noncoronal.

### Anterior–Nonanterior

Anterior sounds are produced with an obstruction that is located in the front of the palato-alveolar region of the mouth; nonanterior sounds are produced without such an obstruction. The palato-alveolar region is that where the ordinary English /ʃ/ (or /š/) is produced. For example, /b f θ s / are anterior; /ʃ k g / are nonanterior.

### High–Nonhigh

High sounds are produced by raising the body of the tongue above the level that it occupies in the neutral position; nonhigh sounds are produced without such a raising of the tongue body. For example, /i u k g / are high; /ɛ æ ɑ / are nonhigh.

### Low–Nonlow

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. For example, /æ ɑ / are low; /ɛ ɪ k u / are nonlow.

### Back–Nonback

Back sounds are produced by retracting the body of the tongue from a neutral position; nonback sounds are produced without such a retraction of the tongue body from the neutral position. For example, /u ɑ o ʊ k / are back; /i ɛ æ / are nonback.

### Rounded–Nonrounded

Rounded sounds are produced with a narrowing of the lip orifice; nonrounded sounds are produced without such a narrowing. For example, /u o w ɝ / are rounded; /i ɛ æ / are nonrounded.

### Distributed–Nondistributed

Distributed sounds are produced with a constriction that extends for a considerable distance along the direction

of the airflow; nondistributed sounds are produced with a constriction that extends only for a short distance in this direction. In English, this feature is useful to differentiate /s z/ from /θ ð/.

## SOURCE FEATURES

Only one source feature is considered here. Other features described by Chomsky and Halle either have been contradicted by acoustic and physiological data or simply have too many difficulties to be useful for the phonetic description of English sounds. A better treatment of source features is needed.

### Voiced–Nonvoiced

Voiced sounds are associated with vibration of the vocal folds and, therefore, with a low-frequency periodic component of the acoustic signal. Nonvoiced sounds are not produced with vibration of the vocal folds.

## RELATIONSHIPS BETWEEN DISTINCTIVE FEATURES AND TERMS USED IN THIS BOOK

Some relationships between distinctive features and phonetic descriptions used in this book are shown in the following list of phonetic terms and their associated distinctive features. For example, the phonetic term *bilabial* used in this book is associated with sounds that have the distinctive features +anterior, –coronal, and +distributed.

### Place of Articulation

Bilabial:
$$\begin{bmatrix} +\text{anterior} \\ -\text{coronal} \\ +\text{distributed} \end{bmatrix}$$

Labiodental:
$$\begin{bmatrix} +\text{anterior} \\ -\text{coronal} \\ -\text{distributed} \end{bmatrix}$$

Linguadental:
$$\begin{bmatrix} +\text{anterior} \\ +\text{coronal} \\ \alpha\ \text{distributed}^1 \end{bmatrix}$$

Lingua-alveolar:
$$\begin{bmatrix} +\text{anterior} \\ +\text{coronal} \\ -\alpha\ \text{distributed}^1 \end{bmatrix}$$

Lingua-palatal:
$$\begin{bmatrix} -\text{anterior} \\ +\text{high} \\ -\text{back} \end{bmatrix}$$

Lingua-velar:
$$\begin{bmatrix} -\text{coronal} \\ +\text{high} \\ +\text{back} \end{bmatrix}$$

### Manner of Articulation

Stop:
$$\begin{bmatrix} -\text{sonorant} \\ -\text{continuant} \\ -\text{delayed release} \end{bmatrix}$$

Fricative:
$$\begin{bmatrix} -\text{sonorant} \\ +\text{continuant} \end{bmatrix}$$

Vowel:
$$\begin{bmatrix} +\text{syllabic} \\ +\text{sonorant} \\ -\text{consonantal} \end{bmatrix}$$

Nasal:
$$\begin{bmatrix} +\text{sonorant} \\ +\text{consonantal} \\ +\text{nasal} \end{bmatrix}$$

Rhotic:
$$\begin{bmatrix} +\text{sonorant} \\ +\text{consonantal} \\ +\text{coronal} \\ -\text{nasal} \\ -\text{lateral} \end{bmatrix}$$

Affricate:
$$\begin{bmatrix} -\text{sonorant} \\ -\text{continuant} \\ +\text{delayed release} \end{bmatrix}$$

Glide:
$$\begin{bmatrix} -\text{syllabic} \\ +\text{sonorant} \\ -\text{consonantal} \end{bmatrix}$$

In the interest of conciseness, we have considered in this review the distinctive features described by Chomsky and Halle (1968). Other systems of distinctive features have been proposed, and revisions have been suggested for some of the features introduced by Chomsky and Halle. Moreover, unlike the linear arrangement of features as shown here, alternative feature systems organized in nonlinear or hierarchical patterns have also been proposed. Figure C-1 is an example of one such nonlinear arrangement of phonetic features. The use of various feature systems is discussed by several contributors in the book edited by Ball and Kent (1997).

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[1]The symbol $\alpha$ is a "dummy variable" used to show that the Chomsky-Halle features can distinguish dental and alveolar consonants only if they differ with respect to the feature distributed. For example, if interdentals are $-\alpha$ distributed, then alveolars must be $+\alpha$ distributed. (See Ladefoged, 1971.)
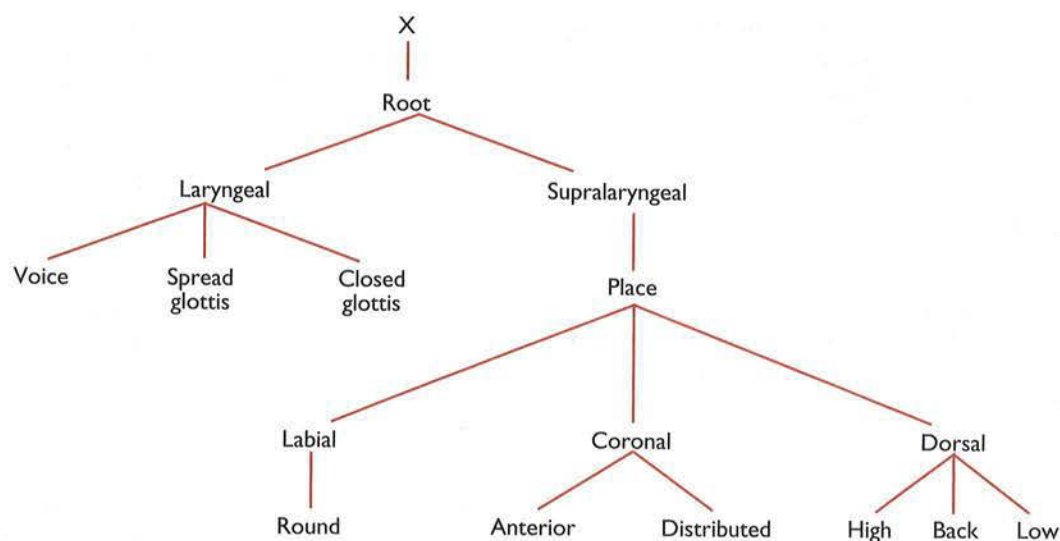
## FIGURE C-1

One example of feature geometry, in which phonetic features are arranged in a hierarchy. The root subdivides into laryngeal and supralaryngeal levels, each of which is associated with additional features at lower levels. Feature geometry, unlike linear systems, readily allows some features to be subsumed under others, i.e., they are not independent. For more information, see: McCarthy, J. 1988. Feature geometry and dependency: A review. *Phonetica 45:* 84–108.

For additional reading on distinctive features, see the following widely cited sources.

## RECOMMENDED READING AND REFERENCES

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