Advanced Phonetics and Phonology

1302741

Lecture (5)

FEATURES
Speech sounds can be decomposed into a number of articulatory components.

Combining these properties in different ways produces different speech sounds.

Phonological inventories are structured in terms of a number of interacting principles which operate on distinctive features, rather than segments or phonetic parameters.
Natural class

Questions:

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

- **Features** show what sounds have in common & how they are related or not related.

- Similar sounds that are grouped together in *natural classes* because they share some *features*.

- Example [p, t, k] is a natural class of (voiceless stops)
Classical Phonetic Features

/mæp/ specified using articulatory descriptors:

/m/ = voiced nasal bilabial stop
/æ/ = front open spread vowel
/p/ = voiceless bilabial stop
Distinctive Features

/mæp/ can be also described in terms of bundles of features in what known as Feature Matrices

\[\text{map} \quad ([\text{mæp}]): \begin{bmatrix}
-\text{syllabic} \\
+\text{sonorant} \\
+\text{stop} \\
+\text{nasal} \\
+\text{labial} \\
+\text{voice}
\end{bmatrix} \quad \begin{bmatrix}
+\text{syllabic} \\
+\text{sonorant} \\
-\text{stop} \\
-\text{nasal} \\
+\text{low} \\
-\text{back} \\
+\text{front}
\end{bmatrix} \quad \begin{bmatrix}
-\text{syllabic} \\
-\text{sonorant} \\
-\text{stop} \\
-\text{nasal} \\
+\text{labial} \\
-\text{voice} \\
-\text{round}
\end{bmatrix}\]
Distinctive Features

Feature Matrices are used to represent phonological rules

Vowel Nasalization

\([+\text{syllabic}] \rightarrow [+\text{nasal}] / \_\_ \ [+\text{nasal}]\)

\[Pom: = \begin{bmatrix} -\text{syllabic} \\ -\text{sonorant} \\ +\text{stop} \\ -\text{nasal} \\ +\text{labial} \\ -\text{voice} \end{bmatrix} \begin{bmatrix} +\text{syllabic} \\ +\text{sonorant} \\ -\text{stop} \\ -\text{nasal} \\ +\text{low} \\ +\text{back} \\ -\text{round} \end{bmatrix} \begin{bmatrix} -\text{syllabic} \\ +\text{sonorant} \\ +\text{stop} \\ +\text{nasal} \\ +\text{labial} \\ +\text{voice} \end{bmatrix}\]
Distinctive Features

Feature Matrices are used to represent phonological rules

Vowel Nasalization (restated)

\[ [+\text{syllabic}][+\text{nasal}] \rightarrow \begin{bmatrix} +\text{syllabic} \\ +\text{nasal} \end{bmatrix} [+\text{nasal}] \]

\[ \text{Pom:} \quad = \begin{bmatrix} -\text{syllabic} \\ -\text{sonorant} \\ +\text{stop} \\ -\text{nasal} \\ +\text{labial} \\ -\text{voice} \end{bmatrix} \begin{bmatrix} +\text{syllabic} \\ +\text{sonorant} \\ -\text{stop} \\ -\text{nasal} \\ +\text{low} \\ +\text{back} \\ -\text{round} \end{bmatrix} \begin{bmatrix} -\text{syllabic} \\ +\text{sonorant} \\ +\text{stop} \\ +\text{nasal} \\ +\text{labial} \\ +\text{voice} \end{bmatrix} \]

\[ [+\text{syllabic}][+\text{nasal}] \rightarrow \begin{bmatrix} +\text{syllabic} \\ +\text{nasal} \end{bmatrix} [+\text{nasal}] \]
Distinctive Features

and the application of the rule yields this
The idea of **Distinctive Features** was first developed by Roman Jacobson (1896-1982) in the 1940s as a means of working out a set of phonological contrasts or oppositions to capture particular aspects of language sounds.

Since then several versions have been suggested.
Phonetic vs. Phonological Features

- **Phonetic features**: correspond to physical articulatory or acoustic events

- **Phonological features**:
  1. look beyond the individual segments at the sound system of language.
  2. features to characterize speech sounds in the languages of the world.
  3. some features are relevant only for consonants; others are only for vowels.
Uses for Distinctive Features

- To specify a phoneme
- To specify a class of phonemes
- To describe the set of speech sounds used in a particular language or dialect
- To write concise rules of phonetic change
- To characterize a speech disorder
  - e.g. substitution, (often involving a change of feature)
Phonetic vs. Phonological Features

- To characterize place of articulation: e.g. [+ palatal]

- **Binary feature**: a feature that has only two values (+ or -)

- Phonologists express true generalizations about phonological structure as **economically** as possible.

- Each speech sound may be described as a “bundle” of features

- Each member of every pair of phones is distinguished from the other member by at least one feature value

- Features are universal, but a given language may use a subset of features as distinctive
Examples of Phonetic Features

- **consonantal**: sounds produced with a major obstruction in the oral cavity.

  [+/- consonantal]: distinguish consonants (obstruents, liquids, & nasals) from vowels & glides.

- [+ consonantal]: involve oral stricture of close approximation ([p], [l], [t])

- [- consonantal]: with stricture more open than close approximation ([j], [e])
Examples of Phonetic Features

- **approximant**: sounds made with an oral tract constriction which is less than that required to produce friction.
  - Vowels, glides and liquids are [+approximant], other sounds are [- approximant].
  - Also known as **syllabic** to indicate that they can form a syllable peak.

[+/- syllabic]: distinguish vowels from other sounds
- [+ syllabic]: functions as the nucleus of a syllable
  - e.g: [æ] & [ɪ] in [ræbɪt]
- [- syllabic]: doesn’t function as syllabic nuclei; [r] & [b] in [ræbɪt]
- Sounds other than vowels might be syllabic (liquids & nasals) in [bʌtn]
Examples of Phonetic Features

- **sonorant**: sounds produced with a vocal tract configuration in which spontaneous voicing is possible.  
  \[+/- \text{ sonorant}\]: distinguish vowels, glides, liquids, & nasals from oral stops, affricates & fricatives.

- [+] sonorant]: produced with spontaneous voicing

- [- sonorant] or (obstruents) spontaneous voicing is inhibited.

- vowels, nasals & liquids are **sonorants**
- stops, fricatives & affricates are **obstruents**.
Examples of Phonetic Features

Vowel (vocalic) place features

- **high**: the body of the tongue is raised from the neutral position.
- **[+ high]**: body of the tongue raised above the neutral position in [ə]

Consonants [j, k]

Vowels [iː, ɪ, ʊ, uː]

- **[- high]**: the body of the tongue is not raised
Examples of Phonetic Features

Vowel (vocalic) place features

- **low**: the body of the tongue is lowered from the neutral position.
- **[+ low]**: body of the tongue is lowered with respect to the neutral position

**Consonants**: [ʔ], [h]

**Vowels**: [ɒ, ɑː, ʌ, æ]

- **[- low]**: without such lowering
Examples of Phonetic Features

Vowel (vocalic) place features

- **back**: the body of the tongue is retracted from the neutral position.
- **[+ back]**: body of the tongue is retracted from neutral position

Consonants: [k, g, ɳ]

Vowels: [ʊ, uː, ɔ, ɔː, ɒ, ɑː]

- **[- back]**: tongue is not retracted

All English consonants except the velars are [- back]
Examples of Phonetic Features

Vowel (vocalic) place features

- **front**: the body of the tongue is advanced from the neutral position.

- [+ front]: sounds for which the tongue is fronted from the neutral position.

Consonants: [k, g, x]

Vowels: [ɪ, iː, æ, e, ɜː]

- [- front]: the tongue is not fronted.
Examples of Phonetic Features

Vowel (vocalic) place features

- **round**: the lips are protruded.
- **[+ round]**: produced with rounded lips

**Consonants**: [w]

**Vowels**: [ʊ, uː, ɒ, ɔ, oː]

- **[- round]**: produced with neutral or spread lips
Examples of Phonetic Features

Vowel (vocalic) place features

- **tense**: sounds requiring deliberate, accurate, maximally distinct gestures that involve considerable muscular effort.

- **[+ tense]**: involve muscular constriction (longer sounds)
  
  \[ i, e, ə, a, ɔ, u \]

- **[- tense]**: no constriction (shorter sounds)
  
  \[ i, ɛ, ə, æ, ə, ʌ, u \]
Examples of Phonetic Features

Vowel (vocalic) place features

- **reduced**: to characterize the central vowel /ə/
Examples of Phonetic Features

Vowel (vocalic) place features

- **advanced tongue root (ATR):** vowels made by drawing the root of the tongue forward, thus enlarging the pharyngeal cavity, tending to raise the tongue body, and tending to give the sound a more tense articulation, e.g. [i e o u].
  - [-ATR] sounds lack this gesture, e.g. [ɪ ɛ ɔ ʊ a ɑ]

- [+ ATR]: the root of the tongue pushed forward
- [- ATR]: tongue root is not pushed forward.
Examples of Phonetic Features

Consonant place features

- **labial**: Sounds that involve a constriction of the lips to give either a labial (labiodental) consonant or a rounded vowel/glide.
Examples of Phonetic Features

Consonant place features

- **Coronal**: produced with the blade or tip of the tongue raised from the neutral position.
- **[+/ - coronal]**: distinguish sounds which involve the front of the tongue from others
- **[+ coronal]**: articulated with the tongue tip or blade raised
  \[j, l, r, n, t, d, θ, ð, s, z, ʃ, ʒ, tʃ, dʒ \]
- **[- coronal]** sounds which don’t involve the front of the tongue
  \[w, m, ɳ, k, g, h, f, v, p, b\]
**Examples of Phonetic Features**

Consonant place features

- **anterior**: An *anterior* ([+ anterior]) sound is made with a constriction at or forward of, the alveolar ridge.

- *Posterior* ([- anterior]) sounds are produced behind the alveolar ridge.

The anteriors are the dentals and alveolars, the posterior sounds are the retroflex, palato-alveolar and palatal sounds.
Examples of Phonetic Features

Consonant place features

- **anterior:**
  - [+/- anterior]: distinguishes between sounds produced in the front of the mouth (labials, dentals & alveolars) and other sounds

- [+ anterior]: produced at or in front of the alveolar ridge
  - [l, r, n, m, t, d, θ, ŋ, s, z, f, v, p, b]

- [- anterior]: produced further back in the oral cavity than the alveolar ridge
  - [j, w, ɻ, ʃ, ʒ, tʃ, dʒ, k, g, h]
Examples of Phonetic Features

Consonant place features

- **dorsal**: Sounds made by raising the dorsum (tongue body) towards the hard palate, the soft palate (velum) or the uvula. The dorsal consonants are the velars and uvulars.

- **radical**: Sounds produced in the pharyngeal or laryngeal (glottal) region, e.g. [ʔ h ɦ ℱ ɬ]
Phonetic Features in terms of Phonological ones

Consonant place features

- **Labials**: [- coronal, + anterior] [m, f, v, p, b]

- **Dentals/ Alveolars**: [+ coronal, + anterior] [l, r, n, t, d, θ, ð, s, z]

- **Palato- Alveoars/ Palatals**: [+ coronal, - anterior] [j, ʃ, ʒ, tʃ, dʒ]

- **Velars/Glotals/ Pharyngeals/Uvulars**: [- coronal, - anterior] [w, η, k, g, h, ?]
Examples of Phonetic Features

Consonant place features

- **strident (sibilant)**: produced with a construction with greater noisiness. Stridency is only defined for *fricatives* and *affricates*.

- Labiodentals, sibilants and uvular fricatives/affricates are [+strident]; all other fricatives/affricates are [- strident].

- [+/- strident]: separates turbulent sounds from others

- [+ strident]: complex constriction resulting in noisy airflow
  
  \[s, z, \textcircled{s}, \textcircled{z}, \textcircled{t}s, \textcircled{d}s, f, v\]

- [- strident]: without such constriction [j, w, l, r, n, m, η, t, d, θ, ð, k, g, h, p, b]
Examples of Phonetic Features

Manner features

- **continuant**: the primary constriction is not narrowed so much that airflow through the oral cavity is blocked.
  - Plosives and nasal stops are [- continuant], other sounds (including laterals) are [+ continuant].
  - [+ / - continuant]: distinguishes between stops & other sounds

- [+ continuant]: there is airflow through the oral cavity
  [j, w, l, r, θ, ð, s, z, ʃ, ʒ, h, f, v]

- [- continuant]: in which the airflow is stopped in the oral cavity
  [n, m, ɲ, t, d, ʈʃ, ɖʒ, k, g, p, b]
Examples of Phonetic Features

Manner features

- **nasal**: the velum is lowered which allows air to escape through the nose.
  
  [+/- nasal]: distinguish nasal & non-nasal sounds

- [+ nasal]: produced with the velum lowered & air flow through the nasal cavity [n, m, η]

- [- nasal]: without airflow through nasal cavity
  [j, w, l, r, d, θ, ð, s, z, ʃ, ʒ, tʃ, dʒ, k, g, h, f, v, p, b]
Examples of Phonetic Features

Manner features

- **lateral**: the mid section of the tongue is lowered at the side.

  [+/- lateral]: separates [l] sounds from others

- [+ lateral]: central oral obstruction & airflow passing over one or both sides of the tongue [l]

- [- lateral]: all other sounds
Examples of Phonetic Features

Manner features

[+/- delayed release]: distinguishes affricates from other [- continuant] segments

- [+ delayed release]: produced with stop closure in the oral cavity followed by frication at some point [tʃ, dʒ]

- [- delayed release]: without frication
**Examples of Phonetic Features**

**Laryngeal features**

- **voice**: the vocal folds vibrate. [+/ - voice]: consonants with vibrating vocal cords & those which are not

- [+ voice]: with airflow through the glottis; vocal cords close to vibrate, such as [l], [m], [n]

- [- voice]: with vocal cords at rest; relevant to obstruents, such as [s], [p]
Examples of Phonetic Features

Laryngeal features

- **spread glottis**: the vocal folds are spread far apart.
  - Aspirated (voiceless) consonants, breathy or murmured voiced consonants and voiceless vowels/glides are [+spread]; other sounds are [-spread].
  - Also known as **aspirated**.
### Distinctive feature matrix for English consonants and vowels

Table 1. Distinctive Features of American English Consonants

|       | p | b | m | f | v | θ | ð | t | d | n | s | z | l | r | þ | sʒ | dʒ | dʒ | j | l | k | g | ɣ | w | ʔ | h |
| Back  | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | + | + | + | + | + |
| High  | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | + | + | + | + | + |
| Coronal| - | - | - | - | - | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Anterior| + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Labial | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Continuant| - | - | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Lateral| - | - | + | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Nasal  | - | - | + | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Sonorant| - | - | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Strident| - | - | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Voiced | - | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |

Table 2. Distinctive Features of American English Vowels

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</table>
Distinctive feature matrix for English consonants

In respect to place of articulation, labials, labiodentals, dentals, and alveolars are [+ANTERIOR]; and dentals, alveolars, alveolopalatals are [+CORONAL]. A way of grouping consonants according to features is as follows:

```
+ANTERIOR
  +CONTINUANT
    p b t d k g
    s z j 3
  f v θ δ

+CORONAL
  +HIGH
    tf dʒ
  +SIBILANT
    s z j 3
    h
  +LATERAL
    r
    l
  +NASAL
    m n
  +SONORANT
    η

+BACK
```
Note that vowels are all [+VOCALIC] (an open oral cavity with voicing) as well as [–CONSONANTAL, +SONORANT, +VOICE, +CONTINUANT]. The diphthongs /eɪ, ɪu, aɪ, aʊ, oʊ, ɔɪ/ cannot be distinguished by these features but must be treated as a combination of vowel + glide. A way of grouping vowels according to features is as follows:
Distinctive feature matrix for English consonants

To compare the traditional description of the distinctive phonetic (articulatory) features with the phonological ones:

Labials: [p, b, f, v]
Alveolars: [t, d, s, z, θ, ð]
Palatals: [j, f, ʒ, ʃ, ɾ]
Velars: [k, g, x, r]

Labials: [+ anterior, − coronal]
Alveolars: [+ anterior, + coronal]
Palatals: [− anterior, + coronal]
Velars: [− anterior, − coronal]

Dentals: [p, b, f, v]
Distinctive feature matrix for English consonants

Vowels:
[i, i, e, e, u, u, o, o]

Glides:
[j, w]

Sonorant consonants:
[l, l, m, n, n]

Obstruents:
[p, b, t, d, k, g, θ, ð, s, z, ʃ, ʒ, ʧ, ʤ]
A fully explicit phonological analysis of a language would use no phonetic symbols.

Only the feature matrices have theoretical status, and the phonetic symbols are meant only as convenient abbreviations for particular feature matrices.

Phonological rules benefit by from features when:

1. To capture a natural class
2. To capture an assimilation
3. To show that a change is minor
Finding the features needed in a rule

- **Tips on Rule Writing**

  A $\rightarrow$ B / C _____ D

  - Formally, rules are written with features.
  - Technically, inclusion of a speech segment in a rule is incorrect notation. However, we permit it because it often makes the rule more accessible to human readers.
Finding the features needed in a rule

- Tips on Rule Writing

Example
In Indonesian, /ŋ/ is deleted before nasals, liquids and glides. Instead of writing [+nasal, +dorsal] → Ø, it is acceptable to present the rule as follows:

\[
\eta \rightarrow \emptyset / \ldots \left[ \begin{array}{c}
-\text{syllabic} \\
+\text{sonorant}
\end{array} \right]
\]
Finding the features needed in a rule

- Reason #1 to use features in rule-writing: To capture a natural class

Example
In Indonesian, /ŋ/ is deleted before nasals, liquids and glides. Since nasals, liquids, and glides are a natural class, it is best to write the context of the rule with features.

\[
\eta \rightarrow \emptyset / \quad \begin{array}{c}
\text{−syllabic} \\
\text{+sonorant}
\end{array}
\]

Indonesian /ŋ/ Deletion
Finding the features needed in a rule

- **Reason #2 to use features in rule-writing:** To capture an assimilation

To capture an assimilation. We do this by showing that the assimilating segment adopts a feature value already possessed by one of its neighbours.

For example, in English, /k, g, ŋ/ become fronted [k, ɡ, ʊŋ] before front vowels, as in *keel* ['kɪl], *gale* ['ɡeɪl], or *dinghy* ['dɪŋi]. This is an assimilation, which can be expressed by:

$$\text{Velar Fronting} \quad \left[ +\text{dorsal}, +\text{consonantal} \right] \rightarrow \left[ +\text{front}, -\text{back} \right]/ \quad \left[ +\text{syllabic} \right]$$
Finding the features needed in a rule

- Reason #3 to use features in rule-writing: To show that a change is minor

  that is, of only one or two feature values. For example, if a rule changes (only) /p/ to [b], one would write \( p \rightarrow [+\text{voice}] \) rather than \( p \rightarrow b \), to show that nothing other than [voice] is changing. Otherwise use of plain symbols is a sensible way to make a rule.
Finding the features needed in a rule

- Start with the complete set of sounds in a language, then use just enough features to take away the sounds not wanted, leaving the target natural class in place.

- Take the following into consideration:
  - There are many features!!
  - They are defined in terms of articulation and/or acoustics.
  - Feature ‘bundles’ define natural classes. They pick out those sounds which match the feature specifications in the bundle.
  - In this sense, features categorize sounds, and the natural classes are the categories of speech the theory of features recognizes.
Finding the features needed in a rule

- Take the following into consideration: ...cont.
  - See which sounds in an inventory match a feature bundle.
  - Examine the effects of a rule’s structural change.
  - Identify common and different features of any group of sounds.
  - Get feedback on whether the feature bundle is a minimal one or not.
  - Produce all the logically possible natural classes for an inventory.
Finding the features needed in a rule

- Example: *optional fricative devoicing utterance finally*

<table>
<thead>
<tr>
<th>Word</th>
<th>phonetic</th>
<th>IPA</th>
<th>IPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>save</td>
<td>/seɪv/</td>
<td>[seɪf],</td>
<td>[seɪv]</td>
</tr>
<tr>
<td>bathe</td>
<td>/beɪð/</td>
<td>[beɪθ],</td>
<td>[beɪð]</td>
</tr>
<tr>
<td>maze</td>
<td>/meɪz/</td>
<td>[meɪs],</td>
<td>[meɪz]</td>
</tr>
<tr>
<td>rouge</td>
<td>/ruːʒ/</td>
<td>[ruʃ],</td>
<td>[ruʒ]</td>
</tr>
</tbody>
</table>
Finding the features needed in a rule

- **Four rules? Too many!**

Table 4.6  Analysis with a separate devoicing rule for each fricative

<table>
<thead>
<tr>
<th>Final /v/ Devoicing</th>
<th>Final /z/ Devoicing</th>
</tr>
</thead>
<tbody>
<tr>
<td>[–sonorant +continuant +labial +voice]</td>
<td>[–sonorant +continuant +anterior +strident +voice]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Final /ð/ Devoicing</th>
<th>Final /ʒ/ Devoicing</th>
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</tbody>
</table>
Finding the features needed in a rule

- Four rules? Too many!

Table 4.6  Analysis with a separate devoicing rule for each fricative
Finding the features needed in a rule

- One rule captures the natural class

```
save  /seɪv/  [self], [seɪv]
bathe /beɪð/  [beɪθ], [beɪð]
maze  /meɪz/  [meɪs], [meɪz]
rouge /ruʒ/  [ruʃ], [ruʒ]
```

Final Fricative Devoicing

\[
\begin{align*}
&\text{–sonorant} \\
&+\text{continuant} \\
&+\text{voice} \\
\rightarrow \ [–\text{voice}] / \ \_	ext{Utterance} \quad \text{(optional)}
\end{align*}
\]
Finding the features needed in a rule

- It can even be shortened as follows:

\[
\begin{align*}
\text{save} & \quad /\text{seɪv}/ \quad [\text{seɪf}], [\text{seɪv}] \\
\text{bathe} & \quad /\text{beɪð}/ \quad [\text{beɪθ}], [\text{beɪð}] \\
\text{maze} & \quad /\text{meɪz}/ \quad [\text{meɪs}], [\text{meɪz}] \\
\text{rouge} & \quad /\text{ruʒ}/ \quad [\text{ruʃ}], [\text{ruʒ}]
\end{align*}
\]

**Final Fricative Devoicing (shortened)**

\[
[−\text{sonorant} \\
+\text{continuant}] \rightarrow [−\text{voice}] / \quad ]_\text{Utterance}
\]
In-Class Exercises
1. What distinctive feature(s) do the sounds in each set have in common?

(a) /k/, /u/, /ɑ/, /ŋ/  
(b) /b/, /ŋ/, /ɛ/, /ʊ/  
(c) /f/, /ʃ/, /ə/, /j/  
(d) /l/, /ʒ/, /t/, /n/  
(e) /j/, /k/, /i/, /w/  
(f) /r/, /ŋ/, /ɔ/, /æ/
In-Class Exercises

2. What feature or features distinguish each of the following sets of sounds?

(a) /t/, /s/  
(b) /f/, /v/  
(c) /r/, /j/  
(d) /f/, /θ/  
(e) /e/, /o/  
(f) /i/, /j/  
(g) /u/, /u/  
(h) /z/, /ð/  
(i) /g/, /ŋ/
3. Give a list of distinctive features for each of the following sounds. Which are necessary to distinguish the sound from all other sounds?

(a) /w/
(b) /dʒ/
(c) /l/
(d) /ɑ/
In-Class Exercises

4. What sound or sounds have the following sets of distinctive features?

(a) \([+\text{CONSONANTAL}, +\text{HIGH}, +\text{SONORANT}, +\text{BACK}]\)
(b) \([-\text{CONSONANTAL}, +\text{HIGH}, -\text{BACK}, -\text{VOCALIC}]\)
(c) \([-\text{ROUND}, +\text{LOW}, -\text{BACK}]\)
(d) \([+\text{ANTERIOR}, -\text{SIBILANT}, +\text{CORONAL}, -\text{VOICE}]\)
5. It could be argued that [±NASAL] is a redundant feature since it is not required to distinguish /m, n, η/ from other sounds. Explain.
In Luganda, [r] and [l] occur in complementary distribution (Chesswas 1963).

olubiri ‘palace enclosure’
liɲɲa ‘climb’
ssaffaali ‘safari’
eraŋ ‘dye’
akasolja ‘roof’
kampala ‘Kampala’
omulere ‘flute’
omulenzi ‘boy’
luma ‘to hurt’

akalulu ‘vote’
eŋiri ‘warthog’
eŋkula ‘rhinoceros’
akasaale ‘arrow’
olumuli ‘reed’
liiri ‘silk’
akabonero ‘sign’
weeraba ‘goodbye’
lje ‘my (poss)’

1. What determines their distribution? List the contexts in which each allophone occurs.
2. Which of these two contexts is statable in terms of distinctive features?
3. Which of the segments would you choose as the underlying one? Please motivate your answer.
That's all Folks!

/ ði end əv lektʃə faɪv/