Features: the atoms of segment structure

- Each feature encodes one of the aspects of speech production
- The specification of features is either positive or negative; specification is therefore binary/bivalent.
- Features are conventionally arranged in a column called a feature matrix.

Features

- [p] +consonantal -syllabic -sonorant -voice +labial -round -continuant -nasal -lateral

Why do we need features?

- natural classes: an economical way of characterizing segments (e.g. /s z ʃ ʒ tʃ dʒ/ = [+sibilant]; /p t k b d g f v s z θ ʃ ʒ tʃ dʒ h ʔ/ = obstruents [-sonorant, +consonantal])
- better understanding of allophonic variation (e.g. assimilation - e.g. liquid devoicing /pr/ → [p r])

Allophonic variation

- Allophonic variation is not simply the substitution of one allophone for another, but an environmentally conditioned change of a feature or features
- /pr/ → [pf] ‘pray’ [pref], ‘prime’ [pɹm]

Liquid devoicing

- /p [consonantal] -syllabic -sonorant -voice -nasal -lateral etc.
- /ʃ [sonorant] -syllabic -voice +coronal -continuant -nasal -lateral etc.
- /ɹ [sonorant] -voice -nasal -lateral etc.
Natural classes

Reason: simplicity in scientific modeling (Occam’s razor).

A set of segments is said to constitute a natural class if fewer features are needed to specify the set as a whole then to specify any one member of the set.

Examples of natural classes in English:

- /s z j f y/ = [+sibilant]
- /p t k b d g f v s z/ = [-sonorant, +consonantal] (obstruents)
- /l/ = [+lateral]

Note: in informal identification of natural classes, you may use conventional phonetic categories instead of features. For example, [-sonorant, +voice, -continuant] = the class of voiced obstruent stops.

It is a fundamental precept of phonological theory that phonological processes apply to natural classes and not just any assemblage of sounds.

Characterizing natural classes

The precise characterization of a natural class in a given language depends on what other sounds there are in the language.

Naturalness is relativized to the expression of contrast in the language/dialect.

A standard five-vowel system (Language X)

<table>
<thead>
<tr>
<th></th>
<th>i</th>
<th>e</th>
<th>a</th>
<th>o</th>
<th>u</th>
</tr>
</thead>
<tbody>
<tr>
<td>Back</td>
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<td>+</td>
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<td>High</td>
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</table>
### Natural classes
- Consider the set of vowels \( \{i, e\} \).
- Is this a natural class in Language X?

### Strategies for determining natural classes
Step 1: identify which features the set \( \{i, e\} \) has in common.

### Natural class
**Step 2:** list the features.

### Natural class
**Step 3:** check that no other sounds share exactly these specifications.

### Natural class
**Step 4:** confirmation: the set \( \{i, e\} \) constitutes a natural class!

### Natural class
**Step 5:** check for redundancies.
An example of an unnatural class

- Consider the following consonant inventory (English):
  - NB: the feature chart for English consonants is given on p. 81 of the textbook.

Natural class

- Suppose, for the purpose of this demonstration, that there is a phonological process that requires us to identify /v, δ, ʒ/ as a class, to the exclusion of /z/.
  - Does the set \{v, δ, ʒ\} constitute a natural class?

Features

<table>
<thead>
<tr>
<th></th>
<th>v</th>
<th>δ</th>
<th>ʒ</th>
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<tbody>
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<tr>
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<tr>
<td>Nasal</td>
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<td>Continuant</td>
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<td>Lateral</td>
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<tr>
<td>Alveolar</td>
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</table>

Natural class

Step 1: identify which features the set \{v, δ, ʒ\} has in common (this information is in the feature chart for English consonants, p. 81).

Step 2: list the features.
**Natural class**

**Step 3:** Check that no other sounds share exactly these specifications.

**Reason:** because /v ʌ z/ cannot be defined using a single set of feature specification, without also including the unwanted sound /z/.

The search stops here!

**Note:** if /z/ was not one of the consonants of this language, the group /v ʌ z/ would constitute a natural class.

**Natural class**

- How would you define the set if it included /z/? \{v ʌ z ʒ\} (i.e. the set of voiced fricatives)
- **Step 1:** identify which features the set has in common.

**Features**

<table>
<thead>
<tr>
<th></th>
<th>v</th>
<th>ʌ</th>
<th>z</th>
<th>ʒ</th>
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<tbody>
<tr>
<td><strong>Consonantal</strong></td>
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<td><strong>Anterior</strong></td>
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</tbody>
</table>

**Natural class**

**Step 2:** list the features.

**Natural class**

**Step 3:** check that no other sounds share exactly these specifications.

**Ok:** no other sounds.

**Step 4:** Confirmation - the set \{v ʌ z ʒ\} constitutes a natural class.
Natural class

Step 5: Check for redundancies.

(b) How do you get rid of the unwanted segments?

Natural class

(c) How do you get rid of the unwanted segments?

We conclude that the most parsimonious definition for the set \( \{v, \delta, z\} \) is:

Note: if you look carefully, you will notice some redundancies in the original table in Step 1:

the feature [lateral]

\[ \Rightarrow \text{this feature is restricted to exclusive sets of sounds and therefore are irrelevant to the definition of the set \( \{v, \delta, z\} \).} \]
Natural class

- If we had included [+consonantal] in the feature set for voiced fricatives, we would need to include more features to get rid of unwanted segments.
- Why?
- Because [+consonantal] includes too many segments!
- Also, [+consonantal] is redundant: every [+voice, -sonorant] (which eliminates most of the unwanted segments) is [+consonantal].

Quick homework

- Determine whether each of the sets below constitutes a natural class in English. If yes, give the relevant (i.e. not redundant) features that define the set.
  a. \{ʃ dʒ\}
  b. \{p b m\}
  c. \{i æ ð\}