Phonemic analysis: a theory of distinction

Observation to be explained

Some of the possible phonetic distinctions in a language are systematically related to their surrounding context.

For instance, not all \( l \)'s are the same in English (subscript \( _r \) ring means voiceless).

(1)

\[
\begin{array}{c|c|c}
\text{blue} & [b\text{lu}w] & \text{plow} & [p\text{lu}w] \\
\text{gleam} & [\text{gli}jm] & \text{clap} & [k\text{la}p] \\
\text{slip} & [sl\text{p}] & \text{clear} & [kl\text{ja}r] \\
\text{flog} & [f\text{lo}g] & \text{play} & [pk\text{ja}] \\
\text{leaf} & [lj\text{f}] \\
\end{array}
\]

(2) What’s the distribution?  

\[
\begin{array}{c|c|c}
\text{after \{\text{voice}\} stop} & [l] & [l] \\
\text{elsewhere} & \text{no} & \text{yes} \\
\end{array}
\]

There is a surprising amount of this kind of structure in the sound patterns of natural languages. Why?

coarticulation  overlapping articulation of segments that are adjacent to one another. This overlap happens because transitions between vocal tract states are gradual.

phonological processes  a change in articulation conditioned by nearby sounds

Although many processes can be understood as originating from coarticulation, there exist others that are purely grammatical. Different languages have different processes.

(3) Example: nasal assimilation in English (superscript \( \sim \) tild means nasalized)

- English vowels are \([-\text{nasal}]\) in most contexts: [b\text{t}] (into an apple), [l\text{is}] (was reviewed by a lawyer), [b\text{og}] (where peat moss grows)....
- Vowels becomes \([+\text{nasal}]\) when followed by a nasal consonant: [b\text{in}] (threw into a), [l\text{in}] (against a wall), [b\text{in}] (the sound a bell makes)... 

Every vowel phoneme has, in fact, two allophones.

\[
\begin{array}{c|c|c}
m\text{o}r & \text{‘big’} \\
\text{i} & \text{‘cattle’} \\
n\text{el} & \text{‘cloud’} \\
m\text{\“} & \text{‘about’} \\
r\text{u} & \text{‘secret’} \\
\end{array}
\]

(4) Scots Gaelic has a similar process (\( \sim \) means long vowel)

Vowels are nasal in Scots Gaelic when preceded or followed by a nasal consonant.
Malay does, too

All vowels and glides following a nasal in Malay are predictably nasalized until a non-nasal consonant is reached.

For the French, nasality is contrastive

(post page 545 in Fromkin)

Explanation

Postulate two levels

1. underlying form (string of phonemes that are distinctive in this language)

2. surface or phonetic form (specifying particular phones in a language-independent way)

and provide phonological rules that derive the surface form from the underlying form. The rule format we will use is $A \rightarrow B / C_D$ “$A$ rewritten as $B$ in the context where it is preceded by $C$ and followed by $D$.”

Any of $A, B, C, D$ might be written more generally as a feature matrix

$$\begin{bmatrix}
+ \text{ feature} \\
- \text{ feature} \\
\vdots
\end{bmatrix}$$

A feature matrix makes positive or negative reference to a combination of phonological features like nasal, voiced, high, affricate etc. Such combinations specify natural classes.

For instance, further English voicing data indicates that /r/ patterns with /l/ just as in (1).

<table>
<thead>
<tr>
<th>(7)</th>
<th>brew [bruw]</th>
<th>prow [praw]</th>
</tr>
</thead>
<tbody>
<tr>
<td>green [grijn]</td>
<td>trip [trp]</td>
<td></td>
</tr>
<tr>
<td>drip [drp]</td>
<td>creep [krijp]</td>
<td></td>
</tr>
<tr>
<td>frog [frug]</td>
<td>pray [krej]</td>
<td></td>
</tr>
<tr>
<td>shrimp [frmp]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

so do /j/ and /w/

<table>
<thead>
<tr>
<th>(8)</th>
<th>beauty [bjuwrij]</th>
<th>putrid [pjuwtrid]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duane [dwejn]</td>
<td>twin [twn]</td>
<td></td>
</tr>
<tr>
<td>Gwen [gwën]</td>
<td>quick [kwk]</td>
<td></td>
</tr>
<tr>
<td>view [vjuw]</td>
<td>cute [kjuwt]</td>
<td></td>
</tr>
<tr>
<td>swim [swm]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>thwack [θwæk]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$$\begin{bmatrix}
+ \text{ approximant} \\
+ \text{ voice}
\end{bmatrix} \rightarrow \begin{bmatrix}
- \text{ voice} \\
- \text{ voice}
\end{bmatrix}$$

“English approximants have voiceless allophones after voiceless stops; elsewhere such approximants are voiced.”
Techniques

**minimal pair** two forms with distinct meanings that differ by only one segment, in the same position. suggests existence of two different phonemes

**complementary distribution** the set of contexts surrounding $X$ is disjoint from the set of contexts surrounding $Y$. suggests $X$ and $Y$ are allophones.

(9) Japanese. Are [s] – [ʃ] allophones of separate phonemes or the same phoneme? What about [h] and [f]? Give a rule for this process.

1. [higaʃi] east 8. [bonto] really
2. [heya] room 9. [furui] old
3. [hiyaku] one hundred 10. [futatsu] two units
5. [haha] mother 12. [ofuro] bath

(10) Tojolabal is a language spoken in Mexico. Determine whether plain [k] and glottalized [kʔ] are allophones of a single phoneme, in free variation, or in contrast.

1. [kisim] my beard 7. [}.{] white
2. [cakʔa] chop it down 8. [kʔifin] warm
3. [koktit] our feet 9. [skufu] he is carrying it
4. [kaʔk] flea 10. [kʔutes] to dress
5. [pʔakan] hanging 11. [snika] he stirred it
6. [kʔaʔem] sugar cane 12. [ʔkʔ] read

(11) Consider the distribution of [s] and [z] in (just) these Italian words.

1. [sala] room 6. [kaza] house
2. [za] I use 7. [askolti] you listen
3. [mostra] he/she shows 8. [dizerto] desert
5. [tesøre] to weave 10. [spal:a] shoulder