Contrastive Features

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1 Determining which features are distinctive

It is not obvious how to determine which features are distinctive in any given language. There are at least two possibilities.

1. Pairwise Algorithm (Archangeli, 1988)
   (a) Fully specify all segments.
   (b) Isolate all pairs of segments.
   (c) Determine which segment pairs differ by a single feature specification.
   (d) Designate such feature specifications as ‘contrastive’ on the members of that pair.
   (e) Once all pairs have been examined and appropriate feature specifications have been marked ‘contrastive’, delete all unmarked feature specifications on each segment.

2. The Successive Division Algorithm (Dresher, 2009)
   (a) Begin with no feature specifications. (This is like assuming all sounds are allophones of a single undifferentiated phoneme.)
   (b) If the set is found to consist of more than one contrasting member, select a feature and divide the set into as many subsets as the feature allows for.
   (c) Repeat step (b) in each subset: keep dividing up the inventory into sets, applying successive features in turn, until every set has only one phoneme.

★ Let’s apply both methods to the following mini-inventory.

<table>
<thead>
<tr>
<th>p</th>
<th>b</th>
<th>m</th>
</tr>
</thead>
<tbody>
<tr>
<td>[voiced]</td>
<td>–</td>
<td>+</td>
</tr>
<tr>
<td>[nasal]</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>
Now what happens when the Pairwise Algorithm is applied to a common inventory of vowels?

\begin{tabular}{|c|c|c|c|c|c|}
\hline
 & i & e & a & o & u \\
\hline
[high] & + & - & - & - & + \\
[low] & - & - & + & + & - \\
[back] & - & - & + & + & + \\
[round] & - & - & - & + & + \\
\hline
\end{tabular}

Dresher calls this the “too many features” problem. It is not always the case that contrastive speech sounds differ along a single phonetic dimension.

Dresher concludes that the Pairwise Algorithm suffers from a “logical problem,” but the Successive Division Algorithm (SDA) does not. On these grounds, further research into distinctive features ought to proceed along the lines as outlined by the SDA.

2. The Contrastivist Hypothesis

Curry-Hall (2007) provides perhaps the clearest statement of this hypothesis. It says that phonological computation can only refer to contrastive features. In other words, if a phonological processes targets a groups of sounds then those sounds MUST be a natural class according to this hypothesis. In other words there must be a set of features which can be ordered in some way to make that group of sounds a natural class. Furthermore, under this hypothesis, non-contrastive processes (such as those described with allophonic rules) are not part of phonology. They are “post-phonology”, and part of how the phonetics spells out the phonology.

3. The Emergence of Distinctive Features

Mielke (2008) conducts a cross-linguistic study of ~500 languages to see to what extent the phonological rules in grammars reflect natural classes. He examines the feature system in Preliminaries to Speech Analysis (Jakobson, Fant, and Halles (1952); The Sound Pattern of English (Chomsky and Halles 1968); and unified feature theory (Clements and Hume 1995). He finds “no single theory is able to characterize more than 71 percent of the classes, and over 24 percent are not characterizable in ANY of the theories.” On this basis, he claims that distinctive features may not be innate but instead “emerge” somehow. He suggests they emerge from diachronic sound change or are somehow learned, and the exact nature of these proposals is the focus of his current research. Mielke currently maintains a database of the phonological processes and inventories of hundreds of languages. You can play with it here: http://pbase.brohan.ca/. 
References


