The Grounding Hypothesis and Javanese Vowels

Diana Archangeli
University of Arizona

1.0 The Problem

Distinctive feature theory (e.g. Chomsky & Halle 1968) proposes a variety of properties of phonological features, for example, that they are distinct entities, that they combine to produce the individual sounds of natural human language, that they are referred to in formally stating the sound patterns of natural human language, and that they have acoustic and/or articulatory correlates.

Distinctive feature theory has met with considerable success in formally characterizing natural language phenomena. At the same time, there are a number of asymmetries in feature distribution which distinctive feature theory alone fails to account for. Logically, there are more combinations of features than naturally occur in language. Furthermore, specific combinations are common cross-linguistically, such as [+high, +ATR], while others are rare, such as [+low, +ATR]. In fact, there is a full spectrum of feature combinations, ranging from nonexistent to occurring in virtually every language. This spectrum is not simply a property of inventories: specific combinations have significant roles in sound patterns and the roles taken by the rare and the common feature combinations differ in substantive ways from each other. These asymmetries are unexpected under distinctive feature theory.

The Grounding Hypothesis (Archangeli and Pulleyblank 1994) addresses these asymmetries. The observations at the heart of the Grounding Hypothesis are that phonetically sympathetic combinations are likely to occur, likely to induce sound changes, and likely to be created by sound changes while phonetically antagonistic combinations are unlikely to occur (i.e. be rare), unlikely to induce sound changes, and unlikely to be created by sound changes.
In this paper, I exemplify the Grounding Hypothesis with several examples from the distribution of vowels in Javanese, using data from Dudas (1976). I first briefly review the grounded conditions that are relevant, namely those involving [high], [low], and [ATR]. (For full discussion, see Archangeli and Pulleyblank 1994). I then illustrate the effect of these conditions in the vocalic alternations in Javanese. Of particular interest is the demonstration that even where antagonistic feature combinations are permitted within a language, the preference for sympathetic combinations is evident in the nature of sound changes within the language. Although the discussion here is not framed in terms of Optimality Theory (Prince and Smolensky 1993, McCarthy and Prince 1993a, 1993b, 1994), the role of the grounded conditions in Javanese -- namely that although they may be violated under certain conditions, they hold under other conditions -- is exactly the "soft" role of constraints in Optimality Theory, where some constraints may be violated in order to satisfy more general requirements yet those same constraints hold over other, less general, requirements.

2.0 THE GROUNDING HYPOTHESIS & TONGUE ROOT AND BODY FEATURES

The Grounding Hypothesis (Archangeli & Pulleyblank 1994:177) is stated in (1).

(1) The Grounding Hypothesis

a. Feature cooccurrence conditions invoked by languages are phonetically motivated.
b. The stronger the phonetic motivation for a condition C
   i. the greater the likelihood of invoking C
   ii. the greater the likelihood of assigning a wide scope to C in the grammar,
   and vice versa.
The features of interest for vowel distribution in Javanese are [high], [low], and [ATR/RTR]. As reviewed in Archangeli and Pulleyblank (1994), the phonetic literature shows that tongue root position and tongue body position influence each other. In brief, the tongue root and tongue body are physically connected and tongue is essentially incompressible (Ladefoged et al. 1972). As a result, a gesture in one direction correlates with a compensatory gesture in another direction. Tongue body raising and tongue root advancement correlate with each other as do tongue body lowering and tongue root retraction. The conditions in (2) formally characterize these observations. Those in (2a-c) relate tongue body raising and tongue root position while those in (2d-f) relate tongue body lowering and tongue root position.

(2) **Grounded conditions**: the formal expression of these observations

- a. Hi/TR: If [+high] then ATR
  If [+high] then *not* RTR

- b. ATR/Hi: If ATR then [+high]
  If ATR then *not* [-high]

- c. RTR/Hi: If RTR then [-high]
  If RTR then *not* [+high]

- d. Lo/TR: If [+low] then RTR
  If [+low] then *not* ATR

- e. RTR/Lo: If RTR then [+low]
  If RTR then *not* [-low]

- f. ATR/Lo: If ATR then [-low]
  If ATR then *not* [+low]

There are ten further logically possible conditions involving these features. These conditions, however, are not phonetically grounded and so are predicted to never play a role in any
natural language. Archangeli and Pulleyblank (1994) propose that neither [+high] nor [-low] may be the antecedent of a grounded condition since these features do not require displacement of the tongue body.

(3) Ungrounded conditions: predicted to never be invoked by any natural language

a. If [+high] then RTR
   If [+high] then not ATR

b. If ATR then [-high]
   If ATR then not [+high]

c. If RTR then [+high]
   If RTR then not [-high]

d. If [-high] then ATR
   If [-high] then not RTR

e. If [-low] then ATR
   If [-low] then not RTR

f. If [+low] then ATR
   If [+low] then not RTR

g. If ATR then [+low]
   If ATR then not [-low]

h. If RTR then [-low]
   If RTR then not [+low]

i. If [-high] then RTR
   If [-high] then not ATR

j. If [-low] then RTR
   If [-low] then not ATR

With this background, we are now prepared to consider vowel distribution in Javanese.

3.0 Predictions for Natural Language Sound Patterns

3.1 Low advanced vowels are rare. One of the strongest expectations, resulting from the gradient strengths of grounding conditions (1b), is that low advanced vowels are rare. This is certainly true of Javanese (Dudas 1976): low vowels are retracted except in two well-defined contexts. The first is when a low vowel appears in word final position, where it surfaces as [ɔ]. The two left-hand columns in (4) show the retracted low vowels followed by suffixes while the right-hand column has the word-final advanced counterpart. (To help in