

Representation of minimal contrast: evidence from phonetic processes

Recently, the significance of contrast in phonology has received renewed attention (e.g. Flemming 1995, Lubowicz 2003, Padgett 1997). The present study advances this research line by focusing on the role of *minimal contrast*. Minimally contrastive segments are pairs of segments that differ just along one dimension of contrast (Jakobson, Fant & Halle 1952). Here, I present evidence for the importance of minimal contrast: experimental results from Lithuanian show the influence of minimal length contrast on a phonetic process that modifies duration. In view of these facts, a new system to encode minimal contrast is proposed and framed within Optimality Theory (OT).

An acoustic experiment tested the influence of minimal length contrast on the voicing effect, a phonetic process by which vowels tend to be longer before voiced obstruents than before voiceless ones. Two vowels minimally contrast for length if they only differ in this dimension. For example, Lithuanian has six vowel qualities but only four minimally contrast for length: /i, i:, e:, æ, æ:, a, a:, o:, u, u:/. Keating (1985) suggests that phonemic vowel length attenuates the voicing effect. This follows from the observation that contextual variation of duration would endanger contrastive vowel length (Hayes 1995). Thus, the hypothesis to test is that the voicing effect will be greater for /e:, o:/, which lack a short counterpart, than for those vowels that minimally contrast for length. The results confirm this hypothesis – non-minimally contrastive /e:, o:/ present a significantly larger voicing effect ($p < .05$).

These experimental results show that the voicing effect outcome depends on whether it acts upon vowels that are minimally contrastive for length: the phonetic process is sensitive to minimal contrast (cf. Kingston & Diehl 1994). Therefore, I argue that the phonological representation must include information about minimal contrast, which the phonetic component can access. I formalize this contrast with a *contrast-coindexing* mechanism. *Contrast-coindexing* applies to minimally contrastive segments capable of distinguishing pairs of words. Minimal contrast is assessed at the word level, taking the language's entire set of words into consideration (Flemming 1995). Framed within OT, the *contrast-coindexing* function is argued to apply after GEN generates the candidates and before EVAL operates over them.

Contrast-coindexing compares any two candidate words and establishes whether they form a minimal pair. If so, the differing segments are evaluated for their dimensions of contrast. If they share all dimensions except for one, then they are *contrast-coindexed* for this dimension. Example (1) shows the *contrast-coindexing* representation for Lithuanian vowel length through hypothetical mono-syllabic words. Mid vowels do not minimally contrast for length. Therefore, they lack a *contrast-coindex* (d-subscript=duration) for this dimension.

(1) p_i_d p_{i:}_d p_u_d p_{u:}_d
pe: po:
p_æ_d p_{æ:}_d p_a_d p_{a:}_d

The moraic representation of length (Hayes 1989) fails to capture minimal length contrast. Lithuanian non-minimally contrastive /e:, o:/ behave like the other long vowels regarding stress and word minimality requirements, suggesting they share a bimoraic status. Basing contrast on number of moras, /e:, o:/ would pattern with other bimoraic vowels. However, *contrast-coindexing* can distinguish /e:, o:/ from other long vowels.