

Gradient OCP and harmonic alignment in English phonotactics

The Obligatory Contour Principle (OCP) prohibits adjacent identical elements (Leben 1973, Goldsmith 1976, McCarthy, 1986, Odden 1986, Yip 1988, Coetzee 2004, among others). Recent research has shown that the OCP emerges gradiently in phonotactics (Berkley 1994, 2000, Frisch, Pierrehumbert, and Broe 2004, Coetzee and Pater 2006). Berkley (1994) demonstrated gradient place and manner OCP effects between English consonant pairs within monomorphemic monosyllables. Berkley showed that the strength of the OCP effect weakens if we increase the amount of intervening material between the consonants: an intervening short vowel (e.g. *bob*, *bomb*) shows a stronger OCP effect than an intervening long vowel (e.g. *babe*).

We replicated and extended Berkley's results using a database that contains all the syllables of English derived from the CELEX2 database (Baayen, Piepenbrock, and Gulikers 1995). We quantified the strength of the OCP effect for each consonant pair in terms of the Observed/Expected (O/E) Ratio (Frisch et al. 2004). Two major generalizations emerge: (i) The quantitative OCP-effect is weaker in stressed syllables than in unstressed syllables for co-occurring labials and dorsals; (ii) The OCP effect is either extremely weak or in the opposite direction for coronals. The database shows that stressed syllables contain more low and mid vowels than unstressed syllables, and unstressed syllables contain more reduced vowels than stressed syllables. We hypothesized that low and mid vowels, being intrinsically longer and more sonorous, can block the OCP effect more successfully, while reduced vowels such as schwa are more transparent to the OCP. The difference in OCP strength between stressed and unstressed syllables would thus be a reflex of vowel quality. The hypothesis was by and large confirmed: the OCP effect was weaker when the consonants were separated by a low vowel and stronger when they were separated by a high vowel or a schwa. Again, this only holds true for labial and dorsal consonants; coronals exhibit the opposite effect.

We derive the relationship between syllable prominence and consonantal place by assuming that syllable prominence and consonantal place are harmonically aligned in English: the more marked labial and dorsal consonants are preferred in combination with the more prominent low and mid vowels as well as in stressed syllables; the less marked consonants, such as coronals, are preferred in combination with less prominent vowels, such as schwa, as well as in unstressed syllables. This hypothesis correctly predicts that stressed syllables with marked consonants and prominent vowels and unstressed syllables with unmarked consonants and non-prominent vowels are among the most frequent syllable types in English. We propose an optimality-theoretic model based on three prominence hierarchies: marked place > unmarked place; stress > no stress; low/mid vowel > high vowel/schwa. A harmonic alignment of these hierarchies yields a small set of constraints, e.g. *X/t 'Avoid a combination of stressed syllable and unmarked place'. Using OT software (Hayes, Tesar, and Zuraw 2003, Anttila and Andrus 2007), we show that the analysis predicts a number of implicational universals that emerge quantitatively in the CELEX2 data.