Experimentally Uncovering Hidden Strata in English Phonology

Lisa Davidson (davidson@cogsci.jhu.edu)
Department of Cognitive Science, Johns Hopkins University
3400 N. Charles St, Baltimore, MD 21218

Introduction

The final state of the phonological grammar of a language *L* permits those structures that are legal in *L* and disallows those which are not. With respect to phonotactics, a possible assumption is that all consonant clusters prohibited by the phonology of *L* should be "equally illegal" for a speaker of *L*. However, several studies of the second language (L2) acquisition of consonant clusters have shown that not all clusters illegal in a speaker's native language are equally difficult for learners acquiring a language with a different cluster inventory than their own (i.e. Broselow & Finer, 1991; Eckman & Iverson, 1993). Assuming that beginning L2 learners or naive speakers faced with foreign words use their native language grammars to produce these words, the graded performance on different consonant clusters sheds light on the nature of the final state of the native grammar. The present study uses an Optimality Theoretic (OT) approach (Prince & Smolensky, 1993) to examine the final state of a native speaker's grammar and to account for this graded performance on clusters. New markedness constraints presented here that pertain to several different types of clusters are not only useful for characterizing speakers' performance, but also for explaining consonant cluster typology more generally.

Experiments 1 and 2

Methods. Previous research has explored minimal sonority distance (MSD) as a major factor affecting the differential acquisition of consonant clusters (Broselow and Finer, 1991; Eckman and Iverson, 1993; Hancin-Bhatt and Bhatt, 1998). Because English has an MSD of 1, it can be hypothesized that English speakers will have difficulty with clusters with an MSD of 0. Instead of using L2 learners, the present experiment examines the productions of native English speakers on Polish initial consonant clusters that have a sonority distance of 0 (SD 0) (/**kt**/,/**kp**/,/**pt**/,/**č k**/,/**vz**/), non-English clusters with an SD of 1 or more (SD 1) (/*dv*/,/*vn*/,/*tf*/,/*zr*/,/*zm*/) and English clusters with an SD of 1 or more (SD 1E) (/šr/,/šl/,/sm/,/sn/,/fr/). In experiment 1, subjects heard a pseudo-Polish word with one of the previous 15 clusters produced by a native speaker of Polish and then were told to read and memorize an English sentence containing a written version of the foreign word. The sentence then disappeared and the subjects repeated the sentence aloud. The subjects were explicitly instructed to pronounce the foreign words as they would if they were English words.

Results. A spectrogram of each target was examined to determine the response. An ANOVA showed that while subjects were significantly better on the English possible clusters than impossible clusters (p<.0001), the distinction between non-English clusters was not significant (SD 0: 33% correct, SD 1: 42% correct, p<.30). It was concluded that SD cannot be the most important factor in determining the difficulty of clusters. A breakdown of subjects' performance on individual clusters instead suggested the following groupings (from worst to best performance): A: /*vn*/,/**vz**/,/*dv*/ > B: /**kt**/,/**kp**/,/**pt**/,/**č k**/,/*tf*/ > C: /*zm*/,/*zr*/ > D: /šr/,/šl/,/sm/,/sn/,/fr/. Post-hoc comparisons indicated that each group was significantly different from every other.

Using a modification of the original procedure intended to minimize memory demands, experiment 2 successfully replicated experiment 1 (with the difference between groups B and C marginally significant, p<.12).

Discussion

An English phonological grammar that makes distinctions between different types of illegal clusters can be captured naturally within OT. In order to achieve graded performance, different markedness constraints must target each of the groups (A-D) of illegal clusters above. These rankings produce hidden strata that distinguish between increasing "foreignness" in nonnative words, much like the strata that correspond to decreasing nativization in loanwords (Itô & Mester, 1999). Native speakers are able to exploit the hidden rankings among these constraints by promoting faithfulness constraints to different points in the hierarchy when producing illegal clusters. Assuming that this movement is performed anew for every target, a speaker can exhibit performance that is not simply 0% or 100% on any given set of clusters. However, the fixed ranking of markedness constraints predicts that if a speaker can produce a more marked group of clusters (such as B) her performance on the less marked group (such as C) must be at least as good as or better. The relevant markedness constraints demonstrate that a universal, cross-linguistic account of consonant clusters must integrate sonority-like constraints with co-occurrence restrictions that employ non-sonority aspects such as place and cluster position.

References

Broselow, E. & Finer, D. (1991). Parameter setter in second language phonology and syntax. *Studies in Second Language Acquisition*, 7:1, 35-59.

Eckman, F. & Iverson, G. (1993). Sonority and markedness among onset clusters in the interlanguage of ESL learners. *Second Language Research* 9, 234-252.

Hancin-Bhatt, B. & Bhatt, R. (1998). Optimal L2 syllables. *Studies in Second Language Acquisition*, 19, 331-378.

Itô, J. & Mester, A. (1999). The phonological lexicon. In T. Fujimura (Ed.), *Handbook of Japanese Linguistics*. Oxford: Blackwell.

Prince, A. & Smolensky, P. (1993). Optimality Theory: Constraint interaction in generative grammar. To appear, MIT Press.