Gradient phonotactic grammars in bilingual speech perception

Many current grammatical theories characterize phonotactic knowledge via a set of numerically weighted, violable well-formedness constraints (Coetzee & Pater, 2008; Hayes & Wilson, 2008). The real-valued constraint weightings in such frameworks define a continuous grammatical hypothesis space. For example, given a constraint banning consonant clusters (*CC) and a constraint against epenthesis (DEP), grammars can differ in both their relative ranking (*CC, 10.0 > DEP 9.0) and numerical weightings (e.g., holding DEP 9.0, *CC can vary continuously: 10.0, 9.9, 9.8,...).

In this work, we examine the possibility that within this continuous space, speaker/hearers can dynamically shift the grammatical hypothesis they utilize to process phonological structures (e.g., temporarily decreasing the weight of *CC from 10.0 to 9.5). Bilinguals provide the ideal testing ground to examine this issue because they must shift between distinct grammatical systems depending on context. Studies of phonetic processing suggest that such shifts are not categorical switches from one language system to another. For example, native language phonetic properties can variably intrude on second language productions (Antoniou et al., 2011). Here we examine whether similar gradient shifting can occur for phonotactic constraints. Specifically, can the phonotactic grammar Spanish-English bilinguals use to interpret Spanish shift away from the weighting appropriate for Spanish, towards that appropriate for English—while Spanish continues to be the target language?

We investigated this issue by examining the influence of phonotactic constraints on speech perception. When listeners encounter suboptimal structures, such constraints (probabilistically) lead to misperceptions. For example, Spanish contains no words with initial #sCV sequences. Native Spanish speakers confronted with a spoken token of snob frequently report hearing esnob, even though the stimulus lacks the initial vowel, whereas speakers of languages that allow #sCV sequences (e.g., French) do not (Cuetos et al., 2011; Hallé et al., 2008; to appear). With a stochastic, constraint-based framework, these misperceptions can be attributed to markedness constraints (e.g., *#sC) dominating relevant faithfulness constraints (e.g., DEP), increasing the probability of prothetic forms vs. the faithful parse of the target.

To determine whether bilinguals can dynamically shift the grammar they utilize to interpret Spanish, we examined whether priming English (which allows #sCV) would cause them to shift that grammar towards English (lowering the rate of misperceptions). Spanish-English bilinguals completed a vowel detection task (Cuetos et al., 2011) in a Spanish experimental context. Half then performed an English picture-naming task before repeating the vowel detection task in Spanish; half performed the picture-naming in Spanish. A monolingual English control group was included for comparison.

The bilinguals exhibited higher rates of misperception than monolingual English speakers, but the rate of misperceptions was modulated by priming. English-dominant (but fluent in Spanish) bilinguals reported hearing /e/ less often after naming pictures in English, even though the vowel-detection task was again presented in Spanish. This suggests that bilinguals can gradiently alter the ranking and/or weights of phonotactic constraints online as conditions change. Here, English-dominant speakers shift the grammar utilized to interpret Spanish speech, decreasing the strength of markedness constraints that induce perceptual prosthesis.

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References


