Second-order phonotactic constraints based on speaker voice are learnable

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Previous work by Onishi, Chambers, & Fisher (2002) shows that listeners can learn second-order phonotactic constraints where consonant position is dependent on vowel identity (e.g. *tas* and *set* are words, but **tes* and **sat* are not words), during brief exposure. In the same paper, and using the same period of exposure, listeners failed to learn second-order constraints where consonant position is dependent on the speaker's identity, as indicated by his or her unique voice (e.g. speaker 1 has *tas* and *set* in his vocabulary; while speaker 2 has *tes* and *sat* but not **tas* or **set*).

However, there is good reason to think that listeners should be able to learn constraints dependent on speaker voice. Direct evidence comes from the fact that bilingual children can learn the phonotactic patterns of two languages represented by their two parents (Sebastián-Gallés & Bosch, 2005). Related evidence comes from studies of speaker voice priming, showing that priming effects decrease when speaker voice is changed from study to test (Sheffert, 1998), and that speaker voice is retained in long-term memory of words (Goldinger, 1996). This suggests that information about speaker voice is encoded in phonetic representations, associated with particular instances (or exemplars) of perceived words stored by the listener (Johnson, 1997), and as such should be available information for use in phonotactic constraint processing.

Our first experiment presented learners with CVC syllables using a continuous study-test design, following Chambers, Onishi, & Fisher (under review). Syllables were constructed from two sets of consonants, {b, k, m, t, f} and {p, g, n, ch, s}, combined with vowels {æ, ɪ, ɛ}. A male speaker had set 1 consonants as onsets and set 2 as codas, while a female speaker had the reverse. Subjects repeated each word as quickly as possible after hearing it. Illegal words (where Set 1 and 2 consonants appear in the "wrong" syllable position for that speaker) were introduced gradually, with the prediction that if the speaker-dependent phonotactic patterns are learned, the "illegal" words will be produced with longer reaction times. This prediction was not confirmed; reaction time data showed that novel illegal syllables were repeated just as quickly as novel legal syllables. This was true whether the stimuli were randomly arranged or blocked by speaker, and whether the subjects were told to look for phonotactic constraints beforehand ("tell" condition), or asked afterwards if they had noticed any constraints ("ask" condition). We hypothesized that one possible reason for failure is that in asking the subject to produce the target words—necessarily using a single voice (their own)— the distinction between the two sets of words produced by the two speakers would flatten into a single merged system, preventing subjects from differentiating the two phonotactic constraints.

Our second experiment tested the same type of phonotactic constraint using a different task. After hearing each word, subjects were asked to click "old" if they had heard the word before during the study phase, and "new" if they had not heard the word before. Subjects did not repeat the words out loud.. Under this paradigm, subjects responded significantly faster to novel legal items than novel illegal items, showing learning of the second-order phonotactic constraint.

Our findings show, contrary to prior research, that listeners can construct distinct mental representations of phonotactic constraints based on speaker voice, even during very brief exposure. Further research is underway to tease apart the factors that make this possible.