Investigating the motivations of sibilant harmony: coarticulation and speech errors

Avery Ozburn, University of British Columbia

Assimilation and harmony are typically thought to result from the phonologization of coarticulatory patterns (e.g. Ohala 1994, Blevins 2004; see also Garrett and Johnson 2013). Though generally not explicitly mentioned, non-adjacent consonant-consonant interactions, like consonant harmony (CH), may also be motivated by coarticulation. However, surprisingly few studies have investigated to what extent long-distance consonant-consonant coarticulation exists. Further, while other claims on the origins of CH focus on speech errors, most research on such errors (see Hansson 2010 for a summary) has focused on cases across words (e.g. '*[ʃ]ea [ʃ]ells*'), which is not the typical context of phonological CH. If coarticulation and errors do drive the phonologization of CH patterns, and in particular determine which patterns are possible cross-linguistically, then we would expect to find evidence of these factors even in languages without a harmony system. Specifically, if CH patterns are motivated by coarticulation or speech errors, then we expect harmonically contrasting sounds to be produced differently or mistaken more frequently in contexts where CH is typologically common compared to contexts where it is less common. Since sibilant harmony (SH) is the most common type of CH (Gafos 1999, Rose and Walker 2004, Hansson 2010), it offers an ideal way to examine these potential effects.

The present study addresses this question by examining the production of English [s] and [ʃ] in different contexts that are designed to test typologically common SH properties, such as its often regressive directionality and the fact that more similar segments are more likely to interact (Rose and Walker 2004, Hansson 2010). Native English speakers produced nonsense words of the form CaCa (initial stress), in which one of the consonants was one of the sibilants [s] and [ʃ], and the other was one of the following: highly similar sibilants [s] and [ʃ], less similar sibilants [z] and [tʃ], or non-sibilants [n] and [m]. Participants produced 7 randomized blocks with each word at a normal pace, followed by 3 randomized blocks of each word spoken as fast as possible. Using Praat (Boersma and Weenink 2015), sibilants were segmented and their spectral centres of gravity (COG) were measured for the middle 50%. These results were analyzed to determine the extent to which the COG values of [s] and [ʃ] differ depending on position in the word and identity of the other consonant.

Preliminary results from 7 native speakers of English show no evidence of acoustic sibilant coarticulation; the effect of context consonant on COG values of [s] and [ʃ] was not close to significant. This result casts substantial doubt on acoustic coarticulation as a motivation for SH. Further, even in fast speech, the vast majority of errors were the substitution of [s] for [ʃ] with the context consonant [tʃ]; participants frequently produced [satʃa] and [tʃasa] for 'shacha' and 'chasha' respectively. While this pattern is the opposite of a harmony tendency, it is expected from English lexical restrictions; analysis of the IPhOD corpus of English (Vaden et al. 2009) using the software Phonological CorpusTools (Hall et al. 2015), shows that before or after [tʃ] on a consonant tier, [s] is far more common than [ʃ]. This result suggests the possibility that, at least in certain cases, word-internal speech errors may be based on existing lexical restrictions, rather than a predisposition for errors that pattern like harmony.

Thus, results suggest that the mechanisms behind SH are more complex than previously believed: long-distance sibilant coarticulation, if it exists, is minimal and not significant, and the production errors here reflect pre-existing lexical restrictions. Overall, this study provides crucial new results for understanding the motivations behind SH. Specifically, it suggests that acoustic coarticulatory influences are less relevant than previously believed, and that we need to look deeper at the properties of speech, perhaps at articulation, to understand why harmony develops.

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