Differential Substitution: Phonetic distance in the perception of interdental fricatives

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This paper addresses the differential substitution of interdental fricatives ([θ,ð]) by learners of English as a second language. Differential substitution occurs when learners whose native language does not include [θ,ð], substitute either [t,d], [s,z], or [f,v], depending on the particular L1. The present work examines Japanese, Russian, European French, and Québec French. Japanese and European French are known to substitute [s,z] in place of [θ,ð], while for Québec French and Russian, [t,d] are reported (Hancin-Bhatt 1994 (Japanese), Berger 1951 (European French), Gatbonton 1978 (Québec French), Weinberger 1988 (Russian)). All these languages have /t d s z/ in their phonemic inventory; therefore, the challenge is to determine the source of differential substitution.

Previous approaches have focussed on structural differences within the contrastive (phonemic) systems of various L1s. Furthermore, while the relationship between perception and production has been investigated for Japanese (Hancin-Bhatt 1994) and Québec French (Trofimovich & John 2011), such research has, until now, been lacking for Russian and European French.

The hypotheses underlying the present research are: 1) language- and dialect-specific representations involving both contrastive (phonemic) and non-contrastive (phonetic) features play a role in segmental transfer -- in particular, the feature strident is hypothesized to be key in the choice of interdental substitute; 2) production errors are due to perceptual errors. To account for how second language learners perceptually map target sounds to their internal representations, the Phonetic Distance Model is presented and coupled with the Perceptual Assimilation Model (Best 1995). In addition, it is argued that feature enhancement (e.g. Stevens & Keyser 1989) renders certain features more salient to L2 learners, viz. in L1s where strident is enhanced on coronal fricatives, such as Québec French, [t,d] will replace [θ,ð]. On the other hand, in L1s with non-enhanced strident, the substitute will be [s,z]. Thus cross-linguistic phonetic variation and diversity in feature weight are what determines differential substitution.

These hypotheses are empirically verified in three studies. Two are perceptual: an AXB paradigm and a picture identification task. These studies were designed to test the hypothesis that differential substitution emerges in phonetic, but not phonemic processing. The third study is a word production task.

The results from these investigations largely support the predictions regarding choice of interdental substitute. Japanese and European French listeners tend to perceptually confuse [θ,ð] with [s,z]; whereas, the Québec French group is more likely to associate [θ,ð] with [t,d]. However, it is found that the Russian participants are more likely to merge [θ,ð] with [s,z] rather than with [t,d], both in perception and production. Furthermore, the [f,v] substitute is also prominent in perception. A comparison of the findings from the (phonetic) AXB test with those of the (phonemic) picture identification study leads to the conclusion that some non-contrastive features are specified at the phonemic level of representation for these learners. Also, findings are consistent with the idea that for Québec French strident is enhanced; whereas, in the other language groups investigated strident is a relatively weak feature. These results indicate that the Phonetic Distance and Perceptual Assimilation Models are helpful not only in explaining interdental substitution, but other types of segmental transfer as well.

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