CROSS-LINGUISTIC ASPECTS OF COARTICULATION: AN ACOUSTIC AND ELECTROPALATOGRAPHIC STUDY OF DENTAL AND RETROFLEX CONSONANTS

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ABSTRACT
In Hindi, Swedish and Tamil retroflexes show a more posterior articulation at the beginning of the closure than at the release. Also their exact place of closure is vowel-dependent, whereas that of dentals is constant. Locus equation parameters provide a clear basis for separating dentals from retroflexes at closure onset, but fail to support the idea that degree of vowel-consonant coarticulation varies with place, and/or is language-dependent.

MEASUREMENTS
The present data come from two speakers of Hindi, two speakers of Swedish and two speakers of Tamil. Electropalatographic and acoustic records were obtained from all of them. The Hindi and Tamil speakers were asked to produce isolated words of either [a'CV] or ['VCa] structure with V = /i/, /e/, /a/, /o/ or /u/. The Swedish utterances, prosodically similar to gul hatt, had symmetrical ['V:CV:] structure. The present findings are based on measurements for V = /i/, /e/, /a/, /o/ or /u/. The test words were read five to six times. Formant estimates were made from spectrograms and short-term spectra using the MIX software of R Carlson (KTH). For all samples, formant frequencies were measured in the first vowel 80 ms after the CV boundary. The EPG data were collected using the Reading system [1].

RESULTS
Figure 1 compares several aspects of the data. Average values are shown from a Swedish speaker (OE, left two columns) and for a Hindi speaker (RM, right two columns). For dentals the place of articulation is at the first row of EPG electrodes. There is no variation with vowel context. Nor is there a change from the VC to the CV condition. However, the retroflex data differs in that the exact place does indeed depend on the vowel front vowels having more anterior variants of retroflexion. Also there are marked differences between the VC and the CV samples: During the closure the place of contact slides forward so that the contrast between dental and retroflex is larger at the VC than at the CV boundary. The retroflex data for the other speakers exhibit similar patterns of vowel dependence and closure displacement. These findings confirm previous findings on Hindi [2].

A comparison of slopes and intercepts for locus equations fitted to the F2 data for each speaker individually reveals no
major differences between dentals and retroflexes. This is in agreement with the results reported by Sussman et al [3]. Since, theoretically, F2 ought to be associated mainly with the cavity behind the closure, this finding implies that dentals and retroflexes invoke similar coarticulation patterns with respect to underlying tongue body configurations. Consequently, a more posterior retroflexion does not necessarily presuppose a tongue body which is also more posterior. Sublaminal articulations are allegedly typical of Tamil retroflexes [4]. They involve the tongue underside more posterior. Sublaminal articulations presuppose a tongue body which is also more posterior articulation, variations in the slope and intercept of locus equations could be seen as variations in degree of coarticulation.

However the present investigation provides no basis for identifying significant differences in slopes and intercept values in the F2 of Swedish and Hindi laminal retroflexes and Tamil sublaminal retroflexes.

A partial summary of the locus equation results is presented in Figure 2: The diagrams pertain to F3 at the VC and at the CV boundary.

2. Do locus equation parameters provide invariant place correlates separating dentals and retroflexes in a vowel-independent manner [6]? The answer based on the present data is no with respect to F2, but yes in terms of F3 (Figures 1 and 2).

3. Is there evidence of a more restricted tongue body variation (less coarticulation) in retroflexes than in dentals? On the basis of considerations of articulatory synergy [7], it might be assumed that a more posterior retroflexion would create a preference for a tongue body which is also more posterior. Applying the reasoning of Krull [5], we conclude that, for the present analyses, degree of coarticulation does not seem to be less in retroflexes. This conclusion is based on the fact that the slopes and intercepts of F2 locus equations were found to be remarkably similar in comparisons of each speaker's dentals and retroflexes.

4. We were unable to identify reliable articulatory or acoustic evidence for the laminal variant of retroflexion supposedly characteristic of Hindi and Swedish as opposed to the sublaminal articulation of Tamil [4]. That may be due to the need for more fine-grained analyses than the ones undertaken so far.

REFERENCES

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Figure 2. Locus equation slopes and intercepts for F3 at the VC boundary (right) and CV boundary (left). Data for all speakers indicated by language name initial. Uppercase stands for retroflexes, lowercase for dental articulations.