Modularity and the Allophone in the Comox-Sliammon (Salish) Vowel System

Gloria Mellesmoen
University of British Columbia

Background: The theory of a modular feedforward phonology, first defined by Pierrehumbert (2002) and further described by Bermúdez-Otero (2007), is a generative model of phonology that proposes discrete levels: lexical, phonological, and phonetic. At the level of the phonology, rules act upon abstract and discrete phonological objects, such as features, and the output of this is then fed into the phonetic grammar, where phonetic implementation rules act upon the output of these phonological rules. One of the core assumptions of this framework is MODULARITY, which means "phonetic rules cannot refer directly to lexical representations" (Bermúdez-Otero 2007:502). Though this framework has been employed to describe the organization and changes within different dialects of English (Dinkin 2016; Dinkin & Dodsworth 2017), its predictions have yet to be tested with data from a language with a markedly different vowel system. The goals of this paper are twofold: (1) to provide a description of the sub-phonemic organization of vowels in Comox-Sliammon (ʔayʔaǰuθəm), and (2) to test whether a modular feedforward architecture of phonology can account for the described patterns.

Comox-Sliammon is a language spoken in British Columbia by the K'ómoks, Tla'amin, Klahoose, and Homalco communities. There are an estimated 47 L1 speakers as of 2018 (FPCC 2018). Impressionistic descriptions of the language include great amount overlap in acoustic space. Blake (2000) reports that [ɛ] may correspond to /i/, /a/, or /ə/, depending on environment. The proposed place features for the [ɛ] allophone are identical, despite originating from different phonemes. This makes a clear prediction under the assumption of modularity: the acoustic realizations of these [ɛ] allophones should be consistent across different underlying phonemes.

Methods and Feature Coding: F1 and F2 measurements were taken at seven points over the duration of a stressed vowel from 396 words produced by two fluent speakers of Comox-Sliammon. These included each of the four vowels (/i a ə u/) in three environments: adjacent to a uvular consonant, adjacent to a palatal consonant, and adjacent to consonants not predicted to substantially affect vowel quality in the language (Blake 2000). Given that the data came from a fieldwork setting, the sample size is small and less balanced. For this reason, a descriptive statistical analysis using confidence ellipses and intervals is presented instead of any statistical test. Only vowels predicted to overlap (/i a ə/) are described at present; /u/ is set aside.

I assume that palatal consonants are [-back], uvulars are [+low], and vowels are specified as in Table 1. Features may be spread to a vowel from adjacent consonant. Following Blake (2000:67), /ə/ is posited to be unspecified: it may take on features associated with an adjacent palatal or uvular, but no phonological features are proposed for /ə/ in a neutral environment. This is treated as underspecification in the phonetics, following Keating (1988:281), and /ə/ in this environment is considered to receive a phonetic target through interpolation.

Results: The data support that phonologically discrete allophones, rather than phonemes, map onto the acoustic space. There is considerable overlap between the phonemes at their midpoint, but discrete categories emerge when environment is coded by features (Figure 1). This is also supported by trajectories, which are better categorized by features than phoneme (Figure 2).

Discussion: The realization of vowels in Comox-Sliammon is consistent with the assumption of modularity in a modular feedforward architecture of phonology. The underlying vowels (input to the phonological grammar) are minimally specified and the phonological grammar motivates spreading of place features from adjacent consonants, which are then the output that the phonetic implementation rules may act upon. The acoustic overlap between different phonemes is not

evidence for a lack of discreteness, but instead evidence for modularity and discreteness at the level of the allophone. The distribution of vowels in Comox-Sliammon is consistent with the predictions of a modular feedforward architecture of phonology if the phonological grammar allows different phonemes to be mapped to the same discrete output (feature specification).

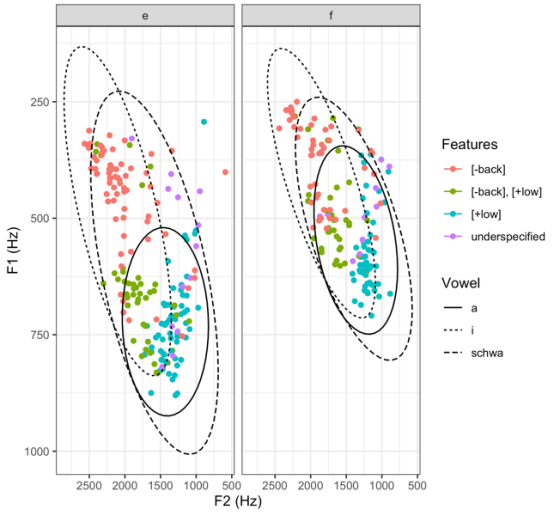

Figure 1. Midpoint F1 and F2 (Hz) measurements for each speaker (e and f), coloured by feature specification and ellipses showing where 95% of each vowel is predicted to occur.

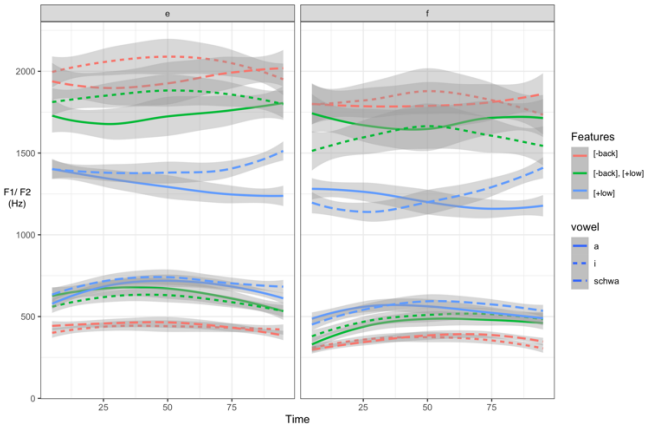

Figure 2. F1 and F2 (Hz) trajectories for each speaker, coloured by feature specification and line types mark underlying vowel.

	INPUT	ENVIRONMENT	OUTPUT
/a/	[+low]	Neutral, Uvular	[**+low**]
		Palatal	[**+low**], [*-back*]
/i/	[-back]	Neutral, Palatal	[**-back**]
		Uvular	[*+low*], [**-back**]
/ə/	∅	Neutral	∅
		Uvular	[*+low*]
		Palatal	[*-back*]

Table 1. Correspondences between phonemes and phonologically discrete allophones with bold text marking features present in the input and italics marking features acquired in the phonology.

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