

Vowel-specific metrics of phonological nasalization in French

Michael Dow (Université de Montréal)

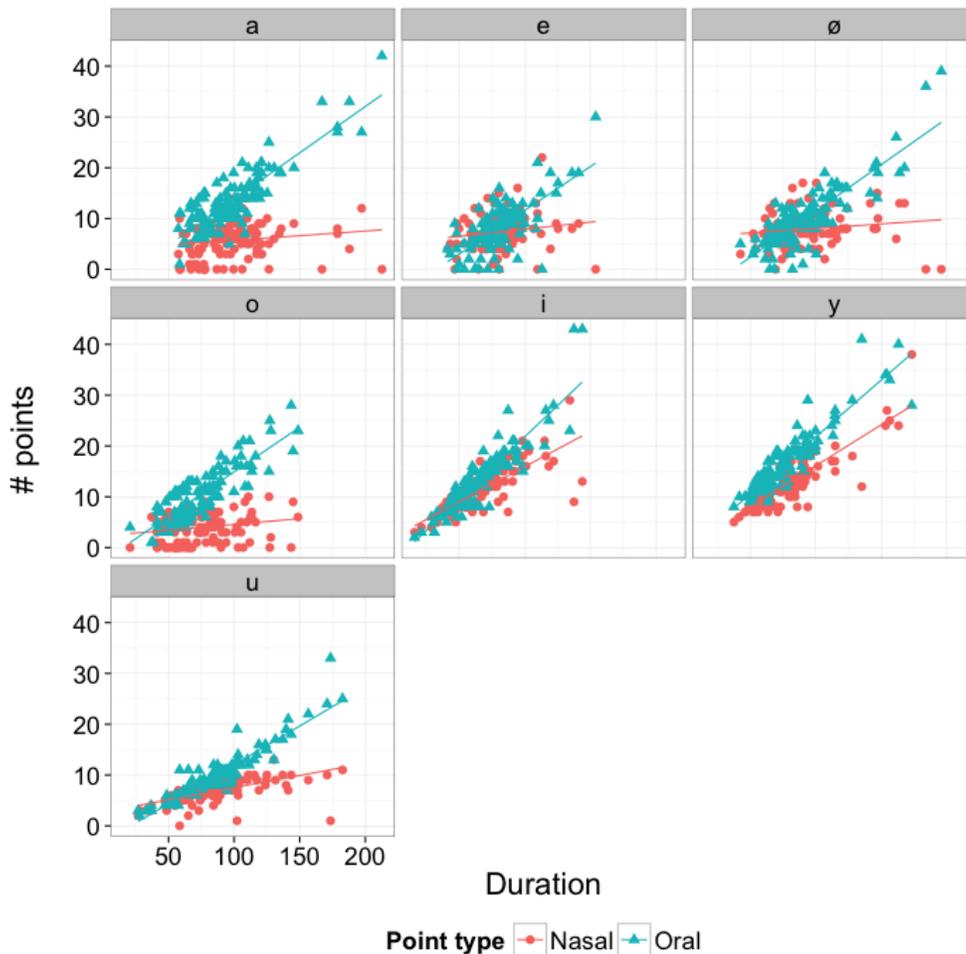
Despite various phonetic methods of quantifying nasality, establishing whether nasal coarticulation is phonological or merely mechanical from such data remains elusive because of vowel-specific interactions with nasality, typically height-based. Namely, percentages of nasality may be artificially inflated on inherently shorter vowels, and other phonetic factors may favour certain nasal vowels over others. Using instrumental acoustic data from European French, this paper pilots a measurement employing a vowel-specific threshold of nasality, as an expansion of Solé’s (1992, 2007) speech rate vs. nasality gauge of phonological function. In contrast with traditional accounts of French, this method finds evidence that regressive nasalization is in fact phonological in the language, but only on high front vowels (/i, y/). This finding is lost if all vowels are treated equally and severely weakened if duration is not taken into account.

Due to comparatively poor and slow control over the velum (Bell-Berti 1993), a certain period of gestural overlap in VN sequences is inevitable. However, given the correlation between vowel aperture and length (cf. Hajek & Maeda 2000), the same duration of nasal coarticulation may translate to exaggerated percentages on shorter vowel categories – typically high vowels. Meanwhile, phonetic factors such as inherent velic height (Bell-Berti 1976), intraoral pressure (Clarke & Mackiewicz-Krassowska 1977), oral and nasal (anti-)formant interactions (House & Stevens 1956) and perceptibility (Maeda 1982) suggest certain vowels are nasalized more easily and more quickly than others. Many of these factors conspire to favour high vowels. In sum, measurements treating all vowel types as equally nasal at a given percentage of nasality may be ill-suited for binary phonological distinctions, particularly for high vowels.

As French already exhibits height-dependent differences in nasalization in the phonetic literature (e.g., Delvaux et al. 2008) – high vowels often demonstrating the highest rates – this language was chosen as a testing ground. Using a nasometric corpus containing the vowels /a, e, ø, o, i, y, u/ in both oral and pre-nasal contexts (e.g., /fis/ vs. /fin/), the oral and nasal energy levels of 2,759 vowels were extracted at 5 msec steps. The mean and standard deviation of each vowel quality’s nasal energy in oral contexts were then calculated for each of the corpus’s 20 speakers; a vowel’s nasal threshold was then defined as mean nasal energy plus 1 standard deviation. The nasal phase of pre-nasal vowels was then defined as the set of points exceeding its oral congener’s threshold. Finally, the duration of that nasal phase was compared to that of its oral phase as a function of overall vowel duration. For instance, the nasal threshold of /i/ for a given speaker is defined as the mean nasal energy + 1*sd* of that vowel in oral contexts, and the degree of nasality of the vowel in words like /fin/ as the number of points exceeding that threshold.

Figure (1) plots the duration of oral vs. nasal phases along overall duration for each vowel in pre-nasal contexts. Nasal phase duration remains comparable only on high front vowels /i, y/, suggesting alignment of velic lowering with (a point of) the vowel itself and therefore an intentional process of nasalization (Solé 2007). Meanwhile, the nasal phase of all other vowels is quickly overtaken by oral phase duration at greater vowel lengths, suggesting alignment with the nasal consonant and thus accidental overlap of nasality. Taken with other phenomena in the language, these findings may point to a revised understanding of nasality in French phonology.

(1) Oral vs. nasalized phases, pre-nasal vowels



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