

## Speaker- & vowel-dependent anticipatory nasal coarticulation in Southern British English

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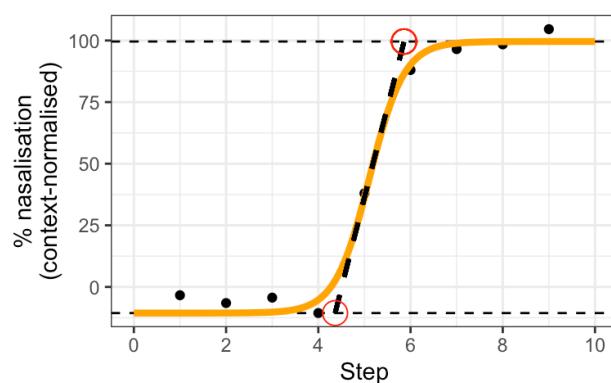
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The timing of anticipatory nasal coarticulation is known to exhibit language-specific differences [1], although the systemic factors underlying such cross-linguistic variation remain unsettled. Once proposed to be an influential factor, the role of (nasal–oral) phonological contrasts [2] has not been supported by cross-linguistic or cross-dialectal instrumental comparisons across languages [3, 4]. In English, much of previous work has focused on American English, for which anticipatory nasal coarticulation is temporally extensive (e.g., [5]) and argued to have undergone phonologisation [6], while other varieties remain understudied, leaving open the question of how and why nasal coarticulation develops in dialect-specific paths (cf. [3]).

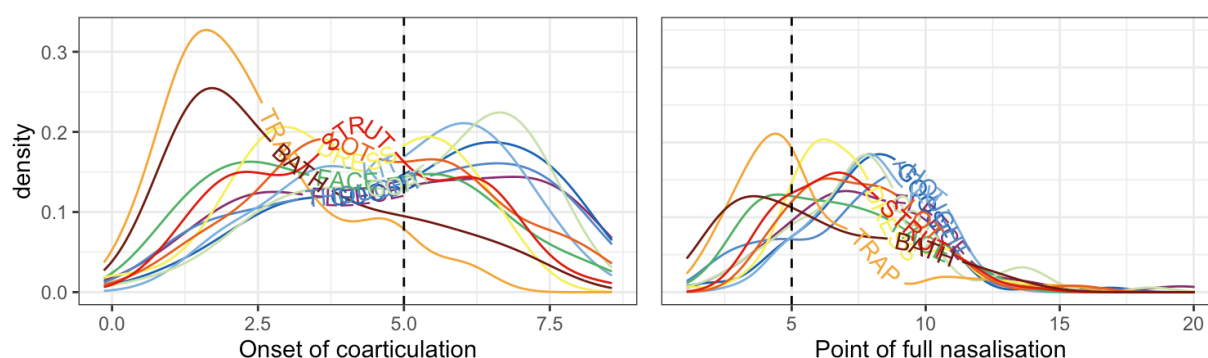
The current study investigates the dynamic characteristics of nasal coarticulation in British English, which is generally assumed to exhibit little anticipatory nasal coarticulation (e.g., [7]). Yet, qualitative descriptions in early literature present a mixed picture [8-10]. Empirical evidence that weighs on such claim thus far remains lacking, although a lower degree of vowel nasalisation in British English than in American English has been found in commercially available systems of neural text-to-speech synthesis [11]. The present study pays particular attention to the role of individual variation, as well-established individual-specific patterns in the production and perception of nasal coarticulation [12] are hypothesised to underpin the diachronic emergence of nasal vowels [13].

11 male speakers of Southern British English each completed two recording sessions, during which they completed an interactive reading task that elicited 176 monosyllabic target words, evenly distributed across 11 vowels in CVC, CVN, NVC and NVN contexts. Speakers were recorded using a handheld nasometer that recorded nasal and oral output on separate channels. The amplitudes of the nasal and oral channels were extracted at 11 equidistant points across the duration of each vowel, and the proportional nasal amplitude at each point was calculated to obtain the trajectory of nasalance. To characterise the temporal dynamics of coarticulation, the trajectory for each CVN token was normalised, using CVC and NVN tokens from the same speaker and vowel as ‘oral’ and ‘nasal’ (0% and 100% nasalised) benchmarks. The middle nine points of the normalised trajectory (i.e., excluding the points at each boundary of the vowel) were then modelled using a sigmoid curve [14]. The onset of coarticulation and the time when full nasalisation was reached were represented respectively by the points at which the tangent of maximum slope reached the minimum and maximum asymptotes (Figure 1).

Overall, the degree of nasalisation in CVN context was found to rise in a cline-like manner that is indicative of a phonetic, rather than phonological, process at work [15], but there is considerable variation across the vowels and individuals to suggest a more nuanced system of nasal coarticulation in Southern British English. The low vowels TRAP and BATH led in the display of a rise-plateau pattern, with early onset of coarticulation and full nasalisation reached by vowel midpoint, whereas other vowels displayed more diffuse distributions of such temporal landmarks (Figure 2). Most speakers displayed vowel-specific variation in their coarticulatory trajectories, but a small cluster of speakers were notably consistent in their use of exceptionally early or late onset of coarticulation. These results provide some support for the claim that there is relatively low anticipatory nasal coarticulation in British English, presenting evidence to reconcile contradictory descriptions in the literature, while highlighting the scope of structured variation within the variety. These findings further add to our understanding of how nasalisation operates over a wide range of vowels within the inventory of a language.



**Fig. 1.** Normalised trajectory of degree of nasalisation over 11 measurement points from /u:/ in *goon* with sigmoidal fit (orange), tangent of maximum slope (dashed solid), and derived onset of coarticulation and time when full nasalisation is reached (red circles).



**Fig. 2.** By-vowel distributions of onset of coarticulation (left) and point of reaching full nasalisation (right) in normalised time (0 = vowel onset; 10 = vowel offset). Vertical dashed lines indicate vowel midpoint.

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