

# Can you say [ṽ] or [x̃]? Aerodynamics of Nasalized Fricatives in Scots Gaelic

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## Introduction: Questions

- Nasalization together with oral frication (in the buccal cavity) may be aerodynamically impossible: if air can flow out through the nasal cavity, oral air pressure will be too low for air to flow out the oral constriction to create frication (Ohala 1975).
- Scots Gaelic is a language claimed to have nasalized fricatives (Terres 1973).
- There CAN be phonological nasal fricatives that are phonetically something else, and there can be [h̃], and nasalized glides.
- How are “mh” and others produced in Scots Gaelic?

## Methods

- Word list prepared in Tucson Arizona with a native speaker from Glendale, Skye.
- Oral and nasal airflow were recorded in Scotland from 14 native speakers of Scots Gaelic, ages 24-80, most from Skye.
- All speakers were monolingual in Gaelic until age 5-6 and use Gaelic regularly now, and are literate in Gaelic.
- Speakers read words with expected nasalized fricative phonemes and words with comparison non-nasal fricatives, up to 10/condition, for several conditions:
  - Underlying /ṽ/, /v/, word-medial and word-final (expected fricative realization):
    - talamh 'earth' [ṽ]
    - gheibh 'will get' [v]
  - Same, but may become approximants instead of fricatives:
    - comhairle 'advice' [ṽ/w̃]
    - cobhair 'relief' [w]
  - Fricatives nasalized by phonological derivation, word-initial (V#\_V):
    - glè phongail 'very sensible' [f̃]
    - ro phait 'too plentiful' [f]
  - Same, but approximants (some places of articulation):
    - a dhàn 'his poem' [j̃]
    - glè dhearg 'very red' [j]
  - Same, with glottal fricatives (spelled “sh, th”)
    - a sheòmar 'his room' [h̃]
    - glè shòlasach 'very happy' [h]
- Predictions: Nasalization for buccal true fricatives will either be neutralized or be realized on the preceding vowel. Nasalization may surface on the consonant for approximants or glottals.
- Measurements for the preceding vowel (V1), target consonant (C1), following vowel (V2), and following consonant (C2): time period of elevated nasal flow, proportion of segment with nasal flow, average and peak oral and nasal flow. Peak and average nasal flow largely confirm categorical measure of nasal flow, and too few tokens have nasalization for statistical analysis of continuous measures.

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## Results

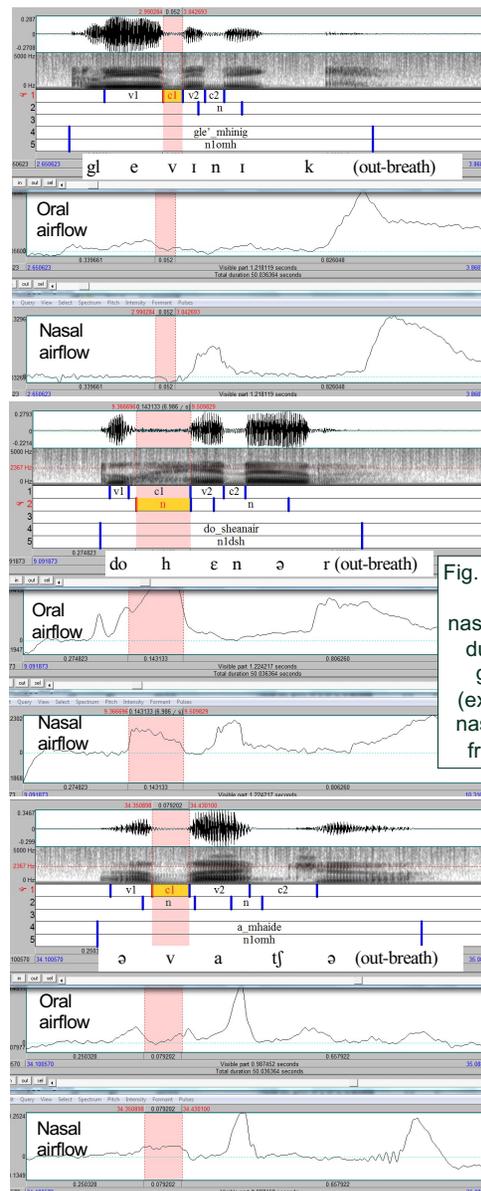


Fig. 1: Token showing the most typical outcome: No nasal airflow related to target (expected nasalized) consonant

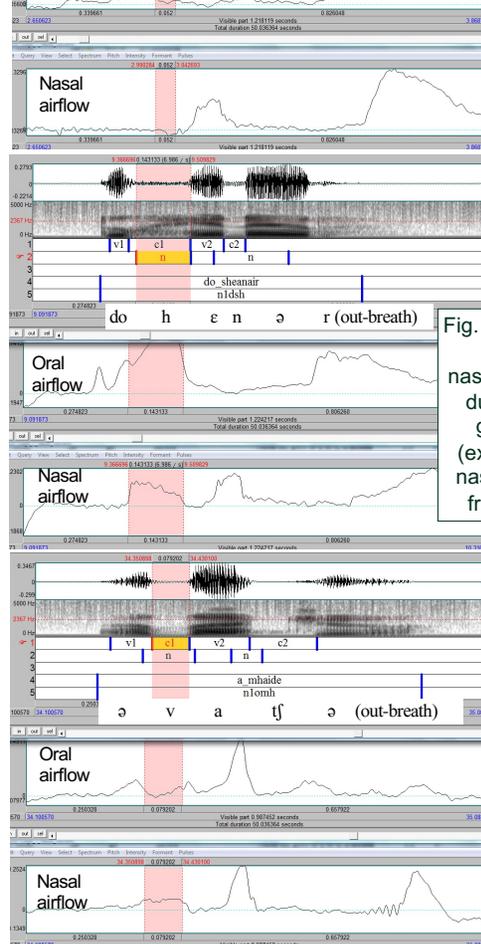


Fig. 2: Token with nasalization during a glottal (expected nasalized) fricative

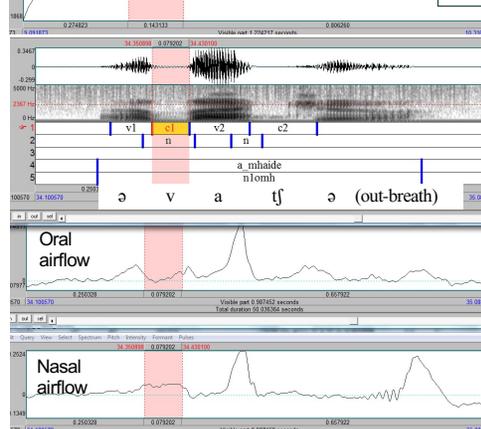


Fig. 3: Rare token with slight nasalization during a buccal fricative, but also very low oral flow (little frication)

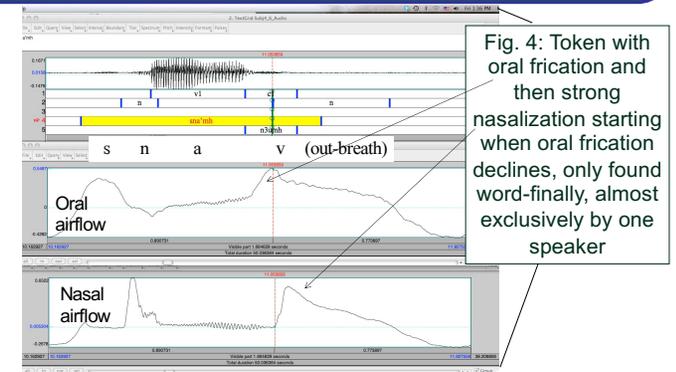


Fig. 4: Token with oral frication and then strong nasalization starting when oral frication declines, only found word-finally, almost exclusively by one speaker

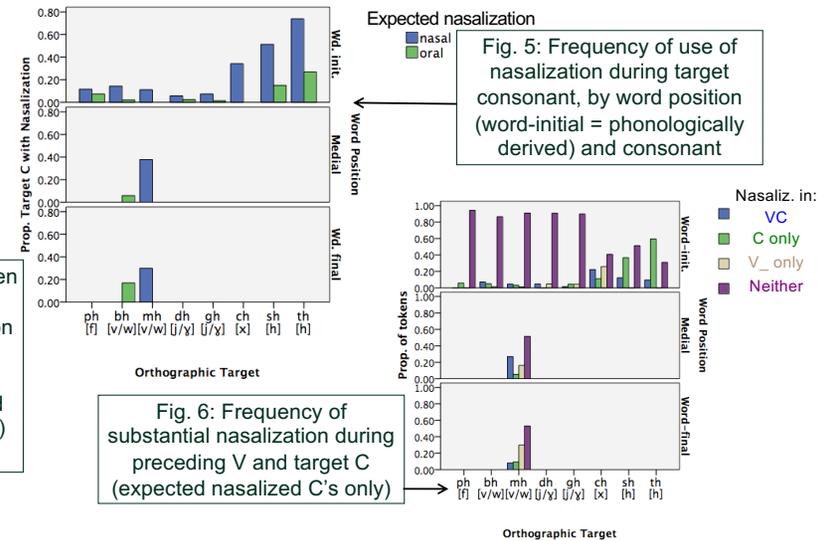


Fig. 6: Frequency of substantial nasalization during preceding V and target C (expected nasalized C's only)

## Discussion

- Buccal fricatives usually lose nasalization. Neutralizing the distinction is the most common outcome.
- Very rare tokens (<10 out of 1600+) may have slight nasalization together with some oral (buccal) frication.
- Nasalization is often maintained on glottal fricatives, where there is no aerodynamic conflict, but is neutralized on approximants, which also present no conflict. -> Phonological generalization.
- Perceptual evidence confirms that the distinction is marginal.
- A single language demonstrates several strategies for solving the aerodynamic conflict (nasalized preceding V, biphasic consonant, weak/lost nasalization or frication).