Vowel nasalisation in Scottish Gaelic:
The search for paradigm uniformity effects in fine-grained phonetic detail

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According to the modular feedforward architecture of grammar, the phonetics is sensitive only to the output of the phonology and is thus blind to morphological or lexical conditioning (Pierrehumbert 2002). However, this prediction is challenged by claims that fine-grained phonetic detail may display e.g. *paradigm uniformity* (PU) effects (Steriade 2000) or effects of usage factors such as lexical frequency (Bybee 2001). In the present study I search for potential phonetic PU effects in vowel nasalisation in Scottish Gaelic by investigating alternating items in which a nasalising environment is removed by a morpho(phono)logical process. A clear distinction is found between categorical phonological nasalisation, which displays overapplication in derived forms, and gradient phonetic nasalisation, which disappears completely when the triggering environment is removed. I present this as evidence for the modularity of the phonetics-phonology interface and the non-existence of phonetic PU effects.

Some putative instances of phonetic PU effects can be accounted for in a modular architecture by allowing prosodic structure to grant the phonetics indirect access to morphological structure. Thus, the subtly differing degrees of /l/-darkening and GOOSE-fronting found by Strycharczuk & Scobbie (2016) between simplex *hula* and complex *fool-ing* are compatible with an analysis in which *-ing* is adjoined directly to the prosodic word (cf. Bermúdez-Otero 2011: 2028). I argue that the search for phonetic PU effects must therefore be restricted to cases where a prosodic explanation is unavailable, and that Scottish Gaelic provides an ideal testing ground since it is rich in morpho(phono)logical processes that do not involve overt affixation.

In Scottish Gaelic, vowels normally display strong nasalisation after initial [m], e.g. *madainn* [mãtiɲ̟ʲ] 'morning', but some exceptional lexical items display far less nasalisation, e.g. *marag* [marak] 'pudding'. Under the *lenition* mutation, *radical* initial [m] alternates with *lenited* initial [v] under certain morphosyntactic conditions. In a nasal airflow study of one 62-year-old speaker from Ness, Isle of Lewis, I show that both radical *madainn* [mãtiɲ̟ʲ] and lenited *mhadainn* [vãtiɲ̟ʲ] display high levels of nasalisation throughout the vowel; radical *marag* [marak] displays some nasalisation early in the vowel; and lenited *mharag* [varak] displays no nasalisation at all (*see* Figs. 1 and 2). Bonferroni-corrected unpaired *t*-tests among these and other items, comparing nasal airflow both early and late in the vowel, paint a clear picture of two distinct types of nasalisation: a categorical phonological process of progressive [nasal] spreading that overapplies in lenited forms and may be subject to lexically conditioned blocking, and a gradient phonetic process of coarticulatory nasalisation that is bled by lenition and always applies after [m]. Crucially, *mharag* [varak] displays no trace of nasalisation in spite of the presence of gradient phonetic nasalisation in paradigmatically related *marag* [marak]. This is in line with the predictions of modular architectures, in which categorical phonology has direct access to morphological information but gradient phonetics does not.

Non-modular theories designed to account for phonetic PU effects include phonetic output-output (OO-)correspondence (Steriade 2000), in which OO-constraints penalise differences between paradigmatically related forms at the phonetic level, and Exemplar Theory, in which phonetic detail is stored in the lexicon and production of one form is influenced by simultaneous activation of paradigmatically related forms. While a negative result can in principle be handled by phonetic OO-correspondence using appropriate constraint rankings, it is more problematic for Exemplar Theoretic approaches in which phonetic PU effects emerge mechanically from exemplar dynamics. I conclude that my results are more compatible with a modular architecture in which phonetics has no direct access to morphological (or lexical) information and that wholesale dismissal of this empirically more restrictive framework is premature.

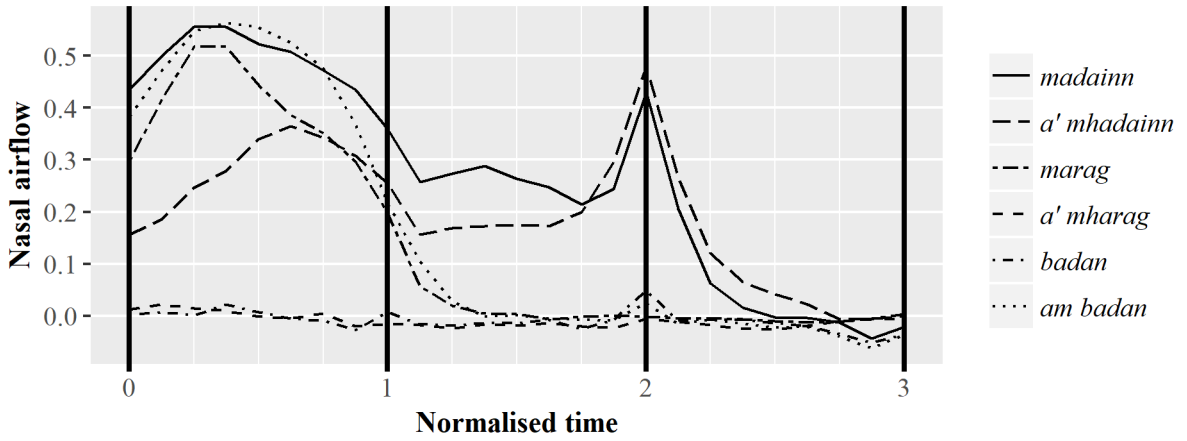

Fig. 1: Dynamic nasal airflow profiles for the underlined portions of madainn [mãtiɲʲ] *'morning',* a' mhadainn [ə vãtiɲʲ] *'the morning',* marag [marak] *'pudding',* a' mharag [ə varak] *'the pudding',* badan [patan] *'thicket' and* am badan [ə matan] (< /əm patan/) *'the thicket'. The* x*-axis represents normalised time, where 0-1 is the duration of the initial consonant, 1-2 is the duration of the vowel, and 2-3 is the duration of the following consonant.*

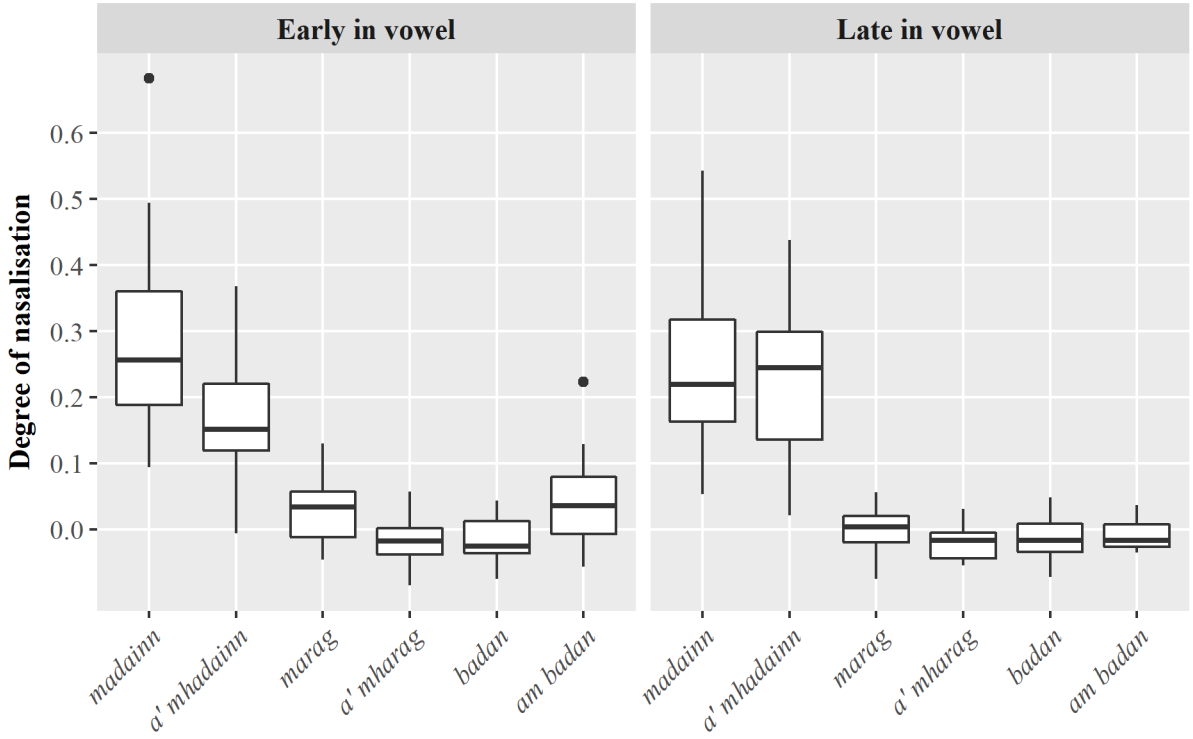

Fig 2: Degree of nasalisation early in the vowel and late in the vowel for the items in Fig. 1.

References: Bermúdez-Otero, R. 2011. Cyclicity. In M. van Oostendorp, C. J. Ewen, E. Hume & K. Rice (eds.), *The Blackwell Companion to Phonology*, 2019-48. Oxford: Blackwell. · Bybee, J. 2001. *Phonology and Language Use*. Cambridge: CUP. · Pierrehumbert, J. B. 2002. Word-specific phonetics. In C. Gussenhoven & N. Warner (eds.), *Laboratory Phonology* 7, 101-39. Berlin: M de G. · Steriade, D. 2000. Paradigm uniformity and the phonetics-phonology boundary. In M. B. Broe & J. B. Pierrehumbert (eds.), *Papers In Laboratory Phonology* V, 313-34. Cambridge: CUP. · Strycharczuk, P. & J. M. Scobbie. 2016. Gradual or abrupt? The phonetic path to morphologisation. *Journal of Phonetics* 59, 76-91.