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 pho-
netic 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 morphophonologival process. A clear dis-
tinction 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 pho-
etics-phonology interface and the non-existence of phonetic PU effects.

Some putative instances of phonetic PU effects can be accounted for in a modular archi-
tecture 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 Śry-
charchzuk & 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(phonologival) processes that do not involve overt affixation.

In Scottish Gaelic, vowels normally display strong nasalisation after initial [m], e.g. *madainn* [mâtip̃] ‘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* [mâtip̃] and lenited
*mhadainn* [vâtip̃] 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 block-
ing, 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 [māt̪iŋ] 'morning', a’ mhadainn [ə vət̪iŋ] 'the morning', marag [marak] 'pudding', a’ mharag [ə varak] 'the pudding', badan [pataŋ] 'thicket' and am badan [ə matan] (< /əm pataŋ/) '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.