Biases in phonology: explaining variation in Scottish Gaelic preaspiration

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Through factorial typology, Optimality Theory predicts a range of theoretically possible grammars. However, factorial typology can result in overgeneration, e.g. by predicting unattested epenthetic repairs to *NC̥ (Pater 1999). There are two conflicting solutions. Some scholars assert that typology is due to *analytic bias*--innate cognitive factors--and thus that theory should be constrained to allow a tighter fit with typology, e.g. via the *P-map* (Steriade 2002). Other scholars argue instead that typology is best attributed to *channel bias:* some constraint rankings are unattested because the relevant *phonetic precursors* do not occur (Ohala 2005, Barnes 2002). Further, if a diachronic explanation for typology is available, to constrain theory is redundant and undesirable (Myers 2002). This paper supports the second view, drawing evidence from asymmetries in the typology of Scottish Gaelic (SG) preaspirated voiceless stops.

The historically preaspirated stops of early SG have undergone processes of *deaspiration* and *fortition* in the modern dialects, and now show at least six configurations:
1. [hp ht hk] 2. [p ht hk] 3. [p t xk] 4. [hp ht xk] 5. [hp xt xk] 6. [xp xt xk]
Deaspiration, or loss of preaspiration, preferentially targets labial stops (dialects 2, 3); fortition, or substitution of the voiceless velar fricative [x] for the glottal [h], preferentially targets velar stops (dialects 3-6). A naive analysis of deaspiration and fortition as repairs to *[hT] (a set of place-specific constraints against preaspiration) results in significant overgeneration; for instance, by ranking *[hk] above MAX instead of *[hp], deaspiration can be made to favor velar instead of bilabial stops.

A production experiment has identified robust phonetic precursors to both asymmetries. Eight native SG speakers were recorded reading a list of Gaelic words designed to elicit preaspiration in a range of phonological contexts. Analysis revealed two phonetic asymmetries mirroring the phonological asymmetries. First, there were sharp differences in the duration of the preaspiration cue: shortest before bilabial stops, longest before velars. Second, several speakers frequently omitted preaspiration cues altogether: most frequently before labial stops, least frequently before dorsals. Thus, articulatory factors can account for the typological asymmetries without recourse to theoretical formalizations such as the P-map.

By contrast, in order for the P-map analysis to resolve the overgeneralization problem, the projection and fixed ranking of faith constraints must be based on perceptual similarities between target and surface forms. This implies two perceptual scales, expressing (A) that the perceptual difference between [h] and [x] is greatest before [p], least before [k], and (B) that the difference between [h] and nil is greatest before [k], and least before [p]:

A. ID[h-x]/V_ p » ID[h-x]/V_t » ID[h-x]/V_k
B. MAX[h-Ø]/V_ k » MAX[h-Ø]/V_t » MAX[h-Ø]/V_p

Attested configurations like [p ht hk] would be permitted by these scales, but unattested ones like [hp ht k] are prohibited.

However, both (A) and (B) remain hypothetical. If they cannot be empirically confirmed, the P-map account fails altogether. If these scales can be confirmed, then the P-map account of asymmetries in SG preaspiration mirrors facts already emergent in the phonetics. Thus, the argument that the P-map and similar extensions to standard OT amount to recapitulations of phonetic facts has considerable merit.