Inter-Morpheme Asymmetry in Vowel Informativity is a Path to Mutation

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Vowel Quality Mutation (VQM) is defined here as stem vowel quality alternation that has its diachronic origin in anticipatory coarticulation with the vowels of former inflectional suffixes, e.g. English *fu**ll*** ~ *fi**ll*** < *f**u**ll-**a**z ~ *f**u**ll-**j**anã [1], Agar Dinka [r**ɪ́**m] ~ [rj**ɛ́**ɛm], *blood*.PL ~ SG, *cf.* Surkum [r**ím**] ~ [r**ím**-**á̱**t̪] [2]. In early Germanic and Dinka-Nuer (Western Nilotic), VQM is pervasive throughout the vowel system and in nearly all areas of grammatical exponence, as illustrated by the examples from Old Icelandic and Nuer in the table below.

Old Icelandic [1, 3]				**Nuer** [4-6]			
Base		***i*-mutation**		**Base**		***a*-mutation**	
bj**ō**ð-a	~	b**ȳ**ð-r	*bid*.INF ~ 3SG.IND	p**ɑ̱̄ʌ̱ʌ̱**t-ɪ̱́	~	p**ä̱a̱a̱**t-á̱	*clap*.MUL.2SG ~ 1SG
f**u**ll-r	~	f**y**ll-a	*full*.M.NOM.SG ~ *fill*	t**ɛ́ɛɛ**t-ɪ̱́	~	t**ɛ́aaa**t-á̱	*claim back*.2SG ~ 1SG
f**a**ll-i	~	f**e**ll-r	*fall*.3SG.SBJV ~ IND	k**ɪ́ɪ**t-ɪ̱́	~	k**ɪ́ɛɛ**t-á̱	*start singing*.2SG ~ 1SG
f**ja**rð-ar	~	f**i**rð-i	*firth*.SG.GEN ~ DAT	k**ɔ̰̀**h	~	k**ɔ̰́a̱**h	*hole*.SG.LOC ~ GEN
f**ō**t-r	~	f**ø̄**t-r	*foot*.NOM.SG ~ PL	t**ɪ̱́**t	~	t**ɪ́e̱**t	*sorcerer*.NOM.PL ~ SG
d**au**ð-r	~	d**ey**ð-a	*death*.NOM.SG ~ *kill*	t**ʊ́ʊ̱ʊ̱**t	~	t**ʊ̀ɔ̰**t	*bull*.SG.NOM ~ GEN/LOC

These languages exhibit several typologically rare properties through VQM relative to their antecedent concatenative systems: nonlinear fusion type [7], a cross-linguistically high number of contrastive vowel quality classes [8], and polyexponence [9] of both lexical and grammatical categories through stem vowel quality (see *full* and *fall* in Old Icelandic, *sorcerer* and *bull* in Nuer). The diachronic shift away from a more common monoexpoenential concatenative system is not explained by appealing to the fundamental components of VQM's diachronic development: vowel-to-vowel coarticulation and the erosion of affixal material are both extremely common (if not universal) phenomena, and could therefore affect any concatenative system in which contrastive vowel quality classes obtain in suffixes. In this paper it is argued that the emergence of VQM can be best understood in an evolutionary framework, where coarticulatory variation becomes exapted for information transmission through language-specific selective pressures.

Previous work has identified a strong association between the inferability of a linguistic unit in the speech stream and its degree of signal autonomy, such that less inferable units are encoded in the signal with greater phonetic specificity and vice versa [10-13], which in turn has been proposed to play a role in long-term phonological change [14-16]. Likewise, it has been demonstrated that coarticulatory variation relates to the inferability of both target and trigger, such that the magnitude of the trigger's coarticulatory influence is greatest when the target has high inferability (low informativity) and the trigger has low inferability (high informativity) [12]. Evidence is presented for such an asymmetry in the informativity of VQ between stems ($\mathbf{V_1}$) and inflectional suffixes ($\mathbf{V_2}$) in early stages of Germanic and Western Nilotic.

This analysis is supported by results from an agent-based simulation designed to model how informativity shapes phonological structure over iterated communicative interaction. The model allows adaptive agents to exchange phonetically detailed signals of words comprising two ordered trajectories in F1xF2 space ($\mathbf{V_1}$-$\mathbf{V_2}$), and the informativity of $\mathbf{V_1}$Q and $\mathbf{V_2}$Q can be manipulated independently across trials. Covariance between the two vowels in the form of V-to-V coarticulation is introduced during each iteration, as well as a small number of $\mathbf{V_2}$-less productions. VQM (e.g. $\mathbf{e}_1$-$\mathbf{i}_2$ ~ $\mathbf{e}_1$-$\mathbf{a}_2$ → $\mathbf{e}_1$-$Ø_2$ ~ $\mathbf{ɛ}_1$-$Ø_2$) emerges only during trials in which the informativity of $\mathbf{V_1}$Q is low, but high for $\mathbf{V_2}$Q. Other permutations of model parameters result either in stability of the original concatenative system, or loss of $\mathbf{V_2}$ without concomitant bifurcation of $\mathbf{V_1}$Q (i.e. $\mathbf{e}_1$-$\mathbf{i}_2$ ~ $\mathbf{e}_1$-$\mathbf{a}_2$ → $\mathbf{e}_1$-$Ø_2$ ~ $\mathbf{e}_1$-$Ø_2$).

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