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Phonetic explanations for recurrent sound patterns: Diachronic or Synchronic?

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1. Sources of similarity. Phonology is the study of sound patterns of the world's languages. In all spoken languages, we find sound patterns characterizing the composition of words and phrases. These patterns include overall properties of contrastive sound inventories (e.g. vowel inventories, consonant inventories, tone inventories), as well as patterns determining the distribution of sounds or features of sounds (stress, tone, length, voicing, place of articulation, etc.), and their variable realization in different contexts (alternations).

Of great interest in phonology is the study of *recurrent* sound patterns. These are patterns which recur with greater than chance frequency across the world's languages. Recurrent sound patterns are found with respect to sound inventories, the distribution of segments and features, and alternations in sound patterns which may characterize related words. A short list of recurrent sound patterns is listed in (1).

(1) Some recurrent sound patterns

Inventories

i. All spoken languages have consonants and vowels.
ii. Most languages with only three vowels have the vowels /i, u, a/
iii. No language has more than six level tones.

Distribution

iv. All spoken languages have CV sequences (C a consonant, V a vowel).
v. In many languages with a voicing contrast, this contrast is not found word-finally.
vi. There are no languages with contrastive vowel length and a stress rule: stress the last/first *short* vowel in the word; if no short vowels stress the first/last vowel.

Alternations

vii. In many languages /s/ is pronounced as [ʃ] when adjacent to /i/.
viii. In many languages voiced stops are regularly devoiced word-finally.
ix. There are no languages where voiceless stops are regularly voiced word-finally.

Many phonologists and phoneticians agree that the majority of recurrent sound patterns in the world's languages have sound phonetic explanations grounded in aspects of speech articulation and perception. However, there is some disagreement as to where phonetic explanations belong. One extreme position is that recurrent sound patterns are the consequence of recurrent phonetically natural types of sound change is that of Evolutionary Phonology where phonetic explanations are aspects of diachronic modeling of sound change, and can be excised altogether from synchronic grammars (Blevins, to appear).[1] Another position is that phonetic markedness constraints encoding phonetic knowledge of articulatory and perceptual ease are active components of synchronic phonologies (Hayes and Steriade, to appear: Steriade this volume).[2] Before assessing the arguments for these diverse positions, a general overview of potential sources of similarity will be useful.

Within biological systems, there are at least five distinct sources for observed similarities, as listed in (2). A biological characteristic, like hair or eye color, may be due to direct genetic inheritance. Another source for similarities however is parallel evolution. In the history of the lizard family, toepads have evolved independently at least three times, in *Iguanidae, Scincidae,* and *Gekkonidae.* In each case, the evolution of toepads correlates with shift to arboreal habitats, and supports the view of toepads as an adaptive feature (Larsen and Losos 1996). Another potential source for shared characteristics are physical constraints on form. For example, there are recurrent similarities in patterns of spots and stripes on cats and seashells which stem from biochemical processes which occur in the course of development (Stewart 1998). Similar characteristics may also be only superficially similar, arising from distinct developments, with distinct functions and structures. A well studied example of this in the biological world involves the eyes of vertebrates and the eyes of cephalopods. A final category in (2e) are non-natural factors that result from human manipulation of biological organisms: these include older methods of grafting and hybridization, as well as new forms of genetic modification.

(2) Sources of similarity for biological characteristics

a. Direct genetic inheritance
    e.g. shared genetic traits of identical twins
b. Parallel evolution
    e.g. lizard toepads in *Iguanidae, Scincidae*, and *Gekkonidae*
c. Physical constraints on form/function
    e.g. patterns of spots and stripes on cats and seashells
d. Chance
    i. (pure) e.g. white coat of arctic hare and albino rabbit
    ii. (adaptive = 'convergent evolution') e.g. eyes of vertebrates, eyes of cephalopods
e. Non-natural factors
    e.g. grafting, hybridization, genetic modification

A parallel set of sources of similarity can be identified for sound patterns, as shown in (3).

(3) Sources of similarity for linguistic characteristics

a. Direct genetic inheritance (within language families)
    e.g. shared features of English and German inherited from Proto-Germanic

b. Parallel evolution
    e.g. final devoicing in Slavic, Germanic, Romance (Indo-European), and Indonesian and Javanese (Austronesian)

c. Physical constraints on form/function
    e.g. similar categories boundaries across languages due to categorical perception

d. Chance (since we can rule out all of above)
    e.g. in Japanese and Gilbertese, the only possible word-final consonants are nasals

e. 'Non-natural' factors
    e.g. spread of clicks from Khoisan to Bantu languages via contact
    e.g. language transfer, e.g. Yurok as spoken by second-language learners

For example, the existence of closed syllables and complex onsets and codas in both English and German can, in many cases, be seen as features inherited from Proto-Germanic. However, final-devoicing is not a feature inherited from Proto-Germanic. The neutralization of voiced and voiceless obstruents to the voiceless series in word-final position is a sound change that has occurred in many different language families, and constitutes a well studied instance of parallel evolution in the world of sounds. Recurrent features of language may also be a consequence of physical constraints on human development, speech perception, or speech production. For example, the fact that the distinctive sounds of spoken languages can be analysed in terms of a small set of distinctive features with similar phonetic ranges may relate to the fact that humans are born with categorical perception for a wide range of speech sounds. And, as with biological traits, linguistic similarities may be a consequence of chance convergence. In both Japanese and Gilbertese, two unrelated languages, the only consonants which can end words are nasals. In earlier stages of both languages, all syllables were open. However, the evolution of word-final nasals in Japanese was due to contact with Chinese, while in Gilbertese, final nasals result from a regular sound change involving loss of word-final voiceless high vowels. Linguistic parallels to grafting, hybridization, and genetic modification include change through direct language contact, language mixing, and second language learning. Note that the only category in (3) which requires reference to the architecture of grammar is (3c).

2. Phonetic explanation. Having reviewed these general sources of similarity, let us return to the two different positions regarding phonetic explanation noted earlier. Within Evolutionary Phonology (Blevins, to appear), the majority of recurrent sound patterns are attributed to parallel evolution (3b). Common phonetically based sound changes give rise to recurrent sound patterns, and phonetic explanation is attributed to diachronic processes, with phonetically-based markedness principles excised from synchronic grammars. Within other approaches, like that argued for in Hayes and Steriade (to appear), and Steriade (this volume), phonetic markedness constraints are active components of synchronic grammars.

Before looking at empirical arguments for each position, let us review a general point concerning the architecture of grammar. If historical explanations from direct genetic inheritance, parallel evolution, or convergent evolution, can be shown to account for sound patterns within one language, a group of related languages, or (in the case of parallel evolution), a group of unrelated languages, then there is no explanatory role for synchronic rules or constraints enforcing the same sound patterns. The same general principle can be stated in terms of a simplicity metric. All else being simpler grammatical models are preferred to more complex ones. A model which duplicates explanation within or across domains is in some basic sense more complex than one which does not. Therefore, if we can demonstrate that principled diachronic explanations exist for particular sound patterns, and that diachronic explanations are needed in any case, considerations of simplicity dictate that explanations for the same sound patterns should not be duplicated in synchronic accounts.

This general point features prominently in Evolutionary Phonology (Blevins, to appear), where principled diachronic explanations for sound patterns replace, rather than complement, synchronic explanations, unless independent evidence demonstrates, beyond reasonable doubt, that a separate synchronic explanation is warranted. Within phonetic markedness accounts, however, there appears to be duplication of phonetic explanations across the diachronic and synchronic domains. Hayes and Steriade (to appear:41) believe there is clear empirical support for the view that “diachrony helps explain some aspects of phonological naturalness”. Nevertheless, they attempt to justify their position that phonetic markedness constraints are active components of synchronic phonologies with three brief arguments. In the remainder of this section, I evaluate these three arguments, and show that data from all three domains is consistent with the view that the domain of phonetic explanation in phonology is diachronic, not synchronic.

The first argument presented by Hayes and Steriade (to appear:41) is that child phonology shows “many phonological phenomena that could not originate as innocent misapprehensions.” In fact, this view is not contested by proponents of historical phonetic explanations. A wealth of data illustrates that the majority of recurrent features of child phonology (e.g. CV syllable stage, cluster reduction stage, consonant harmony, sibilants produced as stops, etc.) are reflections of articulatory developmental stages, reflecting developmental constraints on performance, not on language competence (see, e.g. Locke 1983 and Vihman 1996). Three strong arguments for these recurrent stages as performance effects independent of grammar are: (i) the fact that they are distinct from common phonetically motivated sound changes and recurrent sound patterns; (ii) the use of multiple strategies for avoidance of sounds a child has not yet mastered (e.g. consonant harmony, [l] pronounced as [y], and lexical avoidance, all in words which have /l/-sounds); and (iii) the use of context dependent local strategies in the course of segment acquisition which are also performance based (Berg, 1995).

An additional problem with the use of child language data is that, at least within the tripartite typology of sound change detailed in Blevins (to appear), sound change at the level of the individual will not necessarily be audible or measurable from the outset in children’s speech. Ambiguities inherent in long-domain features or sets of phonetic variants may results in phonological reanalysis, but this reanalysis may have no immediate consequence for phonetic output. Take, for example, the case of laryngeal metathesis, where the inherent ambiguity of a long-domain feature can result in phonological reanalysis. A speaker says, [ʔa̲ʔ] for /aʔ/, a listener hears [ʔa̲ʔ], and represents this as /ʔa/ phonologically. This language learner may continue to pronounce [ʔa̲ʔ], with a covert sound change taking place.

The second objection raised is the doubt that 'innocent misapprehension is capable of driving systematic phonological change' (Steriade 2001:232-33; Hayes and Steriade to appear:42). The particular example mentioned is regressive nasal place assimilation. Place assimilation of a nasal stop to a following oral stop is a common sound change, and also reflected by alternations in many of the world's languages. Perception studies, including Fujimura et al. (1978) and Ohala (1990) *do* show a match between misapprehension and sound change, with CV transition as opposed to VC transition dominating the percept, giving rise to a single homorganic interpretation of place for a medial heterorganic sequence. In the Fujimura experiment, homorganicity correlated with duration of consonantal interlude, while in Ohala's Experiment 1, non-homorganic sequences like [VŋpV], [VnpV] were judged as homorganic 93% of the time. Where, then, is the mismatch between experimental results and attested sound change?

Steriade (2001) cites the results of Hura et al. (1992). In this experiment, where heterorganic VNCV sequences were presented to English speakers (N = [m, n, ŋ] and C = [p, t, k]), nasals showed an error rate of 6.9%, significantly higher than the 3% error rate for fricatives in the same position. The result of interest to Steriade, however, was that most errors were *non-assimilatory*. For example, 76.1% of all incorrect nasal responses were /n/. If listeners had been responding based on the place of articulation of the following stop, responses would be balanced among the three distinct places of articulation. Steriade takes these results as rejection of the general hypothesis that regressive nasal-place assimilation has a perceptual basis, concluding that misperception of nasal place in VNCV may have a perceptual origin, but that assimilation in this context is the consequence of optimizing assimilation which characterizes synchronic grammars.

Steriade's interpretation is surprising, since the authors themselves advise against this conclusion:

> …it would be a mistake to reject Ohala's hypothesis [of perceptually based assimilation; JB] on the basis of our results, because the VC_1C_2V intervals used in our experiment appear to have been longer than the duration at which perceptual assimilation errors typically occur (Repp, 1978; Ohala 1990). In other words, our experiment was not designed to provide a clear test of Ohala's hypothesis.

Not only were intervocalic consonantal intervals long in this study, but the stimulae were made from a set of nonsense names, with N##C sequences spanning the end of the first name, and the beginning of the last name. In the case of final nasals, the first names were *Shanim*, *Shanin*, and *Shaning*, while the last names were *Perry*, *Terry*, and *Kerry*. The fact that 76.1% of errors in perception of nasals involved hearing *Shanim* or *Shaning* as *Shanin* [ʃɑnɪn] may be due, not to the default status of /n/ generally, but to very specific facts about the English lexicon, e.g. the existence of names like *Shannon* and *Sharon*, in the same general phonological neighbourhood as the ambiguous tokens.

As with the first argument, Steriade's objection also involves a simplification of the actual assumed mechanisms of change. Certain sound changes, like * θ > f , are arguably primarily perceptual, with no obvious role for articulation. But in the case of other well studied changes like vocalization and elision of dark /l/ (Recasens, 1996) , **p* > *f* > *h* changes (Foulkes 1997), and velar palatalization (Guion 1998, Chang et al. 2001), perception is demonstrated as just one component of a historical change which also involves significant articulatory weakening (in the first two cases) and/or coarticulation (in the last two).

Steriade's final argument for the integration of phonetic explanations into synchronic grammars comes from the study of stop-sibilant metatheses (Steriade 2001, Hayes and Steriade, to appear). The general structure of the argument is as follows. Metathesis between sibilants and stops can arise through listener error. Confusability, is, in principle, symmetric. Therefore, if asymmetries in observed patterns of sibilant/stop metathesis exist, they suggest that optimization is at work. The fallacy in this argument should be immediately apparent, given the discussion of nasal-place assimilation above. Confusability is not, in principle, symmetric. The fact that cues in CV transitions dominate those in VC transitions where consonantal intervals are relatively short, shows that perception can give rise to inherent asymmetries in sound patterns. In this particular case, the asymmetry is the strong tendency for major place assimilation in VNCV to be regressive, rather than progressive. The opposite asymmetry hold for retroflex coronal assimilation, since cues for this contrast are strongest in VC transitions (Steriade 2001). In principle, then, it is possible that the claimed asymmetries in stop/sibilant metathesis have perceptual explanations as well.

Another potential account of asymmetries in metathesis is related to dominant ambient patterns of the language being acquired. Blevins (to appear) argues that Structural Analogy (4) plays a role in sound change.[3] Sound changes, like sibilant/stop metathesis, with sources in perceptual ambiguity have higher frequencies when their output is pre-existing as an unambiguous sound pattern in the language at large.

(4) Structural Analogy

> In the course of language acquisition, the existence of a (non-ambiguous) phonological contrast between A and B will result in more instances of sound change involving shifts of ambiguous elements to A or B than if no contrast between A and B existed.

Empirical support for structure-preserving sound change is found in cross-linguistic studies of compensatory lengthening (de Chene & Anderson 1979, Kavitskaya 2002), metathesis (Blevins & Garrett 1998, Hume to appear), and syncope (Blevins and Blust, 2003). In compensatory lengthening, reinterpretation of vowels of intermediate length as long is much more likely when a length contrast is pre-existing. Ambiguity of long-domain features is more likely to be resolved by perceptual metathesis when the metathesized string occurs in non-ambiguous contexts. And, the syncope of an unstressed vowel in VC_CV is much more likely to occur in languages with unambiguous closed syllables, than in languages with only open syllables.

Finally, Steriade's approach has empirical weaknesses. Following Grammont's (1933) general approach, and Hume's (1998) analysis of CC metathesis, Steriade (2001:234) views sibilant-stop metathesizing sound changes (in, e.g., Latin, Ancient Greek, and Old Dutch) as optimizing place contrasts for the stop: "the stop moves to a position where it will have CV transitions, the preferred source of place information for major place distinctions." However, not all sibilant/stop metatheses have the effect of optimizing the cues for the stop consonant. Sneddon (1984:31-33) documents metathesis of **t* and **s* within the Sangiric subgroup (Southern Phillipines, Northern Sulawesi) and Blust (in preparation) discusses parallel cases in Northern Phillipine languages, including Ilokano, Bontok, Kankanaey, Kalinga, Isneg, Isinai, and Pangasinan. As illustrated in (5i), the change is restricted to inversion of **t* and **s*, occurs across across intervening consonants and vowels, and results, in Ilokano, in forms with word-final /t/.

(5) Sibilant/stop metathesis *t…s > s…t in some Malayo-Polynesian languages

i. Northern Phillipines *t…s > s…t

PMP	Ilokano	
*Ratus	gasut	'hundred'
*Retas	gessat	'to snap, of string'
*utas	usat	'open a road, clear a path'
*tebus	sambut	'redeem'

ii. Southern Phillipines, Sulawesi *t…s > *s…t

Proto-Sangiric	Sangir	Sangil	Talaud	Bantik	
*Ratus	**hasuʔ**	**rasuʔ**	**ʒasutta**	hatusuʔ	'hundred'
*bitis	**bisiʔ**	**βisiʔ**	**bisitta**	bitisiʔ	'calf of leg'
*taŋis	**saŋiʔ**	**saŋiʔ**	**saŋitta**	taŋisiʔ	'to cry'

*tages **saɣeʔ** **saheʔ** **sahatta** tageseʔ 'reef'

What is interesting about the recurrent sound change in (5) is that a stop which was once pre-vocalic ends up in word-final position, where, under Steriade's model, cues for place of articulation are weakest. Data of this sort, then, does not support her claim that "only certain types of reversal , which can be identified as perception-optimizing, are frequent and systematic."

A further empirical weakeness of Steriade's account is that it misses the generalization which Structural Analogy in (4) is meant to capture. All cases of stop+s and s+stop metathesis cited are cases where output clusters are pre-existing cluster types in the language. As with compensatory lengthening, perceptual metathesis, and syncope, there is a greater than chance frequency of sibilant-stop metathesis occurring, if the language already contains unambiguous instances of the reanalyzed string. This generalization does not fall out from a model in which misperception identifies the target of change, with reversal occurring only in cases where perception is optimizing. Consider, for example, predictions of the two models for a language like Taba (aka East Makian), a South Halmahera language (Bowden 2001). In this language non-derived word-initial clusters include /ps/, /ss/, and /ns/, and there are no non-geminates clusters with /s/ as the first member. Under Steriade's account, prevocalic clusters like /ps/, /ts/, and /ks/ may pose perceptual difficulties with respect to the position of the sibilant noise. If this occurs, resolution of this ambiguity will result in stop-sibilant metathesis, whose output optimizes the perception of the stop, placing it in prevocalic position. However, many derived stop-sibilant clusters occur, (/t-sobal/ 'we incl. sail', /k-sobal/ 'I sail', etc.) , but metathesis does not take place. If this were an isolated example, it would be unremarkable. However, there is no language where pre-existing sT clusters cannot be seen to 'prime' metathesis. To summarize, a model in which sibilant-stop metathesis is both perceptually based, and primed by pre-existing sound patterns, makes better overall predictions regarding attested sibilant-stop metatheses than a model where perceptual ambiguity is resolved by synchronic perception-optimizing ambiguity.

Historical phonetic explanations for recurrent sound patterns find strong support in the experimental and typological literature (see, e.g. Chang et al., 2001). Straightforward phonetic explanations exist for the majority of lenitions, fortitions, deletions, assimilations, dissimilations and metatheses, without reference to markedness constraints (Blevins, to appear). The existence of rare recalcitrant cases of recurrent sound change like stop/sibilant metathesis, low-vowel dissimilation (Lynch 2004), or context-free *$t > k$ (Blust 1990, 2004), does not suggest that this research program is misguided. Rather, these examples demonstrate the need for detailed studies of the perception and linearization of fricative noise, the perception and production of aCa in contrast to other VCV sequences in Austronesian languages, and salient acoustic and perceptual similarities of *t*,*k* in contrast to *p*, in sound systems where *t* and *k* do not contrast.

3. Phonetic knowledge, phonological knowledge, and stochastic grammars. Once diachronic explanation is excised from synchronic grammars, what will these grammars look like? What architecture characterizes the description of sounds and sound patterns, and what types of experimental evidence is most likely to shed light on the content of phonological knowledge? Before answering these questions, it will be useful to dispel three common misconceptions of grammatical models in which phonetic explanation is confined to the diachronic component.

One common misconception is that the existence of explanation in the diachronic dimension is only illusory, since language change itself reflects constraints on synchronic grammars. This view is most succinctly stated by Joseph and Janda (1988) and taken by others (e.g. Hume and Johnson 2001) as a cogent argument for importing phonetic explanations into synchronic grammars. However, when we look closely at the structure of the argument, we can see where it goes wrong:

> Diachrony is best viewed as the set of transitions between successive synchronic states, so that language change is necessarily something that always takes place in the present and is therefore governed in every instance by constraints on synchronic grammars. (Joseph and Janda 1988:194)

The set of transitions between successive synchronic states is discontinuous, involving an initial state, where the newborn does not have an identifiable grammar of a language, and a final state where the young child or adult does. The claim of models like Evolutionary Phonology is that the majority of regular sound changes have seeds in misperception, resolution of ambiguity, and frequency-based choice of 'best exemplar' and that these transforms take place *in the course of language acquisition*. The fact that this acquisition takes place in the 'present' does not mean that change must be governed by constraints on synchronic grammars. On the contrary, if the content of synchronic grammar is what is being discovered in the course of acquisition, then it cannot play a role in acquisition. This is the view taken by, e.g. Lindblom (2000) and Wedel (2004), where formal properties of sound patterns are modeled as emergent structures formed in self-organizing ways through the feedback of the perception/production loop in the course of language acquisition.

Two other misconceptions are common regarding localization of phonetic explanation in the diachronic dimension. One is that synchronic systems no longer characterize phonetic knowledge. Another is that, with phonetic explanations excised from synchronic grammars, there is nothing left for synchronic systems to characterize. These two misconceptions may stem from the failure to properly distinguish between explanation and description, or between innate versus learned knowledge of language.

Once phonetic explanations are taken out of synchronic systems, these systems can *describe* purely and systematically all and only the knowledge for which speakers show positive evidence. This phonetic and phonological knowledge may have a very different character from structuralist, generativist, and optimality conceptions. For example, a recent study argues that Dutch speakers interpret neutralized final devoiced segments in Dutch as voiced or voiceless by making use of phonological/phonetic similarity patterns in the lexicon, with new words interpreted in such a way as to conform to these learned patterns (Ernestus and Baayen 2003). A synchronic grammar of Dutch should be able to characterize knowledge of phonological/phonetic similarity in the sense that it is used by speakers in this particular experiment. In this case, the resulting grammar will be highly descriptive, since word-forms are the basis of analogical generalizations. At the same time, a model of this sort highlights the extent to which knowledge of phonetics and phonology is learned knowledge of language, since the basis of emergent analogical generalizations are learned sound patterns of individual words.

What models of synchronic phonology have this degree of descriptive detail, adopt learning as a primary mechanism, and treat phonetic explanations as primarily historical? One which immediately comes to mind is Stochastic Phonology (Pierrehumbert 2001a). In Stochastic Phonology, phonetic knowledge is represented in detail. Frequencies of sound patterns play a crucial role in the acquisition of phonological and phonetic competence, and it is precisely this competence which one attempts to model. At the phonetic level, exemplar theory provides one model of how probability distributions over cognitive maps may be used in speech perception and production (Johson 1996, Pierrehumbert 2001b). Modeling of the lexicon is most accurately viewed in terms of stronger and weaker connections between words with more and less shared properties. Finally, in Stochastic Phonology, the actual grammar provides a very concrete tracking of generalizations over the lexicon. The form and content of these generalizations are addressed in work on analogical modeling, from the formal work of Skousen (1989, 1992), and the experimental work of studies like Ernestus and Baayen (2003), to the computational modeling of , e.g. Wedel (2004). Since, as summarized by Pierrehumbert (2001a), the lexical network and the cognitive map each explain "a large and diverse battery of findings about implicit knowledge of speech, and no viable alternative has been proposed for either concept", it is surprising that more theories of grammar do not take lexical networks and cognitive maps as architectural starting points for the characterization of phonetic and phonological knowledge.

4. Concluding remarks. These brief remarks highlight four important architectural issues at the phonetics/phonology interface. First, in the search to *explain* recurrent sound patterns, one should give equal consideration to all potential sources of similarity, including, direct inheritance, and parallel evolution, to counter the bias towards synchronic explanations which characterizes modern phonological theory. Second, where historical phonetic explanations can be documented for recurrent sound patterns, synchronic explanations are, at best, redundant, and, at worst, useless. Synchronic grammars can be greatly

simplified once the weight of explanation is lifted. The majority of markedness constraints can be eliminated from synchronic grammars, with exploration of the extent to which feature systems (Mielke 2004) and syllable structure (Blevins 2003) may also be emergent properties of grammar.
Third, the match between diachronic phonetic explanations and attested data is better than that between synchronic phonetic explanations and attested data. The evidence before us strongly suggests that synchronic grammars are not the domain of phonetic explanation. And finally, by locating phonetic explanations in the historical domain, there is neither a denial of phonetic knowledge as part of grammar, nor a sacrifice of descriptive adequacy. On the contrary, frameworks like Stochastic Phonology integrate cognitive maps for detailed low-level phonetic encoding with complex lexical networks, with the architecture relating these two components an area of on-going inquiry.

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[1] A similar position was held by the majority of Neogrammarians, and is also common in modern historical work. See, for example Blevins and Garrett (1998) and Hale (2000).

[2] A similar position was taken by Prague School phonologists (Anderson 1985, Chapter 4), , and is also common in modern synchronic work. See, for example Kager (1999:421), and contributions in Hayes et al. (to appear).

[3] Compare the related notions of ‘priming’ in Kiparsky (1995) and ‘expectation’ in Hume (to appear).