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New Perspectives on English Sound Patterns

"Natural" and "Unnatural" in Evolutionary Phonology

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Principles of Evolutionary Phonology are applied to a selection of sound changes and stable sound patterns in varieties of English. These are divided into two types: natural phonetically motivated internal changes and all others, which are classified as unnatural. While natural phonetically motivated sound change may be inhibited by external forces, certain phonotactic patterns show notable stability in English and are only eliminated under particular types of contact with languages lacking the same patterns. Within the evolutionary model, this stability is expected since natural sound changes involving wholesale elimination of these patterns are not known.

Keywords: *English phonology; English phonotactics; sound change; Evolutionary Phonology; phonetic naturalness*

Natural and Unnatural Histories

Within Evolutionary Phonology (Blevins 2004a, forthcoming), recurrent sound patterns are argued to be a direct consequence of recurrent types of phonetically based sound change. Common phonological alternations like final obstruent devoicing, nasal-stop place-assimilation, intervocalic consonant lenition, and unstressed vowel deletion, to name just a few, are shown to be the direct result of phonologization of well-documented articulatory and perceptual phonetic effects. Synchronic markedness constraints of structuralist, generativist, and optimality approaches are abandoned and replaced, for the most part, with historical phonetic explanations that are independently necessary. Already, this framework has proved useful in identifying new phonetic explanations for well-documented recurrent sound patterns and for distinguishing

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sound patterns with a natural history in phonetic substance from those with an unnatural history involving rule inversion, rule telescoping, analogy, or language contact (Blevins and Garrett 1998, 2004; Blevins 2004a, 2004b, 2005a, forthcoming; Gessner and Hansson forthcoming; Hansson forthcoming; Jansen 2004; Paster 2004; Wedel 2004a, 2004b; Yu 2004; Iverson and Salmons 2005a, 2005b; Odden 2005; Shih 2005; Vaux and Samuels 2005).

What is meant by "natural" history and "natural" sound patterns in Evolutionary Phonology? This term is used quite specifically to refer to sound patterns that transparently reflect language-internal phonetically motivated sound change, whether these sound changes have sources in misperception, ambiguous feature localization, or articulatory variation. These natural sources of sound change are shown in (1), with representative examples, following Blevins (2004a).

The examples in (1i) to (iii) illustrate instances of θ > f, rhotic metathesis, and unstressed vowel syncope, respectively—sound changes that have occurred or are ongoing in many varieties of English. When phonetic patterns with these language-internal sources are phonologized, the resulting sound pattern is natural and has a natural history.

One selective mechanism involves the resolution of intrinsically ambiguous signals. The source of sound change in this class of examples is often long-domain features whose precise segmental location is in question.

(1) Three natural sources of sound change (Blevins 2004a, 32-3)

S = speaker, L = listener

i. CHANGE: The phonetic signal is *misperceived* by the listener due to acoustic similarities between the utterance and the perceived utterance and biases of the human perceptual system.

S says [wɪθ], L hears [wɪf]

ii. CHANCE: The phonetic signal is accurately perceived by the listener but is intrinsically phonologically ambiguous. The listener associates a phonological form with the utterance, which differs from the form in the speaker's grammar.

S says [pʰɚ:ɾij] for /pɹ̩ɪɾi/, L hears [pʰɚ:ɾij], thinks /pəɹ̩ɾi/

iii. CHOICE: Multiple phonetic variants of a single phonological form are accurately perceived by the listener. The listener (a) acquires a prototype or best exemplar, which differs from that of the speaker, and/or (b) associates a phonological form with the set of variants, which differs from the phonological form in the speaker's grammar.

S says [ˈfæməlij], [ˈfæml̩:ij], [ˈfæmlij] for /fæməli/
L hears [ˈfæmlij], [ˈfæml̩:ij], [ˈfæməlij] and assumes /fæmli/

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If resolution of such ambiguity was a chance affair, then we might expect just as many instances of structure-preserving sound change as structure-changing sound change in this category, termed CHANCE. However, at least in the domain of metathesis (Blevins and Garrett 1998, 2004; Hume 2004) and compensatory lengthening (Kavitskaya 2002), there seems to be a strong cross-linguistic tendency for the direction of change under this type of ambiguity to be structure preserving, resulting in a preexisting sound pattern. Blevins (2004a, 154) suggests that the basis for this tendency is Structural Analogy, as stated in (2):

(2) Structural Analogy

> In the course of language acquisition, the existence of a 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.

The basic intuition behind this learning mechanism is an ambient priming effect on incoming data that can apply at any structural level in the phonology.[1] In the case of (1i), where a token pronunciation of [wɪθ] contains a final segment with noise patterns ambiguous between labiodental and some other fricative type, the preexistence of [f] in the language makes it more likely that a shift from θ > f will occur than if there were no unambiguous instances of [f], and Structural Analogy applies at the level of segmental contrast. In (1ii), on the other hand, where rhoticization may extend across a long domain, the existence of unambiguous VR sequences in the lexicon may prime a VR analysis over the historical RV analysis. The typology in (1), along with the tendency in (2), goes a long way toward defining natural sound patterns in the world's languages.

On the other hand, there are many sound patterns that may be productive in a language but whose source is not a single language-internal phonetically motivated instance of regular sound change and for which conditioned alternations are decidedly unnatural or even "crazy" (Bach and Harms 1972; Anderson 1981). An example of this type in English, borrowed ultimately from Latin, is the "velar softening" alternation between /k/ and /s/ in word pairs like *electri[k]/electri[s]ity* triggered by the /ɪti/ suffix (Chomsky and Halle 1968). Although velar palatalization in the environment of nonlow front vowels is a phonetically motivated natural sound pattern that recurs with greater than chance frequency in the world's languages (Guion 1998), phonologization of this sound pattern should result in *k/c* or *k/tʃ* alternations, not the *k/s* alternations borrowed from Latin, and is expected to be more general across the lexicon, not restricted to one or two suffixes. In this case, intermediate processes of deaffrication and dentalization in the history of Romance, along with subsequent borrowing into English, result in an unnatural but clearly learnable and productive pattern (Pierrehumbert 2002).

The classification of all contact-induced change as unnatural might strike some readers as unilluminating or illogical. After all, seemingly natural and common sound patterns, like word-final obstruent devoicing, can arise spontaneously via language-internal developments or spread via contact (Blevins forthcoming). Nevertheless,

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Table 1
Natural and Unnatural Factors in the Evolution of Sound Patterns

	Natural	Unnatural	
Type	Simple Phonetic Source? (Change, Chance, Choice)	Other Internal Factors (Other Sound Change, Rule Inversion, Analogy)	External Factors (Diffusion, Literacy, Other Social Factors)
1	yes	no	no
2	yes	yes	no
3	yes	yes	yes a. facilitate b. inhibit
4	yes	no	yes a. facilitate b. inhibit
5	no	yes	no
6	no	yes	yes a. facilitate b. inhibit
7	no	no	yes

distinguishing seemingly natural contact-induced patterns from similar internal developments is important for at least three different reasons. First, if we are interested in discovering the organic phonetic origins of a particular sound change, we must filter out contact-induced change, where outputs of a completed sound change are assimilated. Second, if we are interested in predicting and evaluating evolutionary stages of language-internal sound change, we must also filter out contact-induced change, for the same reasons. Third, encounters between distinct phonological systems can result in either natural or unnatural developments, depending on the type of contact involved. If speakers of language A with final obstruent devoicing acquire a second language B as adults, final obstruent devoicing may be observed in language B in the next generation. However, if speakers of language B with obstruent voicing contrasts in final position acquire language A with voicing contrasts neutralized finally as a second language, it is possible that final obstruent devoicing can be reversed in language A in the next generation (e.g., Louden 2000 on Yiddish). For all these reasons, it is important to distinguish natural phonetically based language-internal developments, as defined here, from unnatural nonphonetic or language-external developments.[2]

In addition to unnatural histories involving rule inversion, rule telescoping, analogical change, or language contact (including dialect convergence), the progression of a natural language-internal sound change can be unnaturally inhibited by other factors, including literacy, language standardization, and prescriptivism.[3]

Sound patterns then, as indicated in Table 1, may have simple phonetic sources, compounded or not with other internal factors and compounded or not with a range

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of external factors that can facilitate or inhibit the diffusion of sound change.[4] Many instances of simple phonetic sources combined with the full range of internal factors are provided in Blevins (2004a), Garrett and Blevins (forthcoming), and references therein. In (3), schematic examples are given of each type in Table 1, with the types I discuss in this article highlighted in bold.

(3) Instances of sound pattern types in Table 1

Type		
1.	final devoicing	Afar (Blevins forthcoming)
2.	final devoicing + analogy	Malay (Blevins forthcoming)
3.	final devoicing + analogy + diffusion	Malay dialects (Blevins forthcoming)
4a.	final devoicing + diffusion	Eastern Sudan (Schadeberg 1987)
4b.	**final devoicing + diffusion + reanalysis**	Yiddish (Louden 2000)
5.	T > s/_m by analogy	Ancient Greek (Garrett and Blevins forthcoming)
6a.	*a* > *an*/_#V by analogy + literacy/standardization	sixteenth-century Scots English (Devitt 1989)
6b.	regularization of *a/an* > *a* + social factors	Modern American English varieties (*American Heritage Dictionary* 2000)
7.	**final vowel epenthesis**	Suriname creoles (Smith and Haabo 2004)

Here, I focus in particular on the role of unnatural external factors both in inhibiting instances of natural phonetically motivated sound change and in giving rise to sound patterns in modern varieties of English, which, I argue, could not arise from natural factors and are limited to language contact situations like those discussed.

Natural Sound Change: Weak Segmental Contrasts in English

What sound changes with clear phonetic bases are recurrent in the history of Modern English? In this section, I summarize three of these, based on comparison of varieties of English as they have evolved around the world and evidence of similar developments in unrelated languages. I then suggest ways in which literacy, standardization, and globalization have had an impact on these developments. Throughout this study, I rely on, among other sources, the excellent reference tool, *A Handbook of Varieties of English: Volume 1. Phonology*, and the accompanying CD-ROM (Schneider et al. 2004).

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Table 2
Loss of /ð/, /θ/ in Modern Varieties of English

Dialect/Variety	Sound Change	Complete?	Data Source
Shetland	ð > d, θ > t	yes	Melchers (2004, 42)
West Ireland	ð > d, θ > t	yes	Hickey (2004, 74)
Southeastern England	ð > d/#_, θ > f ð > v elsewhere	yes	Altendorf and Watt (2004, 192)
Newfoundland	ð > dð, d, θ > tθ, t	yes	Clarke (2004, 376)
Maori English	ð > dð, θ > tθ	variable	Warren and Bauer (2004, 618)
Gullah	ð > d, θ > s, t	yes	Weldon (2004, 402)
Fiji English	ð > d, θ > t	yes	Tent and Mugler (2004, 755)
New Zealand, Australia	ð > v, θ > f	variable	Gordon and Maclagan (2004, 612); Horvath (2004, 637)

Loss of Interdental Fricatives /ð/, /θ/

Descriptions of Modern Standard American, British, or Australian English will typically list the interdental fricatives /ð/, /θ/ as contrastive consonantal phonemes. However, the vast majority of English varieties in the British Isles, North America, the Caribbean, the Pacific, Australasia, Africa, and Southeast Asia show something other than interdental fricatives (Schneider et al. 2004). In Table 2, apparent independent developments are summarized from different parts of the globe. All have, as a result of apparently regular sound change, the elimination of dental fricatives from the phonological inventory.[5]

What phonetic basis is there to the loss of interdental fricatives in so many varieties of English? As Dubois and Horvath (2004, 411) remark, “Interdental fricatives are highly marked sounds: they are rare in the languages of the world and learned late by children.” However, the same is true of clicks as speech sounds in the Khoisan languages, and yet, the majority of Khoisan languages appear to have maintained clicks as contrastive sounds as far back as one can reconstruct (cf. Blevins 2004a, 194-7). Furthermore, under contact, clicks have been borrowed into neighboring languages. Cross-linguistic markedness and late acquisition, then, do not necessarily imply that neutralizing sound change of a particular segment type should or will occur.

Of more relevance in this case appears to be the perceptual similarity of the phonetic variants of interdental fricatives with allophones of /t/, /d/, /f/, and /v/ in many English varieties. As suggested by the Maori English and Newfoundland variation between dental affricates and stops, as well as by studies of phonetic variation in

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other dialects (e.g., LaVoie 2002), in varieties with fricative allophones of /ð/ and /θ/, laminodental contact may result in a dental affricate or dental stop articulation. From this stage, the neutralization of dental stops with alveolar stops is straightforward and not unexpected, given the range of factors playing a role in mergers, including the functional load of the opposition involved, the number of minimal pairs that depend on the distinction, the extent to which the distinction depends on minimal pairs, the number of distinctions already made along the particular phonetic dimension, the number of phonetic features on which the opposition depends, the discriminability of the phonetic features on which the opposition depends, and limitations in the range of movements that would avoid merger (Labov 1994, 328-31).

In the case of interdental to labiodental shifts, it is clear that misperception is the primary factor. Perception studies support this interpretation for both adults and infants. When noise is used to masked stimuli, the highest confusion rates for English adults are found between [θ] and [f], and [ð] and [v], respectively (Miller and Nicely 1955). In addition, prelinguistic infants have some difficulty distinguishing interdental from labiodental fricatives, in contrast to the categorical perception exhibited robustly for many other contrasts (Eilers and Minifie 1975; Eilers 1977).[6] Finally, typological evidence supports this sound change as natural outside the context of English varieties: context-free θ > f is incipient in Veneto dialects of Italian word-initially (MacKay 1995, xvii), and in Rotuman, there is evidence of a sound change taking *t > θ > f. In all these languages, the shift of interdental to labiodental is a neutralizing one, suggesting that, in the course of acquisition, the existence of /f/ as an independent category may play a role in θ > f shifts, as predicted by Structural Analogy (2).

Despite the numerous varieties of English in which the interdental fricatives have merged with alveolar stops, labiodental fricatives, or sibilants, "Standard" varieties of British, American, Australian, and other Englishes are typically described as having interdental fricatives. In this case, literacy plays an important role in maintaining the notion of "Standard" pronunciation since interdentals are written in English as <th>, and apart from certain names like *Thomas* [ˈtʰaməs] (AE), <th> is consistently associated with interdental pronunciation, unlike many other graphemes in written English with multiple phonemic correspondences.

Loss of /ʍ/

Descriptions of Modern Standard American, British, or Australian English will often list the voiceless labiovelar glide /ʍ/, as in *what, which*, and so on, as a marginal segment, with some comment on its sphere of usage. In refined received pronunciation, only [ʍ] is found, while in traditional received pronunciation, [w] is variable with [ʍ]. However, the vast majority of English varieties in the British Isles, North America, the Caribbean, the Pacific, Australasia, Africa, and Southeast Asia show loss of this highly marked segment type (Schneider et al. 2004). In Table 3, apparent independent developments are summarized from different parts of the

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Table 3
Loss of /ʍ/ in Modern English Varieties

Dialect/Variety	Sound Change	Complete?	Data Source
West Shetland	ʍ > kw	yes	Melchers (2004, 42)
Northern Scots	ʍ > f	yes	Wells (1982, 397-8)
West Midlands	ʍ > w	yes	Clark (2004, 159)
South England (Urban)	ʍ > w	yes	Wells (1982, 371)
Coastal New England and Mid-Atlantic U.S.	ʍ > w	yes	Nagy and Roberts (2004, 278); Gordon (2004, 289)

globe. All have as a result the elimination of /ʍ/ from the phonological inventory of these English varieties.

In the vast English-speaking world, the contrast between pairs like *which* and *witch, where* and *wear*, and so on is only maintained in some Irish, Scottish, and Northern England dialects; by some North American, Australian, and New Zealand dialects that descend from these; and in varieties of English where contrasts like these show evidence of spelling pronunciation.

While contact has clearly played a role in the spread of /ʍ/-loss from southern urban England to many other parts of the world, the distinct changes shown in Table 3 still require some explanation. What phonetic basis is there for the merger of this particular phoneme in so many varieties of English? Unlike the interdental fricatives discussed earlier, which historically occurred initially, medially, and finally in English, the distribution of /ʍ/ was limited to initial position. In addition to this syntagmatic asymmetry, the /ʍ/ versus /w/ contrast was also anomalous paradigmatically: Old English initial /hn/ and /hr/ were lost in Middle English, making this the only voiceless (or preaspirated/prespirantized) versus voiced sonorant contrast in the language.[7] These factors, along with the general weakness of the /ʍ/ versus /w/ contrast in perceptual terms, account for recurrent neutralization to /w/. In West Shetland and North Scots, where the primary phonetic exponent of /ʍ/ was likely [xʍ], West Shetland shows strengthening of the velar component to a stop, conforming to general phonotactics allowing /kw/ clusters initially, while North Scots shows the reinterpretation of labial place and fricative noise as /f/, another structure-preserving change, attributable to Structural Analogy (2).[8]

In the typological realm, similar neutralizations are difficult to find for the simple reason that preaspirated or voiceless resonants like /ʍ/ are extremely rare cross-linguistically. However, typological comparison does support the following generalization: a contrast between /ʍ/ and /w/ is rare or highly unlikely in the absence of a voiced/voiceless contrast for other sonorants in the language. In the UCLA Phonological Segment Inventory Database (UPSID) of 451 languages, only 9 have a /ʍ/ versus /w/ contrast: Sedang, Lakkia, Iai, Yao, Klamath, Otomi, Mazahua, Hopi,

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and Aleut.[9] In all these languages, the voiced/voiceless contrast occurs not only for the labiovelar approximant but for all sonorants in the language.

As with the case of interdental fricatives, the writing system of English provides support for the unnatural retention of /ʍ/ for literate English speakers since this word-initial phoneme is almost always represented as <wh>.[10] In Ghanaian English (Huber 2004, 861-2), there is evidence of spelling-pronunciation for *wh*-initial words. In New Zealand, where the distinction between /ʍ/ and /w/ was maintained as late as the 1960s, Maori influence is possible. In Maori, there is a contrast between orthographic <w> = /w/ and <wh> a voiceless labial fricative or glide. This second phoneme has many dialectal variants, including [ʍ], [f], [ɸ], [ʔw], and [w].[11] In sum, it seems that without conventions of English writing and the serendipitous convergence of speakers of Irish and Scottish English with Maori speakers in New Zealand in the mid-to-late 1800s, there would be little remaining of the /ʍ/ versus /w/ contrast in spoken varieties of English today. As in the case of interdentals, unnatural history has played a role in the maintenance of this typologically rare contrast.

Unnatural Sound Change: English Phonotactics

Many features of English syllable structure have remained relatively constant from the earliest attested Old English texts to the majority of varieties of Modern English. Some of these are listed in (4).[12] At the lexical level, all these properties can be illustrated by the lexemes in (5), which are arranged according to the properties in (4) they are meant to illustrate.

(4) Some stable features of English word/syllable structure

a. Words may begin phonologically with V or C.
b. Nuclei may be simple or complex.
c. Onsets may be simple or complex.
d. Words may end in V or C.
e. Codas may be simple or complex.
f. CR onsets are possible (R = a liquid).
g. sC onsets are possible.

(5) Modern English reflexes of Old English forms, showing stable features of word/syllable structure

	Old English	Modern English
a.	*æppel*, *fūl*	*apple*, *foul*
b.	*fūl*, *full*	*foul*, *full*
c.	*gan*, *growan*	*go*, *grow*
d.	*cū*, *camb*	*cow*, *comb*
e.	*bed*, *east*, *betst*, *fox*	*bed*, *east*, *best*, *fox*
f.	*bread*, *dream*, *grene*	*bread*, *dream*, *green*
g.	*stingan*, *springan*, *skill*	*sting*, *spring*, *skill*

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While changes in the English sound system, from Middle English vowel quantity to the Great English Vowel Shift, have received a great deal of attention in the phonological literature, the stability of other features sometimes goes without notice. In this section, I highlight the stability of the features in (4), in the absence of external forces of change:[13] natural phonetically based sound change (with or without other internal factors; see Table 1) has left these features intact for well over 1,500 years.[14]

However, the same features are sometimes vulnerable where close contact between languages with very different syllable structure is involved. Under instances of contact-induced change, the stable features of syllable structure in (4) can change rapidly and dramatically. Here I discuss several examples from different varieties of English and the consequences of these observations for modern theories of syllable structure. Before doing so, however, it is interesting to look at several aspects of English phonotactics that have remained stable in apparently all situations where new varieties of English have arisen via extensive contact with other non-Germanic languages.

Stable Features under Contact

One extremely stable feature is (4a), the fact that English words can begin phonologically with vowels or consonants. The high frequency of vowel-initial words in English and the low frequency of languages with obligatory onsets seem to be responsible for the absence of varieties of English where all words are C-initial due to contact-induced change. An additional factor is the permeability of "obligatory onset" languages with phonologically vowel-initial words. In Australia, many languages are described as allowing only C-initial words. However, under contact with Australian English, V-initial words are found. In Panyjima, a language of the Pilbara region of Western Australia, words are C-initial with the exception of a handful of English borrowings like *arlipala* 'early' (Dench 1991, 133), and the same is true across the continent in Djabugay, a language of the Cape York peninsula, where loanwords are generally adapted to the phonotactics of the language, except that vowel-initial words are permitted, like *aybi* 'ibis' (Patz 1991, 255-6). The fact that Australian Aboriginal varieties of English allow V-initial words then is not surprising.

Another relatively stable feature of most varieties of English is the possibility of simple or complex nuclei. In English of the British Isles, complex nuclei consist of long vowels or diphthongs. Unlike the situation with V-initial words discussed earlier, the maintenance of complex nuclei seems primarily due to their prosodic prominence in English and the fact that the majority of languages with which English varieties have had contact also allow complex nuclei. However, there are some varieties of West African Englishes, including Ghanaian (Huber 2004, 849), without complex nuclei. This is not surprising since indigenous languages of this area (e.g., Akan, Ewe) generally lack complex nuclei. The Ghanaian vowel system is /i u e o ɛ ɔ a/, with /e/ corresponding to British English /ei/ and /o/ corresponding to British

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English /ou/. Some instances of neutralization from complex to simple nuclei are shown in (6).

(6) Simple nuclei in Ghanaian English

Ghanaian English	Southern British English	Gloss
[sit]	[sɪt]	‘sit’
[sit]	[siɪt]	‘seat’
[pul]	[pʊl]	‘pull’
[pul]	[puʊl]	‘pool’
[kɔk]	[kɔk]	‘cock’
[kɔk]	[kɔ:k]	‘cork’

Other English varieties show a similar feature. These include Sranan, a Suriname creole, with /i e a o u/ and only marginal vowel length (Smith and Haabo 2004, 528), and Bislama of Vanuatu (Crowley 2004). Forms in (7) illustrate neutralization of long/short or monophthong/diphthong pairs in Sranan (tone not indicated).

(7) Sranan simple nuclei

Sranan	Southern British English	Gloss
[fiti]	[fɪt]	‘fit’
[miti]	[miɪt]	‘meet’
[bedi]	[bɛd]	‘bed’
[meki]	[meɪk]	‘make’
[tapu]	[stɒp]	‘stop’
[sopo]	[soʊp]	‘soap’
[futu]	[fʊt]	‘foot’
[lutu]	[ruʊt]	‘root’

In Bislama, complex heterorganic nuclei are realized as bisyllabic VV sequences, while long vowels or homorganic VG are realized as simple short vowels: /pra.is/ ‘price’, /ma.ut/ ‘mouth’, but /pis/ ‘piece’, /fes/ ‘face’, /pama/ ‘Paaama (Island)’, /kot/ ‘coat’.

Unstable Features under Contact

The syllable-based statement in (4c), that onsets may be simple or complex, is one maintained in all varieties of Modern English that have enjoyed relatively natural histories, with little change induced by external forces. Similarly, (4f) and (4g), specifying these onsets as potential Cr or sC clusters, are stable features of Modern English and Germanic languages more generally. However, in some instances, new varieties of English have arisen in close contact with languages that do not allow complex onsets.

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(8) Solomon Islands Pijin vowel epenthesis in initial clusters

Solomon Islands Pijin	Southern British English	Gloss
[sukul]	[skuʊl]	‘school’
[supun]	[spuʊn]	‘spoon’
[tarae]	[tɹaɪ]	‘try’
[kalaem]	[klaɪm]	‘climb’

In these cases, changes eliminating complex onsets are in evidence, including C-deletion and V-epenthesis. In the Solomon Islands, where most languages do not tolerate initial clusters, epenthetic vowels occur in Solomon Islands Pijin, as shown in (8) (Jourdan and Selback 2004, 699). The same basic pattern is found in Tok Pisin (Smith 2004, 724-5), Suriname creoles (Smith and Haabo 2004), Cameroon Pidgin English (Menang 2004, 914), and Fiji English (Tent and Mugler 2004), though the more contact with more conservative varieties of English one has, the less likely the vowel epenthesis pattern in (8) is to be found.

In Fiji English, as spoken by Fijians and Indo-Fijian speakers, epenthetic vowels split up initial clusters for many speakers, as they do when English loanwords are nativized in Fijian (Tent and Mugler 2004, 767). Some examples are given in (9). Epenthesis into CR clusters in (9i) appears to be a consequence of Fijian phonotactics, where no consonant clusters are tolerated. In (9ii), however, there are distinct patterns for Fijian versus Hindi dominant speakers. Though both languages disallow initial /sC/ clusters, Hindi allows CC clusters intervocalically. Speakers with Fijian as a first language maintain the Fijian constraint against consonant clusters by epenthesis after initial /s/, while first-language speakers of Hindi show word-initial /i/ epenthesis, maintaining the cluster.[15]

(9) Fijian English vowel epenthesis into initial clusters

	Fijian Fiji English	Gloss	Indo-Fijian English	Gloss
i.	[kirimu]	‘cream’	[fari]	‘free’
	[porofesa]	‘professor’	[pilet]	‘plate’
	[kalasi]	‘class’	[bilaus]	‘blouse’
ii.	[sipi:niji]	‘spinach’	[ispot]	‘sport’
	[sikaramu]	‘scrum’	[iskul]	‘school’
	[sitoa]	‘store’	[istudent]	‘student’

Here we see an instance where the stability of complex onsets, (4c), is rendered unstable by intense contact or influence from languages with distinct phonotactics: one, Fijian, where CR and sC onsets are both prohibited, and another, Hindi, where initial CR is possible but sC is not. In this second case, a distinct variety of English arises since only (4g) is rendered unstable, not (4f).

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Unlike English (4d), a range of unrelated languages throughout the world do not allow words to end in consonants. These include some languages that have had intense contact with English, like Fijian, Australian Aboriginal languages, and many languages of West Africa. Nevertheless, with only a few exceptions, in most varieties of English arising in these contact situations, words ending in consonants are tolerated, and (4d) is maintained. One exception is the case of Suriname creoles, where epenthetic vowels are added regularly to C-final words (Smith and Haabo 2004).[16] Some examples are given in (10) (tone not indicated).

(10) Final vowel epenthesis in Suriname Creoles

Sranan	Ndyuka	Saramaccan	Southern British English	Gloss
[fiti]	[fiti]	[fiti]	[fɪt]	'fit'
[libi]	[libi]	[liɓi]	[lɪv]	'live'
[wipi]	[wipi]	[hupi], [upi]	[wɪp]	'whip'
[bedi]	[bedi]	[ɓeɗi]	[bɛd]	'bed'

A notable feature of the vowel epenthesis strategies in (8) through (10) is the preservation of consonants in the course of change. This preservation indicates that learners in these contact situations perceive sequential consonants in CC clusters and perceive word-final consonants, but have difficulty producing such clusters or final consonants without vocalic transitions. If consonants were not easily perceived, then consonant loss would be expected instead of vowel epenthesis. However, regular consonant loss is not known in any English variety as a consequence of contact with languages that prohibit complex onsets or lack codas altogether. This is not to say that a sound pattern of regular consonant loss cannot emerge via contact but that the source of loss will not be regular differences in syllable or word phonotactics.[17]

One case of this kind is documented for Cajun Vernacular English as spoken in Louisiana. In Cajun English, final consonants and consonant clusters have generally been deleted. Some examples of words that have undergone final C-loss are given in (11).

(11) Final consonant deletion in Cajun English (Dubois and Horvath 2004, 409)

t > Ø	late	f > Ø	life
d > Ø	food, wide	s > Ø	house
n > Ø	nine	ʃ > Ø	fish
m > Ø	mom	z > Ø	Larose
r > Ø	together[18]	l > Ø	school

Final consonant loss of this type is extremely uncommon cross-linguistically and has no clear phonetic motivation (Blevins 2004c). In terms of the sources identified in Table 1, general final C-loss of this type is expected only in the context of language contact, where a vowel-final or C-loss pattern in one language is imposed on another.

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However, as illustrated in (12), the same consonants that are lost in Cajun English *are* found word-finally in Cajun French.

(12) Word-final consonants in Cajun French (Louisiana State University 2004)[19]

Cajun	Gloss	Final C
aigrette	'egret' (f.)	[t]
laide	'ugly' (f.)	[d] ~ Ø (m.)
plaquemine	'persimmon' (f.)	[n]
femme	'woman' (f.)	[m]
asteur	'now'	[r]
boeuf	'ox'	[f]
avalasse	'downpour'	[s]
fraiche	'fresh' (f.)	[ʃ] ~ Ø (m.)
berceuse	'rocking chair'	[z]
cheval	'horse'	[l]

What then is the source of the final C-loss pattern in (11)? Cajun French, like many other varieties, has C/zero alternations in a range of morphologically or lexically conditioned contexts, including feminine versus masculine adjectives like [led] versus [le], [freʃ] versus [fre], and so on. I suggest that the C-loss illustrated in (11) is not due to transfer of syllable or word-structure constraints from Cajun French to Cajun English. Rather, during the long period of contact and bilingualism between Cajun French and English since the mid-nineteenth century, a unique instance of transfer has taken place: morphophonemic or word-based C/zero alternations have been transferred from French to English, resulting in lexical forms with regular C-loss.

Theoretical Implications

There is great diversity in syllable- and word-based phonotactics across the world's languages (Blevins 2005b). The stable features of English listed in (4) are not found in all languages, and within other language families, very different sets of stable features are apparent. In the Neogrammarian Tradition and descendant evolutionary approaches, sound change is the result of variation and selection at the phonetic level, which becomes phonologized in the course of grammar construction. Under this account, the properties in (4) are expected to be stable given that they are of reasonably high frequency, have robust phonetic cues, and are not sound patterns subject to the common sources of natural phonetically motivated sound change sketched in (1). Since all these things are true of the English sound patterns noted in (4), it is unsurprising that English has not naturally evolved into a language like Yokuts, where onsets and codas can have only a single C, or, more radically, into a language like Fijian, where no consonant clusters are allowed. The English sound patterns listed in (4), like many others, are language-specific inherited properties, acquired through descent under reasonably robust replication in the course of language transmission. Only when this transmission

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is filtered through an entirely different grammatical system, as happens in contact situations, can radical transformations, like those described in this section, take place.

This language-specific learned view of phonotactics can be compared with modern universalist constraint-based approaches. Within Optimality Theory, cross-linguistic variation in syllable and word-based phonotactics is expressed in terms of a set of violable universal “markedness” constraints referring to word-edges, syllables, subconstituents of syllables, segmental phonotactics, and a universal sonority hierarchy, as well as parallel faithfulness constraints preserving phonological correspondences between various forms (e.g., Prince and Smolensky 1993; Kager 1999). Language-specific phonotactics result from distinct rankings of these constraints, and these rankings must be learned. Sound change, within this model, involves constraint reranking. What is unexplained in this model is why the properties in (4) are stable in the history of English since all of them are universally marked within this approach. If there is truly an identifiable “emergence of the unmarked” (McCarthy and Prince 1995), why does it not show itself cumulatively in the *natural history* of English over the past 1,500 years? Why is it only under *external* forces of change that Englishes with less “marked” phonotactics evolve? And in these cases, isn’t the source of change quite clearly the transfer of surface phonotactics (or constraint-rankings) from one language to another, not the emergence of the unmarked? While the question of universal phonotactic markedness constraints is ultimately an empirical one, the history of English with respect to the features listed in (4) is most compatible with models where these properties are language specific and learned.

Summary

In this study, we have looked at examples of natural and unnatural sound changes in the history of English. In an imaginary *natural* history of English, untainted by literacy, prescriptive norms, social conventions, and language contact, the loss of /ð/, /θ/, and /ʍ/ would likely be complete in all varieties of Modern English. The phonotactics of Old English words and syllables, with their variable nuclei and complex initial and final clusters, would be essentially untouched. However, external factors have intervened—among others, the infiltration of American Broadcasting English to ever more remote corners of the Earth. As a consequence, these phonemes and the contrasts they take part in are hanging onto life, while already robust complex syllable types are becoming globally dominant.

As suggested here, natural sound change can be inhibited by unnatural factors, while certain apparent instances of regular sound change are limited to unnatural circumstances. The distinction between natural and unnatural is empirically motivated, in English as elsewhere, and worthy of explanation. To the extent that Evolutionary Phonology makes this distinction and provides explanations for it, it merits further exploration.

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Notes

1. This mechanism is similar to that underlying the perceptual biases seen in experimental exposure to nonnative phonotactics (e.g., Dupoux et al. 1999) and perceptual assimilation in loan word adaptation (e.g., Peperkamp forthcoming; Kang and Dilley 2005; Iverson and Lee forthcoming). In Structural Analogy, an immature grammar with some established phonetic/phonological categories is superimposed on incoming phonetic forms, which are then more likely to fall into these preestablished categories than in an immature grammar that lacks them. In contrast, adult exposure to nonnative phonotactics and loanword adaptation involve interpretation of target phonetic forms according to salient perceptual categories of the mature native language phonology.

2. Under these broad definitions, the history of sound patterns in all natural spoken languages includes complex composites of natural and unnatural histories. For example, significant contact between Old English and Old Norse speakers in the eighth and ninth centuries resulted in unnatural phonotactic changes in English, while contact with Norman French after 1066 gave rise to unnatural stress patterns. One goal of evolutionary phonology is to disentangle these unnatural histories from recurrent internally motivated, phonetically based instances of regular sound change. While the former can lead to irregular stress patterns like that characterizing Modern Southern British English, there is no evidence of similar irregularities from the output of regular sound changes with natural sources like those in (1).

3. Cameron (1995) argues for prescriptivism or "verbal hygiene" as a natural part of speech communities. This notion of "natural" should not be confused with the technical terms proposed here: natural processes in evolutionary phonology are those with phonetic language-internal sources.

4. Note that there is no sound pattern designated as "no" in all three columns because without phonetic sources, reanalyses, analogical changes, or external sound patterns, recurrent sound patterns are not in evidence.

5. Not included here are the most likely cases of contact-induced change, like the Cajun English shift of ð > d, θ > t due to possible interference from Cajun French (Dubois and Horvath 2004, 411). While contact-induced change is always a possible contributing factor and cannot be ruled out for the changes in Table 2, the seeming innovative nature of these changes makes contact a less likely source. Further, neutralization is observed in cases like Fiji English, despite the fact that Fijian languages have a native phoneme /ð/, a voiced dental fricative, and reflex of Proto-Oceanic palatals (Geraghty 1983).

6. Though see Levitt et al. (1988) on evidence that infants use context effects similar to those of adults to distinguish labiodental from interdental fricatives.

7. Some varieties of English have initial voiceless palatal glides in words like *hue, human, huge,* and so forth. However, the restriction of /Cj/ to pre-/u/ contexts (*pure, beauty, muse, cube, lure*, etc.) suggests phonological clusters. Simplification of /hj/ to /j/ for this class of words would then be an instance of initial *h*-loss, not neutralization of a voiced/voiceless glide contrast.

8. For a recent study of the variable realization of /ʍ/ in Glaswegian, based on a 1997 corpus, see Timmons, Tweedie, and Stuart-Smith (2004).

9. In Kaliai, there is /ʍ/ but no contrasting /w/, only a voiced bilabial fricative /β/.

10. Of course, not all words spelled with <wh> are pronounced with /ʍ/ in these dialects, notable exceptions being *who, whom, whose, whole*, and *whore* with initial /h/ or zero. Wells (1982, 229) notes at least one exception in the other direction: *weasel* is reported to have initial /ʍ/ in much of central and eastern Scotland.

11. It is possible that the labiodental pronunciation has occurred under the influence of contact with English. For a detailed discussion of the history of Maori *wh*, see Maclagan and King (2002).

12. The stable features in (4) can probably be attributed to all Germanic languages, though frequencies of various patterns have undoubtedly been affected by contact-induced change (see note 2), regular sound change, analogical change, lexical replacement, and other factors. Note that the surface occurrence of glottal stop phrase-initially does not conflict with the phonological generalization in (4a) and that many English varieties also allow phonetically V-initial syllables word-initially as a result of initial *h*-deletion (e.g., West Midlands; Clark 2004, 157-8) and medially via consonant lenition (e.g., Dublin English; Hickey 2004, 84).

13. See notes 2 and 12.

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14. See, however, notes 2 and 12. For a recent treatment of contact-induced phonological change in the history of English, see Iverson and Salmons (2005a).

15. On universal patterns and phonetic explanations of cluster adaptation and cluster "splitting," see Fleishhacker (2005), Zuraw (2005), and Steriade (2005).

16. In addition, word-initial consonant clusters are typically reduced via C-deletion or epenthesis. See discussion above. Another creole with final vowel epenthesis after single stops is Berbice Dutch, a Dutch-based creole; however, medial CC clusters, including obstruent clusters in this creole, are maintained (Kouwenberg 1994; Schramm 2005).

17. For example, perceptually based consonant loss can occur with especially weak final consonants (e.g., glides, liquids) or when coarticulation or masking in the source language reduces phonetic cues for consonant perception. In both cases, C-loss will be restricted to certain segment types and/or certain segmental or prosodic contexts.

18. Relevant only for *r*-ful varieties of English.

19. Cajun French forms are represented orthographically, following dictionary entries in Louisiana State University (2004). Recordings of these words can be heard at the same Web site.

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