PHONOTACTICS OF CONSONANT CLUSTERS IN THE HISTORY OF ENGLISH*

KATARZYNA DZIUBALSKA-KOŁACZYK
School of English, Adam Mickiewicz University, Poznań, Poland

INTRODUCTION

Consonant clusters are rare in the languages of the world (Maddieson 1999). Most languages (70%) do not have clusters, and those which do have them prefer simple syllable onsets. The ground for this is the universal preference for the CV-structure which in terms of *Beats-and-Binding Phonology* (Dziubalska-Kołaczyk 1995, 2002) is predictable in accordance with the major preference for the n → B binding. The latter means that a combination of a non-beat (= n) with a beat (= B), best realized by a consonant + vowel syntagma, is the most preferred phonological structure. It provides a good phonetic contrast which is both easy to hear and pronounce. The preference for the n → B binding (and, in consequence, for the CV) is derived from higher order semiotic and functional principles of, respectively, figure-and-ground and perceptibility/pronunciability. There are languages, however, among them also some major world languages with respect to the number of speakers, which do allow for clusters of consonants. English has been among them throughout its whole history.

In order to survive in a language, clusters need to satisfy certain universal conditions, expressible in terms of *phonotactic preferences* which derive the preferred clusters for all positions within a word. Their function is, on the one hand, to *counteract the CV-only preference* and, on the other, to counteract the creation of dysfunctional clusters. Phonotactic preferences also allow for the evaluation of a given language-specific phonotactics. In particular, more and less stable clusters can be distinguished, and thus predictions can be made as to their "behaviour" in language use, acquisition and change.

Consonantal phonotactics of English has undergone changes throughout the history of the language (cf. especially Lutz 1988, 1991). Present-day phonostylistics also shows variability in consonantal phonotactics (cf. *e.g.* Shockey 2002). Every-day casual talkers of the past and present can be expected to demonstrate/have demonstrated similar or parallel tendencies of cluster improvement and/or reduction driven by phonotactic preferences. A synchronic scenario, deduced on the basis of universal phonotactic preferences, can thus potentially find a typological "match" in diachrony. In this indirect way, one arrives at historical phonostylistics. Providing actual evidence for variation in historical casual spoken English which eventually did lead to attested phonotactic changes in consonant clusters may prove unsuccessful. The attested changes themselves, however, already constitute evidence for the validity of predictions based on universal phonotactics. Intermediate steps which had putatively led to those changes may have to be reconstructed.

In the present talk I will attempt to follow the above "matching" procedure, using phonotactic preferences of *Beats-and-Binding* (B&B) *Phonology*. They specify, for a given position in a

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word, the "goodness" hierarchy of clusters. In other words, they divide a potential *cluster space* into the preferred clusters, the dispreferred clusters (which are possible, though dysfunctional in the given position) and the impossible clusters. B&B phonotactics is based on the *Optimal Sonority Distance Principle* (OSDP). OSDP refers to the relation of distances in sonority between members of a cluster in a given position (initial, medial or final) in a word. The function of OSDP is to counteract the preference for a CV (consonant + vowel) sequence in the languages of the world. If allowed to operate fully, the CV preference would lead to the abolishment of all clusters. OSDP is superior to the Sonority Sequencing Principle in being able to account for more clusters and more precisely than the latter.

Beats-and-Binding Phonology is embedded in the framework of *Natural Linguistics*, and in particular, *Natural Phonology* (originally by Stampe 1969, 1979, and Donegan & Stampe 1979, later encompassed within the holistic epistemology of Natural Linguistics by Dressler 1985, 1996, 1999). Basic principles and assumptions of the framework will necessarily have to be presented below.

1. CONSONANT CLUSTERS IN THE HISTORY OF ENGLISH

The term "phonotactics" was coined by Robert Stockwell in 1954 (cf. Hill 1958: 68-88). The interest in the combinatorial possibilities of speech segments, however, is as old as the interest in the syllable, *i.e.* it dates back to the ancient times. Just as any other aspect of language-specific phonology, phonotactic constraints undergo modifications throughout history. Consonantal phonotactics of English since early Old English till Modern English has evolved to become richer, although some clusters also disappeared. Let us classify the changes according to the effect they produced, *i.e.* into those which led to the simplification of clusters and those which resulted in the rise of new ones[1].

1.1 *Simplified clusters*

A cluster is simplified due to a consonant weakening or loss. "The first consonants to be affected were always the weakest ones in the weakest positions, the next ones the stronger consonants in the weakest positions as well as the weakest consonants in the stronger positions, and so on…" (Lutz 1988: 224-225).

➢ This is well illustrated with the history of /h/ in English (cf. Lutz 1988, 1991): it disappears first in the head of an unaccented syllable preceded by an accented open syllable or one closed by a resonant, then in the coda of unaccented monosyllabic words, then in late Old English and early Middle English, /h/ is lost in the accented onsets of /hn-/, /hl-/, /hr-/ and /hw-/[2], then in the 12th century it is lost in the onset of unaccented monosyllabic words, then in the 14th and 15th century /h/ disappears in the coda of accented syllables.

/hn-/, /hl-/, /hr-/ and /hw-/ were simplified, in the order as enumerated; *e.g.*:

[1] The classification below aims at revealing the overall patterns of change throughout the history of English. I am aware of the richness and variety of detail concerning: the interpretation of the quality of particular sounds, their various developments in dialects, and many other corollary factors which contributed to the changes. For the purposes of this paper, however, I'd like to concentrate on the general trends.

[2] /hw/ deserves a separate treatment, since it followed a different route: it eventually changed into (a) a voiceless labio-velar fricative or (b) reduced to [w], via a stage of /xw-/.

hnecca > *neck*
hlūd > *loud*
hræfn > *raven*
hwæl > *whale*

/hw-/ started to disappear last and still today may be present in some dialects (cf. Vachek 1954, 1964) or at least perceived as desirable (cf. *e.g.* Wells 1999: 39). One of the explanations for the disappearance of /h/ in the above clusters (as opposed to hw-/xw-) is a claim that they, possibly, constituted single consonants (or developed into such at the end of OE, cf. Fisiak 1968a: 63), *i.e.* /hn-/, /hl-/, /hr-/ stood for preaspirated or voiceless [n̥ l̥ r̥] (cf. Fisiak 1968b: 7; Lutz 1991: 29ff).

Apart from the above mentioned contexts, loss of /h-/ was dependent on the style of speech: in the onset of secondary-stressed words in a phrase, /h/ was lost especially in allegro speech, *e.g. e/a* for *he*, *er/ar* for *her*, *it* for *hit*; *held im*.

A glottal fricative appeared in general only in the initial position. In the final position a velar fricative /x/ which was not lost, due to careful speech or emphasis, changed to /f/, *e.g. rūh* > *rough* [uf] > [ʌf].

Two other developments:

(a) vocalization of the fricative
miht [miçt][3] > *might* [mi:t]
boughte /o/ + /h/ > /ou/

(b) a new /h/ came into being, from /k/, /g/ or /hh/ (=/xx/)
ah vs. *ac*
burh vs. *burg*
hlihan vs. *hlihhan*

➢ /wl-/ and /wr-/ clusters lost their first consonant /w/, in this order, *i.e.* in /wl-/ before /wr-/
wlispian > *lisp*
wrītan > *write*[4]

Another development of /w/ was a change /w/ → /b/, *i.e.* strengthening of the first element of the cluster:
wlæfian > *blaffere*

➢ /fn-/, /gn-/, /kn-/ clusters lost their first element in the order as given; in some words, /fn-/ was replaced by /sn-/; *e.g.*:

[3] [ç] was an allophone of /x/ after front vowels.

[4] In some dialects /wr-/ > /vr-/, *e.g. wrap, wrench, wrestle*.

fnēosan > *sneeze*
gnagan > *gnaw*
cnēo > *knee*

For the /kn-/ cluster, which was the latest to be reduced, a [tn-] variant was proposed on the way from /kn-/ to /n-/ (cf. Dobson 1968: 976ff, Kökeritz 1945, Lutz 1991: 243):
kʰn → kˀn → tˀn → (t)n̥n → n

Apart from being replaced by /sn-/, /fn-/ also changed into /g-/, *e.g. fnasten* > *gasp*.

➢ Coda weakening affected clusters of /l/ + consonant, *e.g.*:

yolk, *chalk*, *half*, *psalm* BUT *alpha*, *Alfred*, *salvage*, *Alps*, *Albert*, *Albion*

as well as /nasal+stop/ clusters, *e.g.*[5]:
clīm.ben > *climb*
wīn.den > *wind*
siŋ.gan > siŋgən > siŋən > sɪŋ

1.2 *New clusters*

➢ The clusters of /p, t, k, b, d, g, s, f, θ, v, m, n, l, h/ with /j/ in the second position resulted from a shift of the first component of a diphthong from the nucleus to the onset of the syllable (cf. Lutz 1988: 229). One could call the process 'partial desyllabication of diphthongs'.
e.g. strewen, *knew* /(C)(C)(C) iu̯/ > /(C)(C)(C) juː/

➢ Clusters /θl-/, /θr-/ were modified in two ways:
/θl-/, /θr-/ > /fl-/, /fr-/
/θr-/[6] > /tr-/, /dr-/

➢ Fricatives /f, θ, s/ (and their voiced counterparts) as well as aforementioned /h/ were affected both by strengthening processes (stopping, replacement by a stronger fricative, devoicing) and weakening processes (voicing, vocalization, deletion), manifested by the following changes:

- /θ/

/θ/ → /d/ by occlusion (stopping)[7], *e.g.*:
wuldor vs. *morðor*
fealdan vs. *weorðan*

[5] Again, this development varied across dialects.
[6] Of course, /θr-/ could also remain, *e.g. three*.
[7] But also: d → ð fricativization of stops *mōdor* > *mōther*.

fiddle < **fiðele*
byrðen > burden

oð- → æt-, of- by occlusion and devoicing
vs.
/θ/ → /ð/ in onset of function words – by voicing

- /f/
  hlæfdige[8] > *lav.di* > *lā. dy* by vocalization of the fricative
  or
  he.fig > *hē.vi* by voicing

  /fn-/ → /n-/ (→/sn-/) by deletion[9]

- /s/ least affected

- strengthenings of fricatives by means of replacement by an inherently stronger one (cf. Lutz 1991: 147) can be summarized as follows:
  /h/ → /θ/
  → /f/ later
  /θ/ → /f/
  → /s/ function words, affixes
  /f/ → /s/

Thus selected data pertaining to the evolution of consonantal clusters in the history of English will be scrutinized from two perspectives. One perspective refers directly to the leading theme of this conference, *i.e. Historical Linguistic Studies of Spoken English*. A parallel will be drawn between the processes which must have been active in the spoken casual English of the respective time (Old English, Middle English, early Modern English) and the processes which are productive in present day spoken English. In section 2 below I will argue for the term 'historical phonostylistics' which, in analogy to other types of historical linguistic research, derives from the uniformitarian principle. In section 3 this first perspective will be applied to the discussion of the above data. The other perspective originates in the study of language universals (cf. section 4). Modifications of clusters, whether diachronic or synchronic, can be analysed functionally as motivated by universal phonotactic preferences. If the preferences are respected, structures improve; if they are violated, marked structures arise. Although the latter ones are dysfunctional, their rise can also be explained.

[8] Here and in the following example, /f/ was voiced already in OE.
[9] But /fl-/ & /fr-/ stayed.

2. HISTORICAL PHONOSTYLISTICS?

Uniformitarianism in historical linguistics has demonstrated itself in such well-known manifestos of the uniformitarian doctrine/principle as the ones by Labov or Romaine:

> the same mechanisms which operated to produce a large-scale changes of the past may be observed operating in the current changes taking place around us (Labov 1972: 161).

> the forces operating to produce linguistic change today are of the same kind and order of magnitude as those which operated in the past five or ten thousand years (Labov 1972: 275).

> we accept that the linguistic forces which operate today and are observable around us are not unlike those which have operated in the past (Romaine 1982: 122).

The uniformitarian doctrine is one of the principles of geomorphology. The term is borrowed from geology; it was introduced by James Hutton at the turn of the 18th century (and opposed to catastrophism) (cf. Labov 1972: 275). For linguistics, the uniformitarian principle translates into integrating changes from the past with changes in progress in order to investigate the mechanisms of change, its causes and functions.

Whereas Labov's motivation for observing the principle stemmed from his scepticism about the validity of historical data *per se*:

> Historical linguistics can then be thought of as the art of making the best use of bad data (Labov 1994: 11).

Romaine's attitude was more conciliatory and resulted in her pioneering work in the discipline of socio-historical linguistics, using sociolinguistic models to analyze historical data. Socio-historical linguistics, or, more recently, historical sociolinguistics (cf. *e.g.* Nevalainen and Raumolin-Brunberg, 2003. *Historical Sociolinguistics.* and their discussion of the term, p. 14, note 1), has established itself firmly in the landscape of historical studies of language. As Nevalainen and Raumolin-Brunberg (2003: 2) assert:

> Because no language evolves in a social vacuum, the speakers of earlier English should not be ignored when their language is looked at through the telescope of historical linguistics.

Moreover, "it is speakers, and not languages, that innovate" (Milroy[10] 1992: 169). One can try to look at those historical speakers directly, by means of finding such corpora of texts which promise to have some manifestations of spoken language (*e.g.*, legal language of court trials). Indirectly, one can try to interpret historical processes through the modern speaker's

[10] It needs to be mentioned that James Milroy, and especially Gabriella Mazzon criticised the unconditional use of the uniformitarian principle in linguistics. "[T]he widespread 'uniformitarian principle' whereby the factors influencing and the mechanisms presiding over change and variation are assumed to be the same over time (cp. *e.g.* Trudgill 1983: 102-103; Labov 1994: 21ff.) may be misleading; there is no way to prove that in a society with totally different demographic, social, cultural characteristics from those typical of the communities investigated by modern sociolinguistics the forces at play were the same and operating in the same way. Especially since language phenomena appear to be so strongly conditioned by extralinguistic factors, this leaves us with very little 'uniformity' to hypothesize, unless of course we make reference to very general physiological principles, which however are not the sole responsible for change" (Mazzon 1997: section 4, p. 9 of 30 of the www printout; cf. also Mazzon 2000).

mouth and ears, thus indirectly arriving at historical phonostylistics. Below I will attempt to adopt this "modern-casual-speech filter" to the data concerned[11]. However, one needs to be aware of the fact that the data comes from the times when there was no spoken standard available (RP counts basically from around mid 19th century). Starting with the 16th c. some evaluative remarks can be found in various sources, which point to the raising awareness of the dialectal diversity. Written sources may thus be cautiously assumed to have documented "scripted formal speech" which must have reflected the changes actually having taken place in "unscripted informal speech".

3. CASUAL SPEECH PROCESSES OF MODERN ENGLISH: SOME POTENTIAL PARALLELS BETWEEN PAST AND PRESENT

3.1 *Confusion about styles*

The factors triggering stylistic variation have been identified as *topic*, *setting* and *relationship between interlocutors* (Hymes 1974). The most influential approach to stylistic variation was that of Labov (1972), who analysed formality as a linear continuum from very casual speech to very careful speech according to the degree of attention given to speech by speakers. In other words, he defined style in terms of self-monitoring (Labov 1972), *i.e.* the amount of attention paid to speech. Recently, however, Labov (in Eckert and Rickford eds. 2001) states that he did not intend this continuum to describe how style-shifting is produced and organized in every-day speech but rather to describe the intra-speaker variation in the sociolinguistic interview. This interpretation allows for the analysis of stylistic variation within the speech of a given speaker independently of his/her social status, thus avoiding the clash with the social status variable. An unclear correlation of the style variable with other external variables in variation and change, especially with the social status variable, has been one of the points of criticism against Labov's approach. Another criticism of the attention-to-speech view of styles derives from the observation that speakers accommodate to their interlocutors, even during sociolinguistic interviews (cf. Nevalainen and Raumolin-Brunberg 2003: 188). For example, Allan Bell proposed a model of style in terms of "audience design" (Bell 1984, 2001).

The other factor usually associated with casual speech is tempo, physically related with the inertia of articulators. According to Shockey (2002: 11) "cognitive factors are more important than inertia", since "does it seem likely that anyone would run their vocal tract so fast that not all of the sounds in a message could be executed?" (12). She does not come to specify those "cognitive factors" in any precise way, however. In my understanding, she avoids the questions of the "triggers" of reductions (which happen in normal every day pronunciation as opposed to citation forms). The reductions themselves belong to a language-specific phonology (with universal underpinnings) and become active in the so-called "unscripted speech".

[11] An affined approach to phonostylistics and sound change was proposed by Rubach already in 1978. He considered phonostylistics to be the best for observing sound change in progress, with a view of predicting future stabilization of currently optional phenomena: "Assuming that in sound change rules are first variable and only later become obligatory (according to Labov, confirmed in Kiparsky 1971: 603) we may further hypothesize that today's transparency of phonostylistic palatalizations will be true of obligatory processes in the future" (Rubach 1978: 330). While Rubach's was a look from the present into the future, mine is a look from the present into the past.

> Degree of formality seems to have little effect on unscripted speech [spontaneous = not read or memorized]: one finds the same types and nearly the same number of reductions in formal English as one does in casual speech. […] Since most connected speech phonology is subconscious, it is not changed in different styles (cf. Brown 1977: 55). The impression that formal speech is less phonologically reduced than casual speech is probably based on the fact that much of (if not most) formal speech is scripted rather than spontaneous (Shockey 2002: 17).

Shockey does not explicitly consider attention to be a factor, although "subconscious" in the above quote does refer to the degree of attention. To paraphrase the above: we reduce since we do not pay attention, no matter the style we use. Thus, style does not depend on attention, while reductions do. So style does not correlate with reductions: you can reduce as much in formal style as in casual style as long as you do not pay attention. What is formality, then? Is it never expressed by pronunciation in conversational (unscripted, unread) speech?

Consider also Shockey's reference to the studies of connected speech processes by the Cambridge group (Shockey 2002: 76): "attention was a determinant of reduction: at a rate where reduction would be predicted, it could be eliminated by focusing on pronunciation" (77); "rate and style contributed to reduction" (77). Thus, (a) rate did condition reduction and (b) change of style did mean change in attention: didn't it then means also a change in formality?

The above discussion reflects the degree of confusion in the area of phonostylistics. In my work so far I have adopted an approach shortly sketched below.

3.2 *Phonostylistics*

The term *phonostylistics* stands for the phonological processes conditioned by style, *i.e.* style-sensitive or style-dependent ones. A scale of styles may be set up in a variety of ways, still it is generally encompassed within the extremes of *emphatic* vs. *informal*, with *formal* in between. Emphatic style is well-exemplified by motherese and citation forms, informal styles include casual, colloquial, intimate, while a speech, a lecture, or a job interview are examples of a formal style. For the purposes of clarity, I will refer to a simplified binary distinction between *formal* vs. *informal* only.

As far as the informal style is concerned, there exists a whole array of terms in the literature used to refer to approximately the same type of speech: *fast*, *rapid*, *allegro*, *casual*, *connected*, *informal*, *real*, *spontaneous*, or *conversational*. With respect to the primary style-differentiating criteria, the term *casual* seems to be the most adequate or, indeed, the least narrow or vague. The criteria are: tempo of speech and attention paid to speech. The criteria take on different values depending on the situation in which a speech act takes place (topic, aim, relation to the interlocutor, place of a conversation) and on the individual features of the speaker. Most commonly, exactly those situations do arise which trigger casual speech, *i.e.* in other words, most often we speak casually. The relationship between the two criteria is inversely proportional: the higher the degree of attention the slower the tempo.

The main types of phonostylistic processes are:

- assimilations, *e.g.* of stops and nasals, as in: *that pen, good mother, could get, ten men;* palatalization and coalescence, *e.g.* in: *did you, hit you, don't you, as yet*;
- reductions, *e.g.* cluster reductions and degeminations, as in: *a test drive, I asked him;* smoothing, as in: *hour, lawyer*;
- hiatus avoidance, *e.g.* in: *law and order; situation*;

- assimilation + reduction, *e.g.* in: *I can't go, don't be silly*;
- reduction and elision of vowels conditioned by rhythm in iso-accentual, stress-timed languages, *e.g. perhaps*;
- consonant epenthesis, *e.g.* in: *prin*[t]*ce, min*[t]*ce*.

I propose a graphic way to represent stylistic variation (Dziubalska-Kołaczyk 1990: 20; see Fig. 1 below). Underlying intention is a term compatible with the mentalistic, psychological theory of the phoneme (cf. such notions as *Lautabsicht, sound image*, *intention*, in the works of Baudouin de Courtenay, Sapir, Stampe).

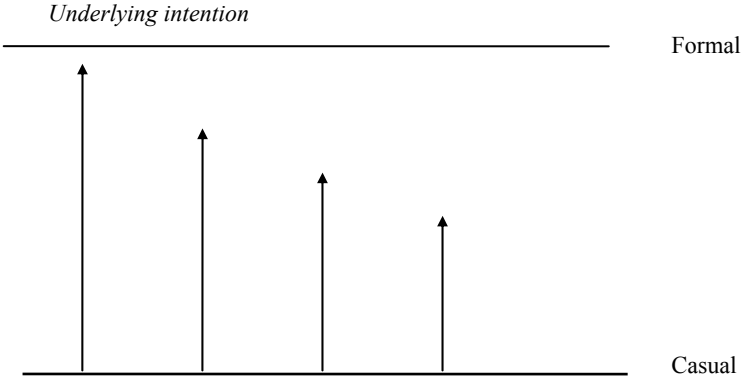


Fig. 1.

For instance: underlying intention *happen* /hæpən/, realization in production [hæpm̩]. Further illustrations of phonostylistic processes are quoted below:

(1)

hisediwuŋgəu	*he said he wouldn't go*
jəʃəːrəbaunəkstaɪm	*you sure about next time?*
n̩widinsiːiməgen	*and we didn't see him again*
bəpræpʃəkəgimiwʌn	*but perhaps you could give me one*

(Sobkowiak 1996: 238)

(2)

And also by using a low impedance you can use two conductors shielded.

Conversational style:

and: ænd > æn > ən

also: l > u

using: ŋ > n

impedance: ən > n̩, s + j > ʃ

you: uː > ə > ∅

can: kæn > kn̩ > kŋ̩
shielded: l > ʊ, z + ʃ > ʃ
Total: 13 processes

Reading:
and: ænd > æn
a: eɪ (hypercorrection)
can: kæn > kən
conductors: z + ʃ > ʃ
shielded: l > ʊ
Total: 7 processes
(Shockey 1973: 83)

Indeed, in Shockey (1973) as much as in Shockey (2002), phonostylistic processes distinguish between conversational and read speech.

(3)
An example illustrating the CV-preference (Shockey 2003: 42)
And the scientists are always saying that there's no life on Mars.
ændðəˈsaɪəntɨstsɑɹɔlwɪzˈsɛɪɨŋðætðɛɹznoɯˈlaɪfɑnmɑɹz
VCCCVVCCVCCCVCVCCVCCVCVC CVCCVC CVCC
nəˈsaɪnəsɹɔɪˈsɛɪnəttɛɹsnoɯˈlaɪfɑmɑɹz
CVVCVCVCCVCVCV CVCCCV CVCVCVCC
8 consonant clusters → 3 consonant clusters

(4)
Pol. *to wszystko* → [skɔ], *nie wiem* → [ɲɛm]

3.3 *Parallels between past and present*

In this section I will refer across to subsections of point 1 in order to find parallel processes active in modern spoken English to the processes which could have affected the historical clusters. This is the first of the two perspectives of analysis I chose to adopt.

HISTORY	**MODERN CONVERSATIONAL ENGLISH**
The history of /h/ in English	The loss of /h/ modulated by the positional strength of the inherently weak consonant finds a parallel in modern h-dropping, which also reflects the prosodic hierarchy of strength, both in casual speech and in first language acquisition. For example, *'is 'en'ouse > 'is hen'ouse > 'is henhouse > his henhouse* (Stampe 1969/1979: 16). Modern English shows reduction of initial /h/ of short unstressed words, especially when preceded by a fricative, *e.g. What does he* [dəzi] *want* (cf. Shockey 2002: 44).

HISTORY	**MODERN CONVERSATIONAL ENGLISH**
/hw-/ started to disappear last	Still today it may be present in some dialects or at least perceived as desirable (cf. *e.g.* Wells 1999: 39). This is evidence for the reality of the reduction, although it's not stylistic now (cf. section 4 for the discussion of cluster reduction).
Loss of /h-/ was dependent on the style of speech: *e/a* for *he*, *er/ar* for *her*, *it* for *hit*; *held im*; /-x/ > /-f/: *rūh* > *rough*	Another dimension of h-dropping present both historically and now is the reinforcement of h-dropping in casual speech. Good evidence for the presence of this dimension historically was the fact of strengthening of the appearance of a velar fricative in the final (weak) position where the consonant was maintained (its change to /f/ shows some weakening, but could also be conditioned articulatorily).
miht [miçt] > *might* [miːt] *boughte* /o/ + /h/ > /ou/	Since fricatives don't vocalize in modern spoken English, the remote cognate process for /h/-vocalization may be /l/-vocalization which also aims at improvement of syllable structure. On the other hand, /h/ is not a typical fricative due to its extreme weakness, and as such is referred to as a voiceless counterpart of the following vowel. In the described historical process, it was a voiceless second element of a monophthong (?).
ah vs. *ac* *burh* vs. *burg* *hlihan* vs. *hlihhan* (/xx/) (cf. also d → ð below)	Due to articulatory undershoot, stops lose their closure in unstressed syllables (cf. Shockey 2002: 27f). *E.g.*, *you can* [juɤŋ], *because* [biɤɔz], *completed* [kmˈpliʂɪd]. This is a comparable lenition to the historical one. "Relaxed speech generally displays less contact for consonants than careful speech when viewed using an electropalate" (Shockey 2002: 28). In the case of a geminate affricate, this is a reduction and weakening in the medial position, comparable to smoothing.
Yolk, *chalk*, *half*, *psalm*[12]	So-called 'l-vocalization' is a connected speech process aiming at the CV structure or at least reduction of a final cluster. *E.g.*, *people that's* [ˈpipotʂ̩] (Shockey 2002: 36), *milk* [mɪok].
/θ/ → /d/ occlusion (stopping)	Historical stopping of a dental fricative in the context of alveolars finds a parallel in the so-called ð-reduction by assimilation to a previous alveolar consonant. *E.g.*, *what the heck* [wɒtd̪əˈɦɛk] (Shockey 2002: 43).
he.fig > *hē.vi*	In parallel to tapping, there is a process of lenition referred to as 'voicing through' in an intervocalic position, especially in continuant consonants. *E.g.*, *But I think in…* [bədaiˈθĩɤɪn] (Shockey 2002: 32).
mōdor > *mōther*	Another case of reduction of closure for obstruents, resulting in a lenition.

[12] I'm not dealing with a /ps-/ cluster here, but cf. Fisiak (1968b: 8).

4. "GOODNESS" OF CLUSTERS IN *BEATS-AND-BINDING* (B&B) *PHONOLOGY*

The other perspective originates in the study of language universals. Modifications of clusters, whether diachronic or synchronic, can be analysed functionally as motivated by universal phonotactic preferences. If the preferences are respected, structures improve; if they are violated, marked structures arise. Although the latter ones are dysfunctional, their rise can also be explained: most often they result from speaker-friendly casual speech processes.

4.1 *Phonotactics in Beats-and-Binding Phonology*

Phonotactic preferences dictate the syntagmatic relationships between and among segments on the lexical and postlexical level. Beats-and-Binding phonology, worked out on the principles of Natural Phonology, is a theory which accounts for the representation of segments in sequences. Specifically, it focuses on explaining how sequences come into being as well as which sequences are preferred to others and why. B&B phonology assumes the minimal units of a beat (B) and a non-beat (n), prototypically realised by, respectively, a vowel and a consonant. Sequences of non-beats, realised by consonant clusters, result from reorganisation of the basic beat/non-beat structure of sequences. The resulting clusters are subject to phonotactic preferences specified for all positions within a word, *i.e.*, a given cluster qualifies best to function as word-initial, -medial or -final on the basis of the preference it obeys. The phonotactic preferences specify the universally required relationships between distances in sonority within clusters which guarantee, if respected, preservation of clusters. If not respected, phonotactic preferences guide the changes (*e.g.* in acquisition and phonostylistics) leading to the improvement of structure.

Clusters, in order to survive, must be sustained by some force counteracting the overwhelming tendency to reduce towards CV's. This force is a contrast of sonority. The *Optimal Sonority Distance Principle* (OSDP) defines the way in which segments should order themselves in a successful sequence: the relations between sonority distances between pairs of neighboring phonemes should be *optimally balanced*. Optimal sonority relations take the form of well-formedness conditions holding for double, triple and n-member clusters in all positions in a word, *i.e.*, initial, medial and final. They refer to the sonority values of the scale below:

Vowels	Semivowels	liquids	nasals	fricatives	affricates	plosives
0	1	2	3	4	5	6

Fig. 2. The sonority scale[13].

The scale is modifiable (*e.g.*, one can argue for placing affricates together with plosives). Sonority itself is understood as a perceptual effect brought about to the ear by manner of articu-

[13] Instead of a sonority scale, one may think of a sonority hierarchy, represented as a branching structure from the most general, major classes (consonants and vowels) to those most specific (particular manners or even particular laryngeal features). Specific languages would make use of such a hierarchy to varying degrees; for instance, in a CV language, only major classes would be of use, while in a language with double clusters at the most, three positions in a hierarchy would be necessary (*i.e.* Cs and Vs, and among Cs, sonorants and obstruents). The scale I'm referring to, however, is supposed to serve as a universal reference point, mid-way between a much less complex and much more complex hierarchy. Balancing sonority distances between segments remains a valid measure throughout, although, with increasing complexity, the hierarchy would require amendments.

lation of sounds, *i.e.* all aspects of sound production contributing to manner. These are: (a) aperture/shape/obstruction of the vocal tract; (b) energy exerted during production; (c) complexity of movements/configurations of articulators involved.

Sonority, however, is not the only factor contributing to the overall perceptual effect obtained by a cluster of sounds. What the language user actually prefers, considering the needs of both his/her speaker- and listener-self, is mediated by place of articulation and voicing[14] values of the consonants involved. In fact, it may turn out to be more correct to talk about a *Net Auditory Distance* (NAD) to which all the three factors contribute (sonority, POA and voicing) rather than sonority distance alone.

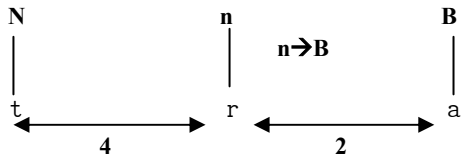
The working of the OSDP will be illustrated by the preference defining double initial clusters.

C_1C_2V:	$\|son\ (C_1) - son\ (C_2)\| \geq \|son\ (C_2) - son\ (V)\|$ i.e.: sondis $(C_1,C_2) \geq$ sondis (C_2,V)

The condition reads:

In word-initial double clusters, the sonority distance (sondis) between the two consonants should be greater than or equal to the sonority distance between a vowel and a consonant neighbouring on it.

For instance, as in a sequence /tra/:



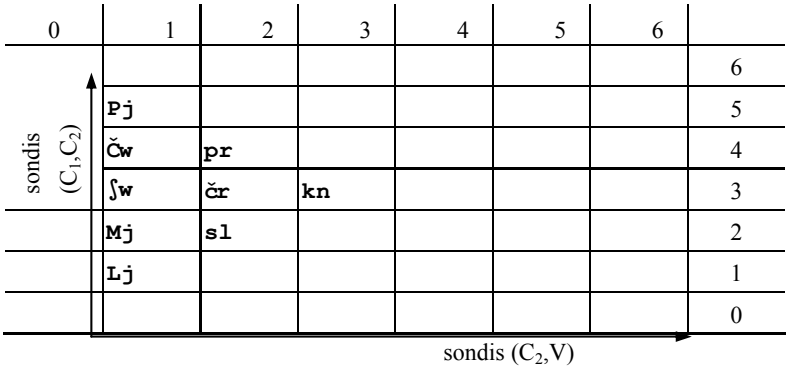


Fig. 3. Cluster Space of preferred double initials.

[14] Voicing used to be included in some sonority scales, since voiced sounds are more sonorous than voiceless ones. However, a distance between sounds of different manners is not compatible with a distance in voicing: one cannot order one scale along two criteria.

Sonority distance between the two consonants of the cluster is plotted on Y [sondis (C_1,C_2)], sonority distance between a vowel and a consonant neighbouring on it – on X [sondis (C_2,V)]. Clusters are plotted according to the condition 1. above (*i.e.* a given value Y must be bigger than or equal to its corresponding values X). In this way, we arrive at a picture representing the space of initial double clusters. For the sake of clarity of the picture, the consonants in the clusters shown in the graph are specimens of a given class having the same sonority value (*e.g.*, /p/ represents stops, /j/ represents semivowels). This means that /pj/ stands for any stop + semivowel cluster. Within so depicted cluster space we can differentiate among degrees of preferability of clusters: the best are the ones showing the biggest difference between the two values of *sondis*. Thus, the best clusters are the /pj/-type ones, then /čw/, then /pr/ and /ʃw/, then /čr/ and /mj/, and finally /kn/, /sl/ and /lj/-type ones. Clearly, a condition (or constraint) which does not impose an absolute requirement on the outputs must be a preference.

The working of the NAD Principle is illustrated below (a preliminary version).

Net Auditory Distance NAD
What contributes to NAD?

- sonority distance sondis
- POA distance POAdis
- voice distance voidis

POA

	v e l	(w)					k
	p a l	j					
	d / a		r l	n		S s	C
	l a b	w		m			p
	V	gl	liq	nas		fric	stop affr

SONORITY

Fig. 4. Preferred double initials according to NAD.

The above are the clusters that formed a preferred cluster space for initial doubles. They all also observe the preference for initial doubles, but on the above graph, with the help of NAD, one can show that *e.g.* /pw/ is worse than /pj/, or /pr/ is better than /tr/ etc.

The preference for C1C2V (*i.e.* initial double clusters) reads now:

NAD C1C2 ≥ NAD C2V

since:
sondis C1C2 ≥ sondis C2V
POAdis C1C2 >> max
voidis C1C2 >> max (C1 >> vless, C2 >> vd) and voidis C2V >> min (C2 >> vd, V = vd)
how to calculate NAD:
NAD = $\sqrt{(\text{sondis}^2 + \text{POAdis}^2)}$ + voidis
(I suggest that voidis has only two values: 0 or 0.1)
e.g. /pj/
sondis = 5
POAdis = 2
voidis = 0.1
NAD = $\sqrt{(5^2 + 2^2)}$ + 0.1 = $\sqrt{29}$ + 0.1= ca. 5.4 + 0.1 = ca. 5.5

Cluster spaces for preferred double clusters in initial, final and medial position are shown below.

sondis (C_1,C_2)

								6								
						jp		**5**		pj						
					rp	wč		**4**		čw	pr					
				nk	rč	w∫		**3**		∫w	čr	kn				nk
	ps	čn	st	nč	ls	jm		**2**		mj	sl	čn	ls, ps	nč	st	
	pč	čs, čt	sn, sč	nl, ns	ln	jl		**1**		lj	nl, jl	ln, sn	ns, čs	sč, pč	čt	
	pt	čč	ss	mn	lr	jw		**0**		jw	lr	mn	ss	čč	pt	
	6	5	4	3	2	1	0		0	1	2	3	4	5	6	

sondis (V_1,C_1) sondis (C_2,V_2)

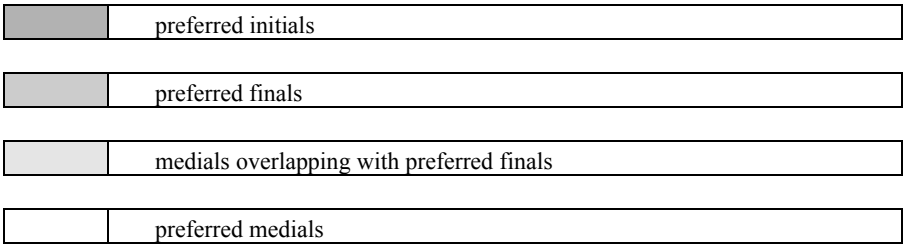


Fig. 5. Cluster Spaces of preferred double initials, finals and medials.

4.2 *Diachrony of English clusters in view of universal phonotactics*

Let us examine the historical changes in the phonotactics of English clusters from the point of view of B&B phonotactics. One general remark refers to any reduction of a cluster: their motivation is the CV-preference.

HISTORY OF ENGLISH	**UNIVERSAL PHONOTACTIC PREFERENCES**
/hn-/, /hl-/, /hr-/ and /hw-/	The /h/ + sonorant clusters were reduced in a specific order which can be explained by the phonotactic preference for initial doubles: fricative + nasal belongs to the medial clusters space, so it was reduced first as the worst of the discussed clusters. Fricative + liquid as well as fricative + glide clusters belong to the initial clusters space, but the former are worse than the latter. Thus they were reduced in this order, and /hw-/ even remained in some dialects.
/hn-/, /hl-/, /hr-/ stood for preaspirated or voiceless [n̥ l̥ r̥]?	If /h/ + sonorant stood for monophonematic entities, *i.e.*, CV's, then the order of "undevoicing" them can also be explained: /w/, being most sonorous, needs voicelessness to strengthen as an initial consonant most, and thus may even today be voiceless.
/wl-/ and /wr-/ *wlispian* > *lisp* *wrītan* > *write* *wlæfian* > *blaffere*	Glide + liquid clusters belong both to final and medial clusters space, and they are the worst in both. Thus, reduction is predictable. /wr-/ stayed on longer probably for articulatory reasons, as being nearer to monophonematic interpretation. The change /wl-/ → /bl-/ is a clear improvement of cluster (and a very economical one, by one-feature change): /bl-/ is a very good initial cluster.
/fn-/, /gn-/, /kn-/ *fnēosan* > *sneeze* *gnagan* > *gnaw* *cnēo* > *knee* kʰn → kˀn → tˀn → (t)n̥n → n *fnasten* > *gasp*	Fricative + nasal belongs to the medial cluster space, so the change from /fn-/ to /sn-/ does not essentially improve the cluster, although /s/ is stronger than /f/ and as such improves the perceptual distance between C1 and C2. The change to a single consonant is a change to CV. Stop + nasal clusters are the worst of initial clusters, and as such do not have to be eradicated; the proposal of a gradual change via assimilation would thus be supported.

HISTORY OF ENGLISH	**UNIVERSAL PHONOTACTIC PREFERENCES**
Yolk, *chalk*, *half*, *psalm* BUT *alpha*, *Alfred*, *salvage*, *Albert*, *Albion*	/-lk/>/-lf/>/-lm/, and the first is final, the second both final and medial, the last one is medial, so especially the last one should be reduced. The same clusters are maintained in the medial position, which is the best position for a cluster to be preserved.
Clīm.ben > *climb* *wīn.den* > *wind* siŋ.gan > siŋgən > siŋən > sɪŋ	Nasal + stop clusters overlap between final and medial. It is predictable that they should be more stable in the medial position than in the final one.
/p, t, k, b, d, g, s, f, θ, v, m, n, l, h/ with /j/	All the listed clusters with /j/ as a second element belong to the initial clusters space. An oscillation between consonantal and vocalic glide element is thus well sanctioned, since if a cluster actually arises, it is the most preferred.
/θl-/, /θr-/ > /fl-/, /fr-/ /θr-/ > /tr-/, /dr-/	Fricative + liquid clusters are the worst among preferred initial doubles. The change of C1 from a dental to a labiodental is a slight improvement in terms of consonantal strength. The change of C1 to a stop substantially improves the cluster (the distance C1-C2 increases by 2).
wuldor vs. *morðor* *fealdan* vs. *weorðan*	Liquid + fricative clusters belong to the overlap area between final and medial ones. Liquid + stop are typically final. This direction of change (by stopping) makes the clusters suitable for word-final position.
Hlǣfdige > *lav.di* > *lā. dy*	Fricative + stop is a good medial cluster; here, however, a CV-preference prevailed.
/fn-/ → /n-/ (→/sn-/) but /fl-/ & /fr-/ stayed	As already mentioned above, fricative + nasal belongs to the medial cluster space, so the reduction in an initial position is predictable. Fricative + liquid are within the initial clusters space, and were retained.

5. FINAL REMARKS

In this paper, I have adopted two perspectives to the study of historical English phonotactics. Within the first perspective I referred to historical phonostylistics by finding parallels to putative historical processes in present-day conversational English. It appears to be possible to identify processes which led to historical changes with those active in the speech of modern speakers of English. This reflects a holistic and universalist approach to phonology: phonology operates with speaker-friendly and listener-friendly processes in order to solve articulatory and perceptual conflicts of speakers no matter the time frame.

Within the second perspective, I investigated the diachronic modifications of clusters from the point of view of universal phonotactics. All investigated changes in English consonantal phonotactics obeyed universal phonotactic preferences, *i.e.* all of them were changes in the

direction of improvement of structure towards a more preferred structure. No dysfunctional cluster arose as a result of those changes (of course, some of the clusters had been dysfunctional already at the stage of input to the discussed changes).

Both perspectives appear to offer promising paths for future research.

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