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English phonotactics[1]

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This article presents an analysis of the phonotactic structures of English presented in *The Cambridge English Pronouncing Dictionary*, paying attention to morphological boundaries, the difference between stressed and unstressed syllables, the difference between native and non-native, and considering the distribution of vowels as well as consonants. The phonotactic status of names turns out to be unlike the status of other morphologically unanalysable words, and some new observations are made on consonant clusters as well as vowel sequences, which have previously been overlooked.

1 Introduction

This article presents a description of the phonotactic patterns of English as shown in a single database. Gimson (2001 and earlier editions) provides an excellent first approach to English phonotactics, which has served most researchers well for many years. However, it is not a very sophisticated approach, in that it has, for example, nothing to say about vowels. While the current presentation leaves open some important questions – as will become clear in the course of the exposition – it is hoped that it provides an update on the Gimson material which may be of value to phoneticians, phonologists, morphologists, language historians and language teachers. Other treatments cover different aspects of phonotactics, including Kruisinga (1943) and Dziubalska-Kołaczyk *et al.* (2013), and many phonologists give a more or less complete discussion of English phonotactics in discussing syllable structure, morpheme structure rules or sonority. The sources of their data are rarely explicit, and statements on what is not possible are often of dubious validity.

A brief introductory comment is required on notation. Apart from the usual transcription symbols, I use the names of the lexical sets from Wells (1982) (so the DRESS vowel is the same as /e/ in the system used here), C to stand for any consonant, V to stand for any vowel, X to stand for any random string of sounds, including no sound at all, and # to indicate a word-boundary. Following IPA practice, a syllable division is indicated by a full stop/period where required. I use the percentage sign (%) to indicate a pronunciation where my source (see below) gives more than one variant. The source does not generally indicate how frequent the variants are, so this should not be read as

[1] The research for this article was undertaken while I as on sabbatical leave from Victoria University and Visiting Professor at Newcastle University, UK. I should like to thank both institutions for their support in making this research possible. I should also like to thank Melanie Bell, the anonymous referees for *ELL* and Patrick Honeybone for their comments on earlier versions, which have been invaluable in improving this article.

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suggesting either a majority form or a minority form. The alternative(s) may, of course, not show the feature being discussed.

The examples used for this study are taken largely from Jones (2003), and even more specifically from the searchable CD version (henceforth *EPD*). There was a conscious decision not to use Wells (2008) because of its syllabification, and *EPD* is then not only the most recently up-dated pronouncing dictionary, but also the only one with a CD.

The value of having a dictionary as a database is great: coverage is extensive (it can never be exhaustive) and not restricted by the vagaries of the topics covered in a corpus, the material has not been prepared with the study of phonotactics to the fore and so is independent of the problems it is being used to solve, and the transcriptions are independent of the scholar who is examining the question of phonotactic structure. Nevertheless, dealing with a database like this does have some drawbacks.

Some care is required with this database, since the search engine is not as useful as it might be. Not only does it treat both FACE + COMMA and DRESS + NEAR (an impossible sequence, as it happens) as the same sequence of three symbols ([eɪə]), it also fails to allow the use of syllable boundaries in a search string (even though they are marked). The main problem, though, is that the search engine has difficulty in interpreting those places where the authors have left some partially transcribed sequence as an alternative or as an addition to some other transcribed sequence. For example, the word *defibrillation* comes up as having a geminate /bb/ in its structure, which is not, in fact, intended, and all twenty hits for /ff/ are erroneous. There are also significant numbers of typographical errors, especially with final /s/ for /z/ (see e.g. sv *subtotal*, where the plural is marked with an /s/, or search for final /ŋs/, which is said to be found in *helpings*). Nevertheless, in general terms, the information provided by *EPD* was taken at face value. This means, for instance, that I do not query the validity of the transcriptions provided of individual words except where there seems to be some inconsistency involved.

This has two very important implications. The first is the variety of English transcribed. The editors of *EPD* reject the term 'R[eceived] P[ronunciation]' in favour of 'BBC English'. Whichever label is used, what is referred to is a non-localizable accent of England (and, to some extent, Scotland), and even of some of the Commonwealth countries. I retain the old label 'RP' here, because 'BBC English' seems to me to give too much focus to the broadcast nature of the accent, and RP is no longer ubiquitous in broadcasting.

The second point is that I accept the syllabification given by *EPD*. Any syllabification of English is controversial, but that in *EPD* seems to me to be less controversial than that used by Wells (2008). Having said that, both these sources agree that elements of morphological compounds like *houseboat* appear in separate syllables (and, although *EPD* does not specifically mention this, the same is true for many prefixes), both reject ambisyllabicity and, within their constraints, maximize onsets. Wells, though, does not demand that a stressed short vowel should have a coda consonant within the same syllable, allows /tr/ as a coda cluster, and maximizes stressed syllables (Wells

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2008: xxvii). While these points are well justified (see also Wells 1990), it is my judgement that they make his syllabification more controversial. From time to time, this has implications for the analysis, but it is important that I should not provide my own syllabification in order to avoid prejudging the outcome. Where readers prefer alternative strategies of syllabification from those used in *EPD*, they may find that they accept different solutions to those I present.

Where morphology is concerned, what is important for this article is the notion of morpheme boundary (and hence, indirectly, the notion of morpheme or morph). While there are cases where the borderline between morphs may be in dispute, such examples are largely irrelevant for present purposes. There are instances, though, where the degree of morphological analysability of a word may be in question, and such words are specifically mentioned.

There are many questions of a theoretical nature that arise from the data I present here. In general terms I ignore these. Not only would they make this article far too long, but it is also the case that I see my role here as providing better data for theoreticians to work with, rather than providing a theoretical interpretation of my own. Even the presentation of data is controversial (since we can argue about the limits of good data); interpretations would be much more so.

2 Some preliminaries

Any attempt to look at phonotactic patterns immediately raises a number of fundamental issues. In this section I consider some of these, and, where possible, justify a stance.

2.1 Cluster and sequence

Following Abercrombie (1967: 76) and other authors (e.g. Giegerich 1992 and Kenstowicz 1994 who specifically comment on the syllable as the ideal domain for phonotactic statements, and Ashby & Maidment 2005: 146), I distinguish between a consonant cluster and a consonant sequence. A consonant cluster is found within the confines of a syllable, while a consonant sequence may go beyond the confines of the syllable. Thus in *sphere* there is a /sf/ cluster, but in *dysfunctional*, the sequence /sf/ is not cluster because the source shows the two consonants to be divided by a syllable boundary. In general terms, I am interested here in consonant clusters – which is why the syllabification given by the source is so important. Clusters are more constrained than sequences, even if sequences are restricted to those found within the word (assuming some suitable definition of 'word'). This means that any study of consonant sequences must contain at least all of the consonant clusters, and expand from there, which makes clusters the most restrictive set, and thus, to my mind, the most interesting. This also means, though, that I am rather inconsistent in my treatment of consonants and my treatment of vowels. Vowel clusters in English are involved only in the creation of diphthongs and triphthongs; by definition, other groups of vowels are found over syllable boundaries, and are thus sequences. By treating all vowels as unitary (see

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section 2.5), I exclude diphthongs and triphthongs from my study, and thus deal with sequences of vowels, but clusters of consonants.

2.2 Native and loan

From a phonotactic point of view, native words do not behave in precisely the same way as non-native words do. There are very few words in English that begin with #/sf/. Examples are *sphere, sphincter, sphinx* all borrowed, originally if not directly, from Greek. If there are words in English that begin with #/dv/ they are the name of the composer *Dvorak*, and the Sanskrit loan *dvandva*. Words with final /ʒ/#, such as *beige*, *garage* (%), *liege* (%) are direct borrowings from French. Clearly, the phonotactics of loan words does not necessarily match the phonotactics of native words, although in many instances a loan word is forced into an English pattern. For example, the name of the country *Sri Lanka* is usually in my experience pronounced in English with an initial #/ʃ/ despite the spelling.

The difficulty is in deciding what is native and what is foreign. The word *milked* is a perfectly ordinary native word, but the final cluster /lkt/# occurs with no morpheme boundary before the final /t/ only in the word *mulct*, which is originally Latin. Is *mulct* sufficiently nativized to count as native for phonotactic purposes or not? Such questions must remain rhetorical, because any answer to them requires taking a stance on some other factors. All that can be done is to take care to indicate where words which illustrate a particular pattern are clearly or probably non-native in origin, and also to be aware of the variation in pronunciation of words like *tsunami*, which sometimes fit (/suːnɑːmi/) and sometimes break (/tsuːnɑːmi/) the most general patterns of English phonotactics.

In principle, it is possible to find some kind of independent measure of foreignness which might solve this problem, and allow a non-circular definition of 'native'. It has been suggested to me that lexical strata might allow this. However, not only would I dispute the notion that lexical strata give a consistent and coherent view of the distinction (see Bauer *et al.* 2013: esp. chapter 27), but lexical strata generally categorize affixes rather than bases, and the distinction would have to apply to both to be valuable for phonotactic purposes.

2.3 Speech style

It is one of the commonplace observations about English phonotactics (e.g. Gimson 2001: 243; Roach 2000: 71) that the maximum final consonant cluster length is four, as illustrated by the words *sixths*, pronounced /sɪksθs/. However, for many speakers, including the author, a particularly clear pronunciation may actually contain five consonants in the final cluster, /sɪkstθs/, while in less pedantic speech, for most speakers, many of the consonants are omitted, and we find [sɪksː] or even /sɪks/, indistinguishable from *six*. What style should be used as a basis for statements about phonotactics?

One of the factors to be taken into account here is that in less explicit styles, there may be an indefinite number of extra sound types which cannot be known a priori. Consider, for instance, Brown's (1977) transcription of a British newsreader's pronunciation of the word *because* (in unstressed position) as [pxəz]. In one sense, English does not 'have'

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a voiceless velar fricative; yet such a segment can occur when articulatory gestures are not carefully completed. Similarly, there is no real contrast in English between [sp$^{=}$ɔːt] 'sport' and [sp^{h}ɔːt] 'support', because the aspirated plosive in the second example arises because of the deletion of a vowel before the plosive, so that the /s/ and /p/ do not form – at some level of analysis – a cluster at all. Pronunciations like [pxəz] and [sp^{h}ɔːt] can be predicted by general principles from the more formal or careful pronunciation. The same is true of labio-dental plosives, and a host of other forms which, in the structuralist tradition, are termed allophonic or free variants, or diaphones (Jones 1960: 53–4). Another way of looking at this is to ask about the level of analysis at which phonotactic generalizations are assumed to be valid. The string [pxəz] is a superficial, phonetic level rather than a phonemic or underlying level. Presumably, there is a phonotactics of phonetic segments as well as a phonotactics of more abstract entities, and the question is where the possible, interesting or most valuable generalizations can be made. Fudge (1969) discusses phonotactics of systematic phonemes, and Kruisinga (1943) makes some reference to phonotactics of allophones.

Accordingly, the style (or level of representation) that is used as a basis for discussion here is a careful but not pedantic style, which might occur in natural speech in formal but un-self-conscious production. This is fundamentally the style that all commentators have described, and is the style which is transcribed in pronunciation dictionaries including *EPD*. Ashby & Ashby (1990: 176) call this 'orthoepistic style'. It is not enough to term it a 'phonemic level', since phonemes can be used to describe various styles of elision and assimilation. Scholars often provide no overt comment about what might happen in other styles (though see McMahon 2002: 129 for a brief comment, and Algeo 1975 for a deeper investigation of one aspect), despite the importance of this topic for a study of phonotactics.

2.4 Variation

Even within the kind of style that has been described above, there is a certain amount of variation in pronunciation. Some of this is dialectal, and it is easy to dismiss a great deal, if not all, of this variation as dialectal in a wide sense (i.e. including social, gender and age dialects as well as regional ones). The homogeneity myth, though, is potentially dangerous. Among other things, it may mask change in progress. But even where we have no particular reason to suspect change in progress, as with word-final /ŋ/, the variation between [ŋ] and [n] at the end of a word like *hunting* contrasted with the variation between [ŋ] and [ŋk] in words like *something, anything*, shows important lexically defined areas of pronunciation variation. Where phonotactics is concerned, gemination over morpheme boundaries in words like *seal-less*, *soul-less* may be variable, and this means that the bi-morphemic nature of the words in which it occurs is only variably overtly signalled.

One major problem for the phonotactics of English tied up with variation is the question of epenthetic stops in words like *dance*, *length* and the variable assimilated pronunciation of *twopence* as /tʌpəms/ varying with /tʌpms/. In each of these instances, and the hundreds that are like *dance*, we have two options: /dɑːns/ and /dɑːnts/, /leŋθ/ and

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/leŋkθ/, /tʌpəms/ and /tʌpəmps/. *EPD* simply shows the stop as optional, and searches of the database find a word like *length* illustrating either /ŋkθ/# or /ŋθ/#. In my experience, which is not, it must be admitted, largely of speakers of Received Pronunciation, most younger speakers include the /t/ and cannot without training produce a word like *prince* so that it is not homophonous with *prints*. The *length* case is rather more complex, not least because there is also an alternative assimilated form, [leŋ̪θ], which may be a feature of some regional dialects. The *tuppence* case usually occurs word-internally, in a name like *Gimson*, for instance, and the /p/ is usually pronounced – perhaps by analogy with words like *attempt* and *glimpse* where there is an orthographic <p> to support the [p]. Both varieties of these strings will be found at different points in the transcriptions here, on the basis that both varieties provide strings which form part of the phonotactics of English. It would, however, be reasonable to exclude one of each of these pairs of possibilities.

Another similarly problematical area is what to do with words like *amidst, breadth, svelte, Svengali, width*. In each of these cases the orthography supports the notion that there is a cluster of a voiced obstruent with a voiceless obstruent within the syllable, something which is usually seen as contravening one principle of English phonotactics.[2] In all such instances there is an alternative pronunciation with only voiceless obstruents (although this alternative is not always listed in *EPD*). Gimson (2001) overtly takes the voiceless sequences as the default pronunciation, and ignores the version with mixed voicing (at least in coda-position). *EPD* lists both options with the all-voiceless option first in most, but not all cases (in *hundredth*, the /dθ/ pronunciation appears to be given precedence). In *svarabhakti* and *Sverdlovsk* no /sf/ option is listed, though it is for *svelte* and *Svengali*. Pronunciations with mixed voicing are certainly found, probably supported by the spelling (and, where relevant, the morphology). I have included all of these here, on the same principle as was given above for the /ns/ and /nts/ variants.

2.5 The elements

Phonotactic statements depend crucially on the elements that are assumed to be in syntagmatic relationship with each other. The consonant /j/ is generally assumed to have a very limited distribution by most transcribers, never occurring word-finally, or closer to the nucleus than a liquid or an obstruent. However, in the Trager-Smith transcription system (Trager & Smith 1956), where the FACE vowel is transcribed /ej/,[3] /j/ no longer has the same limits on its distribution. Words like *stay, stale, staid* show strings of /j/#, /jl/# and /jd/# respectively.

There are four places where there are particular questions to answer, each of which will be discussed below: the transcription of long vowels and diphthongs, the nucleus in

[2] This claim assumes that clusters are found purely within the syllable, as discussed above (2.1). The same constraint does not necessarily hold over a syllable boundary, so that /əd.hɪə/ and /əb.sɜːd/ are not considered to be problematic. *Absurd*, however, may also be pronounced both as /əp.sɜːd/ and as /əb.zɜːd/ (the /p.s/ version is not in *EPD*).

[3] Strictly, Trager & Smith use /y/ rather than /j/, but I retain the IPA symbols here.

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a word like *cute*, the initial consonants in words like *spill, still, skill* and the analysis of the affricates. Most other questions of the phonemic structure of English are generally agreed and have no particular relevance for phonotactic statements.

There is a firmly established view of diphthongs in English that they should be transcribed with a string of vowel symbols, so that FACE is transcribed /eɪ/ (this is the case in virtually all British textbooks, dictionaries and pronunciation dictionaries). In systems which take this approach, long vowels such as FLEECE are generally marked with a length mark, or else the length is taken as being predictable from the quality of the vowel (see, e.g., the transcription systems in Giegerich 1992 and McMahon 2002). The Trager-Smith tradition uses /j/ and /w/ as the end points of diphthongs (and long vowels – GOOSE is transcribed as /uw/), and one of the arguments in favour of this approach is precisely that it increases the regularity of phonotactic statements. Trager & Smith use the notation /ah/ for the PALM vowel, since there are no length marks in the system, and none of /r, j, w/ is appropriate. Because I am fundamentally using a British transcription, and the use of the symbol /h/ for vowels PALM is phonetically very dubious, I shall use the vocalic symbols here. However, I do not wish to consider /eɪ/ and other diphthongs as clusters of vowels, because then we would find a large number of clusters of /e/ and /ɪ/ (every time FACE occurs) but no clusters of /e/ and /ʊ/, which might be considered a phenomenon which required explanation. Thus for my purposes here these symbols will be treated as unitary. The transcription symbols do not reflect this unitariness, but will be maintained because of their familiarity and to avoid attempting to set up a pseudo-phonetic set of symbols to replace them. For some discussion and a different conclusion, see Sommerstein (1977: 32–4).

Brown (1977), Giegerich (1992: 157–8), Roca & Johnson (1999: 277) and, particularly, Davis & Hammond (1995) argue that the vowel in a word like *cute* should be seen as diphthong, so that *cute* is transcribed /kɪut/. The default view of this, as indicated in the pronunciation dictionaries, for instance, is that the first element here is consonantal /j/. Whatever happens here, there are phonotactic consequences. If we transcribe this element with a vowel symbol, the initial CCC clusters described in most textbooks are made up of /s/ + stop + {l, r, w} (with /j/ missing in the last slot, although it is part of the same class as /w/); it would also turn out that the diphthong /ɪu/ would have a very limited distribution; if we transcribe it with a consonant symbol, onsets whose last element is /j/ occur only before a very small subset of vowels. On the whole, the system which sees *cute* as being /kjuːt/ seems to make fewer presuppositions, although each has its strengths. This transcription will be used, but the alternative will be borne in mind.

The clusters /sp, st, sk/ provide a number of well-known problems for English phonology.[4] They are often cited as an example of phonological neutralization, since there is no contrasting */sb/ etc., and the phonetic quality associated with what is

[4] There has been a large amount of discussion of these forms in the literature from several points of view, and it is not my intention to revisit it all. See, for example, Davidsen-Nielsen (1969, 1974, 1975), McCasland (1977), Montpean (2006), Reeds & Wang (1961).

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transcribed /p/ in such clusters is suitably ambivalent between the qualities associated elsewhere with /p/ and those associated with /b/, being voiceless like /p/ and unaspirated like /b/. Some authorities run into problems because these clusters appear to break the sonority profile of the syllable (e.g. Giegerich 1992: 137) when they occur in initial position because /s/ is considered more sonorous than /p/ (or the other plosives) and sonority is expected to decrease from the nucleus of the syllable to the periphery. I say 'appear', since a less nuanced sonority hierarchy in which all obstruents were attributed the same degree of sonority in English would accommodate such cases easily. In phonotactic terms, /sp, st, sk/ provide a problem since most initial CCC strings in English begin with one of these clusters. If /sp/ were taken to be a single consonant (rather like the affricates, for instance), perhaps transcribed /π/ (and similarly for the other two clusters[5]), then we would gain a generalization that a maximum onset consonant cluster in English has two slots in it (though note the rare /slj/ in words like *sleuth* added in the discussion in this article, not used by all speakers, but still listed in *EPD*). *Sprang* would then be /πræŋ/. Unfortunately, if this monophonemic solution would provide one benefit, it would create other disadvantages. If we consider the final clusters [sp] and [ps], it is the latter which has the potential to upset sonority gradation, and yet it is presumably the former which would have to be associated with the initial cluster. So *apse* would have to be /æps/, while *asp* would be /æπ/, and the breach of sonority gradation would remain at the ends of words. Moreover, we would not see any corresponding reduction in the length of possible final clusters. Accordingly, there seems to be little benefit to a monophonemic reanalysis, and the transcriptions /sp, st, sk/ will be retained.

Several contrasting theoretical analyses of such forms have been provided in the literature. Wiese (1996) terms the corresponding German forms 'suffricates', and opts for a monophonemic analysis like the one just rejected above; the facts of German do not precisely match those of English, when it comes to justifying this analysis, though. Kaye (1992) analyzes the /s/ in such forms as the coda in a preceding syllable that has no nucleus, and thus not as part of a cluster at all. Many others, and we can cite Giegerich (1992) as representative of them, treat the /s/ as an appendix, prosodically different from the other consonants in the cluster. This plethora of treatments just makes it clear that many theoretical analyses of the same phonetic data are possible, and shows that the analysis with the fewest theoretical presuppositions has benefits in an article like this one.

Finally, there is the question of the status of the affricates. Most analyses of English treat the affricates as monophonemic, contrasting them with a biphonemic sequence in a form like *nutshell* /nʌt.ʃel/. The case for this is made by, for example, Martinet (1939), and the case has been made even stronger by subsequent commentators including Vachek (1973) and Harris (1994). Yet it might appear that it would be more economical

[5] A reviewer suggests the use of a tie rather than a separate symbol [π], chosen to indicate that this is a single phoneme. Apart from the fact that my computer refuses to print a tie, all that is important is that the transcription should not be just the same as s+p, etc.

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in terms of the number of segments (if not in terms of rules) to say that the reason that we get the /ɪz/ allomorph of the plural morpheme on *arch* is because it ends in a sibilant /ʃ/, rather than having to add an extra two phonemes (/ʧ/ and /ʤ/) to the list of sounds that require this allomorph, and having to allow non-continuant sounds to be classified as sibilant.[6] Such economy, however, would come at some cost, since there is no other place where English allows initial clusters of plosive + fricative (except for the occasional pronunciation of clusters such as /ts/, /dv/ and /kv/ in loan words). There are, it is true, phonotactic problems with the affricates: why do they not allow following /l, r, j, w/ in initial position as the other plosives do? But it seems better to face such problems than to create further problems in trying to solve them. The affricates, like the diphthongs, will here be seen as unitary, as, indeed, is generally the case.

It should be noted that the alternative (and here discarded) analyses are motivated by appeal to phonotactic structure. To adopt them in an article on phonotactic structure would therefore run the risk of circularity of argument. This is perhaps the best argument for discarding these alternatives for the basic analysis, even if I shall refer to these analyses from time to time where they are relevant.

3 VC sequences

Most vowels can be immediately followed by most consonants, except where there is some general systematic rule against it, such as the lack of final /h/. This is illustrated in table 1, where lightly shaded cells indicate that there is some factor which makes the included example at that point slightly odd – the presence of an extra consonant, an extra syllable or stress on a different syllable, for example.

The words in table 1 are not necessarily from *EPD*, and even those that are may have alternative pronunciations in *EPD*. Vowels with following /r/ in the same syllable are not found in RP, but in rhotic varieties such as standard varieties of North American English. If more rhotic varieties were considered, it would be possible to find a greater range of vowels before /r/: for example, *four* may be /fəʊr/ in varieties not covered by *EPD,* but captured by Kenyon & Knott (1953). In general, *EPD* does not distinguish the NORTH and FORCE lexical sets, and this distinction is not reflected in the table. Consonants following NEAR, SQUARE and CURE are a subset of those that, in an earlier stage of the language, could have appeared as the final consonant in an /rC/ cluster.

Some of the gaps in the combinations of vowel and consonant have sometimes been pointed out as significant. Most of these generalizations do not hold, or hold only with reservations. Shaded but empty cells show some of the gaps which may be significant. Other gaps are assumed to be accidental (for instance, due to the rarity of certain consonants or vowels).

The MOUTH vowel is often said (e.g. Spencer 1996: 87) to be followed only by coronal consonants, but is illustrated followed by labials in German loans and by /k/

[6] I have seen this argument made, perhaps as a straw man, but have been unable to trace its origin. My apologies to the originator.

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Table 1. *Vowels with following consonants*

	p	b	m	f	v	t	d	n	θ	ð	s	z
KIT	kip	jib	Jim	if	give	lit	lid	din	kith	with	kiss	is
DRESS	step	neb	hem	Geoff	rev	get	led	pen	death	feather	guess	fez
TRAP	tap	tab	ham	naff	have	hat	had	man	math	gather	mass	as
STRUT	tup	tub	hum	huff	love	cut	cud	sun	nothing	other	us	fuzz
LOT	hop	hob	from	off	of	hot	hod	on	moth	bother	moss	Oz
FOOT			room	hoof		foot	hood				puss	Soyuz
FLEECE	heap	grebe	cream	reef	Eve	eat	need	seen	teeth	teethe	fleece	fleas
PALM	harp	garb	palm	half	halve	heart	hard	yarn	hearth		pass	parse
THOUGHT	gawp	orb	form	(off)	mauve	ought	lord	lawn	fourth		horse	hawse
GOOSE	loop	tube	loom	proof	move	hoot	food	goon	youth	smooth	moose	lose
NURSE	burp	verb	worm	surf	serve	wort	word	earn	worth		Erse	furze
FACE	ape	Abe	aim	waif	wave	wait	aid	sane	wraith	bathe	ace	haze
PRICE	pipe	bribe	lime	life	live	light	hide	line		lithe	ice	eyes
CHOICE				coif		quoit	buoyed	coin			rejoice	boys
MOUTH			Lebensraum	Langlauf		out	loud	gown	mouth	mouth	mouse	cows
GOAT	hope	robe	roam	oaf	drove	oat	ode	own	oath	loathe	gross	hose
NEAR					Niamh	Fiat	beard				tierce	shears
SQUARE	Shairp		Perm			airt	laird	cairn			scarce	airs
CURE			vacuum			Stuart	cured	Ewan			sensuous	cures

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Table 1. *Continued.*

	ʃ	ʒ	ʧ	ʤ	l	r	k	g	ŋ	Ø
KIT	fish		itch	midge	ill	fear	kick	dig	ding	
DRESS	mesh	cortege	etch	edge	sell	square	neck	egg	length	yeah
TRAP	mash		hatch	badge	pal		pack	nag	hang	
STRUT	lush		such	sludge	hull		suck	mug	sung	see ya!, uh-huh
LOT	gosh		watch	stodge	col		mock	log	long	
FOOT	push			Lodz	pull	sure	book		Anschauung	
FLEECE	leash	prestige	each	liege	eel	seer	seek	league		fee
PALM	marsh	corsage	arch	large		car	hark	Prague		shah
THOUGHT			torch	gorge	all	four	fork	morgue		law
GOOSE	louche	luge	smooch	huge	fool		Luke	fugue		shoe
NURSE			lurch	urge	earl	err	work	burg		fur
FACE	crèche	beige	aitch	age	ail		ache	plague	Laing	hay
PRICE			Crich	oblige	isle	ire	bike			high
CHOICE					oil	coir	yoik	Doig	boing	boy
MOUTH	stoush		ouch	gouge	howl	tower	gowk			bough
GOAT	gauche	Voges	poach	doge	hole		oak	rogue		low
NEAR	kirsch				real					near
SQUARE		auberge			there'll			berg		square
CURE	qursh				cruel			Strasbourg		cure

in the word *gowk* 'cuckoo', a Scottish and dialectal form. Increasingly, young New Zealanders report that they have MOUTH before labials in words such as *twelve* when the /l/ is vocalized. The report is not entirely accurate in that there is a slight phonetic distinction between *how* and *hell*, but if speakers cannot hear the difference, it is likely to prove unstable. If this occurs in New Zealand, it may also spread to other varieties with vocalized /l/, including innovative versions of RP. The consonant /ʃ/ is often said (e.g. Iverson & Salmons 2005) not to follow long vowels, but is found following FLEECE; in RP it is also found following START; it has been borrowed following GOOSE in *louche* and for some speakers following FACE in *crèche* (where it varies with DRESS); as pointed out by Iverson & Salmons, it can occur following long vowels in more onomatopoeic words like *sheesh* and *swoosh*; and in New Zealand and Australian English it is found following MOUTH in the word *stoush* 'squabble, fight', which suggests that the gap here is purely lexical. The short vowels may, despite standard claims to the contrary (e.g. Carr 1999: 76), appear with no following consonant, but typically in expressions which, because they are phonologically reduced phrases or interjections, might not be considered 'real' words. The author (but not *EPD*) has a pronunciation of *yes* as /je/ with final DRESS (also supported in Upton *et al.* 2001, where a final /æ/ is noted in the US pronunciation of the same word), and also an interjection of mild disappointment, of the form [ʔɒ]. On the other hand, the *EPD* reports /te/ as a pronunciation of *tay* in the tonic sol-fa (something I have not been able to confirm elsewhere). Many Australians and New Zealanders have farewells of the form *see you*, *spot you*, *catch you*, where the final vowel is what they would themselves recognize as a stressed STRUT vowel, more open and longer than their /ə/. *EPD* (and also Upton *et al.* 2001) reports final STRUT in positive *uh-huh*. Some speakers for whom the HAPPY vowel overlaps in quality with KIT might be said to have final KIT, but this is not in stressed syllables. The same is true of final FOOT, transcribed by *EPD* as short /u/, which may occur at the end of words like *onto*, *continue*.

It is also often claimed that /ŋ/ can only follow a short vowel (see e.g. Harris 1994: 86), but it can be found following some diphthongs in some names (e.g. *Laing* %) and onomatopoeic words (e.g. *boing*). While it is clearly not true that all interjections have phonotactic structures which reflect the 'real' words of the language (after all, English has interjections of the form [| |] and [‖ ‖] even though clicks are not part of the normal phonemic structure of English words), the difficulty with the examples above is that they shade from clear interjections into more lexical types, and that they shade from an orthoepistic style to a style which may show elisions and the like. The examples here require evaluation; while they should not be accepted as evidence on quite the same footing as names or nouns and verbs, neither can they all be dismissed out of hand.

Gimson (2001: 240) reports that initial single consonants are fundamentally unrestricted by the vowels to which they attach, and I am not aware of any counterclaim. The only thing that might be worth noting is the lack of voiced fricatives (including here /ʤ/) initially before FOOT, except in foreign words. This would not happen in varieties of Northern English that have not undergone the FOOT–STRUT split. The rarity of initial /ð/ is accounted for by its peculiar grammatical distribution, of initial /ʒ/ by

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the fact that it occurs only in loans, and the gaps before /ʊə/ arise through the rarity of that vowel. The lack of initial /ŋ/ has a well-known historical explanation.

4 Top and tail

There does not seem to be any general problem with putting the same consonant on either side of a vowel (with clusters where possible), unless there is some wider phonotactic problem, such as the inability for /h/ to occur finally, /ŋ/ to occur initially or, given the transcription system, for /j/ or /w/ to occur finally. The sounds /ð/ and /ʒ/ happen not to occur twice in the same monosyllable, but both are rare. While not all consonants can occur on the two sides of every kind of vowel (short, long, diphthong), most can. There are, of course, many lexical gaps, so that /baɪb/ happens not to be a word of English, but the basic principle seems clear.

Similarly, any vowel (except /ɪə/ and /ʊə/, which are rare) can occur either side of a consonant in a XV_1CV_1X pattern.

This makes the following set of restrictions all the more exceptional. Where we have a cluster with an initial /s/, there are restrictions on what may come in the coda of the same monosyllabic word. That is, given a syllable of the form sC_1VC_2, there are restrictions between C_1 and C_2.[7]

Given an initial /sl/, for example, C_2 is never another /l/: /sleɪl/ does not appear to be a possible English form.[8] Given initial /sm/ or /sn/, C_2 is never a nasal. And given /sf/, C_2 is never a fricative, although the sample of possible words here is so small that this observation may not mean very much.

With an initial /sk/, C_2 may well be a plosive (*scope*, *skit*), but is rarely a velar (sole exception: *scag*, whose status is slightly odd, since it is a recent instance of word-manufacture). Similarly, following /sp/ a bilabial consonant in C_2 is dispreferred (sole exception: *spam*, originally a blend). However, note that labiodental fricatives may occur: *spoof*, *spiv* (again, words with unusual etymologies). Given this, we might expect to find similar restrictions after /sw/, but we find both labial and velar consonants in the C_2 position: *sweep*, *swab*, *swim*; *swig*, *swing*. An initial /st/ does not appear to cause any systematic gaps. It may also be significant that given an initial /sC/, monosyllabic words never end with the same /sC/ cluster, and despite counterexamples like *space* and *slice*, any /s/ appears to be dispreferred here.

It should be noted that these restrictions are not found where there is no initial /s/: *lull*, *man*, *name*, *face*, *king*, *gawk*. Why the restrictions should arise only with /sC/ is obscure. There is no reason to believe that the Obligatory Contour Principle is in operation (*pace* Pierrehumbert 1994: 186 and references there) (a) because that would

[7] It is not clear to me who first noted these restrictions. Versions of them can be found in Fudge (1969) and Davis (1990).

[8] *Dyslalia* does not have the two /l/s in the same syllable according to *EPD*, nor, for different reasons, according to Wells (2008). See my earlier comments on the importance of syllabification. Certainly the relevant sequence is found here but the claim in Fudge (1969) and Davis (1990) is limited to monosyllables.

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require evidence that the consonants were on one tier and the vowels on another and (b) because the restrictions disappear in the absence of the /s/.

This, of course, raises the question as to whether similar restrictions are found with other two-consonant onsets. None of /pl, bl, kl, gl/ permit a coda-/l/ in a monosyllabic word, though /fl/ permits final /l/ in *flail*. Neither /fr/ nor /ʃr/ allow a coda /r/ (in rhotic varieties) in a monosyllabic word. However, all of /pr, br, tr, dr, kr, gr/ allow coda /r/, though not in high-frequency words: *prayer*, *br'er*, *Trier*, *drawer* and *drear*, *crore*, *Greer*. Clearly, there is no overarching constraint in place here, but neither is choice completely free for all of these clusters.

Not only do three-consonant clusters in general not allow their third consonant to appear in a coda of a monosyllabic word (that is, there are no words of the form /*splVl/ and so on), if we reinterpret long vowels as strings consisting of vowel + approximant (to allow for the possibility of coda /j/ or /w/) the only possibly awkward example we find is *squaw* (or, similar, *squawk*). The question is how we should interpret the THOUGHT vowel in such a transcription system. The string /ow/ would be the GOAT vowel, so that THOUGHT must simply be /o/, in which case the generalization holds. This might be awkward for anyone who says /θɔːwɪŋ/ for *thawing*, but we can leave this aside here.[9]

5 Initial clusters

In the tables below, initial clusters from the Gimson (2001) list are illustrated (with the addition of a number of others not found in Gimson but used in *EPD*), and then illustrated in the pretonic syllable with a /ə/ vowel. This environment allowed for easy searching using the *EPD* search engine. The use of /ə/ guarantees an unstressed syllable (though, of course, in many cases there are alternative pronunciations with full vowels). It should be noted that the lack of a particular cluster from a pretonic syllable does not imply that the relevant string is not found pretonically. For instance, the string /sprə/ is found pretonically in *disproportion*, but only the /prə/ is marked in *EPD* as being the pretonic syllable, with the /s/ belonging to the antepretonic. On the other side of the coin, some of the clusters listed, such as /sr/ and /tl/, though given in the *EPD*, strike this author at least as entirely unlikely from someone who is not at least partly bilingual (or trained). The country name *Sri Lanka* is typically pronounced with initial /ʃr/ in news broadcasts (except by professional broadcasters on BBC Radio 4), and the website http://ecc.pima.edu/~tourism/TVL104/Mexico/MexicoColonialSouthernCities-Tlaxcala.html (accessed 24 April 2013) gives an English pronunciation of *Tlaxcala* with initial /təl/.

Note that the methodology used here does not allow any comment on post-tonic unstressed syllables. Not only is it much more difficult to search for them, many of the sequences that precede them are split over syllables in the transcription given by *EPD*. Thus *Edward*, according to the *EPD*, shows only /w/ preceding the /ə/ and not /dw/, since the /d/ is analysed as being in the first syllable. It may well be that some

[9] Trager & Smith (1956: 27) give /o/, /ɔh/ and /ɔw/ as options for the THOUGHT vowel.

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Table 2. *Initial CCC clusters*

Cluster	In stressed syllable	Pretonic with /ə/	Cluster with no /s/?
spl	splendid	explanation	please
spr	spray	–	pray
spj	sputum	–	pewter
spw	–	–	–
stl	–	–	–
str	strip	claustrophobia	trip
stj	stupid	–	tune
stw	–	–	twinkle
skl	sclera	sclerosis	clear
skr	script	excremental	crypt
skj	skew	obscuration %	queue
skw	square	–	query
sfr	–	sphragistic	phrase
smj	smew	–	music
snj	(snew)[10]	–	nude
slj	sleuth %	–	lucid %

of the gaps in tables 2 and 3 could be filled with evidence from words where the relevant structure occurs in post-tonic positions, but such evidence seems to be more controversial than that I have presented. Of course, there is an alternative view which considers simply consonant sequences (as, for instance, Hammond 1999), and pays no attention to whether they are or are not in the same syllable, and thus clusters in the definition provided above. My method produces a more conservative result. The results that I present here are for clusters found within the same syllable (and, as stated earlier, that is defined by *EPD*, not by me).

In general terms, the onset clusters found in pre-tonic syllables simply confirm the patterns described by Gimson. The gaps with clusters beginning with /ʃ/ are predictable given that such clusters are all found in loan words, specifically from Yiddish, and since Yiddish has fundamentally initial stress, the number of pretonic syllables in the language is low. Rare clusters and those that are found only in loans or onomatopoeic words are also missing from the onsets to pretonic syllables. However, the foreign onsets reported in *EPD* do raise questions. The inclusion of the name *Mladic* is clearly a political decision, but the pronunciation with /ml/ is a linguistic decision. *Bdellium* and *P(h)nom Penh* are not cited with initial clusters, but *Ptah* has a variant with /pt/, and several plosive + fricative clusters are listed. There is a certain amount of inconsistency (which may or may not reflect speaker behaviour). *Kvetch* has initial /kv/ (with an alternate pronunciation with initial /kəv/) but *kvass* has no clusterless

[10] This is in the *OED* with a last quotation from the mid eighteenth century, but may survive dialectally, often as a past-tense form of *snow* rather than the infinitive. There are twentieth-century attestations from places as far apart as Norfolk and Chicago.

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Table 3. *Initial CC clusters*

Cluster	In stressed syllable	Pretonic with /ə/
pl	play	complication %
pr	pray	produce
pj	puce	computation
pw	pueblo	–
pt	ptah %	–
pf	pfennig %	–
ps	psion %	psoriasis %
bl	blue	emblematic
br	brown	Brazil
bj	beauty	carburettor
bw	bwana	–
tl	–	Tlaxcala
tr	train	contraception
tj	tune	postulation
tw	twin	Antoinette %
ts	tsetse	–
dl	–	–
dr	drain	draconian
dj	duke	corduroy
dw	dwindle	–
dv	Dvorak	–
dz	dziggetai	–
kl	clue	encyclopedia
kr	crater	cravat
kj	queue	circularity
kw	quick	quadrangular %
kn	Knesset %	–
kv	kvetch %	–
kθ	chthonic %	–
gl	glue	Glamorgan
gr	grater	epigrammatic
gj	gules	singularity
gw	Gwen	Linguarama
mj	mule	cumulation
ml	Mladic	–
mn	–	mnemosyne %
nj	new	signorina %
lj	lucrative %	ululation %
fl	flew	conflagration
fr	fruit	fragility
fj	futile	refutation
fw	Tierra del Fuego %	–
vl	Vladimir	–
vr	vroom	–
vj	view	ovulation

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Table 3. *Continued.*

Cluster	In stressed syllable	Pretonic with /ə/
vw	voir dire	–
θl	–	Llanelli %
θr	throw	anthracite
θj	thurible	–
θw	thwart	–
sl	slay	Slavonic
sr	Sri Lanka	–
sj	suit %	encapsulation
sw	swear	Swahili
sp	spill	expurgation
st	still	aristocratic
sk	skill	Scholastic
sm	smile	–
sn	snow	Snowdonia %
sf	sphere	–
sθ	sthenic[11]	–
sv	svelte	–
zl	zloty	–
zj	zeugma	–
zw	zouave %	–
ʃt	shtick	–
ʃl	schlep	–
ʃr	shrimp	–
ʃw	Schweppes	–
ʃm	schmalz	–
ʃn	schnapps	–
hj	huge	–
hw	when %	–

alternative listed in *EPD*. *Knish* is given as having an initial /kn/ cluster by Silverman (2006: 8) but not by *EPD*, although *Knesset* is given an optional initial /kn/. The cluster /sf/ is given as an alternative to /sv/ in *svelte* and *Svengali*, but not in *svarabhakti* or *Sverdlovsk*.

In table 2 a column is added showing examples of the C_2C_3 cluster from a $C_1C_2C_3$ cluster where that occurs. In most instances the lack of a given $C_1C_2C_3$ cluster corresponds to the lack of the equivalent C_2C_3 cluster.

Interestingly, *EPD* also lists /sgr/ in *sgraffito*, which is really odd. Given that the /k/ in /skr/ is unaspirated, it is not clear what the difference between /k/ and /g/ would be here; it would seem that only someone with some competence in Italian would be likely to produce the difference.

[11] Noted by Hammond (1999), not by *EPD*.

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6 Final clusters

Final two-consonant clusters are set out in detail by Gimson (2001: 241–2). What is not clear from the Gimson presentation, however, is the extent to which the clusters are in quasi-complementary distribution as to whether they show grammatical (morphological) information – in that one or more of the consonants represents a morpheme on its own – or whether they are purely lexical clusters. I say 'quasi'-complementary distribution, because proper nouns and loans may fall on the lexical side even when the cluster is otherwise used, for the most part, to mark grammatical information (shown with italics in table 4). There are also a few clusters which have a dual function (shaded in table 4). Clusters such as the /nt/ in *spent* are taken here (slightly controversially) to be lexical in that they provide a second stem for the verb (like *gave*), rather than the /t/ part being an unambiguous past tense or past participle marker. The clusters that I mark as having 'grammatical usage' in table 4 are those that Dressler & Dziubalska-Kołaczyk (2006) term morphotactic clusters (see also Ritt & Kazmierski 2015).

Fewer than 50 per cent of these two-consonant clusters appear to be used in unstressed syllables. Given the algorithm used in *EPD* for syllabification, most medial sequences are split across syllables and most single consonants are attributed to the following syllable. To check use in unstressed syllables, therefore, these clusters were searched for in word-final position following /ə/. It may be that they arise elsewhere (particularly if they are part of longer consonant strings), but the search engine on the CD of the *EPD* makes it virtually impossible to search for them. Examples of the clusters following /ə/ are in the final column of table 4: some of these occurrences are alternative pronunciations to variants with a full vowel, but the important thing for present purposes is that they can occur in unstressed syllables. It should be noted that those clusters which have lexical uses when in stressed syllables retain that feature when used in unstressed ones, and similarly for grammatical usage.

Parenthetically, it is not true, as claimed by Spencer (1996: 87–8), that a long vowel or diphthong cannot occur before a CC-cluster where there is no morpheme boundary between the consonants. Examples which break this postulated constraint include *excerpt*, *corpse*, *traipse*; *coax*, *hoax*, *luxe*; *chant*, *daunt*, *pint*, *point*; *range*; *somersault* %; *baulk*; *child*, *field*, *gold*, *shield*; *aft*, *craft*; *clasp*; *blast*, *boost*, *Christ*, *foist*, *waist*; *ask*, *basque*.

Three-consonant final clusters are said by Gimson (2001: 242–3) to be made up of a subset of CC clusters plus one of /t, d, s, z, θ/. The first four of these go onto the lexical clusters given in table 4 as well as onto clusters from the table ending in /θ/. There are no instances of gemination (so, for example, /pt/ cannot take a following /t/) and some gaps, since words ending in /θ/ tend to be nouns, and thus cannot be marked for the past tense with /t/, and words ending in /lb/ are, as it happens, also nouns. Very few three-consonant clusters occur in monomorphemic words, and where this happens, the words are not generally native: *attempt*, *calx*, *chintz* (but *bounce* %, native), *extinct*, *glimpse* (native!), *lynx, mulct*, *sculpt*, *text* (but *betwixt*, native), *waltz* (see also Ashby & Ashby 1990). Rhotic varieties can add *corpse*, *excerpt*, *infarct*, *Marx*, *quartz*, *world.*

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Table 4. *CC final clusters and their uses*

Cluster	Lexical uses	Grammatical uses	Finally following /ə/
pt	abrupt, apt, opt	shaped	bankrupt
pθ	–	depth	–
ps	apse, biceps, copse	apes, bishops, cops	forceps
tθ	[used lexically only where optional in /ntθ/ clusters]	eighth	hundredth
ts	*blitz, Coates, Graz*	admits[12]	abbots
kt	abduct, act,	clicked, cooked	product
ks	apex, axe, wax, fix	beaks, likes	lummox
bd	–	bribed, mobbed	–
bz	*Hobbes, dibs*	bribes, disrobes	Jacobs
dz	*adze, Leeds*	adds, nodes	forwards
dθ	–	width	hundredth
gd	–	begged, sagged	–
gz	*Higgs, bags*[13]	bogs, brags	–
ʧt	–	attached, itched	–
ʤd	–	abridged, divulged	managed
mp	amp, bump, damp	–	–
mt	dreamt %	–	–
md	–	aimed, beamed	fathomed
mf	bumf, nymph	–	triumph
mθ	–	warmth	–
mz	*Glamis, Thames, alms*[14]	becomes, palms	diddums
nt	count, front, daunt	–	adamant
nd	blend, find, hand	twined, weaned	Auckland
nʧ	branch, staunch	–	–
nʤ	avenge, hinge	–	challenge
nθ	*plinth, Corinth, labyrinth*	ninth, tenth	billionth
ns	dance, once	–	alliance
nz	*Athens, bronze, Keynes*	canes, inns	commons
ŋk	bank, drink, zinc	–	–
ŋd	–	fanged, ponged	–
ŋz	*Hastings*	belongs, clippings	–

Oddly, there are some extras: /ŋst/ as in *amongst* and /dst/ as in *amidst*. The final cluster /ŋs/ is found only in the word *phalanx* as an optional pronunciation (/ŋks/ seems more likely). The three-consonant cluster with final /t/ is found in two words, one of

[12] *Its* is slightly odd here: I take it that it is grammatical, like *it's*, but the case could be argued.

[13] As in *I bags the red one*.

[14] Whether *alms* belongs here (as suggested by the *EPD*) or on the right may depend on personal preference for concord with the noun. If it belongs on the left, where I have put it, it is a rare form in this column.

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Table 4. *Continued.*

Cluster	Lexical uses	Grammatical uses	Finally following /ə/
lp	help, pulp	–	–
lt	adult, bolt	–	tumult
lk	bulk, talc, whelk	–	–
lb	bulb	–	–
ld	child, field, old	curtailed, grilled	herald
lʧ	belch, gulch	–	–
lʤ	bilge, indulge	–	–
lm	calm, elm	–	–
ln	kiln, Colne %	–	–
lf	elf, gulf, wolf	–	–
lv	absolve, valve	–	–
lθ	*Builth*	filth, health, wealth[15]	–
ls	else, false, waltz %	–	–
lz	*Brussels, Charles, gules*	ails, bawls, bills	admirals
lʃ	Walsh, Welsh	–	–
ft	aft, loft	bluffed, chafed	Lowestoft %
fθ	–	fifth, twelfth	–
fs	–	briefs, chafes, cliffs	seraphs
vd	–	approved, believed	–
vz	*Jeeves*	hooves, lives, waves	St Olaves
θt	–	frothed, unearthed	–
θs	–	faiths, growths, maths[16]	behemoths
ðd	–	loathed, seethed	–
ðz	*Staithes*	paths, sheathes	–
sp	clasp, cusp	–	–
st	arrest, blast, just	traced, voiced	locust
sk	ask, disk, tusk	–	damask
zd	–	accused, composed	–
ʃt	*borscht*	finished, unpolished	–
ʒd	–	camouflaged	–

which, *angst*, is a loan. The cluster /dst/ is also found in two words (*midst* and *amidst*), where it may be replaced by /tst/. *EPD* lists both pronunciations, but gives /dst/ first.

Gimson (2001: 243) lists very few four-consonant clusters, all of which have at least one morpheme boundary in them. In table 5, which lists some CCCC clusters not included by Gimson (2001: 243), morpheme boundaries are shown by hyphens.

[15] Not all speakers recognize these as being morphologically complex and related to *foul*, *heal/hale* and *weal*, but etymologically that is the case.

[16] *EPD* puts *maths* and *meths* on the lexical side of this equation. While I am not necessarily convinced that the final /s/ shows plurality, I believe it is a morph, and is thus grammatical.

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Table 5. *CCCC final clusters*

ŋkθs	leng-th-s %
ksts	text-s
ksθs	six-th-s
lfθs	twelf-th-s
lkts	mulct-s
lpts	sculpt-s
lsts	Holst-'s
mpst	glimps-ed
mpts	prompt-s
ntθs	thousand-th-s
ntst	bounc-ed %
ŋkst	angst %, jinx-ed

7 Native and non-native

While it is the case that some final clusters occur predominantly or exclusively in non-native words, while others occur more frequently in native words, this does not seem to lead to any particularly insightful analysis. There may once have been a tendency for any final cluster which contains a morphological boundary not to occur in monomorphemic native words (for example, /ps/, which can mark plural or third-person singular present tense, occurs in only 7 native morphemes, and some of those (e.g. *tuppence* as /tʌpəmps/), are derived by processes of assimilation. However proper names (and I have not here distinguished between native and foreign) provide a bridging category between the morphologically complex and the morphologically simple. *EPD* gives 16 names ending in /ps/, and 19 loans ending in /ps/. *EPD* also lists over 700 forms where the /s/ in the /ps/ clusters is a separate morpheme. Where there is no grammatical boundary in the cluster, the cluster is sometimes used more with native and sometimes more with non-native words. Thus /mp/ occurs more often in native than in non-native words, as does /ŋk/, while /ns/, because of the number of Latinate words ending in *-ance* and *-ence*, occurs far more often in non-native than in native words. The clusters /ts/ (the most frequent cluster to illustrate a morpheme boundary) does not occur in native words with no morpheme boundary at all. Neither does /kt/. The cluster /pt/ occurs in native words only in irregular past tenses like *slept* (which is an argument for treating these as morphologically complex, despite what was said above). The clusters /bz/ and /gz/ occur once each in words which might be considered to be native and morphologically simple (*dibs* and *bags* respectively), though the morphological simplicity of both of these might be in doubt. Neither occurs in loans, but both occur in proper names.

Having said that, drawing the borderline between native and non-native is by no means simple (and the *OED* is not always helpful, especially with words which might be intended as onomatopoeic or which might be corruptions of similar forms). Words such as *brank*, *fink*, *jounce*, *nance*, *askance*, *ounce*, *ponce* – to give a very small set

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of examples – are difficult or impossible to attribute to these categories. And words like *act* and *fact*, which are etymologically foreign (hence the comment on /kt/ above), might be considered to have become naturalized by being part of English for so long.

Where initial clusters are concerned, at least /gj/, /vj, /zj/, /zw/, /pw/, /pt/, /pf/, /ps/, /bw/, /gw/, /dv/, /dz/, /kn/, /kθ/, /kv/, /fw/, /sf/, /sv/, /sr/, /sθ/, /vl/, /vr/, /vw/, /tl/, /ʃl/, /ʃw/, /ʃm/, /ʃn/, /ʃt/, /ml/, /mn/ occur exclusively in loan words, and many of these are correspondingly rare and likely to be replaced by phonotactically more regular alternatives (see section 9 below for frequencies). There are many clusters here not listed by Gimson (2001), yet used in *EPD*. If we ignore these clusters, it means that there is no initial cluster beginning with a voiced fricative (except /vj/) and that /s/ and /ʃ/ are neutralized in the first position of English clusters, that there are no plosive + fricative initial clusters in English, or plosive + stop initial clusters in English, or fricative + fricative initial clusters.[17] This leads to a more restricted set of patterns. We might argue that these cases show just how vague the cut-off point for non-native clusters in English is. Does discussion of the regime of Josaia Voreqe (Frank) Bainimarama in Fiji, add an initial /mb/ cluster to English (and if so, is it, as the Fijian is, within a single syllable or is it disyllabic, which seems more likely given disyllabic pronunciations of *Nkrumah*)? Discussion of Al-Quaeda has clearly not introduced a uvular plosive into English, just as the use of *Ravenna* has introduced neither a tap in word-initial position nor a geminate /nn/. Decisions as to which of these phonological events are part of English are either circular (this is not what English allows, and so it must be non-native) or arbitrary (/vl/ is part of English, but /vw/ is not).

8 Word class

Despite the occasional exception like /lb/# (only in nouns) and /lkt/# (only in verbs, but only one lexical example), there does not seem to be any particular specialization of final clusters for word class. This is perhaps not surprising, given how much conversion there is in English between word classes. A cluster like /ks/# occurs in more nouns than verbs, but does occur with *fix* and its derivatives, and in verbs created by conversion such as *cox* and *fox*. This situation is typical. Since there are more nouns than verbs, we find more final clusters in nouns than in verbs, but the clusters are rarely exclusive to any word class, and when they are, it appears to be an accidental distribution.

9 Frequency

There are marked differences in the frequencies of the various clusters. It might seem that given a facility like the *EPD*, it would be a simple matter to give a count of lexical frequency of clusters, but there are a large number of problems in doing this. For instance, the status of proper names is awkward, since they clearly have the possibility

[17] These are not, of course, original observations; the database if taken at face value discredits them, which is the interesting point.

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Table 6. *Lexical frequency of CC# clusters*

Number range	Final CC clusters
<10	dθ, mf, lp, lb, lʧ, lʤ, ln, lʃ,
11–20	lk, lm, lf, lv, ls, sp
21–100	pt, ps, mp, nʧ, nʤ, ld, ft, sk
101–500	kt, ks, ŋk, lt
>500	nt, ns, st

of adding to the amount of exposure there is to a particular cluster, and yet they do not have the same status as other words. With the final cluster /ld/# with no morpheme boundary between the /l/ and the /d/, over 50 per cent of the items in *EPD* are proper names. Native and foreign again might be relevant factors to consider. More important, it seems to me, are the number of cases where the same affix or compound element is repeated in a large number of items (for instance, the suffix *-esque* adds considerably to the number of /sk/# clusters, and the suffix *-fold* has the same effect on /ld/# clusters). Different spellings of the same word (such as *odalisque, odalisk*) and single listings for homonyms (such as *cricket* 'sport' or 'insect') add to the problems of getting an accurate lexical count.

Despite these problems, the range of numbers of attestations in *EPD* is so wide that it seems worthy of reporting. I have classified non-proper-name items into broad number bands: 10 and under, 20 and under, 21–100, 101–500 and over 500. I have not considered the clusters which are overwhelmingly found with a morpheme boundary between the consonants, and where a cluster has dual use (see above, section 6), I have ignored those instances with a morpheme boundary.

In table 7, I present initial CC clusters in order of frequency, from least frequent to most frequent. These figures are simply the number of hits from the *EPD*, and ignore the difference between names and other words. This counting system also includes something beginning with, say, #/str/ as beginning with #/st/ (a potentially confusing factor which was avoided in table 6). Because the *EPD* lists inflected forms and derivatives of headwords on a par, it is not easy to separate the two out, and no attempt has been made to do that here. Some of the lower figures are proportionately inflated by the fact that inflected forms are included. On the other hand, the figures given are simply for the number of times the cluster appears word-initially. If the number of hits for the same cluster at the beginning of a stressed syllable (which is not always word-initial) were added, some of these figures would be considerably increased. Unfortunately, this is not easily done using the *EPD*'s search engine, since while it is possible to search for stressed syllables, it is not possible to search for initial stressed syllables or non-initial stressed syllables.

The interpretation of these figures is not necessarily straightforward. Many of the most frequent initial clusters are ones that can occur both in two- and three-consonant clusters, which might, in principle, double their chances of occurrence. The counts are lexical counts, not text counts, so that the figures given here are only an indirect guide to

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Table 7. *Frequencies of #CC clusters*

Cluster	*EPD* word-initial count
dl	–
tl	2
dv	2
vl	2
vr	2
zj	4
kv	5
sr	5
sv	7
vw	8
gj	9
bw	10
ʃn	12
θw	13
ʃw	14
θj	15
pw	17
θl	19
vj	21
ʃl	24
ʃm	24
sf	29
dw	36
gw	53
bj	91
ʃr	98
hj	129
mj	133
tj	138
lj	138
fj	146
pj	152
θr	160
tw	177
kj	179
dj	211
sm	241
sj	303
nj	313
sn	333
sw	383
gl	434
hw	455

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Table 7. *Continued*

Cluster	*EPD* word-initial count
dr	552
sl	564
kw	613
pl	620
bl	712
fr	775
kl	821
fl	877
sp	1,011
br	1,045
kr	1,246
sk	1,280
tr	1,424
st	1,927
gr	1,935
pr	2,106

frequency of listener exposure to the different clusters, such as might be useful to those working within exemplar theory (see e.g. Hay 2003). However, the rare clusters tend to occur in rare words, which will reduce their text frequency, while the common clusters also occur in common words, so we would expect to see the range of exposure increased in any textual count. It is notable that we do not get fairly uncontroversial non-loans until a frequency of 13 for initial clusters, but it seems a huge step to turn this into some kind of principled cut-off point for viability, genuineness or importance of clusters. Clearly, some clusters are better established in English than others, but the interpretation of that in any theoretical framework requires argumentation. Dziubalska-Kołaczyk *et al.* (2013) provide a corpus study of sequence frequencies, but do not distinguish between lexical and grammatical (morphotactic, in their terms) sequences, and do not give frequencies for initial clusters. An alternative approach is to consider how frequently the words containing particular clusters are in English. If we use the counts per million words of running text for spoken material in the British National Corpus as provided by Leech *et al.* (2001), we find the results shown in tables 8a–c (clusters with post-vocalic /r/ are listed, and shaded in the tables, but a cluster like /rld/ is not also counted as a /ld/, which will boost the counts of some clusters). The frequency per million of the most frequent and (where possible) the third most frequent word to show the cluster are listed.[18] Words with a frequency of under 20 per million are not considered.

[18] The third most frequent is simply a random choice. The most frequent may be frequent because of unpredictable lexical factors, but the third most frequent shows how big a gap there is before others of the same pattern arise (and this also gives information about overall frequency). Lack of a third word with a frequency of over 20 per million also implies something about overall frequency.

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Table 8a. *Word-final cluster frequency: lexical*

Cluster	Word 1	Freq / m	Word 3	Freq / m
ŋk	think	3,977	bank	85
nt	want	1,776	different	500
rst	first	957		
ks	six	863	tax	107
st	last	788	must	589
kst	next	594	text	21
nd	thousand	516	round	415
kt	fact	492	district	118
ls	else	475		
ps	perhaps	444		
rk	work	415	park	76
sk	ask	399	desk	29
rt	start	365	short	127
ld	told	362	child	130
lv	twelve	278		
ft	left	278	soft	26
nst	against	257		
rld	world	248		
lp	help	239		
rd	word	214	forward	151
lt	difficult	202	built	83
lf	yourself	182	itself	105
ndʒ	change	160	range	59
ns	sense	159	once	114
rl	girl	156		
nθ	month	147		
rs	course	143	worse	71
rm	form	133	warm	54
rθ	worth	114	earth	55
pt	kept	113		
rʧ	church	107	March	43
rt	support	104	court	94
rn	learn	85	turn	52
nʧ	lunch	70	inch	21
lm	film	66		
lk	milk	63		
rdʒ	charge	50		
ŋθ	length	36		
lst	whilst	33		
ŋst	amongst	31		
mp	lump	21		

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Table 8b. *Word-final cluster frequency: including a morpheme boundary*

Cluster	Word 1	Freq / m	Word 3	Freq / m
ŋz	things	1,103	savings	32
rz	years	704	others	126
ndz	pounds	572	sounds	78
ts	its	338	flats	64
mz	comes	328	problems	220
nz	ones	318	happens	140
rd	heard	232	referred	39
ks	looks	226	makes	162
zd	used	225	surprised	48
kt	asked	217	worked	152
nθs	months	211		
dz	words	205	kids	119
ts	gets	204	rights	48
nts	wants	197	students	48
lθ	health	154		
lvz	themselves	124		
ndʒd	changed	120		
lz	schools	118	sales	65
nd	mentioned	111	joined	31
nts	parents	111		
vd	moved	106	involved	80
rnd	turned	100		
vz	gives	97	lives	36
rlz	girls	97		
rts	sorts	88	starts	60
ps	groups	85	keeps	49
rks	works	82		
st	based	79	noticed	49
gz	colleagues	72	dogs	38
pt	stopped	70		
sts	costs	65		
ŋks	thanks	162		
md	seemed	60		
ðz	clothes	58		
rdz	cards	52	birds	26
lts	results	43		
ksθ	sixth	40		
ld	killed	40		
kts	products	39	projects	25
θs	maths	37		
fθ	fifth	36		
ʃt	watched	31		
lps	helps	28		
rmz	arms	27		

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Table 8b. *Continued*

Cluster	Word 1	Freq / m	Word 3	Freq / m
rnz	turns	27		
ldz	fields	24		
ʃt	pushed	23		
nθ	seventh	21		
rdʒd	charged	20		
bz	clubs	20		
lmz	films	20		

10 Geminates

Although most consonants can be found geminated in English, gemination almost always indicates a morphological boundary, even when the gemination arises as the result of elision and/or assimilation. There are very few exceptions, and they are names: *Denmark*, *Sudbury*.[19] Regular examples are listed in table 9 , but since compounds are in principle creatable with any words, geminates not illustrated in table 9 can presumably arise in compounds as the need occurs, and can almost certainly arise in syntax (even, perhaps *beige jabot* to give /ʒʒ/). Note that geminates, even over boundaries, arise only where each of the repetitions of a consonant is supported by its own syllable structure: that is, although we find a suffix *-t* in *height* and a suffix *-th* in *warmth*, we never find words which end in /tt/ or /θθ/.

Geminate vowels are much less common, and some of them are ruled out by principles of the system. Again, they mark morphological boundaries, but vowel geminates can be found in loan words.

Again, it seems that more of these could be created: *re-equalize*, *day-ale*, *bargee-ese*; but even these may feel slightly awkward because of the low level of gemination met in English.

11 Vowel sequences

Vowel final prefixes end in a limited range of segments, when we are talking about the productive variants:

- /ɪ/ *anti-* (%), *ante-* (%)
- /ə/: *hyper-, mega-, super-*
- /iː/: *de-, pre-, re-*
- /aɪ/: *bi-, by-, di-*, *anti-* (%)
- /əʊ/: *co-*, *pro-* (and many neoclassical forms which can attach to words, such as *neo-*, *proto-*, *pseudo*, *electro-*, etc.)

Vowel-initial suffixes are slightly more varied:

[19] Even these had morphological boundaries at earlier stages of the language, though it is not clear that they can be recovered today.

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Table 8c. *Word-initial clusters*

Cluster	Word 1	Freq / m	Word 3	Freq / m
hw	what	75,415	which	2,208
θr	three	1,721	through	155
kw	quite	1,050	queen	34
nj	new	603	news	114
sk	school	431	scale	50
gr	great	363	green	88
pl	please	361	play	194
fj	few	346		
tw	twelve	278		
st	stuff	274	stay	146
br	bring	216	brilliant	73
kr	Christmas	194	cream	41
tr	true	177	trouble	138
vj	view	169		
dj	during	153	duty	38
fr	Friday	150	friend	102
bl	black	147	blue	86
br	brought	143	Britain	77
kl	clear	140	club	90
str	street	137	structure	80
sp	speak	128	spend	105
pr	price	121	provide	88
kw	quarter	112	quick	91
fl	floor	95	flat	32
tj	Tuesday	83		
stj	stupid	83	Stuart	29
mj	music	76		
dr	draw	76	drive	57
bj	beautiful	70		
gl	glad	51		
hj	human	51		
sl	sleep	45	slow	23
sm	smaller	42	Smith	26
skw	squared	40		
spl	split	28		
sw	sweet	28		
spr	spread	23		
skr	screen	23		

- /ɪ/: *-ible*, *-ic*, *-ify*, *-ing*, *-ish*, *-ism*, *-ist*, *-ity*, *-y* (%)
- /e/: *-ess*, *-esque*, *-ette*
- /eɪ/: *-ate*
- /aɪ/: *-ize*
- /iː/: *-ee*, *-ese*
- /əʊ/: *-o*, *-ose*

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Table 9. *Geminate consonants over morphological boundaries*

Geminate	In a compound	In affixation
bb	deadbeat	
dd	god-daughter	mid-day
kk	sack cloth	
ll	full-length	goalless, cruelly
mm	film-maker	alignment, in-mate, embalmment
nn	grand-niece	unknown, drunkenness
pp	lamp-post	step-parent
rr[20]	ear-ring	fore-runner
ss	cross-section	dissatisfaction, ex-service
tt	test-tube	

Table 10. *Geminate vowels over morphological boundaries*

Geminate	In compound	In affixation	In loan
iːiː	bee-eater	mediaeval %	Aeetes
ɑːɑː			pa'anga %
aɪaɪ	pie-eyed		aye-aye[21]
əʊəʊ	oolite	co-ownership	Boötes

- /ə/: *-able*, *-er*, *-ous*

There are other, less productive, affixes which have a lesser effect on phonotactic possibilities. Apart from those prefixes that end in /ə/, where an /r/ is invariably present before a vowel-initial base (e.g. *superintendent*), these give rise to a large number of vowel sequences over morpheme boundaries. We might hypothesize that, given that the morphology is productive here, no vowel would be excluded, provided that the semantics and pragmatics were appropriate. Thus, although I have not found any sequence of PALM + PRICE over a boundary, *shah-ize* might be possible under appropriate circumstances, and would automatically give rise to the missing value. Accordingly, the gaps here have to be seen as accidental gaps in the distribution. This is different from the lack of NEAR, SQUARE and CURE before another vowel, which is a systematic gap, given that these arise in English by the historical deletion of final /r/, which is not deleted if there is a following vowel. Accordingly, a hypothetical *deer-ize* would have an /r/ between the elements, and no vocalic hiatus (note that the loan *kia ora* manages to circumvent this general rule because it has no <r>). There are a few instances which appear to

[20] Only in rhotic varieties.

[21] This is the lemur of Madagascar. *Aye aye* as a response to a nautical command I take to be a repetition of a word meaning 'yes', and no more a compound than *yes yes*.

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be rather random instances of vowels indicating a morphological boundary, such as *whatsoe'er*, where the sequence of GOAT + SQUARE has arisen through univerbation rather than through word formation, but in general terms the vowels in hiatus that indicate morphological boundaries do so in a systematic manner given the segments that happen to occur in edge-position in affixes.

In principle, vowel hiatus could also occur at the boundary in compounds. Although it seems that very few such instances are lexicalized enough to feature in *EPD*, a potential combination such as *sea-orgy* would give rise to a hiatus. This process must also be entirely free, limited only by the tendency to the insertion of an intrusive /r/ or a linking /j/, /w/ (and in some varieties /l/) in appropriate environments.

Some of the same constraints that apply in cases of affixation also apply to names and loans: NURSE, NEAR, SQUARE and CURE are consistently absent as the first of two vowel phonemes in hiatus; PALM and THOUGHT are rare, perhaps because in many varieties they are merged with START and FORCE and consequently we usually find a following /r/ in both of these cases. STRUT and FOOT, being historically the same vowel, occur rather rarely. Rather more surprising is the low occurrence of PRICE, CHOICE and MOUTH. CHOICE is of low frequency in English as a whole, as is MOUTH (Davis & Hammond 1995: 162), but PRICE is noticeably lacking as a second vowel in a hiatus, and MOUTH is also rare in first position. But there does not appear to be any combination which is excluded in principle. Vowel sequences may not arise in morpheme-internal position in ordinary English words (see some comments immediately below), but there does not appear to be any difficulty in principle with pronouncing them when they are found in names and in loan words.

It seems that, except for names, a vowel hiatus in a native English word always marks a morphemic boundary. There are many loans where the hiatus is morpheme-internal (and also instances where the vowel hiatus marks a morphemic boundary within a loan word), and some of those loans are so well established in current English that their foreign status may have been compromised. Common or old loans include *poet, druid, fluid, real*% and *idea*%. An interesting case is that of *prowess*, where there is no modern morphological boundary, but the hiatus still marks a historical boundary. *Miaow* (variously spelt), which might be thought to be purely onomatopoeic, is first attested in English in the early seventeenth century, apparently taken from French (*OED*), though it now also appears in Dutch and German (and respelt in Danish). The vast majority of the names which contain a vocalic hiatus are also borrowed, so that we can summarize the basic situation by saying that a vowel hiatus in English either indicates a morphological boundary or indicates non-native status. Examples are provided in tables 11 –13.

12 Variation once more

The discussion above has largely been couched in terms of British RP (the primary variety transcribed by *EPD*), with some acknowledgement of rhotic varieties, especially North American rhotic varieties. The transcriptions in *EPD* are for fairly conservative

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Table 11. *Vowel sequences indicating morphological boundaries*

	DRESS	TRAP	STRUT	LOT	FOOT	FLEECE	START	THOUGHT	GOOSE	NURSE
FLEECE	preempt	preamble		preoccupy			rearm	reorganize		
START										
THOUGHT						drawee				
GOOSE	Jewess %	effectually (US)		zoography						
NURSE										
FACE	layette		lay-up			payee				
PRICE	triennial	triangle	triumvir %	biology	triumvir %		diarchy			diurnal
CHOICE						employee				
MOUTH	however									
GOAT	bioengineer	coanchor	follow-up	co-operate		coeval	coarticulation	co-author		coerce
NEAR										
SQUARE										
CURE										

	FACE	PRICE	CHOICE	MOUTH	GOAT	NEAR	SQUARE	CURE	KIT	COMMA
FLEECE		de-ice			reopen					reappear
START									Dadaist	
THOUGHT									amateurish %	drawable
GOOSE	effectuate %				zoochemistry %		whoe'er		bluish	doable
NURSE										
FACE		hebraize		layout					playing	surveyor
PRICE	striation	tryout							anxiety	alliance
CHOICE					boyo				boyish	joyous
MOUTH									allowedly	nowadays
GOAT	inchoate	ghettoize		blow-out	co-ownership		co-heir		heroic	bestowal
NEAR										
SQUARE										
CURE										

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Table 12. *Vowel sequences in proper names*

	DRESS	TRAP	STRUT	LOT	FOOT	FLEECE	START	THOUGHT	GOOSE	NURSE
FLEECE	Beelzebub	Piaf		Cheops	Ciudad %			Dior	Ciudad %	
START	Raphael %				Yaounde %	Aida %			Yaounde %	
THOUGHT										
GOOSE	Llewellyn	Fuad %				Anouilh	Fuad %			
NURSE										
FACE	Nureyev	Pelleas		Leon %		Taizz %	Bayard	Mayall	Papandreou	Laertes
PRICE	Baez	Cheyenne	Hyundai %	Diogenes		Aida	Kayyam %			
CHOICE	Dostoevsky									
MOUTH	Dowell %					Aouita				
GOAT	Noel	Boas %		Laocoon		Eloise	Souares			
NEAR										
SQUARE										
CURE										

	FACE	PRICE	CHOICE	MOUTH	GOAT	NEAR	SQUARE	CURE	KIT	COMMA
FLEECE					Cleo					St Neots
START	Bel Paese				Bilbao	Zaire %				Flaherty %
THOUGHT									Hawick %	Haworth %
GOOSE	Niue				Fukuoka				Blewitt	Stuart
NURSE										
FACE					Beowulf	Meir			Adonais	Malaya
PRICE					Iona	Zaire %	Briarius			Gaia
CHOICE					Toyota				Soyinka	Goya
MOUTH	Pontardawe								Cowen %	Aberdouer
GOAT	Croatia	Eloi %			Bootes				Boeing	Alloa
NEAR										
SQUARE										
CURE										

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Table 13. *Vowel sequences in loans*

	DRESS	TRAP	STRUT	LOT	FOOT	FLEECE	START	THOUGHT	GOOSE	NURSE
FLEECE	per diem	fiat		kiosk	deus	mediaeval %	triage	fiord %		
START		pa'anga				naif %				
THOUGHT										
GOOSE	duettino	effectuality (US)			euonymous	cooee	nuance	fluor		
NURSE										
FACE	cayenne		exeunt	chaos	exeunt %	vin du pays	realpolitik	aorta		
PRICE	paella	chiasmus	triumph %	cryonic	triumvir %	hyena	faience	a priori	bayou	diurnal
CHOICE	doyen	paranoiac					bon voyage			voyeur %
MOUTH					Weltanschauung					
GOAT	loess %	goanna					koala		numero uno	
NEAR								kia ora		
SQUARE										
CURE										

	FACE	PRICE	CHOICE	MOUTH	GOAT	NEAR	SQUARE	CURE	KIT	COMMA
FLEECE	creative				brio					
START								ayurveda %	sahib %	
THOUGHT										
GOOSE	roué			luau					suicide	truancy
NURSE									feuilleton	
FACE					aioli				dais %	mea culpa
PRICE	hiatus				iota			ayurveda %		ayatollah
CHOICE	foyer %				coyote				moiety	boyar %
MOUTH									howitzer	
GOAT	oasis				oolite				coitus %	
NEAR										
SQUARE										
CURE										

varieties of English. However, if we look at English more widely, there are places where the phonotactic system of English has been changed or is being changed, and these have implications for what is or is not possible 'in English'.

In Australian and New Zealand Englishes, clusters like /ʃj/ and /ʒj/ occur, variably, in words like *assume* and *presume*. There are four variant pronunciations for these words in these varieties: one with /s/, /z/, one with /sj/, /zj/, one with /ʃ/, /ʒ/ and one with /ʃj/ and /ʒj/. The proportion of each is currently in flux, and the eventual outcome is accordingly uncertain. A more general effect of palatalization can be found in initial /stj/ clusters, which are becoming /ʃtj/ or /ʃʧ/ clusters in words like *student*. My own observation tells me that this is also happening in some varieties of Scottish English and of the English in England.

In some varieties of English, and New Zealand is again one, /tr/ is being replaced by /ʧr/, thus filling one of the unexpected gaps in the system as it has been presented above, but creating another. The /str/ cluster in words like *strong* is being replaced (in some New Zealand, Australian and US varieties of English) with /ʃtr/ or /ʃʧr/. There is, as yet, little parallel development in /spr/ or /skr/ clusters.

What Wells (1982) calls 'yod-dropping' (the loss of /j/ following coronal consonants) is leading to either the loss of the diphthong /ɪu/ or the loss of generalization about #CCC clusters (depending upon one's theoretical point of view – see above). Some sequences of /tj/ and /dj/ have already become /ʧ/ and /ʤ/ respectively in many British accents (so that *due* and *Jew* become homophones – even *EPD* acknowledges this change), and they have already been removed from the potential domain of yod-loss. For most speakers of English it is already the case that /lj/ and /sj/ have virtually vanished (which may be why the cluster #/slj/ has not been commented upon in the wider literature), although they have done so within living memory.

The loss of the #/hw/ cluster is well advanced in most English-speaking areas, and it is showing signs of weakness in (at least urban varieties in) Scotland (Douglas 2006: 49). The retention of #/hj/ under these circumstances is striking.

The vocalization of /l/ in Australian, New Zealand and southern English varieties is giving rise to a whole new set of diphthongs (and in some cases, vowel mergers). New contrastive elements of this type are likely to have a rather limited distribution, but will probably not upset the overall pattern of vowel phonotactics.

The number of varieties in which the HAPPY vowel can be equated with the KIT vowel seems to be falling, and although *EPD* transcribes the HAPPY vowel as distinct from both KIT and FLEECE, for some speakers it is clear that the vowel is to be equated with FLEECE. This is unlikely to have any great effect on phonotactics, since the KIT vowel will remain where two consonants follow.

If Sell's (2012) finding that vowel epenthesis is becoming less common in words like *film* in Galway English can be generalized to Irish English as a whole, then we may see Irish English becoming phonotactically more like Received Pronunciation. However, it seems likely that among the New(er) Englishes consonant clusters will be

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simplified – either by vowel epenthesis or by elision – where the substrate language does not allow complex clusters.

These examples indicate – if the demonstration is needed – that the phonotactics of RP is not necessarily the same as the phonotactics of other varieties, and that there can be no overall 'English' phonotactics. It might be possible to separate out more central phonotactic statements and more peripheral ones, but it is not clear what the value of this would be. The examples here also indicate that the phonotactics of different varieties of English is, as one might expect, always changing, so that we cannot necessarily assume that generalizations which hold today will continue to hold. Interestingly, this is sometimes a matter of global politics. The inclusion of the name *Mladic* in *EPD* has already been commented upon: if the port of Gdansk became a centre of international attention, would a new cluster be added to English (at least for some speakers)? In my experience (but *pace EPD*, for *Myanmar*) the words *Hyundai* and *Myanmar* are rarely pronounced with initial clusters by English speakers, but that may partly be a problem with English orthography rather than a problem with adding new clusters. So there are external factors which affect phonotactics as well as the internal factors of assimilation, elision and the like.

13 Conclusion

In this article I have listed some clusters which have not previously been noted as clusters of English, debunked several widely cited 'truths' about English consonantal phonotactics, and provided a brief introduction to the phonotactics of vowels in English. The phonotactic status of proper names, often containing clusters which are largely restricted to occurring over morpheme boundaries, and the difference between initial and final clusters in signalling degrees of foreign-ness are both results which arise from a consideration of the data. The use of vowel sequences to signal foreign-ness is not unexpected, and the coincidence of vowel hiatus with morphological boundaries outside foreign vocabulary is an important matter for morphotactics. Further research would be required into the lexical frequency (and perhaps also text frequency) of the various clusters of English and into the actual phonetic use of cluster-simplifying phonetic rules of connected speech, and the potential of cluster complication by resyllabification. I have not considered the question of sequences of consonants which may occur over syllable boundaries (or possibly over morpheme boundaries), as the whole question of syllabification in English is extremely vexed (but see Harris 1994: 66, 175 and Hammond 1999 for some observations). The link between phonotactic statements and syllabification strategies is perhaps the most difficult but most necessary future research strategy to emerge from this study.

There is a view of phonotactics as providing a grammar of segment sequences, such that sequences not permitted by the 'rules' are not possible in the language concerned, and are eliminated in the production of, for example, foreign words, or not permitted in the formation of, for instance, acronyms or neologisms (Abercrombie 1967: 76, citing Firth). Such a view is clearly an oversimplification, in the light of the data

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from *EPD*. Foreign words are adopted despite apparently illegal phonotactics, but not without limits. Spencer (1996: 85) proposes weak and strong phonotactic constraints. But it would appear that there is a cline of strength in phonotactic constraints: even Chomsky & Halle (1968: 416–17) allow for 'degrees of admissibility' (see Gorman 2013: 15–17 for a useful summary). For example, in general it seems that English does not permit onset clusters of stops: native words do not begin with /bd/, /pt/, /bm/, /mn/ and so on. However, the data from *EPD* allows individual exceptions with /mn/ and with /pt/ but not with /bd/ or /bm/ (even though this last would fit within the sonority envelope and /kn/ is allowed). We might question how far *EPD* accurately reflects 'RP' or 'English' usage, how far the lack of /bm/ indicates anything other than the lack of opportunity to borrow any such word, or to what extent the editors of *EPD* assume a certain amount of bilingualism among speakers who use particular words. But if we take *EPD* seriously, we might start to consider the prohibition of /bd/ to be stronger than the prohibition of /pt/, and neither of these to be a strong as the prohibition of /tp/, /db/, which appear to be impossible because of difficulties in articulating and/or perceiving them. Other apparently illegal clusters (such as /ʃl/ and /gw/) have been adopted without any apparent problems, yet others (such as /sr/ and /ts/) are avoided rather more regularly, but are still found. Perhaps the time has come to stop seeing all phonotactic constraints as indefeasible constraints, and start seeing some of them as phonetic and phonological structures which speakers prefer to avoid. This opens up the field to questions of relative strength in these constraints, and, more interesting, it seems to me, reasons underlying the preferences speakers show. Perhaps linguistic theorizing is now in a position to adopt such insights and provide a suitable basis for including them in theory and practice, in a way that does not seem to have been easy in the wake of Chomsky & Halle (1968).

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