How Symmetrical are English Vowels?

ПЕТЕРБУРГСКОЕ ЛИНГВИСТИЧЕСКОЕ ОБЩЕСТВО

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INTRODUCTION

The NY–St. Petersburg Institute of Linguistics, Cognition and Culture (NYI) is an advanced study program organized every July in St. Petersburg, Russia at St. Petersburg State University. NYI was founded in 2003 with the goal of bringing together world-famous scholars in under-represented fields of inquiry to facilitate high-level academic discussions in the most modern interdisciplinary fields such as critical Generative Linguistics, Formal Semantics, Cognitive Studies and others. NYI 2013 will be the 11th year of NYI. NYI was created as a joint project between the State University of New York at Stony Brook and St. Petersburg State University to further the study of interdisciplinary education in the transnational classroom.

Since its founding in 2003, more than 1000 students have participated from throughout the Russian Federation as well as from the following countries: Algeria, Austria, Belarus, Bosnia & Herzegovina, China, Croatia, Czech Republic, Denmark, Finland, France, Georgia, Germany, Greece, Hungary, Israel, Italy, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Moldova, The Netherlands, Palestine, Poland, Romania, Serbia, Slovakia, Spain, Sweden, Turkey, UK, Ukraine, USA.

NYI's academic profile features a focus on areas of research that do not easily fall within traditional discipline boundaries or not always been well-represented in the academic programs of many institutions. Among these are the various sub-areas of generative linguistics, including generative syntax, formal semantics, phonological theory, and others. This volume of "Язык и Речевая деятельность" brings together articles by leading generative linguists, in the areas of syntax, semantics, and phonology as well as one literature scholar, all of whom have taught at NYI. A short introduction to the authors in this volume and their articles follows.

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Patrick Honeybone (NYI 2008) is Lecturer in Linguistics at the University of Edinburgh. His research interests are in theoretical phonology, historical phonology, and dialectology. He organizes both the Historical Phonology Reading Group at Edinburgh, and the Manchester Phonology Meeting, one of the UK's leading annual phonology conferences. He holds a Ph.D. in Linguistics from the University of Newcastle upon Tyne. His contribution to this volume, "How symmetrical are English vowels?" involves a phonological analysis of the phonemic systems of various English vowel systems.

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junctive in Russian" with Vladimir Borschev, Elena Paducheva, Barbara Partee and Igor Yanovich.

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HOW SYMMETRICAL ARE ENGLISH VOWELS?

1. Introduction

This article's title seems such an innocent question: as long as we agree that segments form systems, we can ask how symmetrical those systems are. The main point of the paper, however, is that the question is far more complicated than that. Indeed, it may not even be a coherent question to ask. I go on to show that, if it *is* a coherent question (that is, if English *is* a linguistic object), then a fair set of reasoned arguments, some of which I revisit from the work of others, and some of which I present here for the first time, can lead us to perceive a perfect, elegant symmetry among the vowels of English. The reader (like the writer) must decide whether these arguments are reasonable.

I consider the reason why the article's title question arises in section 2. It has often been claimed that segmental systems tend towards symmetrical organisation, and a number of possible reasons for this have been proposed, in Structuralist, classical Generative, Dependency/Government, phonetic-oriented and Optimality Theoretic traditions. I briefly review the basic issues here. In section 3, I begin to consider English, the empirical focus of this article. Some of my questions are English-specific, but others are much more general: there is vast dialectal variation in English, as is to be expected cross-linguistically — can it ever be reasonable to search for *one* linguistic system in amongst that diversity? I show that several strands of work on English do just that, sometimes overtly and sometimes unconsciously, and I consider the arguments involved. Section 4 is more clearly empirical: I discuss which vowels occur in English, focusing on the monophthongal contrasts in four diverse varieties. Section 5 interrogates a number of previous analyses of English vowel systems, weighing up their advantages and showing their problems, and section 6 develops a basis provided by one of these, to show that a fully symmetrical vowel system can be achieved for English, based on the assumptions and data from sections 2, 3 and 4. The basis is the system presented in Giegerich (1992), and I call my development of it 'Giegerich^{+}'. Why might we want such a system? I consider this in part in section 6 and in part in section 7, a codicil to the main paper, which delves further into the phonology of English: on the basis developed here, a pattern can be perceived in the main recent changes in the set of English segmental contrasts. Section 8 concludes, and comes back to earth: is it reasonable to argue in the

way that I do in this paper? If it is (as many have done before), the analysis of the English vowel system presented here strikes me as the best.

Data from English, as one of best investigated languages, has driven theorising in several areas of phonological theory (its 'vowel shift' alternations, its stress patterns, its lexical strata, and its patterns of *t*-lenition, for example, see Carr & Honeybone 2007). Theorising about the structure of vocalic systems has not been one of those areas, however, partly because it is an inherently typological pursuit, but also because English has often been seen as atypical or unusual in this area. In a piece which aims to summarise what we know about segmental inventories, for example, Mielke (2009: 700) writes that "English has some unusual properties, both in terms of the particular segments it contains and the types of segments it contains". Trubetzkoy went further (1935: 256), complaining that "English vocalism is indeed absurd". The issue at stake here, then, is how well this aspects of English fits in with the generalisations that have been made about how languages tend to work, and whether an elegant analysis of this aspect of English can succeed. To repeat: *if* we allow the precepts considered in this article, then we can allow that the beauty of the system considered here may just correspond with the truth.

2. Systems and symmetry in segmental organisation

Some of the foundational texts for phonology devoted quite some space to the discussion of underlying segmental systems. Trubetzkoy (1939) and Martinet (1955), for example, worked to develop both descriptive generalisations about how languages function in this area and a theoretical explanation for why this is so. I discuss the basic observations that have been made about vowel systems, and the line of work which has carried interest in this area of phonology into the present day, in section 2.1. The basic principles of systemic organisation can be applied to consonants as well as vowels, and I consider the consonants of English in section 2.2, in part as a move towards our specific empirical focus, away from language-universal concerns. Together, these two subsections also function to provide both language-universal and English-specific evidence that symmetry can indeed be seen as an organising factor in phonological inventories.

2.1 Symmetry in vowel systems

Somewhat surprisingly, Mielke (2009) makes no direct mention of symmetry as an organising factor in his overview of segmental inventories. The direct intellectual predecessor work to Mielke, however, such as Maddieson (1984), which features the description of the segmental inventories for hundreds of languages and formed the basis for subsequent work in this area, does deal overtly with systemic symmetry, and the idea has both a long history and a lively present.

As Fischer-Jørgenson (1975: 33) notes in her remarkable history of phonology, there is an "implicit assumption of symmetry" in Trubetzkoy's (1929, 1939) discussion of vowel systems, and this is made explicit in later Structuralist work, perhaps reaching its zenith in Martinet (1955). Not all languages can be analysed in this way — some simply don't submit to symmetry. However, as Trubetzkoy (1939) explains, vowel systems tend to have equal numbers of segments at a small number of

levels, with equivalent degrees of distance in phonological space between them. Vowel systems are typically either triangular or quadrangular, Trubetzkoy claims, as shown in (1), which gives Trubetzkoy's exemplification for systems with some of the smallest number of segments. This means that symmetry is most widespread on the vertical axis — found in both types of systems — and only exists on the horizontal axis in quadrangular systems.[1]

(1)

i		*u*	*i*	*o*
	a		*e*	*a*

Trubetzkoy (1939: 107) claims that "by far the majority of languages has three-degree vowels systems", of the type shown in (2). The spacing of symbols is slightly adapted here and all Trubetzkoy's vowel diagrams are inverted, to fit in with current practice, but Trubetzkoy's symbols are kept. He explains that the triangular system is found in many languages, such as Czech and Shona, and the quadrangular one in certain Montenegrin dialects.

(2)

i		*u*	*i*	*u*
e		*o*	*e*	*o*
	a		*ä*	*a*

Four-degree vowel systems are also attested, as in (3). The triangular system is still taken from Trubetzkoy (1939), and is ascribed by him to Italian, but the quadrangular one is from Maddieson (1984), for Temne (leaving aside the dubious mid-central vowel and adapting the presentation to fit with the format adopted here). The eight-vowel system for dialects of Polish that Trubetzkoy discusses uses symbols which are not easily penetrable, so I do not give it here.

(3)

i		*u*	*i*	*u*
e̊		*o̊*	*e*	*o*
ę		*ǫ*	*ɛ*	*ɔ*
	a		*a*	*a*

Trubetzkoy's observations have largely been confirmed by more recent work. Maddieson (1984: 136), generalising over the 317 languages that he presents, writes that "[t]he most prevalent patterns seem to be the so-called 'triangular' systems, particularly those of average size, and notably the 5-vowel systems. For example, over a quarter of the 209 languages in the Stanford Phonology Archive have a triangular

[1] The two-degree, four-member quadrangular system in (1) is somewhat dubious, in fact. Trubetzkoy describes it for Tonkawa, but later work, such as Maddieson (1984) disagrees, describing a five-vowel system for the language. According to Maddieson's charts, a system of the type that Trubetzkoy gives might work for Shasta or Wichita, but all this would likely fail on the grounds of 'surface-respect', described below — it involves considerable deviation from surface placement in the vowel space in order to make the systems look symmetrical. Trubetzkoy essentially acknowledges this, in fact: "there is no symmetry from a phonetic point of view" (1939: 107). The triangular two-degree system is more common: Trubetzkoy (1939) accurately ascribes it to Arabic, for example (at least for one of its vowel systems), Maddieson (1984) gives it for languages such as Ngizim and Nyangumata, and Katamba (1989) mentions Aleut Eskimo and Dyirbal. Quadrangular systems with three or degrees are also on much firmer ground: Katamba (1989) ascribes them to Azerbaijani, British Columbian French and Persian, for example.

5-vowel system consisting of /i, ɛ, a, ɔ, u/, while less than 5% have any of the other 5-vowel configurations; the 'square' 4-vowel and 6-vowel systems combined total less than 10%." And, further, that "[t]he great majority of vowel systems in our sample assume configurations which are predictable from a theory of vowel dispersion … About 86% of the languages have vowel systems that are built on a basic framework of evenly dispersed peripheral vowels" (Maddieson 1984: 153–154). This shows that while by no means *all* languages have symmetrical vowel systems, the large majority do ('dispersion', as we will see below, connects closely with symmetry)

Chomsky & Halle (1968, 401–402) pick up the basic point, and argue that a vowel system such as that in (4) is "more natural, in some significant sense, than one such as" (5) or (6), which are both dispreferred because of their asymmetry.[2]

(4) i u
e o
a

(5) i u
e o
æ

(6) ü ɨ
ʌ
œ a

The basic expectation of symmetry in segment systems thus requires there to be symmetrical units in each phonological slot that is provided by the language's system (in terms of height and backness for vowels, and by voicing and places of articulation in consonants, for example). It can allow for both odd and even numbers of segments, but only if there is good reason for the single segment to be allocated to a position between the pairs at other places, as in (4).

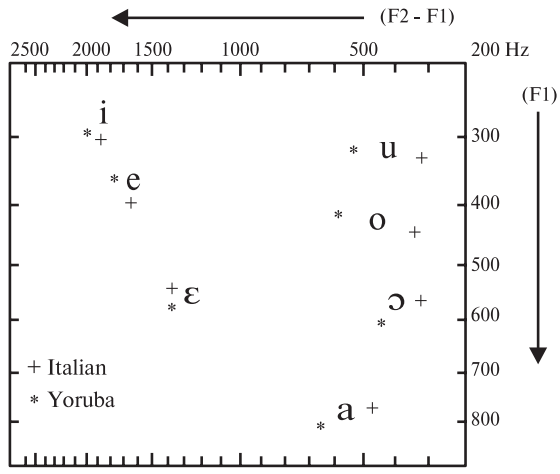
The above diagrams show the underlying segments of the languages concerned, representing the number of contrasts involved in a vocalic system within a language. A further implicit principle of this type of diagrams, widely taken to be important, is that they are arranged with reference to either/both articulatory vowel space or/and F1/F2 plots, which means that they have a definite degree of (what I shall call) 'surface-respect' (although this can also be tempered by a considerable component of phonetic interpretation). Although these are underlying systems, the symbols used show the pull of surface realisation: at least some of the surface realisations of the underlying segments should be directly phonetically interpretable as falling within the phonetic space indicated by the phonetic symbol used to represent them. It might even be expected that the default realisation of a segment determines its positioning in the pattern.[3]

[2] The system in (6) is additionally problematic because it conflicts with markedness expectations in terms of rounding: roughly, front vowels tend to be unrounded, and back vowels rounded, so that no system may have front rounded vowels if it does not also have front unrounded vowels. Although this correlation plays an important role in the overall markedness of vowel systems, I do not consider it further here.

[3] This can be related to the idea that phonological categories have 'intrinsic phonetic content', which is standard in generative approaches to phonology following Chomsky & Halle (1968: 169–170) and Postal (1968) — although there can be a considerable gulf between underlying and surface representations, underlying segments (or, rather, the features that they are made up of) are the same kind of thing as surface segments, and where there is no change between the levels due to an intervening phonological process, underlying segments surface showing that content.

There is no expectation that the positioning is phonetically precise, however — the phonological surface (the output of the grammar) is not the same thing as physical phonetic pronunciation. As (7) shows (taken from Ladefoged & Maddieson 1996: 297), two languages need not use exactly the same spots in phonetic space to be analysed as phonologically identical. Both Italian and Yoruba have the seven vowel triangular system given in (3) — shown here with Ladefoged & Maddieson's more contemporary symbols — but the mean formant frequencies of the phonetic pronunciation of the phonological segments are slightly different. The precise limits of what can 'count as' an underlying /a/ or /u/, for example, are difficult to place, but surface-respect requires that there be some limit — a plot to the left of [ɛ] on a diagram such as that in (7) could not count as a central or back vowel, for instance, and three vowels clustered around the /i, e/ space could not count as an /i, a, u/ system.

(7)



Despite the phonetic disparity between Italian and Yoruba, Ladefoged & Maddieson are happy to analyse both languages as underlyingly the same, because "…vowels can be described using only the major features of vowel quality … [which are] … adequate for specifying the phonological contrasts within each of these languages, but not for discussing the phonetic differences between them" (1996: 297).

This takes us to the final point that we should consider here: what enforces phonological symmetry? Ladefoged & Maddieson refer to the distinctive phonological features required to describe a system, and it is often assumed that the system of features used in a particular language (or the feature system provided universally) pushes languages in the direction of symmetry. Fischer-Jørgenson (1975: 45) explains how this idea first arose: "Trubetzkoy, Jakobson, de Groot and van Wijk all emphasize the tendency towards harmonious systems. Martinet's contribution consists in a reinterpretation of the somewhat vague concept as something more concrete: harmony is a manifestation of economy (a view which was suggested earlier by de Groot (1931)). A system which utilizes a limited number of distinctive features in several pairs is more economical than one with many different distinctive features none of which are put to much work." Thus, for example, if [±back] is used to make a contrast at one level of vowel height in a system, it is expected that it will be used

at other levels, too, so the three-level and four-level systems in (2) and (3) have two vowels at all heights (apart from at the lowest level, which can be central in triangular systems).

This idea has been picked up and developed in recent work, such as Clements (2003, 2009), who is clear that the impetus towards symmetry need not be seen as a system-organising principle in its own right — rather, symmetry is the result of a more fundamental phonological principle. For Clements, "the typical 'symmetry' of vowel systems reflects Feature Economy" (2009: 56).[4]

For others, is it 'dispersion' that enforces symmetry. Although Mielke (2009) does not mention symmetry, he does discuss 'dispersion', which is "the idea that segments are subject to a pressure to be maximally dispersed in the available phonetic space" (2009: 707). Vaux & Samuels (2006), themselves critical of the enterprise, describe many ways in which this has been developed into 'Dispersion Theory', on the basis that "consonant inventories tend to evolve so as to achieve maximal perceptual distinctiveness at minimum articulatory cost" (Lindblom & Maddieson 1988), that is, by balancing the impetus to disperse with the impetus to minimise effort. Many, from early Structuralists to those working in Optimality Theory (e.g., Flemming 1995/2002, Ní Chiosáin & Padgett 2010) or in frameworks which assume that phonological inventories are subject to the principles of self-organising systems (e.g., de Boer 2001) have argued that non-I-linguistic pressures of this type account for the tendency towards symmetry.

Among other explanations for the tendencies in vowel systems, a strong line of argumentation has developed in what is often referred to (for example, in Carr, Durand & Ewen 2005) as the 'Dependency/Government' approach to segmental structure, which derives the most common patterns in vowel inventories from the set of subsegmental primitives that it allows. The approach is found in the literature of Dependency Phonology (eg, Anderson & Jones 1974, Anderson & Ewen 1987), Particle Phonology (eg, Schane 1984, 2005) and Government Phonology (eg, Kaye, Lowenstamm & Vergnaud 1985, 1990), in part through independent development, and latterly through conscious cross-fertilisation (eg, Harris 1994, Botma 2004). All these approaches assume that subsegmental phonological representations are best conceived of in terms of a set of privative primes which are not many in number and which are each used in several ways in the structure of segments. It is most common now to refer to these primes as 'elements', which are fully interpretable in their own right, thus the most common vowels (the only ones found in the smallest triangular system) are composed of one element each, as shown in (8), where the second column represents the most prominent characteristic of the three elements involved.

(8)

vowel				element
/i/	=	palatality	=	**I**
/a/	=	openness	=	**A**
/u/	=	labiality	=	**U**

[4] Clements (2003) is at pains to explain that the simple requirement for symmetry and the formal expectation of Feature Economy do not make exactly the same predictions: systems can be perfectly symmetrical but not fully economical, for example. This does not mean that an impetus towards economy does not lead towards symmetry, however.

Other vowels are composed of combinations of these elements, thus /y/ is made up of the elements **I** and **U**, as a palatal vowel with labiality (ie, rounding). One element is assumed to be the 'head' of an expression (shown through underlining), which means that any other elements in it are 'dependents'. Thus the three and four-degree triangular systems can be represented as in (9).

(9)	Vowel system		Elemental makeup	
	i u		**I**	**U**
	e o		**I, A**	**U, A**
	a			**A**
	i u		**I**	**U**
	e o		**I, A**	**U, A**
	ɛ ɔ		**I, A**	**U, A**
	a			**A**

This approach fits well with triangular systems, but not so obviously well with quadrangular systems. As Durand (2005: 83) explains (his (2) is my (10) and the representations in (11) are adapted to fit in with those used in (9) "[i]f we came across a system like /i e æ ɑ o u/, it would be modelled as inherently symmetrical in the *SPE* tradition:

[(10)]		–back	+back
	+high, –low	i	u
	–high, –low	e	o
	–high, +low	æ	ɑ

By contrast, it would be inherently skewed in a D[ependency] P[honology] approach:"

(11)	i u		**I**	**U**
	e o		**I, A**	**U, A**
	æ		**I, A**	
	ɑ			**A**

This issue for the Dependency/Government tradition may just be an advantage: as we saw above, quadrangular systems are much rarer than triangular ones and asymmetrical systems are uncommon. As the Dependency/Government approach represents such systems as subsegmentally aberrant, it provides a phonological rationale for these observations.

Durand's representation of the *SPE* approach, following in the footsteps of Chomsky & Halle (1968), neatly exemplifies the main competing approach to the privative Dependency/Government type of subsegmental representation: binary features. Durand shows how this approach (the majority position) fits with the Feature Economy approach to modelling patterns in segmental systems: only three features are needed to characterise the potential six-vowel symmetrical system underlyingly and all combinations of them are attested (if we assume that [+high, +low] is an impossible combination on phonetic grounds, as it is not possible to have the tongue both high and low in the mouth at the same time). This approach is clearly attractive for modelling

this type of system, but it is not so compelling when modelling the more common triangular systems.

In terms of providing an explanation for the tendency towards symmetry in phonological systems, there are thus both phonological approaches (Feature Economy and Dependency/Government) and phonetic (dispersion-based) accounts. For our purposes here, we can rise above this disagreement to recognise the overall agreement that *some* type of pressure leads systems to tend towards symmetry. Symmetrical systems are phonologically elegant, and all other things being equal, science prefers elegant solutions. It is by no means the case that *all* languages submit to the pressure towards symmetry at all stages of development, but the overall situation points towards symmetry as the unmarked case, to the extent that we might reasonably expect it, and might thus ask the question: how symmetrical are the vowels of English?

2.2 Symmetry in English consonants

Before I turn to English vowels, let us first take a detour to English consonants (as well as illustrating a further point often connected to argumentation about segmental systems, consonants will return to relevance in section 7). It is reasonable to claim that the 'full' possible inventory of consonants in English, as found in Scottish Standard English, for example (described by Abercrombie 1979 and Giegerich 1992), is as shown in (12).[5]

(12)

Plosives		Fricatives		Approximants
p	b	f	v	w
t	d	θ	ð	l
k	g	s	z	r
		ʃ	ʒ	j
Nasals		x		
m		h		Affricates
n		ʍ		ʧ ʤ
ŋ				

To what extent does (12) exhibit symmetry? Arguably really quite well. In nasals and approximants (all the sonorants), where no laryngeal contrast is relevant, only one series is expected. In plosives and affricates (all the segments involving oral closure), a laryngeal contrast is made, and it is made at all places of articulation. It is only in the fricatives where asymmetry is clear: the fortis back fricatives and the labial-velar do not have a lenis counterpart. This is problematic for the Feature Economy approach outlined above. It is notable, however, that /x, h, ʍ/ have been lost in many dialects, especially in Britain. The segment /x/ has been widely lost, and /ʍ/ has been merging with /w/ in many dialects for a long time (see Minkova 2003, also for potential complications with this picture); /h/ has been lost in the many '*h*-dropping' varieties of British English. This all fits intriguingly well with the idea

[5] This assumes that the distribution of [ŋ] is unpredictable (on the basis of forms like *hangar*) and that [h] and [x] (as in *loch*, *Docherty*) are contrastive. It may well be that [h] and [x] are both realisations of one underlying segment in varieties which have them both — that would alter nothing in terms of the thrust of argumentation here.

that aspects of asymmetry in a system tend to be lost over time, as, for example, Martinet 1955 assumes — it may be that considerations of phonological economy guide phonological change. If so, the consonantal system of English, and certain historical developments within it add a language-specific rationale to the language-universal rationale developed in section 2.1 for believing that symmetry might shape the vocalic system of English.

3. Doing the linguistics of a language

In the last section, I discussed the 'full possible inventory' of English. What does this mean? It is reasonable to consider 'English' in this way — as an overall linguistic system which can be perceived at a level above each individual dialect? Why should we compare the phonology of Leeds English, which has none of /x, h, ʍ/, with Scottish Standard English, which has them all? It is often claimed that the notions that we refer to when we talk of 'languages', such as English, German, Russian and Swahili are socio-political constructs which do not correspond with the kind of thing that can be submitted to linguistic analysis. For example Chomsky (1980) writes that "[i]t is very doubtful that one can give any clear or useful meaning to the 'everyday sense' of the term 'language'" and he advocates analysing only the I-linguistic knowledge of individual speaker-hearers. No one speaker has all the linguistic forms of a socio-politically defined 'language' in their mind — if speakers only know the forms appropriate to the dialect(s) that they use, it cannot be right to analyse 'English'. Rather, we should only ever consider coherent dialects, such as Scottish Standard English, Liverpool English and New York City English.

But are whole dialects coherent linguistic systems? There can be considerable inter-speaker variation between the speakers of one dialect, and dialects are arguably socio-political constructs in the same way that languages in the everyday sense are, two, just at one level of abstraction lower. In this section I consider whether we should consider 'English' in phonological analysis at all. 'English' is an inherently varationful concept, like other languages, so can we ever consider the vowels of 'English'? I argue here that there may be ways in which we can.

It is possible to recognise a range of fundamental linguistic approaches to dealing with inter-speaker variation of the type just identified. Honeybone (2011) proposes the model in (13) to understand this.

(13)

Those who insist that linguistic analysis must only ever consider one linguistic variety take a broadly 'dialectal' approach to analysis, and would deny that 'English' exists as a linguistic concept in the narrow sense. The extreme of this position is arguably the only coherent one — to analyse only the idiolect of individuals, where a language's grammar (including its phonology) resides — because we cannot be sure that any two speakers have exactly the same grammar. This position is not often pursued to its logical conclusion, however. It is common to see analysis of particular dialects of languages, such as Belfast English or Newcastle upon Tyne English, which, although the authors would deny that they are considering more than one system, implies that movement away from the right-hand edge of the scale in (13) is widely tolerated.

There is a categorical difference, however, between the broadly dialectal position (even if it may be covertly polyidiolectal) and the polylectal position, on the left-hand side of (13), which accepts that it is reasonable to use more than one dialect of a 'language' in a single linguistic analysis. On the broadly polylectal position, it is not absurd to talk of 'English' as a linguistic object — it is reasonable to compare the dialects of a language and it may even be reasonable to use aspects of the phonology of more than one variety in the justification of an underlying analysis. The extreme of this position is panlectalism — the idea that we should produce one grammar with a single underlying form which can account for all surface variation in a language through a range of realisation conventions. Although advocated by some (eg, Bailey 1973, 1996), this is not a widely held position, and work which skips over the division from the left to the right side of (13) is not compelled to assume panlectalism.

Most work in phonology is overtly dialectal (if not idiolectal). Indeed, a steady stream of work, such as Harris (1984, 1985), McMahon (1992, 2000) and Lodge (2009) has argued explicitly against the polylectal position. There is work, however, which has either an unnoticed or an overtly polylectal flavour. Just as many analysts do not limit themselves to data from one speaker of one variety, it is not unusual to encounter argumentation with a polylectal tone, even if this only involves assuming that there are the same type of contrasts in an uninvestigated variety of a language as there are in a well-known variety. Despite overt anti-polylectalism, Lodge (2009) talks, perhaps unnoticed, of how he believes that the 'English low front lax vowel' "… /æ/, realized as [æ] (RP), [a] (Manchester) or [ɑ] (Belfast) can be treated as the same vowel …". This is an inherently comparative, polylectal approach which aims to produce one underlying system for this aspect of the phonology of a language, in the face of surface disparity.

Work which has overtly adopted polylectal ideas includes Weinreich's (1954) notion of the diasystem, which is a linguistic system which exists at a "higher level of abstraction" than individual dialects and which can unite related dialects into a single description. Work influenced by Weinreich includes Labov, Ash & Boberg's (2006) seminal *Atlas of North American English*, which is produced within the framework of an 'initial phonological position' (explored here in section 5), which is based on the underlying contrasts of all North American dialects of English, and which is seen as and essential tool in understanding them. In a similar tradition, the influential Trager & Smith (1951) assume an 'overall system' for English, built on data from a large number of dialects.

The position I explore at the end of this article is one which assumes that polylectal argumentation is not absurd, if the aim is to produce a picture of the phonology of 'English'. This is a diasystemic notion — a framework in which the lower level dialects (which may differ phonologically, as this is not a fully panlectal analysis) exist. It is relevant here that speakers have knowledge of more than their own dialect, and they have an idea of who speaks the same language as them — that is, of who belongs to their close or extended speech community. These are the speakers who they would try to understand when they meet (even if it sometimes proves very difficult when their dialects are very different); the same person will not normally expect to be able to, or try to, understand a speaker of what they perceive to be a different language, even if it is a language that is historically or synchronically similar to their own. This all seems to imply that speakers *do* have mentally real conceptions of 'languages' like English. It might be that it is these perceptions (which can be studied

through the methodology of perceptual dialectology, see Preston 1989, Montgomery 2006) that we can point to, to say that this is where languages (in the everyday sense) exist. This knowledge of languages may be of a very different kind to a Chomskyan knowledge of an I-linguistic system (a grammar), but they both exist in the same mind/brain. It is also relevant here that it is not unreasonable to argue that an analysis which works well for lots of dialects of a language is more likely to be true.

The position developed here assumes, as is standard, that dialects of a language are more alike at an underlying level than at the surface level, but it also allows that they differ fundamentally in the light of different types of contrasts: where two dialects have different numbers of contrasts, this needs to be representable in any system; purely realisational differences (in terms of how underlyingly contrastive segments are realised on the surface), on the other hand, can be accounted for by differences in the realisational component, whether this be driven through rules or constraints. If our investigation of English produces such a diasystemic analysis, it is clearly reasonable to use argumentation which derives from more than one dialect. Specifically, we can allow the requirement of surface-respect (in terms of the underlying segments assumed), to be fulfilled by a pull from the surface forms of more than one dialect. Furthermore, we *can* answer the question about the symmetricality of English vowels, because we have a way of understanding what 'English' is, which allows for it to be analysed as a phonological system.

4. Which vowels occur in English?

In considering the vowels of English here, I set aside a number of things. Essentially, I shall focus on the monophthongal vowel contrasts which occur in stressed syllables. I ignore the much reduced inventories of unstressed syllables, which have a very different phonology, on the assumption that schwa is the phonological realisation of 'nothing' (that is, a vowel with no subsegmental content). I also ignore any issues that might arise from considering the pre-*r* vocalic environment. As Labov, Ash & Boberg (2006, 14) write "… it is not immediately evident whether the vowel of *bore* is to be identified with the vowel of *boat* or the vowel of *bought*, or whether *bare* belongs with *bait* or *bet*. As a result, sets of vowels before /r/ show a puzzling array of mergers and chain shifts quite distinct from those operating in the rest of the vowel system." I do not believe that the vocalic phonology of this environment is incompatible with what I discuss here, but I do not consider any special issues that might need to be addressed to account for it. The two preceding restrictions also mean that I do not consider central vowels at all. Although [ɜ] occurs in stressed syllables, such as *fur* in many dialects of English, it, like the centring diphthongs which can occur in words such as *fear* and *cure*, can be conceived of either as derived from the effects of an underlying following /r/ before it is deleted, or as further segments which contain a portion of phonological nothingness, also realised as a central vowel.

On top of this, I set other surface diphthongs aside in what follows: I ignore those segments which are sometimes referred to as the 'true diphthongs' (eg, in Giegerich 1992: 50, and see also Labov, Ash & Boberg 2006: 11), that is, those which are realised as diphthongs in such words as *price*, *mouth* and *choice* in most varieties. Kurath (1964: 20) argues that "[t]he phoneme /ɔɪ/ of *boy*, *join* … is an odd unit that cannot be assigned a meaningful place in the vowel system … As the only foreign vowel

phoneme in English it has not been integrated into the system." Even if we don't fully accept Kurath's claims, there is certainly reason to believe that this vowel behaves differently from the monophthongs: it has the most restricted distribution of any English vowel, only occurring before a subset of the coronals (see, for example, Kruisinga 1943 and Hammond 1999). The diphthong in *mouth* has almost as restricted a distribution, also only occurring before coronals (a slightly wider set of them than is the case for the vowel of *choice*) and this sets these two apart from other vowels. Although the vowel of *price* has a wider distribution, it forms a class with the *mouth* vowel in English because the two pattern together in 'raising' and related processes in a number of varieties (see Trudgill 1986, Moreton & Thomas 2007 for an overview of such processes). It therefore seems reasonable to exclude these three vowels from consideration: as well as being characterised by being composed of two sets of subsegmental material,[6] they have different phonological behaviour from other vowels. I thus focus in what follows (as also, in fact, was the case in section 2.1) only on vowels which can be perceived as underlying monophthongs, and which pattern together phonologically, for example in lengthening patterns or in terms of their distribution. This includes the vowels of *face* and *goat* — although they can be realised as diphthongs in some varieties (and are often transcribed as such for RP, as I discuss in section 5), they are clear, contrastive monophthongs in many varieties (eg, Scottish, Northern English, American dialects).

4.1 The maximal set of English monophthong constrasts

With all the above in mind, we can adopt the 'maximal' set of English monophthongal contrasts as our initial position for consideration. I consider this 'Maximal English' set of contrasts in this section (and some of the dialects that it is found in) and, later, three other sets of contrasts found in other dialects. It would be impossible to consider all dialects of English in this article, but the four discussed here are relatively representative of varieties of English in this respect.

There are 12 possible contrasts in 'Maximal English'. Wells (1982) introduced a set of 'standard lexical sets' as a way of comparing the vowels of dialects of English, and I use these sets here for reference (indeed I used the notion already to refer to vowels individually in section 4). All the words in each lexical set feature the same vowel (in most dialects), but the precise nature of the vowels used in the sets can vary cross-dialectally (as can the number of distinct sets — not all dialects have all the contrasts, of course). Each set is referred to by a 'keyword', which exemplifies the set. Those relevant here (typically featuring monophthongs, and ignoring those designed to account for pre-*r* developments, unstressed vowels and purely distributional differences) are listed in (14). The basic idea behind Wells' keywords has also been developed elsewhere, and I also list the equivalent keywords used for similar purposes by Labov, Ash & Boberg's (2006) *Atlas of North American English* in (14), for comparative purposes.[7]

[6] The nucleus of *choice* is unambiguously diphthongal in this way, and those of *price* and *mouth* have two sets of subsegmental material in them for the vast majority of varieties. They can monophthongise in some dialects, but then they tend to merge with an already existing low monophthong.

[7] Labov, Ash & Boberg (2006) see their *balm* as only partially correlating with Wells' PALM, as it also overlaps with LOT, but this would leave *cot* with no correspondent, so, while the sets may not completely

(14)	Wells (1982)	*ANAE*
	KIT	*bit*
	DRESS	*bet*
	TRAP	*bat*
	LOT	*cot*
	STRUT	*but*
	FOOT	*put*
	FLEECE	*beat*
	FACE	*bait*
	PALM	*balm*
	THOUGHT	*bought*
	GOAT	*boat*
	GOOSE	*boot*

I shall work with these 12 possible contrasts below, but it will also be important to recognise the widely assumed distinction between two subsets of vowels within this list. Although there is disagreement about how the difference between these two sets of English monophthongs should be characterised phonologically (as we shall see in section 5), the two subsets of vowels in (15) are recognised on the basis of a number of phonological criteria. I adopt the labels 'free' and 'checked' to label these two vowel sets as they are the least theoretically loaded (and have long been used to make this distinction, for example in Kurath 1964).

(15)	*Free*	*Checked*
	FLEECE	KIT
	FACE	DRESS
	PALM	TRAP
	GOOSE	FOOT
	GOAT	STRUT
	THOUGHT	LOT

As the organisation of (15) implies, it is often recognised (for example in Giegerich 1992) that there are *pairs* of vowels within these two sets (which might differ only by one feature value but are otherwise phonological identical), made up of the two members on each line (thus the FLEECE vowel is paired with the KIT vowel and the FACE vowel with the DRESS vowel). This lets us describe the phonetic and phonological differences between the two groups of vowels (following many others, such as Kruisinga 1943, Kurath 1964, Giegerich 1992) thus:

- the two members of each free/checked pair occur at approximately the same place in the vowel space (or at least can be associated with the same place through some type of polylectal argumentation)
- free vowels tend to involve more extreme or peripheral articulations (and are often described as 'tense'), whereas checked vowels tend to involve less extreme/peripheral articulations (and are often described as 'lax')

coincide, I think the equivalences given here will work for our purposes. The *ANAE* also considers a *suit* vowel. If this is not a consonant+vowel sequence, it is a diphthong, and can still be set aside for our purposes.

- free vowels tend to associate with phonological length and weight, whereas checked vowels associate with phonological shortness and lightness
- the phonological distribution of the sets is different: free vowels can occur in both closed and open syllables, and can occur before final [ʒ] but not before [ŋ], whereas checked vowels can only occur in closed syllables, and can occur before [ŋ] but do not occur before final [ʒ].[8]

4.2 Variation in English monophthong constrasts

The 'Maximal English' set of underlyingly monophthongal contrasts in (15) is found in many dialects of English, including the canonical Southern English varieties (including the Southern-derived 'RP'), Southern Hemisphere native-speaker varieties and, Kurath (1964) notes, certain dialects in eastern New England. I briefly consider three other 'inner circle' (Kachru 1985) type varieties of English here, to illustrate the type of variation that exists in this area in a reasonably representative way.

A relatively 'nondescript' North American set of contrasts, of the type described by Wells (1982) as 'General American' is shown in (16).[9] Dialects of this type (often associated with the Midwest of the US, and with national newsreaders) have one less contrast than the vocalically 'Maximal English'.

(16)

FLEECE	KIT
FACE	DRESS
PALM	TRAP
GOOSE	FOOT
GOAT	STRUT
THOUGHT/LOT	—

Dialects from the north of England, such as those spoken in the North East of England, centred about the city of Newcastle upon Tyne, and that spoken in Liverpool have the set of contrasts shown in (17). This set also has one less contrast than the vocalically 'Maximal English', but the difference between the types of dialect is different.

(17)

FLEECE	KIT
FACE	DRESS

[8] Although some form of this distributional difference is widely adduced, its precise formulation is difficult. Free vowels *do* have an essentially free distribution (excepting the pre-ŋ prohibition), but the way the distribution of checked vowels is formulated here only works if words such as *matting, ladder, banner etc*. involve ambisyllabicity or coda-capture of the medial consonant. In frameworks denying these phenomena, such as Government Phonology (see Harris 1994, 2004, for example) some reformulation of the constraint is required. Kurath (1964: 17) explains the difference thus: "[c]hecked vowels do not occur at the end of morphemes … [f]ree vowels, on the other hand, appear both finally and before consonants". The *happy* environment (to use a further keyword from Wells 1982), which occurs in words with a final unstressed open syllable which feature a front, non-low vowel, complicates this picture, however, because checked vowels can occur here, as in *city* [sitɪ], found in Old RP and many Northern English varieties. The asymmetric distribution is real, however. It is unambiguously the case, for example, that monosyllabic words can only occur without a final consonant if they contain a free vowel, and checked vowels cannot occur in this environment.

[9] American dialectologists often do not like to use the term 'General American'. Labov, Ash & Boberg (2006) write that it has hardly been used since Kurath (1949), and Phillips (2011: 179) writes that is "neither General nor particularly American" (because it explicitly lacks eastern or southern colouring). The existence of the basic type of dialect in question is not in dispute, however.

PALM	TRAP
GOOSE	FOOT/STRUT
GOAT	—
THOUGHT	LOT

Dialects from Scotland have quite radically different surface vocalic phonology from most other varieties of English, in part thanks to the Scottish Vowel Length Rule, which accounts for the length of free vowels in a very different way to the generally categorical manner of other varieties: as, among others, Aitken (1981), McMahon (1991) and Scobbie, Hewlett & Turk (1999), explain, free vowels can only be long under the SVLR if they precede a lenis fricative, rhotic or morphological boundary. The underlying system of many speakers, especially those who speak Scottish Standard English can be described as in (18), meaning that this set has three less contrasts than the vocalically 'Maximal English'.

(18)

FLEECE	KIT
FACE	DRESS
PALM/TRAP	—
GOOSE/FOOT	—
GOAT	STRUT
THOUGHT/LOT	—

The manner of presentation of the types of variation among dialects of English that has been adopted here is inherently polylectal, but it is not panlectal. It assumes that there is an overall framework for English at this underlying level, which is exemplified in 'Maximal English' varieties and which provides a structure within which dialects vary. If a dialect lacks an underived potential English surface contrast (such as that between *thought/caught* and *lot/cot*, for example), it is not written into the underlying description of the variety. That is (to use the terminology of Wells 1982, based on Trubetzkoy 1931), 'systemic' differences between dialects are respected underlyingly, but 'realisational' differences, as their names suggests, are not. The overall model, based on that of Giegerich (1992), might thus been seen as partially polylectal.

The kind of variation observed here illustrates what I shall call Giegerich's Generalisation about English vowel systems: "…the way in which certain accents … do *not* have certain vowel phonemes is rather telling: what is a pair in one accent is collapsed into a single phoneme in another. […] In distributional terms, the phoneme that is absent is in all such cases the one with the more restricted occurrence … " (Giegerich 1992: 49, emphasis in the original). That is, where dialects of English differ from each other, it is because the checked member of a pair, or more than one checked vowel, is absent. This insight underlies our ability to develop an overall vowel system for English, which is only partially polylectal, but which itself does allow us to wonder how well it fits with the observations about the tendency towards symmetry in vowel systems that were considered in section 2.

It could be argued that it is a category error to ask such a question — the systems considered in section 2 are intended as phonological, cognitive systems, and symmetry might only apply to them. The system for the language (in the socio-political sense) called 'English' that is considered here is a diasystem of sorts. Like all diasystems, its psychological reality is questionable — can the expectation of symmetry be expected to apply to such a construct? The psychological reality of the system for English may

be questionable but its usefulness is not, and as long as we situate ourselves on the left-hand side of the model in (13), it is a desirable thing. As we saw in section 3, the systems that phonologists deal with are typically assigned to whole dialects, rather than individual speakers, and so are already away from the very right-hand side of (13). The systems discussed in section 2 are listed in the works that refer to them as systems for *languages* — so it may be the case that symmetry only applies at *this* level of abstraction. I consider previous analysis of English vowels in this light in section 5, and move on to the system that I advocate in section 6.

5. Segmental analyses of the English vowel system

Section 4 simply deals with vowel contrasts. Section 2, however, was predicated on the basis that the structure of phonological systems can be understood by considering the identity of the segments involved. If the phonological surface is respected, the system of contrast between the FLEECE, KIT and GOOSE vowels, for example is not just a matter of phonemic differences, but of phonological entities, each with their own different identity. What are those identities? They are typically expressed using symbols of the type found in section 2. Although such symbols are generally intended as shorthand for co-occurring sets of subsegmental features or elements, each precise symbol should be taken seriously. There may be slightly differing traditions in symbol usage, so we must be careful when comparing the analyses of different authors, but we can expect coherence within each analysis, and symbols must refer to phonological entities with a precise definition.

I consider a number of previous analyses of English vowels in this section, weighing them up against the criteria established in the previous sections, asking two questions: how well do they work for 'English'? And how do they fare in terms of the expectation of symmetry? While it need not necessarily be the case that the correct analysis measures up perfectly against both criteria — not all phonological systems are fully symmetrical, after all — an analysis which *does*, and which also fulfils all other necessary criteria, is superior to any that doesn't. I consider only six analyses here. English has been analysed many times and no article could discuss all of this work. I consider a number of classic and recent analyses which are useful for the purposes of discussion and I take the symbols used in each analysis at face value (once properly interpreted).

5.1 Gimson's "Introduction to the Pronunciation of English"

Gimson's *Introduction to the Pronunciation of English* is a standard authority for those learning British English as a second language. The third edition (Gimson 1980: 100), the last by Gimson himself, summarises its analysis of English vocalic phonemes as in (19).

(19) 7 *short*: /i, e, æ, ɒ, ʊ, ʌ, ə/
5 *long* (relatively pure): /iː, uː, ɑː, ɔː, ɜː/
3 *long* (glides to [ɪ]): /eɪ, aɪ, ɔɪ/
2 *long* (glides to [ʊ]): /əʊ, aʊ/
3 *long* (glides to [ə]): /ɪə, ɛə, ʊə/

I set aside Gimson's /aɪ, ɔɪ, aʊ/ as 'true diphthongs', and /ə, ɜ:, ɪə, ɛə, ʊə/ as pre-*r* or central vowels, which can either be derived from other underlying segmental sequences or from a featurally unspecified syllabic nucleus. Even after that, this analysis is still deeply problematic from a phonological perspective, as Gimson acknowledges. It is intended to "give a good deal of explicit information in the notation about the phonetic realization of the phonemes" (1980: 100), in order to be useful for those who want to learn the pronunciation of RP. It is explicitly based more on phonetic criteria than on phonological considerations (but yet, oddly, it has appeared in several textbooks on the phonology of English).

The FACE and GOAT vowels are represented as diphthongs: /eɪ, əʊ/, and this is problematic for two reasons: (i) it is true that these vowels are commonly somewhat diphthongal in RP, but to write this into the underlying representation means that the system is not applicable to other varieties, such as Scottish, Northern English and many American dialects, where these vowels are typically monophthongal, with qualities of the [e, o] type; (ii) these are not the only vowels which can have diphthongal surface forms, even in RP — for example, Gimson writes in the description of the vowel that he analyses as /i:/ that "[t]he vowel is often noticeably diphthongized, especially in final position" (1980: 102) and, further, that "[j]ust as RP /i:/ is rarely pure, so RP /u:/ is usually diphthongised, [ʊu] or [uw], especially in final positions" — it makes little sense to represent two of the (non-true diphthong) free vowels as underlying diphthongs, and the rest as monophthongs, if the ability to occur as surface diphthongs is not limited to those two. Most other analyses considered here treat the checked vowels as underlying monophthongs which may diphthongise on the surface in certain dialects or in certain environments.

Overall, the system makes no reference to symmetry or any other phonological principle of organisation, with five groups of vowels of unequal numbers and largely asymmetric systems. The 'short vowels' (the checked vowels of section 4) can be seen as a symmetrical system, but the 'long pure vowels' (a subset of the free vowels) form an odd system with one front and three back vowels. As the analysis is so phonologically inelegant we may conjecture that it misses the underlying pattern.

Gimson's use of 'short' and 'long' to characterise the checked and (most of the) free monophthongs is also questionable, especially as he analyses the difference between the free/checked pairs (FLEECE and KIT, for example) on both a qualitative and quantitative basis. As Abercrombie (1964), among others, has pointed out, this is phonologically flawed: only one of these distinctions need be written into the underlying forms as the other can always be predicted. If a quantitative approach is taken, the FLEECE : KIT contrast can be analysed as /i:/ : /i/, and the surface laxness (non-peripherality) of KIT can be derived to give [ɪ] because all short vowels are non-peripheral (in most varieties, including RP, which Gimson focuses on); or if a qualitative approach is taken, the FLEECE : KIT contrast can be analysed as /i/ : /ɪ/ and the surface length of FLEECE can be derived to give [i:], because all tense vowels are long on the surface (e.g., in RP). Gimson's analysis of the free/checked contrast as /i:/ : /ɪ/ *etc.* thus encodes redundancy into the underlying representation in a phonologically problematic manner, and this should surely be rejected. Both quantitative and qualitative non-redundant analyses of the free/checked monophthong contrast have been defended: the quantitative position by Lass (1976), Durand (2005) and a tradition to be discussed in section 5.2, for example, and the qualitative position (which typically describes

the difference as one between 'tense' and 'lax' vowels) by Abercrombie (1964) and in a number of the analyses discussed below.

5.2 Labov et al's "The Linguistic Atlas of American English"

Labov, Ash & Boberg's (2006) monumental work, which largely deals with phonological variation in North American dialects of English, proposes an 'initial position' which acts as a framework for understanding the changes that are currently in progress in these dialects. It "is an abstraction that may not correspond to any actual uniform state of the set of dialects in question" (2006: 11), and thus is a diasystem for (many of the dialects of) English. The system assumes that the free/checked distinction is underlyingly one of long : short, and is based on a tradition of analysis going back to Bloomfield (1933), Trager & Bloch (1941) and Trager & Smith (1951).[10] It is shown in (20).

(20)

	SHORT		LONG					
			Upgliding				Ingliding	
			Front upgliding		Back upgliding			
	V		Vy		Vw		Vh	
nucleus	front	back	front	back	front	back	unrounded	rounded
high	i	u	iy		iw	uw		
mid	e	ʌ	ey	oy		ow		oh
low	æ	o		ay		aw	ah	

The checked vowel subsystem is a perfectly symmetrical three-degree quadrangular system on this analysis, and this is something of a recurring theme. We already saw it from Gimson, and Kurath (1964: 19) noted already that "[t]here is less symmetry between the free front and back vowels than in the set of checked vowels", and there is considerable, although not unanimous agreement that the checked vowels are organised in line with the expectation of symmetry discussed in section 2: perfectly symmetrically on both axes, in the less common quadrangular way.

Labov *et al*. consider all free vowels to be long, and furthermore, in fact, to be underlying diphthongs, with a nucleus and with glides which give three unsymmetrical subsystems within the free vowels. The length of this quantitative system (which Labov *et al* call 'binary') is thus implemented by the addition of glides. If we remove the 'true diphthongs' (Labov *et al*.'s /ay, aw, oy/), and /iw/ which represents the cluster in words like *suit*, the system makes more sense, with a two degree symmetrical 'upgliding' subsystem perceivable, but this leaves the 'ingliding' vowels, and is a problematic step on the basis of this analysis because it is built on the assumption that diphthongs are integrated into the system. Furthermore, the qualitative approach

[10] Trager & Smith (1951) in fact propose a nine-vowel, three degree perfectly symmetrical quadrangular system, which is extended by the three types of glide that Labov *et al*. use, to give 36 possible vowels (as well as a further 36 'vocalic nuclei' which involve an *r*) an as 'overall system' for English. This is an impressive achievement and was influential in American phonology but has few if any defenders in its entirety now, in part because it needs to scrape around to fill each slot: /ɨ/ is listed for the AmEng adverb *just*, for example, arguably based only on a phonetic, predictable difference from other vowels, and the /ew/ slot is filled using the surface form of *house* in Tidewater Virginia.

is challenged by Scottish free vowel phonology. According to the Scottish Vowel Length Rule, mentioned already in section 4.2, free monophthongs are only long when followed by a lenis fricative, a rhotic, or a morpheme boundary (creating derived contrasts such as *need* /nid/ → [nid] : *kneed* /ni+d/ → [ni:d]). If this is a lengthening process, the rule can be straightforwardly formulated, but if the underlying vowels are long, the shortening needs to apply before all plosives, fortis fricatives, most sonorants and needs to be stopped from applying before the morpheme boundary in forms like the past tense example above, and this poses real problems for the formulation of a rule or constraint to enforce it. This problem disappears on the qualitative analysis, where both types of vowel can be underlyingly short.

5.3 Kurath's "A Phonology and Prosody of Modern English"

The analysis in Kurath (1964, 20) is presented in (21). It is qualitative, and hence compatible with the SVLR and is organised with the question of symmetry in mind.

(21)

	Front			Central			Back		
	Checked	:	*Free*	*Checked*	:	*Free*	*Checked*	:	*Free*
High	ɪ	:	i				ʊ	:	u
Mid	ɛ	:	o			ɜ	ʌ	:	o
Lower mid	æ						(ɒ)[1]	:	ɔ
Low			ai	(ɑ)[2]	:	(ɑ)[3]			au

As will be clear from the quotations from this volume given earlier in this article, Kurath excludes the CHOICE diphthong from his set of vowels, but includes the PRICE and MOUTH vowels, which gives a four-degree system. While intriguing, and backed by some fair phonetic argumentation (the starting point of the diphthongs is lower than the vowels that Kurath describes as 'lower mid' in some dialects), this seems overall to be a problematic analysis. It includes the MOUTH vowel, whose integration into English is almost as poor as the CHOICE vowel in terms of distribution, and it leaves the checked system as symmetrical (as long as the vowel with superscript 1 is included — this is "[o]nly in BE, as in *lot*" 1964: 20), but with gaps in the low degree in terms of the overall system, and is not supported by the varieties with a low TRAP vowel. The organisation of the central vowels is also surprising (if insightful). That with superscript 2 is "[o]nly in AE, as in *lot*" and that with 3 "[o]nly in BE and in coastal AE, as in *far*" (1964: 20), and they make English a triangular four-degree system with a non-symmetrical free vowel system if the diphthongs are removed (Kurath in fact uses a slightly different symbol for the superscript-2 vowel and the superscript-3 vowel). While quite compelling, a better system can be found.

5.4 Chomsky & Halle's "Sound Pattern of English"

Chomsky & Halle (1968) famously assume the system in (22). This is the presentation of the system given in Imai (1975: 414), who sets out the system clearly, including all vowels and most features used to characterise them (Chomsky & Halle nearly do this on page 236). It is reminiscent of the presentation of a six vowel system from

Durand (2005) in (10), except that both free and checked vowels are included (interpreted qualitatively as 'tense' (that is, [+ tense]), indicated by the macron, and 'lax' (that is, [– tense]), indicated by the absence of macron), and, also, [± round] is also needed to make the three-way contrast in the low vowels.

(22)

	– back			+ back			
– low		ī	i	ū	u		+ high
		ē	e	ō	o		– high
+ low	ɶ̄	ǣ	æ	ɔ̄	ɔ	ā	

This system is fully symmetrical on the vertical axis, but it is neither triangular nor quadrangular and is asymmetrical by including a three-way contrast at the low level, which is the only level to make use of [± round]. Feature Economy makes this seem problematic: why is this feature not used at other levels? A further issue with Chomsky & Halle's system is that it incorporates the 'true diphthongs', because they are derived from underlying monophthongs (the PRICE vowel from /ī/, for example, and the MOUTH vowel from /ū/). This is due to the extremely abstract phonology allowed in the model, which has generally been rejected since (see, for example, Bermudez-Otero & McMahon 2006). I assume, along with the phonological majority, that this model fails on those grounds, despite its elegance.

5.5 Hammond's "The Phonology of English"

Hammond (1999: 6) analyses "the vowels of English" as in (23). This is based on a much less abstract model of phonology than that assumed in *SPE* because it is couched in Optimality Theory, which is much more surface-oriented than previous generative models because there can be no constraints on underlying forms ('inputs'). However, it partially shares with *SPE* the tense/lax analysis of the free/checked distinction: "'[t]ense' vowels appear in the periphery of the diagram and 'lax' vowels in the central regions" (1999: 6), although Hammond goes on to claim later that this might be better interpreted as a distinction between long and short.

(23)

	Front		Back	
High	[i]			[u]
		[ɪ]	[ʊ]	
Mid	[e]			[o]
		[ɛ]	[ʌ]/[ə]	
Low		[æ]		[ɔ]
				[ɑ]

Hammond's analysis fails on the criterion of symmetry for both the free and checked vowels as there are gaps or crowding at the low level. While this is hardly fatal for an analysis, given that section 2 recognises that symmetry is only a major tendency in vowel systems, the analysis also fails on polylectal grounds, as it cannot account

for all 12 of the contrasts shown for 'Maximal English' in section 4. This was not an issue for Gimson, Labov, Ash & Boberg or Kurath, and while it would often not be seen as deeply problematic for a phonological analysis either, section 4 argues that an analysis is better if it does not fail on this criterion. Those to come do not.

5.6 Giegerich's "English Phonology"

Giegerich (1992: 49) presents the analysis of English monophthongs given in (24). This is a qualitative tense/lax analysis, compatible with all dialects of English. It assumes a three-degree system and follows Chomsky & Halle (1968) in making a contrast at the low level using the feature [± round], but only one such contrast is made in this system: the /ɔ/ : /ɒ/ contrast. Like Hammond (1999), it is closer to the surface than *SPE* as the vowels /i, u/ surface as monophthongs, for example.

(24)

	Front ⟷ Back	
High	/i/ — /ɪ/	/ʊ/ — /u/
↑		
Mid	/e/ — /ɛ/	/ʌ/ — /o/
↓		/ɒ/ — /ɔ/
Low	/a/	/ɑ/

This system is nearly perfectly symmetrical. If we tease apart the free (tense) and checked (lax) subsystems, as in (25), this becomes clear. The checked subsystem is fully economical in terms of the three features needed to characterise it, in the way shown for tense vowels by Durand in (10). However, the free subsystem is asymmetric, and this renders the system questionable: why is [± round] only used in the low back free vowels? This is highly uneconomical.

(25)

Free vowels		Checked vowels	
i	u	ɪ	ʊ
e	o	ɛ	ʌ
	ɑ, ɔ	a	ɒ

The analysis uses /a/ as the symbol for a low front lax vowel. This derives from a tradition with a good analytical heritage (see, for example, Abercrombie 1964), but it conflicts with the transcription practice of all other analyses considered here. The STRUT vowel (/ʌ/) fits into the system as a back vowel, the pair of the GOAT vowel, as in the analyses of Kurath (1964) and Labov, Ash and Boberg (2006).

With this set of symbolic analyses, GIEGERICH'S GENERALISATION works well for the North American system and the Northern English system considered in (16) and (17): when one of the /ɔ : ɒ/ free/checked pair is absent, it is /ɒ/, and THOUGHT and LOT are merged; and when one of the /o : ʌ/ free/checked is absent, it is /ʌ/, and FOOT and STRUT are not split. However, GIEGERICH'S GENERALISATION does not work quite so well for Scottish English. When one of the /ɑ : a/ free/checked pair is absent, with PALM and TRAP merged, Giegerich symbolises this as the absence of /ɑ/, with /a/ transcribed in words like *bath, Sam, darn* and *shah*, but this is the symbol for the checked ([–tense]) vowel in Giegerich's system. The only other analysis which can easily incorporate GIEGERICH'S GENERALISATION is that of Kurath (1964), but that too may fail for the low

vowels. The benefit of working with Giegerich's Generalisation in order to be able to provide a partially polylectal analysis is non-negligible, given the argumentation in section 4. Giegerich's system nearly succeeds, just as it nearly succeeds in being fully symmetrical. In the next section I propose a simple modification which rectifies these failings and which also has surprising implications.

6. The Giegerich^{+} Analysis of the English vowel system

If the two criteria considered in this article — systemic symmetry and partial polylectalism — are valued, the system proposed in (26) is the best analysis of the English vowel system. Of the previous analyses, it is closest to that of Giegerich (1992), simply involving the reallocation of the vowels in the low level of the system, so I call it the Giegerich^{+} system, although it is also close to the analysis of Kurath (1964).

(26)

Free		Checked		Full system	
i	u	ɪ	ʊ	i : ɪ	u : ʊ
e	o	ɛ	ʌ	e : ɛ	o : ʌ
a	ɔ	æ	ɒ	a : æ	ɔ : ɒ

The summary of the 'full system' in (26) represents the overall framework for the monophthongs of English, with the free vowels on the left of each of six pairs and the checked vowel on the right. It represents a fully symmetrical, phonologically elegant system, into which distinct dialects fit. As long as we see these as desirable characteristics, it is a better system than all those considered above. It is a quantitative model which coincides with those varieties which have the 'Maximal English' set of contrasts and provides a framework to understand other varieties which may lack one or more of the checked vowels, in line with Giegerich's Generalisation. The most problematic free/checked vowel pair in Giegerich (1992) is the low PALM/TRAP pair. Giegerich symbolises this as /ɑ : a/, but I adopt /a : æ/. My usage is in line with most other practice in using /æ/ as the checked vowel, and almost fits with Labov, Ash & Boberg, and some other American practice, such as Trager & Smith (1951), in using /a/ as the low unrounded free vowel. This aligns the vowels of English with the Maximal English contrasts in a fully symmetrical way, as shown in (27).

(27)

Free vowels		Checked vowels	
FLEECE	GOOSE	KIT	FOOT
FACE	GOAT	DRESS	STRUT
PALM	THOUGHT	TRAP	LOT

The system assumed here respects the surface on a polylectal basis. For example, FLEECE, GOOSE, KIT and FOOT are realised as [i, u, ɪ, ʊ], sometimes with length, in many dialects. FACE and GOAT are front and back monophthongs respectively for many speakers. TRAP is a low front vowel like [æ] for many speakers in America, for example, and PALM can be the front vowel [a:] in several varieties, including Liverpool English (see Watson 2007), Leeds English (Wells 1982) and Australian English (Trudgill & Hannah 2002).

GIEGERICH'S GENERALISATION works in the same way for the American and Northern English varieties considered in section 5.6, but it also works for Scottish varieties: when one of the /a : æ/ free/checked pair is absent, with PALM and TRAP merged, this involves the absence of /æ/, with tense /a/ left to transcribe the vowel in words like *bath, Sam, darn* and *shah*. This is both in line with transcriptional tradition and respects the surface better for the majority than would the use of /ɑ/ (Wells 1982).

As with all systems which abstract over inter-speaker variation, the Giegerich^{+} analysis requires a considerable component of dialect-specific realisation conventions, which could be implemented either through rules or constraints. For example, in those varieties where PALM is not front, the vowel must be backed by the surface (a → ɑ); in the same way, FACE and GOAT are diphthongised for many speakers and free vowels are often lengthened; similarly, the GOOSE vowel is fronted (u → ʉ) for many speakers, including, but not limited to, those with Scottish accents; and there is a realisation convention for STRUT for the large number of speakers who do not have a surface back vowel.

The overall system is quadrangular, and therefore of the less common type, but it fully complies with the expectation of underlying symmetry in the free vowel subsystem, and in the checked vowel subsystem in 'Maximal English', while allowing for systemic differences in this part of the framework, in line with GIEGERICH'S GENERALISATION. It is a phonologically elegant diasystem which, as we shall see in section 7, predicts or allows for an understanding of some aspects of phonological behaviour of English which may just, unexpectedly, be attested.

6.2 What do the symbols mean?

The symbols of phonological transcription like those used in the system proposed here in (26) are to be understood as complexes of co-occurring atoms of subsegmental material. As we saw in section 2.1, these atoms are typically conceived of either as binary features or privative elements (although systems which mix binary and privative units also exist). I briefly consider in this section how the symbols of (26) can be understood in these ways, providing an answer to the question 'what do the symbols really mean?'

If we assume binary features, little needs be added to what we have already seen. Durand (2005) provides a set of feature specifications for a six vowel system (given here in (10)), which we also saw at work in Chomsky & Halle's (1968) system in section 5.4, and these work perfectly for each of the free and checked subsystems proposed here. If we add a feature to make the checked/free distinction ([± tense] is used here, following Giegerich and others, such as Chomsky & Halle, but others could work equally well), then only four features are needed to characterise the system of (26), and all possible combinations of them are attested (if we again assume that [+high, +low] is an impossible combination on non-phonological grounds). This makes for a highly economical system, as in (28).

(28)

	–back	+back
+high, –low	i : ɪ	u : ʊ
–high, –low	e : ɛ	o : ʌ
–high, +low	a : æ	ɔ : ɒ
	+tense : –tense	

Can a set of specifications based in the Dependency/Government tradition also work? Although Harris (1994) is avowedly dialectal in his phonology, he proposes a set from within this tradition for the "most familiar" subsystems of English vowels, which we can reasonably correlate with the 'Maximal English' position considered here. He uses the representations in (29) for free vowels.[11]

(29)	i	u	**I**	**U**
	e	o	**A, I**	**A, U**
	a	ɔ	**A**	**A, U**

Although fully usable, this set of specifications lacks symmetry because it follows the basic principle of the 'I,A,U' elemental system in implicitly assuming that all vowel systems are triangular. Because of this, it really implies that the English free vowel system is as in (30), a four-degree, asymmetric triangular system, which loses the symmetrical advantage of the Giegerich^{+} system.

(30)	i		u
	e		o
			ɔ
		a	

Harris (1994: 115) represents checked vowels considered here as in (31). They are "neutral-headed", using a fourth element, which by itself represents articulators in the neutral position. This element is also required for other purposes, and Harris uses it here to add laxness to a representation. A potential advantage of this type of representation is that it could provide a rationale for the more restricted distribution of the checked vowels: they have a more complex representation and would therefore be expected to be less common than their free partners, which are simpler vowels.

(31)	ɪ	ʊ	**I, @**	**U, @**
	ɛ	ʌ	**A, I, @**	**@**
	æ	ɒ	**I, A, @**	**U, A, @**

As well as the problem shown in (30), the representations in (31) lose the phonological identity between the pairings of vowels that have been assumed as the basis of the Giegerich^{+} system: compare the representations for /a/ and /æ/ and for /o/ and /ʌ/. While Harris' system has its benefits, its problems make it incompatible with the basic criteria of symmetry and partial polylectalism. An alternative set of representations from within the Dependency/Government Phonology tradition is possible, however, as shown in (32).

(32)	i	u	**I**	**U**
	e	o	**I, A**	**U, A**
	a	ɔ	**A, I**	**A, U**

[11] In some representations, Harris actually specifies the GOAT and THOUGHT vowels in exactly the same way. I assume that this must be a typo here, and that the lower of the two has lower element as its head. I have also interpreted what Harris' text implies that he means in the representations of checked vowels in (31).

ɪ	ʊ	**I, @**	**U, @**
ɛ	ʌ	**I, A, @**	**U, A, @**
æ	ɒ	**A, I, @**	**A, U, @**

This set of representations retains the sense of identity between the two members of each free/checked pair, and implies a quadrangular system. It also retains Harris' benefit of making the checked vowels more complex. This also provides an explanation and characterisation for Giegerich's generalisation: the more phonologically complex vowel of a free/checked pair is the one which can be missing in dialects, and this absence can be characterised as the inability of a particular segment to have the neutral element **@** in its subsegmental makeup.[12] The characterisation of /æ/ with an occurrence of **I** in its make-up is reasonable — the vowel is relatively mid in many accents — but it could be a weakness that **I** is also included in /a/. It may also seem odd that the element **A** does not characterise any of these vowels by itself, but both of these points may be not fatal. As we have noted, quadrangular systems *are* unusual: perhaps this is the phonological characterisation of that unusualness.

Both types of characterisation — using binary features or privative elements — work, and are compelling in different ways. The privative model has the advantage of making the system a little unusual, while it seems almost perfect on the binary feature model. The fact that relatively few languages have such a system, as discussed in section 2.1, may tip the balance in favour of privativity, but it is worth noting that the Giegerich^{+} analysis proposed here is fully compatible with either model.

7. Codicil: Corollaries of the Giegerich^{+} system

Perhaps this paper should end here. An analysis of English vowels has been proposed and defended as possibly offering the best analysis of the relevant set of observations. And yet it is tempting to see if the analysis can be further supported because it allows for an explanation or understanding of phonological phenomena which are not obviously connected to it. This section considers two ways in which that might be the case, both deriving from the type of argumentation considered in section 2.2: that movements towards symmetry, driven perhaps by a desire to increase phonological economy, dispersion or to make more rational use of subsegmental material, can drive phonological change. The argumentation in section 7.1 seems intriguing to me; that in section 7.2 may be going too far — I take it as far as it can possibly go here, however, to see where we might end up.

7.1 Modern changes in the set of monophthong contrasts

The Giegerich^{+} system can be seen as providing a rationale and framework for understanding key changes in terms of numbers of contrasts among the vowels of English in the Modern period. The late Early Modern English vowel system (from the late 17th century) can be analysed as in (33). This represents a stage after the Great Vowel Shift

[12] This assumes that there is a clear way in which **@** is not in the active make-up of all segments, an important point for those involved in this theory.

and the complex *meet/meat/mate* mergers (see, for example, Lass 1999, for details of these phenomena and the historical background to the analysis given here).[13]

(33)

Free		Checked	
i	u	ɪ	ʊ
e	o	ɛ	
	ɔ	æ	ɒ

As they stand, in (28), both subsystems are asymmetric, with obvious 'gaps'. The two main developments in terms of numbers of contrasts during the (Early) Modern Period, after all the Great Vowel Shift changes had occurred (including the *meet/meat/mate* reorganisation) are the FOOT-STRUT split and BATH-broadening (to use the labels of Wells 1982). On the picture presented in (33), these both fill the gaps in the systems perfectly, to leave the system in (26).

The FOOT-STRUT split involved the development of the vowel symbolised above as /ʌ/ from many (but not all) occurrences of the vowel symbolised as /ʊ/. This is a rather inexplicable change unless the systemic pressure to fill the quadrangular system is considered: /ʊ/ splits, with the rough phonological conditioning that the lowering and unrounding is inhibited in the neighbourhood of labial and certain other consonants (see Honeybone 2005, for example), but there is no obvious phonetic or exogenous reason to cause this change. If we perceive the pressure towards symmetry (which is in principle resistible, but is nonetheless always hovering, perhaps normally low in the hierarchy of constraints on phonology) as the motivating force behind the change, it makes sense, as in (34), with a broken line to show that not all occurrences of the input segment change. While this change occurred in what we can view as 'Maximal English', it did not occur in the North of England, which accounts for the pattern of contrasts in (17).

(34)

ɪ	ʊ	
	↓	
ɛ	ʌ	
æ	ɒ	

The BATH-broadening change filled the /a/-shaped hole in the free vowel system. It involved many (but not all) occurrences of the vowel symbolised above as /æ/, changing, also with a rather rough phonological conditioning, essentially originally involving a following rhotic or voiceless fricatives, then a following nasal, and eventually leading to a split (so the change could be called the TRAP-PALM split). The precise phonetics of the segment that was the output of the change are complicated, and vary from dialect to dialect (also eventually being implicated the phenomenon sometimes called 'ash-tensing' in American English, discussed in many places, including Labov 2007). As is clear from the name that Wells gives this phenomenon, the change is often referred to

[13] Lass considers far more than can be addressed here, including copious historical detail, and would not agree with the position that I adopt. My analysis is, I think, a reasonable if heavily phonologised one, however. It may be that the two subsystems described here existed in these forms at slightly different periods, with the FOOT-STRUT split (discussed below) occurring before the free vowel system had settled on the form given in (33). That would not fundamentally alter the thrust of argumentation considered here.

as 'broadening'. It typically leads to surface-long vowels in the varieties into which it was innovated, but the core change on the model considered here is that it involved tensing to give /a/, filling the gap in the free vowel subsystem, as shown in (35).

(35)

	i	u	ɪ	ʊ
	e	o	ɛ	ʌ
	a	ɔ	æ	ɒ

This is also a rather unusual type of change. Such tensings are not common (and nor are non-compensatory lengthenings, if we bring in the segment's surface length). While it has a rough phonological conditioning, it was subject to lexical diffusion (which helped create the contrast with the original TRAP vowel), as was the FOOT-STRUT split, in fact. Perhaps these are the characteristics of changes which are driven by the pressure towards symmetry in vowel systems.

To the extent that the accounts of the vowel changes considered here are coherent and insightful, they add further credence to the Giegerich^{+} analysis of the current English monophthong system proposed here — they are exactly what would be expected if that system is correct.[14]

7.2 English phonology = symmetrical series of threes?

Section 7.1 deals only with vowels, as has been the case throughout most of this article. The section considers whether any parallels can be seen between the Giegerich^{+} analysis of English monophthongs and the English consonant system. As we saw in section 2.2, symmetry can also be perceived in consonant systems, and it might be at play in driving changes in the set of consonantal contrasts in English.

It is difficult to avoid the observation that the subsystems of plosives and nasals in English are congruent with the subsystems of free and checked vowels. All involve series of three segments, in symmetrical pairs where any contrast is made in a subsystem, as is clear from (36).

(36)

Free		Checked	
i	u	ɪ	ʊ
e	o	ɛ	ʌ
a	ɔ	æ	ɒ

Plosives		Nasals
p	b	m
t	d	n
k	g	ŋ

[14] Other analyses of the data considered here are available. Both of the systems in (33) could be represented as triangular if /ɔ/ and /æ/ were moved to the centre and /ɒ/ positioned opposite /ɛ/, but that would seem too disrespectful to the surface on the basis of the symbols used here. This might be a problem of my analysis, however. Lass (1999) would certainly claim that it is — he gives the checked system as /i, e, a, o, u/, which could much more reasonably be analysed as triangular, for example. If this is the case then both changes still make sense on this model, however. They involve a change from a triangular three-degree system to a quadrangular one, enforcing 'series of threes' among the segments involved.

Is this a coincidence? Perhaps, but it is also notable that the fricative system shows signs of moving in this direction. As well as the loss of /x, h/ in many varieties, and the merger of /ʍ/ with /w/, the dental fricatives are under threat in a number of ways. The traditional broad forms of several dialects, such as New York City English and Liverpool English often do not feature these segments, as they have been lost through 'TH-stopping', merging with /t, d/ for some speakers. One of the most vigorous changes in current UK English (in dialects without TH-stopping) is 'TH-fronting', in which /θ, ð/ merge with /f, v/. Dental fricatives are cross-linguistically marked segments and English seems to have a range of ways of removing them from its system. If this ongoing loss is completed, the English fricative system will be as in (37), which is suspiciously parallel to the systems in (36). (37) further reanalyses the approximant subsystem of (12) in line with the most common realisation of the rhotic — it has become a surface (and perhaps therefore underlying) glide in most varieties of English, which corresponds to non-high vowels in the same way that /w/ corresponds to /u, ʊ/ and /j/ corresponds to /i, ɪ/, including breaking hiatus, as in *r*-sandhi (see, for example, Broadbent 1999). On this basis, there is a series of three glides in English. (37) also reminds us that there is a set of precisely three 'true diphthongs' in English.

(37)

Fricatives		Glides	Diphthongs
f	v	w	aɪ
s	z	ɹ	aʊ
ʃ	ʒ	j	ɔr

In this way, a case can be made that the entire underlying segmental phonology of English can be understood as involving movement towards segmental series of three. These series are perfectly symmetrical wherever they involve a contrast between pairs. It is perhaps only a coincidence that all this leaves precisely three segments in the English system, as shown in (38).

(38)

Segmental remainder
l
ʧ
ʤ

8. Conclusion

How symmetrical are English vowels? If the type of argumentation considered here in sections 2 and 3 is accepted; if we want to develop a diasystemic underlying phonology for 'English'; if 'Maximal English' is a useful idea; if we should allow underlying representations to differ non-negligibly from surface representations, but with a polylectal pull towards surface-respect; if all this is allowed, then I hope to have shown that there is very good reason to believe that the monophthong system of English is perfectly symmetrical. The system is phonologically elegant, economical and explanatory (fulfilling the three *E*s of phonological goodness) because it makes best use of the subsegmental material out of which the segments are composed, and it offers a framework for understanding otherwise surprising changes in the history

of the language, which it was not designed to do. It may even fit in with an overall thrust towards an extremely elegant underlying phonology for the language. While this latter point may be going too far, and while many will doubtless reject at least some of the premises on which the analysis is based, if we expect beauty to equal truth, the system proposed here may yet be right.

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