*Vowel system universals and typology : prologue to theory**

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1 Fragestellung

Considering all the work done on vowel system typology and universals in the past half-century (Trubetzkoy 1929, 1939; Hockett 1955; Sedlak 1969; Crothers 1978), my title may seem rather arrogant. There are after all theories of vocalic organisation about, or at least models and taxonomies; there are even attempts to explain why certain implicational universals seem to hold (from Jakobson's 'laws of solidarity' (1968) to the more sophisticated treatments in Liljencrants & Lindblom 1972; Kim 1973; etc.).

But I suggest that there are major problems – conceptual, theoretical, empirical – in the formulations of typological schemata and universals that have been proposed so far, and that something of a new beginning, or a critical survey anyhow, is in order. A number of fundamental questions, on matters such as primitives, degree of permissible idealisation or normalisation, and the status of certain nucleus types are still at best *sub judice*. In particular, despite the notable and welcome phonetic sensitivity of the most recent large-scale systematisation (Crothers 1978), the problem of typology has been approached – for the state of our knowledge – too 'phonologically'.

This has led to important questions of principle being begged in advance, and some rather dubious assumptions being relegated silently to 'pretheoretical' background knowledge. I argue here that a much more 'phonetic' initial approach is needed: or at least one that asks some different and more detailed phonetic questions, as well as some different phonological ones. And this is necessary before some of the most interesting and basic phonological questions can even be asked. The main difficulties stem from the fact that the primary data base (the corpus of objects properly called 'vowel systems') is ill-defined, and insofar as it is defined, problematical.

The central theoretical questions are:

(i) The relation between phonetic exponence and symbol choice: what do we really mean (or what ought we to mean) by saying that a language (for instance) 'has /u/'? (§§ 3–4).

(ii) The status of long vowels. Are they a separate subsystem in a language

that has them, with independent status? Or a kind of appendage to the 'real' system of short vowels? Or do they have no autonomous 'unit' status, but are rather to be taken as combinations of vowel plus 'covowel' /:/, 'glide', or another vowel (i.e. as clusters), or part of a 'chronemic' system independent of the quality system (Jones 1950), or different things in different languages? (§5).

(iii) Related to (ii), the status of diphthongs. Are they (however we analyse them) 'part of' vowel systems proper, or merely combinatorial phenomena? E.g. which is the correct systematic equivalence: English /ai/ ≡ /i:/, or /ai/ ≡ /sp/? (Cf. Pike 1943: ch. 3 on the status of 'fluctuants'.) If diphthongs are part of systems, where do they go in the conventional 'spatial' arrays of contrasting units – assuming that these indeed are appropriate representations? (Cf. §§6, 3.)

(iv) Following from (i), how much normalisation is benign, and when (if ever) does it get malignant? E.g. both Dutch and Afrikaans have one short and one long low vowel; should they both belong to (say) a type '/a/:/a:/' conceived as a 'natural kind', even if phonetically the opposition is [ɑ]:[a:] for Dutch (ABN) and [ɐ]:[ɑ:] for Afrikaans?[1] (See this section below and §§2–4.)

(v) Following from (i) and (iv): how fine-grained should our representational vocabulary be? Can we do with four heights and three degrees of backness, plus rounded *vs.* unrounded? Or do we need to distinguish, say for the half-close unrounded vowels, at least the degrees of backness in [ɛɪɔ ɤ̈ ɤ]?[2] Is there a justification for operating with a system of front vowels [i y e ø ɛ œ a], and not having [ɪ ʏ æ] as separate primitives? In fact, should [ɪ], if we admit it, be 'front', and [ɔ] 'back'? If we recognise [ɔ] as a prime, then why not [ɤ̈], its unrounded congener, as in East Coast U.S. *book*? We must decide how big a piece of the 'pseudo-articulatory' (Ladefoged 1966) vowel space can be assigned legitimately to the same symbol, without loss of potentially valuable information (§§4, 7).

(vi) Following from (v), what counts as a 'difference in type'? E.g. if the norm (§3) for the vowel in *bit* is [ɪ] in British RP, [ɘ] in most varieties of South African English, and [ɛ̈] in many varieties of Central Scots, do all these merely 'have /ɪ/' (identification by lexical incidence – an Anglicist temptation), or are there three/two distinct types? (§§4, 7).

Some kind of principled decision on (if not solution to) such questions is a precondition for responsible typology. If they aren't answered, we run the risk (as has happened often enough in the past) of doing typology as *Lehre von den Buchstaben*, where unconscious normalisation in the direction of a small inventory of familiar symbol shapes destroys potential data. If a notation fails to observe a distinction, no user of the notation can recover it. The obverse of this is of course the problem of 'tact' (cf. Bloomfield 1933: 84 on 'exact' transcription): one could fall into the opposite trap of notating absurd phonetic minutiae, and come up with a dog's dinner instead of a usable taxonomy. I will suggest below (§7) some basic rules for steering between the two.

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2 What is a 'type'? What is a 'universal'? Problems and desiderata

In phonology, as elsewhere, universals float about pretty freely, whether absolute, implicational, or the innominate (and deservedly so) 'All languages have X except 7.5 %' type. To take an implicational one, 'a front rounded vowel implies a back rounded vowel of the same height' (Sedlak 1969: 31). This happens not to be true: an accessible example is working class urban Central Scots with [y] or [ʏ] but no [u].

This suggests one (non-culpable) source of specious universals: ignorance. Nobody knows everything, and it's impossible, or as near as makes no difference, for anybody to survey all the 'data' – particularly as much of it resides in field-workers' notebooks. But there is another source of garbage, and this can be culpable: sloppy theorising and unsophisticated (or at best inexplicit) use of data. Difficulties of this kind cast grave doubts on the utility of at least one major survey (Sedlak 1969). Sedlak commits two errors (one shared by virtually all other attempts at typology), and I will use these to suggest some of the ground-clearing that has to be done.

(i) He omits diphthongs completely from his 'vowel-quality systems', which produces misleading equivalences. We must either find a way of getting them in, or develop principled and justifiable reasons for omitting them (cf. §6).

(ii) He seems unconcerned about the problems involved in the use of letter-shapes in published phonemic analyses as sources of 'systemic' data. We must decide to what extent phonology (even 'universal') is based on the manipulation of graphic symbols, what sort of content the symbols we do use must have, and more important, to what extent phonology is a phonetic discipline.

I will illustrate the need for these decisions by looking at some of the ways Sedlak (not untypically) goes astray. Point (i): by omitting diphthongs he is able (1969: 36) to give German and Hungarian as examples of the 'same' system type, i.e.

(1)	i	ü	u		iː	üː	uː
	e	ö	o		eː	öː	oː
		a				aː	

But a look at the full inventories of contrasting nuclei for the two languages shows that German has three diphthongs (in his notation presumably /ai au oü/), but Hungarian has none (Sebeok 1943; Makkai 1972a). Surely this is a notable difference (but in all fairness – cf. §6 – virtually all typologists disregard diphthongs, so I will let this one rest for now).

Now to point (ii): by listing merely /a aː/, /i iː/, /ü üː/ in both languages, he misses important phonetic differences. If we look at standard German and standard (Budapest) Hungarian,[3] making somewhat finer (but not unusual) distinctions, we find:

(2)

				iː	yː	uː				i	y			
	ɪ	ʏ	ʊ	eː	øː	oː						ʊ	eː øː	oː
	ɛ	œ	ɔ							ɛ	œ	ɔ		
	a					äː						ɑ ~ ɒ	aː	
		German										Hungarian		

The notation /i iˑ/ obscures the difference between an [i iː] language like Hungarian (or Zulu: Doke 1960) and an [ɪ iː] one like German or English. The same goes for [ʏ yː] *vs.* [y yː]. Similarly, the lack of symmetry between the height relations of (Sedlak's) /i iˑ/ and /e eˑ/ in Hungarian is not shown; nor the fact that for both languages the short mid vowels are opener than the long (which is not a predictable or universal phenomenon). And perhaps worst of all, his /a aˑ/ notation fails to tell us about the relative (or absolute) backness of the long and short low vowels, or to indicate that German belongs to a type (like most Germanic languages except Dutch) where the long low vowel is backer than the short one, whereas Hungarian belongs to the (apparently) much less common type (along with Dutch) where this relation is reversed.[4]

Another point obscured by Sedlak's equivalences is the 'occupancy' of particular height slots (missed by most typologies, except, in an often indirect way, Crothers': see §4). That is, since the symbol 'e' can stand for [eː] or [ɛ] in *these* two languages, and the same in any language without an [e] *vs.* [ɛ] distinction at the same length (unlike say French or Danish), we could never tell from a notation '/i e a/' whether it meant:

(3)

i				i				i				i		
e		or				or		e			or			or...
				ɛ								ɛ		
a					ɐ				ɐ			a		

And of course '/a/' could also be [ɑ], since Sedlak tends to distinguish what this letter means partly by spatial location (in which case of course he's wrong for both German and Hungarian). And if, as I will suggest later one should, one wants to ask about the distribution of 'crowded' or 'gapped' or 'dispersed' systems at a given degree of backness, or overall, the symbols don't permit recovery of this information.

Without wishing to make Sedlak a scapegoat, I will nevertheless belabour one more example, as it raises clearly the two questions of use of published data, and the extent of 'abstractness' or 'pre-analysis' that should be allowed. It also suggests the vital importance of insuring comparability of metalanguage at the outset of a typological endeavour.

Sedlak presents this as 'English' (38):

(4)

i	ɨ	u
e	ə	o
æ	a	ɔ

i.e. a 'typical 3 × 3' system. But (4) is of course Trager & Smith's (1951) 'overall pattern' for English, which is controversial, and rather a 'diasystem' than a system proper. It is not intended as the set of nuclei for any one dialect, or the complete set of possibilities; since the three 'glides' /y w h/ combine with the simple nuclei to form complex ones, which are part of the syllabic inventory for any dialect (cf. the discussion in Lass 1976: ch. 1).

There is no (non-Pickwickian) sense in which an object like (4) could be taken as a 'West Germanic Vowel System' – even for short vowels. Among other things it is intended as an abstract representation of part of an analysis which crucially involves long vowels and diphthongs; Trager & Smith's *whole* analysis (unlike Sedlak's misuse of part of it) in fact captures the typologically 'dichotomous' nature of the English system: English in general has (except for Scots: Lass 1974, 1976: ch. 1) two identifiable and distinct vowel sets, a 'short' (monophthongal) and a 'long' (monophthongal or diphthongal), which are differentially distributed, morphophonemically related in complex ways, etc. (I will return to long vowels and diphthongs in §§5–6.)

I suggest that neither normalisations of the more reductive 'structuralist' sort, nor abstract analyses of any kind ('overall', 'underlying') can be of any use in typology – at least where we are now. If we want a theory of universals, or the basis for a rational typology, we need good phonetic data, presented with minimal pre-analysis, and subjected to principled ways of making notational choices – as well as a theory of what notations represent (cf. §3).

Obviously the choice of input to a taxonomy depends on what you want the taxonomy for: provided the input features are empirically justifiable, *any* choice is as 'true' as any other if it is relevant to a particular use (Lass 1980a: ch. 5). But the coarser the initial grid, the less enlightening the taxonomy is likely to be in the end: particularly if you don't know in the beginning exactly the kind of questions you're going to ask of it later on. (For certain purposes whales – or even seals – might perfectly well be fish; but if you were interested in how babies were fed, this would not give very good predictions.) I assume that at the moment the purposes of phonological typology are rather inchoate; we know what *kinds* of questions it might be interesting to ask, but we don't know what all of them are. In particular we don't know which conceivable questions might be dead ends, and which might be interesting. I suggest below some that I think are worth asking; a few have apparently been answered (if wrongly or imperfectly); others aren't askable given current frameworks of representation in the typological tradition.

(i) What is the inventory of 'natural kinds' in the domain of vowel systems? This is clearly dependent on notational choice, and interacts (perhaps circularly) with it: the fewer distinctions we make, the fewer variants in the domain (cf. §1, points (i)–(ii), (v)–(vi), and §4 below in particular).

(ii) What is the minimal/maximal size of a vowel system? This can be

interpreted (a) in terms of number of items, and (b) in terms of coverage of the 'vowel space'.

(iii) Must a language have any peripheral vowels?

(iv) If some vowels in a system are peripheral, is peripherality necessarily/likely front–back symmetrical? (Clearly this one depends on notational choice: in a framework where both [i] and [ɪ] count as 'front', a language like Yiddish with only [ɪ] would have a peripheral vowel in this position; in a finer-grained system it wouldn't.)

(v) Are there any slots that are obligatorily filled? There is a consensus that /i/ and /u/ are such slots, but again this is a matter of finesse: see §4.

(vi) Are there any generalisations about the relation between long and short systems? E.g. in terms of numbers, peripherality, closeness etc. (relatively) of one set *vis-à-vis* the other?

(vii) Are there general patterns in the way the vowel space is filled? E.g. limitations on crowding or dispersal? Is 'degree of dispersal' a relevant typological parameter, on either the horizontal or vertical axis, or with respect to the whole?

(viii) What is the maximum number of contrasts on any one dimension? E.g. are there systems of the type /i y i ʉ ɯ u/? Norwegian has /i y ʉ u/, giving three vowels differing only in backness. Is the patterning the same at all heights? I know languages with three contrasting non-front unround vowels at the lowest height (e.g. broad South African English with [ɐ:] in *bite*, [ä:] in *bout*, [ɑ:] in *bark*). How many heights/degrees of backness may a language use with no other contrast?

(ix) How many lip-attitudes may contrast at one height? Is Swedish with three at half-close front (spread, inrounded, outrounded: Lass 1976: ch. 2 and references) unique, or maximal?

(x) Are all combinations of vowels acceptable in diphthongs? Is there any preference for (a) first or second position for the syllabic member, (b) a particular height relation for the two members? Are diphthongs like [æɑ] (reconstructed for Old English, attested in Malmö Swedish: Bruce 1970) frequent or rare?

(xi) What is the relation between 'basis of articulation' (Honikman 1964) or 'setting' (Laver 1980) and vowel systems? Could it be that e.g. languages with velarised settings would be likely to have retracted front vowels and peripheral back vowels, while languages with say palatalised or dental settings would have the reverse? Clearly this kind of question requires a pretty narrowly transcribed input.

(xii) What is the full set of non-vocalic articulations that can be superimposed on vowels, and to what extent do vowels so modified form independent subsets? And what are the numerical relations (if any) between such modified vowels and unmodified ones? I am aware of nasalisation, pharyngealisation, retroflexion, breathy voice, creak; but there are probably quite a number of others.[5]

This sample of the possible questions system typology might be concerned with suggests the size of the domain, and some obvious aims.

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3 What is 'the system of L'? Norms, iconicity, ontology

This isn't as easy as it sounds. The obvious answer, 'the set of entities that constitute distinctive syllabic peaks',[6] skirts some fundamental issues. And this even if we avoid vexing 'un ou deux phonèmes' questions that arise with respect to diphthongs and long vowels (which I postpone for now). The title question actually unpacks neatly into four sub-questions, of increasing ontological import:

(i) How many vocalic entities are there in L?
(ii) What symbols should we use to represent them?
(iii) Should our system display be iconic or aniconic?
(iv) What *is* a 'vocalic entity' or 'phoneme'?

Question (i) is operational, by and large, and answered by analytical procedure; in practice usually some version of a 'classical' phonemic analysis (for the extension of the term, Vachek 1964a; Sommerstein 1977). This constitutes a first-order input to typology.

Number (ii) however produces some difficulties, if we take it seriously. Traditionally we say that L 'has the vowel (phoneme) /X/', and that /X/ 'has the allophones [A], [B] in environments Q, R', etc. But what *is* /X/? Take a concrete case: my English has a unit most linguists would call '/æ/', whose exponents include [æ] before voiceless stops, [æ̝ː] before voiced stops and all fricatives, [æ̝̃ː] before nonvelar nasals, and [æ̝] before /r l/ (/r/ is a velar-pharyngeal approximant: Lass 1983a, and /l/ is velarised). But I call the thing /æ/, not any of the others, since [æ] is the quality that occurs in the environments least likely to exert specific combinatorial effects. Indeed, the (*ex hypothesi*) combinatorial effects are deducible in a 'natural' way from the environments. That is, we expect length (*ceteris paribus*) in voiced environments; and this vowel on distributional criteria belongs in the 'short' series, e.g. it cannot appear in final open syllables under accent. Further, we expect [æ] → [æ̝] before nasals, not [æ̃] → [æ] before orals, retraction before pharyngeals and velars, etc. Hence a symbol represents something like an 'average' or 'dominant' or 'least-modified' value for a unit, occurring in the (articulatorily or acoustically) most neutral contexts.[7] (Or, more simplistically – though it may in the end often amount to the same thing – we select as 'norm' or 'principal allophone' the exponent that 'seems more important than the other(s)...because it is commoner...or because it is the one used in isolation, or because it is intermediate between extreme members' (Jones 1950: §24).) This rather laboured attempt at explicitness I take as reconstructing the normal implicit practice of most 'surface' phonologists, and even – in a paradoxical way – of 'deep' ones as well.

Operating this way, the choice of notation seems simple: given the resources of an alphabet (IPA, *Svenska Landmålsalfabet*, or whatever), select the graph in the alphabet that is defined as corresponding most closely to the 'norm' as derived above for each distinctive entity.

Question (iii). But what in fact is a system? Is it merely a list of graphs arrived at by such a procedure? Given a segmental notation (as opposed to a feature-notation: see below), the normal procedure seems to be to place

the symbols on a coordinate grid representing in some way the parameters of choice. The usual way nowadays is essentially iconic, based on a 'sagittal man' (the phrase is John Laver's) facing left, with normal vertical orientation, so that 'high' is at the top and 'low' at the bottom.[8] The grids normally used do not represent lip-attitude as a separate dimension (though see Gleason 1961: 267 and §7 below); contrasts of rounding at one height and backness are simply represented next to each other, front rounded vowels slightly to the right of front unrounded ones, nonlow back unrounded ones to the left of rounded ones. The front rounded and nonlow back unrounded vowels are sometimes grouped if possible with the central or 'mixed' series (so Trubetzkoy 1929; for a reason for this see Crothers 1978: 100f, and note 15 below). All of these representation types are in one way or another iconic.

Whether what they are icons of is 'real' is of course an open question. Virtually all typologists have assumed that it makes sense to talk of vowels as existing – on one level of analysis anyhow – in a 'space': the traditional 'vowel space' or 'phonological space', with its vertical and horizontal (or if you wish, F1 and F2/F3) dimensions. What we might call 'classical' typology has been concerned fundamentally with the arrangement of distinctive entities (or as I suggested above, more accurately with the notional centres of the exponence-sets of such entities) in this space – whatever its status.

Certainly doubts have been cast on the reality of the space: there is a tradition of argument stretching from at least Ladefoged (1966) through Lindau (1975) and in most detail Wood (1974, 1975, 1979), suggesting that the 'tongue-arching model' of vowel articulation is untenable. Still, there is enough 'behavioural' evidence to suggest that the model is useful. E.g. vowels that one would characterise traditionally as 'the same height, front and back' show parallelism in vowel shifts (English /i:/ > /ei/, /u:/ > /ou/ in the Great Vowel Shift); we can make statements like 'in Vulgar Latin, each earlier Latin nonlow short vowel lowers one height along with the loss of distinctive length', 'in Papago /t/ → [ʧ] before high vowels', etc. These statements, even if they are in the end pseudo-iconic metaphors, are usable and insightful, and seem to reflect some kind of inherent parametrisation that we can call the 'vowel space'. I will use the traditional terms without apology.

Iconic displays are so by virtue of choice of primitives; here, articulatory 'points' defined in a matrix (Stewart 1976: ch. 2) derived from the sagittal man. Each point however can be derived non-iconically, using a system of non-spatial coordinates, i.e. the intersection of a set of feature specifications. Thus the locus occupied by /i/ could be taken as the aniconic intersection of [−back] & [+high]. It would then appear that the two representations below are equivalent:

(5)a.

i	u
e	o
a	

b.

	i	e	u	o	a
high	+	−	+	−	−
low	−	−	−	−	+
back	−	−	+	+	−

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And indeed in a non-metaphorical sense they are. But the imagery possible in (a), as a direct consequence of the representation, is not possible in (b). Indeed, if there were a chain shift involving the raising of back vowels in system (5), with /o/ > /u/ > /y/, the difference in representation would be striking. (5a) gives rise directly to (6a) below, while (5b) yields only (6b):

(6) a. i y ← u
   ↑
   e o

   a

b. (i) $\begin{bmatrix}+\text{high}\\+\text{back}\end{bmatrix} \rightarrow [-\text{back}]$

(ii) $\begin{bmatrix}-\text{high}\\+\text{back}\end{bmatrix} \rightarrow [+\text{high}]$

There is a clear sense in which the metaphors produced by a system of notation are as much a part of the process of discovery and as valuable as formalisations without metaphor (cf. Stewart 1976: 95ff, 171 n.16; Lass 1977; Ortony 1979a). The idea of a spatial icon is a 'constitutive metaphor' (Boyd 1979); the notion 'chain shift' for example could not have arisen without it (cf. Lass 1976: ch. 2).

In keeping with certain kinds of questions I want to ask, I assume that segmental and feature representations are metaphorically – hence heuristically – non-equivalent; segments are not 'informal abbreviations' of feature-complexes, but primitives in their own right, even if 'reducible' to features (Lass 1984: §10.1). A segment is a 'holon' (Koestler 1978); it is a 'Janus-faced' entity which takes its nature from where you happen to be standing when you look at it. Insofar as segments obey constraints on crowding and dispersal, participate in chain shifts, etc., they are 'things'; insofar as they assimilate or trigger assimilations, fall into natural classes, etc., they are (complementarily) feature bundles. But not 'essentially' either. Therefore I reject – along with system typologists in general – the view that systems can be taken as low-level 'byproducts' of rule applications (Stanley 1967: 397, 400) – the idea that they are 'artifacts', 'epiphenomena', etc. Systems, segments, features, rules, are complementary primes.

Question (iv). Given segments, however, there is still a 'reality' problem, if a different one. What is the status of the 'items' displayed? This is raised by the initial choice of 'phonemes' as inhabitants of the domain. That is: is a phoneme an entity of an order of being different from that of (the set of) its allophones? The implicit assumption here (and in much of the literature) is that it is: a phoneme is 'basic', even 'substantial', and its allophones are 'accidents'. This view presupposes a 'derivational' or 'realisational' theory (which in this case amount to the same thing) of what phonemes are: 'underlying' entities with 'surface' realisations or exponents.

This is problematic if we're interested in ontological parsimony. It would be preferable to take the phoneme, not as a 'thing', but as a SET of equi-existent entities, a 'family of sounds' in the sense of Jones (1950). This would allow us to bypass the dubious ontology of 'synchronic

process' (see the arguments in Allen 1951; Robins 1957). But it makes in the end a nonsense of the notion 'phonemic system' in the typological sense. So for the rest of the paper I revert to the less optimal philosophical position, and reify 'norms' as the subject of discourse. I commit myself to little more than instrumental convenience – the conduciveness of this view to order and insight.[9]

4 Normalisation

We have already looked at some of the problems inherent in the (by itself neutral) process of normalising phonetic data for systemic purposes (cf. the earlier discussions of [i: ɪ] and low vowels). But the process as a whole needs more detailed examination, particularly the root concept, 'equivalence': what sets of phone-types 'count as the same'? This is not trivial; there are a number of pretty shaky universals in the literature which owe their existence and credibility to a loose definition of equivalence. I will look at one of them here.

The problem arises out of an imbalance between concern with the CONTENT of oppositions (the Praguian 'identifying function') and their NATURE (the 'distinctive function'). If a phoneme is, in the mystical definition of Jakobson & Halle (1956) 'mere otherness', then of course all equivalence problems vanish. As they do with a sufficiently reduced set of distinctive features (the old problem of [+flat] marking rounding, retroflexion, and pharyngealisation: cf. the anatomy of the issue in McCawley 1967).

For instance: in the typology proposed by Trubetzkoy (1929), if a language has a single opposition along the dimension *Öffnungs-* or *Schallfüllegrad*, it would not matter if it were phonetically [a]:[i] or [æ]:[i] or [a]:[ɪ] or [æ]:[ɪ], etc., since in all cases the 'phonemic content' is merely the distinction between minimum and maximum aperture/sonority. These four types (as well as oppositions involving [ɐ] or [ɑ] and the others) would be one – 'functionally'. I will argue here that this kind of oppositional normalisation is at best premature, and at worst misleading and information-destroying. It sharply reduces the number of potential dimensions along which questions about universals and types can be asked, and diminishes the inventory of natural kinds without adequate justification.[10]

I will focus on what can be called the 'X counts (typologically) as Y' strategy, as exemplified in Crothers (1978). I use him as an example because he is admirably clear about what he is doing, and therefore vulnerable. Consider his procedural commentary on the process of normalisation. He begins (103):

> ...if one is interested in what sorts of phonetic means languages employ to make distinctions, it is important not to normalize the data prematurely, and thus build preconceived ideas into the results.

So far so good; but he continues:

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(Emphasis mine).

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without assumptions of ec
'UCLA' notation with IPA

(7) **Three-V Systems**

a. Fully peripheral, two

i u
ɐ

Alaskan Eskimo, Ale
Greenlandic, Shilha,
Totonac

b. Peripheral, no close

e o
ɐ

Amuesha

Of course, for typological purposes considerable normalization is necessary, but I have done this at the last minute, as it were, in the assignment of particular phonemic systems to a general type. For example, all of the three vowel systems in the sample are grouped into a single type: /i a u/. The phonetic manifestations vary considerably, particularly in the case of /u/...However, the decision to treat the different phonetic units, [u ʊ ɯ o], AS BEING TYPOLOGICALLY /u/ was only made at the point when I was considering all the vowel systems, to determine HOW MANY BASICALLY DIFFERENT PATTERNS OF ARRANGEMENT they exhibited.

(Emphasis mine).

The following questions need to be asked:

(i) What does it mean for an empirically/pretheoretically clear non-X to be 'typologically X'? Is this a functional notion only (like evolutionary 'analogy'), or a more substantive one (like 'homology')?[11]

(ii) What 'type' can possibly subsume [u ɔ ɯ o]? Clearly not a phonetic one – even though he says he's interested in 'phonetic means'.

(iii) What is 'basically' different?

Note that Crothers is not disingenuous; the various systems with their phonetic exponents are given in an appendix, and it is perfectly possible to unpack his judgements if you want to, by inspecting the sample (as I will do below).

The results of such an exercise are interesting in view of Crothers' aims; in particular because his 'typologically-equivalent' judgements lead him to postulate the universal (115): 'all languages have /i a u/'. Let us see what this universal means, and by implication what Crothers' whole system means. Given his sample (Appendix III, 138) of three-vowel systems, we can arrange them to illustrate iconically their dispersion patterns. This gives a much more complex and heterogeneous picture than his basic 'type' /i a u/ would lead us to expect; his one type subsumes seven geometrically quite different ones. I represent his systems spatially without assumptions of equivalence (the transcriptions replace his 'UCLA' notation with IPA equivalents):

(7) **Three-V Systems**

a. Fully peripheral, two close Vs, one open:

i u ɐ	i u a	i ɯ ɐ
Alaskan Eskimo, Aleut, Greenlandic, Shilha, Totonac	Moroccan Arabic	Jaqaru

b. Peripheral, no close Vs, one open:

e o
ɐ
Amuesha

c. One peripheral, one close, one open:

i	ɯ
ɔ	ɪ
ɐ	ɐ
Haida, Karok, Ojibwa *et al.*	Nunggubuyu

d. One peripheral, no close, one open:

ɪ ɔ
ɐ
Alabaman

e. No peripheral, no close, one open:

ɪ ɔ
ɐ
Quechua

f. Two peripheral close, no open:

i u
ɜ
Gadsup

g. No peripheral, no close, no open:

ɪ ə ɔ	ɪ ɔ
	ɜ
Tagalog	Telefol

The display in (7) represents the basic arrangement types in Crothers' data spatially; because I am interested in precisely what he claims to be: 'patterns of arrangement'. But I refrain from conflating all the types, because even if he has a typological 'intuition' that they are 'the same' (see below), I fail to share it: all that these systems have in common is the fact that they are three-V.

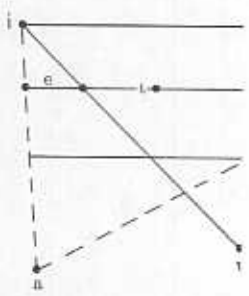
They are in fact (except perhaps for Tagalog, if this representation is correct) 'triangular' (Trubetzkoy's '*dreieckig*'). But let's follow the metaphor a bit further, on a genuinely spatial rather than functional-reductivist track, using the shape as a heuristic to prompt a different set of questions. I propose two deviations from Crothers' taxonomy:

(i) Rather than taking 'low', 'high' as RELATIONAL terms, defined within a system (as we will see, the basis of '/i a u/' is the notion that whatever is low*est* or high*est* is therefore 'low' or 'high') – let us take them as ABSOLUTE properties, defined in 'universal phonetics', not functional system typology.

(ii) Let us also address questions of SYMMETRY (attacked in Hockett 1955 and Sedlak 1969, but not in Crothers).

We could base a rough preliminary typologisation on a pair of intersecting triangular grids like these:

(8)



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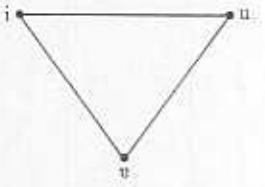
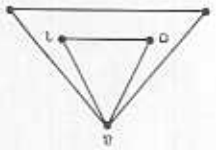
(9)

I. Maximally Dispersed



(*a*)

II. Non-Maximally Di



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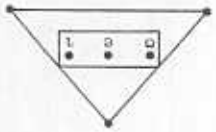
III. Minimally Disper



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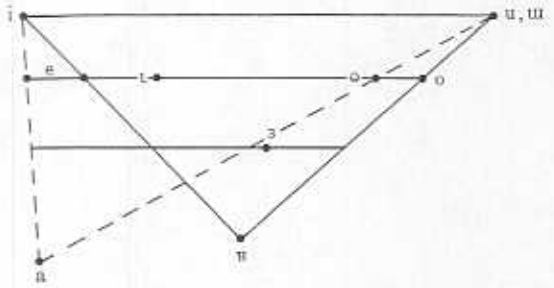
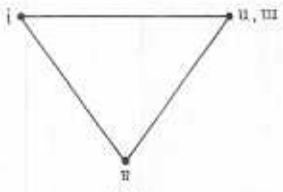


This accounts for the segment types in Crothers' sample: there appear to be none that have /ɑ/ as the lowest vowel. If there are any such – and I suspect that there must be – then a third triangle with its bottom vertex on /ɑ/ could be imposed on (8).

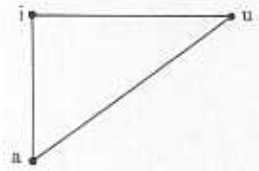
We now find that the type /i a u/ (phonetically, in Crothers' transcription, [a] = [ɐ]) falls into the following subtypes:

(9)

I. Maximally Dispersed

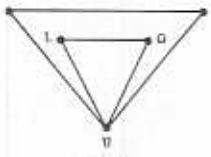


(*a*)



(*b*)

II. Non-Maximally Dispersed, Symmetrical



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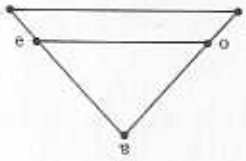
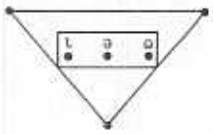


(*b*)

III. Minimally Dispersed, Symmetrical



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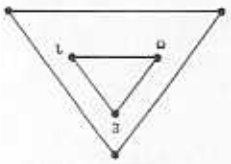
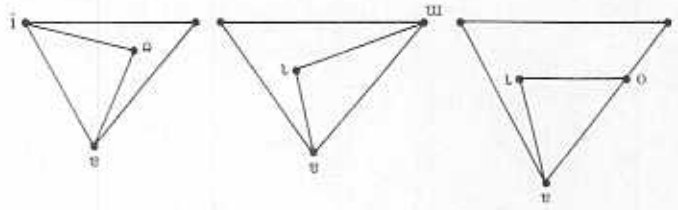


(*b*)

IV. Skewed



(*a*) (*b*) (*c*)

How does this relate to the '/i a u/' universal? Given for instance systems with /o/ but no /u/ on initial 'non-typological' analysis, Crothers says that 'it SEEMS TO ME that this [o] is REASONABLY CLOSE to [u], GIVEN TYPICAL VARIATION in such systems, and CAN BE INTERPRETED AS /u/' (115; emphasis mine). Explication is needed on at least these points:

(i) On what basis does it 'seem' that this is the case?
(ii) What is the argumentative status of 'seeming-to-C' (or anyone else) as a typological criterion? I.e. does 'type' as a natural kind depend on intuition? (This is probably the key question, for both methodological and 'sociology of linguistics' reasons: my problem is that Crothers' intuitions are inapparent to me – partly as a result of 'British' rather than 'American' phonetic training?)
(iii) How close is 'reasonably' close? What are the units of closeness in terms of which such judgements are made? (See the discussion in §7 below.)
(iv) What is 'typical' variation? How typical in fact is it? Do all or most languages with apparent /o/ but no /u/ have some [u] allophones, or a 'floating' value for /o/? (The same problem occurs in languages like Jaqaru, whose '/u/' is /ɯ/: does /ɯ/ have [u] allophones? Crothers supplies no evidence on these matters.)
(v) What is the latitude of 'can' in interpretation (i.e. assignment to type)? Is there a 'permissiveness-space' within which X 'can be interpreted as' Y, but outside of which this is not allowed? (To be fair, Crothers does try at one point to delimit such a 'space', and claim that his opposition-types are not 'simply relative' (109); but his delimitation is too vague for my taste.)

Crothers may indeed have answers to these questions, but they are not explicit; and the fact that I find his procedure dubious indicates a need for clarification (unless it can be shown that I am being obtuse).

Some further difficulties arise from this mode of analysis, in that even if our aim is to find out about what kinds of units occur as opposition members, we are constantly short-circuited by the same segment type counting as different things.[12] Thus in a system /ɪ o ɐ/, /o/ 'counts as /u/'; but in a system /ɪ u o ɐ/ it would 'count as /o/', simply because there's another ('real' as opposed to 'typological') /u/ to count unproblematically as /u/.

Of course one difficulty
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certain systems are genera
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what the universal /i a u/
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dialects of English: a loc
Town) and a working-cla

(10)
e (ɪ) ə ɵ̈
ɛ ɜ
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South African

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(11) iː ʉː
oː
ɐː äː ɑː ~

Again, either /ʉ/ or /o/
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front to back) could be '
so taking it as '/u/' wou
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primitives for typology
size', 'reduced isosceles

Of course one difficulty – as always – is the 'non-culpable ignorance' (§2) arising from either (a) the structure of the sample, or (b) the fact that certain systems are generally not well described in the normally available literature (though familiar to specialists). It would be interesting to see what the universal /i a u/ strategy would do with the short monophthong systems (on the theoretical significance of these systems see §5) of two dialects of English: a localised lower-middle class South African (Cape Town) and a working-class Edinburgh:[13]

(10)

						i			
e	(ɪ)	ɔ	ɔ̄		e	ʏ		o	
ɛ		ɜ			ɛ	ɛ̄	ʌ	ɔ	
			ɒ̈			ä			
South African					Scots				

The South African English (SAE) system has a low vowel, which is rounded, but no close vowels; and [ɔ̄] is certainly 'interpretable as /u/' only by virtue of the insistence that any triangular system, regardless of how the space is filled, should have the upper left and right vertices labelled /i/ and /u/. Similarly, the Scots system, with /o/ and /ʏ/, but no /u/, could have either of them labelled '/u/' (historically it should be /ʏ/): but this seems an arbitrary move to save the universal.

The same difficulty would come up with the long vowel system of SAE:

(11)

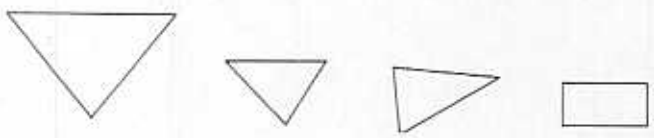
i:	ʉ:		
		o:	
ɐ:	ɑ̈:	ɑ: ~ ɒ:	

Again, either /u/ or /o/ qualities would have to be chosen as '/u/', and presumably one of the three low vowels (in *bite*, *bout*, *cart* respectively from front to back) could be '/a/'. (The /o:/ – in *caught* – is just about C[o], so taking it as '/u/' would depend on how low F1 has to be before you're willing to assign that letter-shape; or if you chose /ʉ:/ for this role, the parameter involved would be F2/F3 latitude. Note that I am leaving length out of account at this point.) My own impulse – perhaps simple-minded – would be to propose that no vowel should be called X unless it is phonetically within the range that a competent phonetician would feel comfortable writing with X. Anyone who hears [u] or [o] as 'a kind of [u]' either needs his ears attended to, or is an amateur.

Whatever else might be said, it seems clear that under the particular normalisation strategy discussed here, certain dimensions of potential typological interest are ruled out. The two most notable are 'size' (in the sense of total space covered by the system, i.e. dispersion, not number of elements), and 'shape' (in this case, what kind of triangle or other plane figure you get by connecting the segment-loci). We could even suggest that primitives for typology might include items like 'isosceles system, full size', 'reduced isosceles', 'left-facing right-angle', 'rectangular reduced',

etc. Such items as those in (12) below (though their status is certainly unclear) might well be part of a fully developed typological lexicon:

(12)



The preceding remarks on normalisation, by the way, are not to be taken as denying the existence of 'functional equivalence'. There is an obvious sense in which given (say) two systems /i a u/ and /i a ʉ/, the /ʉ/ of one can be seen as 'equivalent to' the /u/ of the other. This would show up e.g. in second-language learning (I think of English speakers managing at best an [u:] for German /y:/), and professionally in the experience of phoneticians teaching practical phonetics. Anyone who has taught the Cardinal Vowels, for instance, in Scotland or South Africa knows of items like 'Scots C[a]' which is [ɐ], or 'SA C[a]' which is [ɛ], 'Scots C[u]' which is [ʉ], and so on. That is, when a speaker of a language lacking a certain phone type tries to produce it, he takes the 'closest' one he has. In this sense it is of course (trivially) true that the closest, backest rounded vowel in one system has a functional or perceptual equivalence to the closest, backest, rounded vowel in another. But this is not to say that such equivalences (Crothers' 'reasonably close to X' is along the same lines, probably) are *typological* equivalences, such that a [ʉ] or [o] can ever really be 'a kind of [u]'. The two dimensions of description are quite different, and second-language learning or practical phonetics, though they may tell us something about speakers' perceptual/performance incompetences, do not give us cross-linguistic information about system types.

As far as I can see, turning this kind of equivalence into a typological criterion is like saying of a man with one leg who uses a crutch that a crutch is 'typologically a kind of leg'. This then leads to the 'universal' that all men (even amputees) have two legs.

5 Long vowels

'The basic quality system of a language is the arrangement of...normal length oral vowels' (Crothers 1978: 100). This seems to have been taken for granted by most typologists (except Trubetzkoy 1929, 1939); but there is room for doubting its utility. For instance, on a simple numerical level, given a language like German with seven short vowels, seven (or eight, if you take a dialect with /ɛ:/) long vowels, and three diphthongs, why should the short system be privileged as *the* system? In this case, the shorts account for a little under half of the contrasting units, and are rather more limited in distribution overall than the others (e.g. with respect to freedom of occurrence in particular syllable positions).

This suggests one problem in using essentially numerical taxonomies

like Crothers' or Hockett's:[14] the judgements that emerge about which clusters of languages represent 'a type' often seem arbitrary if judged by other perfectly reasonable criteria. Crothers for instance uses a binomial taxonomy x:y, where x = the number of 'peripheral' vowels (front unround, back round, low unround) and y = the number of 'interior' vowels (front round, nonlow back unround, nonlow central).[15] Among his '6.0' languages, for instance, we find:

(i) Six phonemes (/V/): Araucanian, Chontal, Chuckchi
(ii) Twelve (6/V/, 6/V:/): Carib, Dagbani
(iii) Twelve (6/V/, 6/Ṽ/): Guaraní, Barasano
(iv) Eighteen (6/V/, 6/V:/, 6/Ṽ/): Delaware, Guajiro
(v) Ten (6/V/, 4/V:/): Yukaghir
(vi) Ten (6/V/, 4/Ṽ/): Ticuna

Surely it is at least arguable that the number of distinctions *in toto* that a language makes (not to mention how they are distributed across vocalic subsystems) might be an interesting typological criterion. And even one with extrasystemic implications, e.g. for such matters as morpheme-length (cf. the information-theoretic consideration of change in system-size in Old Norse in Sigurd 1961). At least it ought not to be excluded *a priori*.

The exclusion of length and nasality from 'basic' typology is probably a reflection of the 'universal template' notion: all languages (but see below) apparently have a system of 'normal length' vowels, but not all languages have long or nasal vowels. Hence a system of short vowels is the only 'universal model' of a vowel system (cf. the parallel argument for CV as a minimal universal syllable, discussed in Lass 1980b: 32f).

But to begin with, the term 'normal length' is not well defined. How long does a vowel have to be to qualify as 'normal' or 'short'? If there is only one system in a language, is it in fact 'normal length' by DURATIONAL criteria (as the term would imply), or only so in the absence of anything longer for it to contrast with? (Cf. the discussion in §4 above of what '/u/' etc. can mean.) Consider the average length (in msec) of comparable vowels in three Germanic languages: Swedish, English RP, and U.S. English (provenance unspecified):[16]

(13)

	/i:/	/ɪ/
Swedish	140	95
RP	222	72
USE	240	180

The USE short vowel average here is higher than the long vowel average for Swedish, and approaches that for RP (similar correlations could be shown for other vowels as well). This suggests that in isolation there is no absolute (or even approximate) 'norm' for length: 'short' is a relational property, intelligibly definable only in complex systems. It's perfectly conceivable, given USE, that there might be languages with one (durational) vowel set, all of whose members might be longer than the 'long' set in a language with a complex system. In this light, Swedish might be said

to have a /V/ *vs.* /V:/ system, and USE a /V:/ *vs.* /V::/ system. Thus the claim that all languages have a set of 'normal length' vowels reduces to the tautology that all languages without a length contrast lack a length contrast.

I am not really interested in pushing this one very far; though it might well be interesting to consider the possibility of looking at absolute duration cross-linguistically. It might be a criterion of interest, with implications for such things as timing-type and other rhythmic phenomena. We won't know till we ask.

We have so far an argument – if a weak and perhaps eccentric one – for not restricting ourselves to numerical typology based solely on short-vowel numbers; we ought to cross-cut our taxonomy with reference to simplex *vs.* complex systems at least. Perhaps these taxa are in order:

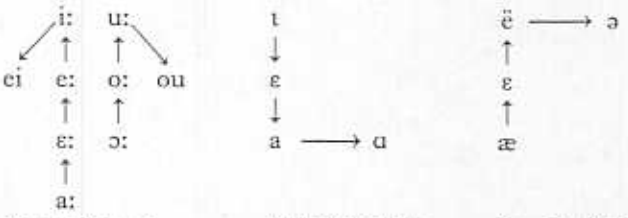
(14)	Simplex		Complex	
	I	V	I	V *vs.* V:
	II?	V:	II	V *vs.* Ṽ
			III	V *vs.* V: *vs.* Ṽ

It is *within* this kind of preliminary framework that we should start asking questions about numbers, not before it's established.

A stronger argument is available, which makes the primacy of short systems much more suspect. This is based on 'behavioural coherence'. That is, if a 'system' is an autonomous object and not merely an aggregation of items, there ought to be phenomena which implicate systems as wholes or parts of systems by virtue of their subsystemic status (cf. Lass 1976: ch. 2, 1984: ch. 5).[17]

A clear case would be chain-shifting, a phenomenon keyed *par excellence* to the existence of systems as 'spatial' objects. Taking the history of English, for instance, as a domain, we find chain shifts in both the long and short subsystems, e.g.:

(15)



Great Vowel Shift

Berwickshire Chain Shift (cf. Lass 1976: ch. 3)

South African Chain Shift[18]

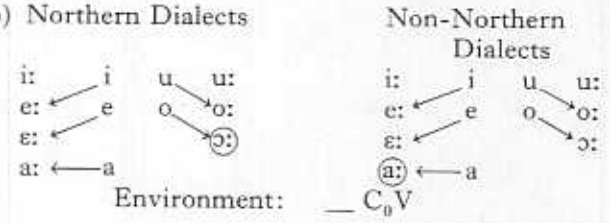
(For more examples of shifts in both systems in English see Labov *et al.* 1972.)

Imagine trying to write a history of English vocalism as the history of the short vowel system alone – which would have a basis if this were

'privileged' in some 'essential' or type-defining way. The thought would simply not arise for anyone seriously interested in what most Anglicists would unreflectively (and I think correctly) call 'the history of the English vowel system' – where by that term they would mean the long, short and diphthongal systems as a unit.

For a clear case of why this is so, consider a change-sequence involving interaction between the two systems, where new vowel types are created by a change affecting both quantity and quality in a short system. Let us take open syllable lengthening in Middle English, which seems to have behaved roughly like this:[19]

(16)

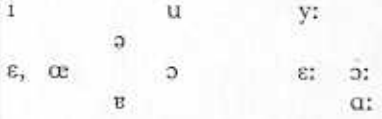


Circled segments are created by the change; to see what the systems were like beforehand, omit them.

In this case two new long vowel phones are created; the northern dialects get [ɔ:] and the non-northern ones get [a:]. With later loss of final unstressed /ə/, the new vowels become contrastive; that is, the short systems are unchanged, but (a) the long systems are richer by one, and (b) the relations between long and short are now different. Would we want really to say that the addition of /a:/ and /ɔ:/ to systems that lacked them before leaves the 'basic quality system' unchanged? Or that globally a system with pairs /a a:/ and /ɔ ɔ:/ is no different ('essentially') from one with a gap in the correlations?

To take a synchronic example, consider a language with a highly skewed distribution of qualities in its long and short systems. Afrikaans, for instance:

(17)



Each subsystem by itself violates a (near) implicational universal: the short by having a nonhigh front rounded vowel but no high one, the long by having a front rounded vowel but no corresponding front unrounded or back rounded one. Each system, that is, is more 'marked' than the total inventory (and this would be of interest to a taxonomy operating on the misguided but still arguable principle that markedness is meaningful, like Sedlak 1969). Further, both systems, having one low vowel each, are 'triangular' in Trubetzkoy's sense; but the aggregate system is more dispersed, and is in fact 'quadrangular', since – whatever the role of length

(and it can be partly argued away through cleverness) – the system has two contrasting qualities at the lowest height. So does Afrikaans have two triangular systems or one quadrangular? And if we look at the patterns of matching and isolation in the global system, we find symmetry at half-open, correlation at open, and isolation elsewhere:

(18)

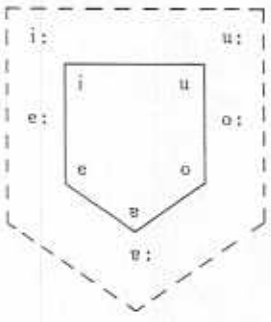
i, y:		u
	ə	
ɛ, ɛ:, œ		ɔ, ɔ:
	ɐ	ɑ:

This raises again the question of whether phoneme-number and quality-inventory, as well as symmetry and complexity (in the sense of long *vs.* short) aren't perhaps separate dimensions for typology, equally worthy of being taken into account. One might for instance legitimately ask whether Afrikaans is in fact a seven-V or an 11-V language. And if we add diphthongs – a procedure whose justification I will discuss in the next section – we can ask whether it's a seven-V, 11-V, or an 18-V language. (Never mind the length contrast in the diphthongs, which raises a whole separate problem, as we will see.)

But sticking for the moment simply to length and its relation to other possible typological dimensions, we can legitimately ask whether Afrikaans is ('basically' in Crothers' sense) a language with one front rounded vowel /œ/, or two (qualities) /œ, y/, or a triangular language with /ɐ/, or a quadrangular one with /ɐ, ɑ/. This is especially relevant in the light of systems like the reconstructed ME ones in (16), or many modern northern English ones with /a/ *vs.* /a:/, where the long vowels do not 'occupy different spaces' from the short ones.

Considerations like this allow for other forms of spatial typing as well. E.g. are the long and short systems of a language related by 'inclusion', 'intercalation', or in some other way? To explain these (just invented) terms: by 'inclusion' I mean the case where one system as a whole is less peripheral than the other, and while having the same shape, 'fits inside it'. An example would be Czech, where (according to the acoustic data in Lehiste 1970: 31) the short vowels occupy a reduced space of similar shape to the long, but lower and less peripheral (for the nonlow vowels) and closer (for the low). Assigning symbols to the coordinates in Lehiste's graphic representation, Czech has:

(19)



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6 Diphthongs

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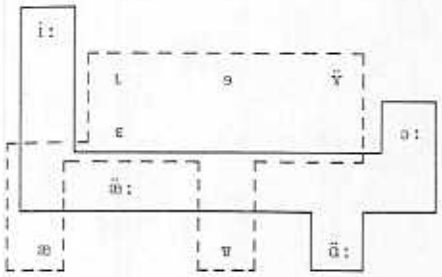
Compare this with my own New York City system (vowel positions impressionistically related to the Cardinal Vowels):[20]

(20)



Here at least one short vowel is as peripheral as any long, and the two systems are mutually 'intercalated' rather than one being included in the other.

Yet another dimension, whose utility or interest will not be apparent until reasonably large samples based on it are examined. As in the rest of this paper, I'm not really proposing a new and precise or even coherent typological schema: merely suggesting dimensions that ought to go into one. The problem of length is not solved, and is more complex – and more relevant – than most scholars have admitted, judging from two pervasive attitudes in the literature: reduce it to clustering (Hockett) or ignore it (Crothers).

6 Diphthongs

If long vowels produce methodological headaches, diphthongs are a positive migraine. In this section I will look first at some of the consequences of ignoring them, and then at some possible typological dimensions that arise if systems are considered to contain ('fully' or 'essentially') both long vowels and diphthongs.

Even typologists (e.g. Sedlak, Crothers) who list long and nasalised vowels in their 'non-basic' inventories normally exclude diphthongs (cf. Sedlak's German, (2) above). A notable exception is Trubetzkoy, as usual (1929, 1939: see below). Such exclusion is inconsistent. I argue below that any system that excludes diphthongs must also exclude long vowels; and conversely, that any argument for including long vowels on a par with short (as in §5 above) holds *pari passu* for diphthongs. In some cases, where languages have short vowels and diphthongs but no length contrast, diphthongs must be included even in 'basic' short quality systems; whereas in others, which have a short/long diphthong contrast, they must be included in both. I present some arguments below.

Diphthongs are excluded either on an intuitive notion of what constitutes a 'quality system', operationally and largely theoretically unjustified (Sedlak, Crothers), or on operational/analytic grounds (Hockett). For

Hockett, the exclusion, parallel to that of the long vowels, is based on the simple/complex peak distinction, in the U.S. structuralist tradition. A diphthong is a sequence /VG/ (G = 'glide') and a long vowel /V:/, where /:/ is a 'covowel' of length. I.e. both are 'tactic' rather than 'elementary' phenomena. English no more 'has the phoneme' /aj/ (to use an appropriate notation) than it 'has' /æt/, /fr/, etc. I will argue that even though the simple/complex distinction is crucial, its significance is not what Hockett suggests: it becomes the primary motivation, in a typological context, for *including* long vowels and diphthongs.

Long vowels as we have seen (§5, arguments from diachrony, and quality-skew in long and short systems) can be argued to be admissible as separate basic units; it remains to be shown that if we accept this, diphthongs are automatically admitted. Some simple arguments (all as it happens from Germanic phonology) will show why.

(i) In languages with both long vowels and diphthongs, the two often form a behaviourally and distributionally coherent subset *vis-à-vis* the short vowels (cf. Lass 1976: ch. 1, 1983b). Thus in English, German, Dutch, Afrikaans, only long vowels and diphthongs constitute legal rhymes in accented syllables with zero codas (*bee*, *buy*, *[bæ], etc.). In languages where length is a function of syllable structure, like Icelandic, vowels and diphthongs are long or short in the same environments: e.g. *is* [i:s] 'ice' (nom. sg.) *vs. iss* [is:] 'id' (gen. sg.), *læs* [lae:s] 'literate' (common) *vs. læst* [laest] 'id' (neuter).[21] In English and German, both long vowels and diphthongs are excluded before /ŋ/, and so on.

(ii) In certain patterns of morphophonemic alternation, such as the 'trisyllabic laxing'/'vowel shift'-complex in English, the nuclei of one set of alternants are always short vowels, and those of the other set either long vowels or diphthongs: *div*[aɪ]*n* ~ *div*[ɪ]*nity*, *ser*[i:]*n* ~ *ser*[ɛ]*nity*, etc.[22] Further, the exponent of a given historical 'long' (monophthongal or diphthongal) category may be either a long vowel or a diphthong in different dialects, e.g. SAE [ɐ:] *vs.* RP [aɪ] in *divine*, local London [əɪ] *vs.* RP [i:] in *serene*, etc.

(iii) In languages that make the 'heavy'/'light' distinction in syllable quantity, zero-coda rhymes containing long vowels or diphthongs count as heavy; rhymes with nuclear short vowels count as light unless the coda is complex. Thus as above any statement we would want to make about long vowels applies *mutatis mutandis* to diphthongs as well. (Cf. Lass 1983b; Lass & Anderson 1975: Appendix II, §6.1.)

(iv) Historically, long vowels often diphthongise, and diphthongs (except in shortening environments) monophthongise to long vowels (except in languages with a short/long diphthong contrast, or languages without a length contrast). E.g. in the Great Vowel Shift /i: u:/ > /ei ou/, and later /au/ > /ɔ:/, /ai/ > /ɛ:/, and so on. The 'long' nucleus set retains its identity regardless of whether particular members happen to be monophthongal or diphthongal. A long vowel or diphthong is *ceteris paribus* 'bound' to its own subsystem except in

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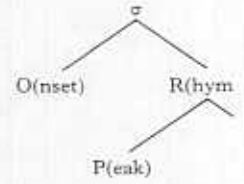

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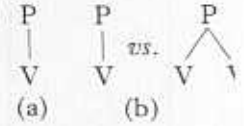

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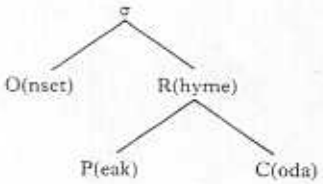
cases of quantitative change (cf. the discussion of ME open syllable lengthening in §5).

One single overarching distinction is involved in all these cases: that between monomoric and bimoric peaks. The presence or absence of such a distinction is surely a major typological feature, with both synchronic and diachronic implications. Refining the simple *vs.* complex dichotomy sketched in §5, let us establish a primary taxonomy based on syllable-peak constituency. That is: how many types of peak-configurations are legal in a particular language? I start from a general model of syllable structure like this:[23]

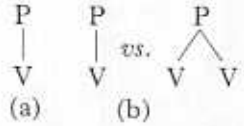
(21)



That is, a model whose primes are both hierarchical (in terms of constituency) and linear (in terms both of node sequence and potential branching: see below).

Given an initial dichotomy of languages with a simple:complex peak opposition and those without, we can interpret this in terms this in terms of BRANCHING as a prime: the two types appear at first to be:

(22)



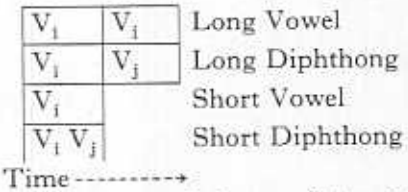
But if we interpret diphthongs as (simply) bimoric peaks, (22) would appear to allow for only two language types: those with short vowels only, and those with short vowels and long vowels/diphthongs, where the latter distinction hinges on whether the two morae are identical or not. But the spectrum of types we ought to be able to characterise comprises at least:

I. Languages with only short vowels and no diphthongs (e.g. Modern Greek, arguably French, and probably Diyari (Austin 1981)).
II. Languages with short vowels and diphthongs only, where the diphthongs are quantitatively indistinguishable from the short vowels (e.g. Yiddish, Polish).
III. Languages with short vowels and diphthongs/long vowels, where there is a genuine quantitative contrast, and diphthongs function as 'long' (German, most varieties of English, Classical Latin). A subcase would be the type with short and long vowels but no diphthongs (arguably Tulu: Bhat 1967).
IV. Languages with short and long vowels, and short and long diphthongs. I.e. those with a basic quantity opposition, but bimoric nuclei in both the long and short sets (Old English, Icelandic on one interpretation, Afrikaans, North Welsh (Thomas 1966)).

Type IV is problematical, and needs some comment. By a 'short' diphthong I mean a bimoric nucleus (or 'non-steady-state' or 'gliding' vowel) that is durationally short, and behaves phonologically (either synchronically or diachronically or both) like a short vowel. E.g. in Old English there were two sets of diphthongs (in the 'standard' interpretation, as in Campbell 1959, Lass 1983b, not the 'radical' interpretations of Stockwell & Barritt 1951, Lass & Anderson 1975), traditionally marked for length, e.g. *ea* in *seah* 'he saw' < */sæx/, *ēa* in *bēam* 'tree' < */baum-/. The short ones monophthongised in late Old English to short vowels, and the long ones to long. In addition, syllables with short diphthongs and a simplex coda count metrically as light, i.e. ≡ −VC, not −VVC, while the longs in the same environment produce a metrically heavy syllable (Lass 1983b).

In Icelandic, the two types enter into the following temporal equivalences:

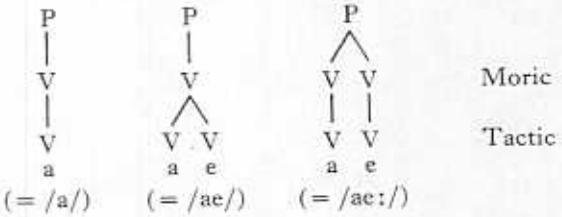
(23)



(Cf. Árnason 1977: 371f; Lass 1983b: 56.)

So we need to provide in an overall taxonomy for bimoric nuclei that are phonetically characteriseable as short, and 'count' phonologically as short as well. In Lass (1983b) I suggested that this can be done by assuming two levels or tiers of organisation within the syllable peak: a 'moric' tier which defines a (prosodic) level of quantitative structure, and a 'tactic' tier which represents the distribution of segmental material under the limitations imposed by the higher-level quantitative definition. Thus the two Icelandic diphthongs [ae] and [ae:] (see above), compared to the short monophthong [a], would be assigned the structures:

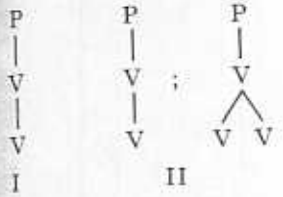
(24)



The quantities are read off the moric tier; the segmental structures off the tactic.

This gives us a full taxonomy of quantitative system types:

(25)



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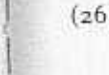
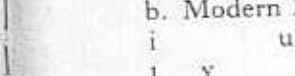


b. Modern Ic



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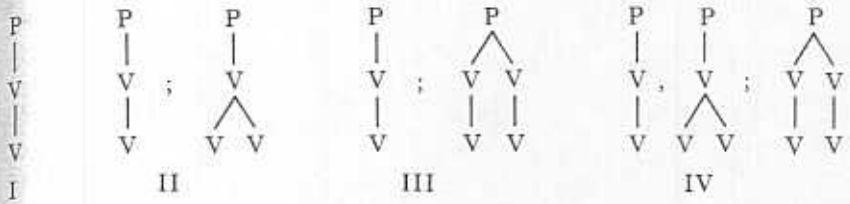

We define the types as follows:

I. Simplex; non-quantitative, monomoric.
II. Complex; non-quantitative, monomoric *vs.* bimoric.
III. Complex; quantitative, monomoric *vs.* bimoric.
IV. Bicomplex; quantitative, monomoric *vs.* bimoric.

Presumably only languages of types III, IV invoke syllable-weight in their phonologies. With these basic types as a background, we also add a historical dimension; e.g. English went from type IV to type III in the course of the OE > ME transition, Latin went from III to II in the early development of the Romance vernaculars, with recrudescences of III, and to I in French.

This of course gets us beyond what seemed to be our original goal: the taxonomy of quality systems. But I have argued in the last two sections that this is an insufficient goal for typology, as all languages except type I have multiplex 'quality' systems, defined along a series of intersecting dimensions. Quality and quantity are often two sides of the same coin, and are not in the 'necessary':'contingent' relation suggested by much of the typological tradition.

But if we accept that diphthongs are part of the descriptive input to typology, how do we integrate them into (iconic) system displays? There seem to be no fully-established conventions of the 'sagittal man' type for doing this (for reasons that will become obvious shortly); but examination of some characteristic display-types uncovers at least two implicit taxonomic frameworks, and there is one explicit one (although only partial) provided by Trubetzkoy. It is however clear in general that if diphthongs are granted 'unit phoneme' status, they tend to be displayed as a kind of appendix to the short/long systems, according to certain articulatory properties. Consider the following full-system displays:

(26) a. Late Proto-Germanic (after Antonsen 1972: 140)

i	u	ī	ū		iu
e		ē			eu
	a	æ	ɔ̄	ai	au

b. Modern Icelandic (after Árnason 1980: 8)

i		u					
ɪ	ʏ				ɛi	œy	au ou
	ɛ	œ	ɔ				
		a			ai		

In both of these, diphthongs are grouped in second-mora taxa, /-i/ *vs.* /-u/ in (a) and /-i/ *vs.* /-y/ *vs.* /-u/ in (b). In (a) the height of the first mora is also significant; in (b) its status is unclear.

Another possible organisation (here diphthongs alone, but parallel to monophthong displays) is according to first morae, subclassified by second; thus Keller (1961: 89) for the diphthongs of Bärndüütsch:

(27) ɪə yə ɑə
ɛɪ œɪ ɔɑ

Here in addition to the front unround *vs.* front round *vs.* back classification, we have centring *vs.* closing for the second mora. But the layout suggests that the primary aim is iconic, following the tradition for Germanic vowel system displays.

On the face of it this seems more sensible than classifying by second mora, at least in a larger phonological perspective; the primary phonological effect of a diphthong (its taxonomic identity as it were) will by and large be vested in the first mora. E.g. one would assume that (as in English, say) a front first mora would palatalise a preceding velar, regardless of what the second mora is: a dialect of English with [æɔ] in *cow*, [æ] in *cat* would have the same [c]-allophone of /k/ in both cases. It seems we can talk sensibly of 'front' and 'back' diphthongs in a simple way.

This gets tricky however if a language has more than one diphthong with the same first mora; in this case we often get two classifications intersecting in the same display, as in Keller's representation of Luxemburgish diphthongs (255):

(28) iə uə
ei ou
ɛːi ɑːu
ɑi ɑu

Here the classification is by first mora for the top three heights, and (apparently) by second mora (and height?) for /ɑ/-diphthongs: unless – though Keller doesn't say anything about it – the first morae are respectively somewhat fronter and backer, and that of the long one closer, as the display might suggest.

Sticking to Keller and the rich diphthong systems of German dialects, we find a different organisation for Darmstadt Hessian (166):

(29) ɑɪ ɑɔ
ɒĩ ɑɔ̃

Here, since all first morae are back, the obvious dichotomy involves the second mora; and the nasalised diphthongs are treated the same way.

Such 'intuitive' displays are not normally explicitly justified, and fail to come to grips with (or ignore, as unimportant or insoluble) the integration problem: do diphthongs fit into, or can they be made to fit into, the rest of a vowel system? There has however been at least one partly

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äi öü au
a

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ai ɔ:
ɑ:

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successful and interesting attempt to incorporate diphthongs into iconic system displays, that of Trubetzkoy (1929 [1964]: 124ff, 1939: ch. 4). For Trubetzkoy, it is in principle possible that 'unit' diphthongs (i.e. those that are 'phonologisch unzerlegbar') can function 'als Vertreter der mittleren Schallfüllegrade in Vokalsystemen maximaler Intensitätstufe' (1929 [1964]: 125). Thus in German, the diphthongs (in his notation) /au öü äi/ fit into the 'empty' positions in the vowel system as follows (I have re-iconised his inverted sagittal man):

(30) i ü u
ę ö ǫ
äi öü au
a

I.e. in general an /ai/ type can 'replace' a missing /ɛ:/, an /au/ type a missing /ɔ:/, and so on. Unfortunately his definition of 'phonologisch unzerlegbar' is too limiting to be very useful for most languages: a diphthong /ai/ for instance can function as a member of a long system ('*Intensität*' is the feature distinguishing longs from shorts), 'nur in solch einer Sprache . . . die keine anderen "i-Diphthonge" kennt' (*ibid.*).

This means that, tempting as it might be, such a solution is impossible for English, where we might be tempted to produce a display like:

(31) i: u:
ei öu
ai ɔ:
ɑ:

Trouble is, aside from violating Trubetzkoy's 'uniqueness' criterion (which I think could be argued against), there are just too many diphthongs: /au/ would be a good candidate to fill an /ɔ:/ space, but there's /ɔ:/ already; and there is nothing to do with the centring diphthongs.

This leaves us with no really good solution, but a multitude of half-baked approaches. It seems clear that (a) diphthongs can't be left out of 'quality systems' (whether or not quantity is involved), and (b) that there is no very good way of integrating them into long systems, except in languages with poor diphthong systems and the proper holes in the long monophthong systems. I will leave the issue here, and merely suggest that it needs work, and that the overall phonological equivalences suggest that there ought to be a solution. Our typological displays will be incomplete until we find one.

As a final thought, it may very well be that Trubetzkoy's notion is a useful one: that there are languages with 'integrated' systems (like German), and languages without them. This might be one way of getting a grip on the problem. At the very least, however, we ought to take diphthongs seriously, and start to look at languages that have them in terms of types (e.g. closing *vs.* centring *vs.* opening: [ai] *vs.* [aə] *vs.* [ia]; rising *vs.* falling; 'level' or 'height-harmonic' *vs.* non-harmonic: [æɑ] *vs.* [æi]; and so on).

7 Segmental primitives: a suggested minimal set

I return to an earlier and basic question (cf. §§1, 2, 4): how fine a representational vocabulary do we need? Alternatively, how many 'basic' vowel types are there? To avoid the temptation of solipsism based on phonetician's *hybris* ('as many as I can discriminate consistently'), I will start with a reasonably principled first rule:

(i) *Phonemic Availability Principle.* Any pair of qualities that contrast phonemically in some language are primitive.

(I take 'primitive' to mean: irreducible, prohibited from 'counting as a variety/type of' something else.)

Nobody is going to worry about [i] or [ɑ] or [y] as primitives; but the phonological literature has long shown some unease about (a) pairs like [i]:[ɪ], [u]:[ʊ], [y]:[ʏ], [e]:[ɛ], [ø]:[œ], etc.; and (b) the status of central vowels *vis-à-vis* back vowels of the same lip-attitude, e.g. [i]:[ɯ], [u]:[u], [ɐ]:[ɑ]. In group (a) the second members of the pairs have been particularly prone to 'de-primitivisation' by ploys like the use of the mythical 'tense'/'lax' distinction (cf. Lass 1976: ch. 1, Appendix); in group (b) the first members have been taken as 'varieties of' the second (so Chomsky & Halle 1968). To establish any of these disputed items as primitive it would be sufficient to show one language in which they contrast as members of the same length-set (thus disallowing 'tenseness' or any other dichotomising operator).

In general this is not all that hard to do, without going very far from Europe: e.g. [i]:[ɪ]:[y]:[ʏ] can be established from Dutch (ABN) *piet*: *pit*: *fuut*: *put* (Gussenhoven & Broeders 1976: §5.2), [e]:[ɛ], [o]:[ɔ] from Standard Scottish English *bait*: *bet*: *boat*: *bought*, and so on. For [ʉ]:[u] we have Standard Norwegian *mor* [mu:r] 'mother': *mur* [mʉ:r] 'wall', for [ɐ]:[ɑ] New York City English *borrow*: *morrow*. I know of no cases of [i]:[ɯ] (non-culpable ignorance?), but [ʉ]:[u], [ɐ]:[ɑ] makes it plausible, and I take [i ɯ] as distinct types.

In the difficult central area, we could justify [ə]:[ɜ] from some South African English *bit*: *but*; and this, with the independence of [ɐ], in any case gives us a full central unround series [i ə ɜ ɐ]. For rounded central vowels I have much less information, but the existence of [ɵ] as contrastive in Swedish (*buss*), and as the first element of a [-u] diphthong in English and Afrikaans (*oat*; *hout* 'wood'), and the independence of [ʉ] suggests it as a primitive.

One further problem is the status of [a]:[æ]. Given two varieties of English, say, one with [a] in *cat* and the other with [æ], and otherwise identical front vowel series (say a Standard Yorkshire and RP), are we dealing with one 'type' or two? I know of no languages with a clear [a]:[æ] contrast; so by principle (i), if I'm right, the two should perhaps be conflated.

But if our interests do extend to a fairly precise picture of the filling of the vowel space, it is worth noting whether, in a particular series, a language uses the lowest height-slot. And perhaps more significantly, from

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(a) Height. Five degrees
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(b) Backness. Five degree
vs. [ɪ], etc.), central,
numbered I to V.
(c) Lip Attitude. At leas
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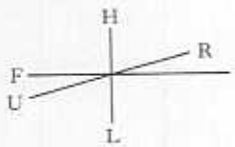

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the point of view of primitivity, this particular distinction can be a clear dialect-differentiator, as well as an indicator of direction of change in English. Anyone familiar with the English (British) dialect picture will be aware of the essential 'southernness' of [æ]-realisations (I include the 'Morningside' Scottish type as 'southern'), and the general picture of increasing openness of the *cat*-vowel as one moves from London into the Midlands and North. And in southern (non-RP) Standard English in general, the [æ]-norm in younger speakers seems (impressionistically) to be yielding to [a] (a trend noted at least as early as Gimson 1962: §7.12). Thus the [a]:[æ] distinction is capable of signalling both regional and chronological differences to the observer; and one would assume, given the constancy of realisation type, to the naïve speaker as well. Therefore it is arguable that this distinction is well within the range of difference available to the normal untutored speaker, and since it is capable of being maintained in contiguous regional and age communities, ought to be taken as a primitive. This leads to another principle:

(ii) *Dialectal Distinguishability Principle*. Any pair of qualities capable of consistently signalling a dialect difference within one language, and therefore available as speaker choices, are primitive.

With these two principles as preliminary and corrigible guides (corrigible both in terms of theoretical justification and empirical adequacy), I suggest the following organisation for a universal quality-grid for system-typing:

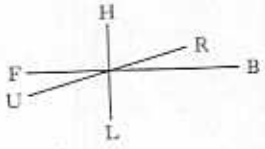
(a) Height. Five degrees overall: close, half-close, half-open, 'raised open' (e.g. [æ]), open, numbered 5 to 1.

(b) Backness. Five degrees overall: front, centralised front (to capture [e] *vs.* [ɪ], etc.), central, centralised back, back (for [o] *vs.* [ɔ], etc.), numbered I to V.

(c) Lip Attitude. At least two, rounded and unrounded (and possibly 'inrounded' as well, at least for Swedish), indicated as U, R.

The vowel space is then a 5 × 5 grid on dimensions (a–b), with lip attitude running 'diagonally':

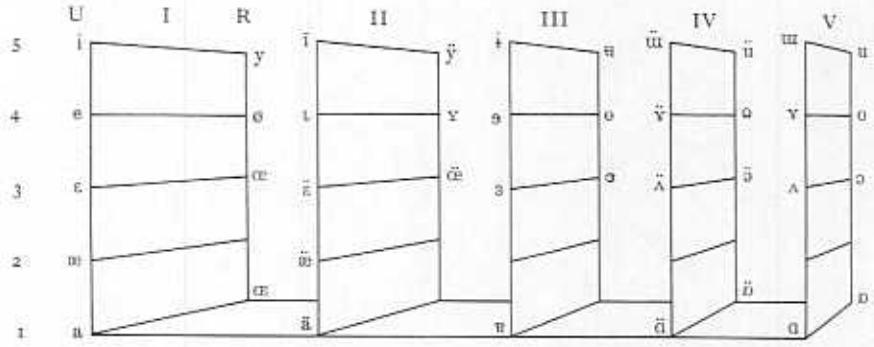
(32)



This is of course something of a 'hybrid', spatially iconic with respect to height and backness, and 'metaphorical' or aniconic with respect to lip attitude. The latter goes in the only 'direction' it can, given the design limitations imposed by my imagination, and monochrome printing on a flat page. But there is a reason for hiving off lip attitude to a separate 'dimension' or 'space', since as we will see the point of the representation is to image dispersal through three dimensions, and to have empty dimensions and empty coordinate intersections available to inspection.

The proposed total 'vowel space' looks like this:

(33)



Empty points are ones for which I don't have direct knowledge of a segment in a language appropriately characterised as having its 'norm' located there. (Curiously, all these lacunae are at heights 2–1, with more in the rounded than the unrounded series. I don't know whether this is significant, but it gives an idea of the heuristic value of the grid: mere inspection frames questions.) Some intersections may be 'universally' empty, which if true would be interesting; but I suspect that most can be filled by investigators with a wider knowledge than mine.

This model suggests a natural linear formulaic representation for vowel systems; we use a five-part formula, indicating occupancy of the five backness dimensions, as follows:

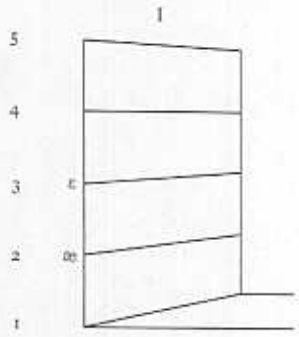
(34) I U: h_m,... + II U: h_m,... + III U: h_m,... +
R: h_m,... R: h_m,... R: h_m,...

IV U: h_m,... + V U: h_m,...
R: h_m,... R: h_m,...

(Where U = unround, R = round, and h_m is a (set of) height label(s).) A roundness or backness gradation that is missing completely is marked by ø, e.g. III ø, or I R: ø, etc. This is a clumsy notation, recalling Pike's 'functional analphabetic symbolism' (1943: 154 ff). But it does at least embody a detailed set of potentially intersecting parameters, and gives us an explicit maximum to subject to reductionist strategies. It enables us, in addition (if we wish, and if it should prove fruitful) to have convenient mnemonic labels for invoking taxa like 'all V ø systems' (i.e. systems with no peripheral back vowels, like Yiddish), or 'all I U: 5, 4, 3, 1 systems' (i.e. languages with four front unrounded vowels but no [æ]), etc. Any such taxon may be a 'natural kind'; the purpose of the system is to achieve a finer-grained inventory than we would have been able to otherwise.

To give an example: the New York City short vowel system in (20) is:

(35)

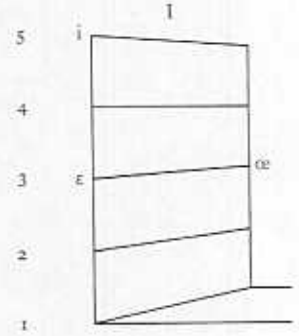


Numerically:

(36) I U: 3,2 + II
R: ø

That is, a member of the
Compare this with the

(37)



That is:

(38) I U: 5,3 + II
R: 3

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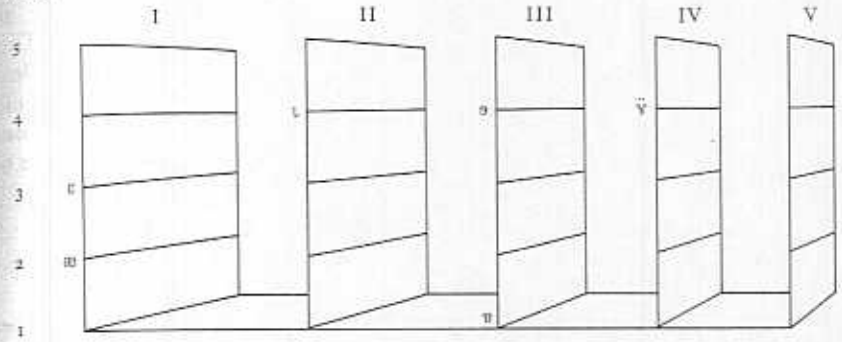
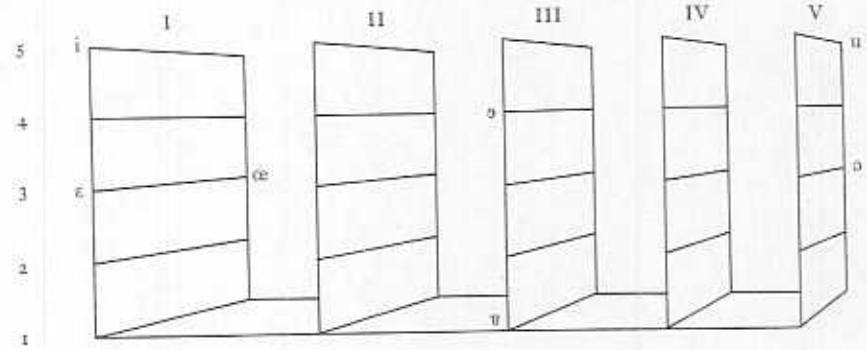


Numerically:

(36) I U: 3,2 R: ø + II U: 4 R: ø + III U: 4,1 R: ø + IV U: 4 R: ø + V ø

That is, a member of the type 'R: ø' (cf. Jaqaru), and 'V ø' (cf. Yiddish). Compare this with the equivalent subsystem in Afrikaans:

(37)



That is:

(38) I U: 5,3 R: 3 + II ø + III U: 4,1 R: ø + IV ø + V U: ø R: 5,3

The symmetries apparent here have formulaic characterisations: e.g. the common matchings I U: n, m, V R: n, m. In other words, we now have a characterisation for a dispersed 'unmarked' symmetry type. Distribution of zeros also gives us a nice notation for minimally dispersed systems like Yiddish or Tagalog or Telefol: I ø + V ø. And so on.

The suggestions made here are crude; but the crudity is nonstandard: non-reductionist plethora rather than reductionist vacuity. I make no apology for it, since I have happily acknowledged my glass house. This is to be considered a working paper in the strict sense: if any of the ideas are of interest, they ought to be worked on, so we can find out if the old way or the 'new' half-way of doing typology is better. By being in favour of closer description and more data, I fancy I'm somewhat on the side of the angels (cf. Comrie 1981: ch. 1).

NOTES

* I am grateful to Nigel Love and Colin Ewen for helpful comments on an earlier draft, Hanni van den Heever, Roy Pheiffer, and Menán du Plessis for Afrikaans data, and Jaime Lass for drawing the diagrams in §7, which made an interpretable display out of my original crude fumblings.

[1] The bulk of examples in this paper will be drawn from a limited set of languages, mainly Germanic, with an emphasis on varieties of English. Where phonetic values or phonemic systems are given without citation, they are from my own work with informants. I am always happier talking about languages I've heard; I tend (perhaps ill-advisedly) to trust myself as a reporter, and at least the examples are cast in the same metalanguage. Other material is acknowledged, and generally taken (in some cases probably mistakenly) at face value.

[2] I avoid (in most of my examples) the symbol [ə], standing for 'schwa' (the range of vowels in the centre that most people don't care to distinguish for height, but are nonhigh and nonlow). I partition the central column in the IPA manner, using [ɘ] for the half-close unrounded central vowel, and [ə] mainly for the offglides of centring diphthongs.

[3] Hungarian values courtesy of Veronika Kniezsa.

[4] Sedlak does admit (18f) that in many cases 'length' can be said 'to affect' the quality of vowels in some way, but he doesn't show this in his displays. This statement is however (illegitimately, on the evidence) theoretically loaded, since it makes the unwarranted and controversial assumption that long vowels are short vowels 'plus something', whereas they might perfectly well be an independent subset, short vowels might be long vowels 'minus' something, or whatever. See §5 on the status of length.

But in any case it's still a 'fact' that if /i: ɪ/ and /i: i/ are distinct taxa, Hungarian and Zulu belong to the same taxon in this respect, while German and English belong in another one. Crothers (1978: 98f) takes [i: ɪ] languages like German as 'having a primary length distinction rather than a distinction between two vowel qualities', but a language without length like Panjabi as having [i] and [ɪ] as separate types. Even Crothers' quite sophisticated overall approach still fails to distinguish Hungarian from German; and because he takes an unsophisticated and over-normalised analysis of Icelandic as his input (compare the system in Crothers (142) with the description in Einarsson 1945 or Árnason 1980), he does not have to deal with a language where at least on the surface the types [i: i ɪ: ɪ] appear.

[5] A subsidiary question that may arise is how to tell if such secondary articulations really are independent vocalic phenomena, or rather belong to a prosodic system. E.g. Lhasa Tibetan on one analysis could be said to have breathy-voiced vowels, but the breathiness is better analysed as part of the tonal system (Hari 1979).

[6] I assume that the first step in typology is a taxonomy of systems of 'code-units' (phonemes), not allophones; system typology is in the first instance a 'structural' pursuit, where 'system' ≡ 'phoneme inventory' (so Crothers 1978: §1.4). Crothers' arguments against 'abstract' (e.g. Chomsky & Halle 1968 English) inputs seem unexceptionable: 'there is no way to tell from Chomsky and Halle's systematic vowel phonemes...what phonetic properties are actually used to

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The Scots system:

beet		
bait	boot	
bet	bit	but
	bat	

distinguish one vowel phoneme from another... Indeed, it is not possible to tell, without detailed comparison of the effects of all the complex rules on all of the vowels, which of the systematic vowel phonemes contrast with each other at the surface level.' (103). Perhaps, if 'systematic phonemic' systems were 'observable' in even the limited and problematic sense that surface systems are, we could envision a 'non-superficial' or 'deep' typology; but the kind of linguist interested in 'depth' usually has little patience with typology of any sort (cf. Lightfoot 1979a, b).

There is of course the possibility of allophonic typology as a separate discipline (what range of allophones may a vowel of type T have in environments X, Y, etc. ?); but this depends on establishing a systemic input. I assume such questions are interesting and intelligible, but will not pursue them further here.

[7] Cf. the usual criteria for 'basic' or 'dominant' constituent orders (not 'underlying' ones): e.g. one doesn't choose a topicalised order as basic. (Though one may choose *any* order as 'underlying' to make transformations work better, etc., as in notorious cases like McCawley's VSO English, 1970.)

[8] There is also an 'inverse-iconic' representation that seems to have been popular in early Prague practice (see Trubetzkoy 1929, 1939), where the sagittal man is upside down, facing right: thus Trubetzkoy (1929 [1964]: 115) represents his 'Dreiecktypus' as:

There may be a metaphorical or punning iconicity here, as the 'openness' parameter is *Schallfüllegrad*, and highest degree ('maximal') is at the top.

[9] Given proper experimental evidence, it might be possible to substitute – at least in some cases – a 'real' definition of phonemic norm for my essentially *ad hoc* or aesthetic one. In one recent tantalising instance, there seems to be some actual empirical evidence for a 'real' value for an unmodified phoneme. At least this is the upshot of an analysis by Jonathan Harrington (1982) of some curious phenomena in stuttering. Harrington remarks that often a stutterer trying to say *keep* or something of the sort, which in fluent speech would have initial [ç], in stuttering perseverates not on [çə] but on [kə]. He suggests that this is something like a representation of a 'norm' somewhere above the level of 'intrinsic' allophony: the speaker is targeting an unmodified /k/, and getting [k]. For us of course the problem is that – for reasons Harrington makes clear – people hardly ever stutter on vowels.

[10] For a nice example of the fruitfulness of an expanded inventory of typological differentia, see Hawkins (1979) on word-order universals and change. I will not produce anything so fruitful here: merely an introduction to a taxonomy.

[11] The wings of birds and insects are analogous; a bird's wing and a human hand are homologous.

[12] The problem discussed below crops up in another form in what is – despite this difficulty – the most phonetically responsible and theoretically interesting set of phonological primitives to date: that developed in the framework of dependency phonology (cf. Ewen 1980). I have discussed the 'X counts as Y problem' in dependency phonology in Lass (1984: ch. 11).

[13] The South African system is based on my own transcriptions: the bracketed (ɪ) represents a problem in analysis (see Wells 1982: §8.3 and his references). The nuclei represent the vowels in

bet	bit		foot
bat	but		
			pot

The Scots system:

beet			
bait	boot		boat
bet	bit	but	bought
	bat		

[14] Crothers' system (see below) is a binomial numerical taxonomy, based on 'peripheral' *vs.* 'interior' vowels. Hockett's is a polynomial multiplicative/additive system based on filled cells in matrices. Sedlak's is based on 'unmarked' and 'marked' subsystems. I make no mention here of markedness, which I consider an incoherent concept, typologically and theoretically uninteresting (for the arguments see Lass 1975, 1980a: ch. 2, 1980b).

[15] The idea is that the 'unmarked' front unround, back round, etc. represent points of maximal 'perceptual dispersion': e.g. [y], because of its lower $F2/F3$, sounds 'more central' than [i]; [ɯ], because of its higher $F2/F3$, sounds more central than [u], etc. For a discussion of this strategy of argument see Lass (1980b) *contra* Kim (1973).

[16] Figures from Elert (1964), Jones (1950: 128f), and Peterson & Lehiste (1960: 702), respectively. The measurements are not perhaps strictly comparable, but I'm interested merely in the possible implications of the existence of a certain kind of disparity.

[17] The very fact that – even if universals like Crothers' /i a u/ are untenable – the construction of vowel systems is non-random suggests the primacy of the system-as-object. E.g. we could construct a set of procedures for making systems like: (i) take one vowel in the range [i – e – ɪ], one in [u – o – ɔ – ɯ], and one in [a – ɐ – ɑ]; (ii) only with this framework established can you add [e o] (contrastive to [i ɪ ɔ u ɯ]); (iii) only then can you add [ɛ ɔ]; (iv) you may have [ɯ] with as few as two other vowels, but [y] requires a system no smaller than five; and so on. (All derivable from Crothers' systemic data.)

[18] This is the most probable scenario for the development of the typical SAE short front system, with its raised *bat*, *bet* vowels and its central *bit* (cf. Jeffery 1982).

[19] Open syllable lengthening is actually not this simple. It was not as the handbooks have it an across-the-board change, and it may in fact not have occurred in 'open syllables', as the account in my text suggests. For a radical revision of the received wisdom on this change see Minkova (1982). But whatever it was and whenever it happened, the quantity:quality relations were as pictured in (15).

[20] For reference, the nuclei in the New York system represent:

beet			
bit	but	book	
bet			bought
can, n.			
can, aux.	pot	father	

[21] The transcriptions [ae], [ae:] are traditional in type, but inaccurate; the length is spread over both morae of the diphthong. See the discussion and references accompanying (23) below.

[22] The fact that Chomsky & Halle (1968) manage to account for these pairings in terms of [±tense] is not to the point. Even in their analysis long vowels and diphthongs constitute a natural class (if indirectly) by virtue of a common 'source' in an underlying '[+tense]' vowel (cf. Lass 1976: ch. 1).

[23] This is of course only one possible model of syllable constituency; there are simpler (autosegmental) ones with multiple single-level branchings from σ, more complex (metrical) ones with intensive stacking of Ss and Ws and no autonomous node labels, and dependency ones with a totally different kind of graphic shape. I have chosen (and modified) the one that seems to be most useful for the purpose of discussing quantity (see the arguments in Lass 1983b). For a survey and critical discussion of syllable-models, see Selkirk (1982), which also gives an excellent historical survey.

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