

Syllables

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I. INTRODUCTION

Kohler (1966*a*, 1966*b*: 346-348) asks whether the syllable is a phonological universal, and concludes negatively.¹ The way to support such a conclusion is not difficult to imagine: the sort of specific objections to the syllable which Kohler raises would, if well-founded, be sufficient to prove his case.

I would wish to maintain the opposite point of view: I would like to state my firm belief that the syllable is a phonological universal. Like any other act of faith, this involves at least three parts: (i) close study of a set of hypotheses, (ii) selection of one of these as being more likely to be true than the others, and (iii) a willingness to face up to counter-claims against the selected hypothesis and also to put it to the test oneself. Kohler's counter-claims are, I think, sufficiently answered by Anderson (1969) (the arguments of Haugen (1967: 806-808) are also germane), and I will not discuss them systematically in this article (though on occasion I will indicate the relevance of the point I am making to a specific counter-claim). Other such counter-claims I will face, and I hope answer, as they are made.

In the meantime it is clearly incumbent upon me to test my selected hypothesis, first by making it explicit (see §2 below), and then by attempting to relate it to the facts of as many languages as possible (§§3-5 below): one complete failure will, of course, be sufficient to destroy it as a universally applicable hypothesis. On the other hand, any facts in a particular language which I am able to handle particularly neatly by using the syllable could provide me with genuine ammunition against those of my opponents who go further than saying that the syllable is not a phonological universal. Kohler, for example, makes the very strong claim that it is universally possible to do without the syllable: '... it can be demonstrated that the syllable is either an UNNECESSARY concept, because the division of the speech chain into such units is known for other reasons, or an IMPOSSIBLE one, as any division would be arbitrary, or even a HARMFUL one, because it clashes with grammatical formatives' (1966*a*: 207, 1966*b*: 346). In such cases, opponents will have to show how a phonology without syllables would cope with the relevant facts.

[1] I would like to put on record my appreciation of the many discussions I have had with Klaus Kohler on the topic of this paper - although not productive of agreement, they have always been cordial and constructive. I am grateful to several others for suggestions, notably John Wells and David Crystal.

2. THEORETICAL PRELIMINARIES

2.1. The function of the syllable is twofold:

(a) To provide a basis for distinctive prosodic features: 'Les particularités prosodiques n'appartiennent pas aux voyelles en tant que telles, mais aux SYLLABES' (Trubetzkoy, 1949: 196). Even where tone- or stress-elements are not directly attributable to syllables, their domains (morae, etc.) will be related to the syllable: 'L'unité prosodique phonologique n'est pas à vrai dire simplement identique à la "syllabe" (au sens phonétique), mais elle a toujours un rapport avec la syllabe, étant donné qu'elle est, selon les langues, une partie déterminée de la syllabe ou toute une suite de syllabes' (*ibid.*: 99; also examples pp. 202-203).

(b) To account for constraints on possible phoneme sequences (Pike, 1947: 180-181): this will be our main concern in this paper. Some of these constraints are accounted for by setting up a syllable structure (Firth, 1957*b*: 17) and then postulating different systems at different places in the structure (Allen, 1957: 72; Cheng, 1966: 139); in other cases, the choice of a particular element at one place affects the range of choice at another place (Allen, 1957: 72-74; Hill, 1966: 217-220).

2.2. With what strata or levels of description will our syllable be associated? And what will be the status of its component parts?

It appears likely that at least two different types of syllable will have to be postulated. These will correspond roughly to the traditional phonetic syllables and phonemic or phonological syllables (Rosetti, 1963, and works cited there): 'On peut définir la syllabe phonologique et l'opposer à la syllabe phonétique' (*op. cit.*: 21). Our phonological syllable will be defined as an element of the systematic phonemic level (in the abstract sense of Fudge, 1967: 3-8), and our phonetic syllable as an element of the systematic phonetic level (Chomsky, 1964: 68) (more specifically, of the extrinsic allophonic type-Ladefoged, 1967; Fudge, 1969). The first type will not necessarily bear any close relation to actual pronunciation. Such syllables will consist of bundles of systematic phonemic features (preferably labelled in non-phonetic terms); it is hoped that they will provide a common basis for the description of mutually comprehensible dialects, even when these are phonetically very different from each other. The second type will represent the norm of pronunciation of a particular dialect or variety, and such syllables might consist of bundles of articulatory features (Ladefoged, 1967: 49-50) or some representation of the neurophysiological basis of the relevant articulations (Fromkin, 1966; Tatham & Morton, 1968).

There is no necessary one-one relation between the phonemic syllables underlying an utterance and the phonetic syllables underlying it. This lack of isomorphism characterizes our syllables in both of their functions (§2.1):

SYLLABLES

(a) 'If the nuclei of phonetic syllables do not coincide with such units of tone or stress placement it is frequently helpful to postulate for descriptive purposes phonemic syllables which are structural units, related to phonetic syllables, but whose nuclei do so coincide' (Pike, 1947: 145).

(b) 'For particular languages the student must be prepared to find that the phonetic syllable does not correspond with the most pertinent structural grouping of segments. Just as segments must be analyzed into the structural phonemes, so phonetic syllables must be analyzed into the structural phonemic syllables' (*ibid.*: 90).

Thus in French we have the well-known 'mute e', which although normally realized as zero, yet must be taken into consideration at a phonemic level: on any other basis, various morphological facts are more difficult to state, while the rules of French metrics cannot be stated at all. As an example of such morphological facts we will consider how masculine and feminine forms of adjectives are related. Phonetically we have the forms shown in Table 1: each

Table 1

	masc.	fem.		masc.	fem.
'high'	o	ot	'yellow'	ʒon	ʒon
'ugly'	lɛ	lɛd	'fine'	fæ	fin
'large'	gro	gros	'healthy'	sæ	sɛn
'grey'	gri	griz	'holy'	sæ	sæt
'red'	ruʒ	ruʒ	'good'	bõ	bõn

form is monosyllabic. The rules for stating the relations are impossibly complex if we take the masculine as basic; with the feminine form as our starting point we have:

- ʒ, -on remain unchanged
- in, -ɛn → -æ
- ɔn → -õ
- t, -d, -s, -z → zero

Table 2 shows a less phonetically based approach incorporating ə as a phoneme

Table 2

	masc.	fem.		masc.	fem.
'high'	hot	ho-tə	'yellow'	ʒo-nə	ʒo-nə
'ugly'	lɛd	lɛ-də	'fine'	fin	fi-nə
'large'	gros	gro-sə	'healthy'	sɛn	sɛ-nə
'grey'	gri	gri-zə	'holy'	sɛNt	sɛN-tə
'red'	ru-ʒə	ru-ʒə	'good'	bõn	bõ-nə

(the approach of Togeby (1951) is rather similar to this); all the feminines are

now disyllabic, and so are the masculine forms of 'red' and 'yellow'. The masculine is now the best choice for the base form, and the rules are as follows:

Morphological rule

Adj. → Adj. +ə (subject to the general constraint that two instances of ə cannot be adjacent in the same word—thus ru-ʒə and ʒo-nə do not add another ə)
 fem. masc.

Phonological rules (of relevance throughout the language)

$$\begin{bmatrix} i \\ \epsilon \\ \text{ɔ} \end{bmatrix} + \begin{Bmatrix} n \\ N \end{Bmatrix} \rightarrow \begin{bmatrix} \text{æ} \\ \text{æ} \\ \text{ɔ} \end{bmatrix} \quad \text{when not separated by syllable boundary}$$

t, d, s, z, ə → zero word-finally

As a further example consider the English 'long u' vowel. Its phonetic realization as [ju:] gives rise to the possibility of initial (phonetic) clusters consisting of [Consonant]+[j] parallel to [Consonant]+[w], [l] or [r] which realize phonemic clusters. Phonetic syllable structure would thus differ from phonemic under two heads:

(a) The inventory of elements capable of acting as the second member of initial clusters will differ (three terms at the phonemic level, four at the phonetic); the fact that only the [u:] vowel normally follows a [j]-cluster does not affect the issue. Actually there are a few words with initial [CjV] where [V] is not [u:], the outstanding example being *piano*. For those who pronounce [pi'ænou] this is obviously trisyllabic phonetically and phonemically, and it could be a phonemic trisyllable / pī - æ - nou / even for those who pronounce [pʲænou]. It could be treated as a loanword, but is perhaps well enough established to indicate one type of structural innovation which might spread in English in the future.

(b) The inventory of elements capable of acting as the first member of initial clusters will differ (stops and voiceless fricatives, except palatals, at the phonemic level; all consonants except palatals and [w], [r] and [l] at the phonetic).

2.3. The relation of phonetic syllables to chest-pulses (Stetson, 1945: 6) or puffs of air (Rosetti, 1963) or voicing (Hála, 1961) will not be discussed. Systematic elements are not defined in terms of their physical manifestations – in fact they are not so much DEFINED as POSTULATED as elements of the abstract calculus in terms of which the underlying system may be described. Only after they are postulated (as a system characterized by certain relations) are these abstract elements linked up by realization rules with observable phenomena; these last CHARACTERIZE rather than DEFINE the abstract elements. The justification for postulating one system of elements and realization rules rather than another is a twofold 'renewal of connection' (Firth, 1957b: 1): (i) that they enable one to predict what types of phonetic events are likely to occur (cf. Chomsky's 'obser-

vational adequacy', 1964: 29–30), (ii) that they agree with the intuitions of native speakers about their language (cf. Chomsky's 'descriptive adequacy', 1964: 29–30). If in addition there is independent phonetic justification for postulating some element, then this will provide further confirmation of the correctness of so doing. For instance, the great difference in acoustic status between vowels and consonants (consonants being acoustically modifications of vowels rather than elements in their own right – Hockett, 1955: 206–208) would tend to confirm the appropriateness of a syllable which is basically CVC in nature. There is also the point that some aphasics are incapable of pronouncing certain words, but remember and reproduce the number of syllables and the position of word-stress (Jakobson, 1968: 64).

The glossematic use of the term 'definition' with its insistence on distributional criteria alone (cf. Togeby, 1951: 80–87) can be just as misleading as uses which imply definition in terms of intrinsic properties. Again we may say that a systematic element is CHARACTERIZED rather than DEFINED by its distribution: thus the fact that Danish *p* and *k* have identical distributions does not matter – they are first postulated as distinct elements, and may then be said to be characterized by identical distribution (cf. Bazell, 1953: 16). Hjelmslev's circular² 'definition' of 'syllable' and 'accent' (each in terms of the other) (1939: 266–268) is not circular if it is understood as a characterization of syllable and accent, which are both in fact postulated as primitives. The same could be said of A. A. Hill's 'definition' of vowel and consonant (1958: 68–69).

For an approach to the morpheme which is analogous to our own approach to phonemic elements, see Koutsoudas (1963): 'The morpheme is that unit of grammar the arrangement of which is specified by the syntax and the resulting sequences of which are used to predict the physical form of utterances' (169).

It should be remembered that the procedures by which we set up the syllable in a particular language (or by which we decide where to place syllable-boundaries in words of that language) are no part of its definition as a theoretical unit, either in general or in that language. This is not to say that such procedures are not important in the 'discovery' phase of linguistic work, but is an affirmation that this phase is to be carefully distinguished from the 'presentation' phase, and that is this latter which is theoretically basic – discovery procedures are essentially 'trial-and-error' in nature, and must be evaluated in terms of whether their results accord with the system best fitted for the description of the language. Chomsky's denial of the theoretical status of complementary distribution (1964: 93) is presumably to be understood in this light.

2.4. One important problem which any theory of the syllable must face is the relationship of syllable and morpheme. The adoption of a generative framework

[2] Alleged to be circular by Togeby (1951: 75), though Hjelmslev claims explicitly to be avoiding circularity (Hjelmslev, 1939: 267).

poses this problem in an acute form: at what point and in what way can a syllable-based phonology (such as Saporta & Contreras, 1962) be 'fitted into' a morpheme-and-formative-based grammar (such as Halle, 1959)? Kohler in effect cuts the Gordian knot, saying that because there is no simple answer to this question, a syllable-based grammar is just unthinkable: '... it can be demonstrated that the syllable is either an UNNECESSARY concept, ... or an IMPOSSIBLE one, ... or even a HARMFUL one, because it clashes with grammatical formatives' (1966a: 207; 1966b: 346). In fact, explicit recognition of this lack of isomorphism has not prevented other scholars from seeing the need for both types of unit: 'Morph patterns may be entirely linked to syllabic pattern, as in Chinese; strongly linked to syllabic pattern, as in the Bantu dialects; feebly linked to syllabic pattern, as in Turkish or English; or independent of syllabic pattern, as in the Semitic dialects' (Bazell, 1953: 62).

2.5. The manner of the tie-up between syllable and morpheme cannot be understood unless a clear distinction is made between the MORPHEME (a functional, grammar-oriented unit, not decomposable into phonemes) and the MORPH (an overt, phonology-oriented unit, consisting in general of a sequence of phonemes), the relation between the two being one of representation: thus English SANK consists of one morph (four phonemes in length) representing two morphemes. For this distinction see Bazell (1953: 51-60).

2.6. The phonological element WORD consists from one point of view of a string of morphs which as individual morphs have no necessary relation to syllables (cf. the quotation from Bazell above), and consists from the other point of view of a sequence of an integral number of syllables – thus the string of morphs is related to the syllable, but only indirectly, via the word. If a morpheme or a string of morphemes forming a constructional unit happens to be represented by a single word, we shall treat this as purely coincidental: in other words GRAMMATICAL WORD is not an element with systematic status. On the grammatical level morphemes will be combined into CONSTRUCTS, whose limits will not necessarily coincide with word-boundaries at all: thus morphemes of tense are best regarded as being in construction grammatically with a complete predicate, although morphs representing such morphemes are very frequently bound to the verb stem (cf. Harris, 1951: 278-279, 1957: 325).

The extreme case is exemplified by the interrogative particle *-ne* in Latin: grammatically the construction is Q + Nucleus not Q + first word, while phonologically we have the CV syllable *-ne* appearing as the last syllable of the first (phonological) word (n.b. not 'attached to' that word – in any particular instance when *-ne* is present, I feel it is more appropriate to say that the morph or morph-sequence to which it is attached does not form a word, irrespective of the fact that it does in cases when *-ne* is not present: thus in *Caesar veniet*

'Caesar will come' *Caesar* is a word, while in *Caesarne veniet* 'will Caesar come?' *Caesar* is not a word).

Only slightly less extreme are cases like the Chinese *-de* which, when attached to the last of a string of syllables representing a phrase or a clause, enables that phrase or clause to function as a noun-modifier. Grammatically, the construction is, say, Clause + Adjectivalizer, while phonologically, it is Last syllable of phrase + *-de*, irrespective of the grammatical status of that syllable – the pitch of the *-de* is entirely dependent on the tone of the syllable to which it is attached (Hockett, 1947: 257).

Very similar, again, is the English *'s* problem: in *the King of England's hat*,

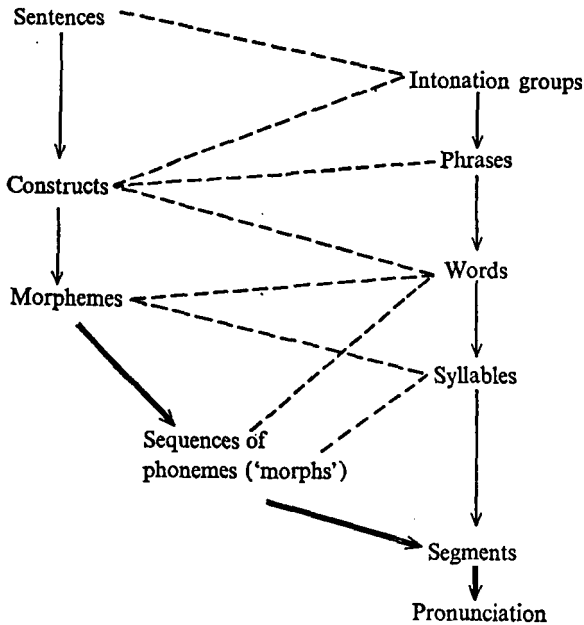


Figure 1

is *'s* a word? If not, how can it be in construction with a phrase (*the King of England*)? But if it is, how is it that it never occurs as a free form? The solution is to recognize that phonological constructions may not correspond with grammatical ones: grammatically we have Noun phrase + Possessive, while phonologically we have *the + King + of + England's + hat*. *England's* is a word, while *England* (in this particular instance) is not.

Thus the grammatical hierarchy ought to be strictly distinguished from the phonological hierarchy (see Fig. 1) (see Pike, 1967: ch. 9, esp. 409–410). There will be close correspondence or even identity between elements in certain particular cases (cf. Bazell's statement of the relation between syllable and morph quoted in §2.4 above): the dotted lines in Figure 1 show some of these

possible correspondences. Morphs form the bridge between the two hierarchies: the relation between morphemes and morphs, and the morphic composition of words (this latter area is, I think, as near as one gets to 'grammatical words') together comprise the domain of morphology (which ought to be kept distinct from phonology, and not included within it as seems increasingly to be the fashion nowadays). The link between morphs and the structures generated by the phonological hierarchy might be effected by an algorithm which takes in order the phonemes composing the morphs and assigns them to appropriate segments in syllable- and word-structure. This would provide a means of adjusting the syllabic position of phonemes belonging to a morph according to the morphic context of the latter – the /v/ of *drive* is syllable-final, whereas it is more natural to take the /v/ of *driving* as syllable-initial (cf. Kurytowicz, 1948: 82–83).

Chomsky & Halle's 'phonological phrases' (1968: 9–10) correspond to our intonation groups (being the 'maximal domains for phonological processes'): the rules for inserting phonological phrase boundaries are part of the rules for converting 'syntactic surface structure' (the output of the syntactic component) into 'phonological surface structure' (the input to the phonological component) (10, 13). This framework suffers from the disadvantage of introducing necessary phonological elements in an *ad hoc* manner, rather than systematically, stating relations between the various elements. These relations are in fact comparatively simple: each element consists of a string of an integral number of instances of the element next below it – a phrase consists of one or more words, a word of one or more syllables. The only more complex structure is the syllable, in which branching structures, as opposed to strings, are relevant (see the following section).

2.7. Obviously the morphs and the structures generated by the phonological hierarchy must be compatible with one another. The question arises, which type of structure has logical priority? In other words, are the sequences of phonemes of which morphs consist subject to the constraints embodied in the syllable-structure rules, or is the converse the case? In the latter case, without syllable-structure rules, the rules for morph-structure can only be of the 'finite-state' type (as Šaumjan, 1962, claims); this leads to such problems as the difficulty in treating VC syllables as special cases of CVC syllables, which in turn leads to unnecessarily complicated descriptions such as Roceric-Alexandrescu, 1967. Syllable-structure rules with the possibility of zeros in some places enable us to use 'phrase-structure' type rules (cf. again Šaumjan, 1962) which greatly reduce the number of distinct syllable-types (e.g. in Roceric-Alexandrescu's case, from 20 to 4 or less).

Moreover, morph-structure rules will either not apply to morphs without vowels (e.g. English *s/z* plural, *t/d* past, and perhaps stress-shift denoting

nominalization), or need to be made more complex to account for such cases; with a properly constituted set of syllable-structure rules, on the other hand, this problem does not arise (see below, §5). Incidentally, one wonders how Kohler would treat a bi-morphic word like *goes* – would he violate his third objection (i.e. that syllable-division and morph-division sometimes clash) by accepting it as a monosyllable? His only alternative would be to call it a disyllable, which seems rather unsatisfactory and unnecessary.

Halle's 'morpheme-structure rules' (1959: 39, 58–61) appear to be (finite-state) morph-structure rules pure and simple: syllables play no explicit part in the phonology. In a recent article Stanley (1967) proposes that Halle's notion of an ordered set of morpheme-structure rules on a par with other types of phonological rule should be replaced by an unordered set of 'morpheme-structure conditions' different in form from the phonological rules proper, and to be kept separate from them. It is important to note Stanley's claim (432) that morpheme-structure conditions of a certain type ('positive conditions') are required for the purpose of 'stating restrictions on syllable-structure, that is, in stating restrictions involving the features Consonantal, Vocalic and perhaps Obstruent'. While it is true that these proposals represent a step forward, they still suffer from two important drawbacks:

(a) Their 'finite-state' character remains unchanged;

(b) They only work really well for languages of the special type in which morph and syllable correlate very closely: the example given in the text (427) is an extreme case of this type. The typical situation in a Semitic language is very different: morphs are of three distinct types:

- (i) Roots, most frequently of the form CCC,
- (ii) Infixes, usually of the form VV (with zero as a possible choice for either V),
- (iii) Particles, Prefixes and Suffixes, usually (C)V(C).

Types (i) and (ii) are discontinuous and 'interweave' yielding sequences over which the usual type of syllabic constraints operate, and for which syllable-structure rules must therefore be set up as completely distinct from the morph-structure rules for the major word-classes.

To talk in terms of syllables is then necessary; however, it is not sufficient. Chomsky & Halle (1968) continually invoke syllables, monosyllables, disyllables, etc. in their less formal discussions (in the text frequently, but sometimes also within the systems of rules proposed), and even postulate a feature Syllabic 'which would characterize all segments constituting a syllabic peak' (354). Unfortunately, none of these terms are made explicit in the text or in the rules; we are left to infer that a monosyllable is probably a formative with only one vowel ('In monosyllables, the vowel receives primary stress' (16)), and perhaps also that a syllable is a sequence of phonemes containing one and only one vowel (' \hat{Z} [is] a stressed syllable, that is, a string of the form $C_0\hat{V}C_0$ ' (35)).

The term 'syllable' does not even figure in the index of Chomsky & Halle (1968).

In fact, we may state that it is not satisfactory to deal with the structure of one element in terms of statements designed to deal with the structure of an essentially different and only indirectly related element. If we want to state syllable-structure, we must explicitly introduce the element 'syllable' into our linguistic description, and state its relations to the other elements of the phonological hierarchy; it is precisely this which Chomsky & Halle fail to do.

3. EXAMPLE I

3.1. The first of the cases to be adduced as a challenge to opponents of the syllable (see §1) is concerned with a stage in my son's linguistic development. At the age of 1 year 4 months, his words fell into the following structural classes:

(a) VC: only two words: [am] 'jam', [ʌp] 'up'.

(b) CV(C): the most frequent type; bilabial consonants occurred only with back rounded vowels, e.g. [bo] 'ball' or 'book', [bɔm] 'beating a drum or playing the piano' (lack of differentiation being not merely lexical!); alveolar consonants occurred sometimes with back vowels, e.g. [don] 'down', but much more frequently with front vowels, [ti] 'a drink', [den] 'again'. The place of articulation of the final consonant (usually a nasal) was always the same as that of the initial.

(c) CV(C)-CV(C) (reduplicated): two (perhaps three) words: [bo-bo] 'dog' and [taʔ-taʔ] 'brick' (derived from *on top*), together with one occurrence of [deʔ-deʔ] 'teddy' (normally [deddi] – see class (d)); the constraints mentioned under class (b) appear to hold for this class also. Stress-wise, these were treated as two words at this stage (hence the linking hyphen).

(d) CVCCV: all the consonants were identical in a given word; alveolars occurred with front vowels, and bilabials with back vowels, with no exceptions; close vowels were never followed by open vowels in the same word: e.g. [daddi] 'Daddy', [mɔmmo] 'Mummy'.

At this stage, it would be reasonable to postulate a phoneme inventory as in Table 3, with realization rules as in Table 4. The system would obviously

Table 3

	A	B		(i)	(ii)
<i>a</i>		t			
1	p/b		P	i/e	o
<i>b</i>		d			
2	m	n	Q	a	ɔ/ʌ
	Consonants			Vowels	

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Table 4

A1	→	{ [p] word-finally [b] elsewhere
B1	→	[ʔ] word-finally (syncretism of t and d in this position)
B1a	→	[t]
B1b	→	[d]
A2	→	[m]
B2	→	[n]
P(i)	→	{ [e] before consonants [i] elsewhere
P(ii)	→	[o]
Q(i)	→	[a]
Q(ii)	→	{ [ʌ] when not preceded by a consonant [ɔ] elsewhere

lend itself better to a prosodic approach, but this will not be elaborated at this particular point. On the 'consonant harmony' compare Jespersen (1922: 109-110); on the constraint between consonants and vowels compare Jakobson (1968: 29-30).

3.2. The next significant developments were:

(i) (At age 1.4) Velars were added to the inventory of allophones: phonemically this meant the addition of a column C to the diagram in Table 3. To begin with, these nearly always occurred with back unrounded vowels, e.g. [kʌk] 'cake' or 'truck', [gʌŋ] 'garden' (both of class (b)), [gʌgʷ] 'doggie' (class (d)), though there were exceptions, e.g. [ka] 'car'.

(ii) (1.4-1.5) The 'harmonic' constraint between vowels and consonants began to break down, e.g. [bɛ] 'bear', [gʌŋ] 'garden'; the constraint between vowels in a word, and that between consonants in a word were, however, maintained: [memi] 'Mummy', [kigi] 'piggie', [bap] 'back'. [e] and [i] now represented different phonemes, and the medial geminates of class (d) words became single consonants.

(iii) (1.5) Words of the form CVNC appeared for the first time: [gɪŋk] 'sink', [dɒŋt] 'don't'.

(iv) (1.5-1.6) Addition of laterals (syllable-initially): [lɔi] 'lorry'; fricatives [ʃ] and occasionally [x] (syllable-finally); [piɛ] 'please', [gax] 'scarf'; vowel [i] in a 'consonantal' function (syllable-finally): [boi] 'boy' (extrinsically CVC [bɔy]).

(v) (1.5-1.6) First signs of a relaxation in the 'consonant harmony' constraint: alveolars (including [ʃ]) began increasingly to occur in final position when labials or velars occurred initially: [piɛ] 'please', [niɛ] or [miɛ] variant forms of 'missed', [ban] 'bang', [map] or [mat] variant forms of 'smack'. This would

appear to confirm the hypothesis that the alveolar place of articulation is unmarked with respect to all others (cf. Jakobson, 1968: 87–88; Kohler, 1967b: 146).

(vi) (1.5–1.6) Reduplicated words (class (c)) were stressed as single words, i.e. rhythm-wise [tattat] ‘brick’ and [dadi] ‘Daddy’ were now identical; reduction of clusters took place in many cases: [maman] ‘milkman’ (extrinsically [manman]), [babai] ‘bye-bye’ (extrinsically [baybay]), assimilations in others: [kikkitt] ‘ticket’ (extrinsically [kitkit]).

(vii) (1.6) Words consisting of reduplicated CVNC appeared: [kiŋkint] ‘kitchen’ (extrinsically [kintkint]), [pampamp] ‘Grandpa’.

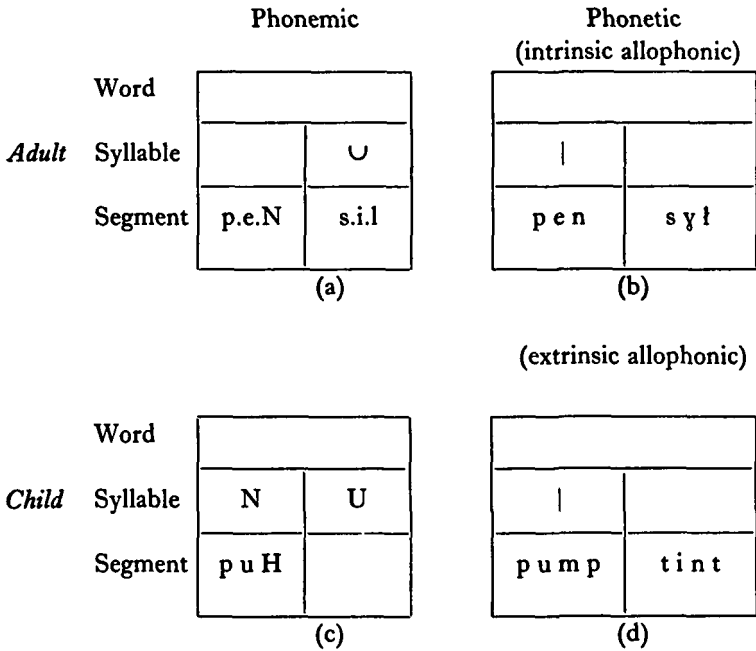
(viii) (1.7) The first genuine (i.e. non-reduplicating) disyllables appeared: [pumptint] ‘pencil’, [pʌptit] ‘butter’, [kuttit] ‘scooter’; the second syllable was always of the form [tint] when the first was CVNC, always [tit] when the first was CVC. This could be taken as further confirmation of the ‘unmarked alveolar’ hypothesis, and suggests that the vowel [i] should also be regarded as unmarked in some way.

3.3. Up to and including stage (v), word-structure rules would be quite sufficient to handle the constraints on co-occurrence of phonemes; however, stages (vi) and (viii) demand the recognition of the syllable as a distinct element. It should be noted that any attempt to evade this recognition, e.g. by saying ‘where the first half of the word is of the form CVC, the second half is [tit]; where the first half is CVNC, the second half is [tint]’, will almost certainly still involve the investigator in an implicit recognition of the syllable. Kohler himself seems to be in rather this position: ‘Es ist . . . von Wichtigkeit, dass das Kind *die* Grundstruktur zuerst lernt, die auch allen Sprachen gemein ist, nämlich CV, und dass es alle weiteren Verbindungen durch Ausbau dieser Basis erwirbt’ (1967a: 126). This CV structure is given no systematic recognition in spite of this explicitly stated universal importance, and in spite of its alleged rôle as perpetuator of the (erroneous) syllable-idea: ‘Als eine mögliche Erklärung für die Hartnäckigkeit, mit der sich der Begriff und der Terminus [“Silbe”] gehalten haben, bietet sich wiederum diese Grundstruktur CV an . . .’ (*ibid.*). I would prefer to believe that the reason why syllables are still with us is that they are valid as basic elements of linguistic structure, and that we cannot do without them.

3.4. Figure 2 shows one way of accounting for the very striking differences between the surface form of the adult version (b) and that of the child’s version (d) of *pencil*. The non-reduced first syllable of (a) is realized as the stressed first syllable of (b) (symbolized by |). The consonants of the unstressed syllable (though perhaps not the vowel: see below) are ignored by the child, but the presence of that syllable is not (in contrast to pretonic unstressed syllables whose presence is usually ignored by the young child). The post-vocalic [n] is taken

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Figure 2



over by the child as a syllable-prosody (Firth, 1957*b*: 24) of Nasality; at this stage in the child's development there will be a rule which states that when N occurs in the first syllable of a word it must likewise occur in the second. The initial [p] is taken over unchanged. H in the last segment of the initial syllable stands for Homorganic, implying that this position is occupied by the voiceless stop which has the same place of articulation as the initial in the syllable (other possibilities here are [ɸ] [t], and zero). The final syllable contains the symbol U for Unmarked, implying that initial and final positions are occupied by [t] and that the vowel is [i] (the other element in this system is R[eduplication]). To account for the vowel of the initial syllable is not an easy matter: it is not automatically selected by the consonant (we have a different vowel in [pʌptit] 'butter'); it might be best to regard it as reflecting the back vowel of the second syllable of (b), the front vowel of the first syllable of (b) being reflected by the automatic [i] of the second syllable of (d). For reasons of articulatory simplicity (presumably), this word soon took on the intrinsic allophonic shape [pʌntint].

4. EXAMPLE II

4.1. Before proceeding to a thorough investigation of the structure of English

syllables (§5 below), we will set the scene by briefly considering syllable-structure in Chinese (chiefly Mandarin) with special reference to certain questions of internal structure which will be more generally relevant (and which, in particular, will be relevant to English).

It is, of course, impossible to say whether syllable-structure formulae for Chinese are syllable-relevant or morph-relevant (since these two units are indistinguishable in Chinese – see §2.4). This was pointed out by Hockett: ‘Hartman’s “syllable” = our “monosyllabic microsegment”’; Hartman, like his predecessors, does not discover dissyllabic microsegments, and does not examine too closely the problem of establishing syllables as phonologically relevant units to start with’ (1947: fn. 27). Accordingly we must be prepared to find that some of the constraints on phoneme-combinations in English, or any other language, are morph-relevant or word-relevant rather than syllable-relevant (here I would emphasize that the syllable is a NECESSARY unit, not an ALL-SUFFICIENT one). This does not, however, imply that we must justify syllables IN ADVANCE (as Hockett appears to demand here): as stated earlier (§2.3), we postulate them, and hope to justify this by the applicability of our description to the facts of the language.

4.2. There is no dearth of studies on Chinese syllable-structure (e.g. Firth & Rogers, 1937; Hockett, 1947; Scott, 1947, 1956; Halliday, 1959 (Appendix A); Cheng, 1966): the large number presumably reflects the fact that Chinese dialects in general demand such a treatment. The four-place structure proposed by Hockett (1947: 258–259; Joos, 1957: 221) and Cheng (1966: 142, cf. 146) for Mandarin appears to be useful for the description of many other Chinese dialects; we will adopt it here in preference to other structures. Like Cheng (1966: 135–136) we will exclude ‘morphophonemically derived’ syllables from the set of syllables to be considered. Table 5 shows the various systems operating at each place. We have adopted Hockett’s three-vowel system (1947: 259; Joos, 1957: 221), replacing # by I, rather than the five-vowel system proposed by Cheng (140–142), in which the distinction *i* – *u* – *ü* appears (redundantly) at two places in the structure. In this particular case, no attempt has been made to equate elements of one system with elements of another (cf. Allen, 1957: 75); this does not imply that it will never be possible to do this (cf. §5.1 below).

The setting-up of syllable-structure clearly accounts in an appropriate way for the majority of the systematic restrictions on sound-sequences: the remainder of these may be stated in terms of the co-occurrence of particular elements of one system with particular elements of another – adapting Firth’s terminology (1957*b*: 11–14) to the phonological level, we might call these ‘collocational restrictions’ as opposed to the ‘colligational restrictions’ summarized in Table 5.

4.3. As stated by Hockett (1947: 259) (and equivalently by Cheng, 1966: 145), /w/ does not occur at place 2 and place 4 in the same syllable, and the same

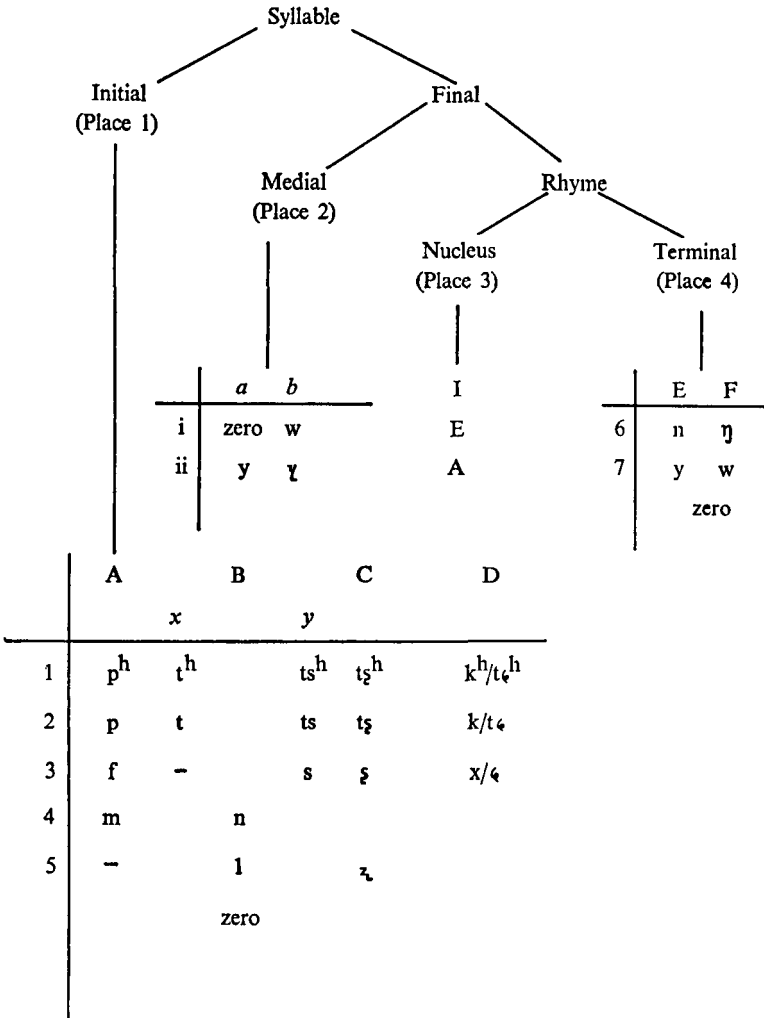
SYLLABLES

is true of /y /, except for /yAy/ which is 'rare and perhaps only literary' (Hockett, 1947: 259, and cf. fn. 16). These facts may be stated as follows:

Rule 1: $2(b) \Rightarrow \sim 4(F7)$

Rule 2: $2(ii) \Rightarrow \sim 4(E7)$ *except: /yAy²/, /k^hyAy³/*

Table 5

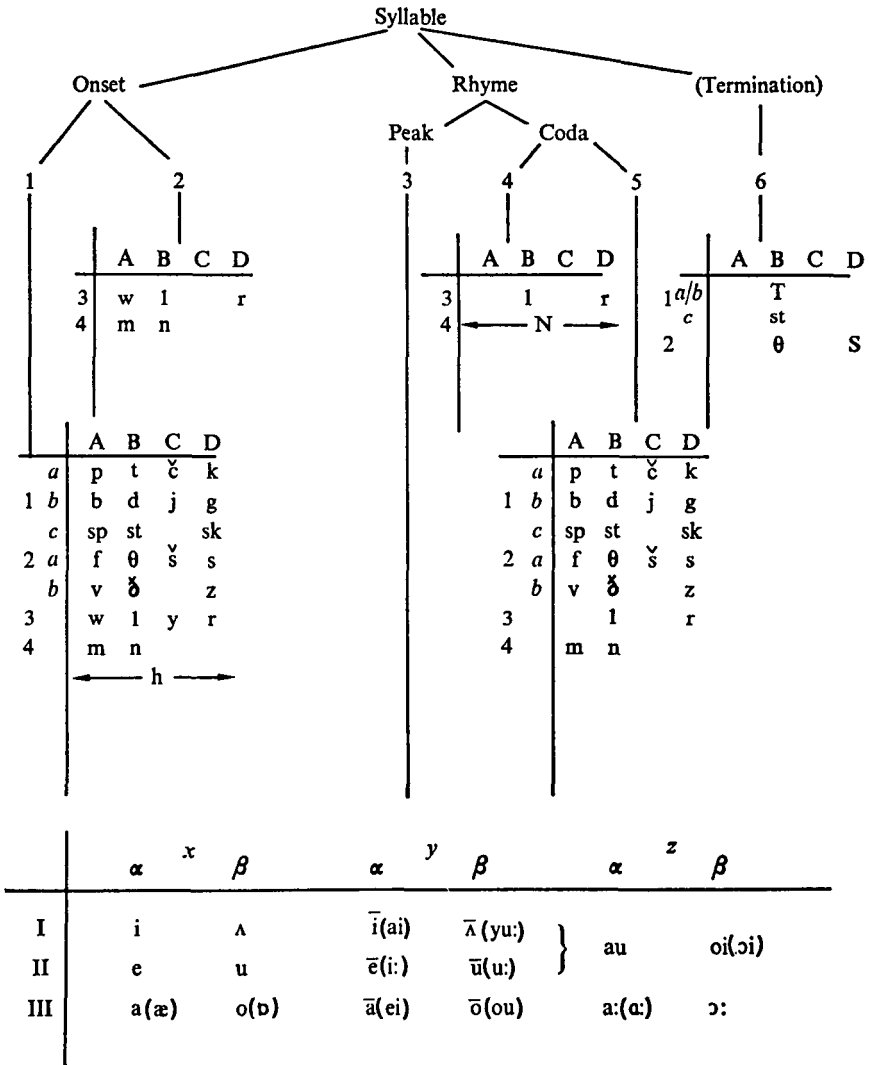


(where superscript numerals represent tones and . represents the selection of zero).

Rule 1 may be paraphrased as follows: 'If phonemic element *b* occurs at place 2, then phonemic element F7 cannot occur at place 4'. The exceptional

syllables could be called 'deviant syllables' (extending the terminology of Chomsky (1961: 233-235) to a phonological context), or 'semi-syllables' (extending Katz, 1964, similarly); the latter has the disadvantage of suggesting something which is half a syllable in length, and we shall therefore adopt the former term. Rule 1 will be called a 'non-violable constraint', while rule 2 (which

Table 6



permits exceptions) will be called a 'violable constraint' (though see the note in parentheses under 'Rules linking places 1 and 4' (§5.8)).

5. EXAMPLE III

5.1. Table 6 shows the scheme for English syllable structure as it will be set up for the purposes of this study. In partial justification for this scheme we will consider certain alternative possibilities and explain why we have rejected them (§§5.2-5.7 below).

Place 6 is used in word-final syllables only, and may be occupied by one of the members of the system operating there, or by a string of two (exceptionally three) of these members. Thus *boxes* is represented as / b.o.kSS / (one phonological syllable although two phonetic syllables), and *sixths* as / s.i.kSθS /, where the symbol . indicates the selection of zero. Realization rules for B1a/b, D2 at place 6 are as follows:

$$\begin{aligned}
 /D_2/ &\rightarrow \begin{cases} [iS] & \text{in the context } (\left\{ \begin{smallmatrix} C \\ D_2 \end{smallmatrix} \right\}) (\text{---}) \\ [S] & \text{elsewhere} \end{cases} \\
 /B1a/b/ &\rightarrow \begin{cases} [iT] & \text{in the context } (B1) (\text{---}) \\ [T] & \text{elsewhere} \end{cases}
 \end{aligned}$$

(where parentheses enclose single segments)

The voicing feature is then added to the extrinsic allophones [S], [T] according to its value in the preceding allophone. If place 6 is non-zero, this usually implies there is a morph-boundary immediately before it, though /S/, /T/ and /st/ occasionally occur without a boundary: *next* /n.e.kst/, *James* /j.ã.mS/, *apt* /..a.pT/, *glimpse* /gliNpS/, etc. Where a monomorphemic word can be accounted for either by selecting places 4 and 5 or by selecting places 5 and 6 (e.g. *hand*), the former will be preferred.

The distinction between m and n at place 5 is not generally made in syllables which are not word-final: thus *rumble* is represented as /r.ã.N - b.e.l./ (hyphens denote syllable-boundaries, while vertical lines will be used when it is desired to show morph-boundaries). There are a few exceptions to this rule in which /m/ must be fully specified, e.g. *gremlin*, *clumsy*.

For the counter-phonetic position of s, z, and r within the consonant-system see my earlier paper (Fudge, 1967: 20-21). Notice that we are implying here that, e.g. r in place 4 is comparable, if not precisely equatable, with r in place 1, and moreover nearly all the consonants occurring at place 5 may be precisely equated with their opposite numbers in place 1. This is in direct contrast with the Chinese case of §4, as well as differing from the normal Firthian teaching on the subject (Allen, 1957: 74-75). Unless we do this, there is no way of allowing the same phoneme to occupy different syllabic positions in different forms of the same lexeme: thus (cf. the example of §2.6 above) *drive* is /dri.v./, while *driving* is /dri.. - v.iNg./; *bind* is /b.iNd./, while *binding* is /b.i.N - d.iNg./.

The inclusion of post-vocalic r (places 4 and 5) must not be taken as implying that the scheme does not apply to 'r-less' dialects: D3 is an abstract element which in some dialects (notably RP) may often have no realization of its own,

but which will, so to speak, contribute to the realization of the preceding vowel. For RP we have the realization rules shown in Table 7. There is syncretism

Table 7

	Position 1	Position 2	Position 3
/ir/	ə:r (<i>stirring</i>)	ir (<i>stirrup</i>)	ə: (<i>stir</i>)
/er/	ə:r (<i>detering</i>)	er (<i>ferry, deterrent</i>)	ə: (<i>deter</i>)
/ʌr/	ə:r (<i>furry</i>)	ʌr (<i>hurry, recurrent</i>)	ə: (<i>fur, hurt</i>)
/ar/	a:r (<i>starry</i>)	æ:r (<i>marry, comparative</i>)	a: (<i>star, cart</i>)
/or/	ɔ:r (<i>abhorring</i>)	ɔ:r (<i>lorry, abhorrent</i>)	ɔ:/ɔə (<i>abhor, port</i>)
/ir/	ai(ə)r (<i>firing, iris</i>)		aiə (<i>fire</i>)
/ɛr/	iər (<i>fearing, hero</i>)		iə (<i>fear, fierce</i>)
/ʌr/	juər (<i>furious, during</i>)		juə (<i>pure</i>)
/ūr/	uər (<i>touring</i>)		uə (<i>tour</i>)
/ār/	ɛər (<i>bearing, fairy</i>)		ɛə (<i>bear, scarce</i>)
/ōr/	ɔ:r (<i>storing, storage, story</i>)		ɔ:/ɔə (<i>store</i>)
/aur/	auər (<i>flowering</i>)		auə (<i>flower</i>)

Position 1: before a vowel morph-finally, when followed by an inflexional affix or an affix like adjectivalizing -y

Position 2: before a vowel otherwise

Position 3: elsewhere

between /ir/, /er/, and /ʌr/ in positions 1 and 3 (though some Scots dialects maintain the distinctions at the realization level – Grant, 1914: 50, 55–56, 62). There is also syncretism between /or/ and /ōr/ in the same positions (though again some Scots dialects maintain a distinction between *horse* [hɔrs] and *hoarse* [hɔrs] (Grant, 1914: 58–59) – phonemically perhaps /h.ɔrs./ versus /h.ɔrs./). On the other hand, the distinction must be maintained when certain derivational affixes follow: *abhor* must be /..a.b – h.ɔ.r./ because of *abhorrent* /..a.b – h.ɔ.. – r| .eNt./, while *store* must be /st.ɔ.r./ because of *storage* /st.ɔ.. – r| .ā.j./; it is, however, conceivable that this is again a question of different subsystems of the vocabulary.

Another important syncretism is that of /ā/ and /ū/ which in RP occurs:

(i) for all speakers, after /w/, /r/, /l/ and palatals, i.e. all consonants in the same row or column as /y/. The pivotal position of /y/ in this group ties in very nicely with the relation

Realization of /ā/ = Realization of /y/ + Realization of /ū/;

(ii) for most speakers, after / s / and / z / ;

(iii) for some speakers, after / θ /.

Other varieties of English (including many American types) lose the contrast after any alveolar consonant.

Phonetically identical pairs of words may sometimes have differing representations: *find* / f.iNd. / and *fined* / f.i.n|T /, *board* / b.ord. / and *bored* / b.ō.r|T /. Although *tide* / t.i.d. / and *tied* / t.i..|T / are pronounced identically in RP, this does not hold in Scots where they are [tʌɪd] and [taed] respectively (cf. Grant, 1914: 63); admittedly, though, this could be regarded purely as due to the morph-final position of / i / in the second case.

These considerations indicate that the scheme proposed has interesting possibilities as the basis for a diasystem, though there will be distinctions in some dialects that it cannot handle, e.g. the contrast in certain Northern Irish dialects between *lie* 'tell lies' and *lie* 'recline'.

Some of the phonemic elements are more firmly established in the system than others: the *æ* vowels are the most marginal among the vowels while the *θ/ð* opposition is perhaps the most questionable consonant distinction ([ð] occurring intervocally, and initially in demonstratives, etc.: [θ] in other positions³). The vowel *æIIIα* (phonetically [a:]) is particularly marginal, as nearly all of its occurrences can be regarded as realizations of other, well-established, phonemic elements or sequences. Thus (for RP):

1. / ar / → [a:] in Position 3 (see Table 7)

2. / al / → [a:] in the context: (——) (A $\left\{ \begin{matrix} 2a \\ 4 \end{matrix} \right\}$)
(i.e. before f and m)

3. / a / → [a:] in the following contexts:

(i) (——) (D₃) in position 1 (see Table 7)
(i.e. before r)

(ii) (——) ($\left\{ \begin{matrix} A \\ B \\ D \end{matrix} \right\} \left\{ \begin{matrix} 1c \\ 2a \end{matrix} \right\}$) (i.e. before voiceless fricatives except *ʃ*)
except in Position 2, thus: *pass*, *passing*, but *passage*, *tassel*¹ with [æ]; *telegraph(ing)* but *telegraphic*, *traffic* with [æ].

(iii) (——) (4) ($\left\{ \begin{matrix} B1 \\ C1 \\ D2 \end{matrix} \right\} a$) (i.e. before -nt, -nč, -ns)

except in Position 2, thus: *plant*, *planted*, but *plantation*, *canter* with [æ]; *dance*, *dancing*, but *fancy* with [æ].

[3] Exceptions to this rule are not lacking: *bathe*, *loathe* (neither of which I would regard as including an intervocalic [ð]), *ether* (with intervocalic [θ]). This does not detract from the value of stating the rule – even an '80% rule' is well worth stating, provided that the exceptions to it are indicated.

and possibly (iv) word-finally in a non-reduced syllable: *grandma*.

There are many exceptions to these rules; thus the context for rule 2 could be extended to 'before f, v, or m' to handle *halve*, but there would then be difficulties with *valve* and (in some dialects) *salve*. Other exceptions:

(a) [æ] instead of expected [a:] (rule 3(ii)) *ass, crass, gas, lass, mass: gaff, riff-raff: asp*: (rule 3(iii)) *ant, cant* 'hypocrisy', *pant, rant; stance*.

(b) [a:] instead of expected [æ]: (rule 3(ii)) *master, basket, rascal; father, rather*; (rule 3(iii)) *command, demand, slander*.

(c) either pronunciation: *drastic, lather* ([dræstik], but [la:ðə] in my speech).

Indications are that exceptions are increasing rather than decreasing, i.e. phoneme æIIIα is gaining ground: the introduction of abbreviations (*caff, maths, Staffs*) takes place without the rule being applied.

The occurrences of [ɔ:] can to some extent be accounted for in an analogous fashion:

- 1. / or / → [ɔ:] in Position 3
- 2. / al / → [ɔ:] in the context: (—)(D1a) (i.e. before k)
- 2a. / a / → [ɔ:] in contexts: (—)(B3) ($\left\{ \begin{array}{c} \# \\ B1 \\ D2 \end{array} \right\}$)
(i.e. before -lt, -ld, -ls and word-final l)

and (for some older dialects)

- 3. / o / → [ɔ:] in the following contexts:

- (ii) (—) ($\left\{ \begin{array}{c} B1c \\ \left\{ \begin{array}{c} A \\ B \\ D \end{array} \right\} 2a \end{array} \right\}$) (i.e. before voiceless fricatives except ʃ)
- (iii) (—) (4)(C1a) (i.e. before -nč)

5.2. First we will attempt to justify the particular branching structure postulated for the English syllable. Other possible schemes include those of Tables 8, 9 and 10. We have preferred Table 6 for the following reasons:

(a) Table 8 implies that there are two types of Coda (non-word-final, in which place 6 is not used, and word-final); it also links the normally morphological place 6 too closely to the Coda – we shall want to ignore place 6 when we come on to study co-occurrence restrictions within the syllable (§5.8 below; also Fudge, forthcoming: §3.2).

(b) Table 9 implies that the relationship between Peak and Coda is no closer than that between Peak and Onset. For English this is by no means true – more important in this case than the facts adduced by Kuryłowicz (1948: 104) in support of the branching structure shown in Tables 6, 8 is the fact that certain Peaks do not co-occur with certain Codas (only x-vowels with / -Np /, / -Nk /

and / -Ng /, etc.), while there is no such constraint between Onset and Peak (cf. T. Hill, 1966: 209).

(c) The last fact mentioned under (b) is also one reason why we reject the scheme of Table 10 (for which see Togeby, 1951: 55). Furthermore, transformational rules would be needed for this approach – for reasons against this, see §5.6 below.

Table 8

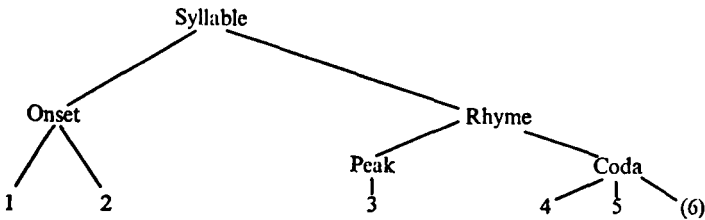


Table 9

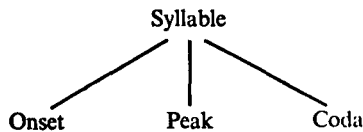
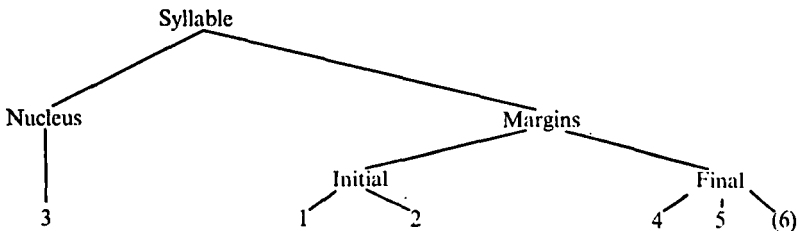


Table 10



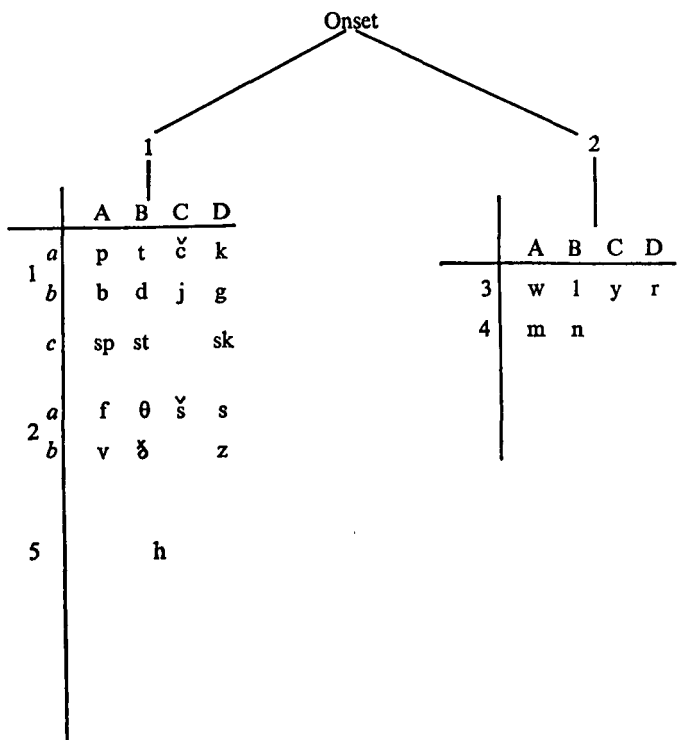
5.3. The next alternative to Table 6 is the scheme of Table 11, in which [sp], [st], and [sk] are regarded as realizations of clusters of two phonemes. The chief advantage of the preferred scheme (for which I am indebted to Kohler (1967b: 151); something like it was also proposed by Firth (1936: 543; 1957a: 73), though Firth also appears to have advocated that *str-* etc. should also be taken as indivisible units) is that it avoids the necessity of postulating an extra place in the syllable structure (place 0) at which a system of only one element operates, and which must be filled by zero except when place 1 contains p, t, k, m, n, and perhaps f, v; other advantages include the avoidance of an arbitrary decision on whether to identify the stop portion of [sp] with the stop of series *a* (i.e. [p]) or that of series *b* (i.e. [b]) (though admittedly this could be achieved

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Incidentally, a more satisfactory location for [au] within the system might be as a variant realization of $\hat{\lambda}$ (cf. *profound/profundity, south/southern*, etc.), the conditioning factor being membership of one co-existent phonemic system rather than another. For the purposes of this study, however, we will leave [au] in the α series of vowels.

Although Table 6 is the one we adopt, it must be admitted that the relationships of Table 13 do exert an influence on the phonological system – sound changes set up phonetic structural pressure in an innovating direction, while morphological relationships which persist through a sound-change tend to pull

Table 12



in the direction of conserving the old phonemic system. There is therefore a struggle, and the implication of our approach is that this struggle is one between present-day phonetics and present-day morphology: we do not need to bring in diachronic considerations at the basic theoretical level. On the other hand, dissimilarities between phonemic patterning and phonetic patterning will normally reflect sound-change in some way: the position of [Λ] as the realization of / α Iβ/ (Table 6) is a case in point – it reflects the sound-change [u] → [Λ], but without implying that Modern English [Λ] is a high back rounded vowel,

Table 13

	Peak					
	3					
	<i>x</i>		<i>y</i>		<i>w</i>	
	α	β	α	β	α	β
I	i	u	i:		yu:	u:
II	e	o	ei	oi		ɔ:
III	a	ʌ	ai		au	ou

even at an underlying level. Chomsky & Halle's approach implies exactly this (1965: 124-125; 1968: 203), with the further implication that the 'struggle' mentioned above is between present-day phonetics and the phonetics of a past stage of the language; it thus lacks descriptive adequacy - can we expect the (untrained) native speaker to know anything at all about the past history of his language?

Table 13 offers the further possibility of restricting place 3 to the *x*-vowels, and adding *w* and *y* to the place 4 system to handle *w*-vowels and *y*-vowels respectively, as in Table 14; compare this last with the approach of Trager & Smith (1951: 27). Syllables with long vowels and final clusters would then need a slightly different representation: *bind* would be / b.aynT / instead of / b.iNd. /. A few syllables of this type which are quite normal by the Table 6 system would become deviant under this alternative system (*faint*, *fierce*, *scarce*: these would in fact be impossible to present unless voicing was admitted as distinctive in place 6); on the other hand, Table 6 probably generates more unwanted syllables than Table 14, and so needs more extensive collocational restrictions.

5.6. The scheme shown in Table 15 again treats [sp], [st] and [sk] (this time syllable-final) as realizations of two successive phonemic elements. It entails the complication of including an extra row (row 2) at place 4; however this enables us to treat *-ft* on the same level as *-st*, and also to distinguish phonemically between the phonetically identical *-ft* and *-ffed*. Table 16 shows the differences between the schemes at this particular point. Unlike the situation in place

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Table 14

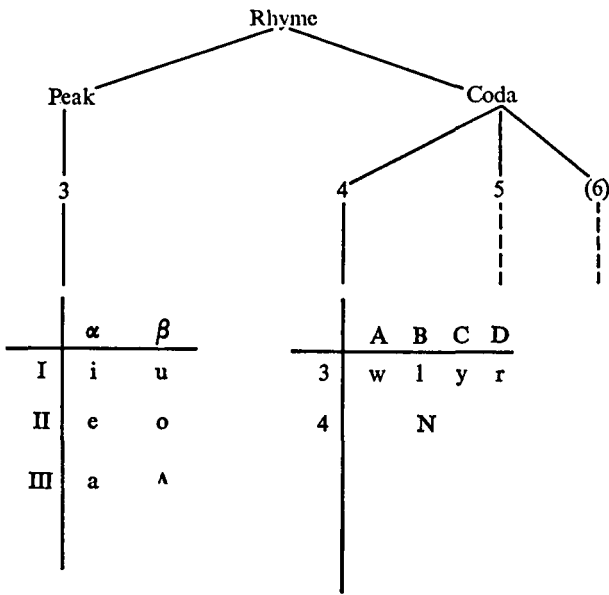
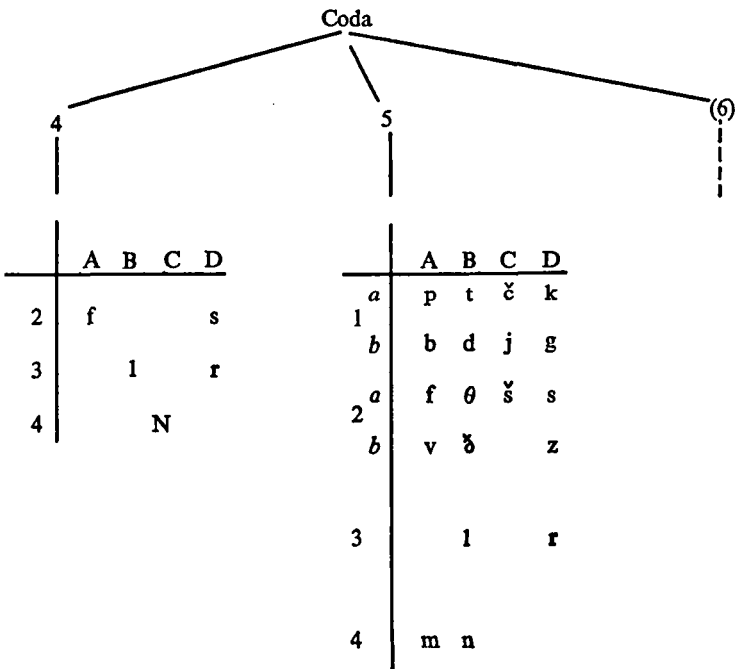


Table 15



1 (§5.3 above) the [p] of [sp] would be here unambiguously assignable to / p / : it selects the voiceless members of S and T after it.

On balance it seems uneconomical to include an extra row at one place in the structure in order to generate just one cluster (-*fp* and -*fk* do not occur) which could be quite adequately generated without it – hence our preference for the Table 6 scheme here. Incidentally, Table 6 is more symmetrical than Table 15: the system at place 1 is very similar to that at place 5, while the systems at places 2 and 4 are also comparable. Notwithstanding this similarity, we will not adopt here Šaumjan's suggestion (1962) that final clusters may be derived from initial clusters by applying a transformational rule ('mirror-reflection'): such a rule would certainly not be universal – it would not apply to Chinese (§4 above), Spanish (Saporta & Contreras, 1962) and many other languages. For languages such as English where such a relation holds, it can be stated AFTER both types of cluster have been generated: a transformation of the Harris type rather than of the Chomsky type (Matthews, 1961: 200–201). In this way minor discrepancies between initial and final clusters cause fewer difficulties (e.g. English permits initial -*gl*- but not final -*lg*, final -*lt* but not initial *tl*-).

Table 16

	<i>mist</i>	<i>missed</i>	<i>lift</i>	<i>sniffed</i>
Under scheme of T.6	m.i.st	m.i.sT	l.i.fT	sni.fT
Under scheme of T.15	m.ist.	m.i.sT	l.ift.	sni.fT

Incidentally, the fact that [st] occurs freely both initially and finally (with or without morph-boundary when final), whereas [ts] does not occur initially, and occurs finally only with morph-boundary (except in borrowings like *blitz*, *ritz*) might well be taken as further evidence for treating [st] as the realization of a single phonemic element). Moreover, the fact that it is possible, as far as I know, to describe the phonological⁴ structure of any language perfectly adequately without transformational rules appears to reflect something essential about the nature of the phonological hierarchy as compared to that of the grammatical hierarchy.

5.7. As for places 1 and 2 (§5.4 above), a slightly smaller inventory could be obtained by deleting r from place 5, but again this would obscure the difference between the collocational restrictions which operate on final r (alone) and those which affect r in final clusters. We can eliminate m and n from place 5 only if

[4] 'Phonological' in the sense of §2.6, i.e. excluding the morphological rules (Halle, 1959: 37–38). In other words, the phonological hierarchy as normally defined involves no transformational rules.

we are willing to make words like *elm*, *kiln* deviant, while *l* must be retained because of the fairly large group *girl*, *curl*, etc. Thus, unlike the case of §5.4, although the inventory is reduced, the system remains just as complex (no rows or columns can be removed).

5.8. We will now proceed to a statement of collocational restrictions, using rules like those formulated for Chinese (§4.3 above). First we will list the non-violable constraints:

General rules:

- 1(zero) \Rightarrow 2(zero) (These rules establish places 1 and 5
 5(zero) \Rightarrow 4(zero) as the heads of Onset and Coda
 respectively)

Rules governing initial clusters:

- 2(non-zero) \Rightarrow 1($\left. \begin{matrix} A \\ B \\ D \end{matrix} \right\} \left\{ \begin{matrix} 1 \\ 2a \end{matrix} \right\}$) (Only stops and voiceless fricatives (but
 not those of series C) can stand first in
 initial clusters)
 2(4) \Rightarrow 1(D2a) (Only s can form initial clusters with m
 and n)
 2(A3) \Rightarrow \sim 1(A) (No pw-, bw-, spw-, fw- except in loan-
 words)
 2(B3) \Rightarrow \sim 1(B) (No tl-, dl-, stl-, θ l-)

Rules governing final clusters (excluding place 6):

- 4(4) \Rightarrow 5($\left. \begin{matrix} 1a \\ 1b \\ 2a \end{matrix} \right\}$) (Nasals form final clusters with plosives
 and voiceless fricatives only)
 4(B3) \Rightarrow 5($\left. \begin{matrix} 1a \\ 1b \\ 2a \\ A2b \\ 4 \end{matrix} \right\}$) (l forms final clusters with plosives,
 voiceless fricatives, v and nasals only)
 4(D3) \Rightarrow \sim 5($\left. \begin{matrix} A1c \\ D1c \\ B2b \\ D3 \end{matrix} \right\}$) (r forms final clusters with any consonant except
 sp, sk, δ , r,; the place-name *Thirsk* would have
 to be treated as exceptional)

Rules dealing with constraints between places 3 and 4:

- 4(4) \Rightarrow 3(x) unless 5(D2) or 5(B1) (Note that D2 and B1 are the
 4(B3) \Rightarrow 3(x) unless 5(B1b) alveolars: unmarked again?)
 4(D3) \Rightarrow 3(x) unless 5(D2a) or 5(B1b)

Rules dealing with constraints between places 2 and 4:

- 2(B4) \Rightarrow \sim 4(B3) (No syllable begins with sn- and ends with an l-cluster)
 2(4) \Rightarrow \sim 4(4)

$2(B_3) \Rightarrow \sim 4(B_3)$ (The same element cannot be selected in both place 2
 $2(D_3) \Rightarrow \sim 4(D_3)$ and place 4)

It is at this point that we can justify the inclusion of w, l, r, m and n at place 1 as well as place 2 (§5.4 above): the rule $1(B_3) \Rightarrow \sim 4(B_3)$ is violated by the word *lilt*, $2(B_3) \Rightarrow \sim 5(B_3)$ by *flail* (see below). The constraint $1(B_3) \Rightarrow \sim 5(B_3)$ is hardly worth stating: of the 16 possible words of the form /l.V.l./, at least 4 actually occur (*lull*, *loll*, *lall*, *lisle*, and perhaps *loyal*) – a fairly high proportion. Twaddell (1939, 1941) notices the very low incidence of lVl and rVr in German, but cannot make the distinction between, for example, CIVIC and l.V.l, for the very reason that he has not postulated a syllabic framework, but works entirely in ‘finite-state’ terms.

Rules dealing with constraints between places 3 and 5:

$5(\text{zero}) \Rightarrow \sim 3(x)$ word-finally

This rule could be extended to all syllables if single-consonant interludes following *x*-vowels (Hockett, 1955: 52) were treated as belonging phonemically to both the preceding syllable and the following syllable: thus *butter* would be /b.A.t-t.e.r./, and there would need to be a rule stating that geminated consonants within a word were realized as single consonants. The words *is*, *was*, *has*, *does*, *says*, *had*, *did*, *said*, *could*, *should*, *would* are exceptions if we treat their final consonants as S or T (rather than z or d) as indicated by the grammar. Alternatively, we could omit this rule altogether and permit *x*-vowels to occur word-finally, with the proviso that they were realized like their *y*- or *x*-vowel counterparts (cf. rule 3(iv) above (§5.1); also Chomsky & Halle, 1968: 74–75): this is made more complex by vowel reduction.

Rules dealing with constraints between places 1 and 5:

$1(1c) \Rightarrow \sim 5(1c)$ (syllables do not both begin and end with s+stop except where ‘stop’ is T in place 6)

We will now list some of the violable constraints, together with the deviant words which violate them (for the asterisks see below, §5.10):

Rules linking places 2 and 4:

$2(B_3) \Rightarrow \sim 4(D_3)$ blurb, blurt, *clerk, flirt, slurp, splurge

$2(D_3) \Rightarrow \sim 4(B_3)$ *grilse

$2(4) \Rightarrow \sim 4(3)$ smarm, *smart, *smelt (the verb *to smelt*), smirch, smirk, snarl, snort

(Note that *blurred*, *thrilled*, *snored*, etc. are /blA.rT/, /θri.lT/, /sno.rT/ respectively, and hence do not violate these rules.)

Rules linking places 1 and 4:

$1(B_3) \Rightarrow \sim 4(B_3)$ lilt

SYLLABLES

1(D3) ⇒ ~4(D3)

(No examples: the rule is included here rather than as non-violable because of its similarity to the preceding rule. This means a slight modification to our earlier definitions: by our present criterion both Rule 1 and Rule 2 of §4.3 would be counted as violable)

1(A4) and 5(A) ⇒ ~4(4) mumps

1(B4) ⇒ ~(4)

*(a)noint, *nymph (*ninth* is /n.i.n|θ/)

Rules linking places 2 and 5:

2(4) ⇒ ~5(4) smarm

2(A4) ⇒ ~5(A) smarm

2(B4) ⇒ ~5(B) *snail, snide, *?snood, snoot, snort, snot, snout
(Rather a lot of exceptions tolerated – unmarked alveolars again)

2(B3) ⇒ ~5(B3) *flail

2(D3) ⇒ ~5(D3) drear, and perhaps *briar, *friar (*prayer and *drawer fit the pattern, but probably include morph-boundaries)

5.9. In this section we consider an alternative way to set up the syllable-structure, one which permits a considerable saving in the number of constraints to be stated, but which on the other hand greatly complicates the statement of the systems operating at each place.

We begin by considering place 2, setting up the same system as in Table 6:

w, l, r, m, n, zero.

We then have for place 1 the following systems:

Before m or n:		s	
Before w:		B	D
	a	t	k
1	b	d	g
	c		sk
2		θ	s

Before l:		A	D
	a	p	k
1	b	b	g
	c	sp	
2		f	s

Before r:

		A	B	D
	<i>a</i>	p	t	k
1	<i>b</i>	b	d	g
	<i>c</i>	sp	st	sk
2		f	θ	s

Before zero:

As in Table 6, with zero as a further alternative.

For place 4 (with zero as a possible option in each case);

After l + Vowel:

		B	D
3			r
4		N	

After r + Vowel:

		B	D
3		l	
4		N	

After m or n + Vowel:

		B	D
3		l	r

In all other contexts:

		B	D
3		l	r
4		N	

For place 5:

After N:

		A	B	C	D
	<i>a</i>	p	t	č	k
1					
	<i>b</i>		d	j	g
2		f	θ		s

SYLLABLES

After l:

	A	B	C	D
<i>a</i>	p	t	č	k
1 <i>b</i>	b	d	j	
<i>a</i>	f			s
2 <i>b</i>	v			
4	m	n		

After r:

	A	B	C	D
<i>a</i>	p	t	č	k
1 <i>b</i>	b	d	j	g
<i>c</i>		st		
<i>a</i>	f	θ	š	s
2 <i>b</i>	v			z
3		l		
4	m	n		

After zero:

As in Table 6, with zero as a further alternative.

This formulation is observationally equivalent to the earlier one, which, however, seems notationally preferable; in our further work we shall restrict ourselves to the earlier formulation.

5.10. Further violable constraints could be formulated, but it is noticeable that the number of deviant words becomes large. However, some of the lists of deviant words are interesting from a semantic point of view – consider the following rules involving syllables ending in clusters of Nasal + Consonant:

- 4(4) and 5(A) ⇒ ~1(A) blimp, bump, frump, mumps, pimp, plump, pomp, primp, *pump, vamp
- 4(4) and 5(D1) ⇒ ~1(D1) clang, clank, cling, clink, clonk, clung, clunk, conk, crank, *gang, gink, gong, gunk, *king, kink, skunk.

The lists of deviant words contain a very high proportion of words which could very loosely be described as ‘expressive’ (this notion will be made more explicit in Fudge, forthcoming; we will content ourselves here with pointing out the large number of onomatopoeic and pejorative words). Words not falling into this category have been asterisked in the lists here and in §5.8 above. Analogous

to the two rules just given are the following (but note the rather different character of the deviant-word lists):

4(4) and 5(B) $\Rightarrow \sim 1(B)$ daunt, *dent, *dint, *don't, *(re)dound, *land, *lend, *lent, *lint, *(a)noint, *stand, *(in)stant, *stint, (a)stound, *strand, stunt, *(re)straint, taint, taunt, *tend, *tent, *tint, *trend, *(ro)tund, also *(ek)stend, *(ek)stent

4(4) and 5(C) $\Rightarrow \sim 1(C)$ *change

In the first case there are 26 exceptions, of which all but 5 are asterisked; in the second there is only one exception, and that is asterisked.

We will interpret this situation as indicating that column B is unmarked relative to A, C, and D: this is reminiscent of the 'unmarked alveolar' hypothesis again, except that B does not correspond completely with the alveolar place of articulation. In fact, however, when D is divided into D₁ (velars) and D_{2/3} (alveolars) we see that the latter behave very much more like the other alveolars than like D₁ (see Table 17). This strongly suggests that it is allophonic features (notably place of articulation) rather than phonemic features which are operative at this level. The figures for labials (A) and velars (D₁) show conclusively that these two places are marked in relation to the alveolars (B and D_{2/3}) for syllables of the type under consideration. The figures for palatals (C) are so small as to preclude the drawing of reliable inferences (cf. Twaddell, 1939: 197-199.)

Table 17

Deviant words containing syllables of the form C(L)VNC, summarized according to place of articulation of the C's at places 1 and 5. The first figure of each pair gives the number of deviant words, the second gives the number of these which have the semantic feature 'expressive'.

		Place 5:				
		A	B	C	D ₁	D _{2/3}
Place 1:	A	11/9	67/2	23/10	34/15	18/6
	B	14/6	26/5	11/5	33/9	9/2
	C	4/2	5/2	1/0	4/2	1/0
	D ₁	13/7	19/6	9/5	17/14	4/1
	D _{2/3}	7/2	17/2	5/2	26/6	3/0

The facts that have been touched on in this last section will be treated at greater length in a study (Fudge, forthcoming) which supports the hypothesis that there is a statistical connexion between syllabic structure and the semantic feature of 'expressiveness'.

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