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SYLLABLE STRUCTURE IS SYLL STRUCTURE* IN DEFENCE OF CV AS THE ONLY SYLLABLE TYPE

1. Background

Traditionally, syllable structure is assumed to be as in (1).

(1) (C*)V*(C*)

where C = consonant, V = vowel, and * = "any number of".

Parentheses indicate optionality.

In the linguistic literature of the past 50 years various additional assumptions about the nature of the C* sequences have arisen, some of the most popular being those given in (2)-(4).

(2) Sonority Sequencing

Successive consonants must rise in sonority up to V* and fall in sonority after V*.

(3) The Coda Mirror

Given Sonority Sequencing, we expect that sequences of consonants permitted after V* will be the mirror image of consonant sequences before V*.

(4) Extrametricality

Consonants at the end of a word which violate Sonority Sequencing are extrametrical. An extrametrical consonant is not a part of a syllable, but is linked directly to the word itself.

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* The research on which this paper is based, and in particular the CV analyses proposed in the second part of the paper, stem from a program of research which Friedrich Neubarth and I began in about 1997, and which is still continuing. In addition I would like to thank in particular Rose-Juliet Anyanwu, Monik Charette, John Harris, Jonathan Kaye, Jean Lowenstamm for inspiration and discussion of ideas contained here, plus all the GP phonologists in Vienna and Budapest. The blame is mine.

This view is unsatisfactory for several reasons:

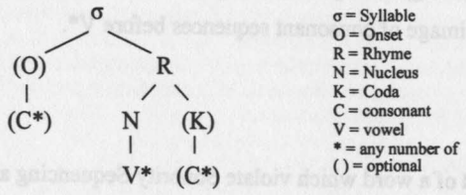
1. For any given natural language there is a limit on C* and V*, but this approach gives us no principled reason for why languages vary with respect to these limits, and why in any given case the limit is whatever number it is.
2. Sonority Sequencing is blatantly false, and usually defined in a circular way (i.e. syllable structure determines relative sonority, and relative sonority determines syllable structure).
3. The Coda Mirror does not work in any language (except "free consonant order" languages).
4. Extrametricality only exists in order to correct what Sonority Sequencing gets wrong; it has no independent justification. Given that there are only two possible orders of consonants A and B, and that extrametricality applies only when Sonority Sequencing gives the wrong result, then we can always obtain both of the orderings AB and BA.

I will exemplify each of these points immediately.

1.1 How many C's and how many V's?

In keeping with traditional practice, we will break the sequence (C*)V*(C*) into the constituents Onset, Nucleus and Coda, as shown in (5), and will add the traditionally recognised Rhyme constituent.

(5) The traditional constituents of a syllable (based mainly on Kiparsky, 1981)



Some languages allow maximally a single consonant in the Onset, a single vowel in the Nucleus, and have no Coda. At the other end of the scale of syllable complexity, Georgian is said to have Onsets of up to 7 consonants (Gil & Radzinsky, 1987) – though there may exist languages with more, and English has codas with 5 consonants, like [ndʒdst] in *(thou) estrang'dst* – though again, there may be languages with more. For

Nuclei, I know of no sequences longer than triphthongs, i.e. 3 vowels, as found in Portuguese.

Looking at the other end of the scale of syllable size, i.e. minimal syllables, many languages allow Onsets or Codas to be completely empty. These figures are given in the table in (6). It is important to remember that there are all kinds of varieties of intermediate languages, and that the number of consonants in an Onset is completely independent of the number of vowels in the Nucleus and largely independent of the number of consonants in the Coda.

(6) Sizes of Onsets, Nuclei and Codas

	Onset	*Nucleus*	*Coda*
smallest minimum in a language	0	1	0
smallest maximum in a language	1	1	0
largest maximum in a language	7	3	5

Why should these be the limits? And why do languages evidently select different limits? And why do speakers continually overstep these limits in fast or casual speech, and in loan words?

1.2 Sonority Sequencing

Why is Sonority Sequencing blatantly false? Well, firstly because English has word pairs like *wasp* and *copse*, where the order of *s* and *p* in the Coda are reversed. Of course, extrametricality saves the day by declaring the *s* of *copse* (just like that of *spin*, at the other end of the word) to be extrametrical.

(7) Violations of Sonority Sequencing in English

wasp (i.e. $_{\sigma}[_{O}[w]_{N}[ɒ]_{K}[sp]]$) vs. *copse* (i.e. $_{\sigma}[_{O}[k]_{N}[ɒ]_{K}\mathbf{[ps]}]$)

spin (i.e. $_{\sigma}[_{O}\mathbf{[sp]}_{N}[ɪ]_{K}[n]]$)

NB: According to the sonority hierarchy, *s* is more sonorous than *p*, so the bold underlined sequences should not exist.

Worse: There are languages with "free consonant order", like Arabic. Here, if the sequence of consonants AB occurs as an Onset, then the sequence BA also occurs. The

same goes for codas and for medial consonant sequences. There is simply no restriction on the relative order of 2 successive consonants.

(8) Onset sequences in Moroccan Arabic (from Lowenstamm, 1999)

brɪd	'cool down'	rbɪṭ	'bind'
ḍrɪb	'hit'	rḍa	'accept'
glɪʕ	'remove'	lga	'find'
bka	'cry'	**kb**ɪr	'grow larger'
nzɪl	'descend'	**zn**a	'commit adultery'
dna	'come near'	**nd**ɪm	'regret'
bqa	'stay'	**qb**ɪl	'accept'

Arabic presents a further problem for the traditional view of syllable structure: consonant clusters do not always remain consonant clusters. Depending on the paradigm, vowels of various qualities can pop up between two consonants.

1.3 The Coda Mirror

For some consonant sequences in some languages (notably Indo-European languages) it has been observed that permissible Onset sequences of consonants are mirrored in the Coda (i.e. they appear in the reverse order), and vice versa. A glance at (9) and (10) will show that this observation falls a long way short of covering all the facts.

(9) Some Coda-Mirrored sequences in English and German

English		*German*		
Onset	*Coda*	*Onset*	*Coda*	
pr	rp	pr	rp	
pl	lp	pl	lp	
fl	lf	fl	lf	
tr	rt	tr	rt	
kr	rk	kr	rk	
kl	lk	kl	lk	
br	rb	br	rp	(with final devoicing)
dr	rd	dr	rt	(with final devoicing)
gr	rg	gr	rk	(with final devoicing)
sp	ps	ʃp	ps, pʃ	(German [pʃ] marginal)
st	ts	ʃt	ts, tʃ	(German [tʃ] rare)
sk	ks	*sk, *ʃk	ks, *kʃ	

(Assuming that initial German ʃ+C corresponds to English s+C.)

(10) Some non-Coda-Mirrored sequences in English and German

English		*German*		
Onset	*Coda*	*Onset*	*Coda*	
*pn	mp	pn	mp	(with place assimilation of the nasal)
*kn	ŋk	kn	ŋk	(with place assimilation of the nasal)
*dʒn	ndʒ			
*ʃn	nʃ			
bl	*lb	bl	lp	(with final devoicing)
gl	*lg	gl	lk	(with final devoicing)
*tl	lt	*tl	lt	
*tn	nt	*tn	nt	
*dl	ld	*dl	lt	(with final devoicing)
*kn	ŋk	kn	ŋk	(with place assimilation of the nasal)
*gn	ŋ	gn	ŋ	(if [ŋ] is from /ng/)
		*fn	nf	
		*çn	nç	
		*çl	lç	
		kv	*vk, *fk	
sj	*js			
sw	*ws	ʃv	*vs, *fs	(with final devoicing)

1.4 Extrametricality

The concept of extrametricality is closely bound up with a particular view of phonological structure, which allows individual segments (in particular, consonants) to be outside syllable structure. Given this possibility (which I do not accept: for me a theory of syllable structure must include **all** segments within syllable structure), one would at least expect extrametricality to have some principled basis. But it has none. It is a purely observation-based device which removes untreatable cases from the domain of the theory of syllable structure.

(11) Two examples of extrametricality

spin $_{e}$[s] $_{\sigma}$[o[p] $_{R}$[$_{N}$[ɪ] $_{K}$[n]]]

estrang'dst $_{\sigma}$[$_{R}$[$_{N}$[ɛ]$_{C}$[s]]] $_{\sigma}$[o[tr] $_{R}$[$_{N}$[eɪ] $_{K}$[ndʒ]]] $_{e}$[dst]

e = extrametrical

However, one aspect of extrametricality is interesting: the observation that extrametrical consonants at the ends of words tend to be coronals. There is a good, principled reason for this; but it is not captured by extrametricality.

2. The CV approach

2.1 What is the domain of syllable structure?

Traditional theories of syllable structure usually take over two ideas from structuralist linguistics which should be questioned:

(12) Two relics of structuralist linguistics within traditional conceptions of syllable structure

(a) The beginning of a word is the same as the beginning of any word-internal syllable, and the end of a word is the same as the end of any word-internal syllable.

(b) Morphology is irrelevant to syllable structure.

Even on an observational level, these two points are incorrect. Accepting (12a) requires extrametricality to get the facts right. Accepting (12b) means ignoring the obvious fact that certain sequences of segments occur **only** across a morpheme boundary.

(13) Some English consonant sequences which only occur across word boundaries

*$_{K}$[bd], but *robbed* /rɒb+d/, i.e. $_{K}$[b+d]

*$_{K}$[dz], but *beds* /bɛd+z/, i.e. $_{K}$[d+z]

*$_{K}$[gz], but *dogs* /dɒg+z/, i.e. $_{K}$[g+z]

*$_{K}$[ŋd], but *winged* /wɪŋ+d/, i.e. $_{K}$[ŋ+d]

The CV approach to phonology therefore distinguishes between structures found **within a single morpheme** and those found **across morpheme boundaries**. Clearly, the latter environment will potentially allow a wider range of structures.

In fact, there are two types of morphology, analytic and non-analytic (Jonathan Kaye, p.c.). These can be visualised as in (14).

(14) Analytic vs. non-analytic morphology

p(m1)+p(m2) vs. p(m1+m2)

(where p(x) = "do phonology on x" and m1, m2 = morpheme 1, morpheme 2)

We can therefore stipulate that a phonological domain is either one morpheme (in analytic morphology) or a sequence of morphemes (in non-analytic morphology). In the former case, sequences like those in (13) go through phonology without the final /d/ or /z/ ever being sensitive to the preceding consonant.

2.2 CV as the only syllable structure

Recall that in traditional views of syllable structure, certain constituents are allowed to be empty. Indeed, they may be empty without any particular justification. Now, given that any constituent can be empty, surely the onus is on proponents of more complex syllable structures to show that such complexity is necessary.

A primary argument of traditionalists will be that the complex structures reflect "linguistically significant generalisations" about the language concerned. However, what these structures capture are **observations**, not **generalisations**.

In the CV approach, every empty position which is to remain phonetically silent has to be licensed by some means. And the means available are very limited: parametric licensing or government. The licensing mechanisms relevant to this paper are given in (15).

(15) The licensing of empty C or V positions

(a) parametric licensing

The FEN parameter: A final empty Nucleus is / is not licensed in language X.

Government licensing:[1] The licensing of empty positions by means of government is / is not permitted in language X.

(b) C-government

$Syll_j$ C-governs its left neighbour $syll_i$ iff the consonantal melodic strength of $syll_j$ is greater than that of $syll_i$.

(A "syll" is a CV syllable constituent. "Consonantal melodically stronger" refers to the strength value of the onset melody of a syll, shown as a superscript number in the diagrams below.)

Licensing is not always a yes-or-no business, but can be subject to internal parameters. Also, licensing failure does not automatically mean that a representation is illicit; it just means that the unlicensed position cannot remain phonetically empty – it must identify itself. In a sense, this means that only reconstructible empty positions are allowed to remain phonetically silent.

(16) The realisation of C or V positions

(a) Unlicensed position with lexical melody: full lexical melody is realised.

(b) Licensed position with lexical melody: possibly suppression of (parts of) lexical melody (parametric).

(c) Unlicensed position without lexical melody: no change (i.e. phonetic identification).

(d) Licensed position without lexical melody: silent (= phonetic identification suppressed) (parametric).

[1] This is not the "government licensing" referred to in the work of Monik Charette and others at SOAS. Also, traditional GP terminology has been preserved here for clarity; in Neubarth & Rennison (in press), licensing is redefined.

If the CV approach can account for all syllable shapes found in a language by setting the parameters mentioned above, then it is superior to the traditional approach because it has actually made a linguistically significant generalisation. But the actually occurring phonetic sequences of consonants or vowels are now an epiphenomenon of more basic principles.

Let us take the simplest case first: a language which has only CV syllables. Here all parameters are set to "no". A final empty Nucleus is not permitted: so every word must end with a vowel. Government is not permitted, so no C or V position is allowed to be empty.

(17) Parameters for a language with only CV syllables

Final empty Nuclei are not licensed.

Government is not licensed.

2.3 Some case studies

2.3.1 Koromfe (a Gur language spoken in the north of Burkina Faso, West Africa

Koromfe is almost a CV language if one regards only the beginnings and ends of words.

(18) The syllable structure of Koromfe

(a) Beginnings and ends of words are purely CV, except:

(i) A few words begin with a vowel out of the set /a,ɪ,ʊ/ (precisely the set of melodically weakest vowels), out of a total inventory of 20 lexical ("phonemic") vowel qualities.

(ii) A final empty nucleus is permitted after /l,m,n,ŋ/, so words can end with phonetic [l], [m], [n] or [ŋ].

(b) Word-internally **any** sequence of consonants is permitted between two vowels (subject only to lexical accident).

(19) Commercial break: Prototype Koromfe - English / French / German Online Dictionary http://www.univie.ac.at/linguistics/personal/john/kd_main.htm

You can check the facts that I have summarised here in the online dictionary, and for words beginning with A to the middle of D you can hear my friend Jacques Konfé actually pronounce them. Beware, however, that you will hear the maximum number of schwas, because he is speaking slowly. In slower speech, some consonant sequences are interspersed with schwas ([ə]); in faster speech, these schwas disappear. Geminate consonants, nasal+C sequences and some other combinations are never broken up by a schwa, even in slowest speech.

(20)*sɪgtrgo* 'gutter', from /sɪgØ+tØ+dØ+gʊ/ (trad.: CV**CCC**CV)

(*sɪg* 'become calm', *-t* 'TRANSITIVISER', *-d* 'IMPERFECTIVE', *-gʊ* 'INSTRUMENT')

If we now look at the very first word in (20), we see that the hypothesis that the beginnings and ends of words and syllables are the same is ridiculous. Here we have a sequence of 4 consonants, but only one C position before the final vowel in which to put them. In other words, the 3 bold underlined consonants are "extrametrical". Now, a traditional analysis might indeed resort to declaring consonants in the middle of words extrametrical.

What is really happening here? The parameters for Koromfe syllable structure are given in (21).

(21)The parameters of Koromfe syllable structure

(a) Final empty nuclei are licensed.

(b) Licensing of empty nuclei by government is not permitted.

(c) Final empty nuclei are licensed phrase-finally after /m/, /n/, /ŋ/ or /l/.

(d) Morphology is analytic.

Note that (21d) tells us that **morpheme**-final empty nuclei are licensed. In the word *sɪgtrgo* each of the medial consonants is followed by an empty Nucleus (V) and a morpheme boundary: in other words, by a parametrically licensed final empty Nucleus. These nuclei must remain silent.[2] Incidentally, the same parameters hold for Mòoré, the largest language of Burkina Faso, and the name of the capital, Ouagadougou, was given extra vowels by the French speakers who first wrote down the name.

[2] Realisation with schwa does not constitute true realisation. In Koromfe, when an **unlicensed** empty Nucleus needs to be realised, a full vowel is needed.

(22)Cf. the Mòoré name of the capital of Burkina Faso: Móoré [waʊgdgʊ], French [wagadugu] 'Ouagadougou'.

2.3.2 English (and German)

I realise the futility of discussing syllable structure without referring to English. "Insignificant" languages like Koromfe are swept under the table by the mainstream of linguistic thought. German is marginally permissible.

To deal with English, we need to consider the internal structure of segments. In my brand of Government Phonology, a segment consists of some combination of 0-6 phonological "elements". These elements are perceptual acoustic units that are hard-wired into every human brain. The same set of 6 elements is used for both consonants and vowels, though with different results. (One element, the coronal element R, is restricted to consonants only; this accounts for the well-known asymmetry of vowels and consonants in human languages that they almost all have more consonants than vowels.)

The elements are listed in the table in (23), together with their strength values. These strength values are inherent in the elements and therefore immutable. We cannot change them to account for language-specific idiosyncrasies. Since only the strength of the onset of a syll is ever phonologically relevant, the values have not been entered for vowels. If the melody of a segment has more than zero elements, then precisely one of the elements must be the head.

(23) The elements

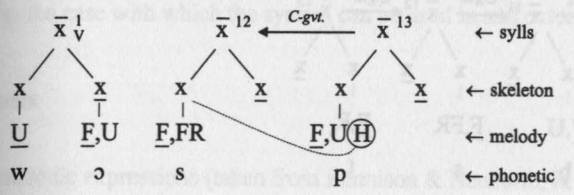
element	*position*	*typical realisation as head*	*strength as head of C*	*typical realisation as operator*	*strength as operator of C*
F	C	stop	10	fricatives	–1
	V	"A" (non-high)		ATR	
I	C	i/j-glide	1	palatal	1
	V	"I" (front)		front	
U	C	u/w-glide	1	labial, "dark"	1
	V	"U" (rounded)		rounded	
R	C	liquid	3	coronal	3
	V	rhotacised		(illicit)	n/a
H	C	fricative[3]	5	aspiration	2
	V	breathy voice		high tone	
L	C	nasal	5	voiced	2
	V	creaky voice		nasal / low tone	

Let us consider consonant sequences at the ends of words in English and German. Here the final nucleus is empty and parametrically licensed, and several of the previous sylls also contain empty nuclei. The only restrictions on possible word-final consonant sequences result from assimilation and historical accident (whereby German is less restricted). In (24) I give a selection of AG and English words with various word-final consonant sequences.

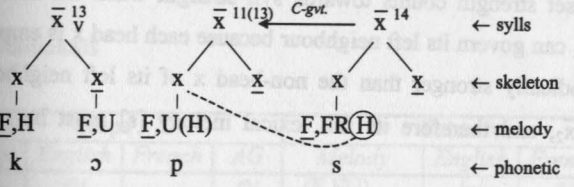
[3] The analysis of (some) fricatives as (H,…) will be explored in future research.

(24) Some word-final consonant sequences in English. (Strength values of onset consonants are shown as a superscript on the syll constituent. A subscript V indicates that a syll has an interpreted nucleus and therefore does not require C-government. The x-bar notation is used: $\bar{x} = \sigma$ = syll, x = O = C = Onset (consonant), $\underline{x}$ = N = V = Nucleus (vowel).)

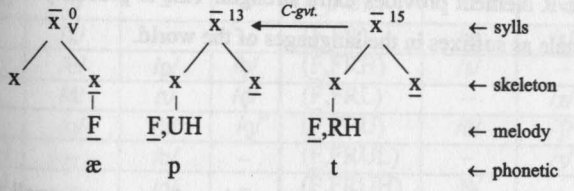
a. E. *wasp*



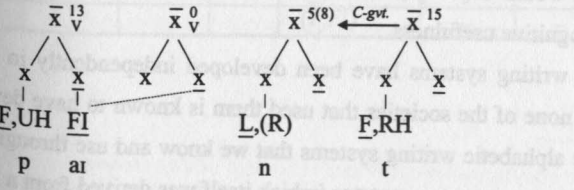
b. E. *copse*



c. E. *apt*



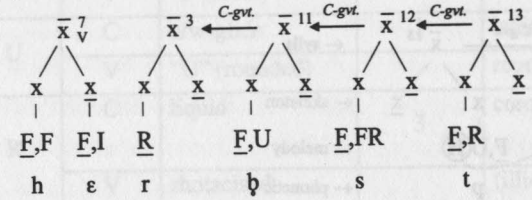
d. E. *pint*



The *s* in *wasp* is lexically a *z* which acquires voicelessness by assimilation of the H element in the following *p*. This analysis is corroborated by the presence of *bz#* and absence of *zb#* in English.

Finally let us consider the longest word-final sequence of consonants in AG that I have found so far — that in *Herbst* 'autumn'. Its representation is given in (25).

(25) Austrian German *Herbst* 'autumn' (cf. English *harvest*)



Recall that in AG all obstruents are neutral (i.e. contain no tone element for voicing). Parametrically in AG onset strength counts towards syll strength when the nucleus is silent. Each syll except $\bar{x}_2$ can govern its left neighbour because each head x is empty and each non-head x is melodically stronger than the non-head x of its left neighbour. $\bar{x}_1$ cannot be governed by $\bar{x}_2$, and therefore its full lexical melody [ɛ] must be realised phonetically.

Clearly, coronal obstruents will tend occupy the last position in a string of sylls with empty nuclei, because the R element provides extra strength. This is probably the reason for the frequency of coronals as suffixes in the languages of the world.

3. Epilogue

What does all this get us? Answer: A phonological theory based on a very small number of units and principles. I would like to present an analogy with writing systems and their relative efficiency and cognitive usefulness.

So-calles "syllabic" writing systems have been developed independently in various places in the world, but none of the societies that used them is known to have developed widespread literacy. The alphabetic writing systems that we know and use throughout the world today all stem from one common ancestor (which itself was derived from a syllabic writing system). Now, why is alphabetic writing so obviously more learnable than syllabic writing? Because there is a far smaller number of units in an alphabet. For syllabic

writing, each consonant has to be multiplied by the number of vowels, and so we arrive at 21x5=105 symbols to replace a 26-letter alphabet.

I can imagine that the arguments of a proponent of syllabic writing against alphabetic writing would be much the same as those levelled against CV-based syllable structure by proponents of traditional syllable structure. The solution of such a dispute does not lie so much within its area of origin (i.e. writing systems *per se*, or syllable structure *per se*), but rather in the ease with which the system can be used in and extended to other areas.

Appendix

Some melodic expressions (taken from Rennison & Neubarth, in press).
(AG = Austrian German)

1. Consonants

Stops				Fricatives			
Melody	*English*	*French*	*AG*	*Melody*	*English*	*French*	*AG*
()	/ʔ/	–	/ʔ/	(F,FU)	/v/	/f/	/f/
(F,UH)	/p/	–	–	(F,FUH)	/f/	–	
(F,RH)	/t/	–	–	(F,FUL)	–	/ʋ/	–
(F,H)	/k/	–	–	(F,FR)	/z/	/s/	/s/
(F,U)	/b/	/p/	/ɒ/	(F,FRH)	/s/	–	–
(F,R)	/d/	/t/	/ɖ/	(F,FRL)	–	/z/	–
(F)	/g/	/k/	/g/[4]	(F,FRU)	/ð/	/ʃ/	–
(F,UL)	–	/b/	–	(F,FRUL)	–	/ʒ/	–
(F,RL)	–	/d/	–	(F,FRUH)	/θ/	–	–
(F,L)	–	/g/	–	(F,FRUI)	/ʒ/	–	/ʃ/
				(F,FRUIH)	/ʃ/	–	–
				(F,FI)	–	–	[ç]

[4] AG has no voicing contrast. Single obstruents are partially voiced, geminates voiceless. English has "H-devoicing" and French has "L-voicing" (cf. Harris 1994). The initial voiceless, lightly aspirated [k^h] is a contour segment which parallels [p^f] and [t^s], but which is probably synchronically reanalysed as having a lazy H element.

Nasals, liquids and glides							
Melody	*English*	*French*	*AG*	*Melody*	*English*	*French*	*AG*
(L,U)	/m/	/m/	/m/	(R,U)	/l/		
(L,R)	/n/	/n/	/n/	(R,UI)		/l/	/l/
(L,I)	–	/ɲ/	[ɲ]	(U)	/w/	/w/	/v/
(L)	(/ŋ/)	–	(/ŋ/)	(I)	/j/	/j/	/j/
(R)	/r/	/r/	/r/	(F,F)	h	–	/h/~/x/[5]

2. Vowels

Melody	*English*	*French*	*AG*	*Melody*	*English*	*French*	*AG*
()	/ə/	/ə/	/ɐ/	(I,F)[6]	/i/		/i/
(I)	/ɪ/	/i/	/ɪ/	(U,F)	/u/		/u/
(U)	/ʊ/	/u/	/ʊ/	(F,F)			/ɑ/ ([ɒ])
(F)	/a/	/a/	/a/	(F,IF)	/e/	/eː/	/e/
(F,I)	/ɛ/	/ɛ/	/ɛ/	(F,UF)	/o/	/oː/	/o/
(F,U)	/ɔ/	/ɔ/	/ɔ/	(U,IF)			[y]
(U,I)		/y/	[ʏ][7]	(F,UIF)			[ø]
(F,UI)		/ø/	[œ]				

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[5] In AG /h/ and /x/ are in complementary distribution – /h/ word initially, elsewhere /x/ (phonetically [ç] after segments containing I, otherwise [x]) – with the usual exceptions for onomatopoeia, loanwords and compounds.

[6] English and German have tense vowels only in long vowel structures (involving 2 sylls). In contexts with accent shift, those vowels become phonetically short but remain tense. We assume that structure does not change in these contexts, only the phonetic realisation is different (i.e. shorter).

[7] AG has no lexical front rounded vowels; the equivalents of Standard German /y/ etc. are unrounded (/i/ etc.). However, front rounded vowels arise from front unrounded vowels before /l/ (which is not phonetically realised, but whose U element is realised in the preceding nucleus). Cf. Rennison 1980.

Abstract

Occam's razor encourages us to get rid of unnecessary duplications if one thing suffices. In the case of syllable structure, there has traditionally been no principled limit to the number of consonants (hereafter: C's) or Vowels (hereafter: V's) that are permitted to fill the general syllable scheme (C*)V*(C*) – where "*" indicates "any number of" and parentheses indicate optionality.

In this paper I apply Occam's razor and show that facts of phonotactics in any human language can best be described and explained by means of the single syllable template that is used in more recent Government Phonology: CV. Clearly, this template also needs mechanisms which permit either the C or the V position to be phonetically silent. These will be presented in a non-technical manner, with examples from a variety of languages such as English, German, Koromfe and Arabic.

Why bother? Because this has serious implications for the (alleged) complexity of cognitive structures. Under the "CV" approach, structural complexity is minimised and cognitive processing (of a general, independently necessary kind) is more fully utilised. This has huge consequences for theories of language acquisition, loss, etc. (which, however, will not be treated in the paper).