Is ʔ an Element?
Towards a Non-segmental Phonology*

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This paper argues that the element calculus of Government Phonology is overburdened. In particular it shows that the simple act of supposing extra elements to explain consonantal phenomena leads to far reaching and undesirable empirical consequences. An alternative approach is proposed which leaves the elemental inventory containing only those elements attested in both nuclei and non-nuclei. The phonetic impression of consonantism is attributed to the direct interpretation of supra-skeletal structure. Some typical textbook problems involving consonant 'mutations' are explored in light of this simple shift of perspective, with attractive solutions. The metatheoretical benefits of this approach are highlighted and particular areas of existing supra-skeletal theory are singled out as likely to require 'tweaking'.

1. The evidence for ʔ

There is a considerable quantity of phonological evidence that ʔ is an element. An element represents a property that defines a set of expressions that is active in a phonological process and distinguishes it from the complement set of expressions inert in that process. Typically we find languages whose set of vowels can be partitioned into a subset that triggers, say, palatalisation of the immediately preceding onset, and its complement, which doesn't. We would use this as evidence that the representations of the vowels of the active subset (the palatalisers) all contain an element (in this case I) which is absent from the representations of the members of the complement. Such was the line reasoning in favour of an element ʔ. In the Fula (Fulani, Pulaar) languages of the Gambia, initial consonant alternations play a key role in the inflexional system. The following suggestive examples are taken from the Firdu Fula dialect described in Gamble(1958).

(1)	allaːdu	gallaːɗi	'horn ~ horns'
	waːndu	baːɗi	'monkey ~ monkeys'
	fɛrlo	pɛrle	'hill ~ hills'
	hinɛrɛ	kine	'nose ~ noses'
	reːdu	deːɗi	'stomach ~ stomachs'
	saːre	caʔe	'town ~ towns'
	wudɛrɛ	gude	'cloth ~ cloths'
	yitɛrɛ	gite	'eye ~ eyes'
	yeːso	jeːse	'face ~ faces'

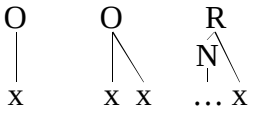
Gamble makes the additional observation (*op.cit*, 3) that 'ɓ, ɗ, ny, ɗy, l, m, n, t, remain constant.' The onsets of the nominal classes represented in the first column include /w/, /h/, /r/, /y/ and zero, whose representations we know to be single element expressions (U, h, R or A, I and zero) so it is impossible to base the set of expressions representing these onsets on a single element. The active set must therefore be the set of onsets found in the nominal classes represented by the second column (which includes the 'constants').

Furthermore, this set cannot be defined with reference to any of the elements (U, h, R/A, I or zero). We are driven to the conclusion that another element is needed to characterise this set. This is the element ʔ for which an acoustic signature has since been identified (Lindsey and Harris 1990).

2. 'Consonants' in Government Phonology

I shall use the term 'consonant' in the following technical sense: a structure **S** is called a *consonant* iff **S** is not dominated by a nuclear constituent. We admit therefore the structures $[_{O}\ x\ ]$, $[_{O}\ x_{i}\ x_{i+1}\ ]$, $[_{R}\ [_{N}\ \ldots\ ]\ x\ ]$ (2).

(2)



There are certain Elements that seem to occur exclusively in phonological expressions associated to consonantal points, *viz* h^{o}, R^{o}, $ʔ^{o}$, and conversely those which never do, *viz* A^{+}, $ɪ^{+}$. This suggests there is a certain amount of formal redundancy in the representation of consonants. Faced with this embarrassment of riches we must make a choice. This choice is far from innocuous, and very different theories result from the chosen solution. We can draw up the possible solutions into two camps which I shall call the *Neo-segmental* and the *Non-segmental*. A Neo-segmental solution is one which accepts that elements are required to characterise the natural classes discovered in consonantal processes such as those we looked at in §1. This approach, typified by Harris and Lindsey(1994), requires individual phonological expressions, which they call *segments*, to encapsulate most (if not all) the locally relevant phonology. There are startling and unpleasant side-effects of the Neo-segmental approach.

3. Metatheoretical considerations

One consequence of the Neo-segmentalist solution is an unexpected division of the set of elements. We have noted that there are elements that occur only in consonant positions. It should also be noted that the distribution of segments is not free within a phonological domain. For a Neo-segmentalist this must be viewed as an 'accident'. Consequently a Neo-segmantalist theory must clutter UG with subtheories which regulate segmental distribution (*eg* complexity conditions: Kaye(1990), Harris(1990); licensing inheritance: Harris(1993); or even unspoken *fiat*: 'no ʔʔor h in nuclei'). Ultimtately an account along these lines is going to have to face the 'syndromes' and 'clusterings' that follow from the partitioning the set of elements. Recent proposals accept these consequences as 'facts of life' and extend the axiomatic content of the theory accordingly by stipulating universal dependencies between specific elements, centered around nodes on a sub-skeletal tree (Harris and Lindsey1994).

This proliferation of representations and axioms seriously undermines the empirical content of the theory. Most of the segments generated by the fusion operation over the set of elements, exploiting the head-operator distinction, seem to have no interpretation. Even the most streamlined version of the Revised Theory (*v.sub*) with only {A, I, U, H, L, ʔ} and no dependency nodes generates a total of 256 representations. But languages typically seem to support between 50 and 100 linguistically significant contrasts in their phonologies:

at best a mere 40% of the contrasts the theory leads us to expect.

The Revised Theory is a research programme that addresses the over-generation of GP. Concentrating on nuclear systems, it attempts to reduce (ultimately to eliminate) universals that endow particular elements with particular formal properties. The first casualty was Charm Theory and along with it the element I^{+} (Charette and Kaye 1993). Since then the inventory of elements has been under attack. The anamolous behaviour of R^{o} has led some researchers to propose its abandonment (Backley1994); the persistent co-occurence of N^{+} with L^{-} and H^{-} with h^{o} in many expressions found in the world's languages is motivating an ambitious drive to unify them as L and H (unpublished work in progress). If the proposals in this paper amount to anything, then we can remove ?? from the set too. The resulting set {A, I, U, H, L} is to all intents and purposes free from distributional restriction: all these elements have been attested in both nucleic and consonantal positions. Generating only 112 expressions, this set has a more realistic chance of modelling actual phonological systems.

At the heart of what I have called the Non-segmental approach is the denial of the hypothesis (explicit or otherwise in much of the work cited above) that there is a one-to-one mapping from a phonological expression to a slice (or segment) of acoustic signal. The sections that follow will be an exploration of this Non-segmental idea. I hope to show that there are many empirical rewards to be reaped by exploiting the model of structural knowledge given by constituent theory (Kaye, Lowenstamm and Vergnaud 1990; Kaye 1990) while banishing from the element calculus all artefacts of quasi-phonetic taxonomy.

4. The Non-segmentalist Hypothesis

Incorporating a long-known equivalence between vowels and glides, GP analyses the glides [j] and [w] as simply the elements I and U associated to an onset position, whereas the same expressions attached to a nuclear position represent the vowels [ɪ] and [ʊ]. The perceived acoustic difference between the vowel and the glide is said to be a by-product of the expression's position within the phonological domain. That is to say it is not an inherent property of any expression to be a vowel or a glide.

In the Non-segmental approach, I should like to generalise this insight into the following hypothesis: the perceived acoustic differences between vowels and consonants are direct phonetic interpretations of particular *positions* within the constituent structure of a phonological domain. Note that 'constituent structure' here is to be understood weakly as the governing and licensing relations that obtain between points in a given domain. These so-called 'major class features' should not therefore be represented in the elemental structure of particular phonological expressions. This has the pleasing metatheoretical consequence that we can abandon the purely consonantal elements and freely attach any expression to any skeletal point.

A particularly useful corollary of the Non-segmentalist Hypothesis is the following: we expect to find consonant 'mutations' (such things as lenition and fortition) only as a result of a change in constituent structure. Furthermore, given the (Phonological) Projection Principle (Kaye, Lowenstamm and Vergnaud 1990) which requires that governing relations are established in the lexicon, and cannot be changed during the course of a derivation, we must expect that consonant mutation can only take place as a result of non-analytic morphology (in the sense of Kaye 1994: two L(exical)-structures A and B are concatenated, yielding a third L-structure, AB = CONCAT(A,B). L-structure AB is then processed by the Phonology (viewed as a function PHI onto phonological domains) as a single domain PHI(CONCAT(A,B))).

In the following sections we consider two classic cases of consonant alternation: Bantu 'nasal' fortition, and Irish 'lenition'. This will show us the typical constituent structure associated with the phonetic impression of stop consonants and the unmistakable presence of morphology accompanying the alternations. This confirms the existence of the predicted symbiosis of consonant alternation with (lexically generated) morphology.

5. Synthesising the 'fortis' stops

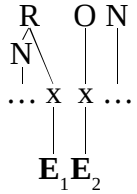
Sesotho (Sesuto), in common with many Bantu languages displays a class of stem initial consonant fortitions after nasal or 'historically' nasal prefixes (3) (data adapted from Jacottet 1927).

(3)	hɔ haha	ua ŋkˣahɛla		hɔ ʔɛma	ua ŋgɛlɛma
	hɔ ɟa	ua ntʃa		hɔ ʃapa	ua ntʃapa
	hɔ lisa	ua ntiseca		hɔ rata	ua nt^{h}ata
	hɔ bɔna	ua mpona		hɔ fɛpa	ua mp^{h}ɛpa
	hɔ ʎacwa	ua ntʎacwa		hɔ seɲa	ua nc^{h}eɲa

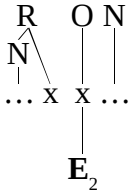
The fortis stops that occur after the overt nasal in the above paradigm occur in other paradigms when the nasal is *not* present. This is the case with derivations involving the 5th Class, which is said to have been marked with a nasal prefix in the proto-language. This is to say that words which apparently begin with a fortis stop are claimed, for morpho-syntactic reasons, to be morphologically complex, involving a historical prefix (now 'lost') and a stem initial 'continuant'. The diachronic approach has successfully identified an area of systematicity in the morphology, although we must disagree with the cognitively agnostic conclusions. As we pursue a Non-segmental analysis we shall see that the 5th Class prefix is far from 'lost'. It is in fact just the same as the nasal prefixes, but without the 'nasality'.

The homorganic nasal-stop clusters in the paradigm above are likely candidates for *Coda-lisenced* structures (4a), that is [… [$_{R}$ [$_{N}$ …] x$_{i}$:(**E**$_{1}$)] [$_{O}$ x$_{i+1}$:(**E**$_{2}$)] …], where **E**$_{1}$ and **E**$_{2}$ are well-formed phonological expressions, and **E**$_{2}$ (trans-constituent) governs **E**$_{1}$ (Kaye 1990). Obligatory homorganicity is a manifestation of element sharing induced by (trans-constituent) government. Let us propose then that when the nasal is not overt, there is simply no 'nasal' element (L) attached to the rhymal position, x$_{i}$, leaving the prosodic structure intact (4b). If this is the case, we predict that the fortis stops are actually no different from true phonological geminates. Supporting evidence for this hypothesis is mounting. Recent attempts to explain the behaviour of 'tense' consonants in Scandanavian (pre-aspiration in Icelandic: Gibb 1992) and Irish (tense liquids: Cyran 1993) have converged on an analysis of these objects as Coda-licensed structures.

(4a)



(4b)

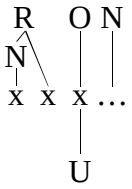


The consonant alternations we observe are then simply the result of the presence or absense of the prefix — PHI(CONCAT(A,B)) and PHI(B) respectively. The expression attached to an *idle* onset point (where 'idle' means 'does not govern or license any point') is realised as a glide or fricative; attached to an onset trans-constituent governor it is realised as the'intrusive' fortis stop. These phonetic terms are meant merely to be suggestive of the acoustic impression particular to Sesotho. The universal acoustic requirement on the interpretation of these structures is probably severely underdetermined: perhaps nothing more than constraints on the gradient of the signal energy across various governing domains. We should therefore expect to find great variety and ingenuity in the production of consonants world-wide. This is indeed the case: some fashions prefer to suck rather than blow (clicks), others favour energetic spitting (ejectives), lingering (affrication), or different pitch (tension). What is also clear as that these things seem to behave phonologically alike from language to language, despite the diversity in oral acrobatics (for example, for a particularly striking display of the behavioural mundaneness of clicks generally, see Stopa 1960).

6. Irish 'lenition' Bantu style

If we are to make the above conjecture do any work we must take it beyond Bantu. Crudely we wish to say that, for example, a 'b' is simply a 'w' with a rhymal prefix. Specifying any extra elemental content to 'b' that does not already exist in 'w' is therefore vacuous. More technically we are supposing that an object such as $(U^{o}.h^{o}.ʔ^{o})^{o}$ should be represented as $[\ \ldots[_{R}\ [_{N}\ \ldots\ ]\ x_{i}\text{:}(\ )\ ]\ [_{O}\ x_{i+1}\text{:}(U)\ ]\ \ldots\ ]$, dispensing with $ʔ^{o}$ and h^{o} completely (4c).

(4c)



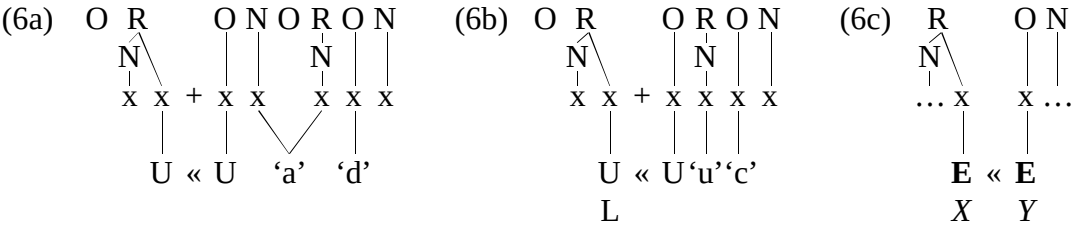
How would such an analysis help us to understand the famous Celtic 'mutations'? The following data are from 'Classical' (essentially Munster) Irish with traditional spelling retained (Graiméar). The word *mo*, 'my', is said to 'lenite' its following noun.

(5)	póg	mo phóg	'(my) kiss'	pʰoːg	mə ɸoːg
	taoiseach	mo thaoiseach	'(my) government'	tʰiːʃəx	mə hiːʃəx
	cat	mo chat	'(my) cat'	kʰɑt	mə xɑt
	bád	mo bhád	'(my) boat'	bɑːd	mə wɑːd
	duine	mo dhuine	'(my) man'	dɨɲɪ	mə ɣɨɲɪ
	gadhar	mo ghadhar	'(my) dog'	gəjr	mə ɣəjr
	muc	mo mhuc	'(my) pig'	muk	mə wuk
	sac	mo shac	'(my) bag'	sɑk	mə hɑk
	focal	m' fhocal	'(my) word'	fokəl	mokəl

As with Sesotho, these effects take place in given morpho-syntactic environments with or without the presence of an overt 'trigger'. So in Irish the relative form of the verb (in the spoken language) begins with a consonant from the lenited series. Let us suspend

disbelief a little and explore these data from a Bantuist's perspective. The unlenited consonant series would perhaps be interpreted analagously to the 5th Class fortis series: nasal fortition with loss of a historic nasal prefix. The lenited series would then be analysed as basic to the stem. Suppose then that *bád*, 'boat', is of the form PHI(CONCAT(A,B)), where B, the lexical stem, = /waːd/ and A, a 'grammatical' prefix, = $[_R\,[_N\,x_i\,]\,x_{i+1}$:( )] (6a), whereas for *muc* we have B = /wuk/, but A = $[_R\,[_N\,x_i\,]\,x_{i+1}$:(L)] (6b).

Once again, as with Sesotho, and probably universally, the synthesis of the fortis series seems to be accompanied at P-structure by 'homorganicity' or the sharing/spreading of at least one element between the rhymal prefix and the following onset under trans-constituent government (6c, where **E** ranges over single Elements and **E**.*X*, **E**.*Y* are well-formed phonological expressions).



Much as in Bantu, a picture is emerging of Irish morphology that it exploits extensive *prefixing*. An interesting and important prediction arises from the structure proposed in the previous paragraph. Given an L-structure prefix with a rhymal ending (necessarily non-analytic) based on an element **E**, it should be impossible to find a following consonant based on **E** from the lenited series. In particular only the fortis consonant should be realised. It is therefore encouraging for this analysis to read that 'sometimes, in circumstances where lenition is normal, it may not occur where homorganic consonants are involved' (Ó Siadhail 1989:113). Most striking is the resistance of 'coronals' to lenition after some forms of the definite article ending in *-n*. For example *an bhó* 'the cow', but *an deoch* 'the drink', not **an dheoch*. We might note in passing that Ó Siadhail speculates that this resistance to lenition may be due to 'secondary sandhi' effects, such that lenition does take place, but the homorganic environment causes a fortition (with or without cluster simplification) at a later stage in the derivation (eg /dɣ/ → /d/, where ɣ is the result of an earlier lenition of /d/, *op.cit*,114). Intuitively this is similar to the analysis proposed in this paper, except that here we predict that these secondary sandhi phenomena *must* take place: for Ó Siadhail they are an unexpected exception which requires a stipulative 'fix'.

7. Theory internal considerations

The wary reader will have noticed that the foregoing analysis requires branching rhyme structures in places that they have been unknown hitherto. Given also the widespread presence of stop-like consonants in the world's languages it looks doubtful whether there is such a thing as the branching rhyme parameter: it makes more sense to require all three constituents (O, N and R) to be unconditionally present.

Most interesting are the implications for the theory of p-licensing (Kaye 1990 *bis*; Kaye, Lowenstamm and Vergnaud 1990; Charette 1990 among others). Note that the proposals of this paper predict a proliferation of p-licensed domain *initial* empty nuclei with rhymal complements. These structures are already known to the theory through the 'magic' licensing parameter (Kaye 1992), although their distribution has been considered anoma-

lous (hence 'magic') because of its restrictiveness. The present approach recognises magic structures as commonplace and points perhaps to the need for a fully articulated theory of domain initial empty nuclei, analagous to the theory of domain final empty nuclei. It also points to the need for another look at the interaction of p-licensing with governing domains, till now thought to be 'barriers' to proper government.

8. Non-segmentalism, a summary

We began this paper by considering consonant alternations in Fula. These alternations apparently divided the Fula consonant inventory into two complementary subsets. Using the methods typical of what I have called the Neo-segmentalist philosophy, the members of one of the subsets (the 'active' one) were supposed to be characterised by the presence in their sub-skeletal (or, segmental) representations of a designated element absent from the representations of members of the complement.

We noted that this philosophy tends to swell the inventory of elements (reducing the empirical insightfulness of the theory by over-generating), and requires a host of auxiliary hypotheses to make sense of the otherwise unexpected distributional patterns of attested expressions.

The line of enquiry proposed in this paper, called Non-segmental, rejects the Neo-segmentalist elemental bias. It sees in consonantal alternations like those of Fula, Sesotho and Irish a systematic use of changes in constituent structure, effected through the morphological CONAT function. The phonetic impression of consonant 'mutation' is attributed directly to the language-specific interpretation of the local licensing relations in the dominating constituent structure. We saw by the way that the puzzling exceptions to the Irish lenition process are in fact a necessary consequence of the Non-segmental analysis.

We also noted that there are universal requirements on the phonetic interpretation of constituent structure of a very underdetermined nature. The diversity of articulations world-wide is a natural consequence of the freedom this underdeterminacy grants to the language acquirer.

In the light of the streamlined axiomatic content of the theory (fewer elements; no distributional restrictions; no parametrically determined presence or absense of the constituent R) we mentioned areas of the theory that are in need of immediate clarification. These are chiefly in the theories of proper government and p-licensing which have been assumed to be sensitive to rhymal structure. Encouraging for us in this area is the observation that 'magically' p-licensed domain initial empty nuclei are not so magic after all: they are in fact rather common. Equally encouraging is the evidence from Icelandic and Irish that indicates a close connection between 'tense' consonants, rhymal positions and p-licensing in the explanation of local nucleic phenomena.

Much, as they say, remains to be done. I hope that I have shown, however, that revising the theory along Non-segmentalist lines is a programme worth the effort and is not 'a chasing after the wind' (or airstream mechanism) … .

Notes

* An earlier version of this paper will appear in the procedings of the Third (1994) Manchester Postgraduate Conference in Linguistics under the title *The Proper Treatment of Consonants*. This paper is meant as a contribution to the Government Phonology

research programme, and assumes the formal methods associated with it, for which see the references. My thanks go to all phonologists in the department at SOAS who have been exposed to this paper during its transmogrification.

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