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Contents

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Preface

In the general context of growing dissatisfaction with derivational phonological models of the SPE type (Chomsky and Halle 1968), in which phonological activity was assumed to consist in applying a system of rules transforming a deep, underlying structure into its surface, phonetic representation, came the realisation that more constrained models need to be sought which would aim at restricting the rule component, and eventually, dispose of such arbitrary artefacts of phonological theory as rule ordering, or indeed the rules themselves. The modifications within the mainstream generative approaches in the form of, for example, Autosegmental Phonology, Feature Geometry and Underspecification Theory were steps in this direction in that more emphasis was now put on the representational aspect while still retaining the basic assumption of having two levels of representations. The drift away from derivation culminated in the recently developed Optimality Theory (Prince and Smolensky 1993) which completely replaces the rule component with a system of ranked, hence violable, universal constraints on output representations. In this respect Optimality Theory may be assumed to be a non-derivational framework. It is worth noting, however, that the constraints on output representations in this framework cannot be equated with emphasis on structure, and thus, they do not preclude the danger of arriving at arbitrary generalisations.

Beside the above attempts at constraining phonological representations, models which represent a completely different way of viewing phonological activity came to existence in the form of Particle Phonology (Schane 1984), Dependency Phonology (e.g. Anderson and Ewen 1987), and especially Government Phonology which was developed in the eighties in North America and in the nineties in Europe. This model, codified in Kaye *et al.* (1985, 1990), the papers contained in *Phonology 7.2*, Charette (1991), and Harris (1994), has been applied in the study of large portions of German (Bockhaus 1995), Japanese (Yoshida 1996) and Irish (Cyran 1997). It is fundamentally a non-derivational framework, in that no mapping of one level of representation onto another is permitted. Instead, there are universal principles defining well-formed phonological representations and parametric choices concerning these principles, which are responsible for linguistic variation: for example, whether a given language makes use of vowel quantity distinctions is a matter of a simple choice allowing nuclei to branch. The well-formed representations are directly interpreted without mediation of any kind of further rules or constraints. This, among other things, is possible due to the fact that the smallest linguistic primes, the elements, which this framework employs, are individually pronounceable and do not require a special interpretative apparatus.

It is not my intention to fully introduce the model here as the reader will find very lucid introductions to particular aspects of Government Phonology in the papers contained in this collection, as well as in such seminal works as Kaye (1990), Kaye *et al.* (1990), Charette (1991), Gussmann and Kaye (1993), and Harris (1990, 1994).

This volume contains articles exploring the principles-and-parameters model of Government Phonology either by applying it to particular sets of data or by reacting to the "standard" model and proposing sometimes quite dramatic modifications. There are several studies of vowel structure and the function of vocalic systems. Thus, Anna Bloch-Rozmej writes on nasal vowels in Polish, and Anita Buczek addresses some issues concerning the vowel system of Welsh. On the other hand, Phillip Backley and Toyomi Takahashi, Monik Charette and Ash Göksel, and Duck-Young Lee and Shohei Yoshida explore the relationship between the different representational conventions for vowel systems and their function in vowel harmony processes in Maasai, Akan, Turkic languages, and Korean respectively. It is interesting to note the considerable difference between the proposals of Backley and Takahashi, who develop a model relying on the different configurations of autosegmental tiers, and that offered by Charette and Göksel, who apply a system of licensing constraints on element combinability to define vowel systems and harmony effects.

Several studies deal with the function of melodic primes – elements in Government Phonology. Both John Rennison and Péter Szigetvári address certain issues concerning subsegmental organisation drawing on data from German dialects, African languages, and Hungarian. On the other hand, Eugeniusz Cyran and Morgan Nilsson explore the possibility of reducing the number of phonological primes in their analysis of Slavic obstruentisation phenomena, while Kuniya Nasukawa demonstrates that the voicing phenomena in Yamamoto Japanese would be better understood if the low tone element (L) and nasality (N) were conflated into one prime, (N), which would define both properties depending on its status in the representation.

Finally, the volume contains a number of studies referring to the syllabic organisation of phonological material. John Harris and Edmund Gussmann review the main arguments against treating word-final consonants as codas, as well as put forward a number of positive arguments suggesting what structure best explains the phonological phenomena found in this context. Edmund Gussmann and Eugeniusz Cyran write on Polish initial consonant sequences and point to possible interpretations referring to a system of prosodic relations which are contracted at relevant projections both between nuclei and between onsets. Grażyna Rowicka explores the advantages of Trochaic Proper Government when applied to the intriguing phenomenon of ghost vowels in Mohawk. A new model of prosodic organisation called Head-Driven Phonology is presented in the paper by Harry van der Hulst and Nancy Ritter and is applied to the analysis of Kammu minor syllables. Finally, Tobias Scheer explores the consequences of adopting the Strict CV structure of the syllable for Government Phonology in terms of some necessary modifications that this model would have to undergo.

Related to the issue of syllabic organisation is the connection between the prosodic organisation and permissible melodic structure. This relation has been referred to as the interaction between prosodic and autosegmental licensing and involves such concepts as "licensing inheritance" developed in, for example, Harris (1994, 1997) which determines the arrangement of melodic material in particular prosodic configurations and is responsible for such phenomena as lenition of consonants as well as phonotactic restrictions on segmental strings. There are two papers in this volume which address these issues. One paper is by Edmund Gussmann, who offers a fresh look at the facts concerning the phonology of the English velar nasal, and the other by Krzysztof Jaskuła, who writes on lenition of voiceless spirants in Old Irish.

It follows from the above survey that the main preoccupation of the studies in Government Phonology is to establish a structure which would conform to universal principles of phonological organisation and to search for mechanisms, inherent in the structure, which are responsible for particular phonological phenomena and are not part of a separate component such as rules, constraints, etc. Hence, the main title of this volume, "Structure and Interpretation", appeared to be most fitting.

Some of the papers contained here were first presented at the 6th annual conference of the Polish Association for the Study of English (PASE) in Puławy organised by the Catholic University of Lublin. The publication of this volume has been made possible by a financial support from the British Council and the Cultural Relations Committee of the Irish Department of Foreign Affairs. I would like to thank Prof. Edmund Gussmann for enormous help and guidance in this enterprise. Dr Aidan Doyle has been very efficient as a language consultant. Thanks also go to Prof. Bogdan Szymanek and Dr Jan Słowiński of Folium Publishers for their efficiency and guidance. Finally, I would like to thank all the contributors for splendid cooperation, which allowed us to bring out this publication within a very short period of time.

Eugeniusz Cyran

References

Anderson, J. M. and C. J. Ewen (1987) *Principles of dependency phonology.* Cambridge: Cambridge University Press.

Brockhaus, W. (1995) *Final devoicing in the phonology of German.* Tübingen: Max Niemeyer Verlag.

Charette, M. (1991) *Conditions on phonological government.* Cambridge: Cambridge University Press.

Chomsky, N. and M. Halle (1968) *The sound pattern of English.* New York: Harper and Row.

Cyran, E. (1997) *Resonance elements in phonology. A study in Munster Irish*. Lublin: Folium.
Gussmann, E. and J. Kaye (1993) Polish notes from a Dubrovnik café. I: the yers. *SOAS Working Papers in Linguistics and Phonetics* 3:427-462.
Harris, J. (1990) Segmental complexity and phonological government. *Phonology* 7:255-300.
Harris, J. (1994) *English sound structure*. Oxford: Blackwell.
Harris, J. (1997) Licensing inheritance: an integrated theory of neutralisation. *Phonology* 14.
Kaye, J. (1990) 'Coda' licensing. *Phonology* 7:301-330.
Kaye, J., J. Lowenstamm, and J-R. Vergnaud (1985) The internal structure of phonological representations: a theory of charm and government. *Phonology Yearbook* 2:305-328.
Kaye, J., J. Lowenstamm, and J-R. Vergnaud (1990) Constituent structure and government in phonology. *Phonology* 7:193-231.
Prince, A. S. and P. Smolensky (1993) *Optimality theory: constraint interaction in generative grammar*. Piscataway, N.J.: Rutgers University Center for Cognitive Science.
Yoshida, S. (1996) *Phonological government in Japanese*. Canberra: The Australian National University.

Element activation*

Phillip Backley and Toyomi Takahashi

1. Introduction

In this paper we consider some of the ways in which the mechanism of *vowel harmony* (henceforth VH) has been approached in the recent literature. We then address a number of problems associated with these accounts, and offer an alternative view built around the concept of element activation. We begin by looking at the operation of autosegmental spreading, which most multi-linear approaches have conventionally adopted as a means of capturing assimilatory phenomena. While this notion of spreading remains central to Element-based models of melodic structure (Kaye, Lowenstamm, and Vergnaud 1985, Harris and Lindsey 1995), it fails to provide a suitable account of VH cases involving tongue root position. In order to accommodate such systems, a number of solutions based on the properties of headship have been proposed. These are outlined in section 3, and then explored more fully in section 4.

Although the headed-headless distinction offers an elegant means of expressing tongue root contrasts and harmony processes involving ATR, it forces us to accept an increase in the number of legitimate operations available to the phonology – a move which has clear repercussions for overall restrictiveness. Besides the established operations of spreading and delinking, we must recognize an additional device which formalizes the alignment or the special licensing of heads across a domain. A mechanism of this sort has the immediate effect of expanding the predictive power of the model to an undesirable extent. We shall argue, however, that this outcome may be avoided by assuming that phonological oppositions are encoded via a lexical instruction to "activate" individual primes: active elements are interpretable, while inactive material lies dormant in the melodic structure. This is described in section 5. We claim that element activation is appropriate for analysing a variety of VH types, and is equally applicable to the representation of non-harmonic contrasts conventionally referred to as "segmental". We also propose that a strict interpretation of Structure Preservation is compatible with the notion of lexical activation, whereas the same principle must be weakened in the context of head agreement. In section 6 we offer an analysis of an ATR harmony system couched within element activation terms.

* An earlier version of this paper has appeared as Backley and Takahashi (1996). We are most grateful to Eugeniusz Cyran and John Harris for their helpful comments and suggestions.

2. Autosegmental spreading

Since the late 1970s it has been recognized that the standard linear model of phonology cannot be maintained as an adequate means of representing the kinds of phenomena that have been subsumed under the general label "prosodic". This description may be taken to involve properties such as, for example, stress patterning. In response, the idea of multi-linear structure has since dominated the theoretical arena, having developed initially from early autosegmental models presented by, amongst others, Goldsmith (1976) and Clements (1977). It has been noticed, however, that we encounter problems if we attempt to draw any absolute distinction between suprasegmental processes of the type envisaged by Goldsmith, and purely melodic patterns conventionally referred to as "segmental". Certain assimilatory phenomena such as vowel harmony, for example, apparently have recourse to both melodic and prosodic information in their description.

The analysis of Akan vowel harmony proposed in Clements (1981) was built around this very observation, where harmonic agreement is described as "a phenomenon located at midpoint between true prosodic characteristics such as stress and tone, and purely local phenomena such as the assimilation of one segment to a neighbour" (1981:55). This amalgamation of melodic and prosodic characteristics is employed by Clements as a means of highlighting the appropriateness of a nonlinear mode of representation, his departure from the linear tradition being motivated in the following way. Vowel harmony may be seen to operate by isolating the kinds of phonological properties (specifically, melodic primitives) normally used to define segments, and then giving them a prosodic, or suprasegmental role. So, a feature such as [–back] – which is conventionally specified in the melodic make up of front vowels such as [e, æ, i, ö], etc. — may alternatively be abstracted from this segmental level and elevated to a higher position in the phonological structure, where it becomes the property of a larger prosodic domain, typically the word. In the case of [–back] specified as a suprasegmental unit, we observe the palatality effects of this feature across (the vowels of) entire morphemes, rather than individual melodic expressions. Harmonic agreement with respect to palatality is characteristic of a number of Altaic systems, such as Mongolian and Turkish.

If the feature [–back] can be treated in this way, then we expect other melodic primes to be accessed in a similar fashion, creating a range of VH systems observable across different languages. In the paper cited above, Clements focuses his attention on the tongue root harmony system of Akan. Leaving aside some of the more complex details regarding the distribution of vowels in this language, we may generalise by saying that the vowels within a prosodic word domain all agree with respect to ATRness. That is, the feature value [+ATR] is associated either to all of the vowels in the domain, or to none of them; in the latter case, the default value [–ATR] is supplied. Clements proposes that this pattern be encoded in Akan via a lexical marking which specifies each noun and verb root

as either an ATR or a non-ATR morpheme. Then, following affixation, the vowels of affixes tend to reflect this marking. The effects of harmonic agreement are demonstrated in (1), which shows two verb roots that are minimally distinct – they differ only in terms of the presence/absence of morpheme-level ATR.

(1)	a.	tʊ	'throw'	ɔ-bɛ-tʊ-ɪ	'he came and threw'
	b.	tu	'dig'	o-be-tu-i	'he came and dug'

The fact that the feature [+ATR] is specified as a property of the word domain, rather than of an individual vowel, is illustrated by the morphologically complex forms above. In the case of (1b), the scope of ATRness is extended beyond the root vowel to all other vowels within the expanded domain. We may assume that the lexicon does not support any tongue root distinction in affixes, and therefore, that affixal vowels are subject to [±ATR] alternation, according to the lexical marking of the root to which they are attached. In order to capture the suprasegmental behaviour of [+ATR] in this system, Clements (1981) adopts the kind of autosegmental structure first presented in Goldsmith (1976), where the harmonising feature resides on a separate autosegmental tier, and is lexically associated to the root. During the derivation of an ATR form, additional association lines are then inserted via a *spreading* operation, linking affix vowels to the same harmonic feature.

The widespread acceptance of this nonlinear model has led to the same process of feature spreading being applied in countless other autosegmental analyses of harmonic phenomena. Indeed, it offers a substantial degree of versatility since, we may assume, any unit belonging to the set of distinctive features may potentially be autosegmentalised in the same way. Familiar harmonic processes may thus be characterised in a straightforward manner: labial harmony (e.g. Turkish) identifies [+round] as a prosodic feature, while height harmony (e.g. Chichewa) corresponds to the selection of either [+low] or [–high] as the relevant autosegment (see Mtenje 1986 for discussion). In the context of a restrictive generative model, however, this versatility cannot be viewed favourably, since we predict that all available features are equally likely to be accessed as a harmonic property within one language or another. Yet, in the absence of any serious empirical backing, such a prediction cannot be maintained. For example, while nasal harmony systems involving [+nasal] are widespread (e.g. Orejon, Gokana), the complement process of oralisation, which would target the feature [–nasal], is unattested. Let us briefly consider an alternative approach, couched within a theory of monovalent elements, that has attempted to overcome this potential problem.

3. The Element Theory approach

3.1. Introduction

The response to overgeneration of this sort has typically come in the form of a radical revision of the melodic prime inventory. Specifically, it has been acknowledged that a reduction in the number of primes available to the phonology should go some way towards curbing generative capacity. The only permissible units of subsegmental structure would, of course, be those representing phonological properties which are active in observed processes. Generally speaking, revised approaches to vocalic representation have been based on the insights of Anderson and Jones (1974), who posit a triangular vowel space marked out by the three fundamental "characteristics" listed in (2).

(2)[1]

I-ness	(frontness, palatality)
U-ness	(roundness, labiality)
A-ness	(lowness, openness)

Clearly, a vocabulary of only three melodic primes significantly reduces the potential for autosegmentalisation, the central claim being that the range of harmonic processes exclusively involving vowels (hence, those excluding nasal harmony) should correspond to the set of properties listed in (2).

However, we need look no further than the data in (1) above to see that such a claim cannot be upheld. The harmonic pattern observed in Akan is representative of the kind of assimilation phenomenon which involves an active tongue root property, rather than any of the vocalic properties corresponding to (A), (I) or (U).[2] Assuming the validity of an ATR-harmony analysis for systems such as Akan, a potential problem immediately arises: within the version of Element Theory (see references cited above) adopted throughout the remainder of this discussion, no melodic prime akin to the [+ATR] unit, as exploited by Clements, is currently established as an independent object. The absence of a tongue root element is sufficiently well motivated (at least, theory-internally) for us to rule out a spreading account of the data in (1). The challenge for Element Theorists, then, has become one of finding an alternative means of representing the ATR distinction, together with an alternative mechanism for capturing its harmonic properties.

[1] The basic A-I-U model has been taken up and developed in a number of different frameworks, including Dependency Phonology (Anderson and Ewen 1987), Particle Phonology (Schane 1984), and Element Theory (Kaye, Lowenstamm and Vergnaud 1985, Harris and Lindsey 1995).

[2] Here we follow the position adopted in Harris and Lindsey (1995) with regard to elemental representations. Other triangular approaches to melodic structure do involve one or more of the resonance elements in tongue root contrasts. See, for example, van der Hulst (1989), where it is proposed that a particular manifestation of the (I) prime contributes ATRness to an expression, while (A) is responsible for RTRness.

3.2. Head alignment

The most widely accepted solution has opted for a development of the headship properties of the three resonance elements as a way of approaching the question of ATR distribution. Element Theory standardly employs an asymmetric dependency relation which may exist between different primes within the same melodic expression. This allows one element to be identified as the head of that expression, where head status results in (phonologically) relative salience and (acoustically) relative prominence. For example, the vocalic properties of lowness, present in (A), and labiality, present in (U), may combine in unequal proportions, yielding either the (A)-headed expression (A•U) or the (U)-headed expression (A•U). The relative salience of the head element is, in each case, reflected in the interpretation of these expressions as [ɒ] and [o] respectively. For the purposes of capturing the ATR distinction, this notion of headship is harnessed not as a relational property, as in the way just described, but as an intrinsic property of individual elements. Thus, a headed (U), for example, may potentially contrast with a non-headed (U), the general assumption being that headed expressions (whether single elements or compounds) correspond to ATR vowels, while non-headed structures represent non-advanced vowels. Returning to the illustration of compounds involving (A) and (U), we may now introduce a third combinatory possibility – a headless expression – representing the non-ATR vowel [ɔ]. The three-way distinction shown in (3) is assumed within the version of Element Theory supported in, for example, Harris and Lindsey (1995).

(3) (A•U) = ɒ (A•U) = o (A•U) = ɔ

The view that ATR distinctions are encoded via headship properties is appealing in a number of ways. Most significantly, we do not need to refer to any independent ATR prime, which is clearly beneficial in terms of generative restrictiveness. Furthermore, we need not posit any additional structure in order to capture ATRness; instead, we simply exploit what is already present as an established representational property.

Extending this idea to cases of ATR harmony, we may infer that harmony arises from an agreement with respect to headship across a given domain. Let us illustrate this with reference to examples from the ATR harmony language Maasai (Tucker and Mpaayei 1955).

(4)

a.	pɛrr	'split'
b.	ie	applicative suffix
c.	a-ɪ-pɛrr	infinitive - class 2 - 'split'
d.	aa-i-perr-ie-ki	1 sing. - class 2 - 'split' - applicative - passive

The verb root in (4a) contains no ATR vowels, and hence, no headed vocalic expressions; for the purposes of harmony, it is a headless object. In contrast, the

ATR vowels of the suffix in (4b) indicate that this morpheme is lexically a headed object. This is confirmed by the observation that its headedness properties are seen to "associate" to the vowels of neighbouring morphemes following affixation. The example in (4d) demonstrates these harmonic effects, where the lexically non-ATR root *pɛrr* 'split' is interpreted with the headed expression [e], under the influence of a headed object elsewhere in the prosodic word domain. These forms outline one proposal put forward within the restrictive context of Element Theory to account for the way in which headship harmony of this kind may be achieved. This mechanism of *head alignment* is employed by Lowenstamm and Prunet (1988), Harris and Lindsey (1995), and others.

Harris and Lindsey (1995) employ the case of ATR harmony in Akan to illustrate the way in which the process of head alignment operates. As an alternative to feature spreading, the Element Theory view centres on the claim that harmonic effects arise from changes in the internal representation of harmonising vowels, such effects being triggered by particular characteristics of a dominant vowel present in the relevant domain. Given the means by which the tongue root distinction is captured in (3), it follows that these changes should typically involve a switch in the headship status of nuclear expressions. For instance, within the set of non-low vowels, an expression which is lexically non-ATR may acquire full-headedness in the context of a dominant ATR vowel. It is in this way that head agreement is achieved, where the head elements of every vowel within the relevant span are aligned on the same melodic tier.

Let us recast the Akan data given in (1) in terms of this alignment mechanism. As the examples in (5) demonstrate, harmony is captured by means of headship agreement, where headedness may be most appropriately viewed as the property of a melodic tier, rather than of individual elements. In representational terms, then, the effects of harmony are such that all elements on the designated harmony tier are uniformly either headed or headless (where headed status is indicated by underlining).

(5) a. ɔ-bɛ-tʊ-ɪ 'he came and threw' b. o-be-tu-i 'he came and dug'

The vowels in (5a) are all lexically headless. The absence of any (dominant) headed expression in the word allows each vowel to remain structurally unaltered, thus yielding the non-ATR interpretation [ɔ-bɛ-tʊ-ɪ]. The representation in (5b), on the other hand, is characterised by the presence of a lexically headed expression in the verb root *tu* (see (1b) above), which has a harmonising effect on affix vowels. The aligned configuration in (5b) is achieved by allowing the headship status of recessive vowels to be manipulated via an ON/OFF setting. So, an operation of head switching permits, say, a lexical [ɔ] = (U•A) to be interpreted as [o]

= (U•A) under harmony conditions. As we now demonstrate, this head alignment approach also serves as the basis for a formalised view of headship agreement – in the shape of head licensing – which is applied and developed in, for example, Cobb (1995) and Walker (1995).

3.3. H(ead)-licensing

The mechanism of h(ead)-licensing (see Walker (1995) and references therein) offers a formalised account of the way in which head agreement is achieved across a specified domain. Bypassing the precise details of this procedure, which are not central to the present argument, we address the question of how h-licensing may be incorporated into an overall theory of phonological well-formedness. Its proponents view the mechanism essentially as a "lexical function" which maps headless expressions on to headed ones, although it may also apply in a derivational capacity (where harmony is found to occur in morphologically complex forms, for example). In either case, the melodic configurations which come about via h-licensing must interact with a number of language-specific licensing constraints, the latter serving to restrict the way that elements are permitted to combine within any one system.[3]

Given that both of these devices – h-licensing and licensing constraints – are involved in the manipulation of the same phonological property, that of headship, it is inevitable that a certain degree of conflict will arise with regard to their respective predictions. In some instances of clashing, licensing constraints are overridden, in order that the output of the h-licensing function can remain intact (and thus, be interpreted successfully). In other instances, however, constraints behave as inviolable requirements on structural grammaticality and, as such, force the breakdown of the h-licensing process. In view of this dynamic behaviour shown by h-licensing, its status within the grammar appears somewhat indeterminate. The possibility of resolving grammar-internal conflict on a language-specific basis suggests an approach reminiscent of OT-type constraint ranking (Prince and Smolensky 1993), where the violation of a constraint is sanctioned only to ensure that the conditions prescribed by a more highly ranked constraint (located in a language-particular hierarchy) are met. However, if h-licensing is to be most appropriately seen as a well-formedness constraint on output representations, on a par with the other grammaticality constraints with which it interacts, then its defining characteristic as a *lexical* function is to some extent undermined.

The recent literature has seen a number of attempts to extend the application of head licensing to a wider range of languages exhibiting tongue root harmony. Although the outlook is not altogether discouraging, the results seem to

[3] Licensing constraints are central to the theoretical context in which h-licensing has been conceived. They typically take the form of generalisations regarding the headship of particular elements, e.g. *(A) does not license operators* – see Charette and Göksel (this volume).

indicate that the h-licensing mechanism cannot be subject to the kind of rigid definition that had originally been proposed. Instead, the focus of its development appears to be centred on the incorporation of parametrically controlled properties, in place of absolute requirements. For example, Cobb (1995) suggests that the domain of h-licensing (in Zulu) need not correspond directly with either morphological or prosodic categories,[4] while it is proposed in Denwood (1995) that the directionality of h-licensing be specified on a language-particular basis. In the same paper, Denwood also raises a number of theory-internal matters, such as the predicted incompatibility between the mechanism of h-licensing and the presence of phonologically empty nuclei. The references given above provide discussions of these, and other recent developments in the formulation of h-licensing; these issues will not, however, be pursued here.

Of greater significance to the present argument is the question of the appropriateness of headship harmony to a restrictive theory of well-formedness – whether this is achieved by referring to melodic tiers, following Harris and Lindsey (1995), or to h-licensing, as in Walker (1995) and elsewhere. In other words, how successfully may this approach be incorporated into our established view of phonological structure? In the following section we shall argue that head agreement may be considered problematic in two particular respects. First, it is a structure-altering mechanism, and, as such, is incompatible with a generally established principle of grammar. Second, if we choose to sanction structural (i.e. headship) agreement as a manifestation of VH, then it must exist in addition to, rather than in place of, the established analysis of vowel assimilation as feature/element spreading. Under the assumption that a spreading mechanism is still required in the description of, for example, rounding or palatal harmony, we are then forced to recognise two independent ways – spreading and head agreement – of representing what is essentially the same harmonic effect.

4. Headship harmony: some disadvantages

4.1. Structure Preservation

Recall the Maasai data in (4) above, where we showed how the vowel of a lexically non-ATR morpheme is interpreted as an ATR expression when that morpheme falls within the scope of an ATR suffix. The vowel of the verb root *pɛrr* 'split', specified lexically as [ɛ], is interpreted as [e] under the harmony conditions prevailing in (4d): thus, the melodic expression (A•I) shows up as (A•I). As we have already seen in section 3, it is via headship properties that Element Theory captures this tongue root distinction; and consequently, it is proposed that head-dependent relations can be manipulated, or *switched*, in order to account for vowel alternation. This possibility is exemplified by Charette and Göksel (1996)

[4] In effect, this analysis allows a harmonic domain to be described independently of the harmonic mechanism employed. This view has much in common with the Optimal Domains approach to harmony, as presented in Cole and Kisseberth (1994).

who, within the context of a Government-based approach, propose that VH languages differ with regard to whether or not head-operator switching is permitted, and if so, under which circumstances it operates: they claim, for instance, that switching is ruled out in the phonology of Turkish, but sanctioned in both Sakha and Kazak (requiring a different triggering environment in each case). The same mechanism of switching is also exploited in other triangular models of representation, notably Dependency Phonology. To illustrate, consider the diachronic vowel changes collectively referred to as Old English *i*-umlaut (Anderson and Jones 1977), which include a vowel raising process /æ/→/e/. From a Dependency perspective, such a change is analysed as involving a switch in the dependency relation holding between the two components contained within both expressions – specifically, from {a;i} to {i;a}(where the head appears to the left).[5] We shall claim, however, that a mechanism which allows head status to be manipulated in this way poses a potential obstacle to the established idea of Structure Preservation (SP).

Although the term SP has been employed in the phonological literature for some considerable time, theorists have been less than consistent in defining its status and function. The earliest reference to SP is found in Selkirk (1982), where "structure" specifically relates to syllable structure. Here, the central claim is that syllabic configurations produced during derivation (via resyllabification rules) must conform to the syllable template of the language in question. What is preserved, then, is the set of lexically possible syllable types. Some time later, Kiparsky (1985) transfers a similar conception of SP to melodic structure, where he proposes a ban on the creation of segments which are unable to contrast lexically. That is, a melodic expression produced during the course of derivation must already be a member of the language's segment inventory. Once again, therefore, it is a particular set of lexical possibilities which must remain intact. We shall employ the cover term "Templatic SP" to refer collectively to these formulations; this will allow a straightforward comparison between these and a revised interpretation of the notion SP to be introduced below.

In some representational models, the emphasis on preserving phonological structure has been extended to include not only the individual units referred to at the lexical level, but also the particular relations holding between those units. This position is perhaps most strictly maintained in the Government-based literature[6] where, following the view currently established within syntax, it is assumed that the licensing relations present at derived levels of representation are necessarily the same as those given lexically. Harris (1994) offers a phonological

[5] Interestingly, this switching analysis survives in the Dependency Phonology literature alongside an apparent commitment to the Dependency Preservation Condition (Anderson 1986), which states that "dependency relations are preserved, where possible, throughout a derivation (and in diachronic changes)" (1986:84). In its original formulation, this condition refers to headship stability in processes such as monophthongisation.

[6] See, for example, Charette (1991), Harris (1994), Brockhaus (1995), and references therein.

instantiation of Structure Preservation which requires that licensing conditions holding of lexical forms also hold of derived representations. As with the formulations of Templatic SP given above, this has the effect of preventing a phonological process from adding to a language's inventory of prosodic templates or patterns of melodic association defined in the lexicon.

On the other hand, Kaye *et al.* (1990) choose to develop the issue of SP primarily in relation to prosodic structure – that is, in relation to those lexical categories that are (potentially) projected. This is achieved by making a direct appeal to the representation of syntactic structure, and specifically, to the Projection Principle (see Chomsky 1981, 1986). The latter requires that relational properties (e.g. subcategorisation) be "projected" from the lexicon on to the derived structure, thus ensuring that lexical structure is fully represented at every syntactic level. We observe the effects of this projection in a number of ways. For instance, head-complement relations established in the lexicon must be preserved throughout derivation – the head/complement status of an object is immutable with respect to any dynamic structural operations. From this, it follows that the categorial status of lexically specified constituents must similarly remain fixed. So, if a position is projected from the lexicon as a verb phrase, then it cannot lose this identity during the course of derivation.

As Kaye *et al.* demonstrate, there are clear advantages to be gained from transferring the syntactic notion of lexical projection to the phonology. In a Government-based approach, it is assumed that all prosodic units must participate in licensing relations with each other,[7] and that such relations contribute to the well-formedness of lexical objects. By allowing the Projection Principle to constrain phonological derivation – thereby ensuring that the licensing relations established in the lexicon are maintained at all levels – we are able to make the (desirable) prediction that no resyllabification operations of any kind will be permitted. This result is obtained if we assume that a timing unit which is resyllabified must either undergo some change in its categorial status, or otherwise must be involved in a change affecting prosodic licensing relations.

Whether or not melodic structure should be similarly controlled by constraints such as SP or the Projection Principle is clearly a matter for debate. It may be argued that the behaviour of melodic elements ought not to be expected to mirror that of prosodic constituents, given the fundamental differences existing between the two planes involved – for example, all units of prosodic structure must be lexically identified as either a head or a complement, whereas the elemental expressions of melodic structure may stand as "headless" objects. However, from the discussion in 3.3 it is evident that, like prosodic units, the melodic elements, together with the relations holding between them, are nevertheless subject to certain licensing conditions; this much is clear from the way in which

[7] This requirement results from the Phonological Licensing Principle (Kaye 1990), which demands that all phonological units, with the exception of the ultimate domain head, must be licensed.

(melodic) licensing constraints are formulated and expressed within the model.[8] So, if we consider the notion of licensing to be responsible for the well-formedness of both melodic and prosodic structure, then it is reasonable to make the further assumption that the nature of licensing relations ought to be determined, in both cases, by the same set of principles (some of which are universal generalisations, others system-specific). In other words, the principles of licensing should determine the grammaticality of structure *in general* – an assumption that highlights the way in which the notion of licensing may be seen to unify the different components of a phonological representation into a single, coherent structure. This goal of a unified melody-prosody representation has much in common with the Dependency Phonology notion of Structural Analogy (Anderson 1987, 1992), which assumes that all levels of representation are characterised by the same fundamental principles of structure – including the dependency or modifier-head relation. On the basis of Structural Analogy, we can assume that, for instance, the Phonological Licensing Principle (see note 7) refers to melodic elements as well as prosodic constituents, since both are to be viewed as phonological units that must be licensed within their respective domains.

Having established this theoretical stance, let us return to the question of head switching, by which tongue root harmony is achieved within the standard Element-based model. Recall that a lexically headless object such as [ɛ] = (A•I) may be interpreted as its headed counterpart [e] = (A•<u>I</u>) in the appropriate harmonic environment. Here we make the claim that a mechanism which can convert [α] into [<u>α</u>] must constitute a violation of SP and/or the Projection Principle, in view of the fact that the lexically assigned head-dependent relations controlling the organisation of melodic categories – and consequently, the licensing relations responsible for determining headship status – are overridden during the course of derivation. For orthodox Element theorists, the question of whether the Projection Principle is violated in such cases does not arise, since it is claimed that the latter involves only the projection of *prosodic* categories from the lexicon, thus placing melodic structure outside the scope of its influence. We argue, however, that the constraining effects of the Projection Principle are not sufficiently restrictive. An obvious inconsistency arises from the assumption that, while the notion of licensing is equally applicable to both melodic and prosodic units, the preservation of licensing relations is restricted exclusively to the prosodic structure.

Turning to the question of SP violation, it may not be immediately apparent how such a conclusion is to be motivated; indeed, we acknowledge that this failure to preserve lexically-given structure may not seem to correspond directly to the idea of Templatic SP outlined above (which is chiefly concerned with the control of a language's inventory of structural resources). In response, however, we propose an alternative – a stronger, and more highly restrictive – instantia-

[8] Proposed constraints on element licensing include *Nothing can license (I)* (for English), *Operators cannot be licensed* (for Zulu) and *(A) cannot be a head* (cross-linguistic).

tion of the general SP formula which extends Kaye's implementation of the Projection Principle to incorporate the entire phonological structure.

(6) INHERENT STRUCTURE PRESERVATION (ISP)

Lexical head-complement relations must be retained throughout derivation

The condition in (6) effectively places a ban on any move which results in a change in the relation between phonological units – where a relation may be one of government, or dependency, or licensing, for example. ISP also entails a ban on any categorial change, whether "category" refers to a syllabic constituent or to a melodic prime, thereby ruling out any operation of head switching as a grammatical possibility. Thus, in the same way that, for example, a lexically specified onset position cannot be re-defined as a rhymal complement, we shall claim that a melodic object such as [α] cannot be interpreted as another object [α̲], without falling foul of this very general constraint on phonological derivation. While there appears to be little motivation for ruling out the introduction of *additional* licensing relations during derivation, the reasons for preserving lexically established (i.e. inherent) relations – and consequently, the head or dependent status of melodic primes – are compelling from the point of view of restrictiveness.

4.2. A non-uniform analysis of harmonic agreement

Leaving aside the issue of SP violation, we encounter a further difficulty with respect to head alignment and h-licensing when we consider the analysis of VH from a rather more general perspective. In broad terms, we may view harmony as some kind of agreement with respect to a melodic property across a wide domain. We shall claim, therefore, that it is not unreasonable to expect all instances of harmony to be explained in the same way, regardless of which particular melodic property happens to be active in any given case. Such an outcome is especially appealing within the context of a restrictive theory of representation, where the desire to minimise the number of possible process types is given high priority. Ideally, then, cases of rounding or palatal harmony should be captured in the same way as, for example, ATR or height harmony. By adopting a head agreement analysis, however, we encounter difficulties with many instances of harmonic alternation, as demonstrated by the Chamorro data given below.

The Philippine language Chamorro has a vowel fronting system (i.e. palatal harmony) in which the following melodic changes occur in the first syllable of a root, when that root is preceded by a front vowel.

(7) u → i
o → e
a → æ

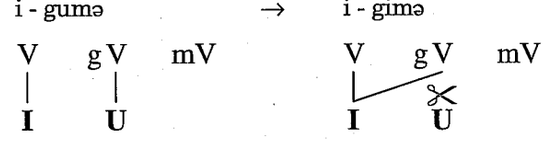
These vowel alternations are exemplified in (8). The nominal roots in (8a) are interpreted as the "palatalised" forms in (8b) when they follow the [i] vowel of the definite article (data taken from Kenstowicz and Kisseberth 1979).

(8)

a.			b.		
	gumə	'house'		i gimə	'the house'
	tomʊ	'knee'		i temʊ	'the knee'
	lahɪ	'male'		i læhɪ	'the male'

Recall that, under a head alignment analysis, vowels are either headless, or they are all headed by an element on the same tier (see (5) and the discussion in 3.2 above). Yet with respect to the Chamorro alternation, the headship status of individual vowels seems to behave as an essentially redundant property: whether we consider the alternating vowel of [gumə] to be a headless (U) or a headed (U̲), we are unable to arrive at the desired output form in any straightforward way. In order to successfully capture the effects of palatal harmony, we would most likely have to describe the sequence of events shown in (9), where the delinking of (U) is forced by the spreading of the (I) element.

(9)



An analysis of the same facts in terms of a mechanism akin to h-licensing proves equally inappropriate. The latter appears to have been formulated solely as a means of describing the kind of headship agreement found in ATR harmony systems. While nothing prevents us from introducing an operation such as I-licensing for describing palatal harmony, we suggest that this can exist only in addition to, rather than in place of, a more conventional I-spreading account.

In the light of harmony systems such as Chamorro, let us return to the problem alluded to above – namely, that we have two independent ways of representing the propagation of a melodic property beyond its lexically given domain. On the one hand, we must recognise the validity of a spreading account in the context of palatal harmony cases,[9] and on the other, we must rely on some kind of alignment or head licensing for tongue root systems. Yet the end result of these two mechanisms is essentially identical, to the extent that a melodic property is uniformly present, or *active*, throughout a given domain. In view of this functional overlap, we will now present an alternative means of representing the specification of melodic properties which, we claim, will make some advancement towards a uniform description of harmonic agreement.

[9] Presumably, this may be extended to include other harmony types, involving *rounding* and *nasal*, for instance.

5. Harmony as element activation

5.1. Introduction

Recall the strict interpretation of SP (labelled ISP) we offered in 4.1, which required that all aspects of lexical structure be preserved throughout phonological derivation. While this position allows for the possibility of structure-building operations such as the introduction of new licensing relations, it places a ban on any move which fails to leave lexical information intact. The latter effectively eliminates i. all categorial changes, and ii. any changes in the licensing relations established in the lexicon. The changes grouped under i. typically involve the substitution of one representational object for another, whether "object" refers to a prosodic category such as a syllabic constituent, or to a melodic expression such as (A). In order to maintain this stance, we are forced to introduce a number of modifications to our basic view of melodic representation, particularly with regard to headship distinctions. We show how this revised approach will permit us to accept the fundamentals of head alignment, but without the potential problems associated with SP violation.

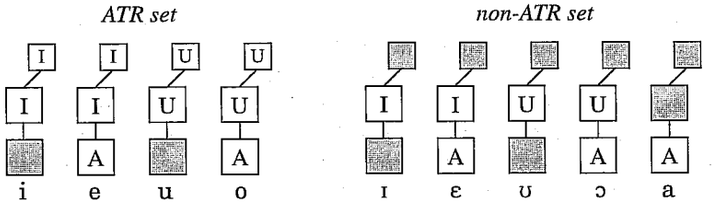
Our modified approach to melodic structure also assists in providing a unified account of harmonic agreement, thus overcoming the "functional overlap" described in 4.2 above. We introduce the notion of element activation – a lexical instruction which specifies the melodic material that may potentially be interpreted in the phonological string. Any member of the element inventory may be selected as an activation target; and furthermore, it is proposed that a means of identifying a specific domain of activation be included as an integral part of the lexical instruction itself. We anticipate the mechanism of element activation to be sufficiently flexible to encompass a range of phonological events, including minimal lexical contrasts and harmonic alternation in its numerous guises. As an ultimate objective, elemental activation would effectively dispense with the need to rely on spreading in the description of assimilatory, and other phenomena. In the present discussion, however, our aims are rather more modest, and we shall demonstrate the suitability of an activation approach to vowel harmony operating at the word level.[10]

5.2. Melodic templates

We propose that the nine-vowel system of Maasai be represented as in (10).

[10] See also Backley (1998) for an analysis of Yoruba VH in terms of foot-level activation.

(10)



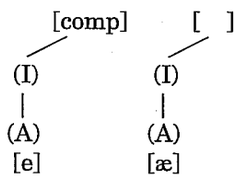
The structure shown in (10) departs from the standard autosegmental view of representation in two respects. First, we claim that a full set of resonance elements is present within each nuclear expression, which allows all the vowels of a language to be defined with reference to the same structural configuration. Under this assumption, melodic oppositions are expressed not in terms of the presence or absence of particular elements, but via the *activation* of elements already resident in the structure. The filled boxes in (10) show activated elements, while the shaded boxes indicate inactive melodic material. Second, we introduce the notion of *complement tier*, which has the effect of enhancing the acoustic image of its head element. In the context of the present illustration, the complement tier contributes ATRness to the expression in which it is active.

As suggested in Backley (1995), we shall assume that the vocalic inventory of a language is circumscribed by a parametrically defined configuration of melodic tiers. This follows the idea of tier division/conflation developed in, for example, Kaye *et al.* (1985) and Rennison (1987), whereby any elements residing on the same melodic tier are barred from co-existing within a single expression. Thus, the widespread symmetrical five-vowel system found in Spanish, for instance, must recognise a shared "colour" tier comprising the elements (I) and (U), together with an independent (A)- or "aperture" tier. In this way, three distinct vowel heights may be generated, while the presence of rounding in front vowels is categorically ruled out. Turning to the inventory of Maasai, we find that an identical set of conditions holds with respect to both height distinctions and the question of front-rounding. Additionally, however, the Maasai system involves opposition along another dimension described as tongue root advancement or ATRness. We have already seen how the standard Element-based model employs headship properties to encode these tongue root contrasts. We have also discussed some of the shortcomings associated with such an approach, especially with regard to the issue of head switching as a non-structure-preserving event.

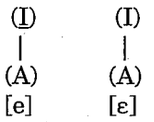
We argue that, by reconfiguring the headed/headless distinction in a structurally dynamic way – namely, via the postulation of a colour tier complement – the problems arising from head switching may be successfully overcome. Our proposal motivates the representation in (10) for systems like Maasai, where a complement tier (contributing ATRness in non-low vowels) is superimposed on

to a basic 5-vowel configuration to yield a structure consisting of three distinct melodic tiers: the colour tier, its complement, and an aperture tier. As already mentioned, the phonetic effects of an active complement are such that the acoustic properties of its head become enhanced. This, of course, directly parallels the way that the more traditional notion of headship status affects the interpretation of an expression: if we compare (I•A) with its headless counterpart (I•A), we find headedness translating into the relative salience of the expression's colour property, palatality. As far as interpretation is concerned, then, it seems that the phonological opposition encoded in (11a) is all but identical to that given in (11b) – in other words, that the concept of complement tier is, in fact, merely a notational variant of the established headship distinction.

(11) a.



b.



The present discussion aims to demonstrate, however, that there are significant benefits to be gained from adopting the structure in (11a), these advantages becoming apparent when the idea of complement tier is taken up in conjunction with the notion of element activation, to be described in 5.3 below.

It is important to note that the addition of, say, an (I)-tier complement to a melodic expression does not constitute any increase in the number of *tokens* of the (I) element present in the structure. In other words, a [comp] does not imply the operation of any kind of element stacking system, akin to that assumed in the standard Particle Phonology approach (Schane 1984, 1995). In the latter, a potentially unrestricted number of tokens of any given prime could be employed in order to generate a potentially unlimited set of phonological contrasts. In theory, a grammar could therefore support the unlikely opposition between the expressions (I•I•I•A) and (I•I•I•I•A), where the additional token of (I) in the second structure is intended to contribute to the greater salience of palatality inherent in that structure.

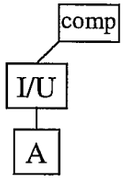
In contrast, the proposed notion of complement tier closely reflects the head/complement relation as it is motivated and employed elsewhere in the phonology (i.e. in prosodic structure) – and indeed, elsewhere in the grammar. For example, it is maximally binary; thus, in the same way that a nuclear head may license, at most, a single complement position, a melodic prime such as (I) is similarly restricted to one complement.[12] Furthermore, following the way in which

[12] See Takahashi (in prep.) for a discussion of the Unique Path Constraint, which captures this binarity restriction in melodic structure without the need to refer to the (in this context, irrelevant) principles of locality or directionality that characterise the binary relations holding within prosodic structure.

a nuclear complement is dependent on the presence of a non-empty head position, we assume that an (I)-comp cannot be activated unless its head element is also active. This serves to highlight the asymmetric dependency which necessarily holds between a head (I) and its complement. There is ample justification, therefore, for treating the complement tier not as an additional token of an element, but rather, as a controlled means of expanding the phonological properties of its lexically specified head. By exploiting the established head-dependent relation in this way, we bypass the need to stipulate any (binary) upper limit on the number of tokens of any element present within an expression.

Let us return to some of the assumptions that have been made above. First, we began by assuming a full set of vocalic elements to be present under each nuclear position in the phonological string. Second, we have assumed the validity of a sub-segmental melodic geometry, which predicts the range of vowel contrasts exploited within any one system (such as the colour vs. aperture split which characterises the canonical 5-vowel system). On the basis of these two claims, we are able to recognise a particular structural configuration, or melodic template, such as the one shown in (12) for the vowel system of Maasai. From this template we may derive the full set of vowel oppositions of the language in question.

(12) *Melodic template for Maasai*



If an element template such as (12) contains a full set of elements and resides under each nuclear slot, then it is clear that the conventional approach to melodic opposition – which relies on the presence vs. the absence of an element – is no longer appropriate for the purposes of representational distinction. Instead, the ubiquitous presence of a prime forces us to investigate an alternative means of encoding lexical contrast, which we propose to express in terms of element activation. This is described below.

5.3. Element activation

As already indicated, we shall claim that an element contributes to the overall interpretation of an expression only if that element has been activated; inactive elements fail to be interpreted, and are therefore only latently present in the structure (the shaded boxes in (10) represent inactive elements). By what means, then, does an element become active? We propose that activation is essentially a lexical instruction. Thus, the melodic properties of a morpheme (which are, of

course, idiosyncratic) are specified in terms of a series of activation "operations" occurring at different points throughout the length of the phonological string. So, the vowel in the English word *foot* is represented in the lexicon by the single instruction ACTIVATE (U). On the other hand, a melodically complex expression, such as a front mid vowel, is encoded lexically by means of (at least) two simultaneous activation instructions – ACTIVATE (I) and ACTIVATE (A). Note that a third instruction, ACTIVATE [COMP], may also be involved (see (11a) above), depending on the melodic template of the language in question.

Returning to the representation of Maasai vowels given in (10), we find that the two harmonic sets, ATR and non-ATR, are structurally distinct – they are identified by an active [comp] and an inactive [comp], respectively. Accordingly, we expect the lexical specification of the vowel [i], for example, to contain the instruction ACTIVATE [COMP], which is lacking in this vowel's non-ATR counterpart [ɪ]. However, we have already remarked on a particular feature of the ATR property in Maasai, such that, whenever it is present in a morpheme, its melodic properties are extended to encompass the remaining vocalic expressions within the same word domain too. In other words, the language exhibits dominant ATR harmony. We suggest that this harmonic behaviour may be formalised by referring to the same operation ACTIVATE [COMP], but by ruling that, in the case of Maasai and similar harmony systems, this instruction be specified at the level of the prosodic word. Indeed, we claim that it is this word-level activation of [comp] which gives Maasai its particular harmonic characteristics.

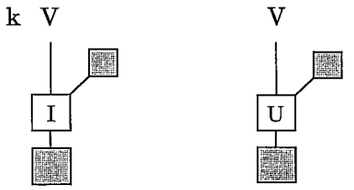
In the light of our proposal, let us consider some examples of root-controlled harmony in this language.

(13) *Focus: root-controlled harmony*

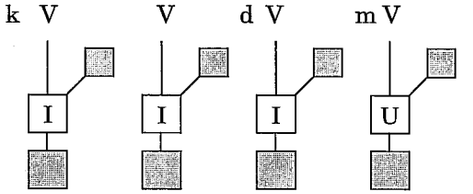
a.	kI-ñorr-U	kiñorru
	1pl-*love*-extra future	'we shall love'
b.	kI-IdIm-U	kɪdmʊ
	1pl-*be able*-extra future	'we shall be able'

As illustrated in (14a) and (14b), the affixes *kI-* (1pl prefix) and *-U* (extra future suffix) contain an inactive complement tier. This is encoded lexically by the absence of any ACTIVATE [COMP] instruction.

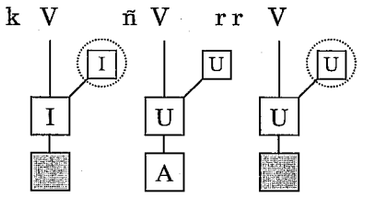
(14) a. *1pl. prefix* b. *extra future suffix*



c. kɪ-ɪdm-ʊ



d. ki-ñorr-u



However, when these forms are attached to an ATR root in the formation of a prosodic word, the complement tier is activated in the affix vowels, due to the presence of an active [comp] in the verb root. (More specifically, it is the *word-level* instruction to activate the complement tier which brings about the harmonic agreement observed).

As demonstrated by the representations in (14c) and (14d), wide-scope activation – that is, activation affecting a domain larger than that defined by a single nucleus – gives rise to the kind of agreement which has already been characterised in 3.2 as *alignment*. Following Harris and Lindsey (1995), we maintain that this notion plays an important role in the formal definition of harmony. But rather than opting for the alignment of headship status, we see this form of structural agreement as one which requires all (or otherwise, none) of the elements on a particular tier to be active throughout a given domain. In this way, we are able to generalise our description of harmony by referring only to the notion of activation.

(15) ACTIVATE 'α'

TYPE OF HARMONY	ALIGNMENT TARGET
palatal harmony	(I)
rounding harmony	(U)
nasal harmony	(N)
height harmony	(A)
tongue root harmony	[comp]

Our proposals, then, are supported by the claim that element activation is applicable to any type of harmony – thus dispensing with the apparent "functional overlap" described in 4.2 above.

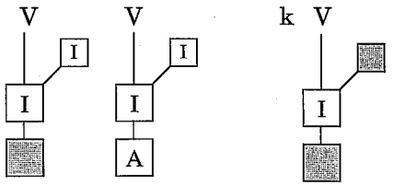
The example language Maasai has been analysed as one which features a dominant ATR harmony system. Having considered the effects of root-controlled harmony, let us briefly return to the case of suffix-induced harmony cited earlier. The data in (4) are repeated here.

(16) *Focus: suffix-induced harmony*

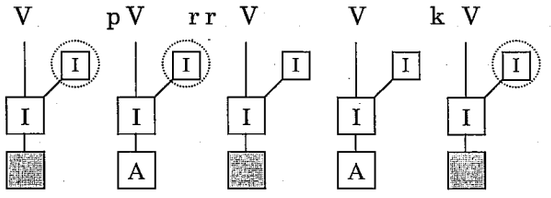
a.	aa-I-pErr-ie-kI	aaiperrieki
	1s-classII-*split*-applied-pass.	'I was split with something'
b.	A-I-pErr	aɪpɛrr
	infinitive-classII-*split*	'to split'

The form in (16a) contains two suffixes: in *-ie* (applied) the colour tier complement is lexically active, while in *-kI* (passive) it is inactive. When both suffixes are attached to a non-ATR root, the complement tier is activated throughout the extended prosodic word domain. This effect comes about as a result of the same requirement that was stated above with respect to the case of root-to-suffix harmony – namely, that the instruction ACTIVATE [COMP], which contributes to the lexical representation of the form *-ie*, is specified as a word-level property, and thus, affects all the nuclear expressions occurring within the scope of that domain. If no inherently ATR suffixes follow a root such as *pɛrr* 'split', then the complement tier remains inactive.

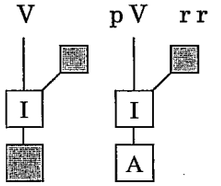
(17) a. *applied suffix* b. *passive suffix*



c. aa-i-perr-ie-ki



d. a-ɪ-pɛrr



The lexical forms of the two suffixes – one ATR, the other non-ATR – may be compared in (17a) and (17b). Harmonic effects within the prosodic word domain are then illustrated in (17c), which shows how alignment along the complement tier results from the word-level activation of [comp], yielding so-called ATR agreement.

In this account of Maasai harmony we have been able to describe the facts without referring to any head switching operation of the kind that is required under a head agreement analysis. Since the flipping of head/licensee status is never observed in prosodic structure, we maintain that it should similarly be ruled out at the melodic level. To this end, we have attempted to model the acquisition of headedness in terms of alignment along the complement tier, which is specified lexically as a word-level activation instruction. In this way, lexical head-complement relations are retained throughout derivation, and no new structure need be introduced which was not already present in the lexicon (since a full melodic template is assumed at all stages). In short, the above proposals allow us to maintain a highly restrictive interpretation of Structure Preservation, set out in (6) above as ISP. We claim that this, together with the benefits to be gained from a unified approach to harmonic description, as summarised in (15), supports the postulation of activation as a feasible alternative to current analyses which employ structural operations such as spreading, head alignment, and h-licensing.[12]

6. ATR harmony in Akan

For many years, the West African language Akan has been employed as a favoured source of data for studies into the mechanisms underlying tongue root harmony (see Stewart (1967) and Clements (1981)). We shall assume that an approach in terms of element activation and alignment will account for the basic distributional facts and harmonic alternations, and that such an account would largely duplicate the analysis of ATR harmony already given in the case of Maasai above. For this reason, we set aside any discussion of these regular harmonic

[12] At this preliminary stage, we cannot categorically rule out the need for a lexical operation which *de*activates melodic material (the case of metaphony in certain dialects of Italian may be an appropriate instance – see Calabrese 1984). However, we predict that most apparent examples of deactivation will be accountable for in terms of prosodic conditioning.

patterns, and instead, focus our attention on another feature of the Akan harmony system, the opaque behaviour of low vowels.

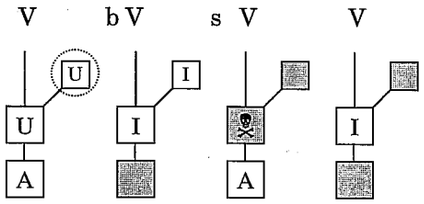
(18) *Focus: low vowel opacity*

a.	o-bisa-ɪ	'he asked'	*o-bisa-i
b.	wa-kɔri	'he has weighed it'	*wɔ-kɔri

This language employs a vowel inventory similar to that of Maasai (the latter is fully illustrated in (10) above). The vowel set of Akan differs from (10) only with respect to the inclusion of a tenth vowel, transcribed here as [ɔ], the distribution of which suggests that it be identified as the ATR counterpart of the low vowel [a]. The non-ATR low vowel [a] is interpreted as [ɔ] when the following two conditions are met: i. it is not morpheme-final, and ii., it is immediately followed by an ATR span (see Backley 1998 for a formal treatment of the ATR alternation in low vowels).

A particular feature of the low vowel in Akan is that it blocks the progression of ATR agreement across a domain, as shown in (18a). In the context of our proposed model, this example is represented as follows.

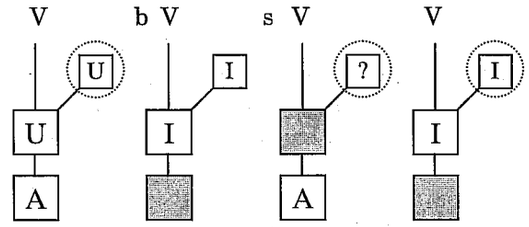
(19) o-bisa-ɪ



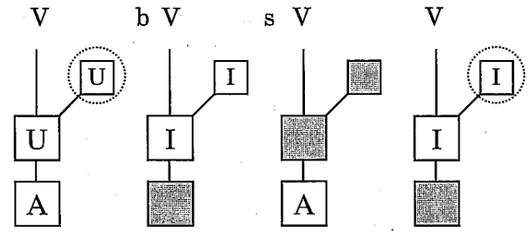
In order to account for the low vowel opacity – that is, the incomplete alignment – shown here, let us consider the representation itself for a possible explanation. Recall our earlier description of the notion "complement tier" (see 5.2), where we noted the requirement that [comp] could be active only if its head element was also active. This restriction was seen to serve two purposes: first, it limits the range of contexts in which the licensing of [comp] can be sanctioned; and second, it brings the concept of "complement tier" into line with the notion "complement" as it is more generally employed elsewhere in the phonological vocabulary (a parallel with the complement position of a branching syllabic constituent was used to illustrate the point).

In the example *o-bisa-I* 'he asked', the low vowel contains no active colour tier, and consequently, no appropriate licenser for an active [comp]. Under this nuclear position, then, the instruction ACTIVATE [COMP] fails to have any effect, due to the inactive status of the head element. In addition, however, this failure has repercussions for other vowels within the same word domain. At the particular point in the phonological string where [comp] cannot be interpreted, the span of activation effectively collapses, resulting in a breakdown in the transmission of the lexical activation instruction. From this, we are able to develop a specific characterisation of alignment in terms of an *unbroken* span of activation – a description that fully accords with the way in which "activation" has been employed in the examples above.

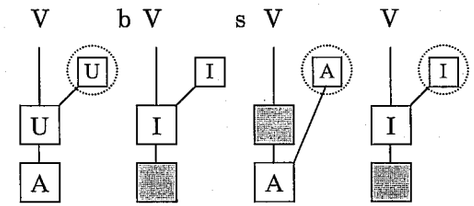
(20) a. *ACTIVATE [COMP] *without active head element*



b. **Interruption of activation span*



c. **Violation of Structure Preservation*



The ill-formed configurations in (20) demonstrate how low vowel opacity remains the only grammatical outcome in the present example. While (20a) depicts the impossible situation of allowing an active [comp] with an inactive head element, the structure in (20b) highlights the necessity of recognising a continuous span of activation for the harmonic property [comp]. This interruption within the activation domain corresponds to the "breakdown in the transmission of the lexical activation instruction" referred to above. (20c) shows a structure which we assume to be universally ill-formed; consequently, such a configuration must lie beyond the generative capabilities of the model. Here, the active

(A) in the root-final vowel carries the burden of transmitting the lexical instruction to the rightmost nuclear position. In this case, however, the configuration requires a structure-changing operation (in which a new relation is introduced between [comp] and the aperture tier), and is ruled out in accordance with our restrictive view of SP. In conclusion, (19) must be regarded as the most satisfactory and well-formed representation, despite its incomplete alignment. Thus, the string [o-bisa-ɪ] remains the only attested interpretation of the verb phrase in question.

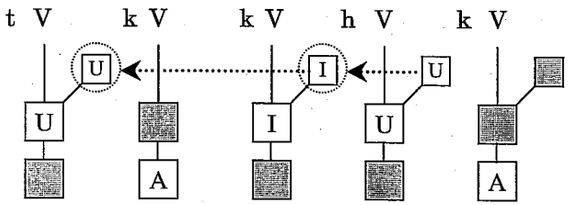
While the opacity effects observed in Akan are readily predicted as a consequence of the representations employed, it would appear that additional machinery is required in the description of the more marked option of low vowel transparency, as exemplified by the ATR harmony language Kinande (see Hyman 1989 and Valinande 1984).

(21)	tu-ka-ki-lim-a	'we exterminate it'	*tʊ-ka-ki-lim-a
	tu-ka-ki-huk-a	'we cook it'	*tʊ-ka-ki-huk-a

In these Kinande forms, the verb roots *lim* 'exterminate' and *huk* 'cook' are both ATR, and trigger harmony on other vowels sharing the same domain. In such cases, however, tongue root agreement is observed on *all* potentially alternating vowels, despite the presence of a word-medial low vowel in the prefix *ka-*. In this language, then, ATR harmony is permitted to radiate from the root throughout the entire word domain, effectively "passing through" the non-harmonising low vowels *en route*. So, how should this difference between opacity and transparency be treated in the phonology? We propose that the treatment of such cases requires the introduction of notions such as localised constraint ranking, which immediately places any detailed analysis of these patterns beyond the scope of the present discussion. To gain an insight into the direction that an activation account might take, however, let us consider the following two possibilities.

First, we might assume a configuration of the following sort, in which local relations are preserved between the units on the complement tier (resulting in an unbroken span of activation), but where [comp] activation can still effectively "skip over" the harmonically neutral vowel [a].

(22) tu-ka-ki-huk-a 'we cook it'



In this configuration, the active (U)-comp and active (I)-comp of the two high vowel prefixes are adjacent on their melodic tier. The absence of any [comp] slot in the melodic template of the intervening low vowel [a] then allows the lexical activation instruction to construct a harmonic span right up to the left edge of the word domain; crucially, this is achieved without any violation of the condition on locality. It is suggested in Backley (1998) that certain structural units may be omitted from the representation in accordance with the Principle of Structural Economy (PSE) – a formal instantiation of a very general criterion of representational simplicity. In particular, the PSE isolates any unit which fails to be independently motivated, either by serving as a target for lexical activation or by playing an active role in maintaining the well-formedness of the structure as a whole (e.g. by acting as a licenser for another unit). Evidently, the inactive [comp] unit may be identified in this way, and is consequently eliminated in those languages where the PSE has a dominant influence on overall well-formedness; this move then permits complement tier activation to progress unhindered throughout the word domain.

An alternative account of the transparency case might exploit the notion of percolation as a means of transmitting the relevant harmonic activation instruction to all vowel targets in the domain. This option is explored in Takahashi (in prep.), to which the reader is referred for a full explanation. Briefly, however, percolation can be conceived of as the instantiation of the lexical instruction ACTIVATE [α] applied for a non-terminal prosodic domain. Alignment is then achieved if all the (relevant) terminal positions within the domain fulfil the required instruction. However, if some positions fail to become active, while others are targeted for harmonic activation, this presents a case of transparency. According to this line of argument, the difference between transparency and opacity is not explained by referring to the composition of melodic units – for example, the transparent low vowel in Kinande may well have the same melodic structure as the opaque one in Akan. Instead, such a difference reflects how alignment is prompted in any given system – by (top-down) percolation as described here, or by (string-adjacent) expansion as illustrated earlier.

7. Summary

This discussion has identified one particular aspect of the Element Theory approach to melodic structure which, we have suggested, fails to maintain the same level of restrictiveness that is characteristic of the theory as a whole. In order to provide a satisfactory description of vowel harmony phenomena, we have shown that two independent devices must be employed – on the one hand, the conventional notion of spreading, and on the other, the idea of headship agreement. This has the effect of expanding the repertoire of possible phonological operations to include not only spreading and delinking, but also head alignment/licensing. We have argued that this move augments the model's predictive power unnecessarily, and consequently, is undesirable from the point of view of generative restrictiveness.

In an attempt to unify these two disparate mechanisms, we have motivated a melodic structure in which a full set of elements is present under each position; the primes are arranged according to a language-specific melodic template established according to parametric choice. Lexical oppositions are then encoded by means of a single instruction ACTIVATE [α], where α is a variable over the universal set of melodic units available to the phonology. Included in this set is the object we have referred to as [comp] or "complement tier", which represents – in a structurally dynamic way – the properties typically described in terms of melodic headship. We propose that α may be activated at different levels of the prosodic structure to give a range of different assimilatory or harmonic effects.

As the account of harmony in Akan has demonstrated, we may appropriately equate an active [comp] with the melodic property of ATRness. This allows us to collapse into a single mechanism the two independent devices formerly required in the description of, on the one hand, harmony involving resonance elements, and on the other, harmony involving tongue root properties. We have also aimed to show how a restrictive interpretation of Structure Preservation may be maintained in the context of the proposed modifications. While the present discussion has considered only cases of word-level harmonic agreement, we suggest that a key area for future research will explore the extent to which the notion of activation can be generalised to accommodate other phonological events too. By allowing lexical activation to interact with universal principles of licensing, we anticipate that the predictive power of the model will be further enhanced – to the point where we can expect to account for a range of phenomena such as local harmony, lenition, and reduplication.

References

Anderson, J. M. (1986) Suprasegmental dependencies. In *Dependency and nonlinear phonology*. J. Durand, ed., 55-133. London: Croom Helm.

Anderson, J. M. (1987) Structural analogy and dependency phonology. In *Explorations in dependency phonology*. J. M. Anderson and J. Durand, eds., 15-48. Dordrecht: Foris.

Anderson, J. M. (1992) *Linguistic representation: structural analogy and stratification*. Berlin: Mouton de Gruyter.

Anderson, J. M. and C. J. Ewen (1987) *Principles of dependency phonology*. Cambridge: Cambridge University Press.

Anderson, J. M. and C. Jones (1974) Three theses concerning phonological representations. *Journal of Linguistics* 10:1-26.

Anderson, J. M. and C. Jones (1977) *Phonological structure and the history of English*. Amsterdam: North-Holland.

Backley, P. (1995) A tier geometry for vowel systems. *UCL Working Papers in Linguistics* 7:399-436.

Backley, P. (1998) *Tier geometry: an explanatory model of vowel structure*. Ph.D. dissertation. London: University College London.

Backley, P. and T. Takahashi (1996) Activate α: harmony without spreading. *UCL Working Papers in Linguistics* 8:487-518.

Brockhaus, W. (1995) Skeletal and suprasegmental structure within government phonology. In J. Durand and F. Katamba, eds., 180-221.

Calabrese, A. (1984) Metaphony in Salentino. *Rivista di Grammatica Generativa* 9/10:1-140.

Charette, M. (1991) *Conditions on phonological government*. Cambridge: Cambridge University Press.

Charette, M. and A. Göksel (1996) Switching and vowel harmony in Turkic languages. In *A Festschrift for Edmund Gussmann from his friends and colleagues*. H. Kardela and B. Szymanek, eds., 29-55. Lublin: Redakcja Wydawnictw KUL.

Charette, M. and A. Göksel (this volume) Licensing constraints and vowel harmony in Turkic languages.

Chomsky, N. (1981) *Lectures on government and binding*. Dordrecht: Foris.

Chomsky, N. (1986) *Knowledge of language: its nature, origin, and use*. New York: Praeger.

Clements, G. N. (1977) The autosegmental treatment of vowel harmony. In *Phonologica 1976*. W. U. Dressler and O. E. Pfeiffer, eds., 111-119. Innsbruck: Innsbrucker Beiträge zur Sprachwissenschaft.

Clements, G. N. (1981) Akan vowel harmony: a nonlinear analysis. *Harvard Studies in Phonology* 2:108-77.

Cobb, M. (1995) Vowel harmony in Zulu and Basque: the interaction of licensing constraints, h-licensing and constituent structure. *SOAS Working Papers in Linguistics and Phonetics* 5:23-39.

Cole, J. and C. Kisseberth (1994) An optimal domains theory of harmony. *Studies in the Linguistic Sciences* 24(2):1-13.

Denwood, A. (1995) Could Khalkha Mongolian be a head-licensing language? A comparison between Khalkha Mongolian and Vata, a typical 'ATR-harmony' language. *SOAS Working Papers in Linguistics and Phonetics* 5:41-63.

Durand, J. and F. Katamba, eds. (1995) *Frontiers of phonology: atoms, structures, derivations*. London: Longman.

Goldsmith, J. A. (1976) *Autosegmental phonology*. Bloomington: Indiana University Linguistics Club.

Harris, J. (1994) *English sound structure*. Oxford: Blackwell.

Harris, J. and G. Lindsey (1995) The elements of phonological representation. In J. Durand and F. Katamba, eds., 34-79.

Hulst, H. van der (1989) Atoms of segmental structure: components, gestures and dependency. *Phonology* 6:253-284.

Hyman, L. M. (1989) Advanced tongue root in Kinande. Ms. Berkeley: University of Calfornia.

Kaye, J. (1990) 'Coda' licensing. *Phonology* 7:301-330.

Kaye, J., J. Lowenstamm, and J-R. Vergnaud (1985) The internal structure of phonological elements: a theory of charm and government. *Phonology Yearbook* 2:305-328.

Kaye, J., J. Lowenstamm, and J-R. Vergnaud (1990) Constituent structure and government in phonology. *Phonology* 7:193-232.
Kenstowicz, M. and C. Kisseberth (1979) *Generative phonology: description and theory*. New York: Academic Press.
Kiparsky, P. (1985) Some consequences of lexical phonology. *Phonology Yearbook* 2:83-136.
Lowenstamm, J. and J-F. Prunet (1988) Tigré vowel harmonies. Montréal: Université du Québec à Montréal.
Mtenje, A. (1986) *Issues in the non-linear phonology of Chichewa*. Ph.D. dissertation. London: University of London.
Nasukawa, K. (this volume) An integrated approach to nasality and voicing.
Prince, A. S. and P. Smolensky (1993) *Optimality theory: constraint interaction in generative grammar*. Piscataway, N.J.: Rutgers University Center for Cognitive Science.
Rennison, J. R. (1987) Vowel harmony and tridirectional vowel features. *Folia Linguistica* 21:337-354.
Schane, S. A. (1984) The fundamentals of particle phonology. *Phonology Yearbook* 1:129-155.
Schane, S. A. (1995) Diphthongization in particle phonology. In *Handbook of phonological theory*. J. A. Goldsmith, ed., 586-608. Oxford: Blackwell.
Selkirk, E. O. (1982) The syllable. In *The structure of phonological representations* (part II). H. van der Hulst and N. Smith, eds., 337-383. Dordrecht: Foris.
Stewart, J. M. (1967) Tongue root position in Akan vowel harmony. *Phonetica* 16:185-204.
Takahashi, T. (in prep.) *The theory of phonological licensing and elements*. Ph.D. dissertation. London: University College London.
Tucker, A. N. and J. T. O. Mpaayei (1955) *A Maasai grammar with vocabulary*. London: Longmans, Green and Co.
Valinande, N. (1984) *The structure of Kinande*. Ph.D. dissertation. Washington: Georgetown University.
Walker, C. (1995) ATR harmony as h-licensing. *SOAS Working Papers in Linguistics and Phonetics* 5:107-120.

Contour structures in the vocalic system of Polish

Anna Bloch-Rozmej

The aim of the following discussion is to analyse the problem of Polish nasal vowels with respect to the mechanism of phonological licensing and language-specific parameter settings. The theoretical framework adopted in this article is that of Government Phonology as proposed by Kaye, Lowenstamm, and Vergnaud (1985, 1990), Charette (1991) and Harris (1994). Using the tools provided by the government-based model we shall attempt to provide a phonological representation for these nasal vowels; we shall argue that their distribution is to a large extent conditioned by the specific structure that we propose. Previous analyses have tried to answer the question of whether nasal vowels actually exist as independent phonological units in Polish (e.g. Doroszewski 1963 or Laskowski 1975), or whether they should be viewed as sequences of vowels plus nasal segments (e.g. Biedrzycki 1963, Gussmann 1974, 1980, or Rubach 1984). The present analysis, however, identifies the nasal vowels as different from both other vowels and other vowel plus nasal sequences.[1] Specifically, we shall argue that they should be represented as contour (short diphthong) structures.

1. Theoretical background

Government Phonology is a representationally-oriented framework which assumes that phonological phenomena stem from a small series of universal principles and language-specific parameters. The relations of government defined as a binary asymmetric relation holding between adjacent positions can be established within syllabic constituents (constituent government), between constituents (interconstituent / transconstituent government), and between either nuclear or onset heads (projection government). Governing relations have to be strictly local and strictly directional at the level of both constituent and transconstituent government.

The model permits the existence of three syllabic constituents: the onset, nucleus and rhyme, all of which are maximally binary.

[1] One example of a non-linear approach to the nasal vowels which views them as distinct from oral vowels and vowel-consonant clusters is Bethin (1992). See also Bloch-Rozmej (1997a) for a different government-based analysis of Polish nasal vowels.