Aspects of Underspecification Theory

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*Aspects of underspecification theory**

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1 Why underspecification?

An evaluation metric in Universal Grammar provides a means of selecting between possible grammars for a particular language. The evaluation metric as conceived in Chomsky & Halle (1968; henceforth *SPE*) prefers the grammar in which only the idiosyncratic properties are lexically listed and predictable properties are derived. The essence of underspecification theory is to supply such predictable distinctive features or feature specifications by rule. Viewed in this way, the general idea of underspecification has always been a part of any theory of phonology that includes such an evaluation metric.

Acknowledging this connection raises the issue of whether underspecification is demonstrably both theoretically possible and empirically desirable, the first point addressed in this paper. Once it is established that there is reason to explore underspecification, a further question arises: which values of which features may be underspecified? In considering which values may be underspecified, I compare two theories of underspecification currently being explored, Contrastive Specification (Clements 1987a; Steriade 1987) and Radical Underspecification (Kiparsky 1982; Archangeli 1984; Pulleyblank 1986; Archangeli & Pulleyblank forthcoming a): I consider how these two models differ both conceptually and empirically, and I show how these differences furnish arguments suggesting (but not conclusively) the preferability of Radical Underspecification. First, however, I review the theoretical and empirical reasons for considering underspecification at all.

1.1 The theoretical argument

Examples of the dichotomy between the idiosyncratic (listed) properties and the predictable (derived) properties are readily available in the literature, particularly in the literature on prosodic structure. Forms are typically listed without syllable structure, because syllable structure is predictable from the segment string and so can be derived. (See Kahn 1976, Steriade 1982, Clements & Keyser 1983, Itô 1986 and Cairns this volume for approaches to syllabification by rule, by template-matching, or by some other mechanism.) Stress placement is purely predictable in many languages (e.g. Hungarian: Hammond 1987) and so is omitted from the underlying representation of the string, being derived during the course of the phonology. (See Liberman & Prince 1977, Hayes 1980, Prince 1983, Hammond 1984 and Halle & Vergnaud 1987 for a variety of approaches to stress, all of which entail underspecification of stress in underlying representations.) Skeletal structure (or moraic structure) has also been shown to be predictable in at least part of the phonology/morphology of some languages, and consequently is part of derived structure, not part of underlying structure. (See McCarthy 1981, 1987, Archangeli 1983, Carrier-Duncan 1984, Hyman 1985, McCarthy & Prince 1986, 1987 and Spring 1987 for discussion of skeletal and moraic structure.)

Such prosodic underspecification has received little attention as underspecification *per se*, contrasting sharply with the recent high profile of underspecification relating to distinctive features. The contrast between the two is possibly a historical accident, and may be due to the rejection of derivational specification of features in early generative work, a result of the proposal that distinctive features are strictly binary. Although the merit of some kind of underspecification was recognised in early generative work (cf. Lees 1961; Kuroda 1967), Lightner (1963) and Stanley (1967) argued that to omit specifications entailed allowing binary features to create a ternary contrast among segments. Because of the hypothesised binary nature of features, a (derived) ternary contrast is an undesirable result. As a consequence of these arguments, Chomsky & Halle (1968) adopted the position that feature values cannot be left incompletely specified prior to the application of any phonological rules. In other words, underspecification was limited to features in the lexicon, with feature fill-in due to markedness conventions (*SPE*; Kean 1975). (Syllabification escaped from this constraint, as did stress and the CV skeleton. Neither syllabification nor the CV skeleton was included in the *SPE* model, and later, as Hooper (1972), Vennemann (1972) and Kahn (1976) provided motivation for the syllable and McCarthy (1979, 1981) presented arguments for the CV skeleton, the proposed representation did not involve true binary distinctions. As a result, in these cases the Lightner–Stanley arguments were irrelevant. Similarly with stress: the issue of derived *vs.* listed specification has pertained only to whether the stress pattern is predictable, and not to formal questions of whether representations without metrical structure are legitimate.)

The structure of the Lightner–Stanley argument is roughly as follows.[1] Assume a binary distinctive feature system, and the three segments and three rules noted below, ordered so that feature *changing* rules precede feature *filling* rules:

(1)

	X	Y	Z	
G	−	−	−	a. $[+F] \rightarrow [+G]$
H	−	−	−	b. $[-F] \rightarrow [+H]$
F	+		−	c. $[\quad] \rightarrow [-F]$ or d. $[\quad] \rightarrow [+F]$

In applying these rules to the representations, there are two possibilities with respect to segment Y. First, we might assume that rules apply as long as the string is not distinct from the focus stated in the rule, where distinct is defined as in *SPE* (p. 336). In this case, rule (a) applies to X, Y and rule (b) applies to Y, Z, as in (2a). The second possibility is to assume that Y is distinct from both X and Z because they are not *identical*, i.e. that the *SPE* definition of distinct must be revised to address the status of underspecified segments such that this type of differentiation arises. In this case, rule (a) applies only to X and rule (b) applies only to Z, as in (2b):

$$(2)\quad \text{a.}\quad \begin{array}{cccc} & X & Y & Z \\ G & + & + & - \\ H & - & + & + \\ F & + & & - \end{array} \qquad \text{b.}\quad \begin{array}{cccc} & X & Y & Z \\ G & + & - & - \\ H & - & - & + \\ F & + & & - \end{array}$$

A three-way distinction is created between X, Y, Z, regardless of which of (1c, d) is selected. The conclusion drawn from this demonstration was that underspecification is unsound because, if blanks exist during a derivation, the derived specifications can create a three-way distinction, thereby severely undermining the theory of binary features.

Ringen (1975: 40) gives the following synopsis of the argument:

(3) If we assume
   A. that rules can be extrinsically ordered [so that (1a, b) may precede (1c, d) – DA]
   B. that certain rules or rule applications are possible in natural languages [governed by 'distinct' or by 'identical' – DA]
   C. that phonological representations contain blanks
then
   D. certain undesirable consequences result [namely deriving a ternary distinction from binary features – DA]
Therefore, phonological representations should not contain blanks.
   ([A and B and C] → D, not-D, therefore not-C.)

Once the structure of the argument is revealed, its invalidity is obvious. Ringen (1975) and Archangeli (1984) propose that premise A should be rejected, and that rule ordering should be governed by general principles (although the principles that each proposes are somewhat different), thereby prohibiting the undesirable results. Kiparsky (1982) suggests that premise C must be modified, to disallow both specifications for a single feature in a given environment.[2]

Despite Ringen's argument, features appeared to remain under the Lightner–Stanley cloud. Although the linear representation of *SPE* was enhanced to include autosegmental features, it has generally been assumed that every segment compatible with an autosegmental feature 'P' (i.e. every 'P-bearing unit') must acquire some value for P prior to the application of any phonological rules (cf. Goldsmith 1976; McCarthy

1979; Clements 1981). For instance, early versions of the Universal Association Conventions, assumed to precede all phonological rules, included a statement like the following (for versions of the Universal Association Conventions, see Williams 1971, Goldsmith 1976, Halle & Vergnaud 1982, Clements & Sezer 1982, Pulleyblank 1983):

(4) All tone-bearing units are associated with at least one tone.

Under such a convention, the first step of a derivation involving underlying free autosegments (and so underlying unassociated, or unspecified, segments) is to specify the associations between the autosegments and the relevant P-bearing units.[3]

Note, however, that even with such conventions, underspecification has been introduced: the initial state is underspecified and only those segments which may bear the autosegment (i.e. the P-bearing segments) may (and must) be specified for the autosegment prior to application of phonological rules. Non-P-bearing segments remain unspecified for the autosegment P during the derivation. (For example, vowels are typically the P-bearing segments for tone, so consonants remain unspecified for tone throughout the derivation.) In short, despite the overt recognition of the 'necessity' of full specification as shown by the form of the Universal Association Convention in (4), underspecification is implicitly introduced by the division of segments into two classes, the P-bearing segments (which must be specified given (4)) and the non-P-bearing segments (which cannot be specified given (4)). It is important to note that the advantages of autosegmental features are possible only if at least this degree of underspecification is permitted.

We turn now to some further empirical motivation for including underspecification, namely two arguments that even P-bearing segments must remain unspecified for P during at least part of the derivation, the first due to Steriade (1979) and the second due to Pulleyblank (1983).

1.2 Khalkha Mongolian

Steriade (1979) argues for initial underspecification of particular features on the basis of the vowel qualities appearing in non-harmonic domains in Khalkha Mongolian. The basic harmony rules in this language are given in (5) (cf. Hangin 1968; Poppe 1970; Street 1962):

(5) a. harmonise [back] on all vowels
b. harmonise [round] from non-high vowel to non-high vowel

Both rules are illustrated in (6):

(6)	ɑx-ɑɑs	'from elder brother'	düüg-ees	'from younger brother'
	ex-ees	'from mother'	ör-öös	'from debt'
	xot-oos	'from city'	morin-oos	'from horse'

High round vowels ([u] and [ü]) are opaque to the second rule while the vowel /i/, with one exception, is transparent to both. The exception with /i/ occurs when /i/ occupies the initial syllable of the word, in which case subsequent vowels are neither back nor round. Furthermore, after the opaque high round vowels [u] and [ü], non-high vowels are never round:

(7)	yaw-aw	'went'	sonŋs-soŋ	'heard'
	ög-öw	'gave'	bai-saŋ	'was'
	ir-ew	'went'	ir-seŋ	'came'
	üz-ew	'looked'	üz-seŋ	'saw'
	unt-aw	'slept'	suu-saŋ	'sat'

Steriade (1979) argues that in order to express this distribution, it is crucial that harmonic features ([back] on all vowels and [round] on non-high vowels) be restricted to the initial vowel of the morpheme. Non-initial harmonic vowels, she argues, are underspecified for these features, surfacing uniformly as [−round] where rounding harmony cannot apply, and receiving values for [back] via harmony from the initial vowel of the word. In particular, that non-high vowels surface as [−round] in two environments, following all word-initial [+high] vowels and following word-medial [+high, +round] vowels, is explained only through the underspecification of [round]. A model with the free specification of these vowels (as [+round] or as [−round]) claims that the absence of [+round] vowels in these two non-harmony environments is purely an accident.[4]

To the extent that this pattern should not be coincidental, it is not only necessary to allow underspecification of underlying representations, but it is also crucial that *underspecification of P-bearing segments continues in the derivation*. Note also that since the rounding harmony is conditioned by the feature [−high], it cannot be the result of automatic spreading, again supporting the conclusion that underspecification of [round] must persist into the derivation.

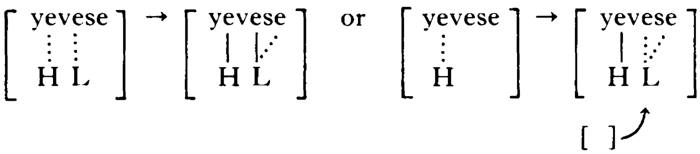
1.3 Tiv

A second demonstration of the same point is found in tonal studies. Building on the early proposals (Williams 1971; Leben 1973; Goldsmith 1976) in which underlying floating tones were assigned to segmental strings by Universal Association Conventions, Pulleyblank (1983) demonstrates that the convention which ensures that all tone-bearing segments are automatically associated to some tone cannot hold for all languages. The following example from Tiv (Pulleyblank 1983, 1985) illustrates the point.

First, there are two classes of verbs in Tiv, those which have a high tone on the initial syllable and those with an initial low tone. This tonal difference is registered only on the initial syllable of the verb, indicating that the tones are unassociated in underlying representation and their location is a result of the left-to-right clause of the Universal Association Conventions. (In certain verb classes, such as the general past illustrated here, the underlying high toned verbs begin with a downstepped high tone, rather than with a normal high tone. Since Tiv downstep is demonstrably induced by a floating low tone, Pulleyblank (1983, 1985) suggests that these tenses are marked by a low tone prefix.)

(8)	ꜜvá	'came'	dza	'went'
	ꜜúngwa	'heard'	vende	'refused'
	ꜜyévese	'fled'	ngohoro	'accepted'

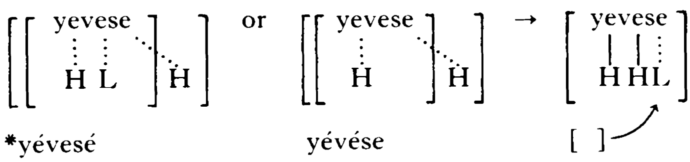
The question of interest here is whether the tone melody of H toned verbs should be a HL sequence in underlying representation, or simply a H tone, with L filled in 'by default':

(9)


Pulleyblank argues that a single H is the preferred melody, in part on the basis of verb paradigms such as the recent past, marked by the presence of a high tone on the second vowel of the verb stem. (Monosyllabic low toned verbs are subject to a tone raising rule under Pulleyblank's analysis. This alternation does not concern the point made here, so monosyllabic verbs are not included in the figure.)

(10)	óngó	'heard' (rec.past)	vendé	'refused' (rec.past)
	yévése	'fled' (rec.past)	ngohóro	'accepted' (rec.past)

Compare the derivations of *yévése* assuming HL and H tonal melodies:

(11)


To derive the tone patterns of the recent past without resorting to variable diacritics, Pulleyblank argues that it is necessary to associate tones *only in a one-to-one relation*. The result is that some tone-bearing segments have no tone during parts of the derivation where tone rules are applying. P-bearing segments remain unspecified *during the derivation*: under-specification of the P-bearing segments is not restricted to a level prior to the application of all phonological rules. Although it is not impossible to create rules and representations which take a HL melody as the starting point, as pointed out in Pulleyblank (1983), such rules would require the ability to distinguish between words of one, two and three moras in length. To the extent that such counting is ruled out (cf. McCarthy & Prince 1987), such accounts are impossible on theoretical grounds.

1.4 Summary

In answering the question 'why underspecification?' (where 'underspecification' refers to the perseverance of underspecified segments during the course of a derivation) it is necessary to show that such a model is theoretically coherent and empirically desirable. In the above discussion, I first addressed the theoretical argument by Lightner (1963) and Stanley (1967) against such underspecification, summarising Ringen's (1975) criticism of that argument. I then sketched two case studies, Khalkha Mongolian (following Steriade 1979) and Tiv (following Pulleyblank 1983, 1985), showing some of the empirical advantages of allowing underspecified P-bearing segments during the course of the derivation. Once underspecification of this sort is established as theoretically possible and empirically desirable, two further questions arise.

First is the issue of whether underlyingly underspecified values are *ever* specified (e.g., in Khalkha Mongolian, is it necessary to insert [−round]?; and in Tiv, is it necessary to insert L tones?). This question can be addressed both from a phonological and from a phonetic point of view. The phonological side of the issue focuses on evidence that some specification must not be present in underlying representation and cannot be present for the early part of the derivation, yet must be present at some later stage (cf. low tone in Tiv and Tonga and mid tones in Yoruba (Pulleyblank 1983), [+high] in Yawelmani (Archangeli 1984), [−low] in Okpẹ (Pulleyblank 1986), [−ATR] in Yoruba (Archangeli & Pulleyblank forthcoming b), [−high] on [+low] vowels in Latin (Steriade 1987)). The phonetic side of this question focuses on the patterns in the physical reflexes of particular features (such as tone (Pierrehumbert & Beckman forthcoming), nasality (Keating 1987), and vowel features (Keating 1985; Öhman 1966)). The phonetic evidence indicates (i) that segments that are not specified phonologically for some feature values also do not always receive phonetic specification (cf. C in the VCV sequences in Öhman 1966 and Keating this volume, and the tone interpolation of Japanese in Pierrehumbert & Beckman forthcoming), but (ii) that this is not necessarily the case: some phonologically unspecified segments do receive a phonetic specification (cf. the nasality of English vowels in Keating 1987).

The conclusion to be drawn from such phonetic evidence is that complete specification cannot be a necessary condition on the output of the phonological component/the input to the phonetic component. Beyond that, much work remains to be done on the evidence for inherent underspecification and for the insertion, both phonological and phonetic, of feature specifications.

The second issue is how the selection is made between which features are underlyingly specified and which are not; we consider this now.

2 Which features are underlyingly specified?

To this point, I have given an overview of the motivation, both theoretical and empirical, for including some version of underspecification in the formal model of phonology. With this established, an issue internal to a theory of underspecification arises: the principles determining which features (or feature specifications) are unspecified and which are necessarily specified in underlying representation. I consider here three answers to this question: (i) that certain features or feature values are not specified due to their very nature, or INHERENT UNDERSPECIFICATION, (ii) that all and only contrastive features are specified, or CONTRASTIVE SPECIFICATION, and (iii) that all and only unpredictable features are specified, or RADICAL UNDERSPECIFICATION.

Inherent Underspecification is seen to be consistent with both Contrastive Specification and Radical Underspecification; however, the latter two assume quite different principles of grammar. Through an examination of the properties of these two approaches, we are led to the conclusion that only Radical Underspecification is both theoretically and empirically supported.[5]

2.1 Description of the three views

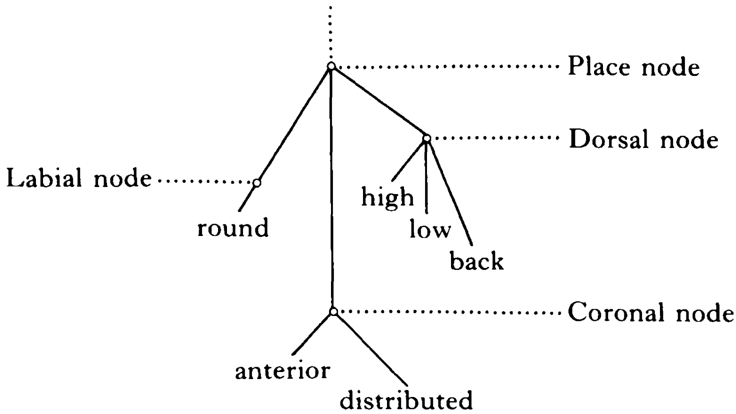
2.1.1 *Inherent Underspecification.* Inherent Underspecification, that is underspecification due to properties of the features themselves, divides into two different classes, monovalent and node dependent underspecification.[6]

The first of these, INHERENT MONOVALENT UNDERSPECIFICATION, is fairly straightforward: the question raised is whether every feature is actually binary, or whether some at least are monovalent. If some features are monovalent, then those features are either present or absent. For example, if [round] is monovalent, then segments may be specified as [round] or unspecified for [round], but there could be no segments marked [−round]. (The idea is akin to the concept of PRIVATIVE features of Trubetzkoy 1967. See Goldsmith 1985 for a recent analysis in which privative features play a pivotal role.) The segment with no underlying specification for a monovalent feature may remain unspecified or it may acquire that feature during the course of the derivation. If there are monovalent features, then such features are in part inherently underspecified, that is underspecified due to the property of being monovalent.

Sagey's (1986) inclusion of articulator nodes, labial, coronal and dorsal, under the place node in a feature hierarchy (Clements 1985) introduces the second type of single-valued features, INHERENT NODE DEPENDENT UNDERSPECIFICATION. On the surface, the articulatory nodes appear to introduce another type of monovalent features: the articulator nodes themselves are either present ('[+F]') or absent. There is no '−coronal node', etc., in this model.

Sagey's proposals go further however. Specific features are dominated by particular articulator nodes:[7]

(12)



Under this model, a segment which is not specified for some node, say coronal, may not be specified for any of the (bivalent) features that that node dominates, here [anterior] and [distributed]. This underspecification of bivalent features depends on the presence or absence of a monovalent node, hence the rubric 'node dependent underspecification'. In other words, underspecification of the features [anterior], [round], [high], etc. is inherent for all segments except those characterised by the relevant articulator node.

It is not possible to argue that all underspecification is inherent because there is good reason to retain the binary nature of several of the distinctive features. Thus, the question still remains of which values of bivalent features are necessarily specified in underlying representation, and which are not. This question is addressed in the other two models, Contrastive Specification and Radical Underspecification.

2.1.2 *Contrastive Specification.* Contrastive Specification assigns specific values to a feature in underlying representation only where that feature is being used to distinguish segments in the respective contexts; non-contrastive values are left blank. This view is advocated in Clements (1987a) as well as Halle (1959) and Steriade (1987).

The five-vowel inventory of a language like Spanish or Japanese (which also has distinctive voicing among the consonants) has the following representation given Contrastive Specification:[8]

(13) *Contrastive Specification*

	full specification					contrasts	contrastive specification				
	i	e	ɑ	o	u		i	e	ɑ	o	u
high	+	−	−	−	+	{i, e}; {o, u}	+	−		−	+
low	−	−	+	−	−	{ɑ, o}			+	−	
back	−	−	+	+	+	{i, u}; {e, o}	−	−		+	+
voice	+	+	+	+	+	—					

The learnability of such a system depends on discovering the feature contrasts exploited in the language and using those contrasts to determine the appropriate representations. In some way, this model requires knowledge of the full specification of each segment: as D. Schlindwein has pointed out to me, such knowledge is required in order to determine the appropriate representation of /ɑ/ and of /o/: [low] distinguishes these two segments only if we know that /ɑ/ and /o/ are both [−high, +back] even though these features are not contrastive for /ɑ/. The necessity of full specification suggests the following algorithm for determining the contrastively specified representation:

(14) a. fully specify all segments
  b. isolate all pairs of segments
  c. determine which segment pairs differ by a single feature specification
  d. designate such feature specifications as 'contrastive' on the members of that pair
  e. once all pairs have been examined and appropriate feature specifications have been marked 'contrastive', delete all unmarked feature specifications on each segment

As the result of such an algorithm, in (13) values for [high] and [back] are absent for /ɑ/ because these values are not contrastive in the context of [+low] (/ɑ/ has no [−back] counterpart, nor does it have a [+high] counterpart); [voice] is not contrastive for any vowel and so is also omitted. Values for [low] are required on both /ɑ/ and /o/ because this feature is the only one distinguishing these two segments (as long as [round] is suppressed in the representation). Note that (14) results in only one possible underlying representation for a given system, a point whose significance will become clear in the discussion of Asymmetry Effects in §2.3.2.

2.1.3 *Radical Underspecification*. Radical Underspecification includes only unpredictable values for features in the underlying representation (Kiparsky 1982; Archangeli 1984, 1985; Pulleyblank 1983, 1986, 1988; Archangeli & Pulleyblank forthcoming a, b). Values are considered 'predictable' if either a context-free or a context-dependent rule can be formulated to insert the absent values: hence predictable values are inserted by rule during the course of the derivation. This model allows a variety of representations for the vowel inventory considered above; three options follow. (The availability of such options is argued for in Archangeli 1984; earlier work (e.g. Kiparsky 1982; Pulleyblank 1983) assumed that the universally marked values would be the only ones specified underlyingly.)[9]

(15) *Some Radical Underspecification options*

	a. i	e	ɑ	o	u	b. i	e	ɑ	o	u	c. i	e	ɑ	o	u
high		−		−			−		−		+				+
low			+					+					+		
back				+	+	−	−							+	+
voice															

a.	b.	c.
[+low] → [−high]	[+low] → [−high]	[+low] → [+back]
[+low] → [+back]	[ ] → [+high]	[ ] → [−high]
[ ] → [−low]	[ ] → [−low]	[ ] → [−low]
[ ] → [+high]	[ ] → [+back]	[ ] → [−back]
[ ] → [−back]		
[ ] → [+voice]	[ ] → [+voice]	[ ] → [+voice]

If such options are freely available, the learnability of a system becomes quite a challenge. Thus, some principle must be included in the theory in order to reduce the burden on simply learning the inventory. The proposal in Archangeli (1984) is that certain rules/specifications are preferred by Universal Grammar. During acquisition the first approximation will be in accord with these universal preferences and other options will be selected only if language-particular evidence motivates such variation. The specifications and rules given in (15a) are taken as a working hypothesis to be those preferred by Universal Grammar.[10]

In both models the features given in (13) and (15) are meant to be the *entire* set of features required on these segments in underlying representation. Values for all other features are non-contrastive and predictable, and therefore inserted by rule.

I turn now to discussion of the differences between Contrastive Specification and Radical Underspecification, differences which convince me of the preferability of Radical Underspecification. I divide this discussion into two parts, theoretical issues and empirical issues.

2.2 General theoretical considerations

2.2.1 *Features* vs. *segments*. A first conceptual difference between the two models of underspecification is each model's view of the phonological primitives that comprise the language-particular inventory. By 'phonological primitives', I mean the set of basic units from which lexical items may be constructed. To my knowledge, this question has not been addressed directly by proponents of either model; however, logical extension of each leads to the *feature* as the most basic unit in Radical Underspecification and to the *segment* as the most basic unit in Contrastive Specification. To the extent that a feature-based theory of phonology is advocated, the result with Radical Underspecification, i.e. that features are the most basic units, is the more coherent result.

I show first how the feature is basic to a model of Radical Underspecification. (Note that the possibility being discussed is available only with Radical Underspecification, and not available with Contrastive Specification, because of its reliance on inventories. However, it is not *necessary* to Radical Underspecification.) For this demonstration, let us consider a standard five-vowel inventory, /i e ɑ o u/ from (15a). If we were to simply take the *feature specifications* [−high], [+low] and [+back] from (15a) and combine them in all logically possible ways, the inventory in (16) is created. (The vertical lines in this and subsequent figures divide feature combinations that represent different segments. Thus, here /ɑ/ is represented by four different combinations and each of /i e o u/ by a single combination.)

(16)

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

The rules in (15a) derive the same configuration of features from all four representations for /ɑ/. Thus, no information is lost, and a simpler representation is gained, by reducing the four to simply [+low], a move forced by the evaluation metric. As a result, the segmental configuration of (15a) is derived from the free combination of elements in a *feature inventory*. Thus, the inventory of phonological primitives in such a language is the set of *feature specifications* that the language requires. The set of 'possible segments' is nowhere listed: such feature combinations are derived from the feature inventory. A striking confirmation of this hypothesis is found in Pulleyblank (this volume), where it is argued that in order to derive morpheme-internal cooccurrence restrictions, it is best to represent *all* vowel features of Tiv vowels as underlyingly floating. In such a case, if there is a segment inventory, the question arises of what the segments correspond to, since there are no segments underlyingly.

Let us turn now to the demonstration that the segment is basic to a model of Contrastive Specification. Recall that determining the correct underspecified representations in Contrastive Specification involves determining whether a feature serves to contrast two segments or not. In order to determine this, the fully specified segments of the language must be compared pairwise. Once all contrastive specifications are identified, the others are removed, leaving only the contrastive specifications (cf. the algorithm in (14)):

(17)

	full specification					contrasts	contrastive specification				
	i	e	ɑ	o	u		i	e	ɑ	o	u
high	+	−	−	−	+	{i, e}; {o, u}	+	−		−	+
low	−	−	+	−	−	{ɑ, o}			+	−	
back	−	−	+	+	+	{i, u}; {e, o}	−	−		+	+
voice	+	+	+	+	+	—					

rules
[+low] → [−high]
[+high, −back] → [−low]
[+low] → [+back]
[+son] → [+voice]

For each segment, the set of contrastive specifications must be represented in the grammar as a set. Were the features represented independently of the segments, the vowel [æ] would be predicted (as [+low] could combine with both [+back] and [−back]). Thus, for this model to express the possible sounds of the language, a *segment* inventory must be posited.[11] Note also that in a language in which certain (non-tonal) features are crucially floating, such a distinction cannot be encoded in a *segment* inventory (cf. Archangeli & Pulleyblank forthcoming a, b).

The concept behind 'inventories' in Radical Underspecification is strikingly different from that with Contrastive Specification. A *segment* inventory *per se* is not necessary in the former model; rather, only a *feature* inventory is required.[12] Sounds in a language are derived through the free combination of features in the feature inventory (subject to general considerations of simplicity, to language-particular rules as seen immediately below, and to language-specific constraints as argued in Archangeli & Pulleyblank forthcoming a, b).

2.2.2 *Markedness*. A second conceptual difference between the two models is in the approach each takes to markedness. Markedness refers to the formal properties that account for cross-linguistic patterns in languages. To the extent that such cross-linguistic generalisations are not accidental, a formal mechanism is required in Universal Grammar for their expression.

First, some 'markedness cost' must be assigned to sets of features. To illustrate this need, consider the difference between a consonantal system using the features [coronal], [anterior] and [labial] and one using the features [labial], [spread] and [constricted]. The basic system of the former set is not at all unusual, while that of the latter set is unattested, at least given a scan of the 319 languages in Maddieson (1984).

Christdas (in preparation) is developing a theory of markedness which addresses this issue directly. She proposes that features are divided into two sets, PRIMARY and SECONDARY. Primary features ([sonorant], [consonantal] and [continuant] for segments of all types; [high], [low] and [back] for vowels; [coronal], [anterior] and [labial] for consonants) are necessarily present in all languages, while secondary features (all other features) are present only at cost. Although Christdas advocates a version of Contrastive Specification, there is nothing in this general proposal that prevents it from being incorporated into either system discussed here: it is a theory of the inherent behaviour of features, not of underspecification itself.

There is a second way in which markedness may be expressed in a language, that is how to encode the relative complexity of *systems* using different arrangements of a single set of features. The two models of underspecification provide quite different answers to this question. To start the discussion, consider two five-vowel systems, both of which require the three primary features (values predicted by Contrastive

Specification are given). The vowel system of (18a) is that of Swahili, (18b) is that of Auca (Saint & Pike 1962):

(18) a. Swahili

	i	e	ɑ	o	u	
high	+	−		−	+	[+high] → [−low]
low			+	−		[+low] → [−high, +back]
back	−	−		+	+	[−back] → [−low]

b. Auca

	i	e	o	ɑ	æ	
high	+	−				[+high] → [−low, −back]
low		−	−	+	+	[+low] → [−high]
back		−	+	+	−	[+back] → [−high]

The /i e ɑ o u/ system is cross-linguistically more common: Maddieson (1984) lists 100 vowel systems which would require the representation in (18a) (ignoring considerations of nasality, pharyngealisation, length, tenseness, etc.), but only one system, that of Auca, with the inventory in (18b). I interpret this as the Swahili system being unmarked and the Auca system being marked. With Contrastive Specification, this generalisation must be encoded independently of the segment inventory itself because there is nothing inherent in Contrastive Specification to select between the two systems: the features are all members of the unmarked set in Christdas' model, there are the same number of feature specifications in each system, and the same number of rules.

Markedness is addressed directly in discussions of Radical Underspecification (see especially Archangeli 1984). The hypothesis is made that specifications and rules divide into two types, universal statements and statements required by language-particular considerations as discussed above. A grammar is more highly valued to the extent that it makes use of the specifications and rules which are provided universally.

Let us consider the Swahili and Auca systems from (18) in terms of Radical Underspecification. Interestingly, the feature specification inventories are identical for the two languages. I have chosen specifications which maximise the use of (what I take to be) the universal default rules (see (15a) and (20)):

(19) Feature inventory for both languages
[−high], [+low], [+back]

(20) Universal Default Rules
[+low] → [+back]
[+low] → [−high]
[ ] → [−back]
[ ] → [+high]
[ ] → [−low]

As seen above in the discussion of (15a), the inventory in (19) and rules in (20) give the typical five-vowel system such as that of Swahili.

If the feature inventories are the same for the two language, some other means is required to distinguish the two systems. To understand the necessary differences let us consider how the logically possible combinations of the features in (19) match with the segments of each language (see (16) above for interpretation of the vertical lines):

(21) a. Swahili

	ɑ				i	e	o	u
high	–		–			–	–	
low	+	+	+	+				
back	+	+					+	+

b. Auca

	ɑ		æ		i	e	o	
high	–		–			–	–	
low	+	+	+	+				
back	+	+				+	+	+

The Swahili system in (21a) combined with the rules in (20) gives exactly the desired combinations of features; the Auca system (21b) does not. Two statements are necessary for Auca, one to allow [æ] and one to rule out [u]. In other words, Radical Underspecification, in conjunction with feature-based inventories, predicts that the system in (21b) would be less marked were it to exclude the vowel [æ] and/or allow the vowel [u], a prediction confirmed in the segment inventories listed in Maddieson (1984). Consider first the exclusion of [æ]. The vowel is formally derived by stipulating that the Universal Default Rule [+low] → [+back] does not apply in this language. Without some statement prohibiting application of the universal rule, a grammar is formally simpler: the system /i e ɑ o/ (or /i e ɑ u/) is derived. Such systems account for fifteen of Maddieson's 26 four-vowel systems, again ignoring length, nasalisation, etc. Consider now the exclusion of /u/. This vowel is excluded from the Auca system by a language-particular redundancy rule marking all [+back] vowels as [−high]. But such a rule is a complication in the grammar: without this added rule, the six-vowel system /i e æ ɑ o u/ is derived (found in six of the 56 six-vowel systems given in Maddieson 1984).[13]

A final point of interest here is the type of generalisation encoded in the feature specification rules under the two models. As detailed above, with Radical Underspecification the default rules correspond to *cross*-linguistic markedness considerations, while with Contrastive Specification the feature specification rules correspond directly to surface generalisations about the segment inventory (cf. Clements 1987a), that is, such rules encode *intra*linguistic generalisations. To the extent that markedness should be expressed in the formal theory of language, Radical Underspecification provides a model which directly incorporates markedness into the statement of the feature inventory and the feature combinations. Contrastive Specification does not: the theory of Contrastive Specification requires an independent theory of markedness.

2.2.3 *Summary*. We addressed here two conceptual differences between Contrastive Specification and Radical Underspecification. Contrastive Specification treats the segments as the phonological primitives of a language and it has no inherent means for expressing the markedness of different systems. Radical Underspecification treats feature specifications as the phonological primitives of a language and it encodes markedness of various systems by the use each makes of Universal Default Rules *vs.* language-particular default rules.

2.3 Empirical differences

Two general phenomena are cited as examples motivating some degree of underspecification, transparency and asymmetry. We consider here examples of each.

2.3.1 *Transparency*. Transparency effects involve some segment which may intervene between the trigger and the target of a rule, and yet have no effect whatsoever on the application of that rule (e.g. consonants are typically transparent in rules of vowel harmony and vowel umlaut). The underspecification proposal is that the intervening segment is not specified for the feature(s) involved in the rule (and may be unspecified for other features too); were the segment specified, the condition against crossed association lines would necessarily block application of the rule and possibly the segment's specification would trigger the rule as well: in either case, the intervening segment would not be transparent. Thus, the transparency effect is argued to derive from the absence of specifications (see Steriade 1987, Archangeli & Pulleyblank 1987, forthcoming a for further discussion of transparency).

Schein & Steriade (1986) present the case of Sanskrit *n*-retroflexion, whereby the coronal nasal is retroflexed when to the right of a retroflexed continuant, provided that no other coronal sounds intervene. Thus, vowels and non-coronal consonants are both transparent to this rule: (22) shows the noun forming affix *-ana* added to verb roots (Whitney 1885, 1889; glosses are not given in Whitney 1885):

(22) a. intervening vowel; rule applies

rakṣ	'protect'	rákṣaṇa	'protection'
pṛ	'pass'	paaraṇa	

b. intervening vowels and non-coronal consonants; rule applies

kṣubh	'quake'	kṣobhaṇa
rambh	'take hold'	-rambhaṇa

c. intervening vowels and coronal consonants; rule does not apply

vṛdh	'grow'	várdhana	'increase'
ric	'leave'	recana	
vraj	'proceed'	vrajana	

d. no trigger; rule does not apply

gam	'go'	gamana
dyut	'shine'	dyutana

The examples of interest are those in (22a, b), where vowels and consonants are transparent between the trigger retroflex and the targeted nasal, when compared with the cases in (22c), where a coronal intervenes and blocks the rule's application. Phenomena with this general property strongly suggest that the transparent segments are not specified for the feature being spread, here either the coronal node or some feature immediately dominated by the coronal node.

A second case of transparency effects is found in Latin, discussed in Steriade (1987). In Latin, the adjectival suffix *-alis* (23a) has a second form, *-aris*, if the preceding liquid is /l/ (23b):

(23) a.	nav-alis	'naval'	b.	sol-aris	'solar'
	flor-alis	'floral'		milit-aris	'military'
	sepulchr-alis	'funereal'		Lati-aris	'of Latium'
	litor-alis	'of the shore'		reticul-aris	'of the net'

Steriade (1987), while arguing for Contrastive Specification, points out that the liquids in Latin are distinguished by the feature [lateral];[14] as such, given Contrastive Specification, only these segments are specified for this feature: no other segment has a value for [lateral]. Under this interpretation, dissimilation can be expressed as a rule eliminating adjacent identical sequences of [lateral]: the fact that all other consonants are transparent to this rule falls out from such an analysis since no other consonant has a value for this feature.[15]

Suppose, following Steriade (1987), that the rule is correctly expressed as deleting [+lateral] from the affix when adjacent to [+lateral], and that the lack of application after /r/ or /l...r/ is due to /r/'s [−lateral] specification. The challenge for Radical Underspecification is how to express this alternation in a system which allows only one value of [lateral] in a given environment, and so does not have both [+lateral] and [−lateral] on liquids in underlying representation. To obtain the same effect under Radical Underspecification, the unspecified value of [lateral] must be inserted on all liquids, but not on any other segments. This result can be obtained in a principled manner if (i) Structure Preservation restricts the feature [lateral] to non-nasal sonorants and if (ii) the dissimilation rule itself refers to [−lateral] by the ordering principles of Radical Underspecification theory (see Archangeli 1984, Pulleyblank 1986b and Archangeli & Pulleyblank forthcoming b on these ordering principles).

Steriade (1987) presents a variety of such cases, involving transparency both in dissimilation and in harmony, as evidence for the necessity of Contrastive Specification, although she acknowledges two real problems for Contrastive Specification: Lyman's Law in Japanese (see also Itô & Mester 1986) and vowel harmony in Finnish (for which she cites Kiparsky 1981). See also Vago (this volume) and Ringen (this volume) for reanalysis of two cases in Steriade (1987).

In summary, Contrastive Specification holds that only segments which do not contrastively bear some feature can be transparent to a rule involving that feature. Radical Underspecification holds that only segments with predictable specifications for some feature will be transparent, allowing for a different class of potentially transparent segments, as evidenced with transparency in Latin dissimilation. Thus, transparency effects present a test between the two models, and requires further research.

Before turning to the second type of empirical effect, it is worth noting that because of this treatment of transparency, Contrastive Specification must include Inherent Monovalent Underspecification, as introduced in Steriade (1987) for precisely the following reason. In Khalkha Mongolian (§1.2), rounding harmonises from non-high vowels to non-high vowels; high round vowels block the harmony (as expected by the prohibition against crossed association lines) while the high unround vowel is transparent to this harmony. Since /i/ contrasts with /ü/ only through the feature [round], if [round] is bivalent and Contrastive Specification is on the right track, /i/ would be specified as [−round], and so should block the rounding harmony process. If [round] is monovalent, then /i/ could not be specified as [−round], and so its transparency is not a violation of the model of Contrastive Specification. Thus, Inherent Underspecification of [round] is crucial to the model of Contrastive Specification.[16]

2.3.2 *Asymmetry*. The Asymmetry Effect is cited in Archangeli (1984, 1985), Pulleyblank (1983, 1986, 1988) and Abaglo & Archangeli (forthcoming) as grounds for accepting a greater degree of underspecification. The Asymmetry Effect is that the rules with the property of treating some segment as featureless converge on a single segment in a given language. One of the most striking and widely cited asymmetries is the case of multiple identical epenthetic vowels, as in Spanish (see Harris 1983). Here, we consider another type of asymmetry, the vulnerability of a particular segment with respect to a variety of segmental processes.

Pulleyblank (1988) presents a variety of asymmetry arguments to support the hypothesis that the vowel /i/ in Yoruba has no underlying features at all; one argument is presented here by way of illustration. In Yoruba there is an optional process of regressive assimilation, exhibited in (24). (Pulleyblank also demonstrates that /i/ is the only vowel that does not trigger a postlexical rule of nasalisation and is the only vowel to interact with a nasal in the postlexical formation of a syllabic nasal.)

(24)	owó Adé	owá Adé	'Ade's money'
	owó ọmọ	owọ́ ọmọ	'child's money'
	owó ẹmu	owẹ́ ẹmu	'wine money'
	owó epo	owé epo	'oil money'
	ilé ayọ̀	ilá ayọ̀	'Ayọ's house'
	àwọ̀ ejò	àwè ejò	'colour of a snake'
	ará òkè	aró òkè	'northern Yoruba'
	ẹ̀bú odò	ẹ̀bó odò	'near the river'
	ara ẹ̀bun	arẹ ẹ̀bun	'Ẹbun's body'
	ara èjìdé	are èjìdé	'Ejide's body'

All vowels except /i/ trigger this regressive spread:

(25) arà ìlú *arì ìlú 'townsman'
èrù igi *èrì igi 'bundle of wood'

This peculiarity of /i/ can be explained by representing /i/ as a featureless vowel (an analysis confirmed by several other processes cited by Pulleyblank): as such, there are no features to spread and so it is not at all surprising that /i/ does not trigger the spreading rule. Asymmetries which argue for some segment being completely unspecified centre on a single segment in a given language, but these segments are not necessarily identical *across languages*. Thus, in Yoruba /i/ is argued to be featureless while in Gengbe /e/ is the completely unspecified vowel (Abaglo & Archangeli forthcoming), even though these two languages have identical oral vowel inventories. If such accounts of Asymmetry Effects are along the right track, then underspecification of a particular segment inventory is not determined independently of language-particular processes (Archangeli 1984). Note that this is an impossibility with most systems given Contrastive Specification: the only way in which a segment may be completely unspecified under Contrastive Specification is if it makes no contrasts with any other segments.

To the extent that this general account of asymmetric effects is satisfactory, these phenomena argue for Radical Underspecification as opposed to Contrastive Specification: in Contrastive Specification, no segment is left completely featureless in a language like Yoruba or Gengbe because all vowels differ in at least one feature (the oral vowels of each language are /i e ẹ (ɛ) ɑ ọ (ɔ) o u/). Thus there is no explanation for the asymmetric effects surrounding a single vowel. Using features to identify the asymmetric segment, as must be done with Contrastive Specification, simply lists the segment in each rule. Such an account does not explain why the *same segment* is the target of each such rule. Note also that Radical Underspecification makes the prediction that Asymmetry Effects and Transparency Effects will target a single segment, a prediction that remains to be explored.

2.3.3 *Unusual inventories*. As a final note about the empirical coverage of Radical Underspecification *vs.* that of Contrastive Specification, consider the vowel system of Maranungku, yet another marked five-vowel system: /i ɑ ə æ ʊ/ (Tryon 1970). The full specification of the three primary features for these vowels would be as follows:

(26)

	i	ɑ	ə	æ	ʊ
high	+	−	−	−	+
low	−	+	−	+	−
back	−	+	+	−	+

Again, Radical Underspecification may take the unmarked specification of each feature as the inventory, [−high], [+low], [+back]. By blocking the universal rule inserting [+back] on [+low] vowels, the vowel /æ/ is permitted. In addition, a rule is needed to create a back *unrounded* segment [ə] where [o] would be expected. The system may be expressed, but the theory predicts that it is a rather marked system because of these two additions.

On the other hand, Contrastive Specification is *unable to distinguish* these five vowels without introducing additional stipulations. The problem is revealed when the fully specified matrices for [i] and [æ] are compared with those of the other segments. [i] differs from [ʊ] by the specification for [back], thus [i] would be specified as [−back]. There are no other pairwise contrasts for the features of [i]. Similarly, [æ] differs from [ɑ] by the specification for [back], so [æ] would be marked [−back]. Again there are no other pairwise contrasts for the features of [æ]:

(27)

	full specification					contrasts	contrastive specification				
	i	ɑ	ə	æ	ʊ		i	ɑ	ə	æ	ʊ
high	+	−	−	−	+	{ə, ʊ}			−		+
low	−	+	−	−	−	{ɑ, ə}		+	−		
back	−	+	+	−	+	{i, ʊ}; {ɑ, æ}	−	+		−	+

The problem is that the inventory created by the algorithm in (14) does not distinguish [i] and [æ]. One could imagine bolstering the theory by allowing an 'algorithm override' to the effect that if contrasts of single features do not distinguish segments sufficiently, then contrasts are taken of pairs of features. This leads to indeterminacy in the representation: which of the three possible pairings of [high], [low] and [back] should be used to determine the remainder of the specifications for [i] and [æ]? Given that some marked deviations from the normal algorithm must be allowed, the predicted range of possible vowel systems must be addressed as well. These are serious questions, and issues that remain to be dealt with in Contrastive Specification Theory.

In this section we have considered briefly the empirical coverage of the two theories of underspecification, Radical Underspecification and Contrastive Specification, examining how each accounts for transparency effects, for asymmetry effects, and for attested segment inventories. These three phenomena involve linguistically significant generalisations and so should be formally expressed in the grammar. As demonstrated here, Radical Underspecification is the preferred model, as it provides a principled account of most. Although Contrastive Specification accounts for transparency effects (provided that Inherent Underspecification is also assumed) and gives a more satisfactory account of Latin dissimilation, it provides no explanation whatsoever of the asymmetry effects, and it is unable to provide a principled inventory for the vowel system of Maranungku. Radical Underspecification by contrast provides a constrained account of these phenomena and so, in the face of the empirical evidence, is the preferred model.

3 Conclusion

The inclusion of underspecification in phonological theory has a number of desirable consequences, both theoretical and empirical.

As shown here, underspecification is preferred over full specification from a theoretical standpoint because it makes the theory of representations consistent with the concept of an evaluation metric: only idiosyncratic information is included in the most basic representations and all predictable information is encoded in rules. Of the two models considered, Radical Underspecification and Contrastive Specification, the former is the closer to this ideal (although this conclusion is not without possible human error: my own involvement with Radical Underspecification may well be reflected in the results here). With respect to distinctive feature theory, Radical Underspecification is also the more conceptually coherent view since, given Radical Underspecification, the phonological primitives of a particular language can be expressed as feature specifications (rather than as feature combinations, or matrices, as is necessary with Contrastive Specification).

Underspecification is also demonstrated to be empirically necessary if the results obtained through the use of autosegmentalised representations are to be maintained. Furthermore, if Transparency Effects in harmonies and dissimilation are to be derived from the representation (rather than stipulated independently), some version of underspecification is necessary.

The strong conclusion is that some form of underspecification is necessary in phonological theory. Beyond that, there are three research options available. One might take the Transparency Effect with Latin dissimilation to be the strongest case and pursue Contrastive Specification; one might take the Asymmetry Effect, the unusual inventories, and the conceptual issues noted above to be the strongest arguments, and pursue Radical Underspecification; finally, one might conclude that a third version of underspecification must be developed, a model which reflects the empirical and conceptual issues more accurately.

NOTES

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[1] Pulleyblank (1983) demonstrates that this argument is consistent with an autosegmental representation. I use linear configurations for ease of representation.

[2] Kaye *et al.* (1985) are working towards a model in which there are no phonological rules: in such a model, premises A and B would be irrelevant (without rules, there is no question of rule ordering or applications). Furthermore, some recent work has questioned whether all features are bivalent for all sounds, i.e. whether 'D' itself is false. Cf. Sagey (1986), Steriade (1987), and below.

[3] This is not quite accurate: Initial Tone Association Rules as in Clements & Ford (1979) allow for the initial association of tones on some vowel other than

that predicted by the Universal Conventions and McCarthy (1979: 252) proposes a rule of 'Eighth Binyan Flop', which reassociates an associated [t] morpheme prior to the initial association of the root consonantism.

[4] Halle & Vergnaud (1982) suggest that such predictable values are the result of 'core specifications' of unmarked values; Pulleyblank (1983: 148–150) argues against the core specification model because of the autosegmental behaviour of default mid tones in Yoruba (they undergo downstep and prevent a floating low from linking up), of default low tones in Tonga (they trigger downstep if set afloat by high tone spread), and of default low tones in Tiv (they create a word-final contour if set afloat by vowel deletion).

[5] Another view, which might be called CLASSIFICATORY SPECIFICATION, holds that all features required on any segment in the language must be fully specified on all segments prior to the application of any phonological rules (either because those features are present in underlying representation or because those features are inserted by convention prior to the application of any rules (*SPE*; Stanley 1967)). Clements (1987a) illustrates Classificatory Specification with a five-vowel inventory in a language with distinctive voicing:

Classificatory Specification

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

Some value of each of these four features must be included in the underlying representations of every segment of a language containing both these vowels and voiced and voiceless sounds ([voice] is present because languages have a voicing distinction, even if it is not distinctive on the set of [+sonorant] segments). The problem with Classificatory Specification is that none of the results noted earlier is possible with this model. Thus, I do not consider it further.

[6] Steriade (1987) terms such underspecification TRIVIAL, which she is quick to note does not translate to a trivial aspect of the theory. I introduce the term INHERENT to avoid negative connotations. As is demonstrated in §2.3.1 below, it is necessary to have some degree of Inherent Underspecification if the model of Contrastive Specification is adopted.

[7] This model of features is akin to the type structure assigned to features in certain syntactic models, e.g. Head-driven Phrase Structure Grammar (Pollard & Sag 1987).

[8] Clements (1987a) uses the feature [round] where I use [back]; representations are altered accordingly. The reason for this switch is because [round] must be monovalent in this model (as shown in §2.3.1 below) and so is inherently underspecified.

[9] The rules in (15) may not be stated as precisely as is necessary. For example, the voicing rule may need to be constrained to [+sonorant] segments, etc. In (15a), a rule like [ ] → [−back] replaces a statement like '[−back] is the unmarked value for [back]'; a rule like [+sonorant] → [+voice] encodes '[+voice] is the unmarked value for [voice] on sonorants'.

[10] It should be noted that the point being made goes through even if there are errors in the exact set of universal default rules assumed here. That is, the structure of the model is not dependent on the rules in (15a) being the correct default set.

[11] A constraint prohibiting the combination of [+low] with [+back] could be introduced to prevent the creation of a sixth vowel. However, such a constraint adds complexity to the grammar, predicting that a six-vowel system is preferred over the five-vowel system.

[12] There are a number of approaches to the representation of sounds not based directly on features, e.g. Charm and Government theory (Kaye *et al.* 1985) and

Dependency theory (Anderson *et al.* 1985). Thus, that phonology should be feature-based is not an uncontroversial hypothesis.

[13] As pointed out to me by D. Pulleyblank, the feature inventory aspect of Radical Underspecification makes strong predictions about diachronic changes in vowel systems: such changes should typically occur along dimensions allowed by the logical combinations of the features in the inventory of the language, and by either adding or relaxing constraints, a point that remains to be explored.

[14] It has been argued that /l/ is [−continuant] while /r/ is [+continuant] (cf. Clements 1987b); if this is the case universally, then some principle is required to determine which feature, [lateral] or [continuant], be used to distinguish /l/ and /r/, possibly the same principle needed for Maranungku, discussed below.

[15] Cases like Latin dissimilation also provide an argument against representing absent values as 'ø autosegments' (e.g. [ø lateral] *vs.* [+lateral] and [−lateral]). If there were a ø autosegment for /t/ between the /l/ of *milit-* and the /l/ of *-alis*, the identical instances of [lateral] would *not* be adjacent and the explanatory force of this analysis would be lost.

[16] A less restricted position is to say that some features are monovalent in some languages but bivalent in others. Making every feature monovalent for some language would give the equivalent of Radical Underspecification. Thus, with this addition to the theory, Contrastive Specification becomes vastly less restrictive than Radical Underspecification. Cf. Ringen's argument (this volume) that Hungarian vowel harmony requires [−round] in underlying representations: if Ringen is along the right track, then [+round] can be monovalent only on a language-particular basis.

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