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Abstractness, Underspecification, and Empty Skeletal Positions

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ABSTRACTNESS, UNDERSPECIFICATION, AND EMPTY SKELETAL POSITIONS

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The development of an independent skeletal tier, either in the form of a CV-tier or an unspecified X-tier, has led to new and insightful analyses of a wide range of traditional problems, such as compensatory lengthening, the behaviour of geminates, syllable structure, reduplication, and various morphological processes in Semitic and other languages. Here, I will consider another interesting, though, I believe, incorrect, application of tiered phonology. It has been suggested, by Clements and Keyser (1983) and Marlett and Stemberger (1983), that the existence of an independent skeletal tier makes possible a new approach to many cases which have previously been analysed as involving abstract segments. They propose instead that such cases involve empty skeletal positions, and they argue that such an analysis is superior to one which posits abstract phonemes. This perceived superiority is based on two considerations: first, the empty element analysis is held to be less abstract, hence more desirable; second, in the absence of language particular evidence concerning the specification of segmental features, leaving a position unspecified avoids the arbitrariness required of the abstract solution. I will argue that these two advantages are only apparent: that on grounds of abstractness, the two analyses are in the same position with respect to any issue of consequence; and that with regard to underspecification, the empty slot analysis is problematic, despite its seeming simplicity, while the abstract analysis is in fact more compatible with other current conceptions of underspecification.

A good illustration of these points is provided by the case of Seri, discussed recently by Marlett and Stemberger (1983). Seri has a number of vowel-initial words which act, with respect to every relevant rule in the language, as though they begin with a consonant. Some of this evidence is summarized in (1):

(1) Anomalous Initial Vowels in Seri

	C-Initial	V-Initial	Anomalous
a. Vowel Del.	/yo+meke/ [yomeke]	/yo+eme/ [yo:me]	/yo+amWx/ [yoamWx]
b. Vowel Epen.	/?+ka/ [i?ka]	/?+eme/ [?eme]	/?+amWx/ [i?amWx]
c. Gemination	/t+meke/ [tmeke]	/t+eme/ [teme]	/t+aX/ [ttaX]

In (1a), a rule of Vowel Deletion deletes the second of two adjacent vowels, lengthening the first. The rule applies regularly to /yo+eme/, but not to /yo+amWx/. In fact, Seri has a number of vowel deletion rules (five, according to Marlett and Stemberger), which are subject to different morphological and syntactic configurations, and which operate in different ways. Each rule, however, is sensitive to whether a vowel is followed by a root-initial consonant or a vowel. In each case, the anomalous verbs pattern with the consonant-initial verbs, and not with the vowel-initial verbs.

Syllable onsets in Seri are quite free, being subject only to the restriction that sonorants (including /?/) must be final in the onset. When a sonorant comes to stand to the left of a consonant, it is attached to the previous coda; if there is no previous syllable, an /i/ is epenthesized to the left of the sequence, as in (1b), <u>i?ka</u> from /?+ka/. A sequence of /?+V/ does not normally occasion Epenthesis, as is shown by <u>?eme</u>. However, the same set of vowel-initial forms which do not undergo Vowel

Deletion do undergo Epenthesis: hence, i?amWx from /?+amWx/.

These last forms are distinguished also by causing the gemination of a consonantal prefix other than ?: thus, we find ttaX from /t+aX/. Gemination does not occur before the regular vowel-initial forms or before consonant-initial forms.

In his earlier analysis of this data, Marlett (1981) noted that the behaviour of the anomalous verbs can be brought under one generalization: these forms, though phonetically beginning with a vowel, act with respect to every relevant rule in the grammar as though they begin with a consonant. He therefore proposed that such forms in fact have an initial consonant in underlying form. He was unable, however, to further specify the features of this abstract consonant, as there is no evidence bearing on its nature.

Marlett and Stemberger propose that a superior analysis is available in the framework of a theory which recognizes separate tiers--specifically, a syllable structure tier, a CV-tier, and a segmental tier--with elements of the different tiers joined by principles of autosegmental association. They propose that the anomalous verbs have an initial onset position which is not associated with any segment. The three types of verbs listed in (1) thus have the representations in (2):

(2) Empty C Position Analysis

```
              C-Initial    V-Initial    Anomalous

Syllables     O N O N      N O N        O N C
              | | | |      | | |        | | |
CV Tier       C V C V      V C V        C V C
              | | | |      | | |          | |
Segments      m e k e      e m e          a X
```

The empty C position in the anomalous verbs serves to break up the environment of every vowel deletion rule in Seri. In similar fashion, the empty C creates a context for Epenthesis. Marlett and Stemberger hold that Gemination is now the result of the autosegmental spreading convention shown in (3):

(3) Gemination

```
   O    N C           O    N C
  / \   | |          / \   | |
 C   C  V C  --->   C   C  V C
 |      | |          \ /   | |
 t      a X           t    a X
```

Marlett and Stemberger comment that the abstract C analysis involves 'a very high level of abstractness and opacity'. In contrast, they find the empty C analysis relatively concrete. So concrete, in fact, that it obeys Vennemann's Strong Naturalness Condition (SNC), given in (4):

(4) The Strong Naturalness Condition (Vennemann 1974)

> The lexical representation of an item must be identical to one of the surface allomorphs that that item has in some member of its paradigm.

For example, the lexical representation of aX is as in (5a); the empty C position appears on the surface in the gemination cases, as in (5b):

(5) Lexical and Surface Representations of aX

a. Lexical Represent. b. Surface Represent.

```
O N C              O   N C
| | |               \  | |
C V C                C V C
  | |               /  | |
  a X              t   a X
```

Of course, the two representations are not exactly identical--we must discount the extra association line in the surface representation which connects the empty C position to the preceding consonant. But suppose we concede identity here. Abstractness is a relation between two levels of representation. Marlett and Stemberger show that if we enrich one or both of these levels, we change the relation between them. But this fact, by itself, is of little interest. The motivation for constraints on abstractness has usually been a concern with learnability--Marlett and Stemberger's reference to opacity is a reminder of this concern. The question we must ask, then, is whether the learnability of the grammar of Seri has been enhanced by the shift from abstract C's to empty C's. Learnability is a relation between available data, D, the grammar for that data, G, and UG, as shown in the conventional diagram in (6):

(6) Learnability: 'The Projection Problem'

D <---> UG <---> G

The question here, then, is: is it easier to learn G-E (the grammar with empty consonants) from D (the data of Seri) via UG-T (a general theory of the three-dimensional type) than it is to learn G-A (the grammar with abstract consonants) from D via UG-L (an SPE-type linear theory)? The answer is, that aside from certain minor perturbations, it is equally easy or difficult. Learnability in either case depends on whether UG incorporates some version of the Naturalness Condition:

(7) The Naturalness Condition (cf. Postal 1968)

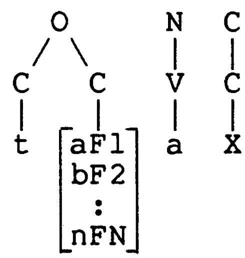
> Phonological classifications are preferred to morphological or arbitrary classifications at all levels of the phonology.

To learn that certain words in Seri have an initial empty C, one has to notice, not just that some words are exceptions to a number of rules; one has to discover that these words, though beginning with a vowel, all act as if they begin with a consonant--that this is what characterizes their exceptionality. But the very same evidence which would lead one to posit an empty C via UG-T would lead one to posit an abstract C via UG-L (still leaving aside the gemination case to which I will return below). Conversely, any UG which does not incorporate the Naturalness Condition will fail to lead a learner to either the empty C or the abstract C; cf. the model proposed by Klausenburger (1983, 623).

Now, there is in fact some difference between UG-T and UG-L with regard to learnability. As Marlett and Stemberger suggest, it may be possible to discern the existence of an empty skeletal position in the fact of gemination in Seri. In UG-L, the gemination would be due to the assimilation of the abstract C to a preceding C. But UG-L has no principle indicating why that C, but no other, should assimilate. Tiered phonology, with a skeleton capable of stability, makes available unoccupied skeletal positions to which adjacent segments can spread. A linear SPE-type theory, with no independent skeleton, draws no connection between deletion and spreading, and hence has difficulty with compensatory processes. Thus, Gemination points to an empty position in UG-T more strongly than it points to an abstract consonant in UG-L.

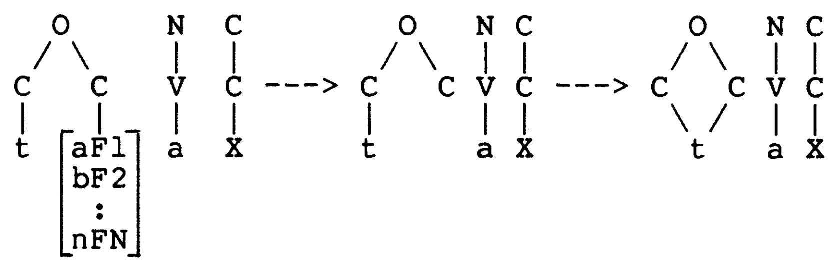
These considerations, however, do not choose the Empty C analysis over an Abstract C analysis; for the latter analysis remains possible in UG-T. Hence, all the facts of Seri would follow equally if the anomalous verbs were represented as in (8):

(8) Abstract Consonants in CV Phonology



Suppose that the abstract C in (8) has the feature matrix [aF1, bF2...nFN]. When this feature matrix is unlinked, the associated skeletal position becomes available to spreading of the preceding consonantal features:

(9) Gemination Following Delinking



Gemination, then, does not show that a skeletal position was always empty--more usually, it indicates that a position has become empty at some point in the derivation.

How can we choose between the empty and abstract analyses? Learnability is no longer at issue--once it is realized that the anomalous verbs have some sort of initial consonant, the learnability problem is essentially over. For since there is no language particular evidence as to what, if any, features this consonant has, the choice of features must be guided by Universal Grammar. We know that this consonant is distinct from all other ones in the language--does UG allow us to leave it unspecified?

We come, then, to the question of underspecification. It might appear attractive to posit an empty C as representing a consonant whose features never appear on the surface or play a role in the phonology. However, this use of underspecification is incompatible with other aspects of underspecification theory, and leads to technical and substantive difficulties. To see why this is so, it is necessary to briefly review the general problem of zero elements in phonology.

Stanley (1967) showed that the presence of unspecified feature values in the phonology could lead to a ternary feature system, where 0 contrasts with both + and -. For example, in (10), the only difference in the initial matrices of A, B, and C is in the specification of the feature F; yet, one can see that whatever value of F is filled in for B, the derived matrices of A, B, and C will be distinct--i.e. a three-way contrast has been produced by a supposedly binary feature:

(10) 0 as a Third Feature Value (Stanley 1967)

a. <u>Initial Matrices</u>

<u>A</u>	<u>B</u>	<u>C</u>
$\begin{bmatrix} +F \\ -G \\ -H \end{bmatrix}$	$\begin{bmatrix} -G \\ -H \end{bmatrix}$	$\begin{bmatrix} -F \\ -G \\ -H \end{bmatrix}$

b. <u>Phonological</u> <u>Rules</u>

1. [+F] ---> [+G]

2. [-F] ---> [+H]

3. Default Rule: [0F] ---> [-F]

c. <u>Derived Matrices</u>

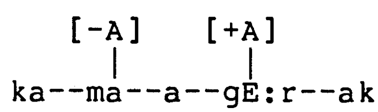
$$\underline{A}\ \begin{bmatrix}+F\\+G\\-H\end{bmatrix} \qquad \underline{B}\ \begin{bmatrix}-F\\-G\\-H\end{bmatrix} \qquad \underline{C}\ \begin{bmatrix}-F\\-G\\+H\end{bmatrix}$$

Stanley (1967) did not question the correctness of the empirical claim that features are binary. In early work, it was assumed that underspecification of feature values should play no role in the phonology beyond being a means of capturing redundancies. Therefore, to prevent situations such as (10), Stanley proposed to specify all 0's before the application of any phonological rule.

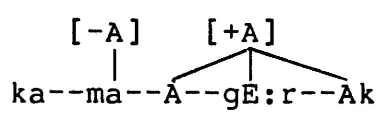
Subsequent work has revealed that features can operate in ternary fashion, within certain limits. Consider, for example, a language having high and low tones, where some morphemes are always high, some are always low, and others are changeable, depending on their environment. Or a vowel harmony system such as that of Kalenjin, where the vowels of some morphemes are always [+ATR], the vowels of other morphemes are [-ATR] except when in the environment of [+ATR], and the vowels of a third set of morphemes are always [-ATR], and interrupt the spread of [+ATR] to variable morphemes:

(11) Limited Ternary Feature Systems: Vowel Harmony

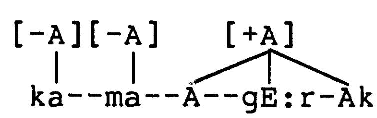
a. Lexical Represention:



b. [+ATR] spreads in both directions:



c. Default: unspecified vowels receive [-ATR]:



In tiered phonology, these distinctions can be expressed in terms of association to an autosegment. In such cases, one feature value is the one that spreads--the 'hot' or 'marked' value--while the other feature value--the 'default' or 'unmarked' value--need not be specified, except in the case of opaque segments, which resist and block spreading. Notice that in such cases the absence of a feature specification is not merely a notational shorthand. Elements unlinked to an autosegment act differently from elements linked to an autosegment: hence, a ternary system. But the ternariness is limited. We do not find the full power of ternary systems illustrated in (12):

(12) Three-Valued Autosegment (Pulleyblank 1983)

a. <u>Initial</u> <u>Matrices</u>

```
 [+F]                 [-F]
   |                    |
   A         B          C
   |         |          |
 [-G]      [-G]       [-G]
 [-H]      [-H]       [-H]
```

b. <u>Phonological</u> <u>Rules</u>

```
                             [+F]
                               |
1. [-G] ---> [+G] /            x
                               |
                               _

                             [-F]
                               |
2. [-H] ---> [+H] /            x
                               |
                               _
```

3. Default assignment on [F] tier: [-F]

c. <u>Derived</u> <u>Matrices</u>

```
 [+F]      [-F]       [-F]
   |         |          |
   A         B          C
   |         |          |
 [+G]      [-G]       [-G]
 [-H]      [-H]       [+H]
```

(12) is simply a recreation of Stanley's example in terms of tiered phonology. As Pulleyblank (1983)

has shown, Stanley's argument is essentially unchanged by the fact that features F, G, and H are on different tiers. In (12), the three-way distinction between [+F], [-F], and 0F is exported to affect features G and H. Yet, as far as I know, this kind of power is not attested. Thus, if + is the hot value of F, and - is the default value, I know of no case where 0 contrasts with - with regard to some other feature H, as in the above example. In this sense, opaque elements--i.e. elements specified for the default value--may be said to be inert. They block the spreading of [+F], but their [-F] specification is not otherwise distinct from 0.

To rule out cases like (12), Archangeli (1984), following Kiparsky (1982), proposes to assign only hot values in underlying representations, so only a two-way contrast between 0 and + or 0 and - can exist. In addition, she proposes the following constraint:

(13) The Redundancy-Rule Ordering Constraint

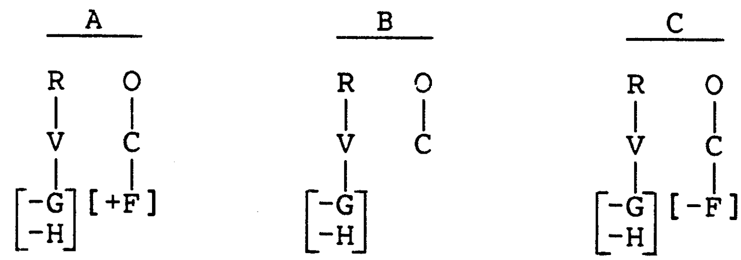
> A redundancy rule assigning "a" to F, where "a" is "+" or "-", is automatically ordered prior to the first rule referring to [aF] in its structural description. (Archangeli 1984)

Note that the first restriction is incorrect: the three-way contrast between +, -, and 0 does arise if there are opaque segments. However, the constraint in (13) gives the right results by itself, and correctly predicts the inert nature of opaque elements. The situation in (12) will never arise because, if [-F] is the default value, it will have to be filled in prior to the operation of rule (2); hence, 0 and - will not contrast with respect to any rule, except a rule spreading [+F].

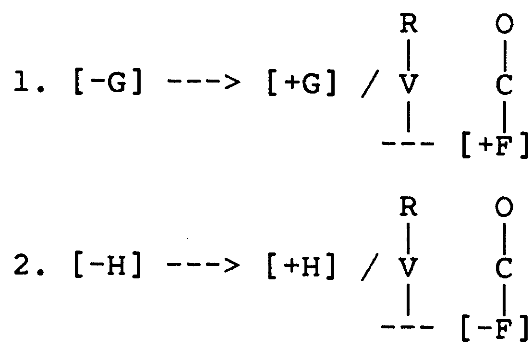
Let us now consider the case of empty elements. As these are elements unspecified for any feature, a ternary system can potentially arise here, too:

(14) Ternary Feature Values with Empty C Positions

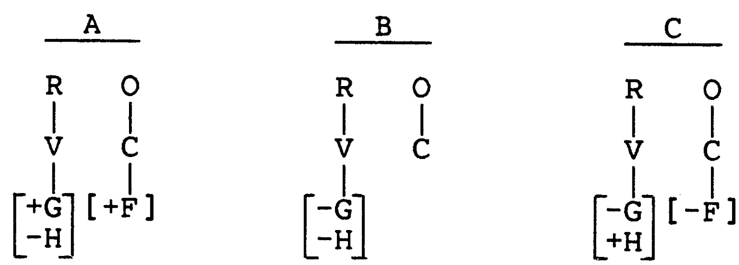
a. Initial Representations



b. Phonological Rules



c. Derived Representations



(14) is another replay of Stanley's case, this time with the empty element supplying the third value. To prevent this non-inert ternariness, we can again invoke the Redundancy-Rule Ordering Constraint to attach the default value of F to the empty slot. Indeed, we could not prevent default values from applying. It follows, then, that an empty slot cannot remain empty after the assignment of any default value.

Requiring empty skeletal elements to be subject to the Redundancy-Rule Ordering Constraint has other constraining effects on their behaviour. Consider, for example, an empty slot created by the delinking of its segmental features (cf. (9) above). If the delinking occurs after some default values have already been specified, the empty slot again threatens to create the ternary configuration shown in (14). To preserve well-formedness of the grammar, we must require that the empty slot be filled immediately--if not by spreading from a neighbouring segment, then by default values. This requirement rules out global compensatory processes, whereby an empty slot is created early in the derivation, and spreading is delayed until some other rules have applied. In fact, though, compensatory processes happen at the point in the derivation where the slot is delinked--that is why the deletion and spreading have sometimes been thought to constitute a single process. In a theory where empty slots are allowed to remain empty indefinitely, there is no reason to expect such a result.

In short, the use of an empty C to represent a consonant necessarily distinct from every other consonant in the language amounts to using zero as a third feature value, and not just in the limited, inert way supported by the data. The only interpretation of an empty C which is compatible with the rest of underspecification theory is that it is the default consonant. If an unpronounced consonant is not the default consonant, it may not be empty in lexical representation, but must be assigned a set of features making it distinct from all other phonemes. What these features are is determined by UG, which must in any case specify feature settings in the absence of language particular evidence in a wide range of cases--that is the whole point of the notion of default, or unmarked, values.

Of course, it is possible that underspecification theory is wrong. An empty C is a formal object whose interpretation depends on the theory in which it is embedded. If we do not allow default elements to be completely unspecified, and if we can limit ternary power in some other way, it may be possible to reserve empty C's only for cases such as Seri. But such an alternative theory remains to be developed.

In the meantime, by requiring the abstract analysis in such cases, we can preserve the coherence of underspecification theory as it exists now, limit the ternary use of features, and impose constraints on possible derivations. In this case, the abstract analysis is the more constrained one.

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