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The Function of Structure Preservation: Derived Environments

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THE FUNCTION OF STRUCTURE PRESERVATION: DERIVED ENVIRONMENTS[1]

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Structure preservation is proposed as a principle in lexical phonology (Kiparsky 1982, 1985, Pulleyblank 1983) to prevent rules of the lexical phonology from creating structures or introducing features that are not used distinctively as part of lexical entries. Archangeli and Pulleyblank (1986) provide a particular formalization of structure preservation, proposing that a grammar contains configurationality constraints, positive and negative constraints that restrict representations, both underlying and derived. For example, if a language does not allow nasalized vowels, this language has the negative configurationality constraint shown in (1).

(1) * V
        |
   [+nasal]

The existence of this constraint blocks a rule of nasalization from applying in this language at the levels at which the constraint holds.

Archangeli and Pulleyblank, following Kiparsky, argue that a function of configurationality constraints is to block rules from applying if their application would create a violation of a constraint. An example of blocking is found in Yoruba (Archangeli and Pulleyblank).

In Yoruba ATR harmony is found, with the nonhigh vowels having both [+ATR] and [-ATR] counterparts. [ATR] is nondistinctive for high vowels; they are phonetically always [+ATR]. There is a configurationality constraint in Yoruba that allows [-ATR], the marked value, to link to a vowel only if the vowel is [-high]. Archangeli and Pulleyblank express this constraint as in (2).

(2) (-ATR : (Node) : -high)

Unlike the nonhigh vowels, high vowels in Yoruba neither trigger nor undergo vowel harmony. These vowels do not trigger harmony because they are not underlyingly specified for the feature [ATR]. They do not undergo harmony because of the configurationality constraint in (2). Since the constraint in (2) allows [ATR] to occur only with the specification [-high], the high vowels, which are unspecified for height, are not eligible to receive an [ATR] specification. The configurationality constraint given in (2) thus serves to block the harmony rule from applying.

In this paper, I argue that while configurationality constraints may function to block rules from applying, as claimed by Kiparsky and by Archangeli and Pulleyblank, there are cases where they do not serve to block rules, but instead to repair violations arising from the application of a rule. More specificially, configurationality constraints block the application of rules within a morpheme. Between morphemes, rules may apply even though they may create violations to the configurationality constraints of the language. The constraints then function to correct representations that violate them. This different functioning of the configurationality constraints within and between morphemes follows, I suggest, from the Morphemic Tier Hypothesis (McCarthy 1979, 1986). Within a morpheme, a violation of a configurationality constraint is immediately visible and thus the constraint can block rules from applying. Between morphemes, however, the violation of a configurationality constraint may not be visible at the point at which the structural description of a rule is met. The rule is thus able to apply. After tier conflation (Younes 1983), the violation of the configurationality constraint is visible and modification of the representation must occur so that the constraint is met. Configurationality constraints thus function similarly to the OCP: within morphemes both block rules from applying, between morphemes both allow the application of rules.

I will examine the between-morpheme effect of configurationality constraints by looking at a rule found in many Athapaskan languages. I draw my data primarily from the various dialects of Slave, an Athapaskan language of northern Canada.[2]

Assumptions

I make several theoretical assumptions in this paper. First, I assume a theory of underspecification (Archangeli 1984, Archangeli and Pulleyblank 1986). I assume furthermore that default values must be filled in as soon as the default value becomes an active value on a tier. Finally, I assume that features are organized hierarchically, as proposed by Clements (1985). Individual features are organized under hierarchically superordinate nodes representing laryngeal and supralaryngeal features. The supralaryngeal node further consists of place and manner tiers. The nodes are dominated by a root node,. which links to the organizing tier.

The D-Effect Rule in Slave

In many Athapaskan languages, a process known as the D-Effect Rule (DER) is found. This process takes a morpheme commonly called *d* and combines it with the following consonant, the initial consonant of the stem. This morpheme, traditionally termed a classifier, can either be part of a basic lexical entry or indicate voice. In the Slave dialects, the results of the D-Effect are as summarized in (3). Not all of the sounds shown in (3) are found in any single dialect of Slave; rather (3) and the inventory given in (4) represent four distinct dialects.

(3) d+continuant	d+?	d+ nasal	d+ other consonant[3]
d+z-->dz	d+?-->t'	d+n-->d	d+b-->b, d+p-->p, d+p'-->p'
d+ð-->dð		d+m-->b	d+d-->d, d+t-->t, d+t'-->t'
d+l-->dl			d+dz-->dz, d+ts-->ts, d+ts'-->ts'
d+ž-->dž			d+dð-->dð, d+tθ-->tθ, d+tθ'-->tθ'
d+w-->gw			d+dl-->dl, t+tl-->tl, d+tl'-->tl'
d+γ-->g			d+dž-->dž, d+tš-->tš, d+tš'-->tš'
d+v-->b			d+g-->g, d+k-->k, d+k'--k'
			d+gw-->gw, d+kw-->kw, d+kw'-->kw'

Before turning to an examination of the D-Effect Rule itself, I present the underlying consonant inventory of Slave.[4]

(4)

	b	p	p'	v	m	d	t	t'	n	dð	tθ	tθ'	ð	dz	ts	ts'	z	dl	tl	tl'	l	dž	tš	tš'	ž	g	k	k'	gh	gw	kw	kw'	w	?
SG		+					+				+				+				+				+				+				+			
CG			+					+				+				+				+				+				+				+		+
ant.																						-	-	-	-	-	-	-	-	-	-	-	-	
cor.	-	-	-	-	-																					-	-	-	-					
round																														+	+	+	+	
distr.										+	+	+	+																					
nasal					+				+																									
lateral																		+	+	+	+													
continuant				+						ʌ	ʌ	ʌ	+	ʌ	ʌ	ʌ	+	ʌ	ʌ	ʌ	+	ʌ	ʌ	ʌ	+				+				+	

(note ʌ = branching segment)

In (4), redundant feature values are left blank. These feature values are provided by default and complement rules, as defined by Archangeli (1984) and by Archangeli and Pulleyblank (1986). Some of the redundancy rules are shown in (5).

(5) [ ] --> [+anterior]
[ ] --> [+coronal]
/\ --> / \
[+cont]
[ ] --> [-continuant]

In (4), it can be seen that stops are totally unspecified for manner features, as are affricates. Fricatives are specified [+continuant] and nasals [+nasal]. The place features [-anterior] and [-coronal] are the marked values.

In Slave, there are a number of constraints on segment structure that restrict the forms of consonant representations. As can be seen from the inventory given in (4), Slave allows branching segments in its inventory: affricates are found. Only nonsonorant continuants can occupy the right branch of a branching configuration. This constraint can be captured by a positive configurationality constraint, as in (6).

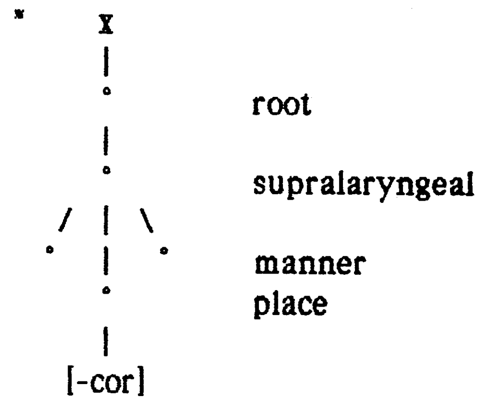
```
(6)      x
         |
         °            root
         |
         °            supralaryngeal
        / \
       °   °          manner
           |
        [+cont]
```

A negative configurationality constraint restricts nasals from occurring on the right branch.

```
(7)    *    x
            |
            °         root
            |
            °         supralaryngeal
           / \
          °   °       manner
              |
          [+nasal]
```

The final relevant configurationality constraint also concerns branching structures. While the coronal affricates *dz, dl, dž* and *dð* are found, noncoronal affricates are not. Because [-coronal] is the marked feature value, this can be stated as a negative constraint, as in (8).

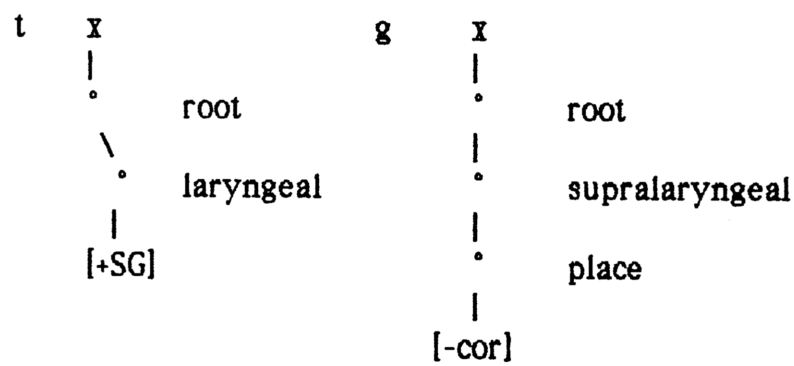
(8)



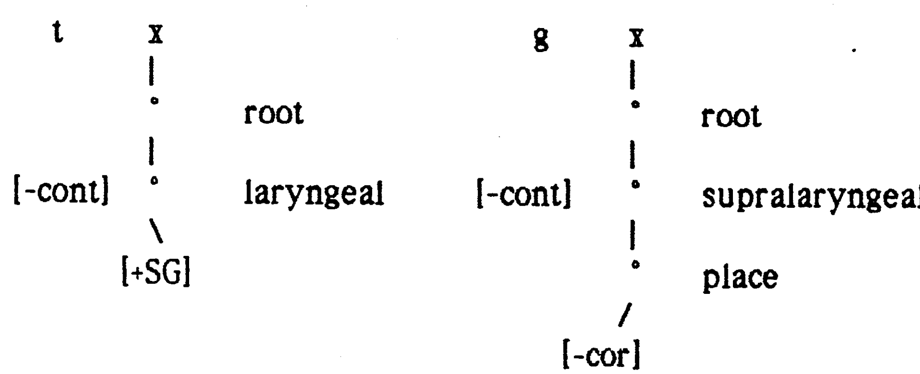
Having established the underlying inventory, underspecification, and relevant configurationality constraints, I turn now to the representation of the morpheme known as the *d* classifier. While I will show that this morpheme is a single feature, I will continue to refer to it as the *d* classifier for convenience. This morpheme never occupies a timing unit itself: it is either phonetically part of the following consonant or is not phonetically realized. This fact suggests that the morpheme is, as proposed by Wright (1984) and Speas (1984) for Navajo and Rice (1985) for Slave, a morpheme without a timing unit on the organizing tier. The morpheme is also largely underspecified for segmental features. As shown in (3), with the exception of d+ʔ, the place of articulation of the segment resulting from the DER has the place of articulation of the following consonant. The underspecification given in (4) suggests that *d* is unspecified for place; it receives its place value from the following consonant except in the case of d+ʔ→t', where the default place values are realized.

The morpheme is also unspecified for laryngeal features as it receives all of these from the following consonant. It is only manner features that *d* imparts. The morpheme appears to consist solely of the marked feature value [-continuant] since its major effect is to create noncontinuants from continuants. A morpheme consisting of a single feature of marked feature value is precedented in Athapaskan languages: there is a classifier and a compound formative, both of which consist of just the feature [-spread glottis]. See Rice (1986), Rice (to appear), and Hargus (1985) for discussion.

I will assume that the underlying representation of this morpheme is [-continuant] and look at how each of the categories shown in (3) is derived. Consider first the stops. Representations for [t] and [g], using Clements' hierarchical feature structure, are given in (9). In these representations I assume that the supralaryngeal node dominates both a place node and a manner node.

(9)


When the *d* classifier is added, the representations shown in (10) arise.

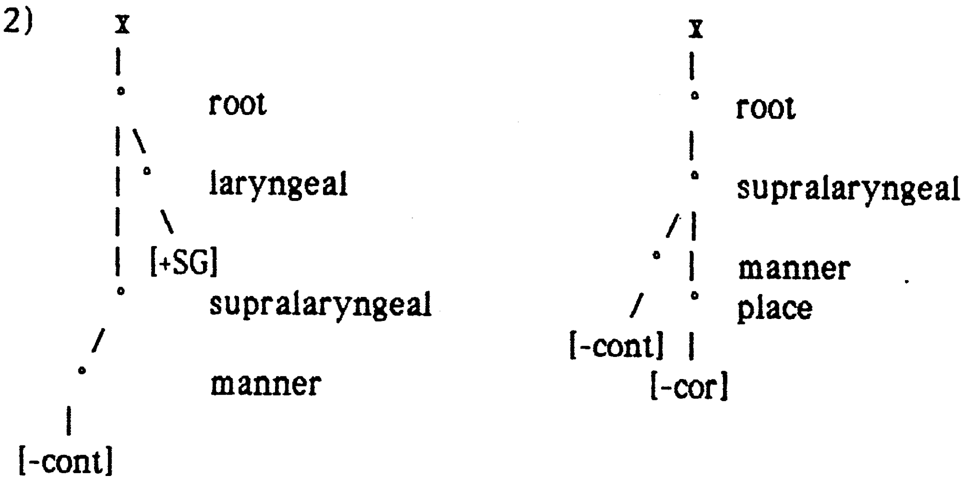
(10)


The floating feature [-continuant] must associate with a timing unit. Formally this is done by a rule that adds an association line to associate [-continuant]. In a well-formed representation, the feature [continuant] is dominated by a manner node which is in turn a daughter of the supralaryngeal node. I assume that the process of node generation, defined by Archangeli and Pulleyblank as in (11), functions to automatically provide the nodes that must intervene between the root and the autosegment to be linked.

(11) A rule or convention assigning some feature or node a to some node b creates a path from a to b.

On the cycle on which the classifier is added, the only available node for the morpheme to associate to is that of the following consonant because no preclassifier morphological or phonological material is present. The D-Effect Rule thus simply states that structure is added with the feature to be associated being [-continuant]. Node generation automatically creates the relevant structure. In the case of [t], both a manner node and a supralaryngeal node are created by node generation when the classifier associates while in the case of [g] only the manner node must be created since a supralaryngeal node is already present. This operation results in the representations in (12).

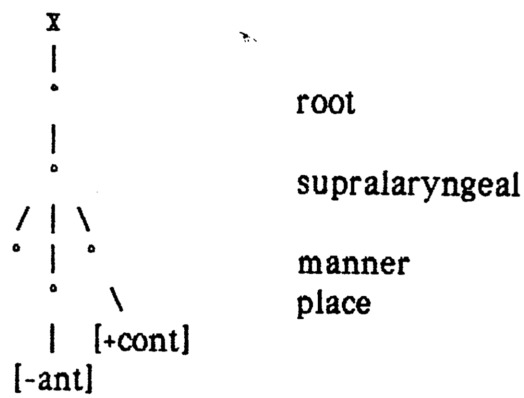
(12)



The default and complement rules in (5) come into play to complete the representation in (12).

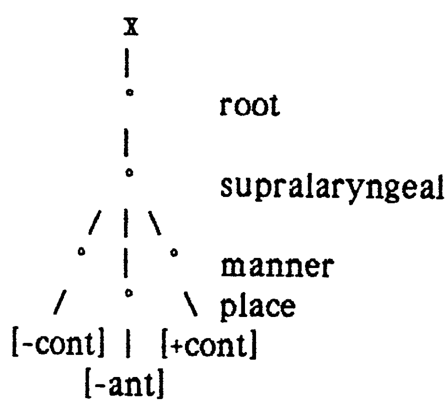
Affricates are similar to the stops. Consider the representation of *dž* given in (13).

(13)



Affricates are branching segments, as illustrated in (13) by the branching at the supralaryngeal node into two manner nodes. When the *d* classifier is added, (14) results.

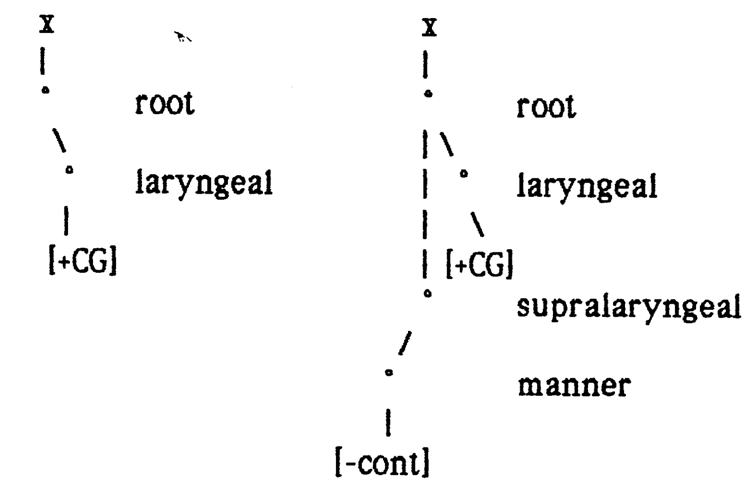
(14)



The feature [-continuant] associates to the left branch, creating an affricate.

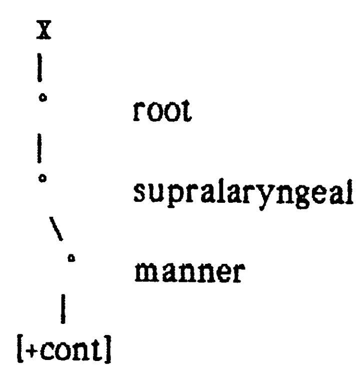
As discussed by Hayes (1986), Goldsmith (1976), and others, glottal stop is represented solely by the laryngeal feature [+constricted glottis]; it has no place or manner features. The addition of the *d* classifier forces the addition of manner and supralaryngeal nodes in addition to the laryngeal node by the process of node generation. The default place features fill in the place values, creating the alveolar [t']. This is illustrated in (15).

(15)



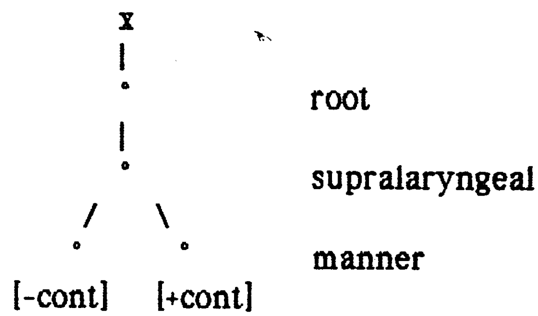
The fricatives are somewhat more complex in nature. I consider the coronal fricatives first. A fricative has the basic lexical representation shown in (16).

(16)



When the *d* classifier is added, it introduces the feature value [-continuant] into a representation that is already specified as [+continuant]. However, Slave allows a branching structure so the association of the *d* classifier creates the affricate structure in (17).

(17)



The place features are automatically shared by both parts of the affricate.

Now consider what happens when *d* combines with the velar and labial fricatives, the noncoronals. In these cases, the [-continuant] morpheme must still associate to the following segment because the result of the D-Effect Rule is a noncontinuant. The expected affricates [gγ] and [b^v] are not found, however. What kind of explanation can be offered for this?

While coronal affricates are part of the underlying consonant inventory, noncoronal affricates are not. This seems to provide part of an explanation: it is what is usually meant by structure preservation. Noncoronal affricates cannot be created because they are not part of the underlying inventory and they are not allowed by configurationality constraints. However, if configurationality constraints have solely a blocking function, the configurationality constraint given in (8) should block the noncoronal affricates from being derived altogether. Notice, however, that unlike in Yoruba, the configurationality constraint in Slave blocking noncoronal affricates cannot function to block the association of the feature [-continuant]: if it did, then the result of adding *d* to stem initial *γ* would simply be [γ] and that of adding *d* to stem initial *v* would be [v]. Instead, association must be allowed to occur. The configurationality constraint then must function as a well-formedness condition, minimally modifying the representation to produce a well-formed structure, one meeting the configurationality constraint.[5] This modification is achieved by delinking the original association line, a proposal originally made by Goldsmith (1976).[6]

The nasals also combine with the classifier in an initially unexpected way. d+n yields [d] rather than [dn] and d+m yields [b] rather than [bm]. The representation for a form derived by the association of the *d* classifier is given in (18).

(18)

```
              x
              |
              °            root
              |
              °            supralaryngeal
            /   \
           °     °         manner
       [-cont]  [+nasal]
```

A branching structure arises which violates the configurationality constraint that the right branch of a branching segment cannot be [+nasal]. Again, this structure must be modified to satisfy the configurationality constraints holding at this level; it too is modified by deleting the right branch, the original association.[7]

As a side issue here, I note that it is primarily with respect to the nasals that differences are found in the D-Effect in the various Athapaskan languages. In Sarcee, d+n yields [n]. This difference between languages can be accounted for if in Slave, the manner features are dominated by a manner node, with the *d* classifier creating its own manner node by node generation when it associates, as described above. In Sarcee, on the other hand, there is not a manner node, consistent with the treatment of manner proposed by Archangeli and Pulleyblank. Instead [-continuant], the feature value introduced by word formation, is consistent with [+nasal], just as it is with the stops and affricates. Thus [n] results. The representation of a derived [n] is illustrated in (19).

(19)

```
              x
              |
              °        root
              |
              °        supralaryngeal
            /   \
       [-cont] [+nasal]
```

With the fricatives, the features [-continuant] and [+continuant] attached to the same supralaryngeal node form a well-formed structure in the language; the structure can be interpreted as an affricate, as illustrated in (20).

```
(20)            x
                |
                °      root
                |
                °      supralaryngeal
               / \
         [-cont] [+cont]
```

The different treatment of nasals in the different Athapaskan languages suggests that one way in which languages may differ is in whether or not they have a manner node.

We have seen that in Slave, the configurationality constraints do not function as in Yoruba, where they block a rule from applying, but instead they function to modify representations that violate them. How might such a situation arise?

McCarthy (1986), makes two proposals concerning word formation. First, according to the Morphemic Tier Hypothesis morphemes enter on different tiers. Second, Tier Conflation (Younes 1983) places morphemes on a single tier at the end of a cycle (or level), creating essentially a nonderived form. Assuming these hypotheses, the different functioning of configurationality constraints in Yoruba and Slave becomes systematic. In Yoruba, only single morphemes are involved, so at the time of application of vowel harmony, an entire representation is visible. In Slave, on the other hand, it is two morphemes that combine with each other. If the classifier, the feature [-continuant], enters on its own tier, it will associate to the root node of the following consonant, with node generation creating the appropriate structure. When tier conflation applies, the two morpheme tiers conflate into one and the feature [-continuant] must be placed on the same tier as the other features.

(21) shows the representation of d+ɣ at the point of word formation, before the application of tier conflation.

```
(21)      [-cont]
             |
             °           manner
             |
             °           supralaryngeal
             |
             °           root
             |
             x
             |
             •           root
             |
             °           supralaryngeal
            / \
           °   \         manner
           |    °        place
       [+cont]  /\
          [-ant] [-cor]
```

(22) is the representation that results from tier conflation.

```
(22)              x
                  |
                  °          root
                  |
                  °          supralaryngeal
                / | \
               °     •       manner
              /   |   \
        [-cont]   °  [+cont] place
                 / \
           [-ant] [-cor]
```

Notice that now the violation of the configurationality constraint disallowing branching noncoronals is visible. The constraint then functions in an active way to correct the representation, yielding the well-formed representation in (23) by delinking of the original association line, the line on the main melody tier.

(23)

```
               x
               |
               °            root
               |
               °            supralaryngeal
             /   \
            °     \         manner
            |      °        place
        [-cont]   / \
           [-ant] [-cor]
```

By allowing configurationality constraints to correct ill-formed representations that arise heteromorphemically, the DER found in many Athapaskan languages can be expressed in a general format, as the linking of a morpheme of the form [-continuant] to the adjacent timing unit. If the configurationality constraints cannot function in this way, the expression of this process is more complex and otherwise unnecessary rules are required.

Summary

To summarize, I have shown, based on data from the Athapaskan language Slave, that configurationality constraints do not have just a blocking function. They may be violated in a derivation and used to repair an impermissible representation. It appears to be predictable just when they will function to block and when they will function more actively to modify: within a morpheme, where the entire representation is visible, the configurationality constraints have a blocking function. However, between morphemes, where an entire representation may not be visible because morphemes enter on different tiers, the configurationality constraints may be violated, necessitating a modification function once the entire representation is visible, after the application of tier conflation.[8] In this way configurationality constraints appear to be directly parallel to the OCP; it too has a blocking function within a morpheme, blocking geminates from being created; and an active function between morphemes, restructuring sequences of like consonants so that the condition is met.

Footnotes

[1]The fieldwork for this paper was funded by the Northern Social Research Division, Department of Indian and Northern Affairs, Ottawa, Canada; the British Columbia Provincial Museum; and the Friends of the British Columbia Provincial Museum. I appreciate the critical reading done by Peter Avery and Elan Dresher.

[2]Slave is a term used for the dialects usually called Hare, Bearlake, Mountain, and Slavey. While I use data from Slave, the process under discussion here is found in many Athapaskan languages and differs in only minor ways between languages. With one exception that I am aware of, the analysis offered here also handles the process in the related languages.

[3]The other consonants are stops and affricates.

[4]The continuants in Slave are represented here with the symbol normally used for the voiced one. While phonetically there are distinctions between voiced and voiceless fricatives in Slave, underlyingly [voice] is not a distinctive feature, but voicing is predictable from the environment. See Rice (1986) for details. In Slave, /w/ and /l/ pattern with the fricatives.

[5]The most elegant treatment of the D-Effect Rule in the Athapaskan literature is given by Howren (1971). He proposes that the manner features of the *d*(vocalic, consonantal, continuant, nasal) and the other features (sonorant, voice, glottal, high, back, strident, abrupt release, round) of the following consonant are maintained as a result of the D-Effect. Howren requires an adjustement rule to account for d+ɣ (and presumably for d+v, which he does not treat). The analysis provided by Howren is groundbreaking, especially considering the framework that he was using. The framework proposed here allows the prediction of the adjustment rule from basic principles.

[6]It appears that in Mende, a constraint must delink a new association line rather than the original association line. The issue of just how configurationality constraints determine what the appropriate minimal modification is requires further investigation.

[7]Only vowel-initial stems have not been mentioned. There are no vowel-initial verb stems in Slave synchronically. Historically, such stems existed. When the *d*classifier preceded a vowel initial stem, restructuring took place to yield an underlying *d*initial stem. In stems in Slave, the onset position of a syllable is obligatorily filled; I assume that the floating *d*classifier was syllabified into this position if nothing else was there, leading to restructuring of the stem to become *d*-initial.

[8]The notion of invisibility proposed here is linked to derived environments. As suggested to me by Elan Dresher, it is likely that cases of invisibility will also arise within morphemes. For instance, if a rule applies before all feature values are specified, a violation of a constraint may not be visible at the time of rule application. Once redundancy rules apply to fill in redundant feature values, the violation becomes visible, triggering the configurationality constraint to act to repair the violation.

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