On Basque Affricates

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1. Introduction *

The representation of affricates and other non-steady-state segments posed se-
rious problems to linear phonological theories. Hierarchical models such as the
one introduced in Clements (1985) offer the possibility of representations that
capture the behavior of these segments in a much more conspicuous way than in
earlier models. Working within a hierarchical theory of phonological representations,
Sagey (1986) proposes that affricate segments differ from simple segments in that
they contain two ordered features [— cont] [+ cont]. Given this representation,
Sagey makes the prediction that affricates will behave as stops for rules involving
their left edge, but as fricatives for rules sensitive to their right edge. Sagey pre-
sents data from a number of languages which offer support for this prediction.

In this paper, I will argue, basing myself on Basque data, that, whereas a
representation of affricates as segments containing two ordered features [— cont]
[+ cont] is essentially correct, it does not necessarily follow from that represen-
tation that these segments will always show edge effects. As I will show, affricates
in Basque are treated as stops with respect to a deletion rule involving their right
side, but sensitive to the feature [— cont]. I will argue for a representation of
affricates as segments containing two ordered supralaryngeal nodes.

2. Basque Stop Deletion

In Basque, sequences of two [— cont] segments are not allowed if the first
of the two adjacent segments also has the feature [— son]. There is a rule which
simplifies these sequences, affecting the first of the two stops. This rule applies
in polymorphemic words, between words which are syntactically closely connected,

and across the board in rapid speech. The operation of this rule can be observed in the examples in (1) (from Salaburu, 1984):

(1)	bat paratu	————>	ba-paratu	'put one'
	bat traban	————>	ba-traban	'one stuck'
	bat kurri	————>	ba-kurri	'run one'
	guk piztu	————>	gu-piztu	'we light'
	gizonak traban	———>	gizona-traban	'men stuck'
	guk kendu	————>	gu-kendu	'we take away'
	ez dut nahi	————>	ez du-nahi	'I do not want'
	bat + naka	————>	banaka	'one by one'

This process also affects affricate-stop sequences, as shown in (2):[1]

(2)	hitz + tegi	————>	hiztegi	'dictionary'
	hitz + keta	————>	hizketa	'conversation'
	hotz bat	————>	hoz-bat	'a cold'
	hotz + tu	————>	hoztu	'to become cold'
	haritz + mendi	———>	harizmendi	'oak mountain'
	haritz + ki	————>	harizki	'oak wood'

As we can see in (2), affricates become fricatives in this context. If we characterize affricates as a type of stop, as in the SPE framework (Chomsky & Halle 1968), we will not be able to account for the facts in (1)—(2) by means of one rule. In such a framework, the whole affricate will be deleted, not only its [— cont] branch, by a rule deleting stops. Consider a possible rule able to capture these facts within the SPE framework, where affricates are [— cont] segments also characterized by the feature [+ del rel]. In the SPE model, if we ignore for the moment the facts in (2), the data in (1) can be straightforwardly accounted for by rule (3):

(3)   [— cont]
      [— son] ————> 0 / ——————— [— cont]

Notice, however, that rule (3), as formulated, will apply to affricates, since they are [— cont, — son] segments, producing incorrect results. Rule (3) will delete an affricate when followed by another stop. Instead of the correct forms in (2), rule (3) will give us the incorrect forms in (4):

(4)   * hitegi, * hiketa, * hobat, * hotu, * harimendi, etc.

In order to obtain the correct results, that is, to account for the fact that affricates do not get deleted, but become fricatives, we would need to modify rule (3) so as to exclude affricates from undergoing the rule and, in addition, we would need another rule affecting only affricates and changing them into fricatives in the same context where stops delete. We would the have the two rules in (5) to account for the data in (1)—(2) whithin the SPE phonological model:

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(1)   Basque has three voiceless sibilant fricatives: dorso-alveolar *z* [s], apico-alveolar *s* [š], and prepalatal *x* [š]. Corresponding to these three articulations, there are three voiceless affricates *tz* [c], *ts* [ć] and *tx* [č].

(5)   a.   [— cont   ]
           [— son   ] ———> 0 / ——————— [— cont]
           [— del rel]

      b.   [+ del rel] ———> [— del rel] / ——————— [— cont]
                             [+ cont   ]

Rules (5a) and (5b) are not collapsible in any interesting way. Yet, both of them account for what arguably is a single process: the suppression of an oral occlusion prior to a second such occlusion.
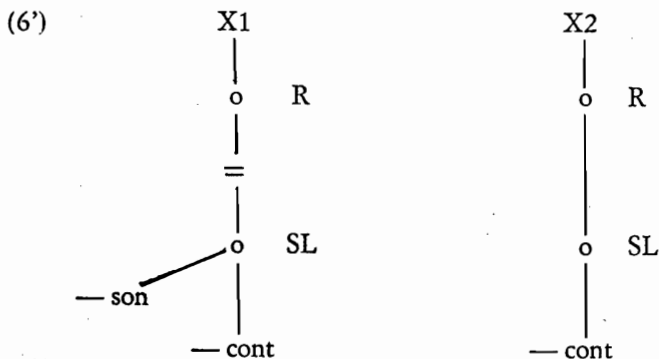
This unsatisfactory result will be produced in any phonological system where affricates are treated as a type of stop, and does not depend on the specific use of the feature [del rel] in the SPE framework.

On the other hand, we can capture the facts in (1)-(2) if we assume that affricates are single segments containing a branching structure. The suppression of the oral occlusion is then expressable as the deletion of all supralaryngeal features of an oral stop, but only the fricativization of an affricate, since the [+ cont] branch should not be affected by the process of deletion.

I will assume that phonological features are hierarchically structured (following Clements (1985), Archangeli & Pulleyblank (1986) and Sagey (1986)) and thus define the process illustrated in (1)-(2) as a rule that delinks a supralaryngeal node:

(6) In a sequence X1, X2 (X1, X2 skeletal slots), where X1 bears the features [— cont], [— son] and X2 bears the feature [— cont], delink the supralaryngeal node immediately dominating [— cont] in X1.

(6)   can be represented as in (6'):

(6')   X1   X2
                          | |
                          o   R   o   R
                          | |
                          = |
                          | |
                        ⁄ o   SL   o   SL
                     ⁄ | |
              — son | |
                     — cont   — cont

In (7a) and (7b), I show how the stop /t/ and the affricate /tz/ are respectively affected by rule (6) when immediately preceding a stop. I assume with Sagey (1986) that affricates are single segments containing two ordered features [— cont] [+ cont]. I depart from her representation, however, in that I assume that these two incompatible features hang on different supralaryngeal nodes: [2]

      (2) I assume that place features of Basque affricates are initially linked only to the [+ cont] branch, since this is patently the part of the affricate that determines the point of articulation of the segment (see fn. 1 above).

(7)a.
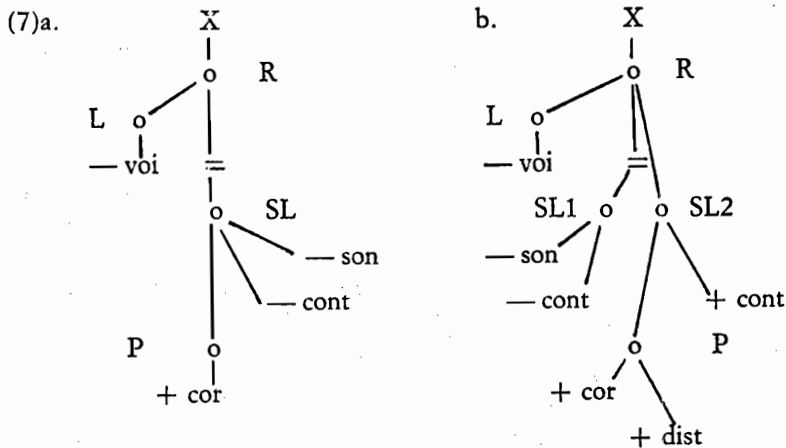
R = root node, L = laryngeal node, SL = supralaryngeal node,
P = place node

The delinking of the supralaryngeal node in (7a) will cause the deletion of all features with the exception of the glottal features. In (7b), on the other hand, delinking the supralaryngeal node immediately dominating the feature [— cont], will leave the right «branch» of the segment intact.

There are three points related to rule (6) that need to be commented upon: First, that the rule delinks a supralaryngeal node without affecting laryngeal features. Second, that affricates do not show edge effects for this rule. Third, that for the correct application of this rule, affricates must be represented as possessing a double supralaryngeal node, and not merely two ordered features under the same node. I will address these three topics separately in the following sections.

3. On the independence of the supralaryngeal features

I have formulated rule (6) as a rule that delinks a supralaryngeal node. This is the only formulation that permits us to capture the observed effects on both stops and affricates. My formulation of rule (6) implies that laryngeal features will not be deleted. There is in fact overwhelming evidence that this is infact what happens.

If the two segments involved in the rule differ in voicing, the voicing features of the segment which undergoes the supralaryngeal node delinking process often spread to the right (obstruents in a coda are always voiceless). Devoicing occurs obligatorily in derivation, compounding and cliticization (examples in (8)); while it occurs optionally and subject to dialectal variation across word boundaries (examples in (9a), from Txillardegi (1980), and (9b), from Salaburu (1984)):

(8) bait da ———> baita 'since s/he is'
     bait gara ———> baikara 'since we are'
     bat batean ———> bapatean 'at once (one in one)'
     bat + gar ———> bakar 'single, only one'
     beinik bein ———> beinipein 'at least'
     erret + bide ———> errepide 'king's road'

(9)a. guk danok ————> gu-tanok 'we all, erg.'
   nik bezala ————> ni-pezala 'like me, erg.'
   gathiak bezala ————> gathia-pezala 'like cats'
   emakumiek berriz ————> emakumie-perriz 'women again'

b. zenbat duzu ————> zenba-duzu, zenba-tuzu 'how many
   do you have'
   guk dakigu ————> gu-dakigu, gu-takigu 'we know'
   bat bakarrik ————> ba-bakarrik, ba-pakarrik 'one only'

The devoicing process shows that the [— voice] feature of the segment which undergoes supralaryngeal node deletion remains and can link to the right.
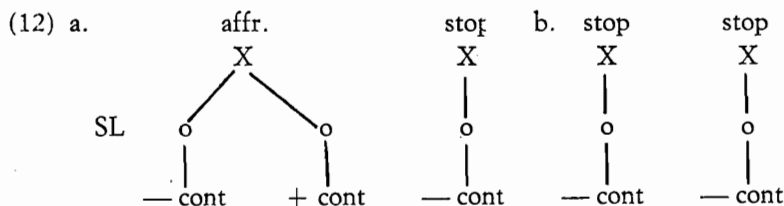
As mentioned, this devoicing process is optional across word boundaries and dialectal variation obtains. Thus, Rotaetxe (1979) indicates that /g/ is not devoiced in this context in the dialect of Ondarroa, although /b/ and /d/ are. But even in cases when the devoicing rule does not apply there is good evidence that the preceding stop has not been totally deleted; but rather, part of the structure remains.

In Basque, voiced oral stops are fricativized roughly in the same contexts as in Spanish (cf. Mascaro (1984), Rotaetxe (1979), Salaburu (1984), Txillardegi (1980)). In particular, the fricative allophone appears after a vowel. Rotaetxe (1979; 95) points out that the articulation of the underlying voiced oral stops is indeed very relaxed in contexts such as intervocalic position and often the consonant is even not heard at all in this position. Examples are given in (10a). In contrast, when there is an underlying stop sequence, a voiced obstruent is always realized as a stop, as the examples in (10b) show (from Rotaetxe (1979; 107)):

(10)a. V————V
   /egon/ [eɣon], [eon] 'to be, stay'
   /egin/ [eɣin], [ein], 'to do, make'
   /lebatz/ [leɣatz], [leatz] 'hake'

b. V————XV
   /semat gat/ [semagas], *[semaɣas], *[semaas] 'how many
   are we'
   /gisonak gas/ [gisonagas], *[gisonaɣas], *[gisonaas] 'we are
   men'

The realization of /g/ as a stop in (10b) indicates that the simplification of the underlying cluster has not left the second stop in intervocalic position. The weakening of /g/ is blocked in these cases because the context is not /aga/ but rather /aXga/, since the application of the stop cluster simplification rule (6) has not totally deleted the first stop in the sequence, but only its supralaryngeal features. The skeletal slot remains behind (with the laryngeal features) and can block the fricativization of the second stop in the original sequence. These facts constitute evidence that rule (6) is correctly formulated as a rule delinking a supralaryngeal node.

Now I will comment on the absence of edge effects shown by affricates in the process that we are considering.
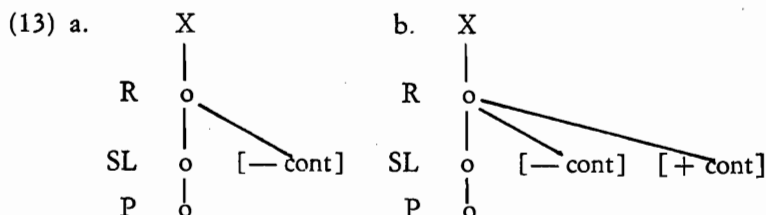
4. On edge effects

As seen in (2), the «stop branch» of affricates undergoes. rule (6), even though the trigger is to the right, and the two [— cont] features are thus not adjacent on the [cont] tier. These facts are in clear contradiction with Sagey's (1986) hypothesis that affricates will show «edge effects»; that is, that they will behave as stops for rules involving their left edge, but as fricatives for rules involving their right edge. Sagey bases her claim on the representation of affricates as contour segments containing two ordered features [— cont] [+cont]. Given this representation and the assumption that the trigger and the target of a rule must be adjacent, the conclusion that affricates will always show edge effects seems to follow directly. For the Basque Stop Deletion Rule, however, affricates fail to show edge effects. I shall demonstrate that it is possible to account for the absence of edge effects in this case without giving up either the representation of affricates as contour segments or the adjacency requirement for the application of phonological rules. For that we must examine how adjacency is determined in phonological representations.

In a unilinear or segmental theory of phonological representations, adjacency can be univocally defined. Within such a theory, the two vowels on a VVC sequence, for instance, are adjacent; and they are not in a VCV sequence. A rule that takes one of the vowels as trigger and the other as target, and applies to both examples, will have a non-local application in the second case.

In a theory where features are hierarchically structured, adjacency can be defined at a number of node levels. Archangeli & Pulleyblank (1986, 1987) show that there are in fact two possible levels on which a rule may scan and on which adjacency is defined. These two levels are the highest structural level (which is the skeletal tier for consonants and the syllable head tier for vowels), and the lowest structural level, which is the tier that immediately dominates the feature directly affected by the rule. This is represented in (11):

```
(11)  Svll. heads        N              N       maximal scansion level
                          \              \       for vowels

      Skeletal tier   X    X        X    X       maximal scansion level
                      |    |        |    |       for consonants
      Root tier       o    o        o    o
                      .    .        .    .
                      .    .        .    .
                      .    .        .    .
      Tier  T         o    o    .   o    o       minimal scansion level
                           |             |       for feature [f]
                         [+ f]        [— f]
```

Consider now the possible effects that a rule sensitive to the feature [— cont], such as the Basque Stop Deletion Rule, may have on both an affricate-stop and a stop-stop sequence. These two types of sequence are represented in (12) in a simplified manner:

(12) a.   affr.   stop   b. stop   stop

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                      affr.              stop    b.  stop         stop
                       X                  X           X            X
                      / \                 |           |            |
      SL          o        o              o           o            o
                  |        |              |           |            |
               — cont   + cont         — cont       — cont       — cont
```

In these representations, the two skeletal slots are adjacent in both (a) and (b). If the rule applies at the maximal scansion level (skeletal slots), both sequences will undergo the rule. If, on the other hand, the rule scans at the minimal level (SL tier), the rule will apply to (b) but not to (a) because the relevant nodes (i.e. those characterized by the feature [— cont]) are not adjacent. Since in the case of the Basque Stop Deletion Rule, the rule does, in fact, apply to both types of sequences, we must conclude that the setting of the scansion parameter for this rule is «maximal».

It is thus perfectly possible to account for instances of affricates not showing edge effects, without giving up the adjacency requirement, once the notion of adjacency is adequately parametrized.

I will, now, offer support for a representation of affricates as containing a double supralaryngeal node, and not just two ordered features hanging from the same node, as in Sagey's model.

5. On the structure of affricates

In (13a) and (13b), I show Sagey's (1986) representation of an oral stop and an affricate, respectively (notice that in Sagey's model the feature [cont] is situated directly under the root node, and not under the supralaryngeal node):

```
(13) a.       X             b.    X
              |                    |
      R   o                 R   o
              \                       \
      SL  o     [— cont]     SL  o   [— cont]  [+ cont]
          |                      |
      P   o                 P   o
```

If we adopted the representations in (13), we would not be able to account for the facts in (1)-(2) as instances of one single phonological process. If we prune the root node in (13), we will obtain empty skeletal slots in the case of both stops and affricates, which is not the correct result. Affecting only the [— cont] feature, on the other hand, will correctly turn the affricates into fricatives, but will not work for the stops. There is not one single operation that can both delete all supralaryngeal features of an oral stop and fricativize an affricate, using the representations in (13). To the extent that this is possible employing the representations in (7), we have an argument for preferring these representations.

The representation of affricates as containing a double supralaryngeal node implies the rejection of Sagey's (1986) minimal branching hypothesis, which she expresses as follows:

(14)   Contour segments may branch for terminal features only. No·
branching class nodes are allowed.

According to this hypothesis, the only representation for an affricate that is
allowed is one in which its two incompatible features [—cont] [+cont] are directly
dominated by the same node. The facts analyzed in this paper, however, show
that this hypothesis is incorrect. Now, I will argue that the representation adopted
in (7) as the only representation able to capture the Basque Stop Deletion facts in
a straightforward manner, follows from a theory which is not less restrictive than
Sagey's and which in addition has some desirable consequences.

Sagey (1986) allows for both ordered and unordered features hanging from
the same node. Two features are taken to be phonologically ordered if they are
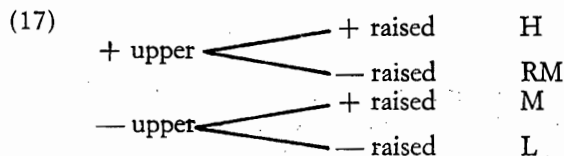incompatible; otherwise they will be unordered.

In the representation in (15) the two features [—cont], [+cont] are ordered
with respect to each other, but the features [—son] is not in an order relation
with the two other features:

(15)   N

          [—son]   [—cont]   [+cont]
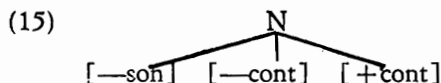
I propose to abandon this view. Instead, I will assume that features are
always unordered. Order relations can be established between node, but not be-
tween features directly dominated by the same node. Order relations between
features are thus only establishable through the ordering of the nodes from which
the features hang. I express this principle in (16):

(16)   In a phonological representation only nodes (and not features) can
be directly ordered.

There is an empirical difference between Sagey's principle in (14) and my
principle (16). Principle (16) allows for two features of the same «class» borne by
one segment to be represented either as ordered (if hanging from different nodes)
or as unordered (if hanging from the same node). An area where this distinction
seems to be needed is the representation of tonal features. Consider Yip's (1980)
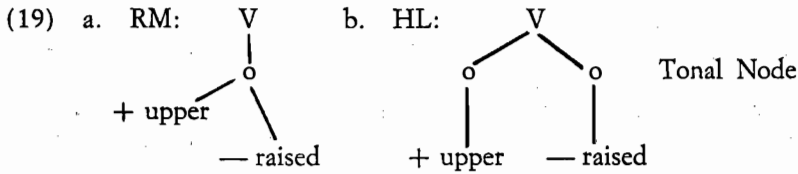proposal for the representation of tonal features, in (17):

(17)
                                      + raised   H
        + upper
                                      — raised   RM
                                      + raised   M
        — upper
                                      — raised   L

Pulleyblank (1987) proposes an underspecified representation of the four tonal
levels distinguished in (18) as follows:

(18)   H   [+ upper]
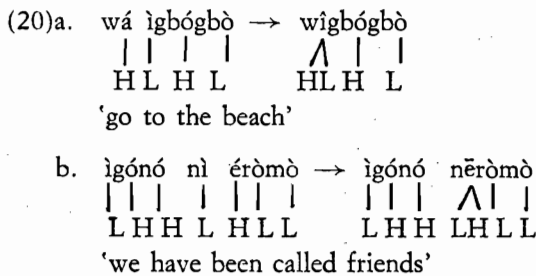   RM   [+ upper], [— raised]
       M   O
       L   [— raised]

The difference between a RM tone, where the features [+ upper], [— raised]

are simultaneous, and a contour HL, where these two same features are ordered, is represented by Pulleyblank (1987) as in (19):

(19)   a. RM: V   b. HL: V

                             o   o   o   Tonal Node

       + upper

                 — raised   + upper   — raised

The correct interpretation of these representations is obtained only if we assume the two tonal features hanging the same node in the representation to the left to be unordered, and the branching tonal nodes in the representation to the right to be ordered. This differentiation, which is predicted by (16), is disallowed by (14). The representation of a contour tone HL as in (19) contains a branching class node (i.e. the tonal node) and is, therefore, expressly prohibited by Sagey's hypothesis.

Let us consider another example involving tonal features. In Agwagwune (Huffman, 1987), the same two tonal features are interpreted simultaneously in some cases, and in a sequence in other cases. The possibility of both ordered and unordered representations for the same two features is thus crucially required in this language. Agwagwune possesses a rule of vowel deletion affecting the first of two vowels in a sequence, but not deleting its tone. Huffman indicates that when Agwagwune Vowel Deletion strands a H tone before L (as in (20a)) the result is a falling tonal contour on the triggering vowel; but when L is stranded before H, a M tone, not a rising contour, results, as in (20b):

(20)a. wá ìgbógbò →   wîgbógbò
        | | | | ∧ | |
       H L H L   H L H L
       'go to the beach'

    b. ìgónó nì éròmò →   ìgónó nēròmò
         | | | | | | | | | | ∧| |
       L H H L H L L   L H H L H L L
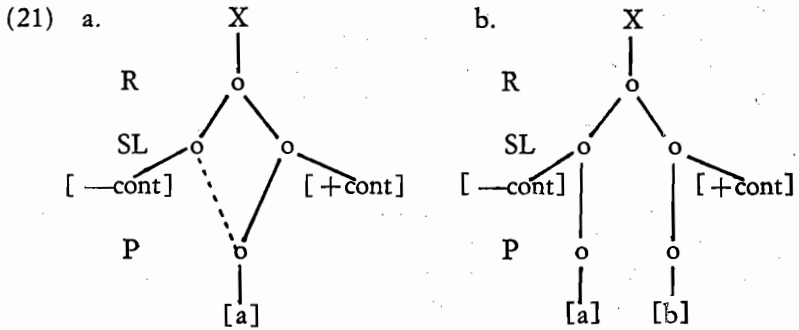   'we have been called friends'

Our theory of phonological representations must provide a way to differentiate between the contour tone resulting in (20a) and the simultaneous production of the same tonal features in (20b). A possible way to view the tonal configurations created in (20) is by representing the falling contour in (a) by means of a double tonal node, which would produce an ordering of the tonal features, whereas in (b) all tonal features are attached to a single node, and, therefore, unordered. The general point that is at stake here is the possibility of universally determining whether two features are incompatible and, therefore, must necessarily be phonologically ordered. Sagey assumes that this is indeed possible; so that for any two features hanging from the same node we will always know whether they are ordered or not from their universally determined compatibility. But we have seen that this cannot be the case for tonal features. I would maintain that tonal features do not constitute a unique phenomenon and that ordering versus simultaneity of two given specifications must be determined language-particularly in other cases as well. Clear candi-

dates are vowel features. A language may, for instance, not allow front rounded vowels, in which case, in loanwords containing theses segments the two incompatible features [+round] [—back] could be obligatorily ordered creating a branching structure. This seems to have happened in numerous French loans into English containing the vowell [y], where [ju] is realized instead, thus ordering the two features that are incompatible in English [3].
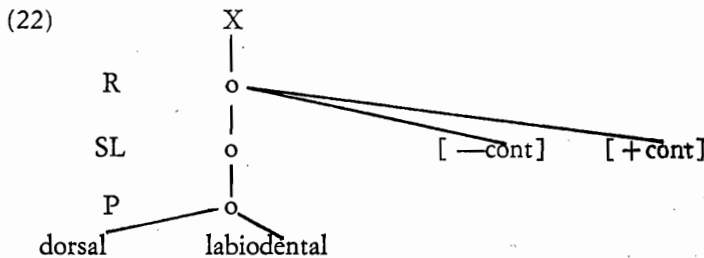
We must, therefore, conclude that phonological representations must indicate whether two features are ordered or not in an unambiguous manner; that is, ordering relations must be structurally represented.

The representation of affricates as having branching nodes predicts the existence of two types of affricates: the two branches of the affricate may or may not be characterized by different place features. Both structures in (21) are predicted to exist:

(21) a.   X   b.   X
                          | |
           R   o   R   o
                        /   \.   /   \
        SL   o   o   SL   o   o
      [—cont]   \ :   / [+cont]   [—cont] | | [+cont]
                       \   / | |
           P   o   P   o   o
                         | | |
                        [a]   [a]   [b]

The structure in (21a) represents an affricate with a single place of articulation. The structure in (21b) is an affricate with two places of articulation: one for the [—cont] branch and another one for the [+cont] branch. Both types of affricates are indeed attested. The English and Basque affricate segments are of the type in (21a). Aghem [pf], [bv] (cf. Hyman, 1979), Noni [tf], [kf] (cf. Hyman 1981) and Kom [bz] (Hyman, p.c.) are affricate segments of the type in (21b).

In the representation of contour segments assumed in Sagey (1986), which I have rejected, the fact that a segment such as [kf] has two incompatible features [—cont] [+cont] appears as totally unrelated to the fact that this segment also has two ordered points of articulation, velar and labiodental. A representation of this segment in Sagey's framework is offered in (22) (I leave aside the issue of how to exactly characterize the points of articulation):

(22)   X
                          |
           R   o ———————————————
                          | \
        SL   o   [—cont]   [+cont]
                          |
           P   _ o
                dorsal /   \ labiodental

(3) On a related issue, see Kaye (1985).

The model adopted in this paper, on the other hand, establishes a clear connection between the [— cont] [+cont] contour and the place contour in these segments.

To sum up, I have offered evidence that affricates in Basque constitute single segments with a double supralaryngeal node. The data which I have presented showed that the position of the trigger cannot uniquely determine which of the two branches of an affricate will be affected by a rule. This was explained by the ability of phonological rules to scan at the skeletal slot level (Archangeli & Pulleyblank, 1986, 1987). The data also offered evidence for rules delinking specific nodes, which will produce very different results depending on the segment tio which the delinking operation applies.

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