Breton Mutation: Linear or Autosegmental?*

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I. Introduction

Much of the recent work in phonology has focused on the development and application of autosegmental and metrical theories to suprasegmental phenomena, e.g., stress, tone, syllable structure. The new notions of phonetic structure allowed by these theories, as well as the new formal devices to account for them, have provided insight in an area where standard generative theory provided little. Furthermore, a new line of research opened up when it was discovered that the tools of suprasegmental research also provide insight into certain segmental processes. For example, Goldsmith (1979) showed that the change of s --> h in Buenos Aires Spanish is best analyzed as the loss of supralaryngeal features, but with retention of the laryngeal ones. Within an autosegmental framework this is realized by assuming that supralaryngeal features are on a separate tier from the laryngeal one. A further extension to segmental processes was made by Halle and Vergnaud (1981) who argued that most harmony processes are better described in either autosegmental or metrical terms, depending on the type of harmony. (By harmony processes they intend the familiar ones such as vowel harmony as well as such assimilatory processes as voicing agreement and palatal agreement.)
The extension of autosegmental and metrical theories to strictly segmental phenomena has recently been questioned. Anderson (1982) argues that such an extension often results in a weakening of the empirical content of these theories. For instance, a basic insight of autosegmental theory is that certain phonetic properties of speech, such as tone or nasality, are the result of a coordination of distinct sub-properties. Autosegmental theory formally realizes this by representing these sub-properties on separate tiers which are coordinated by association lines. Application of autosegmental theory to such processes as vowel harmony, as in Halle and Vergnaud's 1981 analysis, sometimes requires a harmony feature to be simultaneously on more than one tier. This modification, according to Anderson, greatly weakens phonological theory with respect to its claims about phonetic structure. He concludes that since traditional phonological rules, i.e., linear rules, can account for segmental phenomena, the newer theories should be constrained from applying to them.

Consonant mutation is a morphophonological process in which the initial (or sometimes final) consonant of a lexical stem changes depending on the morphological environment. As such, the phonological aspect of consonant mutation would appear to be a segmental process. Recently Lieber (1983) proposes an autosegmental analysis of consonant mutation in which the mutating
features are represented as floating autosegments which become associated with an adjacent underspecified consonant. She shows that although the mutation facts can be captured in a linear framework, the autosegmental framework predicts many fewer possible grammars. In this paper I examine consonant mutation in Breton, as spoken in the Léon région, to determine whether Lieber's proposals represent in Anderson's terms an inappropriate extension of autosegmental theory to segmental processes.

2. Lieber's Analysis

Lieber's analysis of consonant mutation (CM) is based on the following assumptions of autosegmental theory.

(1) a. Words may consist of linkings of a number of autosegmental tiers which in turn may have the status of morphemes.

b. The distinctive feature bundle of each segment is exhaustively partitioned among the tiers such that each feature is projected onto exactly one tier. (This may have lexical exceptions).

c. All tiers must be linked to the skeleton tier which consists minimally of the feature [syllabic].

d. Melody slots are linked to the skeleton tier in a left-to-right manner without crossing lines until one of the tiers is exhausted. Unattached skeleton slots may be associated by language specific rules. Unattached melody slots are uninterpreted.

e. A feature may be preattached to the skeleton tier in certain lexically idiosyncratic cases in which case it takes precedence over any same features appearing on a different tier.
All languages have at least two tiers: a skeleton tier which consists minimally of a projection of the feature [syllabic], and a melody tier, which is a projection of all remaining distinctive features. There are various ways in which features may appear on other than the melody tier, and one of them is CM. In essence, languages with mutation have underspecified initial (or final) segments of the melody tier, the missing features being those involved in the mutation and which are realized as floating autosegments.

As a simple example, consider the following from Nuer, a Nilo-Saharan language. In certain forms, mutations are triggered on the final consonant of a stem by a following morpheme. For example, nouns can be mutated by a certain set of demonstratives resulting in spirantization of final stops, e.g.,

\[(2) \quad \top \text{"peg"} \quad \top \text{"this peg"} \]
\[
\text{dëép} \quad \text{"rope"} \quad \text{dëéfìì} \quad \text{"that rope"}
\]

The lexical representation of noun stems in Nuer consists of lexically linked skeleton and melody tiers which are fully specified except for the last segment which lacks a specification for [continuant]. Lieber gives the following as the lexical representation of the noun stem meaning "rope":

\[(3) \quad \boxed{+ant} \quad \boxed{-cor} \quad \boxed{+lab} \]
\[
\text{C V V C}
\]
In citation form, a floating autosegment [-continuant] will be attached by language-particular rule to the final C slot of the noun stem skeleton giving the structure in (4). (We will see later that citation form autosegments are unnecessary, given certain assumptions of Lexical Phonology.)

```
(4)   d   e   [+ant]   [-cont]
      \___/  
    C   V   V   C

"rope"
```

To derive "that rope" (as in (2)) Lieber assumes that the demonstrative suffix begins with a floating autosegment [+continuant] which, in Nuer, is linked leftward. This is shown in (5).

```
(5)a.   d   e   [+ant]   [+cont]   i   i   i
      \___/  
    C   V   V   C   V   C   V

b.   d   e   [+ant]   [-cont]   [+cont]   i   i   i
      \___/  
    C   V   V   C   V   C   V
```

As Lieber points out, this is not the only possible analysis of the above data. A linear analysis is also possible in which the following segmental rule accounts for the same Nuer data.

```
(6)  C \rightarrow [+cont] / X _____ [+demonstrative suffix]
```

The real advantage of an autosegmental account of CM, according
to Lieber, is that it predicts that CM must be strictly local. For if a mutation is to be triggered the triggering morpheme and the affected consonant must be adjacent (hence at word-edge) or else association lines would cross—in violation of autosegmental theory. "A segmental analysis makes no prediction of locality" (Lieber 1983:169).

Lieber then considers a case of apparently non-local mutation, namely direct object mutation in Welsh which occurs when the direct object is not adjacent to the verb. Lieber argues that direct object mutation is in fact local, that it is an artifact of case assignment. She concludes that locality is a fact about CM, and inasmuch as the autosegmental account predicts such locality it is to be preferred over the linear or segmental account.

Lieber glosses over the phonological changes involved in the Welsh mutation data which in fact closely resemble the Breton data. What is interesting about mutation in these two languages, and in the Celtic languages in general, is that the phonological changes involved are rather complex. Since there is presumably only one autosegment per mutation these complex changes present a possible challenge to Lieber's proposed analysis of CM. However, we will see that the phonological facts actually support her analysis. Thus, from the point of view of both morphology and phonology an autosegmental approach to CM is better supported.
3. Breton Mutation

Listed below in (7)-(9) are the three principal mutations found in Breton<1>. (The names are traditional among Celticists):

(7) LENTION

\[
\begin{align*}
p & \rightarrow b & \quad b & \rightarrow v \\
t & \rightarrow d & \quad d & \rightarrow z \\
k & \rightarrow g & \quad g & \rightarrow h \\
m & \rightarrow v & \quad m & \rightarrow v
\end{align*}
\]

In addition, all consonants are lenis as a result of Lenition (Falchun 1951).

Lenition is triggered by a number of different morphemes some of which include:

- Certain prepositions:
  /beza/ "to be", da ve:za "for to be ..."
  /pesketa/ "to fish", listri da besketa "fishing vessels"

- Possessive adjectives da "2nd person sing./informal", e "3rd pers. sing. masc.":
  /ki/ "dog", da gi: "your dog"
  /grek/ "wife", e hre:k "his wife"

- Certain verbal particles:
  /prena/ "to buy", me a bre:n "I buy"
  /maha:n/ "to main", ne vaha:n ket, "I will not main"

- Certain numbers:
  /mil/ "thousand", dau vi:l "two thousand"
  /paotr/ "boy", tri baot "three boys"

- Article when following noun is feminine singular:
  /bran/ "crow", ar vra:n "the crow"
  /taol/ "table", an daol "the table"
  /mynyte:n/ "minute", er vynyte:n "a minute"
- A single adjective sometimes shows lenition when it occurs following a feminine singular or masculine plural noun:

/bras/ "big", ar vraːn vraːs "the big crow"
/kanoː/ "river", /dun/ "deep", er gaiːnɔːl zɔːn
"a deep river"

SPIRANTIZATION

p ---> f
t ---> s
k ---> x

Occurs primarily after the possessive adjectives
ya "1st pers. sg.", he "3rd pers. sg. fem.", and
o "3rd pers. pl.":
/pas/ "cough", e faːs "her cough"
/ti/ "house", va zzi: "my house"
(by a later rule s ---> z)
/ki/ "dog", o xiː: "their dog"

PROJECTION

b ---> p
d ---> t
g ---> k

Occurs primarily after the possessive adjective ha "2nd
pers. pl./formal":
/bara/ "bread", o paːra "your bread"
/dor/ "door", o toːr "your door"
/gar/ "leg", o kair "your leg"

The environments which trigger CM are rather varied morpho-
logically speaking. Massæ (1983), based on an analysis of CM in
Irish, distinguishes two types of mutation, lexical and mor-
phological. Lexical mutation is triggered by affixes or clitics and
occurs within the lexicon. Morphological mutation is a realiza-
tion of morphological characteristics (e.g., case, number,
gender) which are defined on phrases and occurs post-lexically.
The environments in Irish which trigger lexical mutation are similar to those listed above in (7), namely, certain verbal particles, certain numbers, certain possessive adjectives, etc. This suggests that the environments in (7) trigger lexical mutation. On the other hand, Breton does not have morphological mutation since, as far as I know, mutation is not phrasal, for example, it does not occur across conjuncts. Thus, for the purposes of this paper I will assume that CM in Breton is lexical.

As noted earlier, the non-uniformity of these mutations poses a potential problem for the autosegmental approach. It can be resolved, however, in the following way. I will basically follow Lieber’s approach in assuming that CM is triggered by a floating autosegment which fills in underspecified consonants. In addition, I will also assume the framework of Lexical Phonology (Kiparsky 1982). Two concepts of this framework which will play an important role in the analysis to be presented are underspecification and structure-preservation. According to Kiparsky (1983) lexical representations are under-specified for unmarked feature specifications. Under-specifications may be filled in by any lexical rule, or by a set of “default” rules which supply the unmarked value. For example, in Breton there are three classes of obstruents, voiced and voiceless stops and voiceless fricatives, found in initial position in lexical representations. Assuming under-specification they would have the following form.
(8) Underspecification of Initial Obstruents:

Voiceless Stops  Voiced Stops  Voiceless Fricatives

[ +voice ] [ +cont ]
[ place ]  [ place ]
[ feat. ]   [ feat. ]

One immediate advantage of under-specification is that we can account for the radical forms by default rules rather than by a floating autosegment. This is particularly desirable if the citation form is viewed as being the unmarked case. We will see an example of this below.

Closely related to the notion of under-specification is that of structure-preservation, which is given in (9).

(9) Structure-Preservation:
No rule may introduce lexically non-distinctive feature specifications within the lexical component.

In English, for example, the rules concerning aspiration and glottalization are postlexical, as they involve nondistinctive feature specifications. The importance of this concept will become clear later in the discussion.

Given the above theoretical background, I propose the following analysis of Breton mutation. Obstruents in initial position are under-specified as in (8) above. For example, the words uesta "cough" and bęata "stick" have the following lexical representations.
Their corresponding citation forms are obtained by the application of one or both of the default rules found in (11). In the case of "cough" both rules will apply. However, only (11a) applies to "stick" since it is already specified for continuancy.

(11) a. [ ] ----> [-cont]
b. [ ] ----> [-voice]

The autosegments for the three mutations are given in (12).

(12) Lenition: [+voice] [-tense]  
Spirantization: [+cont]  
Provection: [-voice]

Mutation occurs when a morpheme which is lexically associated with one of the floating autosegments in (12) becomes adjacent and subsequently associated to a following under-specified lexical stem. Association of the mutating autosegment is automatic and occurs after the morphological operation which adjoined the two.

Because under-specification is independent of the actual mutations involved, unlike in Lieber's analysis, it follows that there may arise a conflict in the feature specification(s) of the autosegment and the adjacent segment. In this situation I will assume that the autosegment will supersede any conflicting fea-
ture specification on the melody tier unless it would violate the principle of Structure-Preservation. It is reasonable to assume that floating autosegments should have some effect on adjacent segments, otherwise there would be no reason for positing them. But it is also reasonable to assume that there are some restrictions on the extent to which adjacent segments may be affected, and the principle of Structure-Preservation seems a likely candidate for one such restriction. In the case of such a violation I will assume, following Halle and Vergnaud (1982), that it is the autosegment which delinks<2>.

An example of each mutation is given below in (13)-(15).

(13) Provection -

a. ho "your" paz "cough" b. ho "your" baz "stick"

\[
\begin{array}{cccc}
0 & [-\text{voice}] & [ ] & a \ s \\
V & C & V & C \\
\end{array}
\quad \begin{array}{cccc}
0 & [-\text{voice}] & [+\text{voice}] & a \ s \\
V & C & V & C \\
\end{array}
\]

Association of the autosegment:

\[
\begin{array}{cccc}
0 & [-\text{voice}] & [ ] & a \ s \\
V & - & V & C \\
\end{array}
\quad \begin{array}{cccc}
0 & [-\text{voice}] & [+\text{voice}] & a \ s \\
V & + & V & C \\
\end{array}
\]

Default rule (11a):

\[
\begin{array}{cccc}
0 & [-\text{voice}] & [-\text{cont}] & a \ s \\
\end{array}
\quad \begin{array}{cccc}
0 & [-\text{voice}] & [-\text{cont}] & a \ s \\
\end{array}
\]

Other rules (postlexical):

\[
\begin{array}{cccc}
o & pa & s & "your cough" \\
\end{array}
\quad \begin{array}{cccc}
o & pa & s & "your stick" \\
\end{array}
\]
The association of [-voice] to the following voiceless stop in (13a) will simply fill in the correct value of voice. The same association to the voiced stop in (13b) also results in a voiceless stop because the floating autosegment [+voice] supersedes the prespecified [+voice] of the melody. This is an example of feature conflict which I referred to above. Default rules supply the other missing features, in this case (cont).

(14) Spirantization -

a. he "her" paz "cough"
   ![Diagram of autosegmentation]
   Default rules (11a/b):
a. e [-voice] a s

b. he "her" baz "stick"
   ![Diagram of autosegmentation]
   Other rules (postlexical):
b. e fa:s "her cough" e ba:s "her stick"

The analysis of Spirantization is similar to that of Provec-
tion, at least for the forms where mutation is traditionally said
to occur. In (14a) the Spirantization autosegment fills in a
value for continuancy, and the default rule (11b) fills in the
unmarked voicing specification.
Now let us consider derivation (14b). Notice that the association of [+cont] to the initial segment produces a segment which does not occur in this position in lexical representation, namely a voiced continuant. Because this would violate the principle of Structure-Preservation the floating autosegment is delinked. Thus, even in the absence of a feature conflict Structure-Preservation governs the association of an autosegment as would be expected. Subsequently Default rule (11a) applies to fill in the missing feature [cont].

Lastly, we consider Lenition, a derivation of which is given in (15).

(15) Lenition –

a. e "his" paz "cough"  b. e "his" baz "stick"

\[
\begin{array}{ccccccc}
  e & [\text{+voice}] & [\text{-tense}] & a & s & e & [\text{+voice}] & [\text{+voice}] & a & s \\
  V & C & V & C & V & C & V & C & V & C \\
\end{array}
\]

Association of autosegment:

\[
\begin{array}{ccccccc}
  e & [\text{+voice}] & [\text{-tense}] & a & s & e & [\text{+voice}] & [\text{-tense}] & [\text{+voice}] & a & s \\
  V & C & V & C & V & C & V & C & V & C \\
\end{array}
\]

Default rule (11a):

\[
\begin{array}{cccccc}
  e & [\text{+voice}] & [\text{-tense}] & [\text{-cont}] \\
  a & s & \text{--------} & \text{--------} \text{--------} \\
\end{array}
\]

Other rules (post-lexical):

\[
\begin{array}{cccc}
  e & \text{ba:s} & "\text{his cough}" & e & \text{va:s} & "\text{her stick}" \\
\end{array}
\]
Again, the derivation of the voiceless stop-initial form is straightforward, as shown in (15a). The derivation of (15b), however, requires comment. As shown in the derivation association of the autosegment to the adjacent melody can occur because there is no violation of Structure-Preservation. Furthermore, there is no conflict of features, but rather both the autosegment and the adjacent segment of the melody share the same feature specification. It is in this respect which this configuration differs from the others, and which I would claim makes the difference. Essentially what must occur in (15b) is that the resulting configuration becomes a voiced continuant postlexically. It seems plausible to assume that there is some principle similar to the Shared Features Convention (Steriade 1982) which somehow sets this structure apart and prevents the default rules from applying in this case. I am not quite sure of the precise formulation of this principle, but I hope to gather some insights on it from an examination of the structure and behavior of other complex segments in Breton.

Thus far I have argued that CM in Breton can be satisfactorily treated within an autosegmental framework. Following Lieber, I claim that mutation results when floating autosegments, such as in (12), become associated with adjacent underspecified consonants. Under-specification follows not from the mutation processes themselves, but rather from the notions of markedness
and redundancy. Furthermore, this concept of underspecification allows us to eliminate an autosegment for realizing citation forms. In Breton, at least, these result from the automatic application of default rules which supply unmarked values of certain features.

Association of an autosegment to an adjacent slot is governed by the following proviso: If there is a conflict in specification for one or more of the features shared by the autosegment and the adjacent melody, then the autosegment prevails. An example of this was found in Provection where a prespecified voiced stop becomes voiceless because of the Provection autosegment (see 13b). An autosegment can remain linked only if such an association does not violate Structure-Preservation. Thus, Structure-Preservation requires delinking of the Spirantization autosegment when it is associated to an adjacent stop already specified [+voice], as in (14b). The voiced continuants of Lenition, on the other hand, result not from Lenition directly, but rather from a phonetic rule of realization which applies to the autosegmental structure produced as a result of Lenition.

4. A Linear Analysis

The preceding analysis of CM in Breton is quite simple, relying primarily on the basic assumptions of autosegmental theory and lexical phonology, both of which are quite well motivated independently. As with Nuer, however, there is also a
possible linear analysis. Each mutation could be represented by
one or two, as in the case of Lenition, linear rules. These are
given below in (16)-(19).

Lenition:

(16) \[
\begin{array}{c}
[-\text{son}] \\
[+\text{voice}]
\end{array}
\rightarrow [+\text{cont}] / X \underline{\ldots}
\]

(17) \[
[+\text{cons}] \rightarrow \begin{array}{c}
[-\text{tense}] / X \underline{\ldots} \\
[+\text{voice}]
\end{array}
\]

where \(X\) is one of (da (prep), a (prep), da (poss), e (poss)
a (prt), ne (prt), dau, tri, pevar, nav,...)

Spirantization:

(18) \[
[-\text{son}] \rightarrow [+\text{cont}] \begin{array}{c}
\{\text{va}\} \\
\{\text{he}\} \\
\{\text{o}\} \\
\{\text{etc.}\}
\end{array}
\]

Proyection:

(19) \[
[-\text{son}] \rightarrow [-\text{voice}] \begin{array}{c}
\{\text{ho}\} \\
\{\text{da'z}\} \\
\{\text{etc.}\}
\end{array}
\]

There are several points to be made about the analysis found
in (16)-(19). Again, assuming the framework of lexical phonology
the rules can be stated rather simply in terms of features.
However, unlike the first analysis proposed, the linear one
requires treating Lenition as two separate processes. Lenition
is admittedly complex, but one problem with having two rules is
that it predicts that one or the other might be lost, or that one
rule might change independently of another, neither of which
has occurred. It suggests that Lenition is more complex than the other mutations and thus should be acquired later, although in fact Lenition is the first mutation acquired (Falc'hun 1951). Furthermore, it requires listing the morphological environments, whereas the first analysis only has one environment for each mutation—a morpheme realized as a floating autosegment.

There is a more serious problem, however, which is that assuming Structure-Preservation, rule (16) cannot be lexical since it introduces lexically non-distinct feature specifications. However, it also cannot be placed in the post-lexical portion of the grammar since it is morphologically conditioned. One could not simply propose eliminating Structure-Preservation since it is in part responsible for the simplicity of the linear rules as stated in (16)-(19). For example, without it rule (18) would have to also contain [-voice] in its structural change. Furthermore, if the change of voiced stops to voiced continuants in Lenition is in fact related to the resultant complex structure, as I have suggested, then a linear approach would have further problems. It seems, then, that there is no simple analysis within a linear framework. To the extent that the autosegmental analysis provides a neater characterization of Breton CM facts it is to be preferred over the linear analysis presented here. Thus, the Breton data support Lieber's claim that CM is best treated autosegmentally.
5. Concluding Remarks

Assuming the autosegmental framework to be an appropriate one for CM, I would like to return to the objections of Anderson's concerning the extension of nonlinear theories to segmental phenomena. In my view, his objections were largely premature. For example, regarding harmony processes, the notion of default values has allowed in many instances the elimination of the same feature occurring simultaneously on more than one tier. Furthermore, Kiparsky (1983) has shown that all the processes considered by Halle and Vergnaud in their (1981) work can be successfully treated within an autosegmental framework, thereby reducing the amount of overlap of these two theories. Thus, several of Anderson's specific objections have made invalid or been weakened considerably by recent developments in autosegmental theory.

More importantly, Anderson overlooks the fact that autosegmental theory is more than a theory of phonetic structure; it is also a theory of morphology. In other words, the association of the separate tiers is more than an orchestration of a speech motor event, it is also the assembly of a morpheme or morphemes. For example, an important (and early) claim of autosegmental theory is that there can exist floating tones, i.e., tones without any lexical segmental representation. This claim is only possible if one assumes that the separate tiers posited by the theory can constitute separate morphemes, which in turn intro-
duces morphology into the autosegmental approach. Yet some of the modifications of autosegmental theory to which Anderson objects are based in morphology and not phonetics.

Anderson is correct in wanting to reduce the overlap of these theories, since it would restrict the power of the formalisms now available. But this should not be done by restricting autosegmental (or metrical) theory from segmental processes, at least not in an unprincipled way. As shown in this paper, such a restriction could prevent further advances in segmental phonology and morphology.

FOOTNOTES

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1. According to some scholars, the voiceless fricatives also participate in Lenition and Spirantization by undergoing voicing. However, there is reason to believe that this voicing occurs independently of CM and so I have excluded them from the data.

2. Halle and Vergnaud (1982) propose a similar condition on the association of autosegments which is given below (Halle and Vergnaud 1982:80):

   If the application of a rule results in a violation of the conditions—either universal or language-specific—which must be met by well-formed representations in the language in question, the violation is removed by deleting links between autosegments and core phonemes established by earlier rules or conventions.

REFERENCES


Kiparsky, P. 1982. "Lexical Morphology and Phonology". Unpub. ms., MIT.

----- 1983. "Some Consequences of Lexical Phonology". Unpub. ms., MIT.

