THE PHONOLOGY AND MORPHOSYNTAX OF BRETON MUTATION

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ABSTRACT: This paper presents an analysis of initial consonant mutation in a Breton dialect, with a focus on establishing the division of labour between phonology and morphology in the triggering of mutation and its phonological expression. It is argued that different types of mutation have different status in the grammar: some are purely phonological, others involve subsegmental morphemes with a clear morphosyntactic rationale, and for some the phonological aspects are clear but the morphosyntactic motivation remains obscure. In addition, the differences among the types of mutation support a stratal model of morphology-phonology interactions.

KEYWORDS: initial consonant mutation, Breton, morphology-phonology interaction, nonconcatenative morphology

1. INTRODUCTION[1]

Initial consonant mutations in the Celtic languages have been subject to extensive theoretical treatment. Very broadly, we can discern two camps. Scholars such as Hamp (1951); Lieber (1987); Swingle (1993); Wolf (2007) suggest that mutation lies exclusively within the domain of phonological computation and results from the application of rules in phonologically defined contexts (e. g. in the presence of floating features). I shall call this approach "the autosegmental framework". For others, such as Ellis (1965);

[1] Portions of this paper were presented at the Workshop on the Representation and Selection of Exponents (University of Tromsø) and the 7th Celtic Linguistics Conference (University of Rennes 2 — Upper Brittany). Thanks to the audiences in Tromsø and Rennes, in particular Paolo Acquaviva, Daniel Currie Hall, and Steve Hewitt, for important comments and suggestions. Thanks to Bruce Morén-Duolljá, Yuni Kim and Ricardo Bermúdez-Otero for valuable input. The paper was greatly improved by the comments and suggestions of two anonymous reviewers. All errors and shortcomings remain entirely mine.

Stewart (2004); Green (2006), Celtic mutation is not phonological, but rather represents the selection of "precompiled" (cf. Hayes 1990) forms of certain morphological objects (e. g. stems or words) driven by morphosyntactic context. I shall call this "the allomorphic framework".

In this paper I consider the initial consonant mutations in the Breton dialect of Bothoa described by Humphreys (1995) with a view to resolving this controversy. I argue that not all alternations involving word-initial consonants should be treated under the single label of "initial consonant mutation". Some of these alternations submit to a phonological treatment with no recourse to floating elements necessary, but others do require an autosegmental analysis. Crucially, any such analysis must provide not only an account of the phonological changes involved in the process but also identify the morphosyntactic source of the floating material. In this paper I argue that such an analysis uncovers important facts about Breton morphosyntax that are not apparent without a careful disentangling of the sources of autosegmental prefixation and the division of labour between phonological computation and phonologically arbitrary allomorphy.

Since the focus of this paper is on the morphosyntactic triggering of mutation, I do not present detailed phonological argumentation to support the analysis of the alternations; see Iosad (2012) for the details.

2. CONSONANT MUTATION IN BRETON

The term *consonant mutation* refers to a set of alternations involving word-initial consonants that appear to be triggered by factors other than the phonological context. Common factors are the presence of a certain lexical item (the "trigger"), possibly with additional categorial restrictions (e. g., some items may only trigger a mutation on nouns of a certain gender or number), or a particular morphosyntactic context. In this section, I describe the patterns of Breton consonant mutation treated in detail here. I focus on mutations traditionally called "provection", "spirantization", and "lenition".

I present the phonological analysis, in particular the featural specifications, without argument. Still, a short discussion of the basic featural classes is in order. I assume a representational system based on the Parallel Structures Model of feature geometry (e. g. Morén 2006, Youssef 2010). Here, two important aspects of this system are the assumption that all features are dominated by a class node (such as Laryngeal, Manner, or Place), and that features are assigned on a language-specific basis depending

on the contrasts and patterns of alternations in the relevant variety.

For the purposes of this paper, the important classes and specifications are as follows. Laryngeal contrast is implemented using C-laryngeal [voiceless]: voiced obstruents bear a bare C-laryngeal node, whilst voiceless obstruents (and [h]) bear the feature C-lar[vcl].[2] As for place, dorsal stops [k g] and the fricative [h] are placeless (bear an empty Place node), labials are C-place[labial], the coronals [t d s z] are C-place[coronal], and the postalveolar affricates [ʧ ʤ] are V-place[coronal]. The high front vowels [i y] are both V-place[coronal]. Fricatives (including [h]) have no manner specification, while stops and affricates are C-manner[closed]. The featural composition of some important segments is shown in table 1.

Segment	C-manner	C-place		V-place	C-laryngeal
	[closed]	[labial]	[coronal]	[coronal]	[voiceless]
[p]	✓	✓			✓
[t]	✓		✓		✓
[ʧ]	✓			✓	✓
[k]	✓				✓
[b]	✓	✓			
[d]	✓		✓		
[ʤ]	✓			✓	
[g]	✓				
[f]		✓			✓
[s]			✓		✓
[h]					✓
[v]		✓			
[z]			✓		
[i]/[j]				✓	

Table 1. Representations for some relevant segments

[2] A reviewer notes that systems where voiceless obstruents are marked in terms of laryngeal feature tend to have aspiration in voiceless stops (cf. e. g. Honeybone 2005), and asks why I do not use a more orthodox feature such as [spread glottis]. However, voiceless stops in Bothoa Breton are said by Humphreys (1995) to be unaspirated (cf. also Bothorel 1982). The feature [voiceless] is assigned to these segments on the basis of their phonological activity, not phonetic realization (cf. in particular section 3.3 below)

I concentrate on three types of initial mutation: provection (devoicing of both obstruents and sonorants), spirantization (changes in continuancy and voicing), and lenition (changes in voicing or continuancy, depending on the affected consonant).

2.1 Spirantization

The label "spirantization" refers to a set of alternations shown in table 2, whereby the labial and coronal [p t] change both continuancy and voicing, while the dorsal [k] does not undergo voicing but does become the continuant [h].

Unmutated	p	t	ʧ	k	kl	kr	kw	ʧʯ
Spirantized	v	z	h(j)	h	hl	hr	hw	hʯ

Table 2. Full spirantization

(1)	a.	(i)	[ˈkaːʐ̊]	*kazh*	'cat'
		(ii)	[mə ˈhaːʐ̊]	*va c'hazh*	'my cat'
	b.	(i)	[ˈkriːb̥]	*krib*	'comb'
		(ii)	[mə ˈhriːb̥]	*va c'hrib*	'my comb'
	c.	(i)	[ˈtaːd̥]	*tad*	'father'
		(ii)	[mə ˈzaːd̥]	*va zad*	'my father'

In the case of [ʧ], the outcome of spirantization depends on the following segment. When [ʧ] is followed by [i y ʯ], the outcome is [h], just as for [k]. However, when [ʧ] is followed by some other vowel (such as [ɛ] or [a]), mutation produces the sequence [hj].

(2)	a.	(i)	[ˈʧiː]	*ki*	'dog'
		(ii)	[mə ˈhiː]	*va c'hi*	'my dog'
	b.	(i)	[ˈʧɛzəg̊]	*kazegennoù*	'horses'
		(ii)	[mə ˈhjɛzəg̊]	*va c'hazegennoù*	'my horses'

The full set of alternations shown in table 2 is triggered by some possessive proclitics, which usually immediately precede the noun: [mə] 'my', [om] 'our', [o] 'their', [i] 'her'. I shall refer to this pattern as *full*

spirantization.

In contrast, *restricted spirantization* is phonologically identical to full spirantization but involves only the segments [k] and [ʧ]. It happens in a different set of contexts (following both the indefinite and definite articles, depending on the gender, number, and animacy of the complement).

(3)	a.	(i)	[ˈkaːʒ̊]	*kazh*	‘cat’
		(ii)	[ə ˈhaːʒ̊]	*ar c'hazh*	‘a cat’
	b.	(i)	[ˈʧiːdʒi]	*kegi*	‘roosters’
		(ii)	[ə ˈhiːdʒi]	*ar c'hegi*	‘the roosters’

To sum up, spirantization is triggered by proclitic elements which are almost invariably immediately adjacent to the mutation target. Some of these elements trigger the mutation irrespective of the properties of the target word, and for some the mutation pattern depends on morphosyntactic features of the target.

2.2 Provection

Provection is triggered by the possessive clitic [o] ‘your (pl.)’. Its phonological manifestation is the devoicing of initial voiced obstruents and the prefixation of [h] to vowel and sonorant-initial words.

(4)	a.	(i)	[ˈmaːb̥]	*mab*	‘son’
		(ii)	[o ˈhmaːb̥]	*ho mab*	‘your (pl.) son’
	b.	(i)	[ˈalve]	*alc'houez*	‘key’
		(ii)	[o ˈhalve]	*hoc'h alc'houez*	‘your (pl.) key’
	c.	(i)	[ˈbrøːr]	*breur*	‘brother’
		(ii)	[o ˈprøːr]	*ho preur*	‘your (pl.) brother’

At the same time, the clitic [i] ‘her’, in addition to spirantization, also triggers the prefixation of [h] to vowels and sonorants (but not the devoicing of obstruents).

2.3 Lenition

The lenition mutation, detailed in table 3, is the most complex pattern. Phonologically, it involves the following:

- Voicing of voiceless stops and the affricate
- Spirantization of the labial noncontinuants [b m] to [v]
- Spirantization of [g] to [h], unless the [g] is followed by [w], in which case it is deleted
- The voicing of word-initial [hr] (phonetically [r̥] or [χ]) to [r]
- Word-initial [dʒɥ] alternates with [v]
- Word-initial [d] and [dʒ] are unaffected

	Voicing				Spirantization			Deletion		
Unmutated	p	t	ʧ	k	b	m	g	gw	dʒɥ	hr
Lenited	b	d	dʒ	g	v	v	h	w	v	r
	No change									
Unmutated	d	dʒ	f	v	s	z	ʃ	ʒ	h	n
Lenited	d	dʒ	f	v	s	z	ʃ	ʒ	h	n

Table 3. Lenition

This mutation is also the most complicated one in terms of triggering. Some items always trigger lenition, such as certain prepositions ([də] 'to' or [wa] 'on') or the possessive clitic [i] 'his'. Others, notably the definite article [ə(n)] and the indefinite article [o(n)], cause lenition only for nouns with certain gender, number, and animacy features.

Some restrictions on lenition also concern the phonology of the trigger. Examples such as those in (5) show that nouns with certain gender, number and animacy features (specifically, feminine singular irrespective of animacy, and masculine plural animate) trigger lenition of following adjectives (*bro* 'country' is a feminine noun).

(5) a. Sonorant + underlying voiceless obstruent

(i)	[ˈpəwr]	*paour*	'poor'
(ii)	[o ˌvroː ˈbəwr]	*ur vro baour*	'a poor country'

b. Sonorant + underlying voiced obstruent

(i)	[ˈbjan]	*bihan*	'small'
(ii)	[o ˌvroː ˈvjan]	*ur vro vihan*	'a small country'

However, this only happens if the triggering noun ends in a vowel or a sonorant. Following obstruent-final nouns, the mutation apparently fails for underlyingly voiceless stops (which do not become voiced), although not for underlyingly voiced ones (which do become fricatives), as in (6).

(6) a. Obstruent + underlying voiceless obstruent

(i)	[ˈpəwr]	*paour*	‘poor’
(ii)	[o ˌrwek ˈpəwr]	*ur wreg paour*	‘a poor woman’

b. Obsruent + underlying voiced obstruent

(i)	[ˈbjan]	*bihan*	‘small’
(ii)	[o ˌrweg ˈvjan]	*ur wreg vihan*	‘a small woman’

Below I will argue that the pattern is a fully regular outcome of the phonological computation. The restriction of the (partial) “failure of lenition” to noun triggers is an accident due to the fact that all other triggers of lenition happen to be sonorant-final (Jackson 1967, p. 350, ftn. 5).

A final note concerning lenition: as noted above, the possessive clitics [mə] ‘my’, [om] ‘our’, [o] ‘their’ normally trigger spirantization, which affects the segments [p t ʧ k]. In addition, they trigger the change from [hr] to [r], normally associated with lenition. In this, they differ from the fourth spirantization trigger ([i] ‘her’), which does not affect initial [hr].

3. ANALYSIS

In this section I propose a phonological and morphosyntactic account of the patterns, arguing for the following set of analyses:

- Provection is a purely phonological process involving a clitic-final underlying [h] which either becomes parsed as (part of) the onset of the following syllable or coalesces with a voiced obstruent;
- Spirantization is triggered by an autosegmental word-level prefix which is the exponent of morphological agreement;
- Lenition is triggered by autosegments introduced at the postlexical level.

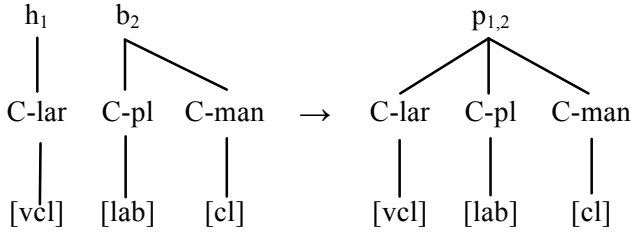
I will show that these analyses correctly capture important generalizations regarding the phonology and morphology of Breton mutation. I also argue, however, that the proposed analysis of spirantization and lenition necessitates a mechanism of phonologically sensitive allomorphy of the subsegmental triggers at the point of lexical insertion (e. g. Paster 2006; Bye 2007).

3.1 Provection

Under the representational system used here, provection must involve the

addition of a C-lar[voiceless] feature: voiced obstruents are devoiced (they acquire the feature), while sonorants and vowels are prefixed with the segment [h], consisting of the same feature. Since provection is strictly local — it requires adjacency to the possessive clitic — I suggest that it is best analysed as pure phonology. If the triggering clitic is underlyingly /oh/, the "prefixation" of [h] to vowels and sonorants is a case of resyllabification. In the case of voiced obstruents, such a resyllabification is impossible ([h] + stop is not a possible onset), and the [h] instead coalesces with the following obstruent to produce devoicing, as in (7).

(7) Provection as coalescence



This account of provection requires no special morphosyntactic machinery.

3.2 Spirantization

The account of spirantization is more complex. First, restricted spirantization interacts with morphosyntax, since its application depends on certain features of the trigger. Second, there are several purely phonological issues.

One challenge is inherent in the representational system. Spirantization involves both voicing and a change in continuancy, which are represented as subtraction processes: thus, the change from [p] to [v], involves {C-pl[lab], C-man[cl], C-lar[vcl]} becoming {C-pl[lab]}, apparently with deletion of both laryngeal and manner specifications. Subtraction is commonly seen as a major challenge to additive models of morphology, and thus to any autosegmental framework for mutation.

A second problem with spirantization is phonological sensitivity. If spirantization is phonological, the grammar of Bothoa Breton must include some device which maps underlying stops (more precisely C-man[cl] segments) to fricatives (mannerless segments). This device is in operation for both full and restricted spirantization, since it effects the mapping from /k

ʧ/ to [h]. However, in some cases it fails to change the featural composition of /p/ and /t/, even where it does affect /k ʧ/. Moreover, it always fails for other set of C-man[cl] segments, namely the voiced stops /b d dʒ ɡ/. This partial application of mutation remains unaccounted for.

A related problem is the existence of a chain shift. Spirantization maps initial /kr/ to [hr]; however, some spirantization triggers also induce a mapping from /hr/ to [r]. If the autosegmental device which militates against word-initial [hr] in spirantization contexts is part of the lexical representation of the trigger (as required by the autosegmental framework), then we also expect it to map a *derived* [hr] to [r]. This, however, fails to happen:

(8)	a.	(i)	[ˈhrɔʃəd̥]	*roched*	‘shirt’
		(ii)	[mə ˈrɔʃədəw]	*va rochedoù*	‘my shirts’
	b.	(i)	[ˈkriːb̥]	*krib*	‘comb’
		(ii)	[mə ˈhriːb̥]	*va c'hrib*	‘my comb’
		(iii)	*[mə ˈriːb̥]		

Such chain shifts are acknowledged to be a major problem for parallel versions of Optimality Theory (e.g. Kirchner 1996, Łubowicz 2003, McCarthy 2007).

In this section I deal with the phonological issues first, and then turn to the morphosyntactic conditioning of spirantization.

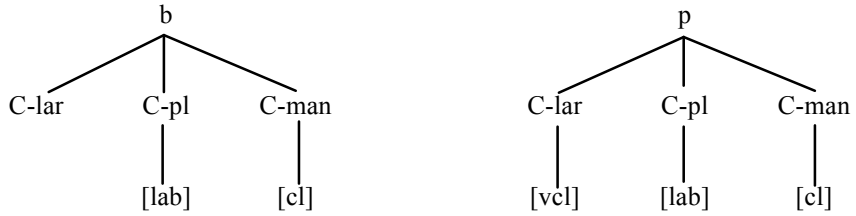
3.2.1 An additive analysis of subtraction

To analyse subtraction, I use the representational possibility of assigning a bare class node to segments unspecified for a feature normally dominated by a node of the relevant type. Thus, in table 1 voiced obstruents such as [b d ɡ v z ʒ] are shown as lacking all C-lar features, while their voiceless counterparts [p t k f s ʃ] bear C-lar[vcl]. I suggest that it is fruitful to distinguish between two types of feature absence.

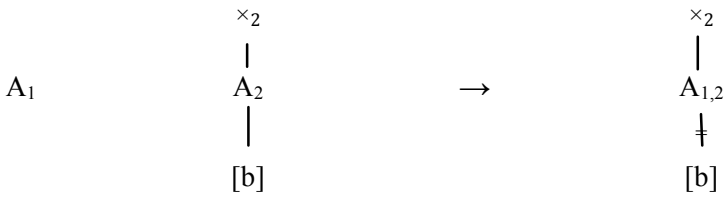
I propose that segments which participate in a laryngeal contrast (in particular obstruents such as [b d ɡ]) do not have any C-laryngeal features but are underlyingly specified with a C-laryngeal node: the true difference between, say, [p] and [b] is that shown in (9). Similarly, while fricatives are mannerless in table 1, in contrast to C-man[cl] stops and affricates, they do bear a C-man node.[3]

[3] A reviewer asks if using such representations amounts to a concession of the need for binary

(9) Full specification of [p] and [b] in Bothoa Breton



A relevant consequence is that the subtraction of C-man[cl] and C-lar[vcl] in the course of spirantization requires the deletion of the feature but not of the class node. In this case, fairly standard phonological devices make an additive analysis of subtraction possible.[4] I suggest that it derives from the prefixation of a floating class node which coalesces with the class node of the initial segment. This coalescence requires the insertion of an association line between the correspondent of the floating node and the feature present in the segment. The insertion of association lines is prohibited by constraints of the DEPLINK family, and if DEPLINK outranks MAX, which requires the preservation of the feature, the correct result is derived. The autosegmental mechanism is shown in fig. 1, and the correct ranking in (10). (For brevity I omit the constraints against surface floating elements and coalescence.)



features. It is true that these representations have the potential to express *ternary contrast*, and in particular surface ternary contrast (see e. g. Strycharczuk 2012), and indeed in section 3.3 I argue that Bothoa Breton does show ternary laryngeal contrast in surface forms. This still leaves open the question of whether binary features are a better way of *formalizing* ternary contrast; see below section 3.3 for more discussion.

[4] As an anonymous reviewer points out, an account of subtraction is required in any analysis of Breton mutation using privative features, since mutation in Breton involves both voicing (in lenition) and devoicing (in provection). Thus, even though the use of the feature C-laryngeal[voiceless] could seem to complicate the analysis of spirantization and lenition unnecessarily, treating [voice] as the marked value would not absolve the analyst of the necessity to account for subtraction.

Figure 1. Subtraction as an additive phenomenon

(10) Subtraction as an epiphenomenon of floating element prefixation

	A_1 + <×, A_2, b>	MAX(A)	DEPLINK(A)-[b]	MAX([b])
a.	<×, A_1, b>	*!	*	
b.	<×, $A_{1,2}$, b>		*!	
c.	<×, A_1>	*!		*
d. ☞	<×, $A_{1,2}$>			*

We can thus see the spirantization of [p t] to [v z] as the simultaneous prefixation of C-manner and C-laryngeal nodes forcing the delinking of the C-man[cl] and C-lar[vcl] features. The spirantization of [k] without laryngeal change is also unproblematic: the floating C-manner node ensures the delinking of C-man[cl], but floating C-laryngeal does not cause [voiceless] to delink from [k] because of an undominated constraint against featureless segments. Thus, [k] loses manner features but preserves the laryngeal one (presumably due to a ranking MAX(C-lar[vcl]) >> MAX(C-man[cl]). This yields [h], exactly the desired result. However, this mechanism does not account for the mapping of /ʧ/ to [h] in the same context: removing both C-lar[vcl] and C-man[cl] from [ʧ] results in [i] under the current representational assumptions. I defer discussion of this issue until section 3.2.3.

"Restricted spirantization", which only affects [k ʧ], can be dealt with if we assume that the prefix consists just of the C-manner node. No matter how exactly the choice between the two featural affxes is made (we shall return to this issue presently), the conclusion is that "full" and "restricted" spirantization must be the exponents of two distinct lexical items. In the next section I argue that this is precisely the case.

3.2.2 The two flavours of spirantization

We established that "full" and "restricted" spirantization are triggered by the prefixation of floating class nodes whose presence is determined by two different lexical items. In this section I show that these morphemes are prefixes which are exponents of two different grammatical categories, building on a proposal by Wolf (2007) to treat certain non-local mutations in

Breton as morphologically driven.

"Restricted" spirantization is triggered by the definite and indefinite articles ([ə(n)] 'the' and [o(n)] 'a') on singular masculine, plural masculine inanimate, and feminine plural nouns. I suggest that spirantization is due to an autosegmental prefix which represents an agreement morpheme for these gender, number, animacy, and definiteness features, rather than being part of the trigger. As for "full" spirantization, triggered by possessive proclitics, I propose that it is due to the presence of an agreement prefix for possessed nouns. Thus, I maintain the central tenet of the autosegmental approach (the triggering of mutation by floating material) but reject the idea that the floating material is underlyingly a subsegmental part of the trigger.

There are several advantages to this approach. first, Humphreys (1990, 1995) notes that "full spirantization" (possession agreement) is moribund in many dialects, being abandoned in favour of either lenition or lack of mutation. At the same time "restricted spirantization" (number, gender, animacy, and definiteness agreement) remains vital throughout the Breton-speaking area. These patterns of loss and retention can be explained if they we consider them to involve two different morphosyntactic processes.

Second, severing the link between the clitics, traditionally seen as the triggers of mutation, and the autosegmental process predicts that trigger and target need not be adjacent. This explains a pattern of non-locally triggered spirantization. Although preposed modifiers, which could disrupt the adjacency of the clitic and the head noun, are rare in Breton, Stump (1988) reports that in the case of *holl* 'all' (itself a trigger of lenition) the mutation on the head noun is determined by the clitic preceding *holl*:

(11) a. *tud*
people
'people'

b. *va* *zud*
my people
'my people'

c. *holl* *dud*
all people
'all the people'

d. *va* *holl* *zud* (**dud*)
my all people
'all my people'

This lack of locality is fully consistent with the hypothesis that

spirantization in (11d) is related to the presence of a morphological feature, itself contingent on the presence of the possessive clitic.

One consequence of this analysis is that non-local behaviour should be unique to spirantization: in particular, provection should be strictly local, since it involves only the interaction of adjacent segments rather than agreement. According to Stump (1988), this is correct: in varieties where the examples in (11) are grammatical, *ho* 'your (pl.)' does not trigger provection "across" *holl* 'all': *daeroù* 'tears', *ho holl zaeroù* 'all your tears' with *holl*-induced lenition, not **ho holl taeroù* with *ho*-induced provection.[5]

A third argument is phonological. As detailed in Iosad (2012), if spirantization is triggered by word-level agreement prefixes, we can understand why the outcome of spirantization depends on the vowel following the initial consonant (table 2). Recall that [ʧ] spirantizes to [h] before [i y] but to [hj] before other vowels. This can be accounted for in a stratal model of morphology-phonology interaction. For concreteness, I assume a tri-stratal organization with stem-level and word-level cycles and a postlexical level, each operating on the output of the previous cycle.

As shown in Iosad (2012), the phonological grammar of Bothoa Breton includes a pattern whereby sequences of a dorsal stop and a glide [j] (assumed to be featurally identical to [i]) coalesce to produce [ʧ]. This process is active at the word level, since relevant alternations involve word-level suffxes, as in (12) (the plural suffix is underlyingly /-iəw/):

(12) a. [ˈlasˌtikən] 'rubber band'
b. [ˈlastiʧəw] 'rubber bands'

Thus, the contrast between [ʧ] and the sequence [kj] is obliterated in the output of the word level. However, if it is intact in the output of stem-level phonology (and thus in the input to the word level), we can account for the behaviour of [ʧ] before vowels other than [i y]. Assume word-initial sequences such as [ʧa] are derived from underlying /kia/. Further, assume that at the stem level /kia/ is parsed as [.kja.] with a glide. At the word level, this [kj] undergoes coalescence, as in (12). However, if spirantization is due to a word-level agreement prefix, it will treat the [kj] as any other stop–

[5] Stump (1988) notes that prenominal elements other than *holl* (such as *kozh* 'old') show no transparency: instead, they undergo the mutation in a local manner: *he c'hozh kazeg* 'her old mare', not **he kozh c'hazeg*. However, this is not incompatible with the status of spirantization as a prefix, if, for certain types of phrase, the relevant morphosyntactic features are spelled out by means of morphemes associated to words at a phrase edge (*edge-based morphology*; Bermúdez-Otero & Payne 2011) rather than its head, as with *holl*-phrases.

sonorant sequence to produce [hj], which does not undergo a similar coalescence process and surfaces intact – exactly the desired result.

I have argued that both types of spirantization in Bothoa Breton are triggered by floating class nodes. Morphosyntactically, this floating material comes from two distinct agreement prefixes, both introduced at the word level (this behaviour is in general characteristic of inflectional morphology). In the next section I turn to the issue of allomorph selection.

3.2.3 Allomorph selection: triggers, not targets

We have seen that an autosegmental mechanism of coalescence can, in the presence of the right floating material, account for the phenomena covered by the label "spirantization". However, so far it has not been possible to account for the distribution of mutation triggers with respect to the featural composition of mutation targets. If "restricted spirantization" (i. e. that affecting [k ʧ]) is triggered by an agreement prefix consisting of a floating C-manner node, then we expect initial [p t], in the same morphosyntactic context, to submit to the same phonological grammar, and map to [f s] (or [v z]). This does not happen in Bothoa Breton.

There are two conceivable approaches to this problem. One involves careful construction of the representation of a single trigger and of the phonological grammar, assuming that the trigger is always present but remains phonologically inert in some conditions. I shall call this "the phonological solution". A second option involves allomorphy: the lexicon provides several underlying representations that could be fed into the phonology, and the choice is made by input subcategorization (e. g. Paster 2006; Yu 2007) or output optimization (e. g. Rubach and Booij 2001).

I suggest that the allomorphic solution is better suited to the Breton facts. Spirantization provides a particularly clear argument. Since both restricted and full spirantization are word-level prefixes, as shown in the previous section, they must be subject to the same phonological computation: Stratal OT permits constraint reranking across strata, but not within one. Therefore, the ranking active at the word level permits the delinking of C-man[cl] to effect the change in continuancy involved in full spirantization. Thus, if the input contains floating C-man, then the [cl] feature is delinked.

However, if the C-man floating node is always inserted as an exponent of the agreement prefix, then we have to explain why it does not affect, for example, voiced stops [b d], which also have a C-man[cl] feature and for

which delinking of that feature creates the licit segments [v z]. There does not appear to be a non-stipulative way of achieving this result.

Similarly, with restricted spirantization the presence of the floating C-man can be deduced from the fact that [k ɡ] lose their manner feature. Why does the C-man not trigger the subtraction in the case of [p] and [t]? The C-man node *can* enforce the mapping *under the same phonological grammar* in the case of full spirantization. The conundrum appears unresolvable.

The allomorphic solution straightforwardly accounts for this aspect of the alternation. If the prefixes can have more than one allomorph, with one of them lacking (sub)segmental content, then non-mutation is due to the selection of the empty allomorph (probably as the elsewhere case). For instance, in an input-oriented approach the subcategorization frames for the possessive agreement prefixes could look like that in (13); that is, the bundle of features [FEM PL DEFINITE] (however exactly those are formalized) is spelt out by a floating C-manner prefix before a stem-initial [k] or [ɡ] and as a zero prefix elsewhere.

(13) Example lexical entry for a spirantization trigger

$$[\text{FEM PL DEFINITE}] : \left\{ \begin{array}{lll} \text{C-manner} & \Leftrightarrow & \_\_\_\ \{k, ɡ\} \\ \emptyset & \Leftrightarrow & \end{array} \right\}$$

This mechanism can also account for aspects of full spirantization. First, it provides a straightforward reason for why [b d] do not undergo any change: the relevant morphosyntactic features are spelt out with an empty prefix before stems that begin with these consonants. Second, it puts us in a position to understans why [ɡ] does not lose its C-lar[vcl] specification in full spirantization: although all segments involved in full spirantization lose both C-man[cl] and C-lar[vcl], [ɡ] only loses the former. This can be accounted for if the "full-spirantization" prefix consists only of floating C-man before [ɡ]; the resulting segment is the illicit {C-man[vcl], V-pl[cor]}, so the place feature is also delinked to yield [h].

Alternatively, lexical insertion could underdetermine the allomorph and leave it to the phonological computation to find the best input–output pair. For Breton, the choice hinges on the ability of each approach to account for within-stratum counterfeeding opacity (chain shifting). Recall that certain possessive clitics trigger not just spirantization, which maps an underlying initial /kr/ to [hr], but also a type of lenition which maps input /hr/ to [r], yet these items do not effect a mapping from /kr/ to [r]. In a version of Stratal OT where all within-stratum mappings are predicted to be transparent this

could be a strong argument for the input-oriented approach. I will adopt the input-oriented solution here, but approaches which either allow limited within-stratum opacity (e. g. via constraint conjunction, as in Bermúdez-Otero 2013) or derive opacity by other means altogether may be able to account for the facts. Fuller discussion is beyond the scope of this paper.

To summarize this section, I have argued that the traditional label "spirantization", when applied to Bothoa Breton, in fact refers to two distinct morphosyntactic processes. Important phonological and morphological properties of these processes can be accounted for in a stratal model of phonology-morphology interaction, but such an account also requires an approach to trigger selection based on input-oriented subcategorization of allomorphs which cause the phonological effects referred to as mutation. In the next section I turn to the last mutation considered here, namely lenition.

3.3 Lenition

Lenition can by and large be analysed using the same set of tools as that used for spirantization. This mutation involves the voicing of [p t ʧ k], spirantization of [b m g] (albeit not [d n], and with a laryngeal change in [g], which maps to [h]), and deletion in the case of [gw dʒɥ hr]. Many phonological issues are essentially the same: voicing and spirantization require subtraction (section 3.2.1), there is a chain shift (/k/ maps to [g] but not to [h]), and the choice of trigger allomorphs does not seem obviously amenable to a phonological motivation.

One aspect in which lenition is relevant for the purposes of this paper is the support it provides for the account of subtraction given in section 3.2.1. Recall that the voicing of obstruents involved in lenition is blocked when the preceding word ends in an obstruent (section 2.3). This fact receives a straightforward analysis in the framework adopted here.

Specifically, I suggest that the phonological grammar of Breton includes a pattern of word-final laryngeal neutralization (cf. Iverson and Salmons 2011) whereby word-final obstruents arrive at the postlexical level surface without a C-lar node (symbolized here by the devoicing diacritic). This lack of specification has both phonetic and phonological consequences.

Phonetically, a lack of phonological specification has been assumed to correspond to the lack of a phonetic target (e. g. Keating 1988; Jansen 2004; Colina 2009). For our purposes, this means that the voicing of final obstruents in Breton should be determined by the phonetic context: they should tend to be voiceless utterance-finally and before voiceless

consonants, and voiced before phonetically voiced segments (voiced obstruents, sonorants, and vowels). Descriptively, this appears to be confirmed: Bothoa Breton shows "final devoicing", "pre-sonorant voicing" of word-final obstruents, and voicing assimilation across word boundaries:

(14)	a.	(i)	[ˈkɔgəw]	*kogoù*	'roosters'
		(ii)	[ˈkɔk]	*kog*	'rooster'
		(iii)	[o ˌhɔk ˈtrøt]	*ur c'hog treut*	'a skinny rooster'
		(iv)	[ˌkɔg izˈmaːj]	*kog If-Mai*	'Yves-Marie's rooster'
	b.	(i)	[ˈtɔkəw]	*togoù*	'hats'
		(ii)	[ˈtɔk]	*tog*	'hat'
		(iii)	[on ˈtɔg ˌal]	*un tog all*	'another hat'
		(iv)	[ˌtɔg ˈʒãː]	*tog Yann*	'John's hat'

Caution is necessary in taking these (impressionistically described) phonetic data as *prima facie* evidence for lack of phonological specification, as discussed in particular by Strycharczuk (2012). Nevertheless, I suggest the Breton pattern is best analysed as the neutralization of the laryngeal contrast between obstruents, more precisely as a deletion of the C-laryngeal node affecting both voiced and voiceless obstruents. In a stratal model, this means that word-final consonants in the output of the word-level cycle always lack a laryngeal specification. Crucial evidence comes from the interaction of lenition and word-final laryngeal neutralization.

Under the analysis proposed in section 3.2.1, the voicing of stops involved in lenition must be the product of a floating C-laryngeal node.[6] This node has to be introduced postlexically (i. e. at the stage of word concatenation), since it has access to the phonological properties of both the left and the right context. As noted above, the majority of lenition triggers are vowel- or sonorant-final, and in those cases the C-laryngeal node cannot dock to the left, as Breton lacks laryngeally specified vowels and sonorants. The node thus docks to the right via the mechanism sketched in fig. 1, producing delinking of the [voiceless] feature, and thus voicing.

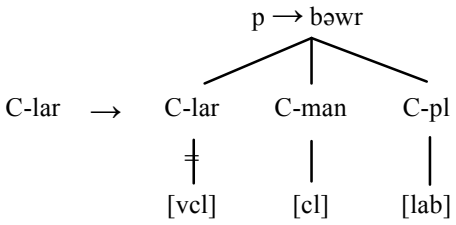
However, if the word to the left ends in a delaryngealized obstruent, the phonological grammar cannot prohibit the node from docking to the left, because laryngeally specified obstruents are permitted. Moreover, such

[6]The behaviour of lenition with respect to non-local mutation (section 3.2.2) is consistent with this analysis: according to Stump (1988), lenition-triggering clitics always mutate whatever words follows them, not some more distant element.

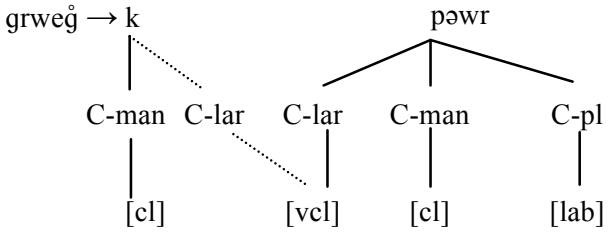
docking is preferred to the rightward variety, since the former avoids the delinking of [voiceless]. This creates two adjacent laryngeally specified obstruents, and [voiceless] spreads from the first consonant of the mutation target to the final consonant of the trigger, creating the devoicing effect in (6-a-ii).[7] The autosegmental mechanism is sketched in (15).

(15) a. Docking to the right: [ˌbro: ˈbəwr] ‘poor country’

bro:



b. Docking to the left: [ˌgrwek ˈpəwr] ‘poor woman’



From a phonological perspective, this analysis brings out an advantage of the geometric approach to ternary contrast. Specifically, it makes explicit the connection between (lack of) contrastive specification along a dimension (laryngeal features in this case) and a segment’s activity in that dimension. It captures both the fact that the positionally determined lack of contrast makes word-final obstruents inactive for the purposes of laryngeal phonology and the greater phonological activity of voiceless obstruents, formalized through their larger structures. These connections can at best be drawn by stipulation if ternary contrast were to be formalized via binary featutres (see Iosad 2012, chapter 8 for explicit discussion).

Morphosyntactically, if this analysis is correct, lenition is different from other mutations in important ways. First, it belongs to the postlexical

[7] For reasons of space and focus, I do not discuss the evidence which shows that there is no general spreading of C-laryngeal[voiceless] across word boundaries in Breton. See Iosad (2012) for details.

stratum, contrasting with full spirantization, which, as we saw in section 3.2.2, must belong to the word level. A further argument for the postlexical affiliation of lenition is the fact, discussed by Pyatt (2003), that it may be sensitive to the boundaries of phonological phrases, which by necessity must be built over stretches larger than the morphosyntactic word, and thus by the postlexical phonology.

Second, lenition further strengthens the argument for the allomorphic approach to trigger choice (section 3.2.3). Recall that lenition may produce voiced fricatives (specifically [v], from [b] and [dʒɥ]). This [v] does not trigger the devoicing of a preceding obstruent; instead we find the "regressive assimilation" normally seen before voiced obstruents in non-mutation contexts: [on ˌiːliz ˈvɛn] 'a white church' rather than *[on ˌiːlis ˈfɛn]. This shows that the mutation triggers inserted before [b]- and [dʒɥ]-initial words do not include the floating C-lar node seen before underlying voiceless stops.

The morphosyntactic conditioning of lenition must at this point remain obscure. Some cases (such as lenition following certain prepositions) are amenable to an account where the mutation trigger is part of the lexical representation of the relevant word. However, this requires storing multiple allomorphs for each trigger to account for the phonological effects of mutation (e. g. 'on' should have an allomorph /wa + C-lar/ for stop-initial words, /wa + C-man/ for [b]-initial ones, and so on). As for lenition contingent on morphosyntactic categories (such as gender and number), the problem lies in the postlexical character of the pattern, because the mutation cannot be accounted for in terms of agreement morphemes in the word (as was possible with spirantization). Lenition triggers are similar to "special clitics" or "phrasal affixes" à la Anderson (2005), in that they appear to be introduced during the construction of morphosyntactic constituents larger than the word. However, the inwards-sensitive phonological selectivity required by the allomorphic approach to trigger choice is unusual for clitics, often assumed to show a low degree of host selection. On the other hand, Bermúdez-Otero and Payne's (2011) proposal of treating special clitics as edge-based morphology, if adopted for Breton lenition, appears incompatible with its postlexical status. I leave disentangling these issues for the future.

4 CONCLUSION

This paper considers the phonological and morphosyntactic aspects of initial

consonant mutation in a Breton dialect. I have shown that the phonological aspects of the data are amenable to straightforward accounts set within what I call the autosegmental framework, deriving the alternations from the concatenation of mutation targets and subsegmental material. Still, recourse to relatively arbitrary allomorphy appears inevitable, even if it concerns triggers rather than targets of mutation.

At the same time a consideration of the morphosyntactic aspects of mutation leads to two conclusions which undermine any analysis of mutation purely in terms of (parallel) phonological computation. An adequate analysis of mutations and other aspects of Breton phonology with which it interacts requires adopting a stratal model of phonology-morphology interaction. Such a model can give a principled account of the interaction of mutation with other phonological processes (stop-glide coalescence, voicing assimilations in sandhi) and sheds light on the morphosyntactic nature of some mutations as exponents of inflectional features.

However, the most important result is the heterogeneous nature of "mutation". The phonological and morphosyntactic diversity of the phenomenon shows that attempts to view all "mutation" as a matter of lexical insertion (e. g. Stewart 2004; Green 2006) or regular phonology (Wolf 2007) may be wide of the mark: despite the superficial similarities between the different "mutations", they may have quite different ontologies. A detailed consideration of the phonological properties and morphosyntactic sources of mutation processes allows us not only to better elucidate the nature of "mutation" but also to gain new insights into the morphosyntactic structure of the language.

In addition, the analysis of Breton mutation presented here provides additional support for modular theories of the morphosyntax-phonology interface, where morphology cannot directly manipulate phonological material: its role is limited to the spell-out of lexical items by chunks of phonological structure, which are concatenated and subjected to phonological computation (e. g. Bermúdez-Otero 2012, Bye and Svenonius 2012). It remains to be seen, however, that this approach to mutation extends to other languages where similar phenomena are attested.

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