Lenition and Gemination in Northern Atlantic Roots

Alison Fisher

1. Introduction

1.1. Overview of Northern Atlantic and consonant mutation

The Atlantic languages are spoken along the west coast of Africa from Mauritania to Liberia. The group's most prominent members are Fula, which has spread as far east as Sudan and boasts thirteen million speakers, and Wolof, which is spoken as a lingua franca in Senegal and the Gambia. The group has been recognized as related to the Bantu languages since Koelle (1854); Atlantic shares several widespread Niger-Congo features such as noun classes marked on the beginning of the stem, many verbal derivational suffixes, five places of articulation in consonants, prenasalized stops, and ATR harmony (Williamson 1989). One major feature distinguishes several of the Atlantic languages from the rest of Niger-Congo: the morphophonological alternation (known as "mutation") of root-initial consonants.

The classification of Atlantic within Niger-Congo and of the various Atlantic languages has been largely based on lexicostatistics. Bennett and Sterk (1977) compared percentages of cognate vocabulary among several Niger-Congo languages and found that the Atlantic languages share very little core vocabulary with other subfamilies, suggesting that Atlantic split from the Niger-Congo tree very early (a fact which in itself makes comparative work difficult; Bantu, a relatively "young" subgroup, has been estimated at 4000 years old (Williamson 1989)). J. Sapir (1971) organized the Atlantic languages into subgroups based on a similar method; his classification, consisting of three main branches ("Northern Branch", "Southern Branch", and the isolated language Bijago) has been widely accepted.

Although several of the subgroups share a large percentage of their lexicon, the Atlantic group as a whole shares only eight percent (Childs 2003), and in fact, some Atlantic languages have more vocabulary in common with non-Atlantic languages than with each other. For example, Papel shares fifteen percent of its lexicon with Common Bantu, more than with any other Southern Atlantic language (Wilson 1989). In addition, the group has no apparent shared innovations. Many scholars have come to the conclusion that Atlantic is not a cohesive subgroup, but a collection of separate branches of Niger-Congo (Childs persuasively argues this position). As Wilson states, "the two features that make Atlantic a meaningful entity are typology and geographical distribution" (81). Areal effects have no doubt played a large role in the development of the group, including influence from the neighboring Mande languages (Childs 2003; see also Heine & Nurse 2008).

Segerer (2010) proposes an updated subclassification of Atlantic, again based largely on lexicostatistics but also on comparative work, while also suggesting that the group may comprise multiple distinct families. His scheme differs from Sapir's in several respects; we will concern ourselves only with the Northern languages. Most significantly, Segerer groups *all and only* those languages with consonant mutation (or remnants thereof) into a single subgroup. His other important innovation is to reclassify Wolof—it is no longer a close relative of Fula and Serer, but of the Buy-Nyun group. Segerer's new Northern group is shown below.

---

[*] Cornell University, amf257@cornell.edu. Thank you to Michael Weiss for learning about Atlantic along with me, and to Sam Tilsen, Draga Zec, the members of Cornell's Ph[2] reading group, and the audience at GURT 2013/ACAL 44 for their helpful feedback, as well as two anonymous reviewers for their comments on an earlier draft of this paper.

 Selected Proceedings of the 44th Annual Conference on African Linguistics, ed. Ruth Kramer et al., 84-97. Somerville, MA: Cascadilla Proceedings Project.

A. *Nalu* (Baga Mboteni, Mbulungish, Nalu)
B. 1. *Fula-Cangin*
  i. a. Fula (aka Fulani/Fulfulde/Pulaar), Serer
    b. 1. *Tenda:* Basari, Bedik, Tanda; Konyagi (aka Wamey)
      2. Biafada, Pajade (aka Badjara/Badiaranke)
  ii. *Cangin* (Lehar, Safen, Noon, Ndut, Palor)
 2. *Wolof-Nyun*
  i. Wolof
  ii. *Buy-Nyun*
    a. Kasanga, Kobiana (aka Buy)
    b. Banyum (aka Nyun/Baïnouk)

As mentioned above, a defining feature of this revised Northern group, and along with the noun class system undoubtedly the most discussed, is a three-way system of initial consonant mutation. In these languages, a root-initial consonant can appear in one of three *grades* depending on the morphological context. The grades can be understood as degrees of consonantal strength. In Serer, for example:

(1) a. saax 'village'
 b. a-caax 'villages'
 c. o-$^{\text{ɲ}}$ɟaax 'small village'
 (McLaughlin 1992-1994:280; the prefixes are noun class markers)

The set **s/c/$^{\text{ɲ}}$ɟ** is called a *series*; in a given language, some or all consonants may appear in one or more series, while some may be non-alternating. The types of consonants appearing in each grade vary by language—generally, Grade I contains fricatives, approximants, nasals and/or voiced stops; Grade II, nasals, stops, and/or geminates; and Grade III, nasals, geminates, voiceless stops, and/or prenasalized stops. The most common morphological triggers of initial consonant mutation are membership in a particular noun class, as shown in (1), and verbal inflection, as in (2) (Fula).

(2) a. o-warii 'he came'
 b. ɓe-$^{\text{ŋ}}$garii 'they came'
 (Arnott 1970:16)

Other than the Nalu languages, which are quite poorly studied (although Wilson's (2007) wordlists for Baga Mboteni and Mbulungish show evidence of mutation), all the mutation systems in the Northern group have been described (Fula: Arnott 1970 among many others; Serer: McLaughlin 1992-1994, Faye 1985; Basari and Bedik: Ferry 1968a,b; Tanda: Wilson 2007; Konyagi: Santos 1977; Biafada: Wilson 1993; Kasanga and Kobiana: Wilson 2007) or reconstructed (Pajade: Wilson 1965; Cangin: Storch 1995, although incomplete; Wolof: Magel 1970; Banyum: Wilson 2007). An illustrative example is the mutation system of Konyagi (Table 1), in which all consonants participate.

		Voiceless stop series				**Voiced stop series**				**Implosive series**			**Nasal series**			
Grades	**I**	ɸ	r	s	x	w	l	j	w/j	β	rj	j	w̃	l̃	j̃	w̃/j̃
	II	p	t	c	k	b	d	ɟ	g	ɓ	ɗ	ʄ	m	n	ɲ	ŋ
	III	p	t	c	k	$^{\text{m}}$p	$^{\text{n}}$t	$^{\text{ɲ}}$c	$^{\text{ŋ}}$k	$^{\text{m}}$b	$^{\text{n}}$d	$^{\text{ɲ}}$ɟ	m	n	ɲ	ŋ

Table 1. Consonant mutation system of Konyagi (Santos 1977).

As indicated by the column headings, the mutating consonants of each language can generally be divided into up to four groups: voiceless stops (and their variants), voiced stops, implosives, and nasals; it is the contents of Grade II that remain most stable from language to language.

The consonant mutation system has been recognized since Klingenheben (1925) as having a phonological basis, like the analogous, and more famous, system in Celtic. In particular, the prefixes that marked noun classes (perhaps going back to Proto-Niger-Congo), as well as verbal tense and agreement prefixes, would have provided the phonological context for the development of each grade. Storch (1996) gives examples from multiple languages where remnants of these conditioning environments can be seen. For example, some Biafada noun class prefixes can be reconstructed from demonstrative forms (which agree in class with their noun). Original *CVN- prefixes require Grade-III consonants at the beginning of the root (e.g. **gu-ncudu** 'bird'), *CV-prefixes (likely from earlier *CVC-, following Holst 2008) take Grade II (**ma-cadə** 'dogs'), and *CVV- prefixes take Grade I (**maa-fuula** 'girls'). Similar patterns recur in several languages. There is also evidence that Grade II is the historically "basic" grade. In Konyagi, for example, forms without prefixes, such as imperatives, take Grade II.

The likely analysis is that vowel-final prefixes caused lenition of the stem-initial consonant (producing proto-Grade I), while a nasal prefix would have caused nasalization or strengthening (proto-Grade III), leaving Grade II as the original consonant set (perhaps preserved by prefixes ending in a non-nasal consonant). This is typologically plausible, as we would expect stops to be more universal than fricatives; nor does Proto-Bantu appear to have had fricatives.[1] Over time, the prefixes were weakened or lost, removing the phonological trigger for the mutation, as seen in the Biafada examples above, as well as in the Serer examples in (1). Fula has lost its original nominal prefixes completely and uses suffixes instead; similarly, Wolof marks noun class on postnominal determiners rather than the noun itself (e.g. **bɔpp b-** 'head').

1.2. Goals of the present study

To reiterate, it seems that the fricatives and approximants of Grade I are not original, but are lenited forms (originally just allophones) of postvocalic non-continuants.[2] Yet this claim, we believe, has not been carried to its logical conclusion; although much ink has been spilled on the mutation and noun class systems, relatively little attention has been paid to the *end* of the root (which is canonically CVC, with few clusters permitted). Our hypothesis is that the lenition process should have affected medial and final consonants as well as initial (as it did in Celtic: e.g. Middle Welsh **y law** 'his hand' < ***ehyo lāṽā** < ***esyo lāmā**, McCone 1994:42). Indeed, we already have some hints that this might be the case: in Wolof, according to Ka (1994), /p c k d q/ are prohibited word-medially, while their lenited counterparts /f s ʔ r x/ are common; similarly, in Fula, /b g p k c/ are rare, and /w f h s/ common (Arnott 1970).

Thus, the questions we will address in this paper are the following: how often do Grade I consonants appear non-initially in Segerer's Northern Atlantic languages? What other consonants may appear, and can we explain their presence? Do cognate consonants in multiple languages typically share the same grade? In this endeavor we will limit ourselves to those languages whose mutation systems have been described or reconstructed with confidence, thus omitting the Cangin and Nalu languages.

Several factors conspired to make this work (and diachronic work on Atlantic in general) more difficult, a dearth of data being foremost. Only the most widespread of the Atlantic languages have extensive published dictionaries and grammars; in many cases we had access only to a Swadesh list and a sketch of the mutation system. Beyond that, the family itself is very old, and as mentioned above, the proportion of vocabulary shared among languages can be quite low.

Nevertheless, our results show that Grade I consonants do indeed make up the largest category of non-initial consonants across all the subgroups examined, thus supporting the claim that lenition applied throughout the root. We also present evidence that Proto-Northern-Atlantic possessed

1 According to the reconstructions given at the Comparative Bantu Online Dictionary [http://linguistics.berkeley.edu/CBOLD/].

2 There could have been fricatives in the proto-language, as Storch (1996) argues, but her claim that they are still distinguishable from secondary fricatives in Serer is debatable.

geminate consonants, which would not have been affected by lenition and have reflexes in many of the non-Grade-I consonants in the daughter languages.

2. Lenition in non-initial consonants

2.1. Methods and general results

For this study we acquired vocabulary lists for eleven Northern Atlantic languages in four subgroups. Due to the dearth of information on many of these languages, as well as the low percentage of cognates among the group as a whole, we could collect sufficient data only by examining each subgroup individually. The eleven languages in this study are marked in bold, along with their data sources:

A. *Nalu* (Baga Mboteni, Mbulungish, Nalu)
B. 1. *Fula-Cangin*
    i. a. **Fula** (Arnott 1970, Eguchi 1986, McIntosh 1984)**, Serer** (Faye 1985, Pichl 1971)
      b. 1. *Tenda:* **Basari** (Ferry 1968a)**, Bedik** (Ferry 1968a), Tanda; **Konyagi** (Santos 1977, Santos & Ferry 1975)
         2. **Biafada** (Wilson 1993), **Pajade** (Wilson 1965)
    ii. *Cangin* (Lehar, Safen, Noon, Ndut, Palor)
  2. *Wolof-Nyun*
    i. **Wolof (**Fal et al. 1990, Ka 1994, Magel 1970, Ndiaye 1996)
    ii. *Buy-Nyun*
      a. **Kasanga, Kobiana** (Wilson 2007)
      b. **Banyum** (Wilson 2007)

Our methods were as follows. First, we matched up the mutation series across languages according to their putative proto-consonant (see Appendix). In most cases this was straightforward, but occasionally we needed to look at likely cognates to find corresponding consonants. Next, we collected as much vocabulary as was available for each language to look for cognates across the languages in each subgroup, eliminating loanwords when they were indicated by our sources. It should be noted that our definition of "cognate" was very strict; we counted only those words whose initial and medial consonants corresponded in proto-series (e.g. Basari **a-nʌf̱**, Bedik **ga-nʌf̱**, Konyagi **ɐ-nnəf̱**, where all three [f]s come from the *p-series). If any further sound changes had applied to a particular word to obscure its original consonant series, it was ignored. Thus, we do not claim to have collected an exhaustive list of cognates for these languages.

We then noted the grade of each non-initial consonant in every cognate set. In those cases where one consonant in a set was ambiguous with respect to its grade (e.g. Kasanga /b/, which may be either Grade I or II), we considered it to belong to the grade of its cognate consonant. For example, Kobiana **sab** 'cold' has a Grade-I /b/, so its cognate Kasanga **sabo** was assumed to also have a Grade-I /b/. (We call this the "best-case-scenario" method.) About 12% of all data points were resolved in this way. Further research into the internal history of each language would help to evaluate the accuracy of this method.

The number of non-initial consonant correspondence sets for each subgroup is as follows:

- Basari-Bedik-Konyagi (hereafter *Tenda*): 253
- Biafada-Pajade: 60
- Wolof-Kobiana-Kasanga-Banyum (*Wolof-Nyun*): 91
- Fula-Serer: 71
- total: 475

Table 2 below shows the eight categories into which the correspondence sets fall, along with examples of each. (See the Appendix for the mutation systems of each individual language.)

Grade I	Basari **-nar**, Bedik **-nar**, Konyagi **-^{n}diil** ‘skin’
Grade I/II[3]	Kobiana **-nnɛgi**, Kasanga **-nag** ‘meat’
Grade II	Biafada **jabb**, Pajade **jaɓɓ** ‘full’
Grade II/III	Basari **-macar**, Bedik **-macar** ‘wild animal’
Grade III	Kobiana **pu^{n}d**, Kasanga **pu^{n}d** ‘white’
Immutable	Serer **ɲam**, Fula **ɲaama** ‘eat’
Mixed grade[4]	Banhum **-lax** (I), Kobiana **-hak** (II/III), Kasanga **-rek** (II) ‘arm’
Outside mutation system	Serer **rep**, Fula **rubbu-** (geminate) ‘cow dung’

Table 2. Examples of non-initial consonants in each grade classification studied.

Table 3 shows the general breakdown of results for each subgroup. Grade I constitutes by far the largest proportion of all consonants in the study, at forty-three percent (more than triple the next largest category); if we consider that the Grade I/II and immutable consonants may also stem from proto-Grade I, the percentage may be as high as fifty-six. This is good evidence for our hypothesis, as it suggests that lenition of non-initial consonants was widespread—perhaps the default—in the proto-language, and that the presence of unlenited consonants requires additional explanation. (We will address the question of geminates in particular in the next section.)

	Tenda	**Biafada-Pajade**	**Wolof-Nyun**	**Fula-Serer**	**Overall %**
% Grade I	47	55	28	34	**43**
% Grade I/II	0	10	15	0	**4**
% Grade II	9	12	11	3	**9**
% Grade II/III	22	0	0	0	**12**
% Grade III	16	7	6	0	**11**
% immutable	0	15	12	31	**9**
% mixed grade	6	2	13	10	**7**
% Cs not part of mutation system (mainly geminates)	0	0	15	23	**6**

Table 3. Percentage of cognate consonants in each subgroup that falls into each grade category.

[3] This label, along with “Grade II/III”, indicates situations in which a series contains the same sound in multiple grades. E.g. Kobiana /g/ appears in both Grade I and Grade II.

[4] This label indicates sets of cognate consonants that do not match in grade.

To check that the Grade-I correspondences do not comprise only a few types of consonants, we calculated the percentage of each type of consonant series found to be Grade I (Table 4). As far as we can tell, lenition does not consistently favor any particular consonant type.

	Voiceless stop series	**Voiced stop series**	**Implosive series**	**Nasal series**	**Total # Grade-I sets**
Tenda	33%	51%	49%	67%	116
Biafada-Pajade	70%	82%	22-78%	44-94%	33-47
Wolof-Nyun	56%	38-52%	n/a	0-95%	25-49
Fula-Serer	60%	63%	0-33%	0-94%	24-40
Average %	55%	59-62%	24-53%	28-88%	

Table 4. Percentage of each consonant type in Grade I in each subgroup. When ranges are given, the lower value counts only explicit Grade-I consonants, while the higher value includes Grade-I/II and immutable consonants.

While we might expect lenition to be more common intervocalically than root-finally, we found no consistent correlation between the position of a non-initial consonant in the root and its grade. In fact, in Tenda, intervocalic consonants were more likely to be Grade II or III than root-final consonants. Such consonants may derive from older clusters, as discussed further in 3.1.

2.2. Hidden Grade I in Tenda

During the course of this study, there was one set of data that seemed to pose a challenge to our hypothesis. Upon our first examination of the Tenda languages, we found only 25% of the correspondence sets to be in Grade I, while nearly 30% were mixed-grade—far higher than in any other subgroup. We will now lay out our solution to this problem, as it offers a glimpse into the history of the consonant systems of these languages.

The key is to notice that nearly all of the mixed-grade sets consisted of the implosive and nasal series. These particular sets of consonants have a messy history in Basari and Bedik, as is evident when their mutation systems are compared with that of Konyagi:

I	β	rʲ	j	w̃	l̃	j̃	w̃/j̃
II	ɓ	ɗ	ʄ	m	n	ɲ	ŋ
III	ᵐb	ⁿd	ᶮɟ	m	n	ɲ	ŋ

Table 5. Implosive and nasal series in Konyagi.

I	w̃	l	j̃	ɣ̃
II	ɓ	ɗ	ʄ	ŋ
III	m	n	ɲ	ŋ

Table 6. Implosive/nasal series in Basari.

I	ɓ	l	ʄ	ɣ
II	ɓ	ɗ	ʄ	ŋ
III	m	n	ɲ	ŋ

Table 7. Implosive/nasal series in Bedik.

While Konyagi has seven distinct, non-overlapping series corresponding to seven proto-consonants, Basari and Bedik (or their common ancestor) have apparently merged them into only four. Each series seems to contain elements of both the original implosive and nasal series. Why might this have happened? Stewart (2007) suggests, in his reconstruction of the Proto-Northern-Atlantic consonants, that the earliest members of Grade III in the implosive series were the plain nasals /m n ɲ/. They would thus have been identical to Grade III of the nasal series. This would open up the possibility of confusion between the two sets of morphological paradigms.

If the merger of the implosive and nasal series was in fact morphologically motivated, then only the *initial* consonants of the root would have been affected; we would expect non-initial consonants to remain the same and thus reflect an earlier stage of the language. This claim is testable; we can compare Basari and Bedik consonant correspondence sets with their cognates in Konyagi to determine which consonants originated in which grade (under the assumption that mixed-grade correspondences are rare).

We demonstrate this using the labial and coronal series, as the palatal series are very rare in our data. Table 8 below shows all correspondence sets in the ɓ-series in our data. The shaded cell indicates an apparent mixed-grade correspondence: Basari /ɓ/ is ostensibly Grade II but corresponds to Grade I in Konyagi.

Basari	Bedik	Konyagi	frequency	analysis
ɓ	ɓ		6x	Grade I/II
ɓ	ɓ	β	2x	Grade I
	ɓ	β	2x	Grade I
ɓ	ɓ	ɓ	1x	Grade II
m	m	ᵐb	1x	Grade III

Table 8. ɓ-series non-initial correspondence sets.

If our assumptions are correct, then the aberrant Basari /ɓ/ may in fact be an original Grade I that was supplanted by /w̃/ in the root-initial mutation system.

Upon further investigation, we find further support for this theory in the root-initial consonants of Basari. Because Ferry (1968a) provides singular and plural forms of all roots, we can see what mutations are prevalent root-initially. In fact, while we find several examples of alternating /ɓ/ and /m/ in Basari (e.g. **ɛ-mɛf/ɔ-ɓɛf** ‘thigh/s’), alternating /m/ and /w̃/, and non-alternating /m/ and non-alternating /ɓ/, we *never* find a root that alternates /ɓ/ and /w̃/. While our data are limited, we take this as evidence that /ɓ/ and /w̃/ are not “natively” part of the same mutation series.

We can repeat the same process for the m-, ɗ- and n-series; in all cases but the /m/-series, the patterns in the non-initial consonants are mirrored in the initial consonants.

Basari	Bedik	Konyagi	frequency	analysis
w̃	m	w̃	11x	Grade I
m	m	m	12x	Grade II/III

Table 9. m-series non-initial correspondence sets.

Basari	Bedik	Konyagi	frequency	analysis
l	ɗ	rʲ	13x	Grade I
ɗ	ɗ	ɗ	4x	Grade II
ɗ	ɗ	rʲ	2x	mixed-grade?

Table 10. ɗ-series non-initial correspondence sets.

Basari	Bedik	Konyagi	frequency	analysis
n	l	l̃	31x	Grade I
n	n		6x	Grade II/III
n	n	n	3x	Grade II/III
n	n	l̃	1x	mixed-grade?

Table 11. n-series non-initial correspondence sets.

Using these findings, we propose the following pre-merger labial and coronal series for Basari and Bedik:

Grade I	ɓ	l	w̃	n
Grade II	ɓ	ɗ	m	n
Grade III	m	n	m	n

Table 12. Proposed pre-merger implosive and nasal series for Basari.

Grade I	ɓ	ɗ	m	l
Grade II	ɓ	ɗ	m	n
Grade III	m	n	m	n

Table 13. Proposed pre-merger implosive and nasal series for Bedik.

The fact that the two languages do not have identical series suggests that the implosive-nasal merger was not complete in their common ancestor (although it had probably begun). We hope these results will be valuable to further reconstruction of the Tenda mutations.

2.3. Intergroup comparison

The results of all the above research support our claim that the lenition that created Grade I of the Northern Atlantic mutation series must also have operated word-internally. As mentioned above, Grade I accounts for between 43% and 56% of all non-initial correspondence sets. By contrast, Grade II makes up between 9% and 34% of the data, and Grade III 11% to 32%. Mixed-grade sets account for only 7% of the data, showing that the alternations affecting root-initial consonants do not extend to the rest of the root, at least within individual subgroups.

We can provide further verification of these patterns by looking at cognates that span multiple subgroups. In our data, we found twelve sets of cognates with consonants matching in series (see Table 14 on the following page; shaded cells indicate Grade-I or potential Grade-I non-initial consonants). Grade-I and immutable consonants dominate, as expected; furthermore, grades in cognate sets are generally consistent across subgroups. The main exception is Wolof, where root-final geminates are frequent.

Table 15 shows three more possible cognates—the correspondences do not match exactly, but are likely to be related. 'Full' gives more evidence that /ɓ/ became /b/ in the implosive-less languages. On the other hand, 'lie down' and 'rain' match implosives /ɓ ɗ/ with nasals /m n/ in Buy-Nyun. This supports Stewart's (2007) theory that the implosive series had nasals in grade III, as seen in Basari and Bedik. The nasals could have merged with the nasal series in Buy-Nyun, while the implosives merged with the plain stops (or remained a separate series, as in Kobiana).

3. Explaining unlenited consonants

3.1. General suggestions

Now that we have accounted for half of all consonant correspondence sets in our data, how do we explain the other half? Where did the unlenited consonants come from? More work on reconstruction of the Proto-Northern-Atlantic lexicon is needed to answer this question fully, but we can suggest a few possibilities to investigate.

1. Prenasalized stops most likely came from original clusters, as seems to be the case root-initially. We found one word, 'feather', which contains a reflex of $*^{ŋ}g$ in six languages, so prenasalized stops were probably present in the proto-language.
2. In that same vein, some non-initial voiceless stops likely came from earlier prenasalized voiceless stops ^{N}T (which themselves may derive from NT clusters); five of the languages in our study do not permit such stops, and we know Wolof underwent the change $\#^{N}T > \#T$ within the past century (Kobès 1923).
3. Some voiced stops may be the result of fortition of voiced fricatives. In several languages we find either voiced stops alone or stops and fricatives in Grade I; for example, in Kobiana and Kasanga, both /g/ and zero (certainly the reflex of an earlier continuant) may function as Grade I of the g-series. This kind of optionality is not common among voiceless stops.

	Serer	Fula	Wolof	Banhum	Kobiana	Kasanga	Basari	Bedik	Konyagi	Biafada	Pajade
‘bite’	ŋat	ŋat-	(ŋaaɲ)	ŋal	ŋah	ŋar	ŋat	ŋas	ŋɐr	ŋar	ŋas
‘ear’	(ŋof)	nof- /nopp-	nɔpp	-nuf	-nuf	-nuf	-nʌf	-nʌf	-nnəf	-nəfa	-nufa
‘eat’	ɲam	ɲaam-	ɲam ‘taste’		ɲaam	ɲaam					
‘eat’			lɛkk					tɔ	took		
‘egg’			nɛn	-niin	-niin	-niin		-lil	-niil̃		
‘eye’	ngid	git-	gət	-gil	-ggih	-gir	-ngɯs	-ngɯs	-nkər	-gərɐ	-aasa
‘feather’			dung		-lung	-lung	-ndongw	ɲarong	-dənkw		
‘head’			bɔpp	-gof	-gof	-gof	gaf	gaf	-nkɐf	-ofɐ	-oofa
‘star’	xor	kood-						-kɔr	-kool		
‘star’					-woolu	-wol				wweela	-wooru
‘tongue’	(delem)	ɗem-	laammiɲ	-lemuc	ɟaarum	(ɟaalumb)	-niw̃	-ɗem	rjəw̃	-deema	-deema
‘woman’		deek-		-dikaam	-likaam	-likaam					

Table 14. Intergroup cognates with consonants matching in series. Shaded cells indicate Grade-I or potential Grade-I non-initial consonants.

	Serer	Fula	Wolof	Banhum	Kobiana	Kasanga	Basari	Bedik	Konyagi	Biafada	Pajade
‘full’					jebb	jebb				jabb	jaɓɓ
‘lie down’					nik	nika	ɗak	ɗak	ɗɐk		
‘rain’	doɓ	toɓo	taw	lim-	tim	tim	tɯɓ	tɯɓ	rəv		

Table 15. More possible intergroup cognates.

4. Several of the unlenited consonants in our set are geminates or plausibly result from shortening of geminates. We discuss these cases more thoroughly in the next section.

3.2. Geminates in Proto-Northern-Atlantic

The distribution of phonemic geminates in the Northern Atlantic languages (as laid out in Table 16) points to their presence in the proto-language. First, we note that geminates are found in every subgroup studied except Tenda. In four of the seven languages with geminates, geminates participate in the root-initial mutation system. Of the other three, two (Fula and Wolof) have lost their noun class prefixes; any resulting word-initial geminates would likely have been shortened. These facts support Holst's (2008) claim that Grade II in the proto-language originally contained geminates (*CVC_1-C_2V… > *CV-C_2C_2V…) which where later shortened, resulting in modern-day Grade II singletons.

	Phonemic geminates?	**Root-initial?**	**Root-medial?**	**What consonants?**
Serer	N			
Fula	Y	N	Y	all but continuants
Wolof	Y	N	Y	/j w l/, stops, nasals
Banyum	Y	Y	Y	voiced stops, nasals
Kobiana	Y	Y	Y	voiced stops, nasals
Kasanga	Y	N	Y	voiced stops, …?
Basari	N			
Bedik	N			
Konyagi	N (allophonic)			
Biafada	Y	Y	Y	voiced stops, nasals, glides
Pajade	Y	Y	Y	voiceless stops, implosives, nasals

Table 16. Distribution of phonemic geminates in Northern Atlantic.

More relevant to our current endeavor is the fact that of the seven languages with geminates, only Wolof and Biafada have geminate continuants. This is crucial to our hypothesis that Proto-Northern-Atlantic had geminates: if lenition had occurred before the creation of geminates from clusters, we would expect to find geminate fricatives, liquids and glides frequently. On the other hand, if gemination happened first, the language would have had no (or few) continuants from which to make geminates. Non-continuant geminates would be resistant to lenition, remaining unchanged to the present day in some cases.

Assuming that Proto-Northern-Atlantic had geminates, the question still remains: what caused the non-initial geminates to form? The most straightforward answer is through assimilation of consonant clusters. In her grammar of Fula, Breedveld (1995) suggests such a source for certain alternating noun stems, like **nof-ru/nopp-i** 'ear/s'. The **-i** suffix, according to Breedveld, comes from an earlier ***-ʔi** whose glottal stop assimilated to the root-final consonant. It is an open question whether this particular development happened before lenition or after (in which case *ff must have strengthened to /pp/), but we can easily imagine a general process of this type occurring in the proto-language.

Noun class suffixes like Fula **-i** come from postposed determiners, which are found throughout the family and agree in noun class with the NP. They were most likely enclitic on the noun as well, so sandhi could well have applied at the end of the noun. Certain determiners could have undergone assimilation but not others. The proto-language would then have had singular/plural (or perhaps diminutive or augmentative) pairs like ***nVp/*nVpp** 'ear', and only the first of such pairs would have been affected by lenition. Then each language generalized one stem over the other (or kept both, in the case of Fula). A similar explanation is required for the final geminates in verbal roots, which are numerous in Wolof and Fula; we can point to phenomena like the so-called "geminating suffixes" in Wolof, which cause the final consonant of the root to lengthen (Ka 1994).

Several questions remain, requiring more work on the reconstruction of Northern Atlantic. In particular, what suffixes might have caused gemination? Was compounding also involved? Did any secondary gemination occur in the individual daughter languages, and can we distinguish it from gemination in the proto-language? Why do Wolof and Fula have so many more geminates than the other languages? Why do so many of the languages have only voiced geminates (typologically highly unusual)? Did the proto-language have geminates that did not arise from cluster assimilation?

In any case, it is highly likely that many of the unlenited singletons we find in languages like Serer come from earlier geminates (compare Serer **goɗ**, Fula **woɗɗ** 'be far away'). In Biafada we may be seeing this process in action, as geminates and singletons co-occur in Grade II of the voiced stop, nasal and glide series.

4. Conclusions

Through examination of consonant correspondence sets, we have shown that postvocalic lenition did indeed affect the whole root in Proto-Northern-Atlantic, not just the initial consonant. Lenited (Grade-I) consonants make up about half of all non-initial consonants in our data. This conclusion should not be surprising, as it simply means postvocalic lenition was a regular sound change in the development of the proto-language. Furthermore, we have provided plausible explanations for many of the remaining unlenited consonants, such as denasalization of prenasalized stops, fortition of voiced fricatives, and shortening of geminates. Geminates themselves, we argue, likely stem (in part, at least) from assimilation of clusters in the proto-language itself.

To verify these claims, more diachronic work on Northern Atlantic is needed; in particular, what suffixes might have resulted in gemination? Where do the mixed-grade correspondence sets come from? More generally, continued work on reconstructing the roots and affixes of Proto-Northern-Atlantic is essential. In turn, such progress hinges on continued fieldwork in the region, especially on the grammars and lexicons of languages like Kobiana and Kasanga, which are poorly documented and at risk of extinction. It should also be informative to compare the North Atlantic languages with their relatives, both in South Atlantic and Niger-Congo more generally.

Appendix: consonant mutation systems in eleven Northern Atlantic languages

Series		Serer	Fula	Wolof	Banhum	Kobiana	Kasanga	Basari	Bedik	Konyagi	Biafada	Pajade
p	**I**	f	f	f	f	f	f	f	f	ɸ	f	f
	II	p	p	p	p	p	p	p	p	p	p	pp
	III	mb	p	mp	mp	p	mp	p	p	p	mp	pp
t	**I**	d, (l?)	t, (l?)	l?	l	h	r	s	s	r	r	s
	II	t, (l?)	t, (l?)	t	t	t	t	t	t	t	t	tt
	III	nd, (l?)	t, (l?)	nt	nt	t	nt	t	t	t	nt	tt
c	**I**	s	s	s	s, r	s	s	ʃ	ʃ	s	s	s
	II	c	c	c	c	c	c	c	c	c	c	cc
	III	ɲɟ	c	ɲc	ɲc	c	ɲc	c	c	c	ɲc	cc
k	**I**	w, x	h	ʔ, h, w, j, x	x, w?	h	h	x	x	x	h, Ø	Ø
	II	k, q	k	k, q	k	k	k	k	k	k	k	kk
	III	ŋg, NG	k	ŋk	ŋk	k	ŋk	k	k	k	ŋk	kk
b	**I**	b, v, w	w, (b)	w	w?	b	b	w	w	w	b	?
	II	p, b	b	b	b	bb	b	b	b	b	b, bb	p
	III	mb	mb	mb	mb	mb	mb	mb	mb	mp	mb	mp
d	**I**	r	r, (d)	r?	l?, n?	l	l	r	r	l	d, l	r
	II	t	d	d	d	d	d	d	d	d	d, dd, r	t
	III	nd	nd	nd	nd	nd	nd	nd	nd	nt	nd, nr	nt
ɟ	**I**	ɟ, j	j, (ɟ)	j	?	ð, ʐ	ɟ	j	j	j	ɟ	?
	II	c, j	ɟ	ɟ	ɟ	ɟ	ɟ	ɟ	ɟ	ɟ	ɟ, ɟɟ	c
	III	ɲɟ, j	ɲɟ	ɲɟ	ɲɟ	ɲɟ	ɲɟ	ɲɟ	ɲɟ	ɲc	ɲɟ	ɲc
g	**I**	g	w, j, (g)	w	?	g, Ø	g, Ø	ɣ	ɣ	w, j	g, ɣ?	w, Ø
	II	k	g	g	g	g, (gg?)	g	g	g	g	g, gg	k
	III	ŋg	ŋg	ŋg	ŋg	ŋg	ŋg	ŋg	ŋg	ŋk	ŋg	ŋk

Series		Serer	Fula	Wolof	Banhum	Kobiana	Kasanga	Basari	Bedik	Konyagi	Biafada	Pajade
ɓ	I	ɓ	ɓ	w	w?	b	b	w̃	ɓ	β	b	b
	II	ɓ	ɓ	b	b	bb	b	ɓ	ɓ	ɓ	b, bb	ɓɓ
	III	ɓ	ɓ	mb	mb	mb	mb	m	m	mb	mb	mb
ɗ	I	ɗ	ɗ	l?	l?, n?	r	l	l	l	rj	d	d
	II	ɗ	ɗ	d	d	dd	d	ɗ	ɗ	ɗ	d, dd	ɗɗ
	III	ɗ	ɗ	nd	nd	dd	nd	n	n	nd	nd	nd
ʄ	I	ʄ	ʔj	j	?	ð, ʐ	ɟ	j̃	ʄ	j	ɟ	ɟ
	II	ʄ	ʔj	ɟ	ɟ	ɟ	ɟ	ʄ	ʄ	ʄ	ɟ, ɟɟ	ʔj
	III	ʄ	ʔj	ɲɟ	ɲɟ	ɲɟ	ɲɟ	ɲ	ɲ	ɲɟ	ɲɟ	ɲɟ
m	I	m	m	m	?	m	m	w̃	ɓ	w̃	m	m
	II	m	m	m	m	m	m	ɓ	ɓ	m	m, mm	mm
	III	m	m	m	mm	m	m	m	m	m	mm	mm
n	I	n	n	n	?	n	n	l	l	l̃	n	n
	II	n	n	n	n	n, (nn?)	n	ɗ	ɗ	n	n, nn	nn
	III	n	n	n	nn	n, (nn?)	n	n	n	n	nn	nn
ɲ	I	ɲ	ɲ	ɲ	ɲ	ɲ	ɲ	j̃	ʄ	j̃	ɲ	ɲ
	II	ɲ	ɲ	ɲ	ɲ	ɲ	ɲ	ʄ	ʄ	ɲ	ɲ, ɲɲ	ɲɲ
	III	ɲ	ɲ	ɲ	ɲ	ɲ	ɲ	ɲ	ɲ	ɲ	ɲɲ	ɲɲ
ŋ	I	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ɣ̃	ɣ	w̃, j̃	ŋ	ŋ
	II	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ, ŋŋ	ŋŋ
	III	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋŋ	ŋŋ
other	I					w	w				w; j	w; j
	II					w	w				w, ww; j, jj	w; j
	III					w	w				ww; jj	w; j

References

Arnott, D. W. 1970. *The Nominal and Verbal Systems of Fula.* Oxford: Clarendon Press.

Bennett, Patrick R. and Jan P. Sterk. 1977. South Central Niger-Congo: A reclassification. *Studies in African Linguistics* 8: 241-273.

Breedveld, J. O. 1995. *Form and Meaning in Fulfulde: A Morphophonological Study of Maasinankoore.* Leiden: Research School CNWS.

Childs, G. Tucker. 2003. *An Introduction to African Languages.* Amsterdam: John Benjamins.

Eguchi, Paul Kazuhisa. 1986. *An English-Fulfulde Dictionary.* Tokyo: Institute for the Study of Languages and Cultures of Asia and Africa.

Fal, Arame, Rosine Santos & Jean Léonce Doneux. 1990. *Dictionnaire wolof-français suivi d'un index français-wolof.* Paris: Karthala.

Faye, Souleymane. 1985. *Morphologie du nom Sérère.* Dakar: Centre de Linguistique Appliquee de Dakar.

Ferry, Marie-Paule. 1968a. *Deux langues Tenda du Sénégal oriental: Basari et Bedik.* Paris: Société pour l'Étude des Langues Africaines.

Ferry, Marie-Paule. 1968b. L'alternance consonantique en Bedik. *Journal of West African Languages* 5: 91-96.

Heine, Bernd & Derek Nurse, eds. 2008. *A Linguistic Geography of Africa.* Cambridge: CUP.

Holst, Jan Henrik. 2008. *Reconstructing the Mutation System of Atlantic.* Neuried: Ars Una.

Ka, Omar. 1994. *Wolof Phonology and Morphology.* Lanham, MD: University Press of America.

Klingenheben, August. 1925. Die Permutation des Biafada und des Ful. *Zeitschrift für Eingeborenen-Sprachen* 15: 180-213, 266-272.

Kobès, A. 1923. *Dictionnaire volof-français.* Dakar: Mission Catholique.

Koelle, Sigismund Wilhelm. 1854 [1963]. *Polyglotta Africana.* Graz: Akademische Druck- und Verlagsanstalt.

Magel, Emil Anthony. 1970. *A Preliminary Analysis of the Permutation System in Wolof.* Duquesne University: M.A. Thesis.

McCone, Kim. 1994 [2005]. *L'Irlandese Antico e la sua Preistoria.* Trans. E. Roma. Alessandria: Edizioni dell'Orso.

McIntosh, Mary. 1984. *Fulfulde Syntax and Verbal Morphology.* London: Routledge & Kegan Paul.

McLaughlin, Fiona. 1992-1994. Consonant mutation in Seereer-Siin. *Studies in African Linguistics* 23: 279-313.

Ndiaye, Moussa Demba. 1996. *Phonologie et morphologie des alternances en Wolof: implications theoriques.* University of Montreal: Ph.D. Diss.

Pichl, W. J. 1971. *The Serer Language.* Pittsburgh: Duquesne University Press.

Santos, Rosine. 1977. *Phonologie et morphotonologie de la langue W̃èỹ (Koñagi).* Dakar: Centre de Linguistique Appliquee de Dakar.

Santos, Rosine & Marie-Paule Ferry. 1975. *Deux lexiques Tenda : lexique w̃eỹ (koñagi) suivi d'un lexique pẽ .* Dakar: Centre de Linguistique Appliquee de Dakar.

Sapir, J. David. 1971. West Atlantic: an inventory of the languages, their noun class systems and consonant alternation. In *Current Trends in Linguistics, vol. 7: Linguistics in Sub-Saharan Africa*, ed. Thomas A. Sebeok. The Hague: Mouton. 45-112.

Segerer, Guillaume. 2010. "Isolates" in "Atlantic". Language Isolates in Africa Workshop, Lyon, December 2010.

Stewart, John M. 2007. Consonant mutation in Proto-Potou-Akanic-Bantu and in the Fula-type languages of Senegal and Guinea. In Wilson 2007.

Storch, Anne. 1995. *Die Anlautpermutation in den westatlantischen Sprachen.* Frankfurt am Main: Frankfurter Afrikanistische Blätter.

Storch, Anne. 1996. Die Anlautpermutation im Westatlantischen und das Problem der Implosiva. *Afrika und Übersee* 79: 111-128.

Williamson, Kay. 1989. Niger-Congo overview. In *The Niger-Congo Languages,* ed. John Bendor-Samuel. Lanham, MD: University Press of America. 3-45.

Wilson, W. A. A. 1965. A reconstruction of the Pajade mutation system. *Journal of West African Languages* 2: 15-20.

Wilson, W. A. A. 1989. Atlantic. In *The Niger-Congo Languages,* ed. John Bendor-Samuel. Lanham, MD: University Press of America. 81-104.

Wilson, W. A. A. 1993. An outline description of Biafada. *Journal of West African Languages* 23: 59-90.

Wilson, W. A. A. 2007. *Guinea Languages of the Atlantic Group: Description and Internal Classification.* Frankfurt am Main: Peter Lang.

Selected Proceedings of the 44th Annual Conference on African Linguistics

edited by Ruth Kramer, Elizabeth C. Zsiga, and One Tlale Boyer

Cascadilla Proceedings Project Somerville, MA 2015

Copyright information

ISBN 978-1-57473-465-2 library binding

Ordering information

Orders for the library binding edition are handled by Cascadilla Press.
To place an order, go to www.lingref.com or contact:

Cascadilla Press, P.O. Box 440355, Somerville, MA 02144, USA
phone: 1-617-776-2370, fax: 1-617-776-2271, sales@cascadilla.com

Web access and citation information

This entire proceedings can also be viewed on the web at www.lingref.com. Each paper has a unique document # which can be added to citations to facilitate access. The document # should not replace the full citation.

This paper can be cited as:

Fisher, Alison. 2015. Lenition and Gemination in Northern Atlantic Roots. In *Selected Proceedings of the 44th Annual Conference on African Linguistics*, ed. Ruth Kramer et al., 84-97. Somerville, MA: Cascadilla Proceedings Project. www.lingref.com, document #3128.