

Nominal classes and phonological agreement in Frò?ò (Tagbana)¹

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Abstract

Besides total vowel harmony and nasal harmony, Frò?ò, a Gur language spoken in Côte d'Ivoire, has a pervasive consonantal agreement in its nominal domain: the morphologically ‘dependent morphemes’ (in terms of concord, Corbett 1991) or ‘associate morphemes’ (Hockett 1958), of nominal heads, agree in their articulator and [±continuant] features, a special case of alliterative concord, because the head noun is playing no role in the alliteration. Besides the consonantal agreement features, these free associate morphemes have their own vocalic features and their own [±voice] feature. The paper starts with a review of nominal classes in Frò?ò and the morphological structure of simple nouns. It is proposed that Frò?ò has a partly non-concatenative morphology and that a standard Distributed Morphology analysis cannot fully account for the phonology of the resulting morphemes. In the second part, the role of phonology is investigated. It is proposed that well-formed morphemes are the result of partial or deficient phonological specifications in need of repair. The phonological approach is couched in an optimality-theoretic framework (see Saba Kirchner 2010 and Bye & Svenonius 2012 among others for similar proposals). Part of the final specification of these morphemes are due to phonological repairs elicited by markedness and faithfulness constraints, and the filling in of features due to vowel and nasal harmony, as well as consonant epenthesis.

1. Introduction

We propose a morphological and phonological analysis of agreement in the seven nominal classes of Tagbana (sometimes spelled Tagwana), a Gur language of the Senufo family spoken in West Africa, and more specifically in the dialect called Frò?ò spoken around the

¹ The first author of this article is a native speaker of Frò?ò and the data discussed here rely on the knowledge of his own language. In some cases, he made sure that the data were confirmed by other speakers. Our acknowledgments go to Ines Fiedler, Beata Moskal and Noam Faust who gave us precious comments as to different versions of this paper. Conversations with Arto Anttila, Jonathan Bobaljik, Gisbert Fanselow, Fatima Hamlaoui, Annie Rialland and Andrew Nevins also helped us to clarify several crucial issues. Lastly, we are also thankful for three anonymous reviews that were largely taken into consideration in this revised version. Many thanks are due to these reviewers and also to the organizers and participants of the 2nd Symposium on West African Languages in Vienna in October 2016 and the 45th Manchester Phonology Meeting (May 2017) for giving us the opportunity to present our work.

town of Fronan in Côte d'Ivoire. A purely morphological analysis delivers deficient phonological structures with non-concatenated features and segments. It is the task of phonology to order the present features and to repair or fill-in the deficient segments.

Almost all language families of the Niger-Congo phylum have nominal classes expressed by affixes called class markers (CM). In many Niger-Congo languages, a noun may belong to a specific class because of the semantic characteristics of its referent, see Creissels (1991:91ff) for examples. However, in Frò?ò, as in other Gur languages, semantic categories only play a secondary role for the distribution of nouns into classes (see Traoré 2018 for more on this topic). Nominal classes are defined here on the basis of agreement that nouns trigger on other elements associated to the nominal domain (the ‘associated words’ of Hockett 1958). Agreement is a relation between two or more elements: a controller and one or more targets (or agreeing elements), i.e. an adjective, a pronoun, etc., that receive their class by virtue of this agreement relation, see Corbett’s (1991:4-5) definition of concord in (1).

(1) Class concord

A nominal expression that is in a relationship of syntactic dependence with the noun carries the class mark of the noun: determiner, adjective, interrogative, pronoun etc.

Frò?ò presents an extensive morphological and phonological nominal concord based on identical consonantal features on all morphemes associated with a noun, depending on their nominal class. We call this phenomenon ‘consonantal agreement’ for lack of a better term. As far as the morphological structure is concerned, we propose an analysis in the framework of Distributed Morphology (Halle & Marantz 1993). The morphosyntactic features obey the principle of ‘syntax all-the-way-down’ proposed by Halle & Marantz (2003) and Bobaljik (2015) among others. As for the phonology, it has non-concatenative properties. The phonological form of morphemes is determined by abstract morphological features, and the surface form is a compromise between faithfulness to the pairing between morphological and phonological form (Vocabulary Insertion) and phonological markedness principles. The pervasive consonantal agreement of Frò?ò is non-local and differs from local consonant harmonies as described by Walker (2000a,b, 2001), Rose & Walker (2004), Hansson (2001) and Bennett (2015) for instance. In this paper, it is analysed as an epiphenomenon of the morphology and phonology of the nominal domain (see Féry & Moskal 2018 for a typology of alliterative concord, in which Frò?ò finds a marginal place).

Nominal classes in Frò?ò are primarily identified on the basis of their phonological properties. The associated morphemes of a nominal head acquire their phonological shape by fusion of different phonological features expressing morphological features plus default phonology. Specifically, the initial consonants of these morphemes agree with each other. Agreement takes the form of distinctive features, as for example privative features for articulator [labial], [coronal] and [dorsal] and binary [\pm continuant]. Examples are given in (2) with three identificational constructions that illustrate the consonantal agreement. The identificational construction consists of a noun (lexical root + class marker CM), followed by an anaphoric pronoun (PRO) and an identificational particle (ID).

- | | |
|--|---|
| (2) a. jē-gē kī gī | b. jē:-rē tí dī |
| month-CM5 PRO5 ID5 | month-CM6 PRO6 ID6 |
| ‘It is the month/moon.’ | |
| c. jñū-mñū pī bī | |
| water-CM7 PRO7 ID7 | |
| ‘It is the water.’ | |

In (2)a-b, the singular and plural CM of classes 5 (singular) and 6 (plural) are suffixed to the lexical root *jē-* ‘month’. The pronouns and the identificational particle are free morphemes following the noun. CM, pronoun and identificational particle share the same class, and they agree with each other in some of their consonantal features. In (2)a, their initial consonant is [dorsal, -continuant], and in (2)b, the agreeing feature is [coronal]. In (2)c, the lexical root, *jñū-* is followed by the CM of class 7 *-mñū*, *pī* is the anaphoric pronoun and *bī* is the identificational particle. In this case, all three initial consonants are [labial, -continuant].²

There is also a regular total vowel harmony between the last vowel of the lexical root (V_{ROOT}) and the first vowel of the CM (V_{CM}), all features of V_{ROOT} being copied to V_{CM} , including tone. Only the length can differ, see (2)b, where [e] is lengthened by the following [r], an effect that we do not discuss here. In the examples in (2), the vowel of the free morphemes is always [i]. The quality of the vowel is determined by the morphemes themselves, and it is not the result of vowel harmony.

Before turning to the phonological properties of the nominal classes, let us briefly introduce the phonemic inventory of Frò?ò. The consonants are shown in Table 1. There are

² The tones are indicated in all examples. There are three level tones, high (H) ‘'', mid (M) ‘-’ and low (L) ‘''. In this paper, we do not provide an analysis of the tonal system of the language, see Traoré, Rialland & Féry (in prep) for the tonal structure of Frò?ò.

22 consonants, 10 of which are stops and two are voiceless fricatives. There is no voiced fricative. The 10 stops are divided in voiceless and voiced ones that can take five places of articulation: labial, alveolar, palatal, velar and labio-velar. Two laryngeal obstruents are present as well: [?] and [h]. Additionally, there are six sonorants, four of which are nasals. The remaining sonorants are two glides [j] and [w], and two liquids, [l] and [r]. The Frò?ò consonant system is close to that of other Gur languages, although some differences emerge as well. For instance, voiced fricatives exist in other languages.

| Table 1. Frò?ò consonants | | labial | alveolar | palatal | velar | labio-velar | glottal |
|---------------------------|-----------|--------|----------|---------|-------|-------------|---------|
| Plosive | voiceless | p | t | c | k | kp | ? |
| | voiced | b | d | ɟ | g | gb | |
| Fricative | | f | s | | | | h |
| Nasal | | m | n | ɲ | ŋ | | |
| Glide | | | | j | | w | |
| Lateral | | | l | | | | |
| Rhotic | | | r | | | | |

Frò?ò has seven ‘plain’ vowels that can be long in some environments, in particular before a heteromorphemic [r], as shown in (2)b. All vowels can be lengthened by a following [r] or [l], but length is not distinctive. All of them have nasal correspondents, except for the mid [+ATR] [e] and [o] that are never nasalized, thus all in all 12 vowels, as shown in Table 2. There is no [ATR] harmony whatsoever in Frò?ò.

Table 2. Frò?ò vowels

| a. Short vowels | | b. Nasal vowels | |
|-----------------|---|-----------------|----|
| i | u | ĩ | ũ |
| e | o | | |
| ɛ | ɔ | ɛ̃ | ɔ̃ |
| a | | ã | |

Nominal phrases may include further morphemes, like adjectives, indefinite article (there is no definite article), demonstrative, numeral, quantifier, interrogative and possessive pronoun. The canonical order of these morphemes is shown in (3). Examples will be given below.

Numeral and quantifier are invariant, all other words are morphologically and phonologically associated morphemes, and vary according to the nominal class of the head noun.

(3) Nominal template in Frò?ò

(Possessive) - Nominal root – (adjective) – CM – (numeral/quantifier) – (demonstrative) (pronoun) - (identificational particle)

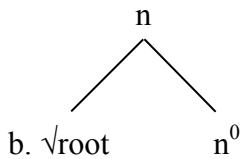
In the remaining of this article, we investigate the morphological and phonological aspects of nominal classes and nominal domains in Frò?ò, with a special attention to the phenomenon of alliterative concord. The next section passes review of nouns and nominal classes in this language and focuses on a morphological analysis in the framework of Distributed Morphology. Section 3 describes alliterative concord in the nominal domain and emphasizes the shortcomings of a purely morphological approach of agreement. In particular the morphological approach needs a phonological account to explain how the different pieces resulting from Vocabulary Insertion are organized into phonological outputs. Sections 4 proposes a complementary phonological account. Vowel and nasal harmonies are the subject of Section 4, as well as consonant epenthesis. Section 5 contains a conclusion.

2. Nouns and nominals

We adopt a version of Distributed Morphology (DM) for explaining how words—specifically nouns—acquire their category (see Halle and Marantz 1993, 1994, Halle 1990, Noyer 1997, Pesetsky 1995, Embick and Noyer 2001, Nevins 2010, Embick 2010, Bobaljik 2015, Moskal 2015 among others). There are three kinds of morphemes: first, lexical items or roots—morphemes without category—that are part of the language-dependent open lexicon; second, category-defining nodes n^0 , v^0 , and a^0 ; and third, functional morphemes bearing their own category. We come back to the latter category in Section 3 and concentrate in this section on the first two categories.

A root X has the form shown in (4)a. It acquires its category by adjunction of a category-defining functional head, n^0 (for noun) in (4)b, that combines with the root (Marantz 2007). In sum, a lexical root in Frò?ò does not have a category all by itself. It acquires its nominal status by combining with an overt or a covert class marker (CM), i.e. the category-defining functional head, n^0 (see Smith 2015 among others for this view).

(4) a. $\sqrt{\text{root}}$



An example of a simple lexical root appears in (5). The lexical root $\sqrt{tì}$ needs a class marker to become a noun meaning ‘tree’ or ‘wood’. In the examples, the class markers are CM5 or CM6, that is class markers of class 5 or 6, and the nouns formed in this way are themselves of class 5 (singular) or 6 (plural).

(5) $t\bar{i}-\bar{r}\bar{i}$

tree-CM5

‘tree’

$t\bar{i}:-r\bar{i}$

tree-CM6

‘tree’

As already mentioned, Frò?ò has seven nominal classes that are recognizable by the phonological form of the CM and the associated morphemes. The first six classes come in pairs of singular and plural and class 7 includes mass nouns lacking a plural. In the present paper and following Creissels (1991), we call ‘gender’ the combination of a singular and a plural form.³

We follow suggestions by Clamens (1952) and by Miehe (2012) for Tagbana.⁴ The nominal classes of Frò?ò are a subset of those proposed by Miehe, Kleinewillinghöfer, von Roncador & Winkelmann (2012) in their introductory chapter to the noun classes in Gur. Their proposal is based on Manessy’s (1962, 1996) reconstruction work, which is itself leaning on the Bantu tradition. Our classes 1 and 2 (gender 1) roughly corresponds to Gur classes 1-2 of Miehe et al. (2012), our classes 3 and 4 (gender 2) to their classes 5-6, our classes 5 and 6 (gender 3) comprise their classes 12, 15 and 21, and our class 7 (gender 4) comprises their classes 14 and 22-23.

In Table 3, examples of the seven classes are listed with their class markers and examples of nouns for each class (for a more detailed survey, as well as a comparison with Miehe et al.’s proposal, see Traoré in prep). A typical root is mono- or disyllabic, regardless

³ We are well aware that the notion of ‘gender’ does not have the same meaning in African languages as in European languages, but we choose to follow the Africanist tradition.

⁴ Miehe’s survey is entirely based on Clamens’ notes that are not glossed and with which the first author of the present article does not always agree (see also Manessy 1996:54 for this judgment). It is thus not an understatement to claim that the present article, Traoré & Féry (2018) and Traoré (in prep) are the first linguistic studies of Frò?ò.

of the nominal class it acquires. If it is longer, it is most probably a compound. The class marker adds a syllable—or two in class 2 and class 4, the plural of gender 1 and 2 respectively.

The vowel of the V_{CM} is typically a total copy of the V_{ROOT} . However, in disyllabic [-hele], [-bele] for class 2 and [-gele] for class 4 the vowel is prespecified as [e]. In class 4, one of the two possible CMs starts with a glottal stop, and the vowels are in total harmony with the V_{ROOT} , even though there are two vowels, see also the examples in (10).

Table 3. Overview of the nominal classes of Frò?ò and the class markers

| Class markers (CM) | Examples of nouns of each class | |
|--|---------------------------------|-----------------------------|
| Class 1 (sg. of gender 1) several CM, including Ø | hō-lō elephant-CM1 | wótìò python |
| Class 2 (pl. of gender 1) CM: [-hele], [-bele], [-lV] | hō-bēlē elephants-CM2 | wótìò-hélé pythons-CM2 |
| Class 3 (sg. of gender 2) CM: [-lV] | lā:-lā belly-CM3 | kpē-lē knife-CM3 |
| Class 4 (pl. of gender 2) CM: [-?VlV], [-gele] | lā-?ālā bellies-CM4 | kpē-gēlē knives-CM4 |
| Class 5 (sg. of gender 3) CM: [-gV], [-ŋV], [-?V] or Ø | jē-gē month-CM5 | āfɔ̃-ŋɔ̃ new thing-CM5 |
| Class 6 (pl. of gender 3) CM: [-rV] | jē:-rē months-CM6 | āfɔ̃:-rɔ̃ new things-CM6 |
| Class 7 (sg. of gender 4) CM: [-mV] | jū-mü water-CM7 | wē-bē foliage-CM7 |

Nominal classes 1 and 2 (gender 1) contain the largest number of nouns. In contrast to genders 2 and 3, gender 1 can partly be characterized in semantic terms: the referents of the nouns of these classes include most human beings, other living beings, as well as animate and inanimate objects relating to humans. Moreover, they also contain loanwords. But not all the referents corresponding to this description are included in gender 1, as there are also animals or objects related to humans belonging to the other genders.

Class 1 nominal roots (the singular) usually form a noun by suffixing a CM, but there is also a non-negligible number of nouns that do not take an overt CM. This happens much more often in class 1 than in the other classes. An additional complication of this class is that

the CM can take several forms by varying its onset consonant (C_{CM}). It can be a nasal [ŋ, n], a rhotic [r] or a lateral [l].⁵ In all classes, total vowel harmony between V_{ROOT} , (the last vowel of the root, which is the trigger), and V_{CM} , the target, is the rule. However, even though this total harmony regularly applies to nouns in general, class 1 nouns present many exceptions.

Class 2 (plural of class 1) can also take different forms. In contrast to the other classes, class 2 nouns do not respect clear formation rules. The largest group of class 2 nouns have a CM starting with [l] and a vowel harmonizing with the V_{ROOT} . The root vowels are often different in the singular (class 1) and in the plural (class 2).⁶ In short, gender 1 is not homogeneous as far as the noun (nominal root + optional CM) is concerned. Some examples appear in (6) to (9). In (6), words with a CM—both singular and plural—and in (7), words without CM in the singular are listed.

(6) Gender 1 nouns with $-IV_{CM}$ in the singular (class 1) and $-IV_{CM}$ in the plural (class 2)

| Sg. | Pl. | Sg. | Pl. |
|----------|-----------|-----------|----------|
| pō-lō | pīē:-lē | hō-lō | húō:-lō |
| male-CM1 | males-CM2 | mouse-CM1 | mice-CM2 |

(7) Gender 1 nouns without CM in the singular (class 1) and with $-IV_{CM}$ in the plural (class 2)

| Sg. | Pl. | Sg. | Pl. |
|---------------|--------------------|--------|-------------|
| nū | nī:-lī | gānū | gānī:-lī |
| mother | mothers-CM2 | rat | rats-CM2 |
| tō | tīē:-lē | nūbūō | nūbīē:-lē |
| father | fathers-CM2 | friend | friends-CM2 |
| līē | līē:-lē | nābī | nābī:-lī |
| older.brother | older.brothers-CM2 | man | men-CM2 |

As already mentioned, class 2 plural CMs may have a specific form: *-bēlē* or *-hēlē*. With these CMs, there is no vowel harmony between V_{ROOT} and V_{CM} . V_{CM} is always [e], regardless of the V_{ROOT} . Examples illustrating these plural formations appear in (8) and (9). The nouns in (9) are di- or trisyllabic and they do not differ in their singular and plural forms. The nouns that take *-hēlē* as their plural CM have no singular CM.

⁵ If there is systematically phonologically or morphosyntactically conditioned allophony here, we could not identify it.

⁶ This is a topic that requires an in-depth study since the reason of the systematic alternations still eludes us.

(8) Class 1 nouns with a CM in the singular and CM *bēlē* in the plural

| Sg. | Pl. | Sg. | Pl. |
|--------------|---------------|--------------|---------------|
| hō-lō | hō-bēlē | nāb̄-ŋ̄ | nāb̄-bēlē |
| elephant-CM1 | elephants-CM2 | stranger-CM1 | strangers-CM2 |
| kā-ŋ̄ | kā-bēlē | | |
| gecko-CM1 | geckoes-CM2 | | |

(9) Class 1 nouns without CM in the singular and *hēlē* CM in the plural

| Sg. | Pl. | Sg. | Pl. |
|-------------|------------------|--------|------------------------|
| lēn̄ | lēn̄-hélē | wótìò | wótìò-hélē |
| snake-CM1 | snakes-CM2 | python | pythons-CM2 |
| tōkp̄ | tōkp̄-hélē | jà:rà | jà:r-hélē ⁷ |
| grandfather | grandfathers-CM2 | lion | lions-CM2 |

Classes 3 and 4 (gender 2) are more regular. In gender 2, the singular and the plural nominal roots are generally identical. This is also true of gender 3.

In class 3 nouns, the onset consonant of the CM is always the lateral [l]. Moreover, total vowel harmony always applies between V_{ROOT} and V_{CM}.

Class 4 nouns are formed in two different ways. The plural CM is either -?VIV, as in (10) or -*gélē*, as in (11).⁸ Total vowel harmony applies between V_{ROOT} and both vowels in -?VIV, but in -*gélē*, the CM vowels are prespecified as [e].

(10) Classes 3 and 4: Plural CM is -?VIV

| Sg. | Pl. | Sg. | Pl. |
|-----------|-------------|---------|----------|
| lā:-lā | lā-?ālā | jí-?é | jí-?é |
| belly-CM3 | bellies-CM4 | eye-CM3 | eyes-CM4 |

(11) Classes 3 and 4: Plural CM is -*gélē*

| Sg. | Pl. | Sg. | Pl. |
|--------------|----------------|------------|-------------|
| c̄-l̄ | c̄-gélē | h̄-l̄ | h̄-gélē |
| calabash-CM3 | calabashes-CM4 | kidney-CM3 | kidneys-CM4 |
| kp̄-l̄ | kp̄-gélē | | |

⁷ The final a in *jà:rà* is not retained in the plural. Some vowels are weak and delete easily. This concerns especially V_{CM} in total harmony with V_{ROOT}, but also root vowels that are identical to the preceding ones.

⁸ With -*gélē* as CM2, the vowel of the nominal root is always a front mid vowel.

knife-CM3

knives-CM4

In class 5 (singular of gender 3) as well, V_{ROOT} is generally copied into V_{CM} . Thus, in most cases, total vowel harmony applies between the last vowel of the root and the vowel of the class morpheme. The C_{CM} can take different forms: it is either [g], [ŋ] or [?], see (12) to (14), respectively. We address the allophonic variation between [g] and [ŋ] in Section 4.2.2 below. There are also a small number of nouns of this class that have no overt CM, see (15) for examples.

Class 6 plural nouns always end with CV:- rV, where rV is the class morpheme.

Vowel harmony is again total between the long V_{ROOT} and the V_{CM} (except for length, which is not copied). There is no consonantal allophony in the form of the CM. All nouns of this class have C_{CM} [r].

(12) Class 5 C_{CM} is [g] and class 6 C_{CM} is [r]

| Sg. | Pl. | Sg. | Pl. |
|---------------|----------------|--------------|---------------|
| jē-ge | jē:-rē | wē-gē | wē:-rē |
| month-CM5 | months-CM6 | medicine-CM5 | medicines-CM6 |
| tō-gō | tō:-rō | | |
| earthworm-CM5 | earthworms-CM6 | | |

(13) Class 5 C_{CM} is [ŋ] and class 6 C_{CM} is [r]

| Sg. | Pl. | Sg. | Pl. |
|---------------|----------------|-------------|--------------|
| jñ-ŋñ | jñ:-rñ | pñ-ŋñ | pñ:-rñ |
| moment-CM5 | moments-CM6 | tam-tam-CM5 | tam-tams-CM6 |
| āfñ-ŋñ | āfñ:-rñ | | |
| new thing-CM5 | new things-CM6 | | |

(14) Class 5 C_{CM} is [?] and class 6 C_{CM} is [r]

| Sg. | Pl. | Sg. | Pl. |
|----------|-----------|-----------|------------|
| tñ-?ñ | tñ:-rñ | lñ-?ñ | lñ:-rñ |
| tree-CM5 | trees-CM6 | river-CM5 | rivers-CM6 |
| rù-?ù | frù:-rù | | |
| mat-CM5 | mats-CM6 | | |

- (15) Class 5 has no C_{CM} and class 6 C_{CM} is [r]

| Sg. | Pl. | Sg. | Pl. |
|-----------|-----------------------|-------|------------|
| jīō | jīō-:rō | jīō̄ | jīō̄-:rō̄ |
| house-CM5 | houses-CM6 | mouth | mouths-CM6 |
| nū̄ | nū̄-rī̄ | | |
| ox | oxen-CM6 ⁹ | | |

In contrast to all other classes, class 7 nouns share a clear semantic property. This class contains mass or uncountable nouns, which have no plural. Accordingly, only singular forms are found here. Similar to genders 2 and 3, the nouns of this class have total vowel harmony between V_{ROOT} and V_{CM}. C_{CM} is usually [m]. In some instances, it is [b], see (17).¹⁰ As can be seen in (16), the vowels preceding and following C_{CM} [m] are often nasal themselves. However, as (18) shows, nasal harmony is not obligatory. Recall from Section 1 that [e] has no nasal equivalent, which explains the absence of nasal harmony in *lē-mē* and *hiē-mē*. However, the vowels of *lā-mā* are not nasal either, even though [a] does have a nasal equivalent. The generalization is that if V_{ROOT} is nasal, then nasal harmony applies, but V_{ROOT} does not need to be nasal, even though it is followed by a nasal, see Section 4.2.2 for more on the subject.

- (16) Class 7 nouns (no plural in gender 4) and C_{CM} is [m]

| | | | |
|-----------|--------------|---------------|--------------|
| jū̄-mū̄ | kpē̄-mē̄ | cē̄-mē̄ | gbā̄-mā̄ |
| water-CM7 | clearing-CM7 | knowledge-CM7 | recovery-CM7 |

- (17) Class 7 nouns (no plural in gender 4) and C_{CM} is [b]

| | |
|-----------|-------------|
| wē̄-bē̄ | kātiā̄-bù̄ |
| cheek-CM7 | foliage-CM7 |

- (18) Class 7 nouns (no plural in gender 4) and no nasal vowels

| | | |
|-----------|--------------|------------|
| lā-mā̄ | lē-mē̄ | hiē-mē̄ |
| belly-CM7 | burrying-CM7 | family-CM7 |

⁹ The word *nj*: ‘oxen’ belongs to class 6 but in the singular, it belongs to class 1, thus the singular identificational construction is *nj wī wī* ‘it is the ox’.

¹⁰ This CM may indicate a different historical origin for these words, and this may imply that different classes came together at a certain stage of the history of the language. When the class marker is a stop, the corresponding identificational construction is invariably formed with the stops as well.

Class 7 nouns and their dependent morphemes have again a clear harmonizing feature, namely [labial]; C_{CM}, pronoun and identificational particle share this feature. Labiality in class 7 is always realized as [-continuant] accounting for the alternation between stop and nasal. The feature [nasal] is optional.

Once a lexical root takes a specific CM, it acquires the class of the CM, and all dependent morphemes agree with it. Lexical roots without an overt CM nevertheless belong to a specific class, as easily verified by the phonological form of their dependent morphemes. Functional morphemes depend on the class of the noun they refer to, which means that if a noun had no class, it could not be referred to by pronouns or articles, relative pronoun etc. In sum, it is not possible for a noun to lack a class.

In many cases, a lexical root can attach to more than one CM, and acquire different meanings. In some cases, a CM plays the role of a derivational morpheme. It can attach to different lexical roots and induce semantic shifts. Consider the following nominal doublets or triplets in (19). The lexical root *cie-* can attach to CM1 and mean ‘woman’, as in (19)a, and the same root can also attach to CM7, as in (19)b. In this case, the noun has the meaning of ‘womanhood, property of being a woman’. The same doublet is illustrated with the lexical root *pì* ‘child’.

- | | |
|---------------|---------------------------------------|
| (19) a. cē-lē | b. clē-mù |
| woman-CM1 | woman-CM7 ‘womanhood’ |
| c. pì-ò | d. pì-mù |
| child-CM1 | child-CM7 ‘property of being a child’ |

Diminutives and augmentatives are formed by affixing CM3, CM4 and CM5, as illustrated in (20). We saw in (7) that *gànū* ‘rat’ in its neutral meaning belongs to class 1.

- | | | | |
|------------|---------------------|----------------------|-------------------|
| (20) gànū1 | gànū:-lū | gànū-?ūlū | gànū-?ū |
| rat | rat-CM3 ‘small rat’ | rat-CM4 ‘small rats’ | rat-CM5 ‘big rat’ |

Lexical roots that are primarily used as verbs (without CM, but in combination with an auxiliary) can easily become nominal by attaching to a nominal CM, as illustrated in (21). It is not clear yet what determines the choice of CM for each individual verb.

- | | | |
|------------|---|-------|
| (21) a. cā | → | cā-lā |
|------------|---|-------|

| | | |
|---------------|---|-----------------------|
| to.look.for | | search-CM3 |
| ‘to look for’ | | ‘search’ |
| b. wèlē | → | wlè.? <i>ɛ</i> |
| to.bark | | ‘bark-CM5’ |
| ‘to bark’ | | ‘barking’ |
| c tā?á | → | tā?á-mū |
| to.walk | | walk- CM7 |
| ‘to walk’ | | ‘the fact of walking’ |

Turning now to the phonological properties of the class markers, at least in classes 3, 5, 6 and 7, the same articulatory features [labial], [coronal] and [dorsal] as the ones found for the associate morphemes are present in the C_{CM}. This is of course no accident, rather it is part of the pervasive articulatory specification for classes.¹¹

(22) Class markers

- a. [CM CLASS 1] ⇔ {[ŋ], [n], [r], [l], Ø}
- b. [CM CLASS 2] ⇔ {hele, bele, [-IV]}
- c. [CM CLASS 3] ⇔ [IV]
- d. [CM CLASS 4] ⇔ {[?VIV], gele}
- e. [CM CLASS 5] ⇔ {[g], [ŋ], [?], Ø}
- f. [CM CLASS 6] ⇔ [-r]
- g. [CM CLASS 7] ⇔ [m]

Table 4 provides an overview of the consonantal features in each class, together with the morphemes of the so-called identificational constructions that we already encountered in (2) (pronoun and identificational particle) in boldface. These two morphemes are typical functional morphemes and the next section discusses their phonological properties. It should be noted that pronouns and identificational particles can be used without the overt noun and still agree with the class marker, see (26) for an example with the pronoun.

Table 4. Agreeing consonantal features of functional morphemes in identificational constructions

¹¹ There is more to be discovered in the phonological form of the CMs. We strongly suspect that some of the specific forms are due to diachronic changes and lexicalized forms, see Dombrowsky-Hahn (2015) and Miehe et al. (2012) for some remarks on this issue in related languages.

| Consonantal features | Example of identificational construction |
|--|---|
| Class 1: [w] [labial, consonantal, vocalic] | hō-lō wī wī elephant-CM1 PRO1 ID1 'It is the elephant.' |
| Class 2: [p, b] [labial, -continuant] | hō-bēlē pē bē elephant-CM2 PRO2 ID2 'It is the elephants.' |
| Class 3: [l] [lateral] | bùò-lō lī lī granary-CM3 PRO3 ID3 'It is the granary.' |
| Class 4: [k, g] [dorsal, -continuant] | bùò-?ólō kē gē month-CM4 PRO4 ID4 'It is the granaries.' |
| Class 5: [k, g] [dorsal, -continuant] | jē-ge kī gī month-CM5 PRO5 ID5 'It is the month/moon.' |
| Class 6: [r, t, d] [coronal, -continuant] | jē:-rē tī dī month-CM6 PRO6 ID6 'It is the months/moons.' |
| Class 7: [m, p, b] ¹² [labial, -continuant, ([nasal])] | jū-mū pī bī (or mī mī) water-CM7 PRO7 ID7 'It is the water.' |

3. Associate functional morphemes

In this section, we introduce the consonantal agreement of associate functional morphemes. First, section 3.1 introduces the morphosyntactic features of functional morphemes. Section 3.2 reviews the agreeing phonological features for all associate morphemes of class 5 and 6 (gender 3) and sums up the phonological agreeing features of all classes. In section 3.3, it is shown how the abstract morphological features are paired with phonological exponents in the operation of Vocabulary Insertion.

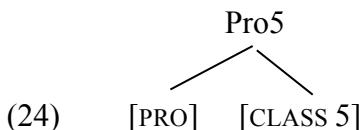
¹² In the identificational construction, pronoun and identificational have two alternative forms: *pī* *bī* or *mī* *mī* respectively. These two forms appear to be in free variation. Notice that in the variant [m], the following vowel is nasal, while it is oral when following [p] and [b]. This strongly suggests nasal harmony.

3.1 Morphosyntactic features of functional morphemes

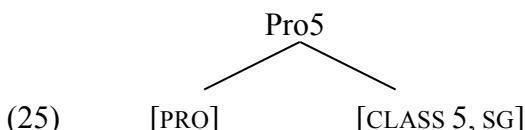
In Distributed Morphology, beside lexical roots and category-defining nodes n^0 , v^0 , and a^0 , a third category consists of functional morphemes bearing their own category. These morphemes and accounted for in morphosyntactic terms. Whether such morphemes are pronouns, demonstratives, interrogatives etc. is established in the syntax and expressed by means of abstract syntactic features, see Moskal (2015) for the difference between lexical roots and functional morphemes in other languages. Some of the morphological categories needed in Frò?ò are listed in (23).

- (23) a. [pronoun] b. [interrogative] c. [demonstrative]

Inflection begins in syntax, by combining abstract elements according to general principles. As an example, a pronoun associated with several inflectional features has an articulated morphosyntactic representation. The assignments of nouns or pronouns into one of the seven nominal classes of Frò?ò is determined by such syntactic abstract features, as illustrated in (24).



Class markers define nominal classes but are also the bearers of number. The abstract feature [SG] may fused with [CLASS 5], see (25).



3.2 Functional morphemes of class 5 and 6

In this section, we concentrate on functional morphemes of classes 5 and 6 for illustration. We chose these classes because there, the class morphemes are fairly regular and do not present much variation. However for the sake of illustrating alliterative concord on the associate morphemes, all classes are regular. The morphemes participating in the concord pattern are: pronouns/possessives (3.2.1), identificational/clause-ending particles (3.2.2), interrogatives (3.2.3), indefinite articles (3.2.4), demonstratives (3.2.5), relative pronouns (3.2.6) and deictic particles (3.2.7). All these morphemes acquire their consonantal form by

sharing their articulatory features, in the case of classes 5 and 6, the shared features are [dorsal, -continuant] in class 5 and [coronal, -continuant] in class 6, as established in Table 4. These features arise in the right branch of (24). In contrast, the vowel and the number of syllables of each morpheme are prespecified by the morphemes themselves, and not by their class, thus by the specification in the left branch of (24).

3.2.1 Pronouns *kí* and *tí*

The class 5 pronoun is *kí* and the class 6 pronoun is *tí*, see (26). The pronouns have the articulator feature [dorsal] in class 5 and [coronal] in class 6. Both are [-continuant]. They are monosyllabic and their vowel is [i] (or [e] in classes 2 and 4). There is no morphological marker for case in Frò?ò, and pronouns can be subjects, direct objects, indirect objects, possessives, obliques, etc.

(26) Pronouns of class 5 and 6

| | | | | | |
|-----------------------|----------|-----|-------------------|----------|-----|
| kí | ná | síé | tí | ná | síé |
| PRO5 | AUX.PROG | go | PRO6 | AUX.PROG | go |
| ‘She/he/it is going.’ | | | ‘They are going.’ | | |

Possessive articles *kī* and *tī*

Similarly, the 3rd person possessive articles *kī* and *tī* agree according to the class they are standing for. These forms are identical with the pronouns, see the examples in (27).

(27) Class 5 and 6 possessives

| | | | |
|--------------------|----------|-----------|--------------|
| kī | tí-?í | tī | tí:-rí |
| POSS5 | tree-CM5 | POSS6 | tree-CM6 |
| ‘her/his/its tree’ | | | ‘their tree’ |

3.2.2 Identificational/Clause-ending particles

The identificational particles *gī* and *dī* are parts of the identificational construction, see the examples in Section 2 and in (28). They share the same consonantal features as the pronouns, except for voicing which is a property of the morphological feature [pronoun]. Their vowel is invariably [i] except for classes 2 and 4 where it is [ɛ].

3.2.3 Interrogatives *gi?*i and *di?*i

Interrogative ‘which’ is *giʔi* in class 5 and *díʔi* in Class 6, see (28). Its initial consonant is again the same as of the identificational *gí* in class 5 and *dí* in class 6. The consonant of the second syllable is [?], that is analysed as the result of consonant epenthesis between two identical vowels, see Section 4.3. The interrogative is disyllabic and its vowel is [í]. It is [e] in classes 4 and 6.

(28) Class 5 and 6 *wh*-words

| | | | | | | | |
|-----------------------|-----------|-------------|-----------|--------------------------|-----------|-------------|-----------|
| <i>tí-ʔí</i> | <i>kì</i> | gíʔí | <i>gí</i> | <i>tí:rí</i> | <i>tí</i> | díʔí | <i>dí</i> |
| tree-CM5 | PRO5 | WH5 | ID5 | tree-CM6 | PRO6 | WH6 | ID6 |
| ‘Which tree is this?’ | | | | ‘Which trees are these?’ | | | |

3.2.4 Indefinite articles *kà* and *tà*

It can be seen in (29) that the indefinite article *kà/tà* starts with [k] in class 5 and with [t] in class 6. The indefinite article has the articulator feature [dorsal] in class 5 and [coronal] in class 6. The indefinite article is monosyllabic and its vowel is [à], except for classes 2 and 4 where it is [e].¹³

(29) Class 5 and 6 indefinite articles

| | | | |
|--------------|------------|--------------|-------------|
| <i>wē-gē</i> | kà | <i>wē:rē</i> | tà |
| medicine-CM5 | INDEF.ART5 | medicine-CM6 | INDEF.ART6 |
| ‘a medicine’ | | | ‘medicines’ |

3.2.5 Demonstratives *gā* and *gā:gē*; plural *dā* and *dā:dè*

Demonstrative articles of classes 5 and 6 are proximal *gā* (*gē*) ‘this’ or distal *gā:gē* (*gē*) ‘that’, see examples in (30). The difference between the two is in the length of the vowel [a] and the disyllabicity of the distal form. Demonstratives show the same consonantal features as before. The pure demonstrative is just the first morpheme, the second morpheme is a deictic marker, comparable to *ci* and *là* in *celui-ci* ‘this one (there)’ or *celui-là* ‘that one (there)’ in French, see 3.2.5 for these particles without the demonstrative.

(30) Class 5 and 6 proximal demonstratives

| | | | | | |
|--------------|-----------|-----------|---------------|-----------|---------------|
| <i>tí-ʔí</i> | gā | <i>gē</i> | <i>tí-:rí</i> | dā | <i>dè</i> |
| tree-CM5 | DEM.ART.5 | DEICT5 | tree-CM6 | DEM.ART.6 | DEICT6 |
| ‘this tree’ | | | | | ‘these trees’ |

¹³ There is no definite article in *Froʔò*. The CM may take in some cases the function of the definite article, although it does not fulfill this role in an unambiguous way.

2.3.6 Relative pronouns *gā* and *dā*

The simple proximal demonstratives *gā* and *dā* also take the function of the relative pronoun, as illustrated in (31).¹⁴ Again [g] and [d] are present and indicative for the class of the antecedent.

(31) Class 5 and 6 relative pronoun

- a. tī-?ī **gā** mī̄ nā̄ p̄ī
tree REL.PRO5 I AUX talk. about
'The tree that I am talking about.'
- b. tī:rī **dā** mī̄ nā̄ p̄ī
trees REL.PRO6 I AUX talk about
'The trees that I am talking about.'

3.2.7 Deictic particles

The deictic particles *gè* and *dè* were already shown in (30), as part of the distal demonstratives. They also vary according to the class of the noun they refer to. Their vowel is always [è].

Table 5 sums up the functional morphemes for all seven classes. In the rows, the morphemes are organized by classes, and in the columns by category of morphemes. In the former case, the similarity of the articulatory features is striking and in the latter case, the syllabic templates and the quality of the vowels. The phonological form of the morphemes is thus the result of the articulatory and continuancy features of the respective classes, as well as the voicing in case of stops, the vowels and the syllabic templates. Notice that the prespecified vowel of the morphemes is always [i], [e], [ɛ] or [a], never a round back vowel.

¹⁴ The sentence structure of Frò?ò generally has the form S Aux O V X, x being everything else (see Fanselow, Traoré & Féry 2018 for the syntactic structure of Frò?ò in a typological comparison).

Table 5. Dependent morphemes in the seven nominal classes

| | Pronoun/ Possessive | Identifica- tional particle | Interro- gative | Indefinite article | Demon- strative Relative Pronoun | Deictic particle |
|-----------------------------|------------------------|-----------------------------------|--------------------|-----------------------|---|---------------------|
| Class 1 [w] | wī | wī | wí?í | wà | ŋā | wè |
| Class 2 [p, b] | pē | bē | bé?élē | pè:lè | bē?élē | bē |
| Class 3 [l] | lī | lī | lí?í | là | lā | lè |
| Class 4 [k, g] | kē | gē | gé?élē | kè:lè | gē?élē | gē |
| Class 5 [k, g] | kī | gī | gí?í | kà | gā | gè |
| Class 6 [t, d] | tī | dī | dí?í | tà | dā | dè |
| Class 7 [m, p, b] | pī~mī | bī~mī | bí?í~mí?í | pà~mā | bā~mā | bè~mè |

3.3 Vocabulary Insertion

In Distributed Morphology, Vocabulary Insertion (VI) refers to the pairing of syntactic nodes with phonological representations or exponents, thus the mapping from syntax to phonological form. This pairing happens after the morphosyntactic operations, like fusion or merger, have been completed. The functional morphemes of each class are associated with their features, which then play the role of filling in the abstract morphosyntactic information with phonological content.

The phonological form of the functional morphemes is the result of putting together several bits of morpho-phonological information.¹⁵ First, the different classes are paired with the consonantal features that are specific for them and which have been reviewed in Table 4. The VI pairing between class features and their phonological features takes the form in (32). The remaining classes pair their own features. Class 7 has two variants, but so far we could not find what triggers the choice of one alternant over the other in individual cases.

¹⁵ Plus tonal information that we ignore here.

- (32) a. [CLASS 1] \Leftrightarrow [labial, +consonantal, +vocalic]
 b. [CLASS 5] \Leftrightarrow [dorsal, -continuant]
 c. [CLASS 7] \Leftrightarrow [labial, -continuant]/[labial, -continuant, nasal]

The second bit of phonological insertion concerns the voicing of the stops, summed up in Table 6. In classes 2, 4, 5, 6 and 7, the initial consonant of the functional morphemes are stops that can be voiced or voiceless. The glide of class 1 and the lateral of class 3 are always voiced: they cannot carry the feature [-voice], and are thus unaffected by this change. Pronouns/possessives and indefinite articles are voiceless and the other morphemes, e.g. demonstratives/relative pronouns, interrogatives, deictic particles and identificational particles, are voiced. In sum, the feature [\pm voice] changes according to morphological features.

Table 6. The role of voicing

| Morphemes | Voicing |
|---|----------|
| Pronouns/possessive, indefinite articles | [-voice] |
| Demonstratives/relative pronouns, interrogatives, deictic particles, identificational particles | [+voice] |

Third, the vowel associated with each morpheme delivers additional phonological information specified by the dependent morpheme itself, see Table 7. Pronouns/possessives, interrogatives and identificational particles have [i] in the singular (classes 1, 3, 5 and 7) and [e] in the plural (classes 2 and 4), except for class 6 which has [i] although it is a plural. The indefinite articles and demonstratives/relative pronouns have [a] in classes 1, 3, 5, 6 and 7 and [e/ɛ] in classes 2 and 4. Recall that the vowel of the CM typically is the result of vowel harmony, except in the cases in which it has a complete prespecification. In other words, the CM is not affected by vowel distribution shown in Table 7.

The trisyllabic morphemes always have prespecified vowels and are thus never subject to vowel harmony. This could be related to the fact that vowel harmony does not iterate (the CM of class 4 being the sole exception).

Table 7. Vowel distribution

| Morphemes | Vowels |
|----------------------------------|---------------------------------|
| Pronouns/possessives | [i] in classes 1, 3, 5, 6 and 7 |
| Interrogatives | [e] in classes 2 and 4 |
| Identificational particles | |
| Indefinite articles | [a] classes 1, 3, 5, 6 and 7 |
| Demonstratives/relative pronouns | [e/ɛ] in classes 2 and 4 |

Finally, the number of syllables is also part of the phonological exponence of morphemes, as shown in Table 8. All syllables are of the form CV (written σ_{CV} below), thus an open syllable with an onset and a simple nucleus (there is no diphthong in Frò?ò), see Traoré & Féry (2018) for a survey of the syllable structure.¹⁶ The morphemes are always monosyllabic in the singular (classes 1, 3, 5 and 7) except for the interrogative which is always disyllabic in the singular, and which always consists of the identificational particle Cí plus a syllable ?í. The initial consonant of the interrogative is determined by the articulatory features listed in Table 5, the second consonant is epenthetic. All pronouns, deictic particles and identificational particles are monosyllabic in the plural (classes 2, 4 and 6). Indefinites and demonstratives/relative pronouns are either mono-, di- or even trisyllabic, depending on the class. The last syllables of polysyllabic morphemes always start with [?] or with [l]. We assume that [l] is prespecified, but [?] is epenthetic.

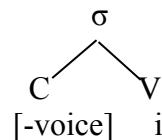
Table 8. Syllabic templates (number of syllables in each morpheme)

| | Syllabic templates |
|------------------------|--|
| Monosyllabic templates | Singular (classes 1, 3, 5 and 7): all morphemes except for the interrogative Plural (classes 2, 4 and 6): Pronouns/possessives, identificational particles |
| Disyllabic templates | Interrogatives singular (classes 1, 3, 5 and 7) and plurals of indefinite articles of classes 2 and 4 <i>pè:lè</i> and <i>kè:lè</i> |
| Trisyllabic templates | Demonstratives/relative pronouns and interrogatives of classes 2 and 4 (plural): <i>bē?élē/ bérélē</i> and <i>gē?élē/ gérélē</i> |

¹⁶ The underlying syllable structure is always open, but resyllabification, and more specifically vowel deletion can result in closed syllables in connected speech, which is ignored here. Codas are limited to sonorants.

As a result of Vocabulary Insertion of consonantal features and the information provided in Tables 6 to 8, morphosyntactic abstract morphemes in Frò?ò, are not paired with fully specified segments or syllables but rather with several bits of phonological information, as is typical for non-concatenative morphology. The phonological form of class 5 pronoun *ki* must be analysed as the result of two pairing operations, articulated as in (33): one for pronoun and one for class. Whether the information should be provided in the form a syllable is open to discussion. In this case, there is no reason to assume anything else than a well-formed syllable consisting of a [-voice dorsal, -continuant] consonant and a vowel [i].

$$(33) \quad \text{a. [PRO]} \quad \Leftrightarrow \quad [-\text{voice}], [\text{i}]$$



$$\text{b. [CLASS 5]} \quad \Leftrightarrow \quad [\text{dorsal}, -\text{continuant}]$$

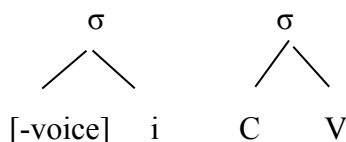
In case of a demonstrative/relative pronoun, the vowel is [a]. The other specifications are similar to those for the pronoun, see (34)a. And the class information remains the same. The result is again a fully specified syllable: *ka*.

$$(34) \quad \text{a. [DEM]} \quad \Leftrightarrow \quad [-\text{voice}], [\text{a}].$$

$$\text{b. [CLASS 5]} \quad \Leftrightarrow \quad [\text{dorsal}, -\text{continuant}]$$

The class 5 interrogative *giʔi* must contain the information that it contains two syllables. At least one consonant is voiced, and one of the vowels is [i], see (35). The result of VI is not enough to fully specify the disyllabic template: VI only provides partial information. The result of VI is thus deficient. Neither the featural content of one of the consonants nor one of the vowels is prespecified. We assume that the quality of the second vowel is due to vowel harmony and that the second consonant is epenthetic, see Section 4.

$$(35) \quad \text{a. [INTERR]} \quad \Leftrightarrow \quad [\sigma_{\text{CV}} \sigma_{\text{CV}}], [+ \text{voiced}], [\text{i}].$$



- b. [CLASS 5] \Leftrightarrow [dorsal, -continuant]

The articulatory features inserted in other classes were listed in Table 3, and the results of VI for all morphemes listed in Tables 6 to 8 can be deduced by analogy.

Peculiarities in the phonological form of some morphemes are accounted for by specific VI rules or pairings that take precedence over the regular ones. An often-cited example of suppletion is provided for English by an abstract feature like [PLURAL] which may be realized by different phonological exponents. The ordering of more specific rules before general ones has been addressed several times in the phonology, Kiparsky's (1973) Elsewhere condition being the option chosen in DM. An alternative is the ranking of specific, context-dependent faithfulness constraints above general, context-free ones in Optimality Theory. In this framework, the choice between phonological allomorphs is best understood as a competition between different forms, and the most restricted rule wins in order to be applicable. In (36), *ox* and *child* are forming their plural by suffixing *-en*, the most restrictive plural in this list. *Fish* and *foot* do not take any suffix. Because they list specific morphemes, the rules in (36)a-b take precedence over (36)c, the regular plural formation.

(36) Plural allomorphy in English

- a. [PLURAL] \Leftrightarrow - en/{√*ox*, √*child*, ...}
- b. [PLURAL] \Leftrightarrow - Ø/{√*fish*, √*foot*, ...}
- c. [PLURAL] \Leftrightarrow - /z/

A suppletive pairing in Frò?ò is class 1 demonstrative/relative pronoun [ŋā], mentioned in Table 5, that has a special non-agreeing consonant. Recall that [w] is the regular consonant of this class. Vocabulary Insertion (37)a takes precedence over (37)b by Elsewhere. The rule (37)a applies in class 1 demonstrative/relative pronouns, and (37)b applies in all other class 1 functional morphemes.¹⁷

- (37) a. [CLASS 1] \Leftrightarrow [ŋ]/ {demonstrative/relative pronoun}
 b. [CLASS 1] \Leftrightarrow [labial, consonant, vocalic]

¹⁷ A reviewer assumes that since [w] is labio-velar and [ŋ] is velar, this suppletion may turn out to be allomorphy. If this is the case, we should be able to find the allophony at other places in the language.

A second peculiarity has to do with the exceptional di- and trisyllabic templates found in classes 2 and 4 interrogatives, indefinites and demonstratives.

- (38) a. [INTERR] \Leftrightarrow $[\sigma \sigma \sigma]$ (class 2, class 4)
 b. [INTERR] \Leftrightarrow $[\sigma \sigma]$

A third prespecification concerns the exceptional vowels in many morphemes of Table 5. For instance, in classes 2 and 4 pronouns, we find [e] instead of regular [i]. These morphemes have their own prespecified vowels. This also takes the form of specific VI rules that take precedence over the elsewhere rules.

- (39) a. [PRONOUN] \Leftrightarrow $[V=e]$ (class 2, class 4)
 b. [PRONOUN] \Leftrightarrow $[V=i]$

The fourth singularity that was mentioned in Tables 4 and 5 concerns the free variation between [p/b] and [m] in most class 7 morphemes. This is due to optionality of the feature [nasal] in this class. We assume that VI has the form shown in (40). The feature [nasal] can be present or not, except in case the CM starts with a stop. In this case, nasality is forbidden.

- (40) a. [CLASS 7] \Leftrightarrow [labial, -continuant] (CM = bV)
 b. [CLASS 7] \Leftrightarrow [labial, -continuant] or [labial, -continuant, nasal]

4. The role of phonology

4.1 VI instructions as inputs in an optimality-theoretic analysis

VI delivers phonological features and some structure, but not enough for completing the phonological form of the functional morphemes described above. In this section, we propose a phonological analysis of the nominal functional morphemes in the framework of constraint-based Optimality Theory (OT). The results of VI instructions play the role of inputs, and faithfulness constraints are responsible for their emergence (or phonological exponence) in the output. Markedness constraints determine whatever phonological structure is not specified by VI instructions, but needed in the output. The results of the markedness constraints is that unspecified slots—features, segments and syllable positions—are filled in. Syllable structure, vowel harmony, nasal harmony and consonant epenthesis are located in the phonological

module, where syntax is not available anymore, see Saba Kirchner (2010) and Bye & Svenonius (2012:428) among others for this view.

We already saw how class 5 pronoun *ki* is the result of fulfilling a consonant with the prespecified consonantal features [-voice], [dorsal] and [-continuant] and the prespecified vowel [i], all information coming from VI, see (33) for how the prespecified features are organized in a syllable at VI. A faithfulness constraint IDENT-IO(F) in (41)a takes care of the preservation of the prespecified information, as shown in Tableau 1. Recall that only the phonological features are available in the phonology, not their morphological origin. IDENT-OI(F) in (41)b militates again additional features in the output.

- (41) a. IDENT-IO(F): Let α be a segment in the input and β be any correspondent segment of α in the output. If α has [F], then β has [F].
b. IDENT-OI(F): Let α be a segment in the input and β be any correspondent segment of α in the output. If β has [F], then α has [F].

Markedness constraints in (42), like ONSET, NOCODA and NUCLEUS are responsible for the fact that the consonantal features are located in the onset rather than in the coda, and that the vowel is the nucleus of the unique syllable. In the tableaux, these constraints are put together under the name SYLLABLESTRUCTURE or SYLLABLE for short. These constraints are always fulfilled in the functional morphemes: all syllables have the form CV.

- (42) Markedness Constraints (SYLLABLESTRUCTURE)
a. ONSET: Syllables have onsets.
b. NOCODA: Syllables have no codas.
c. NUCLEUS: Each syllable has a nucleus.

In Tableau 1, the optimal candidate a. fulfils all constraints. Candidate b. violates ONSET and NOCODA, candidate c. violates IDENT-OI(F) and candidate d. has a voiced consonant and violates IDENT-IO(F). Since all constraints are fulfilled in the optimal candidate, it is not possible to establish a ranking among them.

Tableau 1. Class 5 pronoun

| [-voice], [dorsal], [-continuant], [i] | IDENT-IO(F) | SYLLABLE | IDENT-OI(F) |
|--|-------------|----------|-------------|
| a. ki | | | |
| b. ik | | *!* | |
| c. ki?i | | | *! |
| d. gi | *! (voice) | | |

In the functional morphemes that have been reviewed above, the prespecified consonantal features are implemented in the first consonant, and the prespecified vowel is the morpheme's first vowel. When a single syllable is at stake, these requirements are satisfied by the constraints of (42), and there is no alternative. In the di- or trisyllabic functional morphemes, like class 5 interrogative *gi?i*, the input consonantal and vocalic features are also associated with the first consonant and the first vowel of the word. In this case, alternatives are available, and the position of these features must be regulated by constraints. We propose a constraint called ALIGN(F) (McCarthy & Prince 1993). Due to the effect of SYLLABLESTRUCTURE, the consonantal features are associated with the onset, and the vocalic features with the nucleus.

(43) ALIGN(F): Features in the input aligned with the beginning of the morpheme.

The second C and V nodes are still phonologically unspecified. The constraints at play until now have nothing to say about the form of the second syllable of *gi?i*. Vowel harmony and consonant epenthesis are responsible for the remaining phonological specifications. We thus need a formal analysis for vowel harmony and for [?] -epenthesis between identical vowels.¹⁸ Harmonies are the subject of Section 4.2 and [?] -epenthesis of Section 4.3, where tableaux for *gi?i* are proposed.

4.2 Vowel and nasal harmonies

Vowel and nasal harmonies are pervasive in the entire phonology of Frò?ò, and many examples have been encountered in this article. We understand phonological harmony as 'a phonological effect in which feature(s) agree over a string of multiple segments', see Rose &

¹⁸ In a morpheme like *bé?élé*, it must be assumed that only [b] is subject to ALIGN. The vowel [e] and [i] are prespecified. The glottal stop is epenthetic as shown for *gi?i* in Section 4.3.

Walker (2011) for a slightly different definition. In such a process, at least two segments interact. This interaction may occur locally, between adjacent segments (nasal harmony), or ‘at a distance’ across at least one unaffected segment (vowel harmony).

Segments can participate in a harmony, but they can also be transparent or block the harmony process. Transparent segments are not participating segments, but they let the harmony apply across them. The blockers are also not participating, and they stop the harmony. If the harmonizing feature reaches a blocker, i.e. an incompatible segment, it stops. Incompatibility arises when segments are already specified for the feature at stake, or if it cannot carry the feature. Harmony processes are usually directional, forward or backward, from the beginning or the end of a prosodic domain.¹⁹ In Frò?ò, vowel harmony always takes place from left to right, and nasal harmony applies in both directions.

4.2.1 Total vowel harmony

In total vowel harmony or vowel copy in Frò?ò, vowels harmonize completely across a consonant, i.e. in all their features. The process is schematically illustrated in (44). In many examples that we have discussed in the previous sections, the trigger is V_{ROOT} and the target is V_{CM} . The process applies in the domain of a prosodic word, in the case that we are studying here, it corresponds to a noun comprising a lexical root and a CM, and in the case of a functional morpheme, the first vowel is specified by the constraints formulated above plus vowel harmony. In both cases, the second vowel takes over all vocalic features of the first one.

$$(44) V_1 C_2 V_3 \rightarrow V_1 C_2 V_1$$

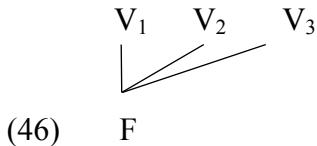
Some additional examples of vowel harmony in nouns appear in (45). V_{ROOT} (in bold), the last vowel of the lexical root, is the trigger. It harmonizes with V_{CM} , the target. In (45)b, the CM are disyllabic, and both vowels of the CM harmonize with V_{ROOT} .

| | | | |
|------|-------------|-------------|-------------|
| (45) | a. kájíé-lé | kógú-ŋú | kà-?à |
| | bird-CM3 | knee-CM5 | village-CM5 |
| b. | cié-?élé | lá-?álá | buo-?olo |
| | feet-CM3 | stomach-CM4 | granary-CM4 |

¹⁹ Another option is that an entire domain agrees in a feature without that there is a clear origin and/or direction of the process. Since harmonies in Frò?ò are directional, we do not discuss this option.

All features are harmonizing by spreading across transparent consonants. At least all consonants that start a CM are transparent, obstruents included. We assume that the target of vowel copy is unspecified prior to harmony and that vowel copy is equivalent to a feature-filling process. All vowels may participate in total vowel harmony, including the nasal ones.²⁰ It is important to note, however, that total harmony does not apply across-the-board. In some cases, V_{ROOT} does not spread to V_{CM} , as in class 5 nouns *jù-gò* ‘head-CM5’, *dà-gò* ‘sheet-CM5’. In such cases, V_{CM} is prespecified.

After the harmony process is completed, all segments V_1 , V_2 and V_3 harmonize in all their features F. The trigger is always V_1 , see (46).²¹



In the OT model proposed here, total vowel harmony is regulated by two constraints, HAVEFEATURES in (47)a that requires that a vocalic position is filled in by a vowel with features, and AGREEV in (47)b, requiring that vowels in adjacent syllables share all their features, in the present case, the constraint addresses V_{ROOT} and V_{CM} . More generally, these constraints demand that if a vowel is completely unspecified in the input, it must acquire vocalic features, and this happens as the result of copying all features from the preceding vowel in the same prosodic word. In our examples, V_{ROOT} is fully specified and V_{CM} acquire the same features by fulfilling the constraints in (47). If a vowel has its own vocalic features, those are not changed because of IDENT-IO(F), that prohibits featural deletion. In other words, AGREEV is only active when the vowel is unspecified. As a result, AGREEV must be ranked lower than IDENT-IO(F).

(47) OT constraints for vowel harmony

- a. HAVEFEATURES: vocalic and consonantal nodes must have features
- b. AGREEV: Vowels in adjacent syllables agree in all features.

²⁰ Notice that the vowels resulting from vowel harmony are often deleted in casual speech, see Traoré & Féry (2018) for a discussion of vowel deletion.

²¹ Walker (2001) and Rose & Walker (2004) make a principled distinction between two models of harmony: first, local spreading of a feature from a trigger to a target. This kind of harmony requires tier-based locality across segments. Second, non-local (at distance) segmental correspondence between segments or Agreement-By-Correspondence (ABC). We take ABC for granted: a single trigger is related to many targets, both adjacent and non-adjacent.

Tableau 2. Total vowel harmony

| kà -?V village-CM5 | IDENT-IO(F) | HAVE FEATURES | AGREEV |
|-----------------------|-------------|---------------|--------|
| ☞ kà?à | | | |
| kà?V | | *! | * |
| kì?ì | *! (V) | | |
| kà?ì | | | *! |

Returning next to the interrogative *gi?i*, we see that the same harmony process is active. We assume that the first vowel of the interrogative is specified by all input features as shown above, and that the second vowel is a copy of the first. It must be noted that the form of the interrogative strongly resembles a lexical root plus a CM5.

We will see below that the glottal stop is to be analysed as a segment interrupting two identical vowels, and that it is as little specified as possible.

To eliminate candidate d, we need to guarantee that prespecified features only emerge once and we propose to use the constraint INTEGRITY to this effect McCarthy and Prince (1995). Notice that the result of vowel harmony does not violate this constraint, since the second occurrence of the vowel is a copy of the first one, and its quality does not originate in the input.

(48) INTEGRITY: No element of the input has multiple correspondence in the output.

The template [σσ] also needs to be fulfilled, and this is achieved with

(49) MAX[σσ]: If the number of syllables in the input is two, the number of syllables in the output is two as well.

Tableau 3. Interrogative *giʔi*

| [σσ], [+voice], [dorsal, -cont], [i] | IDENT-IO(F) | ALIGN(F) | MAX[σσ] | INTEGRITY | AGREEV |
|--------------------------------------|-------------|----------|---------|-----------|--------|
| a. gíʔí | | | | | |
| b. ʔigi | | *! | | | |
| c. gi | | | *! | | |
| d. gigi | | | | *! | |
| e. giʔá | | | | | *! |

Some class markers do not copy V_{ROOT} . Instead they have a prespecified initial vowel: class 2 *héhé* or *béʔéhé* and class 4 *géhé* or *géʔéhé*. Additionally to the trisyllabic template, this prespecification is part of the VI instructions and has to appear as such in the input. As before the first vowel is prespecified and the other vowels are just a copy.

As for class 1 demonstrative *ŋá* the first consonant is different from the unmarked one for class 1 and it needs to be prespecified as such. However, default phonology is also active in the sense that the nasality of the vowel is the result of nasal harmony to which we turn in the next subsection.

4.2.2 Nasal harmony (Vowel-consonant harmony)

Nasal harmony differs from vowel harmony in three respects: first, a continuous string of vowels and consonants is involved, as shown in (50). Nasal harmony is thus strictly local. Second, the process is feature changing rather than feature filling. Third, both consonants and vowels can be trigger and target. In (50)a, the second vowel is the trigger (regressive assimilation), and in (50)b, the first consonant is the trigger (progressive assimilation).

- (50) a. $V_{[\text{nas}]} C V_{[\text{nas}]} \rightarrow V_{[\text{nas}]} C_{[\text{nas}]} V_{[\text{nas}]}$
b. $C_{[\text{nas}]} V \rightarrow C_{[\text{nas}]} V_{[\text{nas}]}$

Let us start with vowels as triggers and consonants as targets, as in (50)a. In (51), a nasal consonant appears between two nasal vowels. The crucial point is that only a nasal consonant is allowed between two identical nasal vowels.

| | | | |
|---------|---------|---------|---------|
| | [nasal] | [nasal] | [nasal] |
| | | | |
| (51) a. | f̄- ũ | j̄- ū | j̄- ū |

‘anger.CM5’ ‘milk.CM7’ ‘peace.CM7’

We assume that /g/ is phonemic and [ŋ] may be an allophone of /g/ when it is surrounded by nasal vowels. [g] can appear between two oral vowels or between an oral and a nasal vowel in both orders, as illustrated in (52) with nominal roots. In (52)a, the vowel preceding [g] is nasal and the vowel following [g] is oral, in (52)b, it is the other way round and in (52)c, both vowels around [g] are oral.

| | | | |
|---------|----------------|----------------|--------------|
| | [nasal] [oral] | [oral] [nasal] | [oral][oral] |
| | | | |
| (52) a. | k̄gàlà | kógū-ŋū | kōgō |

‘jackal’ ‘knee’ ‘cat’

However, [g] does not appear between two nasal vowels, and [ŋ] is found instead, see (51)a. In the allophonic relationship between [g] and [ŋ], total vowel harmony applies first, as in (53)a, resulting in two identical nasal vowels in (53)b. In a procedural description, the [nasal] feature that is found at both sides of [g] spreads back to the consonant, that becomes nasal as well, see (53)c.²² In other words, the feature [nasal] originates in V_{ROOT} (the trigger) and spreads to V_{CM}, and then back to the intervocalic consonant.

| | | | |
|---------|---------|-----------------|------------------|
| | [nasal] | [nasal] | [nasal] |
| | | | |
| (53) a. | f̄-gV | → b. f̄-gū | → c. f̄ -ŋū |

In the second type of nasal assimilation, (50)b, a nasal consonant is the trigger, and the following vowel is the target, see (54) for illustration. The example is the nasal allophone of the class 7 pronoun, the non-nasal alternant being p̄i with an oral vowel.

| | | |
|---------|---------|----------------|
| | [nasal] | [nasal] |
| | | |
| (54) a. | m̄i | → b. m̄ ī |

²² This looks like what Lionnet (2016) calls ‘subphonemic teamwork’: in this case, two distinct nasal features must be present to result in nasalization of another segment .

The nasal harmony illustrated in (54) only targets a vowel that has at least some underlying specification; it cannot affect an oral vowel resulting from total vowel harmony: such a vowel cannot be changed again by nasal harmony. Because of this restriction, oral vowels can be adjacent to nasal consonants, as was illustrated in (18)a with the word *lāmā* ‘interior/belly-CM7’, but only when they are the result of vowel harmony. In this word, the oral V_{ROOT} is copied to the unspecified V_{CM} which harmonizes with its oral specification. As such, nasal harmony cannot apply, and a sequence of a nasal consonant and an oral vowel arises, as the result of a bleeding relationship. In other words, in a derivational view, vowel harmony and nasal assimilation apply in this order, and vowel harmony bleeds nasal assimilation.

Moreover, since vowel harmony is always left-to-right, there is no way that the nasality of the CM consonant can have a regressive effect on the preceding vowel, which remains oral in *lāmā*.²³

Tableau 4 illustrates the vowel-triggered nasal harmony. Two additional constraints are needed. The first one $**[\tilde{V}g\tilde{V}]$ prohibits an oral consonant between nasal vowels, see (55)a. The second one requires a change in the quality of the input segments, and conflicts with IDENT-IO(nasal).

- (55) a. $*[\tilde{V}g\tilde{V}]$: No [g] between nasal vowels.
- b. AGREE(nasal): Adjacent segments agree in their nasal feature

The constraint AGREE(nasal) may be violated when vowels are prespecified as oral, as explained above. This constraint is lower ranked than AGREEV and does not play any role in Tableau 4, since the nasal vowel is copied by vowel harmony anyway.

²³ There is at least one evidence for an additional regressive nasal harmony from a vowel to a consonant. The palatal glide [j] has an allophone [n] before a nasal vowel: *jō* ‘tell’ vs. *nḡ* ‘see’. These segments seem to be in complementary distribution. However, more data are needed in order to be entirely confident that this analysis is correct.

Tableau 4. Nasal harmony (Vowel to Consonant)

| fū- V _{ROOT} | g/ŋ C | V V _{CM} | IDENT-IO (F) | HAVE FEATURES | *[VgV] | AGREEV | AGREE (nasal) |
|--------------------------|----------|----------------------|-----------------|------------------|--------|--------|------------------|
| ☞ a. fū-ŋū | | | | | | | |
| b. fū-gū | | | | | *! | | |
| c. fū-gū | | | | | | *! | * |
| d. fū-gV | | | | *! | | | |
| e. fū-gū | | *! | | | | | |

The word *lā-mā*, is illustrated in Tableau 5. As shown above, the first vowel is specified as an oral vowel, and does not change its specification. The vowel is copied to the V_{CM} without that this vowel acquires the nasality of its onset consonant. This is the result of the ordering of AGREEV above AGREE(nasal). The effect of HAVE FEATURES is taken for granted in the following tableaux.

Tableau 5. Vowel harmony bleeds nasal harmony

| lā- V _{ROOT} | m V C V _{CM} | IDENT-IO(F) | AGREEV | AGREE [nasal] |
|--------------------------|--------------------------|-------------|--------|---------------|
| ☞ a. lā-mā | | | | ** |
| b. lā-mā | | | *! | * |
| c. lā-mā | | *! | | |
| d. lā-pā | | *! | | |

As for the consonant-triggered allophony, no additional constraint is needed. AGREE [nasal] is sufficient to guarantee that nasal features are shared to neighbouring segments, as long as these segments are not the result of total vowel harmony. AGREE [nasal] is ranked lower than AGREEV, guaranteeing in this way that a copied vowel does not acquire nasality by harmony. In *mā* and in class 1 demonstrative *ŋā*, it is assumed that the input vowel is unspecified for nasality and that adding a nasal feature by harmony does not violate IDENT-IO(F).²⁴

²⁴ A different solution would be to separate the constraint AGREE[nasal] into two different ones: for consonant and for vowels and rank them differently.

Tableau 6. Nasal harmony (Consonant to Vowel)

| /m̄i/ | IDENT-IO | AGREEV | AGREE[nasal] |
|--------|----------|--------|--------------|
| a. m̄i | | | |
| b. m̄i | | | *! |

4.3 Glottal stop epenthesis

A phonological process that remains to be addressed concerns the C position of di- and trisyllabic morphemes, when these are not entirely prespecified for both consonants and vowels. In some morphemes, the second consonant is still unspecified after VI has been completed. Returning to class 5 interrogative, it was shown in Tableau 3 that the first syllable is completely specified after VI and a simple OT phonology. In this subsection, it is shown that the glottal stop in the second C is the result of [?] -epenthesis. [?] -epenthesis applies between identical vowel.²⁵ Recall that the second vowel is the result of vowel harmony. Epenthesis is needed to fill in an unspecified consonant position at the CV skeleton. It violates the DEP constraint in (56). Tableau 7 is identical to Tableau 3 to the exception that DEP has been added.

(56) DEP: No epenthesis.

Tableau 7. [?] -epenthesis in class 5 interrogative

| [σσ], [+voice], [dorsal, -cont], [i] | IDENT-IO(F) | ALIGN(F) | MAX[σσ] | INTEGRITY | AGREEV | DEP |
|---|-------------|----------|---------|-----------|--------|-----|
| a. ḡi?i | | | | | | * |
| b. ?igi | | *! | | | | * |
| c. gí | | | *! | | | |
| d. gigi | | | | *! | | |
| e. gi?á | | | | | *! | * |

²⁵ This analysis is confirmed by neighbouring dialects that have [gi:] with a long vowel as an alternative.

In Tableau 7, candidate a. fulfills all constraints except for low-ranking DEP. Candidate b. violates ALIGN(F). Candidate c. violates MAX[σσ], candidate d. violates INTEGRITY and candidate e violates AGREEV.

This closes the survey of the phonological processes governing vowel and nasal harmonies as well as filling in deficient phonological structure in the associate morphemes of a head noun in Frò?ò. For more information on the syllable structure, see Traoré and Féry (2018).

5. Discussion and conclusion

The main topic of this article is the phonological properties of morphemes of the same nominal class in Frò?ò, its most striking aspect being the presence of recurrent articulatory features for each inflectional class, a case of alliterative concord. This pattern arises when several functional morphemes of the same class are linearized. A longer sequence of functional morphemes appears in (57).

| | | | | | | |
|------|--------------|--------------|--------------|--------------|--------------|--------------|
| (57) | jē-gē | kì | gí?í | gī | gā | gè |
| | month-CM5 | PRO5 | which5 | ID5 | DEM5 | CL-END.PTC5 |
| | ⇓ | ⇓ | ⇓ | ⇓ | ⇓ | ⇓ |
| | [dor, -cont] |

‘Which is this month?’

The best answer of morphology is to reproduce the pairing between class and phonological features each time a function word is present. In (57) the same pairing is reproduced six times. In this approach, alliterative concord is considered a purely morphological phenomenon that does not need to be given a phonological account. However, the free associate morphemes consist not only of alliterating consonantal features coming from their nominal class, but also from other morpho-syntactic features paired with additional phonological features. The order of these different phonological features is not reflected in the linearization of the exponents. Instead, features are organized in a non-concatenative fashion, and if there is a hierarchy of morphological features at all, it is not crucial. Purely phonological effects across segments were uncovered as well, and an optimality-theoretic analysis was proposed for them. Different types of vowel and consonant harmonies in the nominal domain have been explored: total vowel harmony, nasal consonant-vowel harmony and consonant epenthesis. Even though they all apply in the nominal domains, they have different operational ranges. Vowel harmony

concerns only two vowels separating by a transparent consonant. Nasal consonant-vowel harmony only affects a sequence of two vowels and in some cases, the consonant in-between.

Consonant agreement is not an accident in Frò?ò, but rather it is part of the phonological system of the language. Frò?ò speakers recognize the class of nouns primarily by the initial consonant of the functional morphemes. The class markers may also help the categorisation, but since they may be absent or have ambiguous forms, class markers are less reliable than agreeing functional morphemes. We propose that class markers are participating to the alliterative concord rather than eliciting it. The alliterative pattern of Frò?ò is rather atypical, when we compare it to similar cases described in the literature.

Alliterative patterns have been described for several languages, see for instance Fortune (1942), Nekitel (1986), Aronoff (1992), Dobrin (1995) and Dimitriadis (1997) for phonological concord in nominal classes in Arapesh and Abu' (Mountain Arapesh), Papuan languages spoken in New Guinea. In Arapesh, the last consonant of a noun is often copied into the pronoun and the verb with which it agrees, resulting in an alliterating concord pattern. This even happens with consonants newly introduced into the consonant inventory of the language through loanwords. However, this process is restricted to part of the vocabulary, which is in its major part non-alliterative.

Sauvageot (1967, 1987) cites Baïnuk, a West Atlantic language spoken in Senegal, where the first CV syllable of some words may be copied in part of its vocabulary (mainly borrowed words but nonetheless 25% of the words) and plays the role of a gender agreement morpheme on an associate adjective or demonstrative.

Moreover, Kaye (1981), Marchese (1986, 1988) and more recently Sande (2017) show that, beside other agreeing words, Vata, Godié and Guébié respectively, all Kru languages of Côte d'Ivoire, have phonologically motivated pronominal systems. Non-human nouns are organized into five (for Godié or Vata) and three classes (for Guébié) according to their final vowel, and subject pronouns referring to them take five or three different shapes, depending on this vowel. Again this kind of alliterative systems is limited to a small part of the functional morphemes, although other kinds of alliterative agreement also takes place in adjectives. In Guébié, the third person subject pronoun can be human or non-human. When human, it has an invariable singular form [ɔ] and an invariable plural form [wa]. The exponent of a non-human third person pronoun, however, is variable: it is [ʊ], [ɛ] or [a] where the feature [-ATR] of the dependent morpheme is lexically specified. Sande (2017:50) writes "Non-human third person pronouns agree with their nominal antecedent not in semantic features like person or number, but in phonological features, where the final vowel of the

noun stem determines the vowel of the pronoun.” The choice between the three forms of the pronoun is determined by the feature [\pm back] and [\pm low] of the final vowel of the stem. These features are phonologically copied from the root. When a noun ends in one of the [+back, -low] vowels [u, ʊ, o, ɔ], its corresponding pronoun is [ʊ]. When the noun ends in one of the [-back, -low] vowels [i, ɪ, e, ε], the pronoun is [ε] and when it ends in a [+back, +low] vowel [ə] or [a], the pronoun is [a].

All the languages just mentioned, thus Arapesh, Baïnuk and Guébié, copy (or are faithful to) a syllable, a segment, or part of a segment as phonological agreement. However, this strategy is unavailable for Frò?ò because the alliterative features are often not literal parts of the head noun (lexical root + CM): the lexical root does not carry any of the feature appearing in the alliterative concord, and the CM may or may not carry the agreeing features. In many cases, the features that are copied are not present in the CM, be it because the CM has a different phonological form, or because the CM is covert, and then absent altogether. If the alliterating features originate in the lexical root or in the CM, it can only be an abstract feature. These original features may be unrealized in a sentence with a pronoun or any other functional morpheme referring to a head noun, see (26) for an example of sentence where a pronoun refers to an absent head noun. In other words, the CM sometimes participate in the alliteration but do not necessarily do so.

In sum, alliteration in Frò?ò is not a classical spreading relationship and not a reduplication or copy and deletion operation. All associate morphemes start with similar consonants, but there is no locality involved. Vowels interfere, as do words and in some cases entire constituents. In (58), the pronoun wí refers to a person and has to agree with class 1. The referent of the pronoun wí does not need to be pre-mentioned in the discourse; it can be contextually present.

- (58) wí mà sébé kā John mà
 PRO ASP book give John to
 ‘S/he gave the book to John.’

In a future research, it will be important to establish a typology of alliterative concord, and to understand the role it plays in the different languages cited above, as well as others. It will also be important to give a phonological account that can cover all cases, something which has not been done so far.

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