DEGEMINATION, COMPENSATORY LENGTHENING, AND GEMINATION IN GUDI NGAMO

RUSSELL G. SCHUH
schuh@humnet.ucla.edu

Ngamo, a Chadic language of northeastern Nigeria, has a number of morphological configurations that bring consonants together across morpheme boundaries. In some cases these consonantal abutments would result in geminates, but Ngamo strongly disprefers geminate sequences, leading to degemination. Degemination has different effects depending on whether the first consonant of the geminate sequence belongs to a suffix or to a root. In the former case, degemination is accompanied by compensatory lengthening, but in the latter, the geminate becomes a singleton with no other change. This basic picture is complicated by the fact that Ngamo DOES allow phonetic geminates when a consonant fully assimilates to a dissimilar consonant. The main purpose of this paper is to lay out a description of the phenomena in question, but a partial analysis proposes that the main facts derive from the interaction of three contraints: a faithfulness constraint on lexical roots, a constraint banning geminates, and a constraint that seeks to preserve the metrical properties of words that are part of an inflectional paradigm. A number of analytical problems remain to be resolved.

1. ALTERNATIONS WHEN CONSONANTS COLLIDE

Ngamo[1] is a Chadic language spoken in northeastern Nigeria. More specifically it is a member of the "A" sub-group of the West Branch of Chadic (Newman 1977). Ngamo has two major dialects, Gudi and Yaya, whose phonologies differ in certain respects. This paper describes only the Gudi dialect. Henceforth, "Ngamo" refers to that dialect.

When consonants come together across morpheme boundaries in Ngamo, they undergo a number of alternations, some of which are illustrated in (1).[2]

(1) Masculine and feminine nouns with possessive pronouns

	tìlì 'heart' (masc. N)	**sàra** 'hand' (fem. N)
	'X's heart'	'X's hand'
1 sg.	**tìlii-nò**	**sàra-n-nò**
2 masc. sg.	**tìli-ŋ-kò**	**sàra-t-kò = sàrak-kò**
2 fem. sg.	**tìli-n-ʃî**	**sàraa-ʃì**
3 masc. sg.	**tìlii-nì**	**sàra-n-nì**
3 fem. sg.	**tìli-n-tò**	**sàraa-tò**
1 pl.	**tìlii-mù**	**sàra-m-mù**
2 pl.	**tìli-ŋ-kù**	**sàra-t-kù = sàra-k-kù**
3 pl.	**tìli-n-sù**	**sàraa-sù**

[2] Doubled vowels represent long vowels. Tone marking is as follows: Low tone = grave accent (`), placed over the first vowel symbol in a syllable with a long vowel; High tone is unmarked; Falling tone (= H+L on one syllable) = circumflex accent (ˆ). All segmental transcriptions are in International Phonetic Alphabet symbols. In particular, "**j**" = palatal glide, not alveopalatal affricate, as it would in traditional Chadic transcription.

As the hyphenation in (1) suggests, genitive constructions with pronoun possessors have the form /Noun+**n**+Pronoun/ for masculine head nouns and /Noun+**t**+Pronoun/ for feminine head nouns. However, if the pronoun possessor of a masculine noun has an initial nasal, the masculine genitive marker /**n**/ is replaced by compensatory lengthening of the preceding vowel, and if the pronoun possessor of a feminine noun begins in a [+coronal] obstruent, the feminine genitive marker /**t**/ is replaced by compensatory lengthening of the preceding vowel. In addition, the feminine genitive marker /**t**/ obligatorily assimilates to a following nasal (/**sàra-t-nò**/ → [**sàra-n-nò**]) and optionally to a following velar (/**sàra-t-kò**/ opt. → [**sàra-k-kò**]). The feminine /**t**/ therefore does not show up phonetically in any form when the full set of alternations is in effect. Ngamo has virtually no geminate consonants in native word roots,[3] and as we will see in the course of this paper, geminates formed by like consonants coming together normally become singletons (sometimes with compensatory lengthening, as the examples in (1) illustrate), yet ironically Ngamo does allow phonetic geminates when they result from assimilation of dissimilar consonants. We can roughly and preliminarily summarize the situation in (1) as in (2).

(2) Alternations in Ngamo suffix+suffix combinations
  a. C_i → V_i / V_i___C_j, where C_i and C_j are "sufficiently similar". "Sufficiently similar" means that both consonants are [+nasal] or both consonants are [-sonorant, αvoice, βplace].
  b. **t** ASSIMILATION:
      t → **n** / ___[+nasal] (obligatory)
      t → [αfeatures] / ___[-sonorant, αfeatures] (optional)
  c. NASAL ASSIMILATION:
      [+nasal] → [αplace] / ___[-syllabic, αplace]

The description in (2), in fact, applies to all configurations of the type SUFFIX+SUFFIX, where the abutting suffixes bring together two consonants. As far as I know, the list of configurations in (3-4) is exhaustive for Ngamo. Examples where deletion with compensatory lengthening or complete assimilation has taken place are contrasted with examples showing the underlying final consonant of the first suffix.

(3) Suffixes with final **-n**
  a. Masculine genitive linker **–n** in Noun-**n**-Pronoun phrases
      (See (1), left-hand column.)
  b. Completive plural subject suffix **–an** + pronoun indirect objects
      ŋgàr-àa-nì   'they tied for him'
      cf. **ŋgàr-àn-tò**   'they tied for her'
  c. Completive plural subject suffix **–an** + totality extension + pronoun direct objects
      ŋgàr-aa-mû   'they tied tied us'
      cf. **ŋgàr-aŋ-kû** 'they tied you (pl.)'
  d. Completive plural subject suffix **–an** + ventive suffix**–no**

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[3] The primary source of Ngamo words containing geminates is loanwords, mostly from Bole, which is widely spoken by Gudi Ngamos, e.g. **kùnnâ** 'thank' < Bole **kùnnu-**. A number of proper names that appear to be native have geminates, e.g. **Luccù** a man's name, **Làkkà** a woman's name. Aside from these categories of words, most Ngamo words with internal geminates in current data have geminate **–ll-**, which can, in at least some cases, be traced to relatively recent assimilation of **d** to neighboring **l**, e.g. **gìllâ** 'shout' (cf. Yaya Ngamo **gìldô**), **gòllà** 'sickness' (cf. Yaya Ngamo **gõdìlà**), **wàllâ** = **wàldâ** 'surpass'.

      ŋgàr-àa-nô   'they tied and brought'
      cf. **ŋgàr-nô**   'he tied and brought'
  e. Completive ventive extension **–(i)n** + pronoun indirect objects
      ŋgàr-ìi-nò   ''he tied and brought for me'
      cf. **ŋgàr-ìn-ʃì**   'he tied and brought for you (f.)'
  f. Totality extension **–(i)n** + pronoun direct objects
      ŋgàr-ii-nî   'he tied him'
      cf. **ŋgàr-in-tô**   'he tied her'

(4) Suffixes with final **-t**
  a. Feminine genitive linker **–t** in Noun-**t**-Pronoun phrases
      (See (1), right-hand column.)
  b. Subjunctive ventive extension **–(i)t** + pronoun indirect objects
      à ŋgàr-ii-tò   'that he tie for her'
      à ŋgàr-in-nò   'that he tie for me'
      cf. **à ŋgàr-it-kò = à ŋgàr-ik-kò**   'that he tie for you (m)'
  c. Totality extension + Intransitive Copy Pronouns (ICP), illustrated with the verb root
      èr- 'stop, come to a stop' in the subjunctive—translation is roughly 'that X stop'

	Singular	Plural
1	**nè èr-ìn-nò**	**mù èr-ìm-mù**
2m/pl	**kò er-ìt-kò = kò er-ìk-kò**	**ŋgù er ìt kù = ŋgù er -ìk-kù**
2f	**ʃì er-ìi-ʃì**	
3m/pl	**à èr-ìn-nì**	**à èr-ìi-sù**
3f	**à èr-ìi-tò**	

Some explanations:

  Completive plural subject suffix (3b-c):   In the completive, though not in other tense/aspect/mood (TAM) forms, verbs with a plural subject in any person have a plural agreement suffix **–an**: **nè ŋgàr-kô** 'I tied' vs. **mù ŋgar-àn-kô** 'we tied' (**-ko** is a completive TAM suffix).

  Ventive extension (3d-e, 4b): The ventive extension is a suffix indicating action initiated at a distance with effect at the place of reference. This extension has several allomorphs. The three illustrated here are **–no** (3d) for completive verbs not followed by other overt affixes, **-(i)n** (3e) for completive verbs followed by a pronoun affix, and **–(i)t** (4b) for non-completive verbs followed by a pronoun affix. The parenthesized "**i**" is epenthetic, used with verb stems ending in consonants. Verb stems ending in vowels have **–n** with completive (**èeʃè-n-tò** 'he called hither for her') and **–t** for non-completive TAM's (subjunctive **à èeʃe-t-kò** 'that he call for you'). A fourth allomorph, **-tu**, is used with non-completive TAM's where there is no following suffix (subjunctive **à ŋgàr-tû** 'that he tie and bring').

  Totality extension (3c, 3f) and ICP (4c): The totality extension in Chadic languages is generally described as meaning "action thoroughly done", though in Ngamo and other Chadic languages in Yobe State, it seems to have an auxiliary focus function. The base form is /**t**/ (Schuh 2005). The base /**t**/ shows up in the completive in forms such as **èeʃ-it-kò** 'he called' (with epenthetic **i** after the heavy syllable of the verb stem), **bàsa-t-kò** 'he shot' (as **t** after a verb stem ending in a vowel), and **à ŋgàr-tì** 'that he call' (as **–ti** when no overt suffix follows). The

/**t**/ shows up with intransitive verbs (4c), which must also bear the Intransitive Copy Pronoun (ICP), a pronominal suffix that agrees with the subject. In the configuration illustrated in (3c), the /**t**/ has dropped, presumably to avoid a CCC cluster, but its tonal effect is present. Compare **ŋgàr-àn-tò** 'they tied for her' (the configuration in (3b), without the totality extension) with **ŋgàr-an-tô** 'they tied her' (the configuration in (3c), with the totality extension). A suppletive allomorph **–(i)n** is used in all TAM's with direct object pronouns (3f). Note that this configuration is distinct only in tones from the configuration in (3e), i.e. **ŋgàr-in-tô** 'he tied her' (3f) vs. **ŋgàr-ìn-tò** 'he tied and brought her'.[4]

   The data in (3-4) show that the phonological phenomena summarized in (2) are not idiosyncratic properties of a particular morpheme. However, (3-4) illustrate those phenomena only with the two consonants /**n**/ and /**t**/. It turns out that in Ngamo, all the consonant-final suffixes that could precede another consonant end in one of these two consonants, but it is possible to create a larger repertoire of word internal consonant sequences by using the configuration ROOT+SUFFIX.

2. DEGEMINATION IN VERB ROOT + SUFFIX CONFIGURATIONS

Verb inflections and derivations provide environments for a variety of word-internal CC combinations. These environments all come from class A1 verbs, viz. verbs whose roots have the structure CVC-.[5] Suffixes on A1 verbs are added directly to the CVC root in the completive TAM and in most configurations in the subjunctive TAM. Also, many A1 verbs form their verbal nouns with a suffix **-ʃe** or **-ʃi** added to the root.

   The following consonants are found as C_2 of A1 verbs: **f**, **ɓ**, **t**, **d**, **ɗ**, **jˀ**, **k**, **s**, **m**, **n**, **r**, **l**, **j**, **w**. Note that the only modally voiced obstruent in this set is **d**, and in current data, there is only one verb with **d** as C_2, viz. **bad-** 'be familiar with', which is probably a recent loan from Bole. The original voiced/voiceless distinction has been neutralized to the voiceless counterpart in C_2 of A1 verbs. This must be the result of the high frequency of A1 verb forms with C_2 in syllable final position, where the voicing distinction of obstruents is neutralized. Compare the following Ngamo forms with cognates in Karekare, which retains the original distinctions: Ngamo **oha**,[6] Karekare **àfèe** 'digging' vs. Ngamo **dàɸà**, Karekare **dàbaa** 'breaking (a stick)'; Ngamo **màtò**, Karekare **mèeto** 'death' vs. Ngamo **àtjò**, Karekare **jadì** 'biting'; Ngamo **èsò**, Karekare **jˀàsùu**

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[4] I entertained the idea that the /**n**/ allomorph of the totality extension may be an analogical formation arising from the fact that the /**t**/ allomorph obligatorily assimilates to a following nasal combined with the fact that there is another extension /**n**/, viz. the ventive. However, Karekare, which is only distantly related to Ngamo in the subgroup to which the two language belong, has an /**n**/ allomorph for the totality extension with essentially the same distribution as that in Ngamo, suggesting that this allomorphic suppletion has been inherited from the common ancestor of both languages.

[5] Lukas (1970-72) formulated a five-way classification of verbs for Bole (Bolanci), a language closely related to Ngamo. This classification is convenient for Ngamo as well. The classes are as follows: class A1 = CVC- roots, where V is a short vowel; class A2 = longer roots ending in a consonant; class B = CVC**a** roots, i.e. B roots differ from A1 roots in have a final –**a**; class C = C**u**; class D = C**a**. Verb class determines features of tone and final vowels that mark TAM, among other things.

[6] The phoneme /**f**/ in Ngamo has allophones [ɸ] or [**h**] in syllable initial position, [**p**] in syllable final position. This is the only voiceless labial phoneme.

'grinding', vs. Ngamo **gìs-àŋ-kô**, Karekare, **ŋgìz-aŋ-kò** 'they forged'.[7] There are no native A1 verbs with **g** as C_2, either in Ngamo or in closely related languages. This may be an accidental lexical gap, but more likely, *g in this position was vocalized and/or lost in the ancestral language.

In (5) is a list of all the consonant initial suffixes that can be attached directly to the CVC- root of an A1 verb. "Object" pronouns serve as indirect objects for all verb forms and as direct objects when the totality extension is present.

> (5) Suffixes used with A1 verbs
> **t**: **to** 3rd fem. sg. object; **ti** subjunctive and sg. imperative totality extension; **tu** subjunctive ventive extension
> **d**: **di** subjunctive and sg. imperative additive extension
> **k**: **ko** completive suffix; **ko** 2nd masc. sg. object; **ku** 2nd plural object
> **s**: **su** 3rd plural object
> **ʃ**: **ʃi** 2nd fem. sg. object; **ʃe**, **ʃi** verbal noun suffixes
> **n**: **no** 1st sg. object; **ni** 3rd masc. sg. object; **na** verbal noun suffix; **no** completive ventive extension
> **m**: **mu** 1st plural object

Most notably absent are any suffixes beginning in labial obstruents, liquids, or glides. Since there are no other morphological processes in Ngamo that would create geminate sequences involving these segments across morpheme boundaries, there is no direct evidence as to what the fate of such sequences would be. There are, however, enough consonant combinations available in A1 verb + suffix combinations to allow us to state general principles with some confidence.

> (6) Alternations in Ngamo A1 root+suffix combinations
> $C_i \rightarrow \emptyset$ / ___]$_{\text{A1 verb}}$ [$_{\text{suffix}}C_i$
> "When the final consonant of an A1 verb root comes in contact with an identical consonant in a suffix, the resultant geminate is simplified WITH NO COMPENSATORY LENGTHENING."

The alternations described in (6) share gemination reduction with the alternations described in (2), but otherwise, the processes are quite different. The alternations described in (6) require that the consonants involved be identical (not just "similar"), there is no compensatory lengthening, and there are no assimilations between C_2 of the verb root and the consonant of the suffix.

Examples in (7) illustrate A1 verb roots ending in the consonants **t, d, k, s**. Verbs ending in **m** and **n** and verb roots with final coronals plus the verbal noun suffixes **ʃe/ʃi** are discussed further below. The left-hand column in each example set in (7) shows verbs with suffixes where the consonants do not match C_2 of the verb (and hence show the unaltered verb root and suffix) and the right hand column shows verbs with suffixes that do match C_2 of the verb root (and hence undergo degemination). Note that degemination in a consonant sequence resulting from contact between a verb root and a suffix requires identity between the two consonants, including voicing identity—the **/dt/** sequence does not degeminate. The only exception to this statement is that **/sʃ/**

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[7] All the examples here except the last are illustrated with nominal forms, which have vocalic suffixes. The noun meaning 'forging, smithing' in Ngamo is **gìzò**, with **z** as C_2. This verbal noun seems to have become dissociated from the source verb, which has **s** as C_2 in its productive conjugational forms, such as the plural subject completive.

degeminates to [ʃ]. There is no compensatory lengthening when degemination takes place, and the optional /**tn**/ → [**nn**] and /**tk**/ → [**kk**] assimilations seen between suffix consonants, as in (1), do not take place, even optionally. Verbs with indirect objects have the totality suffix **-ti**. This is the default citation form and does not affect the Verb+Object collocation.[8]

(7)		No assimilation or degemination	Degemination
	t:	**àt-kô** 'he bit' (**–ko** completive suffix) **àt-ʃìi-tî** 'he bit for you' (**-ʃi** 2nd f.sg. object)' **àt-nòo-tî** 'he bit for me' (**-no** 1st sg. object)	/**àt-tòo-ti**/ → [**àtòotî**] 'he bit for her' (**-to** 3rd f.sg. object)
	d:	**bàd-kô** 'he became familiar' (**–ko** completive suffix) **bàd-sùu-tî** 'he became familiar for them'(**–su** 3rd pl. object) **bàd-nòo-tî** 'he became familiar for me' (**-no** 1st sg. object) /**bàd-tòo-tî**/ → [**bàttòotî**][9] 'he became familiar for her' (**-to** 3rd f.sg. object)	/**bàd-dî**/ → [**bàdî**] 'become more familiar!' (sg. imperative with **-di** additive extension)
	k:	**bòk-nòo-ti** 'he roasted for me' (**–no** 1st sg. object) **bòk-tòo-tî** 'he roasted for her' (**–to** 3rd f.sg. object) **bòk-ʃì** 'roasting' (**-ʃi** verbal noun suffix)	/**bòk-kô**/ → [**bòkô**] 'he roasted' (**–ko** completive suffix) /**bòk-kùu-tî**/ → [**bòkùutî**] 'he roasted for you' (**–ku** 2nd pl. object)
	s:	**màs-kô** 'he counted' (**–ko** completive suffix) **màs-tòo-tî** 'he counted for her' (**-to** 3rd f.sg. object) **màs-nòo-tî** 'he counted for me' (**-no** 1st sg. object)	/**màs-ʃìi-tî**/ → [**màʃiitî**] 'he counted for you' (**-ʃi** 2nd f.sg. object) /**màs-sùu-ti**/ → [**màsùutî**] 'he counted for them' (**-su** 3rd pl. object)

Because there are no suffixes beginning in labials, liquids, or glides, root final **f** [**p**], **ɓ**, **jʔ**, **r**, **l**, **j**, **w** remain generally unchanged before suffixes. Root final **ɗ** → ʔV_i / V_i___C, where "C" = any consonant. The examples in (8) illustrate roots ending in these consonants with the completive suffix **ko**, the verbal noun suffixes **ʃe/ʃi**, and a suffix having initial **n**, where examples with such suffixes exist in current data. Note that there are no assimilations with liquids, though assimilations in clusters comprising a liquid and a nasal are common cross-linguistically, occurring even in some West Chadic languages.

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[8] See the appendix for full paradigms of four verbs with objects.
[9] It is not entirely clear that the **d** of the root DOES assimilate in voicing to the following **t** of the pronoun. The speakers and I discussed this at length, though we did not collect any instrumental data. The **d** does not seem to fully assimilate to the voicelessness of dissimilar consonants such as **k**. What IS clear is that /**dt**/ does not degeminate to singleton [**d**] or [**t**].

(8) **/f/**:   **ŋgàp-kô** 'he held', **ŋgàp-ʃê** 'holding', **ŋgap-ni** 'hold it for him!'
     /ɓ/:   **làɓ-kô** 'he patched', **làɓ-ʃê** 'patching'; **dìɓ-nâ** 'thinking'
     /ɗ/:   **hòʔò-kô** 'he removed', **hòʔò-ʃì** 'removing', **ŋgu hoʔo-no** 'you (pl) should remove it for me'
     /jʔ/:   **hòjʔ-kô** 'it dried up', **hòjʔ-ʃì** 'drying up'
     /r/:   **bàr-kô** 'he hid', **bàr-ʃê** 'hiding'; **ŋgàr-nì** 'he tied for him'
     /l/:   **bòl-kô** 'he found', **bòl-ʃê** 'finding'; **sàl-nìi-tî** 'he built for him'
     /j/:   **mòj-kô** 'he saw', **mòj-ʃê** 'seeing', **mòj-nò** 'seeing'[10]
     /w/:   There are no examples in current Gudi data of A1 verbs where $C_2 = $ **w**. This glide is common in preconsonantal position, however, e.g. **hàwʃì** 'river'.

    Omitted from the data sets in (7, 8) are verbs ending in the consonants **m** and **n**. Consider the data with such verbs in (9):

(9)	**tàm-kô**	**tàn-kô**	**àn-kô**
	'he showed'	'he sharpened'	'he said'
'to/for her'	**tàm-tòo-tî**	**tàn-tòo-tî**	**àn-tòo-tî**
'to/for me'	**tàm-nòo-tî**	**tàa-nòo-tî**	**àa-nòo-tî**
'to/for us'	**tàm-mùu-tî**	**tàn-mùu-tî**	**àa-mùu-tî**

    In current Gudi data, there are six A1 verbs ending in **m** and six ending in **n**. I did not check the behavior of all these verbs with suffixes. The verb 'show' in (9), the only **–m** final verb that I checked, does not show degemination, even with the suffix **mu**, where the phonetic result is a geminate **mm**. Non-assimilation (and non-degemination) of **m+n**, as in **tàm-nòo-tî** is confirmed as the general pattern by examples from texts, e.g. **nam-no** 'he took up' (root **nam** + ventive suffix **no**).

    Verbs with root final **–n** show two patterns. One, probably the productive one, is illustrated by the root **tan-** 'sharpen (a blade by pounding its edge)'. Geminate **n** formed by combining the verb with an **n**-initial suffix degeminates AND occasions compensatory lengthening, as in the case of suffix+suffix (3). The root-final **–n** does not assimilate to other consonants, including **m**, and hence does not create an environment for degemination. The other pattern for **–n** final verbs is illustrated by **an-** 'say'. Not only does an **n**-initial suffix occasion degemination and compensatory lengthening, but the root final **–n** assimilates to a suffix initial **m**, which also degeminates with compensatory lengthening. This latter behavior is shared by the verb **on-** 'give', e.g. **òn-kô** 'he gave', **òo-mùu-tî** 'he gave to us'. Note that these two verbs canonically appear with indirect objects, and two of the most frequent indirect objects are the **n**-initial pronouns **no** 'to me' and **ni** 'to him' (in texts collected as part of this research, there are dozens of examples of the phrase **àanì** '(and) he said to him...'). The pattern for **an-** 'say' and **on-** 'give', illustrated in (9), almost certainly represents analogical spread of the degemination + compensatory lengthening pattern between suffixes illustrated in (3), which likewise is frequent in discourse. In the case of verbs like 'sharpen', compensatory lengthening has probably spread from the frequent verbs 'say' and 'give' as an accompaniment to degemination on the pattern of the verbs illustrated in (8).

    As a final pattern involving A1 verb roots consider the verbs and verbal nouns in (10).[11]

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[10] This root has several verbal nouns, probably with slightly different meanings.

(10)   **màs-kô** 'he counted'   **àn-kô** 'he said'   **ɓàt-kô** 'he cut'
       màʃê   'counting'   **ànʃê** 'saying'   **ɓàʃê** 'cutting'

   The form of 'counting' fits the pattern of **s** final verb roots in (8), i.e. degemination of identical consonants pairs (where **s+ʃ** counts as "identical"). The form of 'saying' also fits the general pattern of root final consonants by not assimilating to a following consonant, hence not creating an environment for degemination. The verbal noun 'cutting' < /ɓat-ʃe/ does not fit any pattern that we have seen so far. Unlike the examples in (8), the root final **t** has apparently assimilated to the suffix **e** and undergone degemination, but unlike the **t** suffixes in (1), where assimilation and degemination are accompanied by compensatory lengthening, there is no compensatory lengthening when **t**-final verb roots add the **ʃe** suffix. Unlike forms seen so far, the forms in (10) are lexical words, not forms created on the fly by productive inflectional processes. There are no Ngamo words with internal sequences **ts**, **tʃ**, or **nm**, the sequences that lose the first component in (1), presumably through assimilation and degemination. It seems to be the case that roots preserve their identity when participating in productive inflectional processes, but internal in words, assimilation of "similar" consonants and degemination override preservation of root identity. Unlike affixes, which accompany degemination with compensatory lengthening, however, roots retain the base vowel length as a way to avoid doubly straying from root identity, viz. losing both the base final consonant AND lengthening the base vowel.

3. NOUN ROOTS WITH INFLECTIONAL SUFFIXES

The only inflectional suffixes that can be added to nouns are the genitive pronouns, illustrated in (1). Nouns that end in vowels require the genitive linkers **n** (masculine) or **t** (feminine), but nouns ending in consonants suffix the genitive pronouns directly to the noun. Most nouns end in vowels, and nearly all nouns with a final consonant end in a sonorant. The only sonorants that have matching suffix consonants are nasals, illustrated in (11).

(11)   **gàm**   'ram'   **kèn**   'uncle'   **sùn**   'name'
       'my...'   **gàm-nò**   **kèn-nò**   **suu-nò**
       'your (m)...' **gàm-kò**   **kèn-kò**   **suŋ-kò**
       'our...'   **gàm-mù**   not elicited   **suu-mù**

   The pattern is similar to that seen for A1 verb roots ending in nasals in (9): **m** neither assimilates nor degeminates when followed by **m**; roots ending in **n** differ in ways that are apparently lexically specific. 'Uncle', like 'ram', does not undergo degemination, even when when the suffix consonant matches the root-final consonant. 'Name', on the other hand, assimilates, degeminates, and undergoes compensatory lengthening. It is as if the root final **–n** of **sun** is interpreted as the masculine genitive linking morpheme added to a root "**su**". Like the verbs in (9) that have high frequency with **n**-initial indirect object clitics, **sun** 'name' would have high frequency with **n**-initial possessive pronouns, which must be a contributing factor to its idiosyncratic behavior.

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[11] There are two verbal nouns suffixes with initial **ʃ**: **ʃe** (with a LF tone pattern on the verbal noun) and **ʃi** (with a LL tone pattern on the verbal noun). These were probably at one time functionally distinct, e.g. in Bole, **ʃi** is a suffix of habitual verb forms for certain verb classes whereas **ʃe** functions only as a suffix for lexically specified A1 verbs (Gimba 2000). In Ngamo, both suffixes are unpredictably distributed as verbal noun suffixes of particular verbs.

4. TOWARD AN ANALYSIS

Though the main purpose of this paper is to describe Ngamo degemination and related phenomena, elements of an analysis nonetheless have emerged. It seems that the interaction of three constraints accounts for the main facts involving degemination and compensatory lengthening:

(12) **ROOT#**: This is an abbreviation of Max-IO(Root#) plus Dep-IO(Root#). "A root should retain its base shape at a clitic boundary," i.e. a root should neither delete nor add anything.
*Geminate: "Geminate consonants are not permitted." The validity of this constraint is supported not only by degemination described in this paper but also by the fact that Ngamo has no geminate consonants in native roots.
MAX-Mora-OO. "Inflected forms that are part of a paradigm should not have fewer moras than other members of the same paradigm." Syllable weight is the basis of metricality in Ngamo and nearly all its West Chadic sisters and cousins. These languages are sensitive to this property in both native poetry/song and various inflectional and derivational patterns. This constraint matches moras contributed by compensatory lengthening to moras contributed by the consonants of affixal morphemes of other members of the same paradigm.

Tableau 1 shows how these constraints interact to account for the attested outputs of **/sàra-t-tò/** 'her hand' (cf. 1) and **/ɓàt-tòo-tî/** 'he cut her' (cf. Appendix).

Tableau 1.

	*Geminate	**ROOT#**	**MAX-Mora--OO**
/sàra-t-tò/			
sàrattò	!*		
sàratò			!*
☞ sàraatò			
/ɓàt-tòo-tî/			
ɓàttòotî	!*		
ɓàatòotî		!*[12]	
☞ ɓàtòotî			*

I should mention an alternative account to compensatory lengthening. There is evidence that at least some suffixes lengthen their vowels when followed by another suffix. We see this in the long vowel of **tòo** preceding the totality suffix **-tî** in **ɓàtòotî**. This pronoun has a short vowel when word final. Likewise, lengthening of the vowel of a suffix before another suffix is productive in closely related Bole (Gimba 2000). Like many languages with distinctive vowel length, Ngamo excludes long vowels from closed syllables, meaning that a long vowel in a –VC suffix would be pronounced as phonetically short unless the C were deleted. This is exactly

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[12] Both **sàraatò** 'her hand' (the attested form) and ***ɓàatòotî** 'he cut her' (a non-attested form) appear to fail root shape faithfulness by the presence of a long vowel. I assume that **ROOT#** means something like "reading left to right, the unaltered input root is present in the word". This is true for **sàraatò**, where the base root is *followed* by a mora of length, but not for ***ɓàatòotî**, where, reading left to right, the root would have a non-base internal long vowel.

what degemination does. Thus, assuming base long vowels in suffixes, we would get the results (3d) **/ŋgàr-àan-nô/** DEGEMINATION → [**ŋgàr-àa-nô**] 'they tied and brought', but **/ŋgàr-àan-kô/** CLOSED SYLLABLE SHORTENING → [**ŋgàr-àŋ-kô**] 'they tied' (with completive suffix **–ko**). Under this analysis, an independently motivated constraint *[+long]C] would give the proper output in the latter form, and no constraint involving metricality would be needed. There are at least two problems with this analysis, however. First, as seen in (1), degemination can be accompanied by compensatory lengthening even where the suffix itself contains no vowel, e.g. **/tili-n-no/** → [**tilii-Ø-no**] 'my heart'. Second, the only output evidence for an underlying long vowel in VC suffixes is compensatory lengthening, the very phenomenon that we are trying to explain. I therefore prefer the account in Tableau 1, which relies on compensatory lengthening.

   The constraints in Tableau 1 fail to account for (assumed) assimilation as an intermediate stage feeding degemination.   Such cases all involve **t** plus a consonant, e.g. (1) **/sàra-t-sù/** → [**sàraa-sù**] 'their hand', **/sàra-t-nò/** → [**sàra-n-nò**] 'my hand', and (11) **/ɓàt-ʃê/** → [**ɓàʃê**] 'cutting'. Current data suggests that Ngamo disprefers the sequence ...**t**[-approximant], i.e. there are words like **bùtjò** 'beard' and **hàtrò** 'ribs', but none with internal sequences *****ts**, *****tn**, *****tm**. A constraint banning this sequence, ranked above MAX-Mora-OO, would account for all the attested outputs.   The output [**ɓàʃê**] 'cutting' would appear to fail MAX-Mora-OO, but as suggested in discussion of (10) and in the formulation of MAX-Mora-OO, this is a derived word, not part of an inflectional paradigm, and hence would probably fail only a lower ranked constraint Max-IO applying to lexical words. The major unsolved problem is why [**sàra-n-nò**] 'my hand' REQUIRES geminate **nn** < **/tn/** and DOES NOT DEGEMINATE. Data in (9) and (11) suggest that geminate nasals are more tolerable than other geminate sequences (though there are no native Ngamo words with internal geminate nasals), but data in (1) and (3) shows that nasals DO regularly degeminate.[13]   The answer lies in the fact that Ngamo speakers know that the geminate nasal in [**sàra-n-nò**] derives from the sequence of dissimilar consonants **/tn/**, whereas the degeminated nasal in (3d) **/ŋgàr-àn-nô/** → [**ŋgàr-àa-nô**] 'they tied and brought' derives from a sequence of identical consonants **/nn/** How to account for the output opacity resulting from this psychological fact in a constraint based analysis remains an unsolved problem.

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[13] Parallel to **nn** < **/tn/** is **ll** < *****ld**/*****dl** mentioned in footnote 3. Because there are no affixal morphemes with **l** at a periphery, we cannot test what would happen with a sequence involving **d** and **l** as a productive process. However, geminate **ll**, like geminate **nn**, does seem tolerable in Ngamo.

APPENDIX

Selected Verb Paradigms

Each paradigm shows the verb with the completive suffix **–ko**, the verbal noun, and the verb in the completive with a full paradigm of indirect object pronouns. The final **–tî** is the totality extension, which is used in the default citation form. Where degemination (and, for 'say', compensatory lengthening) have taken place, morphological divisions are not shown in order to avoid a commitment to which morpheme the remaining singleton consonant belongs.

	'roast'	'cut'	'count'	'say'
'he ....ed'	**bòkô**	**ɓàt-kô**	**màs-kô**	**àŋ-kô**
'...ing'	**bòk-ʃì**	**ɓàʃê**	**màs-nì, màʃê**	**àn-ʃê**
'...to/for me'	**bòk-nòo-tî**	**ɓàt-nòo-tî**	**màs-nòo-tî**	**àa-nòo-tî**
'...to/for you (m)'	**bòkòo-tî**	**ɓàt-kòo-tî**	**màs-kòo-tî**	**àŋ-kòo-tî**
'...to/for you (f)'	**bòk-ʃìi-tî**	**ɓàt-ʃìi-tî**	**màʃìi-tî**	**àn-ʃìi-tî**
'...to/for him'	**bòk-nìi-tî**	**ɓàt-nìi-tî**	**màs-nìi-tî**	**àanìi-tî**
'...to/for her'	**bòk-tòo-tî**	**ɓàtòo-tî**	**màs-tòo-tî**	**àn-tòo-tî**
'...to/for us'	**bòk-mùu-tî**	**ɓàt-mùu-tî**	**màs-mùu-tî**	**àamùu-tî**
'...to/for you (pl)'	**bòkùu-tî**	**ɓàt-kùu-tî**	**màs-kùu-tî**	**àn-kùu-tî**
'...to/for them'	**bòk-sùu-tî**	**ɓàt-sùu-tî**	**màsùu-tî**	**àn-sùu-tî**

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