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Table of Contents

PARASYNTHESIS IN DEGEMA: SIMULTANEOUS AFFIXATION OR SUFFIXATION AND CONCOMITANT PREFIXATION?[1]

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ABSTRACT

This paper discusses parasynthesis, also known as circumfixation, in Degema. It highlights the fact that circumfixes are controversial not only because of the possibility to analyze them as discontinuous units consisting of prefix-like and suffix-like formatives that apply to the stem simultaneously or as units formed in two stages beginning with suffixation and ending with prefixation but also because they are considered rare or non-existent in the world's languages, and are ruled out as impossible in some theories even in principle. Circumfixation in Degema is examined against the traditional view of parasynthesis and in the light of Generative Grammar. The paper notes that circumfixation is a very common and productive way of forming agentive and gerundive nominals and state nouns in Degema, despite claims of its rarity. It also notes that a traditional or theoretical analysis notwithstanding, there is a high degree of morpho-semantic bonding between both parts of the circumfix used in forming deverbal nouns in the language – a bonding that prohibits the optionality of any of the parts of the circumfix in spite of their non-contiguity. Degema provides evidence that the two parts of the circumfix constitute a single morphological unit and express a single meaning, which cannot be realized if the two parts are regarded as cases of "normal" prefixes and suffixes. Furthermore, the paper demonstrates that circumfixation is not impossible as a word formation process, like prefixation, suffixation and infixation. In the light of Generative Grammar, the paper concludes that circumfixation in Degema is a case of suffixation and concomitant prefixation rather than one of simultaneous affixation.

Key-words: Parasynthesis, circumfixation, Binary Branching Hypothesis, Deverbal Nominals, Degema

[1] Degema is spoken in southeastern Nigeria by two autonomous communities – Usokun-Degema and Degema Town (Atala) in Degema Local Government Area of Rivers State. It is a Delta Edoid Language (Elugbe 1989) classified under West Benue-Congo (Blench 1989) within the Niger-Congo phylum. Degema speakers number approximately 22,000 (according to the 1991 population census figures). Each of the Degema-speaking communities speaks a variety of Degema that is highly mutually intelligible with the other and is known by the variety of Degema it speaks. The Usokun-Degema people speak the Usokun variety while the Degema Town (Atala) people speak the Atala variety. Degema data in this paper are based on the Usokun variety.

This is a revised version of a paper presented at the International Conference of the African Language Association of Southern Africa (ALASA) held in Pretoria, South Africa from 17-19 July 2013. I am grateful to the anonymous LASU Journal reviewers for their valuable comments. All errors that remain are mine.

0. INTRODUCTION

There are different word-formation strategies that have been discussed in the literature on morphology. The commonest of them is affixation, which is by far the principal means of building words in the languages of the world. The literature identifies various types of affixes based on their positional relationship to the base to which they attach themselves and on the basis of the function they perform. Of these types of affixes, prefixes and suffixes are by far the commonest among the world's languages (Štekauer et al. 2012). Prefixes and suffixes are considered more natural from the perspective of Natural Morphology than infixes, interfixes or circumfixes, which are considered "less natural" or even "unnatural" (Štekauer et al. 2012: 197f). Of these affixes, circumfixes are controversial not only because "it is possible to analyze them as consisting of a prefix and a suffix that apply to the stem simultaneously" (Aronoff and Kirsten 2005: 3) or as units formed in two stages beginning with suffixation and ending with prefixation (Scalise 1986) but also because they are considered rare or non-existent (Carstairs-MacCarthy 2006: 86). Spencer (1991: 13) remarks that "in some theories circumfixes are ruled out as impossible even in principle". As an introduction to our discussion of circumfixation, we discuss affixation, drawing examples from a variety of languages. Subsequently, we provide background information on the traditional view of circumfixation and a discussion of circumfixation in Degema in the light of the traditional view. Finally, we present background theoretical information on circumfixation and a discussion of circumfixation in Degema in the light of the Binary Branching Hypothesis (BBH)[2].

1. AFFIXATION

Affixation is the process of attaching a bound morpheme, usually an affix, to a base to create wordforms. It is one of the principal means of building words in human language. This process of building words is very common in prototypical agglutinating languages, such as Japanese, Kiswahili and Turkish (cf. Katamba and Stonham 2006, Lieber 2010), in fusional languages, such as Latin and Russian (cf. Katamba and Stonham 2006, Spencer 1991), and polysynthetic languages, such as Chukchee, and Inuktitut (cf. Spencer 1991, Steinbergs 1997).

[2] The following abbreviations are used in this paper: 3SgSCL = third person singular subject clitic, CERT = certainty, FACT = factative clitic, FUT = future, N = noun, NPM = non-past morpheme, Pre = prefix, Suf = suffix, V = verb stem, X = base.

1.1. Types of Affixes

There are different types of affixes. They are usually classified into two main types on the basis of their positional relationship to the base and on the basis of the function they perform.

1.1.1. Positional Types of Affixes

On the basis of their position in relation to the base, affixes are classified as prefixes, suffixes, infixes, interfixes and circumfixes. Of these affixes, prefixes and suffixes are the commonest in the languages of the world.[3] Let it be mentioned that infixes and interfixes are not attested in Degema. The following discussion presents briefly the positional relationship of affixes to the base, with illustrative data from Degema.

Prefixes

Prefixes occur before the base, as in the Degema examples in (1) and (2):

(1) **ɛ-nám**[4] 'animal' (Degema)
(2) **u-tóm** 'head' (Degema)

The forms **ɛ-** and **u-** occurring before the bound stem **-nám** and **-tóm** are prefixes.

Suffixes

Suffixes occur after the base, as in the Degema examples in (3) and (4):

(3)	**fó̱**	'be white'	**fʊ-ɛsɛ́**	'cause to be white'	(Degema)
(4)	**gím**	'pin'	**gim-ené**	'pin oneself'	(Degema)

The forms **-ɛsɛ** and **-ene** occurring after the bases **fó̱** 'be white' and **gím** 'pin' are suffixes. In Degema, affixes, such as prefixes and suffixes, harmonize with nominal and verbal bases in Advanced Tongue Root (ATR). In other words, the vowels of affixes are +ATR when those of nominal and verbal bases are +ATR, and -ATR when those of nominal and verbal bases are -

[3] For an excellent discussion of the distribution of affixes in the world's languages, see Štekauer et al. (2012). They note that suffixation is more widespread in the world's languages than prefixation (Štekauer et al. 2012: 141f).

[4] Degema has two basic tones, high tone, marked (´), and low tone, which is unmarked for the sake of economy. There is also a tonal phenomenon known as downstep, which is the result of a high tone becoming phonetically lower than a preceding high tone. The downstepped tone is the tone that anchors on the syllable after the down arrow, as represented in this work. Our transcription of Degema data uses International Phonetic Alphabet symbols.

ATR. The function of Degema prefixes in (1) and (2) is inflectional whereas the one in (3) and (4) is derivational.

Circumfixes

Circumfixes are discontinuous morphemes consisting of two parts[5]. One part of the affix occurs before the base while the other part occurs after the base. The two parts of the affix, however, constitute a single unit and express a single meaning (cf. Lieber 2010: 78). Circumfixes are attested in Degema (Elugbe 1984, Elugbe 1989, Kari 2004, Kari 2008), as well as in other Nigerian and non-Nigerian languages such as Eleme (Alesi 1998), Esan (Ejele 1996), Odual (Kari 2009), Malay (Allerton 1979), Italian (Scalise 1986) and German (Haspelmath 2002). Examples (5), (6) and (7) illustrate circumfixes in Degema:

(5)	**kpéβ**	'sow'	**o-kpé↓β-ə́m**	'sower'
(6)	**dí**	'eat'	**ɔ-dí-↓ám**	'eater'
(7)	**dér**	'cook'	**o-dér-↓ɔ́m**	'cooker'

In examples (5), (6) and (7) the forms **o-…-əm** and **ɔ-…-am** are nominalizing circumfixes in Degema.

1.1.2. Functional Types of Affixes

Functionally, affixes are broadly classified as inflectional and derivational. Inflectional affixes usually do not change word class. They also usually do not result in the creation of new words rather they produce variations of the same word.[6] Inflectional affixes exist to mark grammatical

[5] Circumfixes, also called ambifixes, are usually thought of as consisting of a prefix and a suffix (cf. Booij 2005:29) or as a unit consisting of the simultaneous presence of two morphemes (cf. Lieber 2010:78).

[6] Although generally, inflection is believed not to change word class, it is worthy to mention that "change in word class" is not a universal criterion for distinguishing it from derivation. Stump (2001: 19) observes that in Breton (France), the attachment of some inflectional affixes to certain bases affects the lexical category of the bases so that the adjectival base **bas** 'shallow' becomes the nominal **basenn** 'shoal' as a result of the attachment of the inflectional suffix **-enn**. Furthermore, he observes that the attachment of the suffix **-enn** to a collective noun such as **buzugenn** 'worms' yields the corresponding singulative form **buzug** 'worm'. There are also instances where the distinction between inflection and derivation is blurred, as there exist certain affixes in Degema that serve an inflectional and derivational function at the same time in some words. For instance, in Degema, the attachment of the prefix **ɔ-** to the verb base **tɛβtéβ** 'be short' to derive the word **ɔ-tɛβtéβ** 'one that is short' not only marks singularity, which is inflectional, but also changes the lexical category of the word from verbal to nominal (cf. **ɪ-tɛβtéβ** 'ones that are short') – a function that is clearly derivational. Under these circumstances, it is not at all clear which part of the prefix is inflectional and which part is derivation. It is therefore difficult to make a clear-cut universal distinction between inflection and derivation, and in some cases, not even within a single language, as facts from Breton and Degema show. In spite of the practical difficulties in distinguishing between inflection and derivation, the distinction between these notions is still valid, as there are areas where the distinction is clear (see Kari 2003).

categories, such as number (8), person (9), tense (10), aspect (11), comparative and superlative (12), mood (13), case (14), as illustrated by the following examples:

(8) ʊ-**k**ɔ́ canoe ~ a-**k**ɔ́ canoes (Degema)
(9) lick lick-s English
(10) kill ~ kill-ed (English)
(11) send ~ send-ing (English)
(12) high ~ high-er ~ high-est (English)
(13) **tùé** 'come' ~ **tə-túù-ní** 'will certainly come'
FUT-come-CERT
(Odual: Kari 2009: 60)

(14) **ótú** 'house' ~ **t-ó˖tú** 'at/to/from house/home'

(Odual: Kari 2009: 16)

Derivational affixes are used to create new words. They are further classified into category-changing and category-preserving. Category-changing derivational affixes result in the creation of new words, which do not belong to the syntactic classes of words from which they were created, while category-preserving derivational affixes are those that result in the creation of new words that belong to the syntactic classes of words from which they were created. This latter category of affixes is sometimes called extensional affixes because they only modify the lexical meaning of the base without changing its lexical category. The derivational affixes in (15) and (16) are category-changing whereas those in (17) and (18) are category-preserving:

(15) **tə̀ɔ́m** 'send' (verb) ~ **o-tɔ́m-ɔ́ə̀ɣ** 'sender' (noun)

(Odual: Kari 2009: 42)

(16) **atarasi-i** 'new' (adjective) ~ **atarasi-sa** 'newness' (noun)

(Japanese: Haspelmath 2002: 69)

(17) **wǒ** 'fall/fail in an enterprise' (verb) ~ **·sə** 'cause to fail' (verb)

(Bafut: Mutaka & Tamanji 2000: 177)

(18) **rata** 'love' (verb) ~ **-rat-ana** 'love each other' (verb)

(Setswana: Cole 1955: 46)

In the foregoing, we have discussed affixation, exemplifying it with data from a variety of languages. In the following sections, we shall discuss circumfixation.

2. CIRCUMFIXATION

Circumfixation, traditionally known as parasynthesis, is defined as a process whereby a word form is derived by means of the simultaneous attachment of prefix-like and suffix-like formatives to a single base to give the form [Pre + X + Suf] (Scalise 1986: 147). According to Scalise (1986: 147), ""simultaneous" attachment refers to the fact that neither the sequence [Pre + X] nor the sequence [X + Suf] exists alone; it is assumed that the two affixes must thus be added at the same time". Although circumfixation may be productive in the languages in which it is attested, it is not a widespread word-building process among the world's languages, unlike prefixation[7] and suffixation (Štekauer et al. 2012: 209, Carstairs-MacCarthy 2006: 85). For this reason, it is left out in the discussion of affixation in some books on morphology (cf. Katamba and Stonham 2006: 44f).[8]

"Genuine circumfixes"[9] are a kind of affix at par with prefixes, suffixes and infixes, given that there exist many instances where the two parts of which they are made constitute a single unit and express a single meaning[10] (and not the "simultaneous presence of two morphemes" (cf. Lieber 2010: 78)), a meaning that cannot be realized if the two parts are regarded as "normal" prefixes and suffixes, which can co-exist with the base one without the other and do not necessarily constitute a single unit or express a single meaning, as seen in the possibilities that exist with the English words *un-happi-ness ~ un-happy ~ happi-ness*. The word *happy* can occur with the prefix *un-*, as in *unhappy*, or with the suffix *-ness*, as in *happiness*, or with both the prefix *un-* and the suffix *-ness*, as in *unhappiness*. However, the meanings of the prefix *un-* and the suffix *-ness* are not dependent on each other or on the presence of both affixes. Each of the affixes can always exist with the base independently of the other but this is not always so with circumfixes, as we shall see in Degema. It is also to be seen in Degema that the two parts that

[7] Spencer (1991: 13) refers to prefixation and suffixation as "standard" (affixation).

[8] Štekauer et al. (2012: 197) refer to circumfixation and other word-formation processes that are characterized by the absence of "diagrammaticity" or "anti-diagrammaticity" and those that violate morphemic integrity, as well as those that produce new words by adding derivational material at two different points, as "minor types of affixation".

[9] Because circumfixes are rare or considered nonexistent, they are thought of as not being different from prefixal-suffixal derivation (cf. Carstairs-MacCarthy 2006: 86).

[10] This view agrees very much with J. Mugdan's description of the circumfix. Mugdan's description includes the fact that a circumfix encloses the base, and that the first part looks like a prefix while the second part looks like a suffix. Of significance is the remark that "neither part has any meaning by itself so that it is preferable to treat the combination as a unit" (Mugdan 1994: 2549).

make up circumfixes do not have independent meanings. Whatever meanings that circumfixes have are compositionally expressed by both parts, which are obligatorily present.

3. CIRCUMFIXATION IN DEGEMA

Circumfixation is a very common and productive word formation process in Degema. Like prefixes and suffixes, which feature prominently in word formation in the language, circumfixation is one of the processes through which nouns are formed from verbs. Among the nouns that are formed from verbs through circumfixation are gerundive nominals, agentive nominals and state nouns. The structure of the affix used in the derivation of gerunds in Degema is discussed elaborately by Elugbe (1984). Kari (1997, 2003, 2004, and 2008), in addition to the gerund, also discussed the derivation of agentive nominals and state nouns in Degema. In what follows, we present and discuss data on agentive nominals, gerundive nominals, and state nouns.

3.1. Agentive Nominals

Agents refer to entities, tangible or intangible, that cause a change in the physical state of some other entity. The shape of the circumfix used in the derivation of agentive nominals[11] is **O-…-(A)m**.[12] The longer form of the affix **O-…-Am** is used with verb bases that terminate with a consonant or a high vowel, such as **i**, **ɪ**, **u** or **ʊ**, while the shorter form **O-…-m** is used with verb bases with more than one syllable and which terminate with a vowel that is not **i**, **ɪ**, **u** or **ʊ**. In monosyllabic verb bases terminating with vowels other than **u**, **ʊ**, **i** or **ɪ**, there is complete assimilation of the underspecified vowel in the second part of the affix to the vowel of the verb base. The data in (19) show some of the bases that take the different forms of the agentive circumfix:

(19)	**mené**	'do'	>	**o-mé↓né-m**	'doer'
	kɛ́l	'begin'	>	**ɔ-kɛ́↓l-ám**	'beginner'
	kotú	'call'	>	**o-kó↓tú-ɔ́m**	'caller'
	loβirə́	'remember'	>	**o-ló↓βírə́-m**	'rememberer'
	bí	'push'	>	**o-bí↓-ɔ́m**	'pusher'

[11] A significant observation made by Kari (2008: xxx) is that agentive nominals cannot be used as complements of the verbs from which they are derived.

[12] Each morphophoneme in the structure of the affix represents two alternants. **O** represents **o-/ɔ-**, while **A** represents **-ə/-a** or **-e/-ɛ** contingent on vowel harmony and the phonological structure of the verb base.

βέβ	'fly'	>	**ɔ-βέ$^{\downarrow}$β-ám**	'flyer'
kpɔ́n	'flay'	>	**ɔ-kpɔ́$^{\downarrow}$n-ám**	'flayer'
sá	'shoot, kick'	>	**ɔ-sá$^{\downarrow}$-ám**	'shooter, kicker'
ɓɔ́	'build'	>	**ɔ-ɓɔ́$^{\downarrow}$-ɔ́m**	'builder'
mɛsɛ́	'sleep'	>	**ɔ-mɛ́$^{\downarrow}$sɛ́-m**	'sleeper'
mará	'yawn'	>	**ɔ-má$^{\downarrow}$rá-m**	'yawner'
pú	'close'	>	**o-pú$^{\downarrow}$-ɔ́m**	'closer'
ɗɛ́	'buy'	>	**ɔ-ɗɛ́$^{\downarrow}$-ɛ́m**	'buyer'
ŋʷáɲ	'count'	>	**ɔ-ŋʷá$^{\downarrow}$ɲ-ám**	'counter'
siré	'run'	>	**o-sí$^{\downarrow}$ré-m**	'runner'
gɛ́n	'look'	>	**ɔ-gɛ́$^{\downarrow}$n-ám**	'spectator'
jɛ́	'expose'	>	**ɔ-jɛ́$^{\downarrow}$-ɛ́m**	'exposer'
sinesé	'hide'	>	**o-síné$^{\downarrow}$sé-m**	'one who hides'
kakɛ́	'show'	>	**ɔ-ká$^{\downarrow}$kɛ́-m**	'one who shows'
ɲɔ́n	'insert'	>	**ɔ-ɲɔ́$^{\downarrow}$n-ám**	'one who inserts'
ɗijesé	'destroy'	>	**o-ɗíjé$^{\downarrow}$sé-m**	'destroyer'

The two parts of the circumfix used in deriving agentive nominals constitute a single morphological unit and express a single meaning. The use or presence of one part of the circumfix without the other leads to ungrammaticality. Consider the data in (20):

(20a)	**o-méné-m**	**o=sóm**	**fíjé=n**	**ɔ́-gɛ́$^{\downarrow}$n-ám**
(b)	***o-méné**	**o=sóm**	**fíjé=n**	**ɔ́-gɛ́n**
(c)	***méné-m**	**o=sóm**	**fíjé=n**	**gɛ́$^{\downarrow}$n-ám**

Example (20a) is grammatical because both parts of the circumfix are obligatorily present. In examples (20b) and (20c) where one or the other part of the circumfix is missing, the sentences are ungrammatical. For this reason, (20b) and (20c) are not glossed. Indeed, examples (20b) and (20c) are meaningless, as far as the expression of agentive meaning is concerned. Example (20b) is ungrammatical because the second part of the circumfix is absent, while (20c) is ungrammatical because the first part of the circumfix is absent. The fact emerging from a comparison of (20a) with (20b) and (20c) is that the morphological/semantic bond existing between both parts of the circumfix used in deriving agentive nominals does not support optionality of any of its sub-parts in spite of the non-contiguity of the two parts.

3.2. Gerundive Nominals

Gerundive nominals,[13] like agentive nominals, are formed from dynamic verbs, i.e. verbs that mainly indicate an action, process, etc. They are formed with an affix having the structure **U-…-(A)m**. The longer form of the affix **U-…-Am** is used with verb bases that terminate with a consonant or with a high vowel such as **i**, **ɪ**, **u** or **ʊ**, while the shorter form **U-…-m** is used with verb bases with more than one syllable and which terminate with a vowel that is not **i**, **ɪ**, **u** or **ʊ**. There is complete assimilation of the underspecified vowel in the second part of the affix to the vowel of the verb base in monosyllabic verb bases terminating with vowels other than **i**, **ɪ**, **u** or **ʊ**. The data in (21) show some of the bases that take the different forms of the gerundive circumfix:

(21)	**mené**	'do'	>	**u-mé$^{\downarrow}$né-m**	'doing'
	kɛ́l	'begin'	>	**ʊ-kɛ́$^{\downarrow}$l-ám**[14]	'beginning'
	kotú	'call'	>	**u-kó$^{\downarrow}$tú-ə̀m**	'calling'
	loβirə́	'remember'	>	**u-ló$^{\downarrow}$βírə́-m**	'remembering'
	bí	'push'	>	**u-bí$^{\downarrow}$-ə̀m**	'pushing'
	βɛ́β	'fly'	>	**ʊ-βɛ́$^{\downarrow}$β-ám**	'flying'
	kpɔ́n	'flay'	>	**ʊ-kpɔ́$^{\downarrow}$n-ám**	'flaying'
	sá	'shoot, kick'	>	**ʊ-sá$^{\downarrow}$-ám**	'shooting, kicking'
	ɓɔ́	'build'	>	**ʊ-ɓɔ́$^{\downarrow}$-ɔ́m**	'building'
	mɛsɛ́	'sleep'	>	**ʊ-mɛ́$^{\downarrow}$sɛ́-m**	'sleeping'
	mará	'yawn'	>	**ʊ-má$^{\downarrow}$rá-m**	'yawning'
	pú	'close'	>	**u-pú$^{\downarrow}$-ə̀m**	'closing'
	ɗɛ́	'buy'	>	**ʊ-ɗɛ́$^{\downarrow}$-ɛ́m**	'buying'
	ŋʷáɲ	'count'	>	**ʊ-ŋʷá$^{\downarrow}$ɲ-ám**	'counting'
	siré	'run'	>	**u-sí$^{\downarrow}$ré-m**	'running'
	gɛ́n	'look'	>	**ʊ-gɛ́$^{\downarrow}$n-ám**	'looking'
	jɛ́	'expose'	>	**ʊ-jɛ́$^{\downarrow}$-ɛ́m**	'exposing'
	sinesé	'hide'	>	**u-síné$^{\downarrow}$sé-m**	'hiding'
	kakɛ́	'show'	>	**ʊ-ká$^{\downarrow}$kɛ́-m**	'showing'
	ɲɔ́n	'insert'	>	**ʊ-ɲɔ́$^{\downarrow}$n-ám**	'inserting'

[13] Like agentive nominal, gerundive nominals in Degema cannot be used as complements of the verbs from which they are derived. Kari (2008: xxx).

[14] Here too, each morphophoneme in the structure of the affix represents two alternants. The morphophoneme **U** represents **u-/ʊ-**, while **A** represents **-ə/-a**, **-e/-ɛ** or **o-/ɔ-** contingent on vowel harmony and the phonological structure of the verb base.

dĩjesé 'destroy' > **u-dĩjé↓sé-m** 'destroying'

Like agentive nominal, the two parts of the circumfix used in deriving gerundive nominals constitute a single morphological unit and express a single meaning. The use or presence of one part of the circumfix without the other leads to ungrammaticality. Consider the data in (22):

(22a) **ʊ-ɓɔ́↓-ɔ́m o=sóm fíjé=n ú-dĩjé↓sé-m**
building 3SgSCL=be good surpass=FACT destroying
'Building is better than destroying'

(b) *?**ʊ-ɓɔ́ o=sóm fíjé=n ú-dĩjé↓sé**

(c) *?**ɓɔ́↓-ɔ́m o=sóm fíjé=n dĩjé↓sé-m**

Like what we saw in (20), example (22a) is grammatical because both parts of the circumfix are obligatorily present. In examples (22b) and (22c) where one or the other part of the circumfix is missing, the sentences are ungrammatical and unacceptable. For this reason, (22b) and (22c) are not glossed. Example (22b) is ungrammatical and unacceptable because the second part of the circumfix is absent, while (22c) is ungrammatical because the first part of the circumfix is absent. Here too, the fact emerging from a comparison of (22a) with (22b) and (22c) is that the morphological/semantic bond existing between both parts of the circumfix used in deriving gerundive nominals does not allow optionality of any of its sub-parts in spite of the non-contiguity of the two parts.

3.2. State Nouns

State nouns[15] are formed from stative verbs. They refer to the states of being of entities. These nouns are derived from stative verbs by attaching a circumfix to the verb base. The shape of the circumfix is **U-…-A**:[16]

(23)	**bí**	'be black'	>	**u-bí↓-ə́**	'state of being black
	fó	'be white'	>	**ʊ-fó↓-á**	'state of being white'
	kɔ́j	'be heavy'	>	**ʊ-kɔ́↓j-á**	'state of being
	róβ	'be sharp'	>	**u-ró↓β-ə́**	'state of being sharp
	βoβów	'be light'	>	**u-βóβó↓w-ə́**	'state of being light'

[15] Unlike agentive and gerundive nominals, state nouns in Degema can be used as complements of the verbs from which they are derived (see Kari 2008: xxxi).

[16] **U** represents **u-/ʊ-**, while **A** represents **-ə/-a** contingent on vowel harmony and the phonological structure of the verb base.

State nouns, like gerundive and agentive nominals, have both parts of the circumfix functioning as a single unit and expressing a single meaning such that one part of the circumfix cannot be used without the other, and still express the meaning of "state of being X". Forms such as ***ʊ-kɔ́j** and ***kɔ́ˡj-á** are morphologically ill-formed, as a comparison of (24a) with (24b) and (24c) shows:

(24a) **u-βóβóˡw-ɔ́ o=sóm fíjé=n ʊ-kɔ́ˡj-á**
state of being light 3SgSCL=be good surpass=FACT state of being heavy
'A state of being light is better than a state of being heavy'

(b) *?**u-βóβów o=sóm fíjé=n ʊ-kɔ́j**

(c) *?**βóβóˡw-ɔ́ o=sóm fíjé=n kɔ́ˡj-á**

Example (24a) is well-formed because of the co-existence of both parts of the circumfix. The sentences in (24b) and (24c) are ill-formed because in (24b) the second part of the circumfix is absent, with a concomitant effect on the prosodic structure of the nouns, while in (24c) the first part of the circumfix is absent. For this reason, (24b) and (24c) are not glossed. Again, as we saw in the case of agentive and gerundive nominals, the morphological/semantic bond that exists between both parts of the circumfix used in deriving state nouns, separated from each other as they may be, does not allow optionality of any of its sub-parts.

From the foregoing discussion, it is clear that in agentive and gerundive nominal and state nouns, the first part of the circumfix is as obligatory as the second part. These nominals contrast with some examples in Dutch discussed by Carstairs-MacCarthy (2006: 85), where the forms **ge-** and **-d** are treated as separate affixes, because the element **-d** can appear with the base without **ge-**. In fact, the impossibility of one part of the affix occurring without the other in these Degema deverbal nominals is a strong basis for treating the two parts of the affix as constituting a single morpho-semantic unit. By the traditional view of circumfixation, therefore, the circumfixes used in deriving agentive and gerundive nominals and state nouns are assumed to attach simultaneously to the base, since one part of the circumfix cannot exist without the other.

4. A THEORETICAL ANALYSIS OF CIRCUMFIXATION

In the preceding section, we considered circumfixation in Degema based essentially on the traditional view of the phenomenon. The analysis of these deverbal nominals, in this section, is

based on generative morphology with particular reference to the Binary Branching Hypothesis (BBH) formulated by Scalise (1986). This hypothesis has its roots in Aronoff (1976) who proposes it as the "one affix, one rule hypothesis". In the light of the "one affix, one rule hypothesis", a word formation rule (WFR) is assumed to attach only one affix at a time to the base. That is to say, that word structure is always binary irrespective of the complexity of the morphological structure of derived words. The BBH provides the basis of the analysis by Scalise (1986: 146ff) of parasynthetic words in Italian that seem to be counter-examples to the hypothesis, showing that in the analysis of such apparent counter-examples a binary analysis is more preferable to a ternary one.

An interesting feature of the BBH credited to Allen (1978) and others, cited by Scalise (1986: 150), is the proposal that the base of a WFR can also be a possible but non-existent word. This proposal makes it possible for a WFR to create a possible but non-existent base by attaching a suffix[17] to the (simple) base. In the light of this proposal, therefore, Scalise (1986) hypothesizes that "the parasynthetics of the traditional literature are actually formed in two steps: first, suffixation creates a possible, though not necessarily existent word, and second, prefixation generates the rest of the form". With the foregoing discussion as a background, let us examine the parasynthetic formation of Degema agentive and gerundive nominal and state nouns.

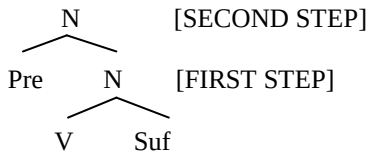
A theoretical analysis of circumfixation in Degema deverbal nominal could be pursued based on the assumption that word structure is always binary irrespective of the complexity of the morphological structure of derived words (Aronoff 1976). It should, however, be borne in mind that the two parts of the circumfixes used in deriving agentive and gerundive nominal and state nouns in the language do not represent genuine cases of prefixal-suffixal derivation found in languages like German and English, for instance (cf. Carstairs-MacCarthy 2006: 85, Štekauer et al. 2012: 205ff).

Based on the BBH, the agentive nominal **o-méˡné-m** 'doer', the gerundive nominal **u-ɗǐjéˡsé-m** 'destroying' and the state noun **u-βóβóˡw-ə́** 'state of being light' could be assumed to derive in two binary stages. The first stage involves the attachment of the second part of the circumfix, which is like a suffix, to the verb base [[V]+Suf]N and a second stage involves the attachment of

[17] It should be pointed out that, unlike in traditional analysis where the suffix in circumfixed words is described as an inflectional element, the suffix in circumfixed words in Degema is analyzed as a derivational element.

the first part, which is like a prefix, to the verb + suffix base [[Pre+[[V]+Suf]N]N to generate the rest of the form. This analysis is represented in (25):

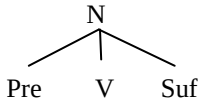
(25)



Even though agentive and gerundive nominals and state nouns tend to support a ternary analysis, instead of a binary one, our theoretical analysis accounts for the formation of Degema deverbal nouns in a uniform and principled way, showing that all three types of deverbal nouns are morphologically derivable in the same way.

From the foregoing analysis, it is obvious from a theoretical point of view that a binary analysis of these deverbal nominals in Degema is more desirable than a ternary one [Pre + V + Suf], as given in (26):

(26)



The ternary representation in (26), which supports the traditional view of circumfixation, presupposes simultaneous affixation of the first and second parts of the circumfix to the verb base – a view that is not tenable in the light of the BBH. This flat structure shows that the structure in question is nominal but it falls short of the BBH, which sees word structure as always binary irrespective of the complexity of the morphological structure of derived words.

It is worthy to state that in spite of the discrepancies in assumptions and analyses between the traditional view of parasynthesis and the BBH, the fact remains that the meaning of the circumfix is compositionally expressed, as neither the sequence [Pre + X] nor the sequence [X + Suf] exists alone. In other words, the circumfix has no meaning until both parts of the morpheme are generated, with the correct application of phonological rules. To this end therefore and since Generative Grammar attempts in a principled way to account for the innate linguistic rules, which reside in the mind of a competent native speaker of a language and which enable him/her

to form different kinds of phonological, morphological, syntactic and semantic structures, this paper aligns itself with this view. Generative Grammar sees linguistic structures as being characterized by binarity, and views circumfixation in Degema as a case of suffixation and concomitant prefixation rather than one of simultaneous affixation espoused by the traditional view.

CONCLUSION

In the foregoing discussion, we have examined circumfixation in the traditional sense and in the generative sense. The paper demonstrates that parasynthesis is a very common and productive word formation process in Degema, like "normal" prefixes and suffixes, and is the source of derivation of agentive and gerundive nominals and state nouns from verbs. One of the interesting findings of this paper is the fact that irrespective of whether the analysis adopted is traditional or theoretical, there is a high degree of morpho-semantic bonding between the two parts of the circumfix used in deriving agentive and gerundive nominals and state nouns, as neither part of the circumfix has any meaning until both parts of the morpheme are generated (with the correct application of phonological rules). The morpho-semantic bonding that exists between the two parts of the circumfix prohibits the optionality of any of the parts in spite of their non-contiguity. The theoretical analysis of circumfixation in Degema deverbal nominals shows that all three types of deverbal nouns are morphologically derivable in the same way. This can be by the attachment of the suffix-like part of the discontinuous morpheme to a verb to generate a non-existent base or by the attachment of the prefix-like part of the morpheme to generate the rest of the form. Our findings show that rare as circumfixation may be in the world's languages, it is not impossible as a word formation process, like prefixation, suffixation and infixation. As evidence from Degema show, the two parts of the circumfix constitute a single morphological unit and express a single meaning, which cannot be realized if the two parts of the circumfix are regarded as cases of "normal" prefixes and suffixes. Finally, the paper concludes that circumfixation in Degema is a case of suffixation and concomitant prefixation rather than one of simultaneous affixation, noting that the two parts that make up the circumfix are not "normal" prefixes and suffixes, which may exist independently of each other and have their separate meanings, but constitute a single morpho-semantic unit.

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REVISITING THE STUDY OF CLASS 5 IN BANTU

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Abstract

One of the most common features of the Bantu languages is the grammatical organization of the nouns into classes according to their prefixes. These different classes are known as noun classes (Bleek, 1862, 1869; Kadima, 1969; Maho, 2000; Meinhof, 1899, 1906, 1910; Guthrie, 1967-71; Werner, 1915; Winston, 1962) that are sometimes distinguished according to their "independent prefixes" (Guthrie, 1962; Winston, 1962). In some Bantu languages, some of these noun classes are without prefixes in which case they are identified by their agreement prefixes. The number of noun class prefixes and their shape vary from language to language.

This paper aims at discussing the class 5 prefix in some Bantu languages spoken in the Southern region of the African continent. The paper focuses on the semantic, morphological, phonological and phonetic characteristics which make the class 5 prefixes different and/or similar in these Bantu languages.

Key-words: Bantu; class; noun; prefix;

Introduction

One of the most common features of the Bantu languages is the grammatical organization of the nouns into groups according to their prefixes. These groups are known as noun classes (Bleek, 1862, 1869; Kadima, 1969; Maho, 2000; Meinhof, 1899, 1906, 1910; Guthrie,1967-71; Werner, 1915; Winston, 1962) that sometimes can also be distinguished according to their "independent prefixes" (Guthrie, 1962; Winston, 1962). However, some of these noun classes appear without prefixes in which case we rely on their "dependent" (Guthrie, 1962; Winston, 1962) or agreement prefixes. These prefixes are attached to words syntactically dependent on nouns to determine their class membership. The number of noun class prefixes and their shape vary from language to language. The average number of noun classes ranges from ten to twenty (Alexandre, 1981). This variation is mainly due to sound changes that over a period caused some

sounds in these prefixes to undergo certain alterations than others. These sound changes that have tended to be more prevalent in some languages than in others, explains, at least partially, why noun classes in Bantu languages vary to some extent from one language to the other.

In this study, we have carried out an extensive study of class 5 in a number of Southern African Bantu languages. These languages are as follows: Barwe, Changana, Chuwabu, Copi, Gitonga, Gorongozi, Kalanga, Koti, Lomwe, Makonde, Makhuwa, Manyika, Mwani, Ndau, Nyanja, Nyungwe, Sena, Subiya, Swahili, Tewe, Tswana, Yao, and Zulu.

The study focuses on the characteristic aspects of the class 5 prefixes concerning the semantics, morphology, phonology and phonetics. In so doing, we intend to highlight some of the synchronic and diachronic changes which make this class prefix different and/or similar in these Bantu languages. Also, since carrying out a study of one noun class prefix across a number of Bantu languages from different sub-groups within Bantu is something that has not been done before, we hope that the study will reveal some interesting aspects of these noun classes across Southern Bantu languages, which will hopefully give us some ideas on the behaviour of this prefix in Bantu languages spoken in other regions of the continent.

The paper is organized as follows: firstly, it discusses the semantics of the class 5 nouns; then it goes on to look at the morphology of the class 5 prefix; followed by the analysis of the phonology and the phonetics of this prefix before presenting the conclusions, which constitute the final section of the paper.

Methodology

In order to achieve its main objective, extensive data collection of class 5 nouns in these Bantu languages was carried out. Some of the data was collected from grammar books, dictionaries and word lists in some of these languages while for other languages, the data was collected through a fieldwork undertaken on different occasions over the years. For some of the data, we visited some villages where the languages are spoken and collected the data from the native speakers themselves. The selection of informants in such cases was often random, as the snowballing method requires.

From the data collected, an analysis will follow from which conclusions will be drawn.

The semantics of class 5

Traditionally, many linguists thought that the grouping of nouns in Bantu languages was semantically motivated. In addition, there is still good evidence for one to believe that this might have been the case in the past. While it shows to be true in some classes such as classes 1 and 1a, and their respective plurals, which mainly refer to persons and names of people respectively, it has now been realised that this is not completely the case in most of these noun classes either. When considering nouns in different classes, it becomes obvious that each class has a large number of nouns belonging to various semantic categories. Moreover, class 5 is no exception in this respect. Oftentimes, this grouping of a wide range of semantic categories under one class has been attributed to the considerable phonetic and phonological changes undergone by the Bantu languages resulting in different configurations in the organization of the noun class system in different languages through merging of some classes, disappearance of others and even emerging of others (see Chimuzu, 2002). This tendency for nouns belonging to certain semantic categories to be found in certain classes where one would least expect to find them is true in most languages already considered in this study. However, semantic categories found in one Bantu language may not necessarily be found in the other.

According to some studies (Chimuzu, 2002; Fortune, 1967; Ngunga, 1987; Mathangwane, 1999), to mention just a few, class 5 comprises nouns predominantly belonging to the animal kingdom, plants, and fruits, parts of the body, natural phenomena and collective nouns. Of the languages already considered in this study, the following were found to exhibit class 5 nouns that fall into these semantic categories[i]:

(1)	Barwe (S13c?):	batha	‘duck’
		dzino	‘tooth’
		thika	‘hyena’
		thikiti	‘pumpkin’
		buwe	‘stone’
	Gorongozi (S13d?):	khosi	‘neck’
		thako	‘buttock’
		buwe	‘stone’
		phutu	‘cheek’
		zina	‘name’
	Changana (S53):	solesole	‘shrimp’
		rihlanga	‘corn plant’
		rigaga	‘green fruit’
		tsolo	‘knee’

	pala	‘carcass’
Copi (S61):	didoda	‘old man’
	didzakani	‘leaf’
	dikanju	‘cashew’
	didele	‘lip’
	dino	‘tooth’
Tonga (S63):	ligondzo	‘mouse’
	lipatu	‘duck’
	liso	‘eye’
	livele	‘breast’
	ligala	‘charcoal’
Otjiherero (R31):	eho	‘eye’
	eke	‘hand’
	ezumo	‘stomach’
	etako	‘buttock’
	emuti	‘enormous tree’
Kalanga (S16):	dzu	‘eagle’
	dabi	‘branch’
	delele	‘okra’
	bhato	‘buttock’
	bhadza	‘hoe’
Koti (P35?):	nziya	‘pigeon’
	nluwaa	‘flower’
	laazu	‘banana’
	nrupo	‘intestine’
	nlaku	‘cheek’
Lomwe (P32):	nlumi	‘tongue’
	nikhule	‘mouse’
	nipwasha	‘duck’
	nikhala	‘charcoal’
	kusupa	‘hyena’
Makonde (P23):	libata	‘duck’
	lihindi	‘grass’
	lihamba	‘leaf’
	lidodo	‘leg’
	lyoyi	‘smoke’
Makhuwa (P31):	nihapukha	‘big female gazelle’
	nihece	‘cold water fish’
	nikhuli	‘skin’
	nikhuwa	‘handle’
	nikota	‘kraal’
Manyika (S13a):	lidrimi	‘tongue’
	khondlo	‘mouse’
	tihlo	‘eye’
	vele	‘breast’
	khala	‘charcoal’
Ndau (S15a.):	gojo	‘mouse’
	disho	‘eye’
	banga	‘knife’
	dama	‘cheek’
	daku	‘buttock’

Nyanja (N31):	zino	‘tooth’
	bele	‘breast’
	khala	‘charcoal’
	khoswe	‘mouse’
	sisi	‘hair’
Nyungwe (N43):	batha	‘duck’
	thika	‘hyena’
	wuswa	‘grass’
	thawale	‘lake’
	tsuku	‘breast’
Sena (N44):	mbedenkale	‘cooking pot’
	phanga	‘murder’
	ngalamu	‘lion’
	ngagayiwa	‘pigeon’
	bemberuwa	‘butterfly’
Subiya (K42):	iyanza	‘hand’
	izulu	‘nose’
	izwi	‘knee’
	ipoosi	‘pumpkin’
	ikwiri	‘potato’
Swahili (G42) :	bata	‘duck’
	beberu	‘he-goat’
	embe	‘mango’
	fuzi	‘shoulder’
	goti	‘knee’
Mwani (G45):	fisi	‘leopard’
	lino	‘tooth’
	liwe	‘stone’
	likosi	‘back of the head’
	lilume	‘tongue’
Tewe (S13b):	gumwe	‘finger’
	thika	‘hyena’
	dako	‘buttock
	buwe	‘stone’
	phondo	‘knee’
Tswana (S31):	lephoi	‘dove’
	lengau	‘cheetah’
	lephutshe	‘pumpkin’
	leina	‘name’
	lee	‘egg’
Yao (P21):	disiimba	‘lion’
	diijani	‘monkey’
	disaamba	‘leaf’
	digoombo	‘banana’
	diipawa	‘lung’
Zulu (S42):	ibansi	‘hunting dog’
	ibhele	‘bear’
	igatsha	‘branch’
	igilebhisi	‘grape’
	igawulo	‘axe’

However, some of the languages considered above may exhibit other semantic categories in class 5 nouns not covered above. For instance, in Tswana there is also the category of nouns denoting national and tribal names of peoples of non-Sotho origin and that denoting people's characters in terms of habit, weakness or other peculiarity of character as seen in (2) below.

(2) Tswana (Mogapi, 1984:53)

a. Nouns of Nationality and tribal names of peoples of non-Sotho origin:

lekgoa	'White person'
leburu	'Afrikaner'
lejeremane	'German'
lejuta	'Jew'

b. Persons characterized by some habit, weakness or other peculiarity of character:

legodu	'thief'
letagwa	'drunkard'
legatlapa	'coward'
leferefere	'cheat'
lesole	'soldier'

Likewise, in Otjiherero some nouns in this class denote some natural phenomena as well as loanwords coming into the language as exemplified in (3) below:

(3) Otjiherero:

a.	eyuva	'sun/day'
	eyuru	'heaven/sky'
	ewe	'stone'
	ehi	'earth/soil'
b.	ekoiì	'cup'
	erambe	'lamp'

The diversity of the semantic categories of the class 5 nouns mirrors the fact that currently there is no class whose nouns belong exclusively to a particular semantic category.

Morphology of the class 5 prefix

Morphologically, the class 5 prefix shows different shapes in the various languages. In some languages, there are overt prefixes while in others the presence of the prefix is felt through some phonological manifestation on the initial consonant of the noun stem as summarized in the following table:

Table 1: Language groups according to the class 5 prefixes.

Proto-Bantu	**Prefixes**	**Languages**
**di-i-*	e-	Otjiherero
	i-	Subiya, Zulu
	li-	Makonde, Tonga, Tshwa, Changana, Rhonga
	le-	Tswana
	ri-	Changana
	di-	Copi, Yao
	ni-	Makhuwa, Lomwe, Chuwabu, Koti
	[+voice]	Kalanga, Manyika, Ndau, Tewe
	[+del rel]	Nyungwe
	Zero (∅)	Nyanja, Swahili, Kalanga
	[+glot constr]	Barwe, Gorongozi, Nyungwe

Table 1 above shows the variety of realizations of the class 5 prefix in some of these Bantu languages. This is not to say that there are no other allomorphs of class 5 prefix that are not included in this study either because the languages concerned are not part of this study or because the allomorph did not appear in our database.

According to the literature (Bleek, 1869; Guthrie, 1967-71; Meussen, 1967; Meinhof, 1899), the following are the possible reconstructions of the class 5 prefix:

(4) Bleek (1869): *di- or *li-
Guthrie (1967): *ị-
Meinhof (1899): *di-i-
Meussen (1967): *lì-

There are different interpretations that one can have of these differences. One is the fact that different languages have different realizations of the class 5 prefix, which may have led various scholars into deriving different reconstructed forms. Another possibility is that the class 5 prefix underwent so many and significant phonetic changes that it has become difficult to trace the original form. A third possible interpretation is that, since the reconstruction work by the different scholars is based upon certain languages or language groups; those languages usually

influence the results of the study. Thus, different scholars working on different linguistic regions on the reconstruction of a particular linguistic item may come to different results. However, by comparing what is seen in Table 1 to what is given in (4) above, it is reasonable to suggest that for a clearer understanding of what is going on in the class 5 prefix in Bantu, Meinhof (1899) should be taken as the reference point.

The phonology of the class 5 prefix

The data in Table 1 above suggest that what is seen in current Bantu languages results from the application of a series of phonological rules. We observe above that the class 5 prefix vowel is a high front one. However, as seen in some languages above, this vowel underwent some lowering process in some languages such as Tswana to become a mid-high vowel. As noted above, the class 5 prefix has various realizations in present Bantu languages even in those languages where its vowel is still [+high, +front], as illustrated in the following examples:

(5) **Glide formation**

Makonde:	ly-anda	'hand'
	ly-oyi	'smoke'
	ly-umi	'frog'
	ly-umiko	'lid'
Yao:	dy-aaja	'breast fruit'
	dy-oosi	'smoke'
	dy-uungu	'pumpkin'
	dy-uuva	'sun'

In these languages, the high front vowel in the prefix-final position may be sensitive to some phonological processes because of which it is realized as a glide when followed by another vowel. The glide formation rule that applies in Makonde and Yao is formulated below.

(6) **Glide formation rule:** $[+voc] \rightarrow [-voc] \; / \begin{pmatrix} \text{-------} \\ +\text{high} \\ +\text{front} \end{pmatrix} \; [+voc]$

The resulting palatal glide becomes part of the complex onset of the initial syllable in all the nouns exemplified in (5) above when the segment in the initial position of the noun stem is a consonant. Observe that sometimes, in languages like Yao, the initial consonant itself undergoes phonological processes like deletion in certain contexts, as illustrated in (7) below.

(7) Yao:

a. pa+dii-tala → peetala 'at the path'

b.	ku+dii-tala	→	kwiitala	‘to(wards) the path’
c.	mu+dii-tala	→	mwiitala	‘in the path’

The examples in (7) show that when the locative affix is prefixed to a class 5 noun in Yao, the consonant of the class 5 prefix undergoes deletion. As a result, other phonological processes such as coalescence of the augment with the prefix vowel, as in (7a), the gliding of the high back vowel as in (7b, c), take place. In both cases, the mentioned phonological processes are then followed by a rule called compensatory lengthening.

Apart from the phonological processes just mentioned, more profound changes determined the different shapes that the class 5 prefix assumes in the various languages. As was seen in Meinhof (1899), historically, the class 5 prefix was followed by an augment. In fact, this was the case with all noun prefixes in Bantu. Languages like Luganda, Zulu, Swati, just to mention a few, still show evidence of this feature. Presently, in some languages, like the ones just mentioned, metathesis occurred, that is, the prefix and the augment shifted positions as in the following examples:

(8)	Changana:	ri-gaga	‘green fruit’
		ri-tsontso	‘dog (type of ...)’
	Copi:	di-kwasa	‘tooth’
		di-jaha	‘young man’
	Koti:	n-laku	‘swing’
		n-ttawi	‘net’
	Makonde:	li-dodo	‘leg’
		li-bata	‘duck’
	Makhuwa:	ni-ino	‘tooth’
		ni-itho	‘eye’
	Tswana:	le-ina	‘name’
		le-uba	‘drought’
	Yao:	di-guluve	‘pig’
		dii-joka	‘snake’

In all languages where metathesis took place, another phenomenon occurred, vowel shortening. That is, instead of the expected lengthening of the prefix vowel, the latter is rather realized as a short vowel. Since the output of this process is the absence of the augment, one would think that the augment underwent deletion before shifting its position with the prefix, which is a wrong analysis as will be demonstrated later.

In other languages, the class 5 prefix underwent deletion and the augment turned into the prefix itself as it is the only element occupying the prefixal position, as shown in the following examples:

(9)		**Class 5**			**Class 6 (plural)**	
	Zulu:	i-sekela	‘assistant’	cf.	ama-sekela	‘assistants’
		i-sela	‘thief’	cf.	ama-sela	‘thieves’
		i-thambo	‘bone’	cf.	ama-thambo	‘bones’
		i-wele	‘twin’	cf.	ama-wele	‘twins’
	Otjiherero:	e-ho	‘eye’	cf.	oma-ho	‘eyes’
		e-ke	‘hand’	cf.	oma-ke	‘hands’
		e-tako	‘buttock’	cf.	oma-tako	‘buttocks’
		e-tambo	‘back’	cf.	oma-tambo	‘backs’

Note that only the class 5 prefix underwent deletion. As is seen in the corresponding plural forms, and all other classes, class 6 is just an example; the noun prefix does not undergo this phonological process of deletion.

In most languages though, the augment was deleted through vowel shortening as mentioned above and the prefixal position is occupied by the class prefix as follows:

(10)		**Class 5**			**Class 6 (pl.)**	
	Changana:	ri-luvana	‘swamp’	cf.	ma-riluvana	‘swamps’
		ri-bze	‘stone’	cf.	ma-ribze	‘stones’
		ri-fu	‘cloud’	cf.	ma-rifu	‘clouds’
	Copi:	di-lembe	‘year’	cf.	ma-lembe	‘years’
		di-kwasa	‘tooth’	cf.	ma-kwasa	‘teeth’
		di-danda	‘egg’	cf.	ma-danda	‘eggs’
	Tswana:	le-ina	‘name’	cf.	ma-ina	‘names’
		le-foko	‘word’	cf.	ma-foko	‘words’
		le-uba	‘drought’	cf.	ma-uba	‘droughts’

As is seen in the plural forms, the vowel shortening affected all noun class prefixes in these languages, and not just the class 5 prefix.

In certain languages like Yao, there was no shifting of the positions between the prefix and the augment. However, there is a situation where the occurrence, or not, of the augment is prosodically determined (Ngunga, 1997). That is, the class 5 prefix can include or not include the augment as illustrated in the following examples.

(11)	Yao:	a.	di-cidiko	‘salt-strainer (basket)’
			di-gonelo	‘sheath of a knife’
			di-kaaka	‘dried cassava’
		b.	dii-pe	‘elephant grass’
			dii-siku	‘day’
			dii-pepe	‘wall’

These examples demonstrate that the augment is deleted when the noun stem is at least trimoraic, as in (11a). In (11b), it is shown that when the noun stem is at most bimoraic, the augment is not deleted. This suggests that in this language, there is a minimality principle that the class 5 nouns must observe in order for them to be regarded as words, which is that the nouns in this class must be at least trimoraic.

An interesting surprise comes from Sesumbwa (Kahigi, 2003) where we learn that the augment and the prefix are in complementary distribution, as shown in the following examples:

(12) Sesumbwa (Tanzania):

a.	li-inso	'eye'
	li-ino	'tooth'
b.	i-haha	'lung'
	i-lunde	'sky'

These examples demonstrate that in Sesumbwa, the augment undergoes deletion when the initial position of the noun stem is occupied by a consonant. However, when a vowel occupies the noun stem-initial position, the augment performs the role of the prefix.

These phonological arguments justify our option to suggest **di-i-* (Meinhof, 1899) as the reconstruction to be considered in a study that seeks to understand the synchronic aspects of the class 5 prefix.

With these phonological considerations, it is considered that the conditions are met for the next discussion of the phonetic aspects of the class 5 prefix.

The Phonetics of the class 5 prefix

As was shown in Table 1, phonetically, the class 5 prefix exhibits the most diverse forms that a noun prefix can show. In some languages, the prefix which marks class 5 is just a zero morpheme. That is, instead of an overt morpheme affixed to the noun radical, the noun prefix undergoes deletion. As a result, the initial consonant of the noun stem may undergo some phonological processes such as deletion, voicing and aspiration. To explain this diversity, the Proto-Bantu prefix will be presented again as follows:

(13) Proto-Bantu: **di-i-*.

As is seen, in Proto-Bantu, the class 5 prefix comprises two parts, namely: the actual prefix (CV-) and the augment (-V-). In different Bantu languages, the phonetic features of the Proto-Bantu

consonant occurring in stem-initial position of what constitutes the class 5 prefix changes in different ways. In some languages, the [-nas] feature of the stop of the class 5 consonant prefix is replaced by the [+nas] feature, resulting in cases like the following:

(14)a.	Chuwabu:	ni-nto	'eye'
		ni-no	'tooth'
		n-cilo	'mouse'
	Lomwe:	ni-itho	'eye'
		ni-ino	'tooth'
		ni-khule	'mouse'
	Makhuwa:	ni-itho	'eye'
		ni-ino	'tooth'
		ni-kule	'mouse'
b.	Koti:	n-laku	'cheek'
		n-cepe	'hoe'
		n-limi	'tongue'

While in the languages in (14.a) the class 5 prefix vowel deletion is context-sensitive, in Koti, it is context-free. That is, apart from the deletion of the augment, the vowel of the prefix also undergoes an obligatory deletion, irrespective of the phonological context where it occurs.

In certain languages, such as those in S10 cluster (Guthrie, 1967-71), the presence of class 5 prefix is marked by voicing of the voiceless stop in noun stem-initial position (see Mathangwane, 1999; Nobre, 2004). This is what is seen in the following examples:

		[+voice] (cl.5)		**[-voice]**		
(15)	Kalanga:	bhalo	'bald head'	cf.	ma-palo	'bald heads'
		bhato	'buttock'	cf.	ma-pato	'buttocks'
		datha	'anthill'	cf.	ma-tatha	'anthills'
		debge	'leather blanket'	cf.	ma-tebge	'leather blankets'
		delele	'okra'	cf.	ma-telele	'many okras'
	Ndau:	banga	'knife'	cf.	ma-panga	'knives'
		badza	'hoe'	cf.	ma-padza	'hoes'
		bapiro	'wing'	cf.	ma-papiro	'wings'
		bendera	'cloth'	cf.	ma-pendera	'clothes'
		bonde	'sleeping mat'	cf.	ma-ponde	'sleeping mats'
	Manyika:	badza	'hoe'	cf.	ma-padza	'hoes'
		banga	'knife'	cf.	ma-panga	'knives'
		betepeswa	'butterfly'	cf.	ma-petepeswa	'butterflies'
		bonde	'sleeping mat'	cf.	ma-ponde	'sleeping mats'
		dako	'buttock'	cf.	ma-tako	'buttocks'
	Tewe:	badza	'hoe'	cf.	ma-padza	'hoes'
		banga	'knife'	cf.	ma-panga	'knives'
		betepeswa	'butterfly'	cf.	ma-petepeswa	'butterflies'
		buwe	'stone'	cf.	ma-puwe	'stones'
		dako	'buttock'	cf.	ma-tako	'buttocks'

We observe the absence of the devoicing of these consonants in the class 6 examples alongside.

Apart from the voicing feature above, in some languages, the presence of the class 5 can be traced through the [+glot constr] feature that marks the consonant in the noun stem-initial position. This is what is known as aspiration of the first consonant of the noun stem. Consider the following examples:

(16)

	[+glot constr] (cl.5)			**[-glot const.] (cl.6)**	
Nyungwe:	thanga	'pumpkin'	cf.	ma-tanga	'pumpkins'
	khoso	'mouse'	cf.	ma-koso	'mice'
	thika	'hyena'	cf.	ma-tika	'hyenas'
Nyanja:	khala	'charcoal'	cf.	ma-kala	'charcoals'
	khole	'cloud'	cf.	ma-kole	'clouds'
	khoswe	'mouse'	cf.	ma-koswe	'mice'
Sena:	phanga	'murder'	cf.	ma-panga	'knives'
	thako	'buttock'	cf.	ma-tako	'buttocks'
Gorongozi:	phutu	'cheek'	cf.	ma-putu	'cheeks'
	khutu	'ear'	cf.	ma-kutu	'ears'
	khosi	'neck'	cf.	ma-kosi	'necks'

That is, the deletion of the class 5 prefix causes the noun stem-initial stop consonant to acquire the feature [+glot constr] the same way as in other languages this consonant acquires the feature [+voice] as seen earlier. However, in some of these languages, if the stem-initial consonant is an affricate in class 5, this sound may change to become a fricative in the class 6 as demonstrated below.

(17)

	[+del rel] (cl.5)			**[-del rel] (cl.6)**	
Nyungwe:	tsamba	'letter'	cf.	ma-samba	'letters'
	tsuku	'breast'	cf.	ma-suku	'breasts'
	tsago	'pillow'	cf.	ma-sango	'pillows'
Sena:	tsamba	'paper'	cf.	ma-samba	'papers'
	tsuku	'breast'	cf.	ma-suku	'breasts'
Gorongozi:	tsamba	'letter'	cf.	ma-samba	'letters'

These examples show that the presence of class 5 prefix can also be marked by the features [+del rel]. In Nyungwe, we found one example that shows a phenomenon which is worth noting. It is a situation where the consonant in stem-initial position is a lateral, but becomes [-cont] when the class 5 prefix is deleted. The following is the only one example that we found in our database:

(18)	**[-cont] (cl.5)**			**[+cont] (cl.6)**	
Nyungwe:	dambe	'baobab fruit'	cf.	ma-lambe	'baobab fruits'

In other words, the /l/ in stem-initial position becomes [d] in class 5.

We would like to believe that an in-depth study of all Bantu languages might reveal more surprises as has been the case in this preliminary study.

Conclusion

This study intended to show that although a lot of work has been done on noun classes, the study of particular classes constitutes the key to the comprehension of this main characteristic of Bantu languages. In this sense, this study was an exercise intended to demonstrate the diversity of the class 5 prefix and to explain the factors that may have contributed to the growing number of allomorphs of this prefix. Thus, after such an analysis, it is correct to conclude that both the phonetic and phonological factors are the main elements that are responsible for the different realizations of the class 5 prefix in Bantu. However, as the study proceeds to consider other languages, it may suffice to find that other factors also come into play. However, from the preliminary results obtained so far, it is possible to organize these languages into six groups, according to the behavior or relationship between the augment and the prefix. Those group include namely: (a) those that deleted the augment and kept the prefix (most of Bantu languages); (b) those that deleted the prefix and kept the augment (e.g. Subiya, Zulu); (c) those that have the prefix and the augment in complementary distribution (e.g., Sesumbwa, which uses the prefix before vowel-initial stems, otherwise uses the augment; Yao which deletes the augment when the stem is at least trimoraic, otherwise keeps it); (d) those that deleted both the augment and the prefix and, consequently, the initial consonant of the noun stem underwent voicing in some languages (e.g., Kalanga, Manyika, Ndau, Tewe and other languages in S10 cluster (Guthrie,1967-71) and glottal constriction in others (e.g., Gorongozi, Nyanja, Nyungwe, Sena); (e) one language (in our data) showed evidence of hardening, that is, turning the lateral /l/ into stop [d], which can be interpreted as an example of the possibility of this change having occurred in some languages we did not come across either in our data or study; and finally, (f) there are those languages that simply did away with the class 5 noun prefix without leaving any trace of it in the noun structure, even though they still exhibit the agreement marker. That is the case in languages such as Swahili and Nyanja.

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SHEKGALAGARI AS A TONIC ACCENT SYSTEM

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ABSTRACT

Like many Southern African Bantu languages, Shekgalagari has often been viewed as a tone language because tone is used in this language to mark semantic and grammatical difference between words. This explanation is not completely satisfactory in itself. Quite interestingly, tone has been observed to differ sometimes even between grammatically/semantically related entities.

This paper adopts a mixed approach combining tone and accent to explain a somehow strange behaviour unaccounted for by an exclusively tonal approach. It uses Shekgalagari infinitive verbs to prove that dynamic tonic accent acts like magnets. It moves around to decisive positions which attract H-tones that are essential in determining the tonal pattern of words as they have the ability to spread from left to right to contiguous unaccented positions.

Key words: tone, accent, dynamic tonic accent, tone levels, the tone-bearing unit, contour tone.

Introduction

The earlier descriptive literature on Bantu prosodic systems offered two major models. This implies that, among these languages we find some which are more tonal following the model of Mandarin Chinese while others are more accentual in the manner of English. However, we do as well find languages that combine both of these prosodic characteristics to different degrees.

Carter's (1973) rule-based typology of Bantu prosodic systems proposes five development stages in the transition from essentially tonal languages to basically accentual languages. As reported in Clements and Goldsmith (1984: 4-5), this typology represents the following five developments from the primitive system:

i) 'Etymological' or 'clear tone' systems, which show a point-for-point correspondence with Proto-Bantu;

ii) 'reversive' systems in which H replaces etymological L and L replaces etymological H;

iii) 'tone doubling' systems in which a H tone is copied onto a following syllable;

iv) 'tone anticipation' systems in which a H tone is copied onto a preceding syllable;

v) 'displacement' or delayed realization systems in which basic H tone is realized on a tone-bearing element later than that with which it is lexically associated.

Like many Southern African Bantu languages, Shekgalagari has often been viewed as a tone language. This language uses tone to mark semantic and grammatical difference between words.

Though not wrong, this explanation is not completely satisfactory in itself. Tone has sometimes been observed to behave in a manner which the exclusively tonal approach cannot explain satisfactorily. McCawley (1970) already expressed a similar view in a paper entitled "Some Tonal Systems that Come close to Being Pitch Accent Systems but don't quite Make it".

The present article rekindles this idea in hypothesizing that the strict classification of languages between tone and accent systems is not entirely correct because languages form a continuum or a scale which has on one end *tonal systems* and on the other end *pitch accent systems* with intermediary degrees in between. Shekgalagari falls in this intermediary category of languages in which tone seems to undergo a clear influence of accent.

(1) e.g.

a)	go bîná	'to dance'	but	go bínísa	'to cause/help to dance'
b)	gô lwá	'to fight'	but	gó lwêlá	'to compete/fight for'
c)	gô wá	'to fall''	but	gó wêlá	'to fall on/at'
d)	go lêmá	'to plant	but	go lémîwa/lêngwá 'to be planted'/cultivate'	
e)	go bôná	'to see'	but	go bónána	'to see each other'
				go bônwá	'to be seen'

A mixed approach combining tone and accent is used in this paper to explain such a strange behaviour of tone that remains unaccounted for by an exclusively tonal approach.

For the sake of brevity and to adhere to space limitations, this paper limits itself to the examination on tone in infinitive Shekgalagari verbs to prove that dynamic tonic accent acts like a magnet. It moves around to decisive positions which attract H-tones that are essential in determining the tonal patterns of verbs by spreading from left to right to contiguous unaccented positions.

The approach used

This paper uses ***Autosegmental Phonology*** according to which phonological representation is nonlinear. Moreover, this approach posits that sequences of segments of the same nature are shown on separate tiers. Though seemingly innovative, this approach is reminiscent of the linear phonological representation in standard generative phonology (Chomsky & Halle, 1968) and in traditional descriptive models before it. The simultaneous realization of segments/elements forming separate tiers like tones and sounds is reflected through association lines.

Tone levels in Shekgalagari

Like most Bantu languages, Shekgalagari has two-tone levels including a **High tone** (shown with an acute accent mark) and **a Low tone** (which will not be marked for the sake of economy). These two tones are sometimes combined to form a **falling contour tone** (which will be indicated with a circumflex mark).

However, under certain odd circumstances, *a high tone occurring after a tonal melody fall is realized as* ***a down-stepped high*** which uninformed observers wrongly think of as a third tone level**.** Such a tone remains high, but not so high as the preceding high tone. On the other hand, a down-stepped high tone is remarkably higher than a Low tone. According to Bendor-Samuel, "the feature of down-step frequently occurs, with the high tone after the low tone being lower than the preceding high tone". Regardless of this relatively lowered pitch level as compared to the previous high, a down-stepped high tone never compromises its highness by accepting substitution with a Low tone. However, replacing a down-stepped high (indicated with ˬH in the examples below) with a high tone does not affect meaning, apart from the fact that it sounds somehow unusual to native speakers.

(2) e.g.

	L HLˬH	
a)	go qônà	'to be full to the point of being fed up with, e.g. food'
	L HLˬH	
b)	go lâbà	'to look at'
	L HL ˬH	
c)	go bônà	'to see'

	L HL↓H	
d)	go qôbá	‘to bend, touch one’s toe’
	L HL↓H	
e)	go bînά	‘to dance’
	L HL↓H	
f)	go râtsá	‘to vomit’[18]
	HL ↓H	
g)	gô zhwá	‘to get/go out’
	HL ↓H	
h)	gô lwá	‘to fight’
	L H HL↓H	
i)	go hékhyôgá	‘to change’
	L HHHL↓H	
j)	go thákáânyá	‘to mix’

The examples in (2) show that once the tonal melody drops in a word, it will never go as high as the H tone(s) before the tone drop in that word.

The Correct Autosegmental Representation

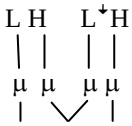
In agreement with the Autosegmental principles, successive identical tones are disallowed in a phonological representation. The foregoing examples should therefore be represented correctly as follows.

(3) e.g.

a) go qônά ‘to be full to the point of being fed up with, e.g. food’

[18] Not to be confused with

	L L L	
(1.6)	go ratsa	‘to wash’



b) g o l â b á ‘to look at/watch’

c) go bôná ‘to see’

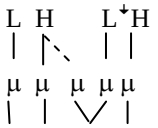
d) go qôbá ‘to bend, touch one’s toe’

e) go bîná ‘to dance’

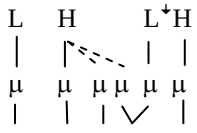
f) go râtsá ‘to vomit’

g) gô zhwá ‘to get/go out’

h) gô lwá ‘to fight’



i) go hékhyôgá ‘to change’



j) go t h á k á â n y á ‘to mix’

The tonal properties of morphemes in Shekgalagari infinitive verbs

The strangeness of the tonal melodies in the foregoing examples lies in the fact that ***the infinitive marker*** which is generally either high or low-toned in many Bantu languages displays a very capricious behaviour in Shekgalagari. Though it is most of the time L-toned (as in examples (4.e) to (4.k)), it does as well in a good number of cases appear with a H tone (as in examples (4.a) to (4.d)) and even sometimes with a falling (i.e. HL) tone (as in examples (4.i) to (4.q)).

(4) e.g.

Infinitive marker with a H tone:

a) gó bôlá ‘to rot’
b) gó bórîsá ‘to cause to rot’
c) gó rágôgá ‘to run’
d) gó râgá ‘to kick’

Infinitive marker with a L tone:

e) go shwélela ‘to be overwhelmed’
f) go shwá ‘to die’
g) go há ‘to give’
h) go gá ‘to draw water’
i) go sá ‘to burn’
j) go qóróla ‘to cough’
k) go góléla ‘to grow in/at/for’

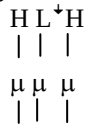
Infinitive marker with a falling tone:

l) gô ná ‘to rain/fall of rain’
m) gô dá ‘to come’
n) gô zhwá ‘to get/go out’
o) gô wá ‘to fall’
p) gô yá ‘to go’
q) gô nyá ‘to excrete’

What is interesting in the infinitive in (4.l to q) is that the falling tone co-occurs in this position with penultimate lengthening, a typical characteristic of Sotho-Twana languages to which Shekgalagari belongs.

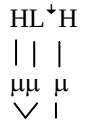
***The Infinitive Final Vowel or the Vowel Suffix /-a/*:** Though the data used might not be representative of the whole language, the fact that it shows a fifty-fifty frequency of occurrence of H and L tones is significant. It hints in the direction that the Shekgalagari FV bears a floating H which may be associated to the segmental tear or not. When a floating tone fails to get associated to any segment of the phonological tear, it deletes or remains invisible on the surface level, i.e. the pronunciation of the verbal word. It should also be remarked in the above examples that since the H tone of the FV occurs after a tonal fall, it is down-stepped, as mentioned earlier. This is a feature of Shekgalagari which can be confirmed in many Niger-Congo languages. A few frequent examples in Čilubà are given below to illustrate this observation. Because Čilubà is a tone reversal system in which H-tones are more frequent, only L-tones are marked in the following examples while H tones are not indicated for the sake of economy.

(5) e.g. in Čilubà



a) ditàma ‘cheek’

b) matàku ‘buttocks’



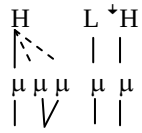
c) mê:nu ‘teeth’

d) mê:su ‘eyes’

e) mê:nyi ‘urines’

f) kufù:nda ‘to write’

g) ku là: la ‘to sleep’



h) muto:mbòka ‘ferocious’

The Verb extensions: In order to explain the tonal behaviour of infinitive verbs, all morphemes or formatives occurring between a verb root and the FV or Vowel Suffix have been included under this category since they tend to follow the same phonological rules. Such morphemes or formatives encompass all derivative extensions (such as the causative, the applicative, the reversive, the reciprocal or any other extension), the VC perfective and any fossilized extension regardless of whether its meaning may be traced in the language or not. Fossilized extensions are generally known to have a VC or VCVC syllabic configuration. In Shekgalagari as in many Bantu languages, verb extensions are toneless because they acquire their surface tone by H tone spreading. Otherwise, they are L-toned by default or H-toned by some phonological rules such as H-tone anticipation.

The tone-bearing unit in Shekgalagari

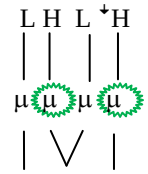
The theory of phonological domains related to that of invisibility which was discussed in a number of publications (Selkirk (1984), Kaisse (1985), Nespor and Vogel (1986), Hyman et al. (1987), among others, attempted to circumscribe the domain in which phonological rules apply. In the tonal field, however, in the light of data from various languages, linguists have, made the following interesting remarks. The domain of tone may be the phonological word (Edmondson and Bendor-Samuel 1966, Rowland 1959), the morpheme (Welmers 1962), the syllable (Pike 1948, McCawley 1964, 1970, Wang 1967), the mora (Trubetzkoy 1939, Jakobson 1937), and the segment (Schachter and Fromkin 1968, Woo 1969, Maddieson 1977). In the present case, I will

rather maintain that, though the domain of tone rule application depends on particular rules, the mora remains the Tone-bearing Unit in Shekgalagari since, as indicated in (3.i), (3.j), (8.g) and (8.h) a H-tone can spread to the first mora in a subsequent long syllable and leave its second mora untouched.

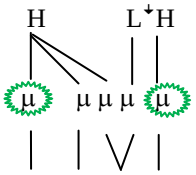
Evidence of the presence of dynamic tonic accent in Shekgalagari

In order to prove that in Shekgalagari H tones are attracted by tonic accent which moves about in the word, the examples given below are derived from the verbs that were listed in (3) above. The data show that tonic accent whose position is indicated by underlining is dynamic, as it does not always stay on the same mora regardless of the fact that the words in each set of examples are derived from the same root.

(6) e.g.



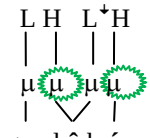
go q **<u>ô</u>** n **<u>á</u>** ‘to fill s.o./s.th. to the point of being fed up, e.g. with food’



but g**<u>ó</u>** q ó n ê g **<u>á</u>** ‘to be/become full to the point of being fed up with, e.g. food’

Though the Final Vowel remains accented in the derived form above, accent shifts from the root to the infinitive marker /go/ hence attracting the first H tone which subsequently spreads from left to right but fails to reach the second mora in the penultimate long syllable. This unassociated mora of the long syllable gets L-toned by default.

(7) e.g.



go l **<u>â</u>** b **<u>á</u>** ‘look at/watch’

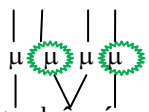
but go l**<u>á</u>**béla ‘to see s.o./s.th. at a distance’

go l**á**béga	‘to be/look presentable’
go l**á**bísa	‘to help/cause to look at’
go l**á**bána	‘to watch e.o.’
go l**á**bélela	‘to watch s.th./s.o. at a distance’

Here the first accent shows some stability by remaining in the same position in different verbs derived from *go lâbá* (to see). The H tone associates with it and may spread from left to right to any available position. As the Final Vowel has lost its accent in derived/extended forms, its H tone remains floating and ultimately deletes. The unassociated moras to which the H tone could not spread are L-toned by default. This comment also applies to the rest of the data.

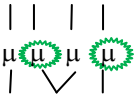
(8) e.g.

a) L H L ˈH



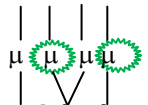
	go b **ô** n **á**	‘to see’
but	go b**ó**néna	‘to see s.th./on behalf of’
	go b**ó**néga	‘to lighten/make visible’
	go b**ó**nísa	‘to show/help to see’
	go b**ó**nána	‘to see e.o.’

LH L ˈH



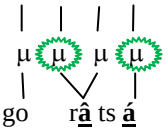
b)	go q **ô** b **á**	‘to bend, touching one’s toe’
but	go q**ó**béla	‘to bend at/towards’

L H L ˈH



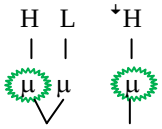
c)	go b **í** n **á**	‘to dance’
but	go b**í**néna	‘to dance for’
	go b**í**néga	‘to be danceable’
	go b**í**nísa	‘to cause/help to dance’

L H L ˈH

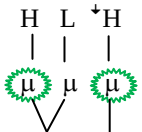


d)	go r**â** ts **á**	‘to wash’
but	go r**á**tsézha	‘to vomit on s.o./s.th.’
	go r**á**tsísa	‘to cause to vomit’[19]

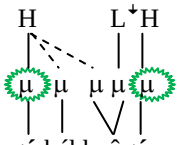
[19] but L L L



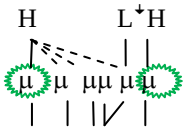
e) g**ô** zhw **á** ‘get/go out’
but g**ó** zhwêl**á** ‘to go out for/on behalf of’
g**ó** zhwîs**á** ‘to get out with’



f) g **ô** lw **á** ‘to fight’
but g**ó** lwêl**á** ‘to compete/fight for’



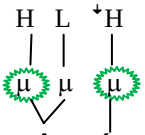
g) g**ó** hékhyôg**á** ‘to change’



h) g**ó** thákáâny**á** ‘to mix’

It should be remarked that in the representations above there is no violation of the Autosegmental ban on successive identical tones where a penultimate syllable with a falling tone is followed by a H-toned Final Vowel since the mora is the tone-bearing unit in Shekgalagari. The two H-toned moras are in this case separated by a L-toned mora, as indicated in the following representation.

(9)



a) g**ô** n **á** ‘to rain/fall of rain’
b) g**ô** d**á** ‘to come’
c) g**ô** zhw**á** ‘to get/go out’
d) g**ô** w**á** ‘to fall’
e) g**ô** y**á** ‘to go’
f) g**ô** ny**á** ‘to excrete’

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go ratsa ‘to wash’
gó rátsîzhá ‘to wash for’
gó rátsísa ‘to cause/help to wash’

Conclusion

From the previous discussion, one may conclude that:

i) The behaviour of tone in Shekgalagari infinitive verbs proves that dynamic tonic accent exists in this language.

ii) It acts like magnets which move around to decisive positions which attract H-tones that are essential in determining the tonal pattern of words.

iii) H-tones in this language have the ability to spread from left to right to contiguous unaccented positions.

iv) Unaccented syllables to the left of the accented syllables get L-toned by default.

v) Any L tone that remains unassociated after the mapping is considered as invisible to tone mapping and is deleted consequently.

vi) Though the FV is often H-toned, its tone is seen as a floating one since where it fails to associate, this H tone can be deleted.

vii) An unassociated H tone may hop to an accented position to the left by H tone anticipation. Once associated to that accented position, such a high tone can spread to the unaccented positions to the right like any other.

As already remarked in connection with other Bantu languages, the major weakness of this mixed approach remains that though it helps us to understand how HL melodies are mapped onto the verbal word and how tones spread, it still does not clearly show the exact location of the accented position in the verb.

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AN ELECTRO-PALATOGRAPHIC STUDY OF SHEKGALAGARI[20] PLOSIVES

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Abstract

This paper examines lingual-palatal articulatory characteristics of Shekgalagari plosives by means of electro-palatography (EPG). Qualitative and quantitative description is provided on the type and extent of articulatory movements for Shekgalagari stops and for the variations observable between the voice types. The results show that the voiceless aspirated stops have the greatest area of contact for all the three places of articulation; the unaspirated plosives also showing area of contact which is slightly greater than that of the voiced plosives. Furthermore, on average, the velar plosives show the least area of contact followed by dental plosives and lastly the palatal plosives. The findings of the experiment in this study are discussed in the light of constraints on the tongue during the production of sounds and in the light of the findings reported in the literature for similar studies in other languages. It was found that the difference in contact pattern between the stop types implies that the tongue has a slightly higher position for the voiceless stops than for the voiced ones, since the voiceless counterparts consistently showed higher percentage of on-electrodes, albeit marginally.

Keywords: Shekgalagari, electropalatography, plosives, lingual-palatal-contact, electrodes, maximum-contact

1.0 Introduction: Lingual-palatal contact patterns for the articulatory behaviour of segments

Different voice types of plosives and other sounds seem to have differing tongue-to-palate contact characteristics (cf., for example, Shimizu, (1990:48-52); Fujimura, Tatsumi and Kagaya, (1973) and Kochetov (2012) *on Japanese*, Kang, (1997:19 *ff.*) on *Korean affricates and fricatives*; Shin (1997) on *Korean stops and affricates*), and Kochetov & Colantoni, (2013) in Spanish liquids. For example, Shimizu (1990:52) observed that for the Japanese /ta/ and /da/, '/ta/ shows a greater contact area than /da/, and the duration of maximum contact is longer in /ta/ than in /da/.' Similar observations were made by Fujimura, Tatsumi and Kagaya (1973:53) whose

[20] This is a Southeastern Bantu language of the Western Sotho-Tswana group spoken (mostly) in Botswana.

comparison of palato-lingual contact patterns for [t] and [d] in Japanese showed some correlation between the degree of contact and the duration of closure, and that the distinction between contact patterns for these stops may be 'characterized by different program values in one control dimension, which may be labelled as tense-lax.' A recent study by Kochetov (2012) showed that the duration of geminate stops was approximately twice that of the single cognates. "On average, the duration of single /t/ and /k/ was 68 msec and 65 msec, while the duration of their geminate counterparts was 143 msec and 147 msec, respectively."(Ibid: 2012:1). Furthermore, geminate stops also showed a greater degree of linguopalatal contact compared to single plosives. Kotchetov (2012: 2) further observed that variation in duration between Japanese geminate plosives and their single cognates stops "can be accompanied by differences in the degree of contact. The longer geminates tend to be articulated with a tighter constriction, compared to the shorter and weaker-articulated singletons."

For the Korean affricates, Kang (1997:19-20) observed that, compared with the aspirated and the so-called 'tense' affricates, the lax type showed lesser tongue-to-palate contact area and that this difference appears 'to be a common feature of the stops and affricates.' Similar observations were made by Shin (1997) for Korean stops and affricates.

Kochetov & Colantoni, (2013) examined the articulation of Spanish nasal-liquid sequences using EPG. The analysis of C1 and C2 showed that "nasals had a more retracted and partly deocclusivized constriction before /r/, and a lowered tongue dorsum before both /r/ and /l/" (Ibid: 2013:1).

2.0 Instrumentation, recording conditions, data and subjects.

2.1 Instrumentation: electro-palatography (EPG)

Electro-palatography is a non-invasive technique used for examining contact patterns between the tongue and the hard palate as well as recording the timing of these contacts in speech. The EPG system developed in Reading system is the one used in this study.

EPG technique in general uses a made-to-fit, thin artificial palate made from acrylic, with built-in gold or silver electrodes exposed to the surface of the tongue as contacts. The Reading system in particular uses 62 silver electrodes (Hardcastle, *et al*. 1989), prearranged in eight horizontal rows

based on the anatomical divisions of the hard palate.[21] The front row carries six electrodes, and the rest eight.

These electrodes conduct electricity when contact between the tongue and the palate occurs. They thus detect lingual-palatal contact. In speech analysis, this makes it necessary for the sounds being studied to have considerable (or measurable) amount of tongue-to-palate contact. The signals resulting from lingual-palatal contacts are then electrically processed, displayed on a monitor or printed out for inspection, or they could be saved on a PC for future analysis. The displays or printouts appear in the form of stylized frames of the artificial palate, and show details of how lingual-palatal contacts vary in time (msec), with a specific time interval (10 msec) between two adjacent frames.

EPG frames provide detailed information about spatio-temporal properties of sounds which could otherwise be difficult to extract from acoustic information alone (Hardcastle, *et al*. 1989: 13). This includes, for instance, qualitative analysis of the extent of frontness of an articulation—determined on the basis of the number of the most front row of the frame on which contact is registered, and of the degree of closeness of an articulation—the sum of contacts in any given row(s) (Ibid.). Simultaneous processing is especially crucial when synchronizing the activity of the tongue in the mouth with that of other articulatory or phonatory activities elsewhere, for instance, in the larynx[22].

[21] It must be mentioned that these divisions of the palate, far from being standard, actually differ from author to author.

[22] Like all analytical instruments, it must be mentioned that there are shortcoming involved in using the EPG technique. These include, for instance, the inability of the technique to provide information about the part of the tongue involved in a particular contact pattern, the impossibility of assuming continued closure where two juxtaposed electrodes register contact, lack of and only partial accessibility to post-velar and velar articulations respectively and the possibility of the technique interfering with the natural production of speech.

EPG only records a signal indicating lingual-palatal contact. It does not give information with regard to the part of the tongue responsible for producing a particular contact pattern. This information has to be extrapolated from the place and timing of contact accompanied by the knowledge of the structure of the tongue. For some parts of the palate, the reliability of deducing information in this way may be reduced considerably. For example, when contact is made with a point forward of the alveolar ridge, it is not easy to determine whether it was made with the front or tip of the tongue.

Another shortcoming relates to the fact that electrodes on the artificial palate are isolated and distanced from each other—making it hard to interpret whether contact in two adjacent electrodes indicate unbroken tongue-palate contact. An example may be, for instance, the lateral approximant /l/ for which two neighbouring electrodes at the side of the palate may register contact, though the articulatory closure may, in fact, be incomplete.

The artificial palate can only go back as far as the junction between the hard and soft palates. Beyond that, it introduces discomfort. This means that the technique is not accessible to articulation posterior to the velar place. Sounds produced in the region posterior to the velar place, e.g. uvular sounds, simply cannot be analyzed using EPG. Velar sounds can be investigated. However, this investigation 'may be incomplete, and analysis of results of these articulations must take this factor into account' (Connell, 1991: 74).

The EPG technique is thus useful in the study of the spatio-temporal dynamics of tongue-palatal contacts in the mouth, and can provide detailed information on this aspect that would not otherwise be obtained through acoustic investigation only.

Figure 1 shows the Reading artificial palate similar to the one used in this study and an accompanying model showing the positions of the electrodes when an informant wears the artificial palate during the recording.

Figure1: The Reading EPG artificial palate similar to the one used in this study, and the plaster impression showing the position of the electrodes in the mouth (Hardcastle, *et al*. 1989: 3)

2.2 Recording conditions, the data and the informant

The electrodes mounted on the artificial palate are connected to lead-out wires, which come out of the corners of the informant's mouth to connect directly to a computer which in turn stores data continuously during the recording. This data can then be analyzed in real time or stored for future processing. In this study, the data was sampled at a rate of 300 frames per second, and the

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The other point relates to the possibility of the technique interfering with the natural production of speech, since it involves the attachment of a foreign object to an articulator. In fact, subjects tend to salivate excessively in reaction to this, which in turn affects the acoustic properties of sounds being studied. In order to offset this problem, consultants are often required to wear the palate for some time, ideally, between 2 and 4 hours, before the recording. This should help to familiarize them with a foreign object in the mouth. In order to detect whether speech has been affected in any way, control measures are often taken, and these involve spectral analysis of data with and without the artificial palate (Connell, 1991; Hardcastle, *et al.* 1989).

One way in which analysts attempt to overcome the above-mentioned shortcomings is to do simultaneous analysis of data in tandem with EPG, for instance, processing the laryngeal component, analyzing the acoustic signal and conducting aerodynamic investigation. In this way, 'a more comprehensible picture of articulatory activity than is possible with EPG alone' (Hardcastle, *et al.* 1989) can be built up. Such attempts have been made by Connell (1991), for instance. See also Hardcastle *et al.* (1989) and the references listed there.

interval between the frames was approximately 3.3 msec. A simultaneous audio recording was also made to aid later identification of the target sequences on the EPG frames. A digital audio recording was made into one channel of a Sony Digital Audio Tape Deck using a SHURE microphone 515 SD UNIDYNE B through a MaPLIN MPX-55 mixer/preamp. The waveform displays and spectrogram were computer displayed using Loughborough Sound Images Speech Workstation (LSWISW) software on a PC 686 MX 233 MHz Pentium 24 Megabytes of RAM. A sampling rate was 20 kHz. To synchronize the simultaneous recordings, a reference signal was made before each group of utterances by tapping a ruler on a desk, thereby enabling the two time scales to be matched using the tap as the starting point.

Data recorded for analysis consisted of a list of 81 words of the form CV***C***VCV:CV[23] produced in isolation, where the target C could be [t^h, t, d/ c^h, c, ɟ/ k^h, k, g], and the flanking vowels could be [a, i, u]. For the relevant VCV sequence, all possible combinations of the stop and vowels were employed. Nonsense words were used where meaningful ones could not be found or generated. The target stop was in the antepenultimate syllable, which was suitable for controlling the effect of penultimate lengthening, if any. There was no effort made to control tone since this would have made the generation of meaningful words for all data almost impossible. The list was read five times, giving a total of 405 words, at a normal speaking rate, on the same day by one female speaker of the Shengologa dialect of Shekgalagari, who served as the informant.

3.0 Processing

3.1 Divisions of the palate

Figure 2 shows a representation of a stylized EPG palate frame printout.

[23] Shekgalagari, like all South-eastern Bantu languages, has typical penultimate length (:).

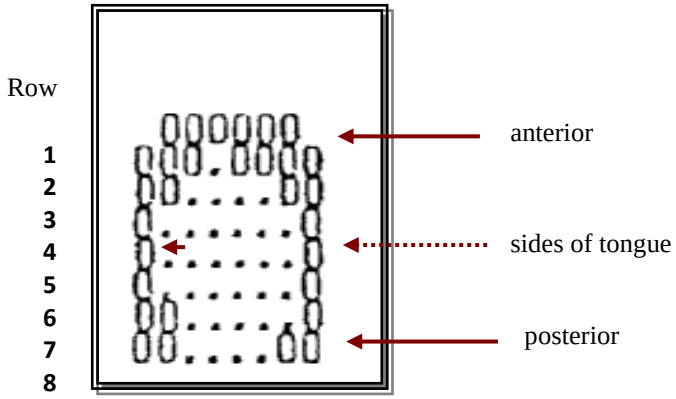

Figure 2: Stylized EPG frame printout (Hardcastle, 1989: 7)

The electrodes are arranged in eight horizontal rows. The front row carries six electrodes, and the rest eight. The 0s indicate contact between the palate and the tongue, and reflect electric conductance as the circuit is completed by this contact. In order to see the overall shape of contact—which region has more contact, and how long the main constriction lasts, over time—the palate can be divided into regions, and this differs from author to author. A detailed discussion of the different divisions of the palate by different authors may be found in Shin (1997:70-74).

In this study, a four-way division of the palate with rows 1-3 corresponding to the alveolar/dental place of articulation, row 4 to post-alveolar, 5-7 to the palatal and row 8 to the velar region is adopted. This is shown in Figure 3.

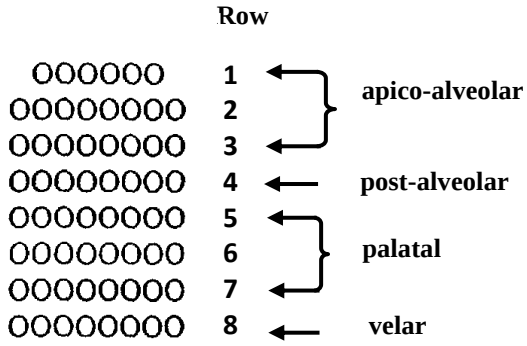

Figure 3: Divisions of the EPG printout adopted in this study

This division was chosen because, from initial observation, the dental stops showed constriction at rows 1 to about the 3rd or 4th, palatal constriction occurred between rows 4 and 7 and velar from around row 7 to 8. Since the artificial palate can only go as far as the division between the soft and hard palate, uvular stops, which are produced beyond the velar place, cannot be used in this study, or for that matter in any study using the Reading artificial palate.

3.2 Criteria for analyzing contact pattern and area

The contact pattern for stops is often described by observing lingual-palatal characteristics at Maximum point of Contact (MC). In order to determine the area of contact for different segments, the number of on-electrodes is counted at MC as well as the differences in frequency of contact for segments. As would be expected, this varies with repetitions of the target token, both when the context is the same and when it is different. A number of proposals have therefore been made regarding how to analyses and represent tongue-palate contact. Shin (1997: 59) groups these methods into three broad classes: the cut off method, the frequency representing method and the average representing method, and these are elaborated on in Shin (1997).

In this study, in addition to the conventional method of counting the number of on-electrodes in the production of a stop at maximum contact, we follow Shin (1997) in extending Farnetani (1990)'s method of 'tongue profile figures.' This method was originally used to study and quantify co-articulation and to present it graphically. Here we extend it to analyses tongue-to-palate contact pattern and area for the plosives. The results are presented graphically, and in this

way variation between the different voice types for the stops—in terms of lingual-palatal contact patterns, tongue configuration and susceptibility to co-articulation, may be clearly seen.

According to Farnetani's method, a percentage for the electrode activation per row is calculated in the following way:

Formula (1) X/Y * 100 =Z%

In formula (1), X is the number of on-electrodes in each row; Y is the total number of electrodes in that row and Z is the activation percentage for each row. A tongue profile graph visualizing tongue contact pattern and area for each voice type may then be plotted using the percentage activation value calculated using formula (1). The procedure for calculating activation percentage and the associated graph are illustrated in Figures 4 (a) and (b) respectively.

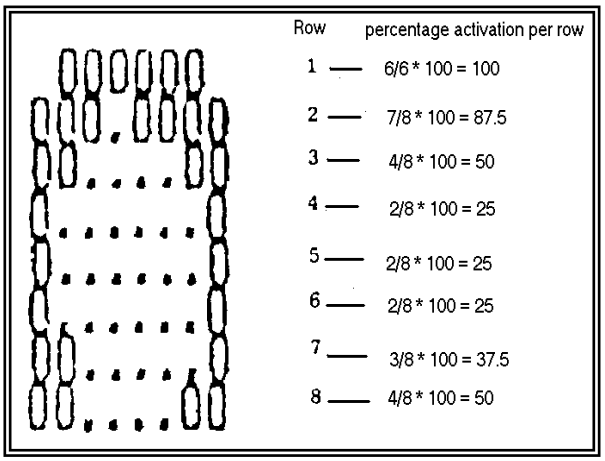

Figure 4 (a): Procedure for calculating activation percentage

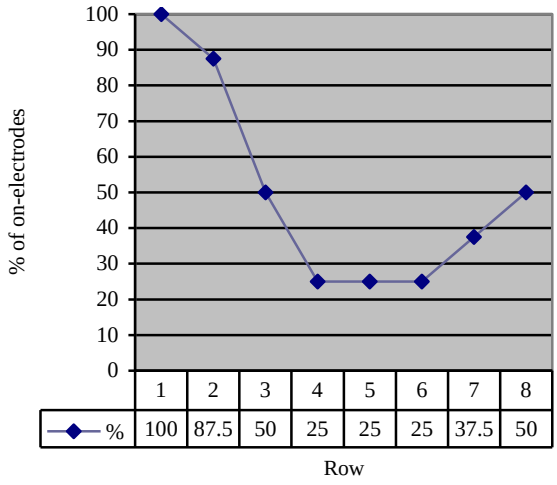

Figure 4 (b): Graph showing tongue contact profile at MC for a hypothetical segment

Figure 4 (b) graphs a tongue profile visualizing tongue contact pattern and area for the hypothetical segment shown by the EPG frame in Figure 4 (a). The profile was plotted using the percentage activation values calculated in Figure 4 (a). The place (row(s)) where the main stricture occurs is indicated by a high percentage of on-electrode activation. This high percentage of electrode activation will extend over a number of rows where the segment being produced has a longer constriction length. In figure 4 (b), the main constriction happens on row 1, and does not extend further to any other row. This could indicate that the segment being produced is considerably short, both spatially and temporally.[24] Contact area is the portion below the line and this may be calculated by adding up the Y-values below the line for each row.

In addition to visualizing the pattern and area of contact for the target stops as well as the differences between them for the different voice types in a Figure like 4 (b), we may also infer information about the shape of the tongue during the production of the stop. Assuming that the part of the tongue that lies directly below any part of the hard palate is the one that makes contact

[24] In this particular case, brief duration is shown by complete closure happening in one row, but complete closure could happen over several rows and still be of short duration. It is also possible to suggest that brief duration could be related to relative speeds by different parts of the tongue. The tongue tip in this case makes complete closure, and this part of the tongue moves relatively faster than the body of the tongue, producing contacts of relatively shorter duration than those made by the body of the tongue.

with the part of the palate directly above it, several inferences could be made. If a constriction extends over several rows for a stop, it could indicate either longer constriction length (i.e. spatial aspects of tongue contact), or, where the same pattern of on electrodes is observed over several successive frames, longer temporal duration. Different voice types have been observed to have different constriction lengths and temporal durations: with the voiceless stops tending to manifest relatively longer constriction and duration than the voiced stops (Shin, 1997; for Korean stops and affricates). It can therefore be inferred that for the voiceless stops, the tongue remains raised towards the roof of the mouth for a relatively longer period.

Place of articulation may also contribute to the configuration of the tongue. In stops produced at the palatal place where the centre of the tongue articulates with the hard palate, the tongue configuration may be inferred to be more convex than stops produced at other places of articulation.

4.0 Results

Spatial characteristic patterns for the plosives: voice types and place of articulation

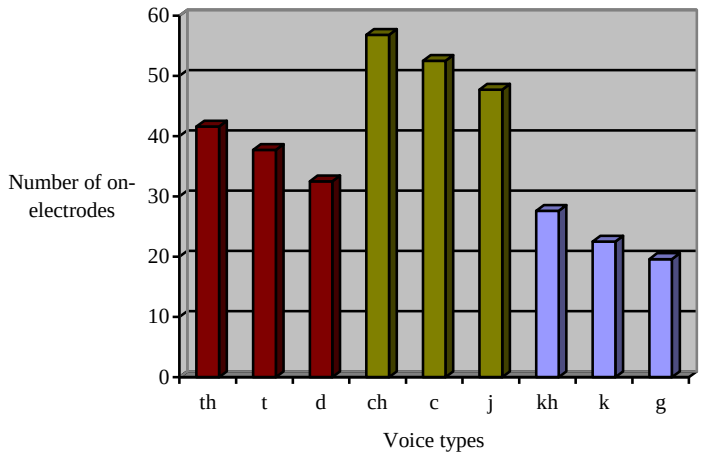

Figure 5: The mean number of on-electrodes at MC for the different voice types for the stops across vowel contexts by place of articulation

Voice types:

(a) Number of on-electrodes at MC. Following the conventional method, the number of on-electrodes at MC was counted and averaged across repetitions and vowel contexts for the different voice types of the plosives and by place of articulation. The results are plotted on Figure 5.

Each bar in Figure 5 represents an average of 45 tokens. It can be seen from Figure 5 that the contact area is different for the different voice types, with the voiceless aspirated stops showing the greatest area of contact for all the three places of articulation, the unaspirated stops also showing area of contact that is slightly greater than that of the voiced stops. In addition, on average, the velar stops show the least area of contact followed by dental stops and lastly the palatal stops, which have a greater area of contact than the stops produced at other places of articulation. The average numbers of on-electrodes at MC across the voice types by place of articulation are: palatal = 52.3, dental = 37.3 and velar 23.2.

(b) Voice types: lingual-palatal contact profile—percentage of on-electrodes. Percentages of on-electrodes for the voice types were calculated across vowel contexts in a straightforward way as explained earlier (see formula (1) above), and a tongue contact profile graph was plotted on Figure 6.

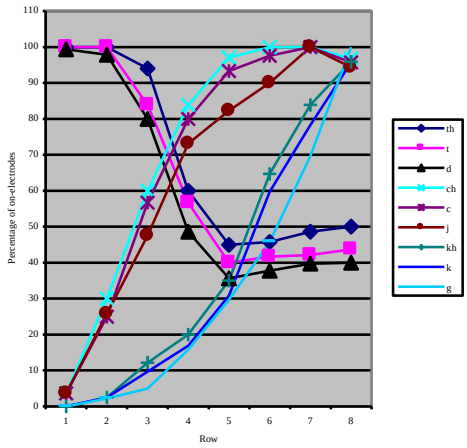

Figure 6: Tongue contact profile: Average percentages of on-electrodes at MC for the stops across vowel contexts, by voice types and places of articulation

As was pointed out earlier, this graph helps us to see how the voice types vary in contact pattern. The three types of stops are produced with different overall contact pattern as can be seen in the figure. According to Figure 6, and at least for the subject of this study, [t] and [d] show most contact in rows 1 and 2, suggesting that lingual palatal contact for these stops is made with the blade/tip of the tongue articulating with the region of the palate around the alveolar ridge and forward. The results in this study help only this far, but there has been a discrepancy in the past with respect to place of articulation for these stops in Shekgalagari, with some authors such as Doke (1954) describing them as alveolar stops whilst others thought they were dental stops. Therefore, in addition to the information provided by EPG, and since the author of this paper was the subject of the study, she also noted that for most of the data containing these stops, the anterior part of the tongue was felt to be constricted against the buccal surface of the front teeth. This appears to suggest that these stops are more likely to be dental stops rather than alveolar, and thus agree with Dickens (1986a, 1987), and Andersson and Janson (1997).

As will be noted for the other articulatory types, the voiceless aspirated stop [t^h] shows higher percentage of on-electrodes than the other two, and there is a weak trend for the voiceless counterpart [t] to show slightly higher percentage of on-electrodes than its voiced cognate [d]. A similar situation was observed for Japanese (Shimizu 1990:52). Both the aspirated and unaspirated voiceless stops recorded the highest percentage of on-electrodes, i.e. 100%, on rows 1 and 2. However, the aspirated cognates recorded a percentage of over 90 on the third row, whilst their unaspirated counterparts recorded a percentage that was below 80. On average, the highest number of on-electrodes, i.e. maximum contact, extended over 11 to 12 frames for the aspirated stops, 8 to 9 for the unaspirated stops and 6 to 7 for the voiced stops.

Compared to the other stops in this study that had slightly more number of frames for MC, this appears to suggest a relatively short constriction duration for dental stops. This may be expected since the front part of the tongue is relatively faster than other parts of the tongue. In addition, for these stops, and at least in this study, the percentage of on-electrodes starts to rise again from the fifth row. This may be attributed to the influence of vowels on the back part of the tongue, which appears to be more sensitive to vowel context, particularly of back vowels (Monaka, 2001:203-208).

The palatal stops [c^h], [c] and [ɟ] show the highest percentage of on-electrodes with full contact being made (mostly) on row 7, suggesting more tongue dorsum contact with the palate. Although the highest percentage of on-electrodes is especially on row 7 for the palatal

stops, it can be seen from Figure 6 that the rise in the percentage of on-electrodes begins at around row 3. This appears to suggest that, in terms of place of articulation, the palatal stops have a bigger constriction, being produced with contact being made from around the post alveolar region to the most back part of the hard palate. In addition, taking into consideration the fact that they are made with mostly the middle part of the tongue/tongue dorsum, it possibly takes a relatively longer time to build the constriction. Thus, the palatal stops appear to have long constriction, both in terms of front-to-back place contact and of time. In is interesting to note that MC for these stops on average tended to extend over a number of frames in this way: the aspirated stops: around 15 to 16 frames; unaspirated: around 13 to 14 and the voiced stops around 11 to 12 frames; thereby appearing to confirm the long stricture and time factors just mentioned. As will be observed below, this would suggest that the tongue remains raised in the oral cavity for a relatively longer period, leading to a relatively constricted oral cavity. In terms of airflow, a constricted oral cavity means that trans-glottal air pressure takes a little while to develop and sustain vocal fold vibration, which in turn leads to delayed onset of voicing for the next vowel. This seems to support the observation in the acoustic analysis where longer Voice Onset Time (VOT) values were obtained for palatal stops than for stops produced at other places of articulation (Monaka, 2001:146-154).

The highest percentage of on-electrodes for the velar stops is in row 8, suggesting that it is the tongue dorsum that articulates with the palate[25], and the length of constriction does not appear to be as long as that of the palatal stops, both in terms of place and time. The voiceless aspirated stop [k^h] marginally shows higher percentage of on-electrodes than the unaspirated cognate, and the voiced stop [g] shows the lowest percentage of on-electrodes compared with the other two. The average number of frames over which MC extended for the velar stops was as follows: frames for the aspirated stops were on the order of 12 – 13, the unaspirated; 9 – 10 and the voiced stops; 6 – 7. Interestingly, the average number of frames over which MC extends for the velar stops in this study is very much similar to those for the dental stops, in spite of the dental stops having larger contact area than the velar stops. In fact, for the voiceless stops, the velar stops appear to have marginally more frames than the dental stops. It will be proposed below that this could be related to the relative speeds of the different parts of the tongue, where velar articulations have relatively slower articulatory speed and therefore maintain tongue-velar contact for a relatively longer time than the dental stops.

[25] It should be noted that the artificial palate can only go as far back in the mouth as the junction between the soft and the hard palate, and it is possible that part of the articulation for the velar stops may be missed out.

We also may infer information regarding the shape of the tongue during the production of the stops by observing Figure 6. The difference in contact pattern between the stop types implies that the tongue has a slightly higher position for the voiceless stops than for the voiced ones across all the three places of articulation, since the voiceless counterparts consistently showed higher percentage of on-electrodes, albeit marginally.

With respect to place of articulation, it can be seen from Figure 6 that the pattern of contact for the stops appears to be different for different places of articulation. The palatal place shows the greatest area of contact, with full contact being formed in row 7, which appears to be maintained for a relatively longer time. The velar place shows the least lingual velar contact area, shown only on one row, row 8. We may deduce that for the palatal and velar stops, the tongue seems to be in a convex shape and remains so for a relatively longer period for palatal stops than for velar stops. According to Figure 6, it appears that the tongue shape is concave for the dental stops in this study. For these, the main constriction extends over only one front row (row 1), and remains for the most part on row two and is dramatically lost afterwards. It was mentioned earlier that the configuration of the back part of the tongue appeared to be more sensitive to the influence of back vowels, and not necessarily as part of the production of the relevant stops.

5.0 Conclusion

The aim of this paper was to examine articulatory characteristics of Shekgalagari stops by means of electropalatography (EPG), providing qualitative and quantitative description of the type and extent of articulatory movements for Shekgalagari stops and for the variation observable between the voice types. It was observed that contact area is different for the different voice types, with the voiceless unaspirated stops showing area of contact that is slightly greater than that of the voiced stops. With regard to place of articulation, the velar stops showed the least area of contact followed by dental stops and lastly the palatal. The difference in contact pattern between the stop types implies that the tongue has a slightly higher position for the voiceless stops than for the voiced ones, since the voiceless counterparts consistently showed higher percentage of on-electrodes, albeit marginally.

With respect to place of articulation, the pattern of contact for the stops appears to be different for different places of articulation, with the palatal place showing the greatest area of contact, followed by the dental place. The velar place shows little lingual palatal contact. It may be deduced that for the palatal and velar stops, the tongue seems to be in a convex shape and

remains so for a relatively longer period for palatal stops than for velar stops. It appears that the tongue shape is concave for the dental stops in this study, although the back part of the tongue may be raised due to the influence of back vowels, and not necessarily as part of the production of the relevant stops.

Data: Articulatory analysis ~ electropalatography

EPG Data
Stops in symmetrical vowel contexts

a~a
Apico-alveolar

ma**t**apoːle	'potatoes'
ma**d**aleːŋ	nonsense word which could mean 'to the old man'
ma**tʰ**areːŋ	locative word for branches

Palatal

pa**c**aχaːna	'be bound together'
ma**ɟ**aqɔːŋ	'gone to sojourn/where people to sojourn'
ma**cʰ**acʰɛːŋ	locative word for problems

Velar

ra**k**anɛːna	'meet/meet for each other'
ma**g**anɔːŋ	nonsense word
ma**cʰ**anɛːŋ	locative word for small trees

u ~ u
Apico-alveolar

bu**t**uruːŋ	'at the sour milk — meaning gone for the / to collect sour milk'
qu**d**uquːdu	onomatopoeic word for eating fast and swallowing noisily.
su**tʰ**uloːχa	to appear suddenly, especially from hiding

Palatal

ru**c**ɛʃɛːla	'be educated for — (someone or something)'
mu**ɟ**uteːŋ	'to the Jew'
mu**cʰ**usiːŋ	locative word for helper

Velar

ru**k**ulɛːla	'de-seed/remove the seeds on the melon for (someone /something)
mu**g**uruːŋ	nonsense word
mu**kʰ**ukʰuːŋ	locative word for small hut

i ~ i
Apico-alveolar

bi**t**ibiːti	nonsense word which could mean a trick

qi**d**iqiːdi onomatopoeic word for eating fast and swallowing noisily.
si**tʰ**imɛːla to disappear suddenly, especially into hiding

Palatal
ri**c**ibaːla ‘calm, be calmed’
bi**ɟ**esoːŋ locative word for stuff traditionally believed to be used for bewitching’
bi**cʰ**itʰɛːla (they are) struggling for

Velar
bi**k**iriːŋ ‘at/gone for/to collect a traditionally made tin mug/ locative word’
bi**g**iriːŋa nonsense word
bi**cʰ**ipʰɛːŋ locative word for T-shirts

Stops in asymmetrical vowel contexts

a ~ i

Apico-alveolar
ma**t**imɛːla ‘strayed cattle’
ma**d**ikɛːla nonsense word
la**tʰ**ibɛːla nonsense word which could mean the sun becoming overcast with clouds

Palatal
la**c**iseːʒa ‘to follow on the trek (of something/someone) for (something/someone)
ba**ɟ**ibaːzɔ ‘the people who eat it (food)’
χa**cʰ**ibɛːla the sun becoming overcast with clouds

Velar
ba**k**isaːna ‘cause each other to never repeat the same mistake again/ to hurt someone in a non-forgettable way’
ma**g**iriːŋ ‘at the spot where the markings of someone or something’ sudden stop are visible on the ground/ locative’
ba**cʰ**ibaːna name of the people living in a particular ward

i ~ a
Apico-alveolar
ri**t**alɛːŋ ‘starving, being in hunger, going through a period of hunger because of lack of food’
ri**d**aqaːqo ‘they, e.g. goats, are coming on the other side’
bi**tʰ**arɛːŋ locative for tress

Palatal
bi**c**alaːla ‘to flatten oneself on the ground behind e.g. the bush in an attempt to hide’
ri**ɟ**arɛːŋ ‘in years (past, present or future)’
i**cʰ**aciːsɔ (person, etc. who) solicits love, admiration

Velar

ri**k**aχaːna	‘surround’
ri**g**agɔːχa	‘be burnt by the fire on the surface’
i**k^{h}**idɛːla	

a ~ u

Dental

ma**t**uruːŋ	‘at/ gone to where there is a lot of a variety of sour milk/ lots and lots of sour milk/locative word for sour milk’
ma**d**upuːlɔ	‘marks or wounds indicating where someone was hit’
a**t^{h}**ulɛːla	nonsense word

Palatal

a**c**upuːχa	‘someone/something falling from a considerable height and hitting the ground with a loud painful bang’
a**ɟ**upuːχa	‘someone/something falling from a considerable height and hitting the ground with a loud painful bang’
ba**c^{h}**usiːŋ	locative word for helper

Velar

ma**k**ukaːna	‘water container, often used for carrying water on the backs of donkeys’
ma**g**upuːŋ	nonsense word
ma**k^{h}**ubuːŋ	locative word for hills

u ~ a

Dental

bu**t**aχaːna	‘to break something’
mu**d**apɛːlɛ	‘first born/ one who comes arrives first’
su**t^{h}**asuːt^{h}a	to dust/clean

Palatal

cu**c**acuːca	‘to burn with a flicker, especially when the fire is having difficulty burning’
mu**ɟ**abɔːʃ^{w}a	‘the heir’
p^{h}u**c^{h}**ap^{h}uːc^{h}a	to pack

Velar

su**k**aχaːna	‘be crowded’
su**g**aχaːna	nonsense word
su**k^{h}**aχaːna	nonsense word

i ~ u

Apico-alveolar

ri**t**uriːtu	‘lots of houses/huts’
bi**du**luːχa	‘suddenly come out a hiding place’
si**t^{h}u**lɔːχa	nonsense word

Palatal

bi**c**ulɔːŋ	'to/at gone for the chairs'
bi**ɟ**uχ^{w}aːna	nonsense word
bi**c^{h}**uleːχa	something that can be hit

Velar

ri**k**ukuːŋ	'locative word for fat cakes'
mi**g**upuːŋ	nonsense word
ri**k^{h}**uk^{hw}aːna	beetles

u ~ i

Dental

mu**t**imɛːri	word improvised from Setswana meaning a lost person
mu**d**ikɔːŋ	nonsense word
mu**t^{h}**ibɛːlɔ	nonsense word

Palatal

cu**c**iseːz̧a	'light the fire for'
lu**ɟ**ikɛːlɔ	nonsense word
mu**c^{h}**ibɛːri	herdsman

Velar

su**k**iriːŋ	locative word for sugar
mu**g**ilɔːŋ	nonsense word
su**k^{h}**iriːŋ	nonsense word which could be locative word for sugar

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