What "Spell-out" reveals: how Niger-Congo prosodification constrains the syntax-semantics interface*

Rose-Marie Déchaine
University of British Columbia
dechaine@mail.ubc.ca

Abstract: The interaction of prosody — including both segmental and tone melody — with syntax and semantics in Niger-Congo languages has been extensively treated in phonological terms (Downing, 2006; J. L. Smith, 2011). This paper shows that approaching prosodification through the lens of syntax yields both empirical and theoretical benefits. Empirically, attending to the syntax of prosodification provides insight into the structure of the lexicon across the Niger-Congo language family. Most notably, it permits a formal account of the relation between regular and ideophonic vocabulary items. Theoretically, it forces a re-conceptualization of the prosody-syntax and prosody-semantics interface, as well as the syntax-semantics interface. In particular, it challenges one of the tenets of *Distributed Morphology*, namely that the entire lexicon is category-less (Embick & Marantz, 2008). More broadly, it also challenges the Saussurean dictate that the relation between form and meaning is always arbitrary. Finally, it confirms the architecture proposed in the model of *Interface Syntax* (Wiltschko & Déchaine, 2010), which correctly predicts that prosody can associate directly with syntactic or semantic atoms, namely both phono-syntactic (sound-category) and phono-semantic (sound-meaning) bundling is attested.

Keywords: Bantu, Benue-Congo, category, ideophone, interface, lexicon, morphology, morphotactics, Niger-Congo, noun, phono-syntax, phono-semantics, phonotactics, prosody, root, semantics, tone, Shona, stem, strata, syntax, verb, word-class, Yorùbá

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1. The relation between prosody and syntactic category

In languages where the mapping between prosody and category is opaque, it is difficult to assess how, or even if, they are related to each other. A better starting point is to look at languages where the mapping between prosody and category is transparent. In this regard, Niger-Congo languages provide an ideal laboratory, as they are famous for the prosodic constraints that they impose on their word-forms; in other words, they have very strict morpheme structure constraints. For example, in Yorùbá, the canonical shape of a verb is [CV] (1), while the canonical shape of a noun is [V-CV] (2).[1]

(1) YORÙBÁ VERBS ARE CANONICALLY **[CV]**

a.	***dí***	H	'to block'
b.	***di***	M	'to become'
c.	***dì***	L	'to hoe'

(Courtenay 1971:239, (1b))

(2) YORÙBÁ NOUNS ARE CANONICALLY **[V-CV]**

a.	***a-wó***	MH	'guinea fowl'
b.	***a-wo***	MM	'secret'
c.	***à-wo***	LM	'plate, disc'
d.	***a-wò***	ML	'eyeglasses, seine'

(cf. Courtenay 1971:239, (1d)

In Shona, all verbs end in a consonant (3): the minimal mono-morphemic verb root is √C and the maximal one is √CVC. And all noun stems end in a vowel (4): the minimal mono-morphemic noun is √CV , and the maximal one is √CVCVCV.

(3) SHONA MONOMORPHEMIC VERB ROOTS ARE ALL **C**-FINAL

a.	√C	*p´-*	*kù-**p**-á*	'to give'
b.	√VC	*ón-*	*kù-**ón**-á*	'to see'
c.	√CVC	*tór-*	*kù-**tór**-a*	'to take'

(4) SHONA MONOMORPHEMIC NOUN ROOTS ARE ALL **V**-FINAL

a.	√CV	*-gá*	*chì-**gá***	'mark, sign, brand, notch, CL7 (d65)'
b.	√CVV	*-kòó*	*mà-**kòó***	'bloodstains, bloodclots, CL6 (d193)
b.	√CVCV	*-pòfù*	*chì-**pòfù***	'groundnut, CL7 (d87)'
d.	√CVCVCV	*-kómáná*	*mù-**kómáná***	'boy, CL3'

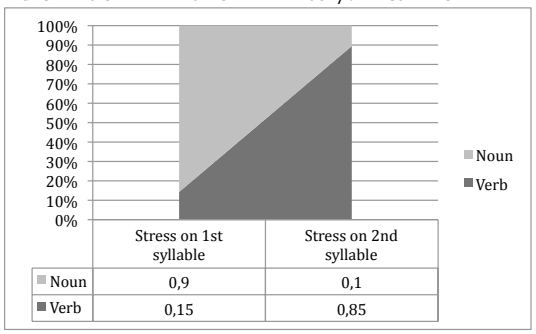
[1] Abbreviations and conventions: % = dialect variation; √ = root; μ = mora; SG = singular; ; AGR = agreement; ASP = aspect; ATR = advanced tongue root; C = consonant; CL = noun class; COMP = complementizer; D = determiner; DEM = demonstrative; DIST = distal; F-category = functional category; FV = final vowel; FUT = future; GEN = genitive; H = high-tone, HTS = high tone syllable; IRR = irrealis; HAB = habitual; HORT = hortative; HUM = human; INANIM = inanimate; INF = infinitive; K = kase; KA = Karanga Shona; KO = Korekore Shona; L = low-tone; L-category = lexical category; M = mid-tone, MA = Manyika Shona; MOD = modal; NEG = negative; PERF = perfective; PL = plural; POSS = possessor; PROG = progressive; PROX = proximal; REAL = realis; SAL = salient; SG = singular; SPEC = specific; TNS = tense; V = vowel; Z = Zezuru Shona.

From a processing point of view, such transparent prosody-category relations facilitate fast mapping: the continuous speech stream can be more quickly segmented and chunked if the relation between prosody and morpho-syntax is predictable. This is the claim made by analyses that invoke prosodic bootstrapping as a mechanism for language acquisition (Höhle, 2009; Soderstrom, Seidl, Kemler Nelson, & Jusczyk, 2003). This indicates that a transparent prosody-category mapping confers, in principle, an advantage for speech perception. But there remains the question of whether such transparency is detectable by language users. If it is, we expect to find the following cluster of properties (Kelly, 1992):

(i) **The information is available in the signal**: there are robust phonological cues for grammatical class; there are widespread correlations within the language; and the individual magnitudes of the correlations are significant.
(ii) **Users are sensitive to the information**, i.e., they perceive it. Children acquiring language are sensitive to the information; adults using language are sensitive to the information.
(iii) **Users exploit the information**. Speakers exploit correlations in ongoing language processing.

English is not usually analyzed as a language with a transparent prosody-category mapping, but there are corners of the grammar where this cluster of properties is found. For example, English two-syllable words show a sensitivity to word-class. As shown in (5), most English bi-syllabic Nouns bear stress on the first syllable (90%), and most bi-syllabic Verbs bear stress on the second syllable (85%). This Noun/Verb contrast is manifest in adult knowledge, in stress and category-shift, and in on-line classification (Kelly, 1992).

(5) ENGLISH TWO-SYLLABLE WORDS AND THE NOUN/VERB CONTRAST

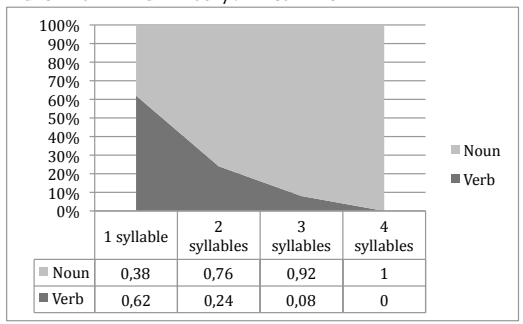


	Stress on 1st syllable	Stress on 2nd syllable
Noun	0,9	0,1
Verb	0,15	0,85

English also displays a transparent prosody-category mapping with word length. As shown in (6), mono-syllabic words tilt towards the verbal category, with most mono-syllabic words being verbs (62%). Longer words tilt towards the nominal category: 76% of bi-syllabic words are nouns; 92% of tri-syllabic words are nouns, and all (100%) quadri-

syllabic words are nouns. This word-length differentiation is confirmed in child-directed parental speech, in diachrony, in adult knowledge, and in L1 acquisition (Kelly, 1992).

(6) ENGLISH WORD-LENGTH: NOUN/VERB CONTRAST



	1 syllable	2 syllables	3 syllables	4 syllables
Noun	0,38	0,76	0,92	1
Verb	0,62	0,24	0,08	0

In English, part of the lexicon has a transparent prosody-category mapping. In Niger-Congo languages, most of the lexicon has a transparent prosody-category mapping. This allows us to examine more closely the first feature of transparent prosody-category mapping, as in Niger-Congo languages, the information is clearly available in the signal. We expect to find robust phonological cues for grammatical class, widespread correlations within the language, with individual magnitudes of the correlations being significant.[2] To see how prosody-category mapping plays out, consider (7), which lists differences in morphologization between two branches of Niger-Congo, namely West Benue-Congo (exemplified by Yorùbá) and East Benue-Congu (exemplified by the southern Bantu language Shona). The division of labor differs across the two languages. Yorùbá has an absence of morphologization: most roots (both verbs are nouns) are [CV], verb roots are invariant, there is no morphological verb class, no verbal derivation, and no morphological passive. Shona roots are not canonically [CV], there is a morphological verb class, as well as derivational morphology on verbs and a morphological passive.

(7) MORPHOLOGIZATION IN WEST AND EAST BENUE-CONGO

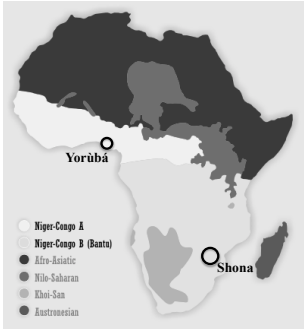
	WEST BENUE-CONGO YORÙBÁ	EAST BENUE-CONGO SHONA
• most roots (verbs & nouns) are CV	✓	✗
• invariant verb root	✓	✗
• morphological verb class	✗	✓
• derivational morphology on verbs	✗	✓
• morphological passive	✗	✓

[2] Two other features are predicted to be present, namely users are sensitive to, and exploit, the information. As these can only be verified via acquisition and experimental studies in production and perception, this awaits future research.

Although the systematicity of these morphologization differences between Benue-Congo and Bantu is widely known — it was explicitly commented on by Westermann & Bryan (1952) — it has not been integrated into formal analyses of Niger-Congo languages. One exception is Hyman (2004) who, in his survey of Bantu-internal morphologization, observes a cline of increased prosodification associated with restrictions on maximal word size, distributional constraints, and differential realization of phonemes by position. Extending Hyman's approach to all of Niger-Congo, I propose that prosodification provides a window into the organization of the grammar. More specifically, by attending to prosodification, we can better understand how prosody, syntax, and semantics interact with each other. This is of interest for two reasons. First, it yields a more in-depth typology of prosodification across Niger-Congo. Second, the strict morpheme structure constraints found in Niger-Congo languages provide a testing ground for theoretical models, and in particular bear on claims concerning how prosody interfaces with syntax and semantics.

I show that, under certain conditions, prosodification constrains syntax and semantics. Nano-syntax (Taraldsen, 2010) — the micro-syntax of lexical categories — is revealing in this regard. Data are drawn from two languages, Yorùbá and Shona, which have a depth of description and analysis that permits investigation of the interaction of prosody with morpho-syntax. The geographic location of the two languages is shown in (8). Yorùbá is spoken primarily in Nigeria (but also in Benin and Togo), and is part of the West Benue-Congo grouping. Shona is primarily spoken in Zimbabwe (but also in Zambia, Botswana and Mozambique) and is part of the Bantu grouping.

(8) GEOGRAPHIC LOCATION OF YORÙBÁ AND SHONA



After introducing background assumptions about how prosody interacts with syntax and semantics (§2), I examine what Yorùbá and Shona morpheme structure constraints reveal about how prosody shapes grammar (§§3-4). §5 concludes.

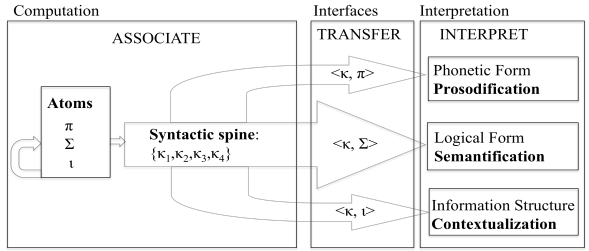
2. The relation of prosody to syntax and semantics: background assumptions

The assumption that lexical formatives are structured seems self-evident. Indeed, this is the basis for the Saussurean principle that holds that the bundling of sound with meaning is arbitrary. But such sound-meaning encapsulation, though attested in all languages, is not the only way to structure lexical formatives. Starting with the widely accepted assumption that lexical formatives are internally structured, I explore less orthodox views about the nature of this internal structuring. In so doing, I introduce a model that provides a vocabulary for more precise discusssion about how prosody connects to syntax and semantics (§2.1), and the ways in which grammar harnesses prosody (§2.2).

2.1 The Interface Syntax Model

The proposed analysis rests on two claims: (ii) there is a universal syntactic spine; (ii) lexical formatives are structured. These claims are embedded within the model of *Interface Syntax* (Wiltschko & Déchaine, 2010), given in (9). This model analyzes lexical formatives as bundles of more basic atoms, which are of three types: prosodic (π), semantic (Σ), and information-structural (ι). Atoms combine with one another via the operation *Associate*, which also combines (simplex or complex) atoms with a syntactic category label (κ).

(9) INTERFACE SYNTAX MODEL



Interface Syntax departs from many other models in positing the existence of a universal syntactic spine, as in (10). This spine consists of a universally defined set of categories that are associated with characteristic functions that cut across the verb/noun divide. The lower-most category label is associated with ***inner typing***; this is the domain that partitions word-classes into the major categories. The next category is associated with ***classifying;*** this is the domain where the major word-classes are subject to sub-categorization. Next is ***anchoring***, which corresponds to discourse activation. And the uppermost category is associated with ***outer typing***; this corresponds to argument typing.

(10)

SPINE	[κ1	[κ2	[κ3	[κ4	]]]]
FUNCTION	[OUTER TYPING	[ANCHORING	[CLASSIFYING	[INNER TYPING	]]]]

This abstract structure is realized as two distinct, but often overlapping, syntactic spines, namely the verbal spine and the nominal spine, as shown in (11)-(12). (11)a shows the ***verbal spine***. Small ***v*** is the locus of inner typing. ***Aspect*** is the locus of event classification (C. S. Smith, 1991; Travis, 2010). ***Infl*** is the locus of event anchoring; this is where tense, or its equivalent, reside (Ritter & Wiltschko, 2009). ***Comp*** is the locus of outer typing; this corresponds to clause-typing. (12)a shows the ***nominal spine***. Small ***n*** is the locus of inner typing (Rijkhoff, 1991), ***Class*** is the locus of entity classification. **D** is the locus of argument anchoring; this is where definiteness and specificity reside (Ionin, 2006). **Kase** is the locus of outer typing of arguments; this corresponds to case-marking. Each of these functions is potentially subject to further sub-division.[3] Relevant to the present discussion is the fact that, in both Yorùbá and Shona, the functions of outer typing (Comp/Kase) and anchoring (Infl/D) are particularly refined. As shown in (11)b, in the verbal domain, Comp partitions into C_{FORCE} and $C_{FINITENESS}$, while Infl partitions into I_{MOOD}, I_{TENSE}, and $I_{MODALITY}$. And, as shown in (12)b in the nominal domain, Kase partitions into K_{POSS} and K_{GEN}, and D partitions into D_{DEM}, D_{SPEC}, and $D_{SALIENT}$.

(11) VERBAL SPINE

a. [Comp [Infl [Aspect [*v*]]]]
b. [C_{FORCE} [C_{FINITE} [I_{MOOD} [I_{TENSE} [$I_{MODALITY}$ [Aspect [*v*]]]]]]]

(12) NOMINAL SPINE

a. [Kase [D [Class [*n*]]]]
b. [K_{POSS} [K_{GEN} [D_{DEM} [$D_{SPECIFIC}$ [$D_{SALIENT}$ [Class [*n*]]]]]]]

The discussion focuses on the lower part of the syntactic spine: small *v* and small *n*. The functional super-structure of the V-spine and N-spine is also considered, but only inasmuch as it provides evidence bearing on the question of how lexical formatives are categorized.

The *Interface Syntax* model allows one to ask precise questions concerning how prosody, meaning, and structure associate with each other. I focus on how prosodic (π) and semantic (Σ) atoms associate with category labels (κ). For example, with simplex atoms, there are three possibilities, (13). Many analyses (Anderson, 1997; Baker, 2003; Croft, 1991) assume that the default is the association of semantic type (Σ) with syntactic category (κ), (13)a. Such encapsulation predicts two surface effects. On the one hand, there will be a regular correspondence between semantic type and syntactic category. For example, entities will tend to be categorized as nouns; events will tend to be categorized as verbs. On the other hand, categorization will be "prosody-neutral": prosodification will be late, and will be independent of syntactic categorization. In Yorùbá and Shona, such semantically driven categorization is found only with Functional categories. *Interface*

[3] In many languages, the classifying function is subject to further sub-division. Verbal aspect sub-divides into ***Outer Verbal Aspect*** (also called viewpoint aspect) and ***Inner Verbal Aspect*** (also called lexical aspect). Nominal class also subdivides into inner and outer aspect, (ii). ***Inner Nominal Aspect*** corresponds to the classifying function relevant for mass nouns, namely sorting. ***Outer Nominal Aspect*** corresponds to the classifying function relevant for count nouns, namely the singular/plural contrast. See Déchaine et al. (xxxx) for discussion and analysis of how this applies to Shona.

(i) [$_{CP}$ Comp [$_{IP}$ Infl [$_{OuterAsp}$ [$_{InnerAsp}$ [$_{vP}$ *v*]]]]
(ii) [$_{KP}$ Kase [$_{DP}$ D [$_{OuterAsp}$ Sg/Pl [$_{InnerAsp}$ Sort [$_{nP}$ *n*]]]]

Syntax predicts that other types of association are possible. We expect to find evidence for the association of prosody with category (J. L. Smith, 2011), as in (13)b. This is attested in the verb and noun lexicon of Niger-Congo, and is associated with two surface effects: (i) regular correspondence between prosody and syntactic category; (ii) late assignment of semantic type.[4] It is also possible for prosody to associate with semantic type, (13)c; this is found in the ideophone lexicon of Niger-Congo.

(13) a. < Σ, κ > associate semantic type with syntactic category
b. < π, κ > associate prosody with syntactic category
c. < π, Σ > associate prosody with semantic type

(13)a and (13)b are instances of early categorization; (13)c is an instance of late categorization, and only the latter is category-neutral. Thus, *Interface Syntax* departs from *Distributed Morphology* which holds that category-neutrality is fully general. In *Interface Syntax*, category-neutrality is a diagnostic for late categorization. (See §6 for discussion.)

2.2 How grammar harnesses prosody

Postulating prosodically driven lexicalization — the prosodification of syntactic categories (for regular vocabulary items) and the prosodificaton of semantic atoms (for ideophones) — raises the question of how grammar harnesses prosody. As summarized in (14), prosody, in the large sense, can be harnessed in a number of different ways (Hyman, 2006).

(14) PROSODY CONSTRAINS WORD-DOMAIN, WORD SIZE, OR WORD SHAPE
(adapted from Hyman 2006:229, (2))

			ATTESTED IN	
PROSODY CONSTRAINS:		CHARACTERISTICS:	YORÙBÁ	SHONA
• DOMAIN	• demarcative	1. marks beginning or end of word	✓	✓
	• culminative	2. occurs only once per word	✓	✓
	• harmonic	3. realized throughout word	✓	✓
• SIZE	• metrical	4. consists of a hierarchy of μ/σ	✗	✗
	• minimal word	5. must consist of minimum no. of μ/σ	✓	✓
	• maximal word	6. can consist of a maximum no. of μ/σ	✓	✓
• SHAPE	• phonotactic	7. only certain output segments/sequences permitted	✓	✓
	• morpho-phonotactic	8. only certain input segments/sequences permitted	✓	✓

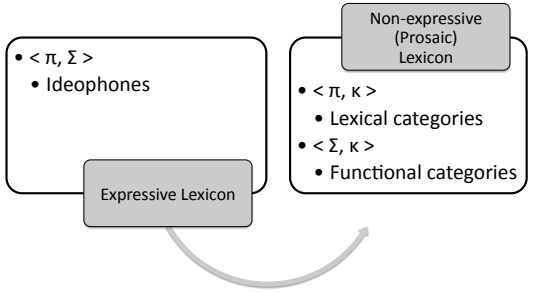
Prosody may constrain word domain, size, or shape. Word-domain constraints can be demarcative (identifying word-edge), culminative (identifying word-occurrence), or harmonic (identifiying word-span). Word size constraints, as well as enforcing minimal or maximal word-size, can also be metrical. Word shape constraints can be phonotactic (by restricting outputs) or morpho-phonotatic (by restricting inputs). The two languages under consideration, Yorùbá and Shona, exhibit prosodic constraints on word-domain, word-size, and word-shape. Attending to these constraints reveals that Niger-Congo languages privilege two modes of encapsulation: (i) prosodified syntactic categories, namely phono-

[4] Information-structure can associate directly to syntactic category, as in (i). For discussion and analysis of how this plays out in Bavarian German, see Thoma (in preparation).
(i) < ι, κ > associate information-structure with syntactic category

syntactic sound-category <π,κ> bundles; (ii) prosodified semantic types, namely phono-semantic sound-meaning <π,Σ> bundles. Once this is recognized, puzzling properties regarding the organization of the lexicon in these languages fall into place.

Three ways of encapsulating information — meaning-category <Σ,κ>, sound-category <π,κ>, and sound-meaning <π,Σ> bundles — form the cornerstone of Niger-Congo lexicons, and define distinct lexical strata and morpho-syntactic domains. As illustrated in (15), the expressive lexicon (which includes ideophones) is characterized by prosodico-semantic lexicalization (Dwyer & Moshi, 2003). The non-expressive (regular) lexicon is characterized by categorization that is either prosodically driven (for Lexical categories) or semantically driven (for Functional categories). Following Doke (1948), I call the non-expressive regular lexicon the "prosaic" lexicon.

(15) ORGANIZATION OF THE LEXICON: NIGER-CONGO



Across Niger-Congo, the [CV] syllable has a privileged status, in that it is a prosodic word. Phonotactically, the [CV] template restricts surface sequences: a well-formed prosodic word minimally consists of one [CV] sequence in its output. In the phonological literature, this is called *minimality*, and has been shown to be a highly ranked constraint in both Yorùbá (Ola, 1995; Orie & Pulleyblank, 2002) and Shona (Mudzingwa, 2010). Morphotactically, the [CV] template restricts underlying sequences: a well-formed word minimally consists of a [CV] sequence in its input. A first step in understanding the logic of the lexicon of a Niger-Congo language is to find which part of the grammar enforces minimality as an input constraint, i.e., as a morphotactic constraint. For the two languages under discussion, Yorùbá and Shona, the morphotactic [CV] word is localized in different parts of the grammar. To see this, consider (16). In Yorùbá, the minimal [CV] word is attested with **verbs**. But in Shona, the minimal [CV] word is attested with **ideophones**.

(16) MINIMAL SIZE OF ROOTS IN YORÙBÁ AND SHONA

	YORÙBÁ	SHONA
MINIMAL √VERB ROOT	**CV**	–C
MINIMAL √NOUN ROOT	–CV	–CV
MINIMAL √IDEOPHONE ROOT	CVV	**CV**

What's special about [CV] syllables? Typologically, [CV] syllables are attested in all languages (C. Levelt & van de Vijvwer, 1998). In terms of acquisition, [CV] is the first syllable that children acquire (C. C. Levelt, Schiller, & Levelt, 2000). In terms of production, [CV] syllables reflect a default oscillatory mode (Nam, Goldstein, & Saltzman, 2009). And in terms of perception, [CV] sequences reflect a default temporal organization (Poeppel, Idsardi, & van Wassenhove, 2008). In Niger-Congo, the [CV] syllable is the basic building block. There are three possible ways of understanding this. On one view, the special status of the [CV] syllable is a product of morpho-phonology (Orie & Pulleyblank, 2002), and reflects prosodic constraints on minimal word size, (17)a. On another view, the special status of the [CV] syllable is a product of morpho-syntax (Déchaine, 2001), and reflects syntactic constraints on word shape, (17)b. Another possibility, the one advocated here, is that the special status of the [CV] syllable is the hallmark of prosodified categorization, (17)c. This third approach captures the insights of morpho-phonological and morpho-syntactic analyses, while resolving many of the stipulations that they must invoke.

(17) a. MORPHO-PHONOLOGICAL HYPOTHESIS (Orie & Pulleyblank, 2002)
[CV] minimality reflects **prosodic** constraints on minimal word size.

b. MORPHO-SYNTACTIC HYPOTHESIS (Déchaine, 2001)
[CV] minimality reflects **syntactic** constraints on minimal word size.

c. PROSODIC CATEGORIZATION HYPOTHESIS (herein)
[CV] minimality reflects **phono-syntactic** < π, κ > bundling.

As discussed by Kelly (1992), if there is prosodification of syntactic categories, as claimed by the prosodic categorization hypothesis, then this information will be available in the signal. This predicts that: (i) there exist robust phonological cues for syntactic categories; (ii) the prosody-category correlations are widespread within the language; and (iii) the individual magnitudes of the correlations are significant.

The emergence of [CV] minimality as a word-size constraint is attested in both Yorùbá and Shona, but in different lexical strata. In Yorùbá the constraint holds in the prosaic lexicon, where verbs are minimally and maximally [CV]. In Shona, the same constraint holds in the expressive lexicon, where ideophones are minimally [CV]. Following this thread reveals that word-size is strictly legislated in both languages. As shown in (18), in different domains, minimality restricts word-size to one mora (μ), to [CV], or to a bi-syllabic foot. In both Yorùbá and Shona, Functional categories (F-categories) are minimally and maximally one mora. As for the [CV] constraint, as already mentioned, this holds as a minimality constraint of the prosaic lexicon in Yorùbá (with verbs), and of the expressive lexicon in Shona (with ideophones). And both languages are subject to a foot contraint, where the minimal word is a bi-syllabic foot (McCarthy, 1983): this is found in the prosaic lexicon of Shona (with L-categories), and in the expressive lexicon of Yorùbá (with ideophones).

(18) WORD SIZE CONSTRAINTS IN YORÙBÁ AND SHONA

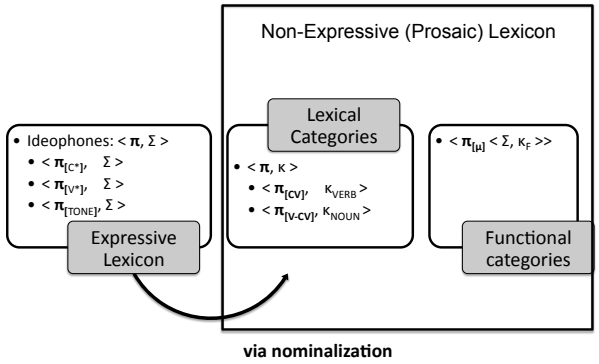
	YORÙBÁ	SHONA
MINIMAL/MAXIMAL WORD = [μ]	F-categories	F-categories
MINIMAL WORD = [CV]	verb	ideophone
MINIMAL WORD = [FT σ σ]	ideophone	L-categories

With these conceptual underpinnings in place, I now turn to the description and analysis of prosodification in Yorùbá and Shona. Yorùbá is discussed first (§3), then Shona (§4).

3. Yorùbá prosodification and the organization of the lexicon

The Yorùbá lexicon has two strata: expressive and non-expressive, as in (19).

(19) LEXICAL STRATA IN YORÙBÁ



The expressive stratum corresponds to the ideophone vocabulary (Courtenay, 1976; Fordyce, 1978, 1983; Rowlands, 1970), where there is a direct association of prosodic (π) and semantic (Σ) atoms. These phono-semantic <π,Σ> bundles involve the direct association of sound to meaning: they are category-neutral, their minimal word size is [CVV], and they enter the prosaic lexicon via nominalization. As for the prosaic lexicon, it groups together lexical items that are prosodified differently according to whether they are L- or F-categories. L-categories display prosodically driven categorization, with a direct association between category and prosody; this is an instance of phono-syntacitc <π,κ> bundling, where verbs are canonically [CV] and nouns are canonically [V-CV]. As for F-categories, they are also prosodified in that they can be no bigger and no smaller than one mora [μ]. They display semantically driven categorization, with a direct association between a semantic atom (Σ) and a category (κ), and late prosodification. With this in place, I consider how prosodification plays out for Yorùbá L-categories (§3.1), ideophones (§3.2), and F-categories (§3.3).

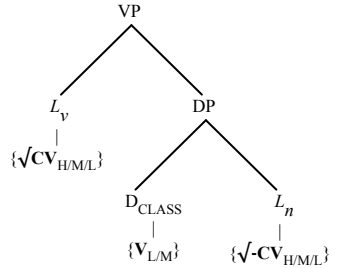
3.1 The prosodification of Yorùbá lexical categories

Yorùba verbs have a [CV] template; nouns have a [V-CV] template. The correspondence between word-class and segmental melody is so regular that it can be stated as an implicational relation, (20).

(20) a. Verb → **[CV]**
b. Noun → **[V-CV]**

Such an implicational relation is expected if the categorization of Yorùbá verbs and nouns is prosodic. In the present analysis, prosody (π) associates with category (κ), forming a phono-syntactic <π,κ> bundle. Consequently, in Yorùbá, syntactic structure can be "read off" of prosody. To see this, consider (21). A bare √CV root can only be parsed as a verb, an augmented √-CV root can only be parsed as a noun, and the combination of a minimal [CV] verb with a minimal [V-CV] noun creates a surface string [CV+V-CV] whose contiguous vowels are resolved by vowel deletion. I explore the implications of such aggressive prosodic categorization for the verb and noun lexicon (§§3.1.1-3.1.2) and for phrasal syntax (§3.1.3).

(21) THE SYNTAX OF YORÙBÁ PROSODIC CATEGORIZATION



3.1.1 The prosodification of Yorùbá verbs

Yorùbá verbs are canonically [CV], and there are three contrastive tones: High, Mid, Low (Akinlabi, 1985; Courtenay, 1969). For a given [CV] sequence, three verb-forms are possible. This is illustrated in (22), for **[ro]**, which may be High, Mid or Low tone.

(22) a. *ró* H 'to stand'
b. *ro* M 'to stir'
c. *rò* L 'to farm'

Because Yorùbá verbs are minimally and maximally [CV], they are a finite set. To see why, consider the segment and tone inventory of Yorùbá (23), which has 18 consonants, 10 vowels, and 3 tones. This yields **540** possible [CV] tokens, a figure derived by multiplying the number of Cs (*n*=18) by the number of Vs (*n*=10) by the number of tones (*n*=3).

(23) POSSIBLE [CV] TOKENS IN YORÙBÁ

[CV] TOKENS	***n = 540***	18_C x 10_V x 3_{TONES}
• CONSONANTS	*n = 18*	{ t, k, b, d, g, kp, gb, f, s, ʃ, h, ʤ, m, n, l, r, y w}
• VOWELS	*n = 10*	{ i, e, ɛ, o, ɔ, u, a, ī, ū, ā }
• TONE MELODIES	*n = 6*	{ High, Mid, Low }

The [CV] constraint means that one can enumerate Yorùbá verb roots: there are exactly 540 of them. Thus, Yorùbá verbs are a closed class: it is not possible to introduce a new verbal form into the Yorùbá lexicon. This prosodic constraint has three consequences for lexical semantics: massive homophony, broad semantic range, and localization of predicative meaning at the phrasal (VP) level.

To see how severely the [CV] template constrains the lexicon, consider (24), which lists the [rV] Yorùbá verb forms. Of the 30 logically possible [rV] melodies (3 tones x 10 vowels), all are attested. In addition, many forms are homophonous, e.g. *ràn* is associated with four meanings: 'send' (A); 'sew' B), 'recur' (C), and 'be.puny' (D). Thus, for the 30 logically possible [rV] roots, **61** lexemes are attested, which breaks down as follows: for the 10 possible H-tone roots, there are **24** lexemes; for the 10 M-tone [rV] roots there are **16** lexemes; and for the 10 L-tone [rV] roots there are **21** lexemes. (24+16+21=61 lexemes.)

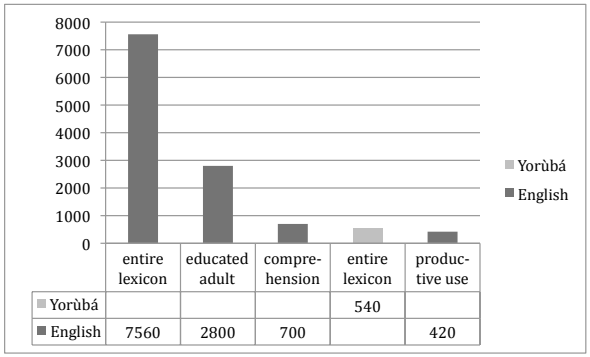
(24) YORÙBÁ: [rX] VERB ROOTS (from Abraham (1958) and Delano (1969))

	H	*n = 24*	**M**	*n = 16*	**L**	*n = 21*	***n = 61***
i	***rí***	A see B obtain	***ri***	A cut round B sink	***rì***	submerge	A565-7 D142
in	***rín***	laugh	***rin***	moist	***rìn***	A tickle B press down C walk	A568-9
e	***ré***	A pare off B take down	***re***	shed	***rè***	A go to B feed	A561-3
ẹ	***rẹ́***	A unite B cut	***rẹ***	soak	***rẹ̀***	A tire B fall to the ground C increase	A564-5
o	***ró***	A stand B utter sound C put on cloth	***ro***	A farm B pain C drip	***rò***	A stir B think C relate	A570-2
ọ	***rọ́***	A push aside B make sound C relate	***rọ***	A drooping B pour into narrow-mouth vessel C forge	***rọ̀***	A soft B hang down C support	A573-4
u	***rú***	A muddle B sprout C haft	***ru***	come to boil	***rù***	A carry B thin	A577-8
un	***rún***	A mix B crush	***run***	perish	***rùn***	emit odour	A579
a	***rá***	A crawl B vanish	***ra***	A perish B rub C wind around	***rà***	buy	A560

an	***rán***	A send B sew C recur (pain) D puny	***ran***	spin	***ràn***	A help B catch fire	A575-6

This exercise can be repeated with any [CV] melody and yields similar results. This means that homophony might increase the expressive capacity of the vocabulary set by a factor of two: the 540 [CV] tokens would then be associated with about 1,000 distinct lexemes. Even allowing for homophony, this still yields a radically constrained verb lexicon. To see this, consider (25), which compares the number of verb-forms in Yorùbá and English.

(25) VERB-FORMS IN YORÙBÁ AND ENGLISH



In English, extant word-families number roughly 54,000; the active vocabulary of an educated adult is 20,000 word-forms; the upper bound of the vocabulary size needed for basic comprehension is 5,000, and and for productive use it is 3,000 (Nation & Waring, undated). According to the OED word-count, approximately 1/7 of English word-forms are verbs, roughly 14%.[5] This means that English verb-forms number about 7,500, a literate adult has a vocabulary of about 3,000 verb-forms; comprehension requires around 700 verb-forms, and productive use requires around 400 verb-forms. The upper bound of Yorùbá verb-forms is precisely 540. While this is comparable to the 400 or so verb-forms needed for productive use in English, it is much below the upper bound of English verb-forms, which clocks in at over 7,000. So, English has about 14 times as many verb-forms as Yorùbá does.

Yorùbá's small verb lexicon has semantic and syntactic consequences: verb-level meaning is extremely vague, and every verb is a light verb (Déchaine, 2005). For example, the root *jẹ*, often glossed as 'eat', actually denotes ingestion, both physical (26) and

[5] According to the OED, nouns constitute a little over half of the English lexicon (roughly 51%), adjectives account for one quarter (25%), with the remainder (10%) being prepositions and other grammatical words.

metaphorical (27). It is the combination of the verb together with its complement that restricts the denotation of the predicate; this is a general strategy in Yorùbá, where the locus of predicative meaning is the phrasal VP, rather than the verb.[6]

(26) a. *Ó* ***jẹ*** *mángòrò.*
3SG eat mango
'S/he ate a mango' (A343)

b. *Màlúù yìí ń* ***j****oko.*
cow this IMP eat.grass
'This cow is grazing' (A343, 466)
(< *jẹ+oko*)

(27) a. *Ó* ***jẹ****ka.*
3SG eat.finger
'S/he felt regret' (A343, 295)
(< *jẹ+ìka*)

b. *Ó* ***jẹ****gba.*
3SG eat.whip
'S/he was whipped' (A344, 175)
(< *jẹ+ẹgba*)

3.1.2 The prosodification of Yorùbá nouns

Yorùbá nouns are canonically [V-CV]. Prosodic and syntactic evidence indicates that they are stems consisting of a vowel prefix [V-] in combination with a [-CV] noun root. Prosodically, as discussed by Stahlke (1974), the [V-] prefix is morphologically distinct in that it is subject to strict prosodic constraints:

(28) a. the prefixal vowel must be oral
b. the prefixal vowel canot be /u/
c. if the prefixal vowel is mid, it harmonizes in ATR value to the second vowel
d. the prefixal vowel must bear non-High tone
(from Stalke 1976:246-257)

Thus, compared to the [-CV] noun root, the segmental and tone melody of the prefixal vowel is impoverished. Especially striking is the fact that, tonally, while the [-CV] noun root maintains a three-way contrast between High-, Mid-, and Low-tone, the prefixal vowel has only a two-way tone contrast, namely Mid- and Low-tone, as in (29). As we shall see below, in Yorùbá, this impoverishment of tone melody is a diagnostic for Functional categories. This leads to the conclusion that the vowel prefix is inflectional, and that [V-CV] nominal formatives are inflected noun stems.[7]

(29)
V-	-CV
|	|
{L,M}	{H, M, L}

[6] Light-verb semantics is also seen in English (Cattell, 1984; Marantz, 1984), as shown by the paradigm in (i-iv). The difference between Yorùbá and English is one of degree: Yorùbá has only light verbs. As discussed in Déchaine (2005), a light-verb lexicon has consequences for the phrasal synax of verbs, most especially for verb serialization and for unaccusative verbs.

(i)	*hit the road*	'depart'	(iii)	*hit the books*	'study'
(ii)	*hit the sack*	'go to bed'	(iv)	*hit a wall*	'arrive at a dead-end'

[7] This converges with Awobuluyi's recent analysis of Yorùbá [V-CV] nouns, which, for semantic reasons, he treats as a combination of a V- prefix with a bound -CV root (O. Ajiboye, personal communication).

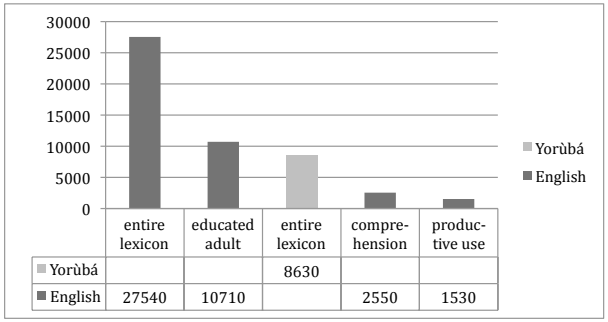
As shown in (30), taken together, these segmental and tone constraints generate **8,630** [V-CV] noun stems, . Since the [V-] prefix never bears High-tone, this means there are six possible tone melodies: LH, LM, LL, MH, MM, ML. There are 6 vowel prefixes: high and low vowels are non-harmonic, while mid vowels trigger ATR harmony. There are a total of 540 [-CV] non-harmonic roots; that is, roots that can occur with the non-harmonic prefixes i- or a-. There are 108 [-CV] roots compatible with [+ATR] harmony (which appear with i-, e-, o-, u-, ī-, ū-); and 72 compatible with [-ATR] harmony (which appear with ɛ-, ɔ-, a-, ā-).

(30) POSSIBLE [V-CV] NOUN STEMS IN YORÙBÁ

	n =	PROSODIC RESTRICTION	
• [V-CV] TOKENS	***8,630***		
	6,480	• non-harmonic	$2_{i/a}$ x 540_{CV} x $6_{TONE\text{-}MELODY}$
	1,296	• [+ATR]	$2_{e/o}$ x 108_{CV} x $6_{TONE\text{-}MELODY}$
	864	• [–ATR]	$2_{ɛ/ɔ}$ x 72_{CV} x $6_{TONE\text{-}MELODY}$
• TONE MELODIES	*6*	• { LH, LM, LL, MH, MM, ML }	
• [V-] PREFIXES	*6*	• non-harmonic	{ i, a }
		• [+ATR]	{ e, o }
		• [–ATR]	{ ɛ, ɔ }
• [-CV] NOUN ROOTS	*540*	• non-harmonic	18_C x 10_V x 3_{TONES}
	108	• [+ATR]	18_C x 6_V {i, e, o, u, ī, ū}
	72	• [–ATR]	18_C x 4_V {ɛ, ɔ, a, ā}

Remarkably, it is possible to identify an absolute upper bound of [V-CV] melodies for Yorùbá noun-stems, namely 8,630. In other words, the Yorùbá noun lexicon is radically constrained by prosody. To see this, consider (31), which compares the number of noun-forms in Yorùbá and English.

(31) NOUN-FORMS IN YORÙBÁ AND ENGLISH



I take as a baseline the English word-form counts discussed above, as well as the fact that, according to the OED, slightly more than half of English word-forms are nouns, roughly 51%. This means that English has about 27,000 noun-forms, a literate adult has a vocabulary of about 10,000 noun-forms; comprehension requires around 2,500 noun-

forms, and productive use requires around 1,500 noun-forms. The upper bound of Yorùbá noun-forms is a little over 8,500 (8,630 to be precise). And although this is comparable to the 10,000 noun-forms of an English-speaking literate adult, it is far below the upper bound of English noun-forms, which number around 27,000. Specifically, English has over 3 times as many noun-forms as Yorùbá does.

3.1.3 Yorùbá prosodification at the phrasal level

Both the verb and noun lexicon of Yorùbá are severely contrained by prosody. Verbs are canonically [CV], and can be enumerated: there are 540 possible [CV] tokens in Yorùbá. Nouns are canonically [V-CV], and can likewise be enumerated: there are 8,630 possible [V-CV] tokens in Yorùbá. As discussed above, Yorùbá's small verb lexicon means that verb roots are semantically vague. A syntactic correlate of this vagueness is the canonical transitivity of verbs (Awobuluyi 1978:51), which are almost always accompanied by a nominal complement. Given that the canonical Yorùbá noun is [V-CV], this yields a surface sequence of [CV] followed by [V-CV], as in (32)a. In Yorùbá, the [CV] template, in addition to being an input constraint on roots, is also an output contraint on surface strings. Thus, a verb-noun sequence [CV+V-CV] (32)a is resolved into a surface [CVCV] sequence, with elision of either the vowel of the verb (32)b, or of the noun (32)c. Following Oyelaran (1970), I represent elision of the vowel of the verb root as [C'VCV], and elision of the [V-] prefix of the noun as [CV'CV].[8]

(32) a. [VERB CV] [NOUN V-CV] combination of verb and noun
b. [VERB C] [NOUN V-CV] elision of the vowel of the verb [C'VCV]
c. [VERB CV] [NOUN -CV] elision of the vowel of the noun [CV'CV]

The two elision strategies are semantically distinct (Oyelaran 1970:181-185). As illustrated in (33), truncation of the verb root via vowel elision is associated with meanings that are always compositional and transparent. This contrasts with truncation of the noun-stem via vowel elision, which is sometimes compositional and transparent (34)a-c, and sometimes non-compositional and idiosyncratic (34)d-f.

(33) TRUNCATION OF VERB ROOTS TO [C-] IN YORÙBÁ VIA VOWEL ELISION: [C'VCV]

	INPUT			OUTPUT			
	TONE	VERB	NOUN	TONE	VERB+NOUN	GLOSS	
a.	H + MH	*mú*	*o-wó*	HH	*m'ówó*	'take money'	Oy175
b.	H + MM	*wá*	*ẹ-ja*	HM	*w'éja*	'look for fish'	Oy175
c.	H + ML	*dé*	*ọ-jà*	HL	*d'ọ́jà*	'arrive at the market'	Oy195
d.	M + MH	*gba*	*e-wé*	MH	*gb'ewé*	'take the leaf'	Oy174
e.	M + MM	*gba*	*ẹ-ja*	MM	*gb'ẹja*	'take the fish'	Oy147
f.	M + ML	*jẹ*	*i-yò*	ML	*j'iyò*	'lick salt'	Oy176

[8] When the vowel of the verb is elided this means that, in some contexts, Yorùbá verbs are truncated to [C-]. I return below (§6) to the significance of truncating Yorùbá verb roots to [C-].

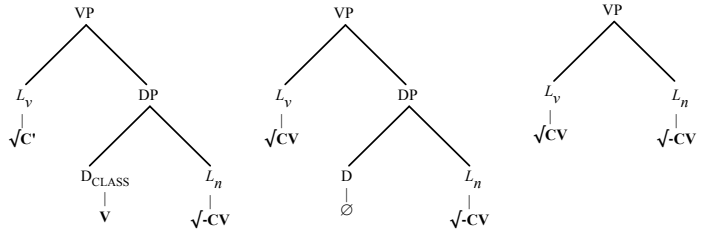
(34) TRUNCATION OF NOUN STEMS TO [-CV] IN YORÙBÁ VIA VOWEL ELISION: [CV'CV]

	INPUT			OUTPUT			
	TONE	VERB	NOUN	TONE	VERB+NOUN	GLOSS	
a.	M + MH	*sọn*	*o-wó*	MH	*sọn'wó*	'pay up'	Oy181
b.	M + MM	*fọ*	*a-ṣọ*	MM	*fọ'ṣọ*	'wash clothes'	Oy181
c.	M + ML	*pa*	*a-sẹ̀*	ML	*pa'sẹ̀*	'beat rhythm w/feet'	Oy181
d.	H + MH	*ró̩n*	*e-tí*	HH	*ró̩n'tí*	'remember' (lit. sew ear)	Oy181
e.	H + MM	*rú*	*o-mi*	HM	*rú'mi*	'make dirty' (lit. stir water)	Oy177
f.	H + ML	*gbé*	*ẹ-sẹ̀*	HL	*gbé'sẹ̀*	'walk briskly' (lit. remove foot)	Ba85

The contrast between [C'VCV] via elision of the verb root vowel, and [CV'CV] via elision of the prefixal noun vowel is also syntactically distinct. When the prefixal vowel is maintained, and the verb root vowel is elided, this is indicative of a structure where a full DP argument combines with a verb, (35)a. Such structures are predictably associated with compositional, transparent meanings. Supression of the prefixal vowel means the verb and noun root can combine directly with each other. The syntactic account predicts such combinations will be structurally ambiguous. Some surface V_{ROOT}-N_{ROOT} combinations involve a nominal complement with a null D position, (35)b; such root-root combinations have fully compositional semantics. But other V_{ROOT}-N_{ROOT} combinations are compounds, (35)c; as such, they are the locus of lexicalized, non-compositional, idiosyncratic meanings.

(35) SYNTACTIC RESOLUTION OF YORUBA [VERB + NOUN] CONCATENATION

a. [C'VCV] b. [CV'CV] c. [CV'CV]



That elision of the prefixal vowel involves root-root compounds is confirmed by the fact that a similar constrast is found when two nouns combine (Akinlabi & Oyebade, 1987; Orie & Pulleyblank, 2002). As shown in (36), concatenation of nouns gives two outputs: either the [V-] prefix of the second noun is deleted, or there is regressive vowel assimilation.

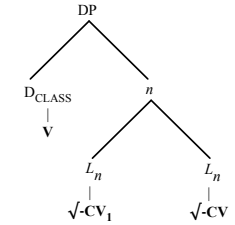
(36) YORÙBÁ N+N CONCATENATION (from Orie & Pulleyblank 2002:144 (62))

INPUT NOUN + NOUN		N-N COMPOUND VOWEL DELETION	NOUN PHRASE VOWEL ASSIMILATION	
ọ-mọ	*o-bìnrin*	*ọ-mọ bìnrin*	*ọ-m**ọ***	*o-bìnrin*
child	female	'girl'	'child of a woman'	
a-ya	*ọ-ba*	*a-ya ba*	*a-y**ọ***	*ọ-ba*
wife	king	'girl'	'wife of a king'	
e-wé	*o-ko*	*e-wé ko*	*e-w**ó***	*o-ko*
leaf	farm	'leaf'	'farm leaf, i.e., leaf of a farm'	
ọ-mọ	*a-já*	*ọ-mọ já*	*ọ-m**a***	*a-já*
child	dog	'delinquent child'	'puppy, i.e., child of a dog'	

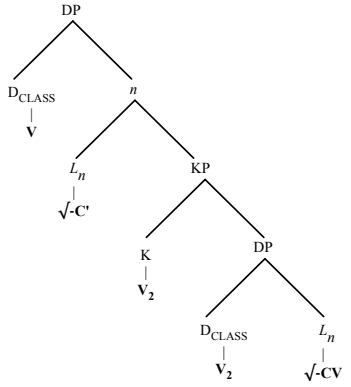
These two phonological strategies — vowel deletion versus vowel assimilation — correspond to distinct structures. Deletion of the vowel prefix arises with N-N root compounding, (37)a. Regressive vowel assimilation arises with a phrasal structure, (37)b. Following Ajiboye (2005, 2007), the copy vowel that surfaces between the head N and the complement N is analyzed as the spell-out of possessive case. (See §3.3.2 for additional discussion of the K position.)

(37) SYNTACTIC RESOLUTION OF YORUBA [NOUN + NOUN] CONCATENATION

a. [V-CV'CV]



b. [V-C']-V-[V-CV]



3.2 The prosodification of Yorùbá ideophones

Other than verbs and nouns, the other major word-class in Yorùbá is the ideophone vocabulary (Awoyale, 1981, 1983, 1989, 2000; Courtenay, 1976; Fordyce, 1978, 1983). Representative examples are given in (38).

(38) a. [CVV] *róo* 'being a very small quantity of liquid' (Aw1989:D19c)
b. [CVCV] *bìrì* 'being something heavy revolving quickly' (Aw1989:D16a)
c. [CVCVCV] *rògòdò* 'being very bulging and round'(Aw1989:D10a)
d. [CVCVCVCV] *fárágádá* 'being repeatedly totally wiped out' (Aw1989:D7c)

The morpho-phonology of ideophones is templatic in that they are formed by a combination of C, V and tone melodies (Akinlabi, 1985). Consider (39), which illustrates how the ideophone root √*rgd*, which denotes roundness, is integrated into the tri-syllabic [CVCVCV] template, with vowel and tone melody modulating the basic meaning of the √*rgd* root. On independent grounds, the default vowel in Yorùbá is **[i]** and the default tone is Mid (Akinlabi, 1985; Pulleyblank, 1986). When the vowel melody is [**i**], and the tone Mid, the basic meaning of the ideophone root emerges, (39)a. Changing the vowel to [**o**], but maintaining Mid tone, connotes a small size (39)b. An [**o**] vowel melody with High tone connotes an even smaller size (39)c, and with Low tone connotes a larger size (39)d. And changing the vowel melody to *ọ-ọ-i*, with Low tone, connotes an even larger size (39)e.

(39) √ *rgd* + [CVCVCV]

	VOWEL	TONE		
a.	*i-i-i*	M	***r*i*g*i*d*i**	'being round' (cf. Awoyale 1989:D2.c)
b.	*o-o-o*	M	***r*o*g*o*d*o**	'being round & small' (cf. Awoyale 1989:D6.b)
c.	*o-o-o*	H	***r*ó*g*ó*d*ó**	'being very small & round' (cf. Awoyale 1989:D7.a)
d.	*o-o-o*	L	***r*ò*g*ò*d*ò**	'being bulging & round (cf. Awoyale 1989:D10.a)
e.	*ọ-ọ-i*	L	***r*ọ̀*g*ọ̀*d*ì**	'being big & imposing' (cf. Awoyale:D8.b)

The semantics of ideophones is also distinctive, in that they always have expressive force (Dwyer & Moshi, 2003). On independent grounds, Potts (2007), argues that expressives have a characteristic cluster of properties: their expressive content is independent of descriptive content (40)a; they exhibit "non-displaceability" in that they predicate something of the utterance situation (40)b; they show perspective-dependence in that they are evaluative relative to a particular person's perspective (40)c; their meaning is ineffable in that it cannot be paraphrased with descriptive terms (40)d; and they are performative in that they achieve their intended act by virtue of being uttered (40)e.[9]

[9] Potts (2007) posits an additional diagnostic for expressives, namely they are repeatable, in that repetition strengthens their emotive content. This diagnostic does not extend to Yorùbá ideophones *qua* expressives. As discussed by Awoyale (1989), ideophones participate in a number of reduplicative processes, including partial suffixal reduplication, full reduplication and a combination of the two. Semantically, ideophonic reduplication marks degree quantification (i-ii), plurality (iii), or both (iv).

(i) [***r*o*g*o*d*o**]-*do* 'being very round & small Aw89:S1.2b)
(ii) a. [***r*ó*g*ó*d*ó**-*do*]-[***r*ó*g*ó*d*ó** *do*] 'being very bulging & round' (Aw89:D10a)
b. [***r*ọ̀*g*ọ̀*d*ì**-*dì*]-[***r*ọ̀*g*ọ̀*d*ì**-*dì*] 'being very big & imposing (Aw89:D8.b)
c. [***r*ọ*g*ọ*d*i**-*di*]-[***r*ọ̀*g*ọ̀*d*ì**-*dì*] 'being heavy & very bulky (Aw89:D29b)

(40) PROPERTIES OF EXPRESSIVES (adapted from Potts 2007)
- a. Independent content: meaning is independent of descriptive content
- b. Utterance-bound: predicate something about the utterance situation
- c. Perspectival: evaluated from a particular perspective (usually the speaker's)
- d. Ineffable: can't be paraphrased with descriptive terms
- e. Performative: achieve their intended act by being uttered

Yorùbá ideophones display all of these properties. For example, the tone melody of ideophones involves a combination of lexical meaning together with emphasis, intensity, and speaker attitude (Awoyale 1989:30). I conclude that the Yorùbá ideophone vocabulary items instantiate expressives. Moreover, the Yorùbá ideophone vocabulary constitutes a distinct expressive lexicon which is organized along very different lines than the prosaic lexicon. We have seen above for verbs and nouns that they display prosodic categorization: there is a direct association of prosody (π) with category (κ). A correlate of this phono-syntactic sound-category <π,κ> bundling is the enforcement of severe prosodic constraints on categorization, such that both nouns and verbs are enumerable. Thus, Yorùbá has 540 possible √CV verb roots, and 8,630 possible [V-CV] noun stems. In contrast, the ideophone lexicon is an open-class system: it is not possible to enumerate the expressive vocabulary. However, there is nevertheless aggressive prosodification, in the form of sound-meaning phono-semantic <π,Σ> bundling. Particular prosodic melodies — consonantal, vocalic, and tonal — are associated with particular semantic atoms. For example, as illustrated in (41), while the consonant melody ***r-g-d*** connotes roundness (41)a, the vowel melody contributes a size dimension (41)b. Observe that ***i-i-i*** is semantically neutral, ***o-o-o*** connotes small size, and ***o-o-i*** conntes large size. And tone melody contributes a degree dimention (41)c: mid-tone is neutral, high-tone expresses a positive degree, and low-tone expresses intensification.

(41) YORÙBÁ IDEOPHONES AS <π,Σ> BUNDLES

		< π ,	Σ >
a.	CONSONANT MELODY	[r-g-d]	ROUND
b.	VOWEL MELODY	[i-i-i]	∅
		[o-o-o]	SMALL
		[o-o-i]	BIG
c.	TONE MELODY	Mid	∅
		High	DEGREE
		Low	INTENSIFICATION

Phonologically, the expressive and prosaic lexicons exploit the same building blocks — the same inventory of consonants, vowels, and tones are avaialbe in both strata — but the deploy them differently. In particular, while phonological features are constrastive in the

(iii) a. [***r****i****g****i****d****i*]-[***r****i****g****i****d****i*] 'several things round' (Aw89:D2.c)
b. [***r****i****g****i****d****i*]-[***r****i****g****i****d****i*]-[***r****i****g****i****d****i*] 'round in groups' (Aw89:T6.c)
c. [***r****o****g****o****d****o*-*do*]-[***r****o****g****o****d****o*-*do*] 'several things round & small' (A289:D6.b))
(iv) [***r****ó****g****ó****d****ó*-*dó*]-[***r****ó****g****ó****d****ó*-*dó*] 'several things very small & round' (Aw89:D7.a)

regular lexicon, in the expressive lexicon these same phonological features are gradient (Waugh, 1994). Syntactically, Yorùbá expressive ideophones are category-neutral in that they can be integrated into either verbal or nomimal projections. Most notably, they enter the prosaic lexicon via nominalization, (42).

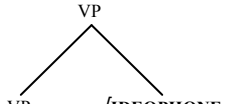
(42) a. *bò-gbiridiri* < *gbiridiri*
NOM-roll.over.many.times 'rolling over on the ground many times'
'the state of rolling over many times'
(Awoyale 1989:30, (a))

b. *a-pepere* < *pepere*
NOM-slim.and.cute 'being slim and cute'
'one who is slim and cute'
(Awoyale 1989:30, (c))

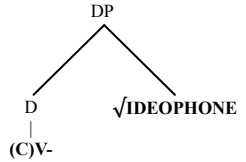
Awoyale (1989) takes nominalization to indicate that Yorùbá ideophones are inherently predicative. While I concur that ideophones are predicative in nature, the fact that they be nominalized but not verbalized in Yorùbá is arguably due to language-specific constraints on categorization. There simply is no mechanism in Yorùbá to integrate ideophones into verbal structures. This is because verbs are maximally [CV], while idephones are minimally [CVV]; so ideophones are too big to ever be verbs in Yorùbá. That this is indeed a language-specific property is confirmed by the fact that Shona ideophones may be freely verbalized or nominalized. (I return to this below.) More broadly, Yorùbá ideophones instantiate category-neutral formatives that are integrated into the clause in one of two ways. As VP-modifiers, they adjoin to VP and appear at the right-edge of the clause, (43)a. And when they are nominalized, they are introduced into the nominal spine, as in (43)b. (For concretness, I represent Yorùbá's prefixal nominalizing morphology as a D head.)

(43) SYNTACTIC INTEGRATION OF YORÙBÁ IDEOPHONES

a. VP-adjunction



b. nominalization



3.3 The prosodification of Yorùbá functional categories

Yorùbá F-categories are prosodically constrained, but not in the same way as L-categories. Recall that Yorùbá roots — both verbs and nouns — can be no smaller than [CV]. In contrast, F-categories are minimally and maximally mono-moraic. In terms of surface-realization, this means that the prosodic lower bound for Yorùbá F-categories is a tone-bearing unit: either a sonorant that supports one mora [μ] (44)a, or a specified vowel melody [V] (44)b. And the prosodic upper bound for Yorùbá F-categories is [CV] (44)c.

(44) a. [κ =F-CATEGORY [π=[μ] **μ**]]
b. [κ =F-CATEGORY [π=[μ] **V**]]
c. [κ =F-CATEGORY [π=[μ] **CV**]]

I show how this plays out for the verbal spine (§3.3.1), and then the nominal spine (§3.3.2).

3.3.1 The prosodification of the Yorùbá verbal spine

By hypothesis, the verbal spine sub-divides into four domains, as in (45)a. The C-domain is the locus of clause-typing; the Infl-domain is the locus of event-anchoring; the Aspect-domain is the locus of event-classification, and the *v*-domain is the locus of categorization. The Yorùbá Infl-domain is highly articulated (Barczak, 2007), and distinguishes Mood, Tense, and Modality, (45)b.

(45) a. [Comp [Infl [Aspect [*v*]]]]
b. [Comp [Mood [Tense [Modal$_{EPISTEMIC}$ [Modal$_{DEONTIC}$ [Aspect [*v*]]]]]]]

As argued by Barczak (2007:149*ff.*), Yorùbá verbal F-categories are minimally and maximally mono-moraic. The lower bound is a mora with no segmental specification, i.e., a tone-bearing unit. This includes the Low-tone that spells out irrealis mood (46)a, as well as the High-Tone-Syllable that spells-out tense (46)b. It is also possible for the mora to have segmental content; this includes future ***á*** (46)c, habitual ***a*** (46)d, and progressive ***ń*** (46)e.

(46) YORÙBÁ VERBAL F-CATEGORIES: **[μ]**

a. ***ì*** *bá ti sùn*
IRR MOD PERF sleep
'he would have slept,…'

b. *Akin* ***ín*** *sùn*
Akin HTS sleep
'Akin (has) slept'

c. *Akìn* ***á*** *sùn*
Akin.IRR FUT sleep
'Akin will sleep'

d. *Akin* ***a*** *sùn*
Akin HAB sleep
'Akin always sleeps'

e. *Akin* ***ń*** *sùn*
Akin PROG sleep
'Akin is/was sleeping'

The prosodic upper bound for Yorubá verbal F-categories is [CV]: all complementizers are [CV], as well as some modal and aspectual particles (47).

(47) YORÙBÁ VERBAL F-CATEGORIES: **[CV]**

a. *ère* ***tí*** *Akin ín ni …*
statue C Akin HTS own
'the statue that Akin owns…'

b. *Akin ín sọ pé* ***kí*** *ó sùn*
Akin HTS tell say C 3SG sleep
'Akin told him to sleep'

c. ***bí*** *Akin ín bá sùn,…*
if Akin HTS MOD sleep
'if Akin sleeps,…; if Akin slept,…; if Akin had slept,…'

d. *Akìn* ***bá*** *sùn*
Akin.IRR MOD sleep
'Akin would have slept, …'

e. *Akin ín* ***lè*** *sùn*
Akin HTS MOD sleep
'Akin can (is allowed to) sleep'

f. *Akin* ***ti*** *sùn*
Akin PERF sleep
'Akin has slept'

Yorùbá also has particles that are larger than [CV], as in (48); Barczak (2007) argues that these are all multi-morphemic. The futurate form *yóò* is tri-morphemic, and consists of realis *y-*, tense *ó* and modal *ò*. Yorùbá has a second futurate form, *máa*, which combines modal *má* with habitual *a*. And finally, ***gbọ́-dọ̀*** 'must' is analyzed as a compound modal.

(48) YORÙBÁ VERBAL F-CATEGORIES: > **[μ]**

a. *Akin* ***y-ó-ò*** *ka ìwé*
A. REAL-TNS-MOD read book
'Akin will read a book'

b. *Akin ín* ***má-a*** *ka ìwé*
A. HTS MOD-HAB read book
'Akin will/is going to read a book'

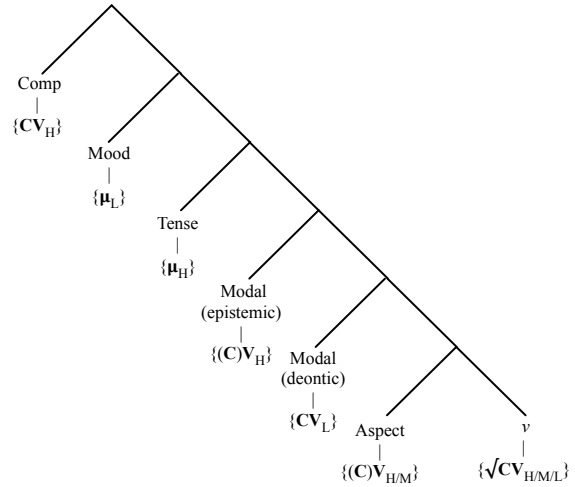
c. *Akin ín* ***gbọ́-dọ̀*** *ka ìwé*
A. HTS MOD-MOD read book
'Akin must read a book'

Consider (49), which shows how L-categories and F-categories are prosodified in the Yorùbá verbal spine. Three generalizations emerge. First, verbal L-categories are minimally and maximally √CV. Second, F-categories are minimally and maximally one mora [μ]. Third, in addition to this size difference, there is also a difference in tone melody, with L-categories exploiting more tone contrasts than F-categories. On the one hand, √CV verbal L-categories have an inventory of three tones, and contrast High, Mid, and Low. On the other hand, each F-category position maintains a two-way tone contrast, either differentiating High/Mid (C, Tense, Modal$_{EPISTEMIC}$, Aspect) or Low/Mid (Mood, Modal$_{DEONTIC}$).[10]

[10]Motivation for the mid-tone formatives in (49) comes form complex verbal F-categories that spell out multiple positions of the verbal spine (Barczak, 2007). For example, *yóò* spells out Mood-Tense-Modality (i), with [y] spelling out (unmarked) Mid-tone. Futurate *máa* spells out Modality-Aspect (ii), with the [a] spelling out a Mid-tone. And *gbọ́dọ̀* is a compound modal (iii).

		[Comp	[Mood	[Tense	[Modal$_{EPISTEMIC}$	[Modal$_{DEONTIC}$	[Aspect	[v	]]]]]]
(i)	*yóò*		***y***	***-ó***		***-ò***			
(ii)	*máa*				***má***		***-a***		
(iii)	*gbọ́dọ̀*				***gbọ́***	***-dọ̀***			

(49) YORÙBÁ VERBAL SPINE



3.3.2 The prosodification of the Yorùbá nominal spine

Recall that the nominal spine has four domains (K, D, Class, and *n*), as in (50)a, with further sub-classification possible in a given language. Consider (50)b, which shows the Yorùbá nominal spine. While Yorùba K divides into two sub-classes (K.Possessor and K. Genitive), D sub-divides into three sub-classes (D.Demonstrative, D.Specific, and D.Salient). As for the Class position, in Yorùbá this is instantiated by the [V-] that attaches to noun roots.[11]

(50) a. [Kase [Determiner [Class [*n*]]]]
b. [K$_{POSS}$ [K$_{GEN}$ [D$_{DEM}$ [D$_{SPEC}$ [D$_{SALIENT}$ [D$_{CLASS}$ [*n*]]]]]]

[11] Plural-marking — which involves the addition of ***à-wọn*** (i), ***wọ̀n*** (ii), or ***ìwọ̀n*** (iii) — is not obligatory Yorùbá, indicating that it is introduced as a modifier (Ajiboye, 2005, 2010).

(i) &***à-wọn*** *o-bìnrin*
D-PL D-woman
'some women, the women'

(ii) a. *obìnrin* ***wọ̀n-yì-í***
woman PL-D-PROX
'these women

b. *obìnrin* ***wọ̀n-y-ẹn***
woman PL-D-DIST
'those women'

(iii) a. ***ì-wọ̀n-y-í***
D-PL-D-PROX
'these ones'

b. ***ì-wọ̀n-y-ẹn***
D-PL-D-DIST
'those ones'

We have seen above that Yorùbá verbal F-categories are never bigger or smaller that one mora. The same holds of Yorùbá nominal F-categories. Those that are one mora include the Mid-tone copy vowel of possessor marking (51)a, and the [V-] prefix that occurs before noun roots (51)b.

(51) YORÙBÁ NOMINAL F-CATEGORIES: [**μ**]

a. *èrè* ***e*** *Kúnlé*
statue K.POSS Kunle
'a/the statue of Kunle

b. &***o***-*bìnrin*
D.CL-woman
'a/the woman, some women'

Yorùbá nominal F-categories that are [CV] and mono-morphemic are genitive ***ti*** (52)a and the specificity marker ***kan*** (52)b.

(52) YORÙBÁ NOMINAL F-CATEGORIES: [**CV**]

a. *èrè* ***ti*** *Kúnlé*
statue K.GEN Kunle
'a/the statue of Kunle

b. *obìnrin* ***kan***
woman D.SPEC
'a certain woman'

All remaining nominal F-categories are multi-morphemic. This includes the specificity determiner ***ná-à*** (53)a, as well as the proximal and distal demonstratives ***yì-í*** (53)b and ***y-ẹn*** (53)c. (The bi-morphemic structure of these Ds is likely the residue — or perhaps the emergence — of the N-class prefix position that is prevalent in Bantu.)[12]

(53) YORÙBÁ BI-MORPHEMIC NOMINAL F-CATEGORIES

a. *o-bìnrin* ***ná-à***
D-woman D-SAL
'the very woman'

b. *o-bìnrin* ***yì-í***
D-woman D-PROX
'this woman'

c. *obìnrin* ***y-ẹn***
woman D-DIST
'that woman'

In sum, Yorùbá noun roots are minimally √-CV, monomorphemic nominal F-categories are minimally and maximally one mora [μ], and bi-morphemic formatives are [C(V)-V]. Putting all this together yields the following picture of the Yorùbá nominal spine:[13]

[12] In Yorùbá, The four D-positions co-occur, creating sequences [D.DEM D.SPEC D.SAL D.CLASS], as in (i). Observe that the nominal head surfaces to the left of all of the D; this reflects the application of leftward NP-movement (Ajiboye, 2005, 2007).

(i) *Mo ri* [*a-já*]$_{\mathbf{i}}$ *yì-í* *kan* *ná-à* **t$_{\mathbf{i}}$**
1SG see D-dog D-PROX D.SPEC D-SAL
'I saw this very same dog' (Ajiboye 2005:216, (74))

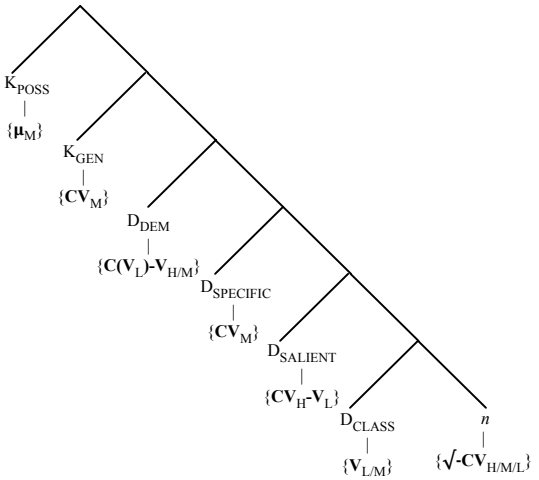
[13] In the nominal domain, Yorùbá has two case-marking exponents: the mid-tone copy vowel (i) and genitive *ti* (ii), which may co-occur (iii). See Ajiboye (2005) for discussion and analysis.

(i) *èrè* ***e*** *Kúnlé*
statue K.POSS Kunle
'a/the statue of Kunle'

(ii) *èrè* ***ti*** *Kúnlé*
statue K.GEN Kunle
'a/the statue of Kunle'

(iii) *èrè* ***e*** ***ti*** *Kúnlé*
statue K.POSS K.GEN Kunle
'a/the statue of KUNLE (versus a/the statue of Tunde) '

(54) YORÙBÁ NOMINAL SPINE

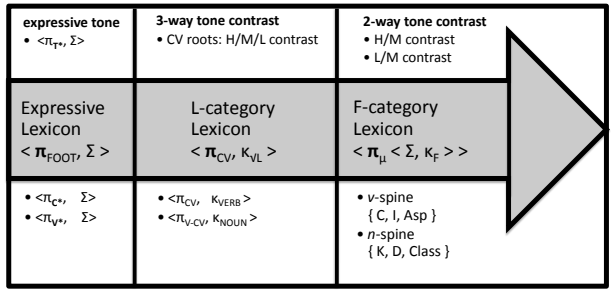


In terms of the prosodic generalizations detectable in the signal, and by hypothesis available to the learner, there are three main findings. First, there is a size difference: while the minimal N root is √-CV, nominal F-categories are miminally and maximally a mora [**μ**]. Consequently, any nominal F-category larger than one [**μ**] is bi-morphemic; this converges with Barczak's (2007) finding for Yorùbá verbal F-categories. Second, there is a difference in tone melody: N roots have a three-way High/Mid/Low contrast, but nominal F-categories have impoverished tone contrasts.

3.4 Summary: prosodification in Yorùbá

Consider (55), which shows that, in Yorùbá, the expressive and L-category lexicons involve early prosodification in the form of phono-semantic <π,Σ> or phono-syntactic <π,κ> bundling. In contrast, the F-category lexicon involves late prosodification: prosody (π) associates to a <Σ,κ> bundle, and generates formatives that conform to the Saussurean dictate of arbitrariness between sound and meaning. The three strata enforce minimality in different ways: the expressive lexicon has a minimal foot (so the smallest ideophone is √CVV), the L-category lexicon is minimally and maximally √CV, and the F-category lexicon is minimally and maximally one mora [**μ**]. This analysis also reveals a difference in how tone is deployed: the L-category lexicon maintains a High/Mid/Low contrast, but the F-category lexicon contrasts H/M or L/M. And in the expressive lexicon, tone and segmental melodies, rather than being contrastive, code gradient scales.

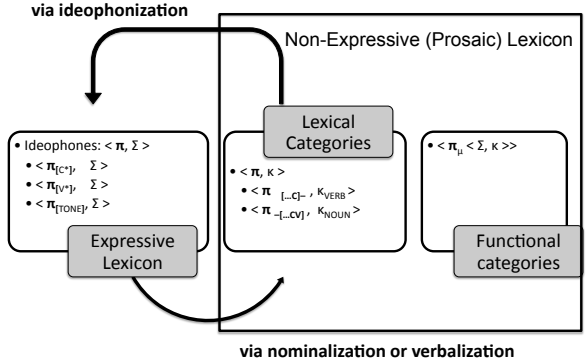
(55) PROSODIFICATION IN YORÙBÁ



4. Shona prosodification and the organization of the lexicon

The Shona lexicon has two lexical strata: expressive and non-expressive, (56). The non-expressive stratum corresponds to the ideophone vocabulary; these category-neutral phono-semantic sound-meaning <π,Σ> bundles are minimally [CV] and enter the prosaic lexicon via verbalization or nominalization. The prosaic lexicon partitions into L- versus F-categories. L-categories display phono-syntactic sound-category <π,κ> bundling; i.e., early prosodification. Verb roots are consonant-final, are minimally [-C], and are obligatorily suffixed. Noun roots are vowel-final, are minimally [-CV], and are obligatorily prefixed. As for F-categories, they are (almost) always prefixal, and minimally and maximally one mora. I show that Shona prosodically differentiates stem-classes (§4.1), and that this has consequences for how L- and F-categories are prosodified (§§4.2-4.5).

(56) LEXICAL STRATA IN SHONA



4.1 Shona stem-classes: bare stems versus inflected stems

Shona has two stem classes: bare or inflected. Bare stems are category-neutral ideophones (57)a: they always end in a vowel, have [CV] as their minimal size, are prosodically independent, and have the distribution of predicates. Inflected stems are verbal or substantival. Verb stems are consonant-final, are minimally [C-], and always appear with a suffixal final vowel, (57)b. Substantival stems are Nouns or Adjectives: they are vowel-final, are minimally [-CV], and always appear with a noun-class prefix, (57)c.

(57)

	SHONA STEM-CLASSES			MINIMAL ROOT
a.	IDEOPHONE	***fé***	'blowing'	[CV]
b.	VERB	*kù-**p**-á*	'to give'	[C]–
c.i	NOUN	*mù$_3$-**tí***	'tree, noun class 3'	–[CV]
c.ii	ADJECTIVE	***-vé***	'bad'	–[CV]

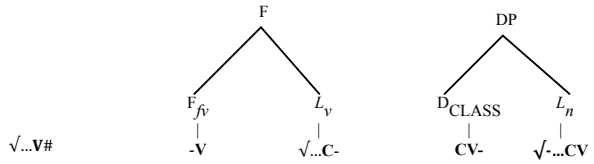
Shona stem-classes reflect the intersection of three prosodic properties: (i) minimal size; (ii) being C-final or V-final; and (iii) being suffixed or prefixed. This can be stated as a series of implicational relations. Ideophone roots are bare roots which are minimally [CV], V-final, and prosodically independent, (58)a. Verb roots are minimally [C], are C-final, and must have something aligned to their right-edge, (58)b. Noun roots are minimally [CV], are V-final, and must have something aligned to their left-edge, (58)c.

(58) a. Ideophone → Min √CV
b. Verb → Min √C & Align (X, Right)
c. Noun → Min √CV & Align (X, Left)

In the present analysis such prosodic regularities instantiate phono-syntactic <π,κ> bundling, as in (59):

(59) THE SYNTAX OF SHONA PROSODIC CATEGORIZATION

a. √IDEOPHONE b. √VERB c. √NOUN



Ideophone roots are category-neutral and are freely integrated into the syntactic spine, (59)a. In contrast, C-final verb roots are prosodically dependent, and are always supplemented by a final vowel. Syntactically, this final vowel is introduced in a head-initial

structure (59)b, with surface order determined by prosodically driven head-movement (see §4.5.3 below). As for V-final noun roots, they combine with a prefixal class marker, which is a D$_{CLASS}$ head that introduces number and gender features, (59)c.

This establishes that Shona stem-classes show prosodic differentiation. With this as background, I examine in more detail the consequences this has for the lexicon as a whole.

4.2 The prosodification of Shona verbal formatives

All verbal formatives in Shona end in C: this includes verb roots (§4.2.1), suffixal verbalizers (§4.2.2), and extensional suffixes (§4.2.3). I consider each in turn.

4.2.1 Shona verb roots are always consonant-final

Shona mono-morphemic verb roots have three segmental templates (√C √VC, √CVC) and two possible tone melodies (High, Low).[14] This defines six root shapes: High- versus Low-tone √C roots, High- versus Low-tone √VC roots, and High- versus Low-tone √CVC roots. Examples are given in (60). The [CV] constraint regulates output forms in Shona, so all verb roots surface with a final vowel whose tone is contextually determined; e.g. in the simplest case the vowel is High after High-tone roots, and Low after Low-tone roots.

(60) SHONA MONOMORPHEMIC VERB ROOTS: [...C-]

ROOT	SEGMENTAL MELODY	TONE MELODY	INF-√VERB-FV	GLOSS
√C	*d͡ʒ-*	H	*kù-**d**-á*	'to love' (F8)
	rw`-	L	*kù-**rw**-à*	'to fight' (F5)
√VC	*úmb-*	H	*kù-**úmb**-á*	'to mold'
	òn-	L	*kù-**òn**-à*	'to see'
√CVC	*tór-*	H	*kù-**tór**-á*	'to take, fetch' (F5)
	bvùn–	L	*kù-**bvùnz**-à*	'to question' (F5)

One question that arises is whether all logically possible verb roots are attested in Shona. To calculate this, one must consider the tone and segment inventory of Shona, given in (61), which has **2** tones, **5** vowels, and **51** consonants.

(61) SHONA TONE AND SEGMENT INVENTORY

TONE MELODIES		*n = 2*	{ High, Low }
VOWEL MELODIES		*n = 5*	{ i, e, o, u, a }
CONSONANT MELODIES	SIMPLE	*n = 27*	{ p, t, k, g, bh, dh, ɓ, ɗ, m, n, ɲ, ŋ, mh, nh, f, s, ʃ, z, ʒ, vh, ɦ, s̻, z̻, ʋ, j, w, r }
	COMPLEX	*n = 24*	{ pf, ts, tʃ, bv, dz, dʒ, ts̻, dz̻, ᵐb, ⁿd, ᵑg, mᵛ, nᶻ, nz̻, pʷ, bʷ, tʷ, kʷ, gʷ, mʷ, nʷ, ᵐbʷ, ⁿzʷ, ᵑgʷ }

(from Mudzingwa 2010, Mkanganwi 1995)

The upper bound of Shona verb roots can be calculated by considering, for each root shape the possible combinations of tones, Cs and Vs. As shown in (62), this gives a total of **26,622** verb roots: 102 √C roots, 510 √CV roots, and 26,010 √CVC roots. Although Shona verbs are

[14] For Bantu, Guthrie (1962) distinguishes three verb stem types: simplex, complex, and extended. Guthrie's "simplex stems" correspond to the mono-morphemic verb roots discussed in the main text.

a large class, because they are enumerable they are a closed class. These counts assume unconstrained root melodies, so it is instructive to see which roots are attested: 34 out of 102 possible √C roots are attested (roughly 30%); 49 out of 520 possible √VC roots are attested (about 10%). √CVC roots have not yet been tabulated, but if the proportions are similar, one expects between 2600 (10%) to 7,800 (30%) √CVC roots.

(62) VERBAL ROOT MELODIES IN SHONA

		POSSIBLE	ATTESTED	
√C	$2_{\text{TONES}} \times 51_{\text{CONSONANTS}}$	*n = 102*	*n = 34*	*.333*
√VC	$2_{\text{TONES}} \times 5_{\text{VOWELS}} \times 51_{\text{CONSONANTS}}$	*n = 510*	*n = 49*	*.096*
√CVC	$2_{\text{TONES}} \times 5_{\text{VOWELS}} \times 51^{2}_{\text{CONSONANTS}}$	*n = 26,010*	*n = ??*	
	TOTAL	***n = 26,622***		

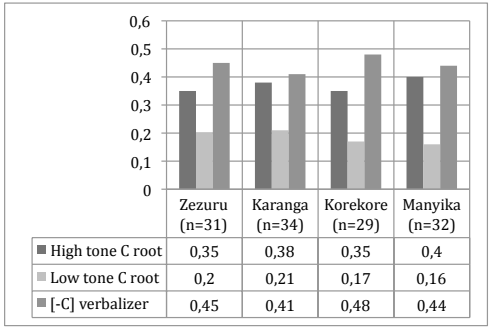
It is revealing to look at the distribution of √C roots: as shown by the shaded cells of (63), from a total inventory of 51 consonants, 31 are recruited as √C roots.

(63) SHONA CONSONANTS THAT FUNCTION AS VERBS OR VERBALIZERS (*n* = 31; see shaded cells)

			LABIAL	ALVEOLAR	PALATAL	VELAR	GLOTTAL
ORAL STOP	3/4	VOICELESS	**p**	**t**		**k** g	
	3/5	VOICELESS LABIALIZED	**p^w** b^w	**t^w**		k **g^w**	
	0/2	BREATHY VOICED	bh	dh			
	2/2	IMPLOSIVE	**ɓ**	**ɗ**			
	2/3	PRE-NASALIZED	**^{m}b**	^{n}d		**^{ŋ}g**	
NASAL STOP	4/4	NASAL	**m**	**n**	***ɲ**	**ŋ**	
	1/2	NASAL BREATHY VOICED	nh	**nh**			
	1/2	NASAL LABIALIZED	m^w	**n^w**			
FRICATIVE	3/5	PLAIN	**f**	**s** **z**	ʃ ʒ		
	0/2	BREATHY VOICED	vh				ɦ
	1/2	LABIALIZED "WHISTLING"		**s̻** z̻			
	0/2	PRE-NASALIZED	m^v	n^z			
	2/4	PRE-NASALIZED LABIALIZED	$^{m}b^w$	**$^{n}z^w$** **^{n}z̻**		$^{ŋ}g^w$	
AFFRICATE	4/6	PLAIN	**pf** **bv**	**ts** **dz**	tʃ dʒ		
	2/2	LABIALIZED		**ts̻** **dz̻**			
APPROXIMANT	2/3		**ʋ**		v	**w**	
TRILL	1/1			**r**			

Each √C root can associate with either High or Low tone; this means the total number of possible √C roots is 102 (= 51 Cs x 2). An inventory of 31 √C roots means roughly 25% of the possible √C roots are attested. Note that this count also includes suffixal [-C] verbalizers (which number 14). As shown in (64), although the roots attested in any given dialect of Shona vary, the overall number is stable (hovering around 30), as is the overall distribution. Roughly 40% of √C roots are High-tone, 20% are Low-tone, and 40% are suffixal [-C] verbalizers.

(64) DISTRIBUTION OF √C ROOTS IN DIFFERENT DIALECTS OF SHONA (based on Hannan (1981))



	Zezuru (n=31)	Karanga (n=34)	Korekore (n=29)	Manyika (n=32)
High tone C root	0,35	0,38	0,35	0,4
Low tone C root	0,2	0,21	0,17	0,16
[-C] verbalizer	0,45	0,41	0,48	0,44

√C roots could in principle contrast High-tone and Low-tone. Surprisingly, they do not. This becomes apparent when one lists attested √C roots according to whether they are High-tone (65), Low-tone (66)7, or variable tone — i.e., surface as High-tone in some dialects but Low-tone in other dialects — (67).

(65) SHONA HIGH-TONE √C VERB ROOTS (*n* = 11)

ATTESTED IN ALL VARIETIES OF SHONA (*n* = 6)			ATTESTED ONLY IN SOME DIALECTS OF SHONA (*n* = 5)		
ROOT	INF-√C-FV	GLOSS	ROOT	INF-√C-FV	GLOSS
√p´	*kù-**p**-á*	give	*√mb´*	*%kù-**mb**-á*	KA exceed, surpass
√pw´	*kù-**pw**-á*	KA MA Z become dry KA Z be convinced KA lose game	*√m´*	*%kù-**mw**-á*	KA MA drink
√b´	*kù-**b**-á*	steal, rob	*√nw´*	*%kù-**nw**-á*	KO Z drink, suck, absorb
√f´	*kù-**f**-á*	die, spoil, break	*√nzv´*	*%kù-**nzv**-á*	KO see
√nzw´	*kù-**nzw**-á*	perceive, understand	*√ts´*	*%kù-**ts**-á*	KA Z dig down
√tsv´	*kù-**tsv**-á*	be on fire, burn			

(66) SHONA LOW-TONE √C VERB ROOTS (*n* = 10)

ATTESTED IN ALL VARIETIES OF SHONA (*n* = 5)			ATTESTED ONLY IN SOME DIALECTS OF SHONA (*n* = 5)		
ROOT	INF-√C-FV	GLOSS	ROOT	INF-√C-FV	GLOSS
√v`	*kù-**v**-à*	become	*√tw`*	*%kù-**tw**-à*	MA stamp in
√bv`	*kù-**bv**-à*	move from	*√n`*	*%kù-**n**-à*	KA Z rain
√d`	*kù-**d**-á*	love	*√sv`*	*%kù-**sv**-à*	KA Z let do
√dzv`	*kù-**dzv**-à*	lose a game	*√gw`*	*%kù-**gw**-à*	KO MA fall (cf. ***-wà***)
√ny`	*kù-**ny**-à*	suffer	*√ng`*	*%kù-**ng**-à*	KO MA seem

(67) SHONA VARIABLE-TONE √C ROOTS (n = 4)

	H-TONE		L-TONE	
ROOT	INF-√C-FV	GLOSS	INF-√C-FV	GLOSS
√*w*	%*kù-**w**-á*	KA fall	%*kù-**w**-à*	KO Z fall
√*z*	%*kù-**z**-á*	KA come	%*kù-**z**-à*	MA Z come
√*pf*	%*kù-**pf**-á*	MA die	%*kù-**pf**-à*	KA bear young
√*dz*	%*kù-**dz**-á*	MA dance	%*kù-**dz**-à*	KA become established

Note that although Shona √C roots don't contrast H versus L, √CVC roots do; examples are given in (68).

(68) H/L CONTRAST WITH √CVC ROOTS

H-TONE		L-TONE		
ROOT	GLOSS	ROOT	GLOSS	
√*bhéur-*	MA turn over	√*bhèur*	KA MA Z open door	d16a
√*bóór-*	MA bellow in distress (cattle)	√*bòòr-*	MA pierce, bore hold through	d26a
√*bvít-*	KA sip	√*bvìt-*	KA throb with pain	d36b
√*chér-*	KA KO MA Z draw water	√*chèr-*	KA MA Z dig	d57a
√*ngám-*	Z get caught up with	√*ngàm-*	Z glitter, sparkle, gleam	d450b

The absence of a H/L contrast with √C roots is perplexing: why are tone melodies under-exploited with √C roots in Shona? This is not specific to √C roots; as we shall see below √VC roots also don't contrast H/L. And though √CVC roots do contrast H/L, this is the exception rather than the rule. Part of the answer to the question of why tone contrasts are under-exploited — i.e., why their functional load is relatively light — comes from looking at the inventory of verbal suffixes, which fall into two classes: (i) verbalising [-C] suffixes; (ii) extensional [-VC] suffixes. I consider each in turn.

4.2.2 Shona verbalizing suffixes are all -C

Shona has a large number of verb-forming [-C] suffixes that attach to nominal, adjectival, and ideophonic roots to derive verbs (Jefferies, 2000). This is where we observe the clear effect that prosody has on syntax in Shona. Recall that non-verbal roots — including nouns, adjectives, and ideophones — all end in a vowel. And all verb roots end in a consonant. So, in a perfect world, the simplest way of deriving a verb from a non-verbal form would be to add a consonantal suffix, and this is exactly what Shona does. Representative examples of verb-forming [-C] suffixes are given below: (69) illustrates verbs formed from noun roots, (70) illustrates verbs formed from adjectival roots, and (71) illustrates verbs formed from ideophone roots.

(69) SHONA VERBALIZING [-C] SUFFIXES THAT ATTACH TO NOUN ROOTS

NOUN ROOT		VERBALIZED NOUN	
-pfímbí	'hold dug to ripen fruit'	*pfímbí-**k**-*	'ripen fruit' (F21)
-kókó	'pot scrapings'	*kókó-**r**-*	'scrape pot' (F7)
-kókó	'pot scrapings'	*kókó-**t**-*	'clean pot with finger' (F21)
-shámwàrí	'friend'	*shámwàrí-**dz**-*	'be friendly' (F21)
-bòfù-rì-pòfù	'blind person'	*pòfù-**m**-àr*	'be blind' (F21)

(70) SHONA VERBALIZING [-C] SUFFIXES THAT ATTACH TO ADJECTIVE ROOTS

ADJECTIVE ROOT		VERBALIZED ADJECTIVE	
-pfúpì	'short'	*pfúpì-**k**-*	'be short' (F7)
-tètè	'thin'	*tètè-**p**-*	'be thing' (F7)
-nyóró	'soft'	*nyóró-**v**-*	'be soft' (F21)
-dúkù	'small'	*dúkù-**s**-*	'make friendly'(F21)
-kòbvú	'thick'	*kòbvú-**m**-ár*	'be thick' (F21)

(71) SHONA VERBALIZING [-C] SUFFIXES THAT ATTACH TO IDEOPHONE ROOTS

IDEOHONE ROOT		VERBALIZED IDEOPHONE	
kòchè	'looping around'	*kòchè-**t**-*	'loop around'
nzvè	'dodging'	*nzvè-**ng**-*	'dodge'
párù	'tearing'	*párù-**k**-*	'get torn'
svì	'dark'	*svì-**b**-*	'get dark'

As shown in (72), Shona has 14 consonantal verbalizing suffixes. Remarkably, all of them attach to ideophone roots, and only a subset attach to noun and adjective roots.

(72) DISTRIBUTION OF SHONA VERB-FORMING [C-] SUFFIXES (n =14)

attaches to:	√IDEOPHONE	√NOUN	√ADJECTIVE
-k, -m-ar	✓	✓	✓
-dz, -r, -t	✓	✓	
-p, -s	✓		✓
-n, -ny, -n', -nh, -nv, -v, -z, -b	✓		

In light of the fact that the minimal verb root in Shona is [C], it follows that these verbalizing [-C] suffixes are themselves verb roots. Accordingly, one can distinguish verbal roots according to whether they are independent or dependent, as in (73). This departs from traditional accounts of verbalizing suffixes, which treat them as a distinct morpho-syntactic class (Fortune, 1984). Tonally, while √-C verbalizing suffixes are toneless, √C verb roots introduce either a High- or Low-tone melody (though they do not contrast the two tones).[15] The tone distinction between √C roots and √-C suffixes correlates with a distributional difference: √C roots, as independent roots, occur by themselves; √-C suffixes, as dependent roots, must co-occur with other roots.

(73) SHONA VERBAL √C ROOTS

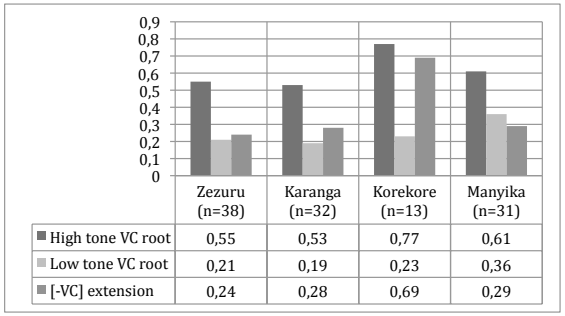
ROOT		κ = v	SPECIFIED FOR TONE	H/L CONTRASTIVE?
independent	√C verb root	✓	✓	no
dependent	√-C verbalizing suffix	✓	✗	—

[15] The proposed contrast between dependent and independent C roots has consequences for the analysis of tone in Shona. Following Stevick's (1969) claim that, in all Bantu languages, H is the marked tone, and L is the unmarked tone, Myers (1990) analyzes the Shona High/Low contrast in terms of (under)specification: while [H] is specified [L] is not. But if there is a distinction between tonally specified (H/L) and tonally unspecified C roots, as argued in the main text, then this means that Myers' underspecification analysis must be revisited.

4.2.3 Shona extensional suffixes are all -VC

Shona verb roots are all C-final, so it is significant that the extensional suffixes that attach to them are also all C-final. In fact, the only difference between √VC roots and [-VC] suffixes is that the latter are segmentally and tonally more contrained. In other words, [-VC] extensional suffixes are defective roots. With this in mind, consider the overall distribution of √VC roots, given in (74).[16]

(74) DISTRIBUTION OF √VC ROOTS IN DIFFERENT DIALECTS OF SHONA (based on Hannan (1981))



	Zezuru (n=38)	Karanga (n=32)	Korekore (n=13)	Manyika (n=31)
High tone VC root	0,55	0,53	0,77	0,61
Low tone VC root	0,21	0,19	0,23	0,36
[-VC] extension	0,24	0,28	0,69	0,29

Three broad patterns are detectable: (i) √VC roots don't contrast for High/Low tone; (ii) most √VC verb roots are High-tone; (iii) [-VC] extensional suffixes are toneless. (75) and (76) list High- and Low-tone √VC roots respectively; and (77) lists toneless [-VC] suffixes.

[16] Not included in this tabulation are the following [VC-] loanwords:

(i)	***ím-***	stop, stand, wait	< Nguni	***ódh-***	order goods by post	< English
	ém-	aim (intend)	< English	***ádh-***	add	< English
	én-	earn	< English	***áin-***	iron	< English

(75) SHONA HIGH-TONE √VC VERB ROOTS (n = 24)

ATTESTED IN ALL VARIETIES OF SHONA (n = 7)		ATTESTED ONLY IN SOME DIALECTS OF SHONA (n = 17)	
ROOT	GLOSS	ROOT	GLOSS
√*íp*	be bad, unpleasant	%√*íbv*	KA KO Z become ripe/fully cooked
√*ímb*	sing	%√*ísv*	KA Z spoil, harm, contaminate
√*ót*	be soft (of leather)	%√*éng*	MA see
√*ón*	see	%√*ír*$_1$/*ér*$_2$	KA$_1$, MA$_2$ Z$_2$ be sacred
√*údz*	tell inform	%√*ózh*	MA Z make foolish statement
√*úng*	be carried away (by flood water)	%√*óz*	MA gather (firewood)
%√*óm*$_1$/*úm*$_2$	KA$_1$ KO$_2$ MA$_2$ Z$_2$ become dry	%√*úmb*	KA MA Z mould, shape, fashion, derive
		%√*únd*	KA KO Z plough new land
		%√*únz*	KO MA Z bring
		%√*ús*	MA bring
		%√*út*	Z collect, gather together
		%√*úzh*	Z win over
		%√*úw*	KA smear (wall/floor for first time)
		%*ónd*$_1$/*únd*$_2$	KA$_{1/2}$ MA$_1$ Z$_1$ become thin
		%*óng*$_1$/*úng*$_2$	KA$_1$ Z$_2$ extract alluvial gold
		%*únz*$_1$/*únzv*$_2$/*úzv*$_3$	KA$_{2/3}$ Z$_1$ give pottery required shape
		%*ámw*	MA suck

(76) SHONA LOW-TONE √VC VERB ROOTS (n = 16)

ATTESTED IN ALL VARIETIES OF SHONA (n = 2)		ATTESTED ONLY IN SOME DIALECTS OF SHONA (n = 14)	
ROOT	GLOSS	ROOT	GLOSS
√*ìt*	do, act, bring about	%√*ìk*	MA copulate
%√*ìnd*$_1$/*ènd*$_2$	KA$_1$ KO$_2$ MA$_2$ Z$_2$ go, go away, depart	%√*ìdz*$_1$/*èdz*$_2$	KA$_1$, MA$_2$ Z$_2$ try, attempt, dare
		%√*òr*	KA MA Z rot, go bad, decompose
		%√*òn'*	KA Z growl (of a dog)
		%√*òmb*	KA Z growl (of a dog)
		%√*òp*	MA appropriate to oneself
		%√*òch*	MA roast on open fire
		%√*òdz*	MA plough virgin land
		%√*ùn*	KO MA Z wither, wilt, shrivel up
		%√*ùny*	Z contract, shrivel up
		%√*ùn'*	Z hum
		%√*ùm*	MA fail to come/do/go
		%√*ùw*	MA hid (bird or small animal)
		%*ànzv*	MA give more to

(77) SHONA TONELESS EXTENSIONAL SUFFIXES (n = 9)

INFINITIVE	GLOSS	EXTENSIONAL SUFFIX		EXTENDED VERB	GLOSS
kù-nw-á	'to drink'	potential	*-ik/-ek*	*kù-nw-**ík**-á*	'to be drinkable'
kù-rày-à	'to warn'	passive	*-iw/-ew*	*kù-rày-**ìw**-à*	'to be warned'
kù-nw-á	'to drink'	applicative	*-ir/-er*	*kù-nw-**ír**-á*	'to drink for'
kù-shamb-à	'to wash'	causative	*-idz/-edz*	*kù-shamb-**ìdz**-à*	'to wash others'
kù-shamb-à	'to wash'	causative	*-is/-es*	*kù-shamb-**ìs**-à*	'to make others wash'
kù-bát-á	'to hold'	reciprocal	*-an*	*kù-bát-**án**-á*	'to hold each other'
kù-nàm-à	'to plaster'	contactive	*-at*	*kù-nàm-**àt**-à*	'to adhere to'
kù-kòmb-à	'to bend'	stative	*-am*	*kù-kòmb-**àm**-a*	'to be crooked'
kù-óm-a	'to become dry'	stative	*-(ar)ar*	*kù-óm-**árár**-á*	'to set hard'

Strikingly, we arrive at the same results for √VC roots as we did for √C roots. To see this, look at (78). Shona √VC verb roots are specified for tone, but extensional [-VC] suffixes are not. And as with √C roots, √VC roots, though specified for High-tone or Low-tone, do not contrast the two tones. The tone distinction between √VC roots and √-VC suffixes correlates with a distributional difference: √VC roots occur by themselves; they are independent roots. In contrast, √-VC suffixes co-occur with roots; they are dependent roots.

(78) SHONA VERBAL √VC ROOTS

ROOT		κ = v	SPECIFIED FOR TONE	H/L CONTRASTIVE?
independent	√VC verb root	✓	✓	no
dependent	√-VC extensional suffix	✓	✗	—

4.2.4 Summary: the prosodification of Shona verbal forms

Close inspection of the verbal root inventory of Shona reveals that √C and √VC roots are sparse in Shona. Recall that Yorùbá, whose verb roots are only √CV, exploits all possible contrasts. In comparison, Shona mono-morphemic √C and √VC roots are relatively rare. What is the significance of this under-exploitation of root melodies in Shona? On independent grounds, Shona has a constraint on word size: the minimal prosodic word is bi-syllabic; i.e., one foot (Mudzingwa, 2010).[17] If minimality screens inputs, then √C, √VC, as well as √CVC roots violate minimality and so are dispreferred. But √CV roots — which violate foot minimality — are pervasive elsewhere in the grammar, namely with ideophones, to which I now turn.[18] This word size difference is one of many clues that indicate that the prosaic and expressive lexicons of Shona are structured in different ways.

4.3 The prosodification of Shona ideophones

Shona ideophones are the engine that feeds the rest of the grammar; they are prolific, both in number and prosodic shape. The most common melodies are mono-syllabic √CV, di-syllabic √CVV and √CVCV, tri-syllabic √CVCVCV, and quadri-syllabic √CVCVCVCV; illustrative examples are given for Karanga Shona.

(79) SHONA IDEOPHONE ROOTS

a.	√CV	*zó*	KA 'going down a slope' (d751a)
b.	√CVV	*zíí*	KA 'buzzing of small insect' (d748a)
b.	√CVCV	*zhìmù*	KA 'revving sluggish engine' (d746a)
d.	√CVCVCV	*zhòkòtò*	KA 'being weary' (d746b)
e.	√CVCVCV	*wíríwírí*	KA 'descending swiftly' (d734)

A hallmark feature of the Shona ideophone lexicon is its gradient use of phonological features (Fortune, 1984). For example, while voicing is contrastive in the prosaic lexicon, in the expressive lexicon it denotes a scale. This is illustrated in (80) where the *p/b/bh* alternation indicates the action takes place on an increasingly larger scale.

[17] Shona dialects differ according to how highly they rank the minimal word size constraint: while xx require all surface output to obey minimality, z does not: -C roots must be supplemented with an additional vowel.

[18] There remains the question of whether there is a causal connection between (morpho-phonological) tonelessness and (morpho-syntactic) dependency in Shona. Are -C and -VC suffixes toneless because they are dependent roots? Are some C and VC roots suffixal because they are toneless? This awaits future research.

(80) SHONA EPXRESSIVE VOICING

a.	bilabial stop, voiceless	***p****áru*	'tearing on a small scale'
b.	bilabial stop, implosive	***b****áru*	'tearing on a medium scale'
c.	bilabial stop, breathy voiced (Fortune 1984:150)	***bh****áru*	'tearing on a large scale'

Syntactically, ideophones, which are from the expressive lexicon, are recycled into the prosaic lexicon via verbalization; representative examples of this extremely productive process are given in (81) for √CVV ideophone roots, in (82) for √CVCV ideophone roots, and in (83) for ideophone √CVCVCV roots. It is also possible for an ideophone root to be nominalized by combining with a noun-class prefix, as in (84)-(85).[19](All examples are from Karanga Shona.)

(81)	a.	√CVV	*téù*	KA spilling
	b.		*téú-**k**-*	KA spill (liquid or grain); be poured as libation
	c.		*téú-**r**-*	KA spill (liquid or grain); pour libation
(82)	a.	√CVCV	*tétsù*	KA rushing out (many)
	b.		*tétsú-**dz**-*	KA cause to emerge (large number, or quantity)
	c.		*tétsú-**k**-*	KA burst out (many together)
	d.		*tétsú-**r**-*	KA release (animals or things, that come out quickly and many, or much at a time)
(83)	a.	√CVCVCV	*tèkèshè*	KA extending over an area
	b.		*tèkèshè-**dz**-*	KA cause (living things) to spread out over a whole area
	c.		*tèkèshè-**r**-*	KA spread over the whole of a wide area or surface
(84)	a.		*bhàbhàngú*	KA beating mediuum-sized and large drum
	b.		***chì**-bhàbhàngú*	KA n7 detonator (d59)
(85)	a.		*dúdú*	KA moving backwards (person or animal)
	b.		***mà**-dúdúdú*	KA n6 act of shriking backwards through fear (d315)

Shona ideophones show pervasize sound symbolism, the hallmark of phono-semantic <π,Σ> association. The phonological formatives have expressive semantics: this includes voicing, manner of articulation, place of articulation, and tone (Fortune, 1984). Ideophones are an open and fluid class, and are the source of lexical innovation (Doke, 1948). Syntactically, they are integrated into clausal structure in several ways: as independent predicates (86)a; via evidential quotative marking (86)b; as adverbials via adjunction to VP (86)c; (iv) as verbs via verbalization (86)d; (v) as nouns via nominalization (86)e.

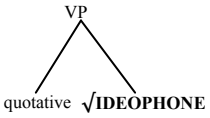
[19] In (85), the ideophone root is bi-syllabic, but the nominalized form is quadrisyllabic. As discussed by Déchaine & Mudzingwa (2014), this reflects the operation of foot structure and larger scale metrical structure.

(86) SYNTACTIC INTEGRATION OF SHONA IDEOPHONES

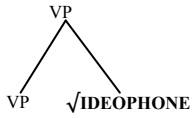
a. predicative

√**IDEOPHONE**

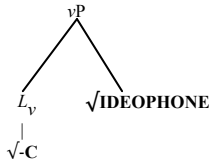
b. evidentialized



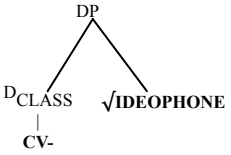
c. adverbial



d. verbalized



e. nominalized



In addition to ideophone roots, Shona also has ideophonized stems; these are formed by attaching a suffix (-V or -VCV) to a verb root. Representative examples are given in (87). Such derived ideophones may undergo verbalization by combining with a verbalizing [-C] suffix. Consequently, in Shona, there is a two-way relation between the expressive and prosaic lexicon: ideophone roots can be verbalized and nominalized; prosaic roots can be ideophonized.

(87)

	DERIVED IDEOPHONE		ROOT	
a.	*ték-**è***	'drawing water'	< *ték-*	'draw water'
b.	*mùk-**éi***	'rising slowly, gingerly'	< *mùk-*	'rise'
c.	*kát-**ánù***	'uncoiling'	< *kát-*	'coil'
d.	*rìm-**aú***	'hoeing all over'	< *rìm-*	'hoe'
e.	*zív-**úrù***	'knowing a lot about st pointless'	< *zív-*	'know'
f.	*chènè-**rù***	'being white'	< chènà	'white'

(from Fortune 1984:152, §5.2.2)

4.4 The prosodification of Shona nouns: the emergence of an open-class

Turning now to nouns, observe that mono-morphemic noun roots in Shona come in four shapes: mono-syllabic, √CV, bi-syllabic √CVV and √CVCV, and tri-syllabic √CVCVCV:

(88) SHONA MONOMORPHEMIC NOUN ROOTS ARE ALL **V**-FINAL

a.	√CV	*-gá*	*chì-**gá***	'mark, sign, brand, notch, CL7 (d65)'
b.	√CVV	*-kòó*	*mà-**kòó***	'bloodstains, bloodclots, CL6 (d193)
b.	√CVCV	*-pòfù*	*chì-**pòfù***	'groundnut, CL7 (d87)'
d.	√CVCVCV	*-kómáná*	*mù-**kómáná***	'boy, CL3'

The larger root size of Shona nouns yields a correspondingly much larger range of possible root melodies; here is where we see the emergence of an open class. The tabulation of possible noun roots is given in (89). Specifically, there are 510 logically possible √CV roots, 5,100 possible √CVV roots, 260,100 possible √CVCV roots, and 132,651,000 possible √CVCVCV roots.

(89) POSSIBLE NOUN ROOT MELODIES IN SHONA

		TOTAL ***n = 132,916,710***
√CV	2_{TONES} x $51_{\text{CONSONANTS}}$ x 5_{VOWELS}	*n = 510*
√CV	510 x (2_{TONES} x 5_{VOWELS})	*n= 5100*
√CVCV	510^2	*n = 260,100*
√CVCVCV	510^3	*n = 132,651,000*

When a language allows a root to be longer then a single syllable, this generates an open-class. In this regard, Shona nouns, as a word-class, are instructive because they behave more like the word-classes that we are familiar with from Indo-European languages. This shows that it is not conceptually necessary for L-categories to be an open-class. Rather, the open-class effect emerges under precise conditions, namely when a language lets roots be bigger than one syllable. And this is exactly what we see in Shona. On the one hand, mono-morphemic V_{ROOTS} can be no larger than a syllable — they can be √C, √VC or √CVC — and so (predictably) constitute a relatively closed class. On the other hand, mono-morphemic noun roots can be larger than a syllable — they can be √CV, √CVV, √CVCV, √CVCVCV — and so (predictably) constitute a relatively open class. Once again, we observe that prosodic constraints regulate the form of the grammar in a very precise fashion.

4.5 Shona Functional categories align to the left-edge: inflection is prefixal

Recall that the F-categories that constitute the verbal spine are Comp, Infl, Aspect (90)a, while those that constitute the nominal spine consist of Kase, Det, Class (90)b. In Shona, formatives that lexicalize each of these positions are part of the inflectional system and they are almost exclusively prefixing (Mkanganwi, 2002). The Shona verbal spine is discussed first (§4.5.1), then the nominal spine (§4.5.2). Because of its intermediate status in the nominal and verbal system, the final vowel suffix is discussed separately (§4.5.3).

(90)

a.	[$_{\text{CP}}$ [Comp-]	[$_{\text{IP}}$ [$_{\text{INFL}}$ SM-]	[$_{\text{AspP}}$ [Asp-]	[$_{\text{vP}}$ OM-	[$_{\text{vP}}$	*v*	]]]]
b.	[$_{\text{KP}}$ [K-]	[$_{\text{DP}}$ [D-]	[$_{\text{ClassP}}$ [Class-		[$_{\text{nP}}$	*n*	]]]]

4.5.1 Shona Functional categories and the verbal spine

The Shona verbal spine includes prefixal complementizers (91), prefixal subject marking (92), prefixal tense/aspect marking (93), and prefixal object marking (94).

(91)

a.	[$_{\text{C}}$ ***há***]-*ndí-ón-è*	b. [$_{\text{C}}$ ***hà***]-*ndí-ón-i*
	H.HORT-1SG-see-FV	NEG-1SG-see-FV
	'let me see'	'I don't see'

c. *w*-[$_C$ ***à***]-*nd-á-ón-à*
AGR-C-1SG-PST-see-FV
'that which I saw'
(cf. Odden 1981:12*f*)

d. … [$_C$ ***pà***]-*ndí-òn-á*
P-1SG-see-FV
'when I saw'

(92) a. [$_{SM}$ ***ndì***]-*nó-zív-á*
1SG-HAB-know-FV
'I know'

b. [$_{SM}$ ***á***]-*nò-zív-á*
H.3SG-HAB-know-FV
'She/he knows'

(93) a. *ndì*-[$_{ASP}$ ***chá***]-*énd-à*
1SG- H.FUT-go-FV
'I will go'

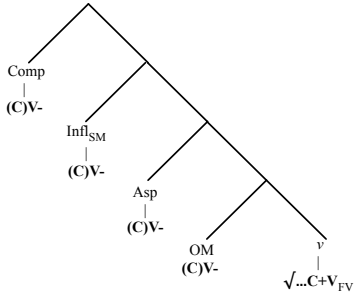
b. *nd*-[$_{ASP}$ ***à***]-*énd-à*
1SG-PAST-go-FV
'I went (today)'

(94) a. *nd-à*-[$_{OM}$ ***mú***]-*ón-á*
1SG-PAST-H.HUM.SG-see-FV
'I saw her/him[CLASS 1]'

b. *nd-à*-[$_{OM}$ ***chí***]-*ón-á*
1SG-PAST-H.INANIM.SG-see-FV
'I saw it[CLASS 7]'

Notice that Shona verbal inflectional prefixes, like their Yorùbá counterparts, are no smaller nor no bigger than one mora, and so may be [V-] or [CV-]. Thus, as shown in (95), the Shona verbal spine is characterized by a succession of prefixal F-categories (which attach as pro-clitics), followed by a verb-stem, which consists of a consonant-final verb root in combination with the final vowel. (I return below to the question of how the final vowel suffix attaches to the verb stem.)

(95) SHONA VERBAL SPINE



4.5.2 Shona Functional categories and the nominal spine

As for the Shona nominal spine, we find prefixal locative inflection (96), prefixal D (97), and prefixal class markers which code gender and number (98).[20]

[20] The infinitive prefix *kù-* is usually treated as part of the paradigm of locative and noun-class prefixes on the basis of its prosody: it is Low-tone and [CV-]. Infinitive *kù-* is homophonous with the locative prefix *kù-* 'at'. In addition, the infinitve has a suffixal final vowel, whose tone melody is High after a High-tone stem, and Low after a Low-tone stem.

(96) a. [$_K$ ***pà***]-*mì-tí*
on-INANIM.PL-tree
'on the trees'

b. [$_K$ ***kù***]-*mì-tí*
at-INANIM.PL-tree
'at the trees'

(97) a. [$_D$ ***ì***]-*chì*
PROX-INANIM.SG$_{CL7}$
'this, [CLASS 7]'

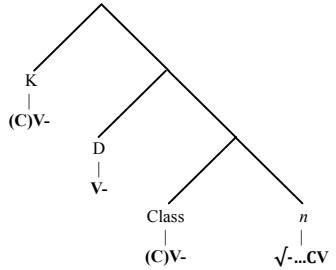
b. [$_D$ ***ì***]-*zvì*
PROX-INANIM.PL $_{CL8}$
'this, [CLASS 8]'

(98) a. [$_{CLASS}$ ***mù***]-*kómáná*
HUM.SG-boy
'boy, [CLASS 1: HUMAN, SG]'

b. [$_{CLASS}$ ***và***]-*kómáná*
HUM.PL-boy
'boys, [CLASS 2: HUMAN, PL]'

Again, observe that Shona nominal inflectional prefixes are no smaller nor no bigger than one mora, and so may be [V-] or [CV-]. As shown in (99), just as the Shonal verbal spine is a succession of prefixal F-categories, so too is the Shona nominal spine.

(99) SHONA NOMINAL SPINE



4.5.3 Why is the final vowel a suffix rather than a prefix?

It is almost true that all inflectional morphology in Shona is prefixal (Déchaine, 2012; Mkanganwi, 2002). The one exception is the final vowel that is suffied on all verb stems. Syntactically, the final vowel is found in two contexts: on inflected verbs (100), and on deverbal nouns (101).

(100) a. *kù-tór-*[***á***]
INF-take-FV
'to take'

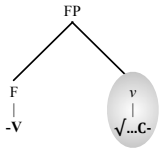
b. *kù-gàr-*[***á***]
INF-sit-FV
'to sit'

(101) a. *mù-tór-*[***ɪ́***]
c1-take-FV.AGENT
'one who takes'

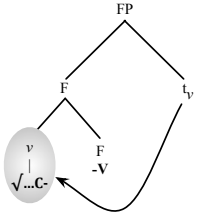
b. *chì-gàr-*[***ɔ̀***]
c7-take-FV.INSTR
'chait; lit. thing that one sits with'

Co-occurrence restrictions show that the final vowel selects for the verb-stem (Fortune, 1984); this indicates a sisterhood relation. We know that Shona is otherwise head-initial. Combining these two generalizations — the final vowel is sister to the verb-stem, and the verb spine is head-initial — leads to the conclusion that the final vowel is introduced in a head-initial structure as in (102)a. The verb-stem undergoes prosodically driven head-movement (Wojdak, 2005), as in (102)b, and so surfaces to the left of the final vowel.[21]

(102) a. FINAL VOWEL IS F-HEAD



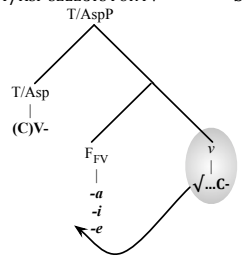
b. PROSODICALLY DRIVEN HEAD-MOVEMENT



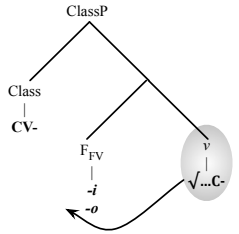
Analyzing the final vowel suffix as introduced in a head-initial structure also accounts for the fact that the vowel is conditioned by material that occurs at the left-edge of the verbal and nominal complex respectively (Fortune, 1984). For example, in verbal contexts, Tense/Aspect prefixes select for ***-a***, ***-i***, or ***-e*** as a final vowel. In nominal contexts, noun class prefixes select for ***-i*** or ***-o*** as a final vowel . Syntactically, this selectional restriction indicates that the Aspect/Class positions are sister to the L-projection of which the final vowel is a head, as in (103). Subsequent movement of the verb stem to a position preceding the final vowel yields the surface order.

[21] Introducing the final vowel in a head-initial structure requires a more abstract input representation, but it yields a conceptually simpler analysis, as it allows Shona to be analyzed as consistently head-initial language.

(103) a. T/ASP SELECTS FOR FV



b. CM SELECTS FOR FV



4.5.4 Summary: Shona Functional categories are head-initial and minimally moraic

The results of this brief survey of Shona verbal and nominal inflection are summarized in (104) and (105) respectively. Observe the segmental melody of both verbal and nominal inflection is minimally and maximally a μ, and so may be [CV-] or [V-]. As for tone melody, verbal inflection may surface with either High or Low tone, but nominal inflection is always Low tone, the unmarked tone in Shona. Syntactically, the nominal and verbal spine is consistently head-initial in Shona. While prefixes attach as proclitics, the one inflectional suffix of the language — namely the final vowel suffix — is introduced in a head-initial structure, with prosodic movement determining surface linearization.[22]

(104) SHONA VERBAL INFLECTION

	HEAD-INITIAL	PREFIX	SEGMENTAL MELODY	TONE MELODY
clause-typing	✓	✓	(C)V-	H/L
tense/aspect	✓	✓	(C)V-	H/L
subject agreement	✓	✓	(C)V-	H/L
object agreement	✓	✓	(C)V-	H/L
final vowel	✓	✗	-V	H/L

(105) SHONA NOMINAL INFLECTION

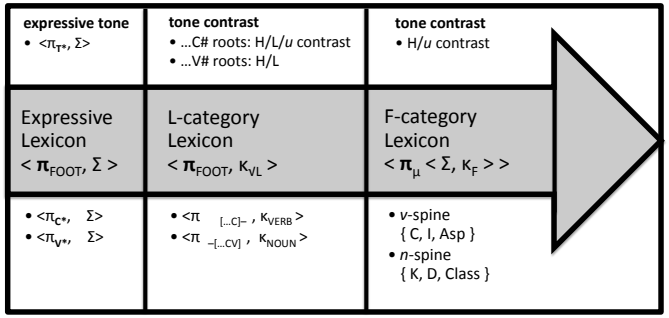
	HEAD-INITIAL	PREFIX	SEGMENTAL MELODY	TONE MELODY
locative marking	✓	✓	CV-	L
determiner	✓	✓	V-	L
gender-number	✓	✓	(C)V-	L
infinitive	✓	✓	CV-	L

[22] One consequence of treating prefixation and suffixation as prosodically conditioned is it is not necessary to posit syntactic head-movement to account for the linearization of affixes in Shona, *pace* Baker (Baker, 1985, 1988) and Baker, Aranovich, and Golloscio (2005)

4.6 Summary: prosodification in Shona

All verb roots in Shona are C-final; at first glance, this seems like an innocuous restriction. By carefully examining the phonotactics of Shona roots, we come to the surprising conclusion that Shona verbs constitute a closed class, with very few of the logically possible monomorphemic C-final roots attested; i.e., monomorphemic √C, √VC roots and √CVC roots are sparse in Shona. Yet Shona does have an open class of derived verb stems, which arise by combining ideophone roots (which are all vowel final) with either verbalizing [-C] suffixes, or nominalizing class prefixes. This means that one of the primary sources of lexical innovation in Shona is the expressive lexicon. In addition, Shona C-final roots — traditionally analyzed as exhibiting a two-way tone High/Low contrast (Odden 19xx, Myers 1987) — were shown to actually show a three-way partition, namely High versus Low, versus unmarked, with the latter corresponding to "dependent roots", namely the [-C] verbalizing suffixes and [-VC] extensional suffixes.[23]

(106) PROSODIFICATION IN SHONA



5. Conclusion: prosody shapes grammar

The present analysis has been couched in the analytic framework of *Interface Syntax*, which recognizes that lexical formatives are "bundled" in different ways. The discussion has focused on two types of bundling that have been previously neglected in formal treatments of word-classes, namely phono-syntactic <π,κ> and phono-semantic <π,Σ> bundles. In this

[23] As discussed in Déchaine (Déchaine, 2012), Shona also has adverbial bi-syllabic [CVCV-] prefixes (Odden, 1981) [-VCVC] suffixes (Fortune, 1984; Jefferies, 2000), with the latter derived from reduplicated [-VC] suffixes. Representative examples are given in (i) and (ii).

(i) *kù-zív-**isis**-a* 'to know very well' > *kù-zív-á* 'to know'
*kù-sung-**umur**-a* 'untie, unarrest' > *kù-sung-a* 'to tie, arrest'
*kù-chek-**erer**-a* 'to cut into tiny pieces' > *kù-chek-a* 'to cut'
(from Jefferies 2000:6)

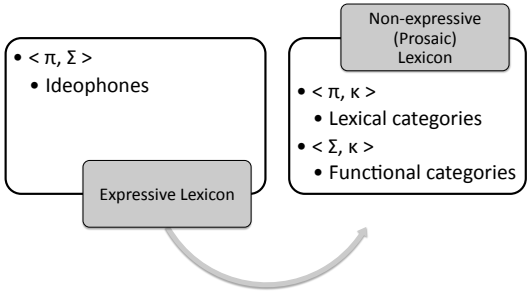
(ii) *nd-à-**svíkò**-bìk-à* *nd-à-**nvátsò**-bìk-à*
1SG-PAST-arrive-cook-FV 1SG-PAST-neatly-cook-FV
'I arrived and cooked' 'I arrived and cooked neatly'
(cf. Odden 1981:15 (18))

closing section, I briefly assess the broader implications of the proposal, as it pertains to the typology of Niger-Congo languages (§5.1), to formal theories of categorization (§5.2), and to the typology of natural language (§5.3).

5.1 Prosodificaton in the Niger-Congo Lexicon

The goal of this paper has been to show that the lexicon of Niger-Congo languages is structured in a very particular way, namely as as in (107), with two lexical strata, one being expressive, the other non-expressive.

(107) ORGANIZATION OF THE LEXICON: NIGER-CONGO



The hallmark property of the expressive lexicon is semantic prosodifcation, namely a direct association with sound and meaning. Using the analytic tools of *Interface Syntax*, this is analyzed as a phono-semantic <π,Σ> association. As for the prosaic lexicon, it exhibits syntactic prosodification: L-categories are strictly prosodified, such that the contrast between "verb" and "noun" can be read off of the prosody. In other words, there is a direct relation between prosody and category. In the Interface Syntax model, this is analyzed as phono-syntactic <π,κ> association. A consequence of this approach is that expressive and prosaic lexicons are formally in complementary distribution. This provides a way of understanding why ideophone vocabularies are structured in the way that they are: whatever constraints hold of the prosaic lexicon are "lifted" in the idephonic lexicion. We have seen examples of this throughout. For example, features that are contrastive in the prosaic lexicion — vowel quality, voicing, tone, place and manner of articulation — are gradient in the expressive lexicon, and express different degrees on a scale. The distinction between contrastive versus gradient deployment of features is only one of the many ways in which the expressive lexicon differs from the non-expressive lexicon. And although the complementarity of the prosaic and expressive lexicon is particularly dramatic in Niger-Congo languages, I conjecture that this is likely a property of all natural languages. Future research will reveal whether this is so.[24]

[24] See Déchaine & Mudzingwa (2014) for discussion and analysis of the how the expressive and prosaic lexicions differ relative to their phonological, morphological, syntactic, semantic, and pragmatic properties.

Specific to the two languages discussed here, we see that though their surface morphology differs radically — Yorùbá is highly analytic, Shona is agglutivnative — the organizing principles that determine their surface form are remarkably similar. I suggest that these organizing principles are characteristic of Niger-Congo languages. In particular, the [CV] constraint is a driving force not only in the phonology of these systems, but also in their phono-syntax and phono-semantics. Surface differences reflect where the [CV] constraint holds. In Yorùbá it is active in the prosaic lexicon, such that all verb and noun roots are minimally and maximally [CV]. In Shona, it is active in the expressive lexicion, where ideophone roots are minimally [CV]. Likewise, the presence of a minimal bi-syllabic foot is detectable in both languages. In Yorùbá, it emerges in the expressive lexicion, where the smallest ideophone root is [CVV]. In Shona, it emerges in the prosaic lexicon, where the smallest stem is [CVCV]; a side-effect of this prosodic contraint is that monomorphemic C-final roots (√C, √VC, √CVC), though possible — are under-exploited in Shona And in both languages, the prosaic lexicon distinguishes L-categories from F-categories prosodically, with the latter being no larger and no smaller than a single mora.

Though the tone inventory of L-categories in Yorùbá and Shona is, at first glance, very different, upon closer examination the two systems show a number of parallels. In the root-domain, both languages exploit a three-way tone contrast: Yorùbá has High/Mid/Low (with Mid the unmarked tone), and Shona has High/Low/toneless (with suffixal √-C and √-VC roots being toneless). And in both languages, the tone contrasts available to the F-category lexicon is impoverished relative to the L-category.

5.2 Prosodified syntactic categories: theoretical implications

The most dramatic consequence of this analysis is the implications it has for how roots are integrated into syntactic structure. In some theories, lexical insertion is claimed to be a uniform operation that proceeds in the same way across all languages. For example, *Distributed Morphology* (DM) claims that phonological material is inserted post-syntactically; this is sometimes called "late lexical insertion" or "late spell-out". Accordingly, a root is treated as a semantic (category-neutral) primitive that is inserted into a particular syntactic configuration, and then assigned phonological content (Embick & Noyer, 2007; Marantz, 1997). On this view, English 'cat' is not inherently a noun; rather the root is inserted into a categorizing context, and then later assigned phonological content, as in (108)a. Similarly, English 'read' is not inherently a verb; it is inserted into a verbal context and then assigned phonological content, as in (108)b.

(108) DISTRIBUTED MORPHOLOGY ANALYSIS OF ROOTS

a. [*n* [√CAT]] → [kæt]

b. [*v* [√READ]] → [ri:d]

In the *Interface Syntax* model, the DM treatment of roots is equivalent to late prosodification of a syntactico-semantic <κ,Σ> bundle, as in (109).

(109) DISTRIBUTED MORPHOLOGY ANALYSIS AS LATE PROSODIFICATION

	< κ,	Σ	>	π	> >
a.	< *n* ,	√CAT	>	[kæt]	> >

b. < *v* , √READ > [ri:d] > >

Though late prosodification is a logical possibility, it is not the only possibility. Languages such as Yorùbá and Shona, which show pervasive phono-syntactic <π,κ> bundling, indicate that it is not only possible, but necessary, to insert phonological material early in the syntactic derivation. To see why, consider (110) and (111), which highlight the phono-syntactic nature of Yorùbá and Shona L- and F-categories. This contrasts with the phono-semantic logic of DM, which in *Interface Syntax* is emerges as a special case. This leads to questions relating to the broader implications of the analysis, to which I now turn.

(110) YORÙBÁ EARLY PROSODIFICATION

	< κ,	π	>	Σ	> >
a.	< *n* ,	√VCV	>	ENTITY	> >
b.	< *v* ,	√CV	>	EVENTUALITY	> >
c.	< F ,	μ	>	—	> >

(111) SHONA EARLY PROSODIFICATION

	< κ,	π	>	Σ	> >
a.	< *n* ,	√ –[…CV]	>	ENTITY	> >
b.	< *v* ,	√ […C]–	>	EVENTUALITY	> >
c.	< F ,	μ	>	—	> >

5.3 Prosodification in natural language

If the claim advanced is tenable — namely that phono-syntactic <x,y> bundlig is the engine of the prosaic lexicion — then it has implications that go well beyond the two languages analyzed here (Yorùbá and Shona), and well beyond the Niger-Congo language family. Prosodification of the sort treated here is rampant in language acquisition (Marquis & Shi, 2012; Shi & Lepage, 2008) and language processing (Borovsky, Elman, & Kutas, 2012; Duta, Styles, & Plunkett, 2012; Friedrich & Friederici, 2005). This relates to the desiderata set out by Kelly (1992) regarding the possibility that prosody drives syntax: (i) the information must be available in the signal; (ii) users are sensitive to the information; (iii) users exploit the information. This paper has focused on (i): it is evident that in languages such as Yorùbá and Shona — and more generally Niger-Congo — prosodic information relating to meaning (in the expressive lexicon) and structure (in the non-expressive lexicon) is available in the signal. Future research will reveal whether users are sensitive to the information and whether they exploit it. One anticipates that the findings will be positive in this regard, and if so, this leads to the question of whether prosody might be more heavily weighted in languages such as Yorùbá and Shona compared to languages such as English and French. On this view, the Niger-Congo lexicon is simply the emergence of the unmarked, and we expect to find similar effects in all languages. Recall that this is precisely the case in English, where we observe syntactic prosodification in a very constrained domain, namely with bi-syllabic words. So it may be that the phono-syntactic effects so prevalent in Yorùbá and Shona, rather than being language-specific strategies, reflect a default strategy for natural language categorization.

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