CHAPTER X

WHAT "SPELL-OUT" REVEALS: NIGER-CONGO PROSODIFICATION CONSTRAINS THE SYNTAX-SEMANTICS INTERFACE*

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In Niger-Congo languages, the interaction of prosody (including segmental and tone melody) with syntax and semantics has been extensively treated in phonological terms (Downing, 2006; J. L. Smith, 2011). I show that approaching prosodification through the lens of syntax yields empirical and theoretical benefits. Attending to the syntax of prosodification has four immediate consequences. First, it provides insight into the structure of the lexicon by permitting a formal account of the relation between regular and ideophonic vocabulary items. Second, 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). Third, it challenges the Saussurean dictate that the relation between form and meaning is arbitrary. Finally, it confirms the architecture proposed in the model of *Interface Syntax* (Wiltschko & Déchaine, 2010), which predicts that prosody can associate directly with syntactic or semantic atoms, correctly allowing phono-syntactic (sound-category) and phono-semantic (sound-meaning) bundling.

THE RELATION BETWEEN PROSODY AND SYNTACTIC CATEGORY

When the mapping between prosody and category is opaque, as it is in well-studied languages such as English or French, it is difficult to assess how, or even if, they are related to each other. A good 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: they are famous for the prosodic constraints that they impose on word-forms, and so 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; the maximal one is √CVC. All noun stems end in a vowel (4): the minimal mono-morphemic noun is √CV; the maximal one is √CV.CV.CV.

(3) SHONA VERB ROOTS ARE 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 NOUN ROOTS ARE V-FINAL

a.	√CV	*-gá*	*chì-**gá***	'mark, sign, brand, notch, CL7'
b.	√CV.V	*-kòó*	*mà-**kòó***	'bloodstains, bloodclots, CL6'
b.	√CV.CV	*-pòfù*	*chì-**pòfù***	'groundnut, CL7'
d.	√CV.CV.CV	*-kómáná*	*mù-**kómáná***	'boy, CL3'

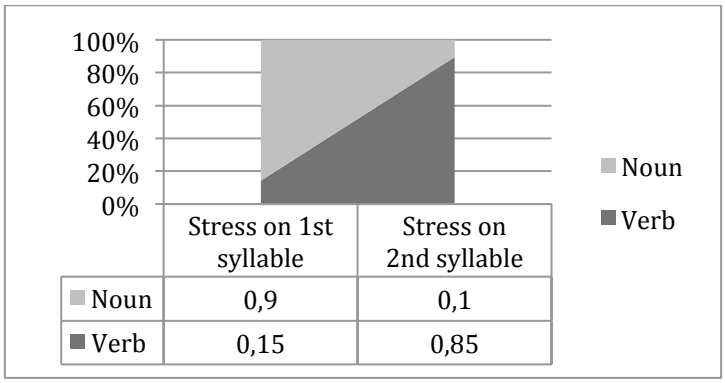
For processing, a transparent prosody-category relation facilitates fast mapping: the continuous speech stream can be more quickly segmented and chunked if the relation between prosody and morpho-syntax is predictable. This is the claim made by analyses that invoke prosodic bootstrapping as a mechanism for language acquisition (Höhle, 2009;

Soderstrom, Seidl, Kemler Nelson, & Jusczyk, 2003). Thus, 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; 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 transparent prosody-category mapping, but there are corners of the grammar where this cluster of properties emerges. 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).

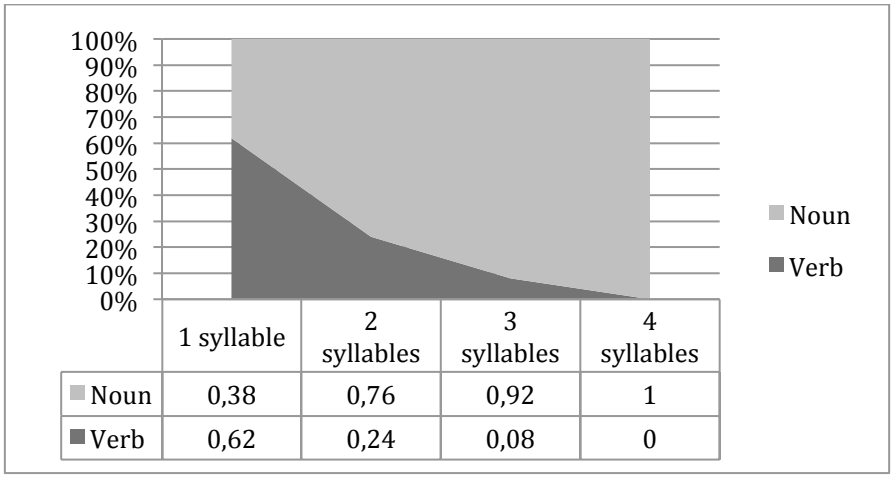
(5) ENGLISH TWO-SYLLABLE WORDS AND THE NOUN/VERB CONTRAST



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

English also has a transparent prosody-category mapping with respect to word length. As shown in (6), mono-syllabic words tilt towards the verb category, with most mono-syllabic words being verbs (62%). Longer words tilt towards the noun category: 76% of bi-syllabic words are nouns; 92% of tri-syllabic words are nouns, and all (100%) quadri-syllabic words are nouns. 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 AND THE 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 investigate the first feature of transparent mapping, namely the availability of the information in the signal. This predicts robust phonological cues for grammatical class, widespread correlations within the language, with individual magnitudes of the correlations being significant. (Two other features are predicted to be present, namely users are sensitive to, and exploit, the information. These can only be verified via acquisition and experimental studies in production and perception, and awaits future research.) To test the first prediction, namely that the information is available in the signal, consider (7), which lists differences in morphologization between two branches of Niger-Congo, namely West Benue-Congo (exemplified by

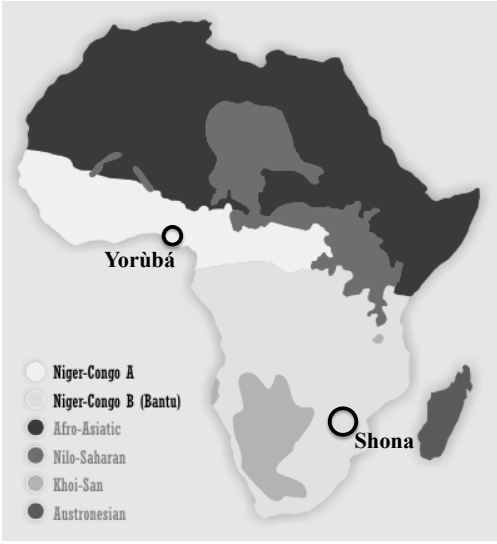
Yorùbá) and East Benue-Congo (exemplified by the southern Bantu language Shona). The division of labor differs across the two languages. Yorùbá has an absence of morphologization: both verb and noun roots are CV, verb roots are invariant, there is no morphological verb class, no verbal derivation, and no morphological passive. As for 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	✗	✓

Although the systematicity of these morphologization differences between West and East Benue-Congo is widely known (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, 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. Of interest is the fact that, under certain conditions, prosodification constrains syntax and semantics. Nano-syntax (Taraldsen, 2010) — the micro-syntax of lexical categories — is revealing in this regard. To explore whether and how prosody shapes grammer, I draw on data from two languages, Yorùbá and Shona, which each have a depth of description and analysis that permits meaningful comparison. 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 East Benue-Congo grouping.

(8) GEOGRAPHIC LOCATION OF YORÙBÁ AND SHONA



After introducing some background on how prosody interacts with syntax and semantics, I examine what Yorùbá and Shona morpheme structure constraints reveal about the ways in which prosody can shape grammar.

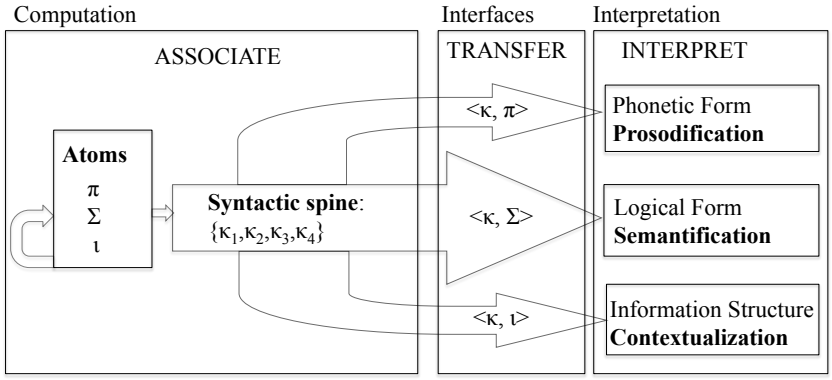
CONNECTING PROSODY TO SYNTAX AND SEMANTICS: BACKGROUND ASSUMPTIONS

That lexical formatives are structured seems self-evident: 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. With the goal of exploring less orthodox views about the nature of this internal structuring, I introduce a model that provides a vocabulary for more precise discussion of how prosody connects to syntax and semantics, and of how grammar harnesses prosody.

THE INTERFACE SYNTAX MODEL

The proposed analysis rests on two claims. First, there is a universal syntactic spine. Second, 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 via *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 the syntactic spine 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 major categories. The next category is associated with *classifying;* this is the domain where major word-classes are sub-categorized. Next is *anchoring*, which corresponds to discourse activation. And the uppermost category is associated with *outer typing*; this corresponds to argument typing.

(10)	**SPINE**	[κ_1	[κ_2	[κ_3	[κ_4	]]]]
	FUNCTION	[OUTER TYPING	[ANCHORING	[CLASSIFYING	[INNER TYPING	]]]]

This abstract structure is realized as two distinct, but often overlapping, syntactic spines, namely the verbal and nominal spine, as in (11)-(12). (11)a shows the *verbal spine*. Small *v* is the locus of inner typing (Ramchand, 2008). *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, resides (Ritter & Wiltschko, 2009). *Comp* is the locus of outer typing; this corresponds to clause-typing (Rizzi, 1997)).

(11) VERBAL SPINE

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

(12)a shows the *nominal spine*. Small *n* is the locus of inner typing (Rijkhoff, 1991), *Class* is the locus of entity classification (Borer, 2005a). *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 (Hornstein, 2001).

(12) NOMINAL SPINE

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

Each of these functions is potentially subject to further sub-division.[2] 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 *prolific domains* (Grohmann, 2003) in that they divide into subcategories. As shown in (11)b, in the verb 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 $D_{SALIENT}$. The discussion attends to 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, inasmuch as it bears on the question of how lexical formatives are prosodified.

The *Interface Syntax* model allows precise questions on how prosody, meaning, and structure associate. I focus on how prosodic and semantic atoms associate with category labels. For example, with simplex atoms, there are three possibilities, (13). Many analyses assume that semantic type associates with syntactic category (Anderson, 1997; Baker, 2003; Croft, 1991), and that such association is universal; this corresponds to (13)a. Such encapsulation predicts two surface effects. First, there will be a regular correspondence between semantic type and syntactic category. For example, entities tend to be categorized as nouns; events tend to be categorized as verbs. Second, prosodification will be late and independent of syntactic category. (This is one one of major tenets of *Distributed Morphology*; see the conclusion for discussion). In Yorùbá and Shona, such semantically driven categorization is found only with F-categories. *Interface Syntax* predicts other types of association, e.g., 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 languages, and correlates with two effects. First, there is a regular correspondence between prosody and syntactic category. Second, there is late assignment of semantic type.[3] It is also possible for prosody to associate with semantic type, (13)c; this type of encapsulaiton is found in the very robust ideophone lexicon of Niger-Congo languages.

(13) a. $< \Sigma, \kappa >$ associate semantic type with syntactic category
b. $< \pi, \kappa >$ associate prosody with syntactic category
c. $< \pi, \Sigma >$ 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. While *Distributed Morphology* holds that both category-neutrality and late prosodification are fully general, in *Interface Syntax*, though such outcomes are possible, they are but a subset of the many logical possibilities. (I return to this in the conclusion.)

HOW GRAMMAR HARNESSES PROSODY

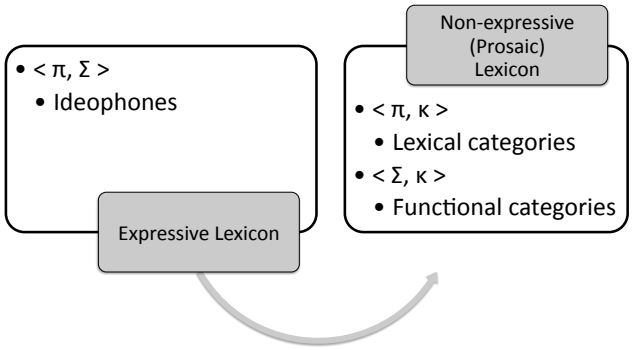
According to Hyman (2006), prosodification can be classifed according to whether it constrains word-domain (14)a, word-size (14)b, or word-shape (14)c. Constraints on word-domain can be *demarcative* (identifying word-edge), *culminative* (identifying word-occurrence), or *harmonic* (identifiying word-span). Constraints on word-size, as well as enforcing *minimality* or *maximality*, can also be *metrical*. And constraints on word-shape can be *phonotactic* (by restricting outputs) or *morpho-phonotactic* (by restricting inputs).

(14) PROSODIC CONSTRAINTS ON DOMAIN, SIZE, AND SHAPE (adapted from Hyman 2006:229, (2))

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

Attending to constraints on word-domain, word-size, and word-shape reveals that three types of bundles form the cornerstone of Niger-Congo lexicons: phono-syntactic <π,κ> bundles, phono-semantic <π,Σ> bundles, and semantico-syntactic <Σ,κ> bundles. These modes of encapsulation define both lexical strata and morpho-syntactic domains. As illustrated in (15), the expressive lexicon is characterized by phono-semantic bundling (Dwyer & Moshi, 2003), while the prosaic lexicon (Doke, 1948) displays phono-syntactic bundling with L-categories, and semantico-syntactic bundling with F- categories.

(15) ORGANIZATION OF THE LEXICON: NIGER-CONGO



A first step in detecting how prosody actively shapes syntax and semantics is to focus on the contexts that pertmit a CV syllable to be a word. 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 a lexicon is to find which part of the grammar enforces CV minimality as an input constraint. While the minimal CV word is attested with verbs in Yorùbá (16)a; in Shona, it is attested with ideophones (16)b.

(16) MINIMAL SIZE OF ROOTS IN YORÙBÁ AND SHONA

	MINIMAL √VERB	MINIMAL √NOUN	MINIMAL √IDEOPHONE
a. YORÙBÁ	**CV**	-CV	CV.V
b. SHONA	-C	-CV	**CV**

What's special about CV syllables? Typologically, they are attested in all languages (C. Levelt & van de Vijvwer, 1998). In terms of acquisition, they are the first syllable type that children acquire (C. C. Levelt, Schiller, & Levelt, 2000). In terms of production, they reflect a default oscillatory mode (Nam, Goldstein, & Saltzman, 2009). And in terms of perception, they reflect a default temporal organization (Poeppel, Idsardi, & van Wassenhove, 2008). In Niger-Congo, the CV syllable is the basic building block. There are three ways of understanding this. First, it could be that the special status of the CV syllable reflects morpho-phonological constraints (Orie & Pulleyblank, 2002), (17)a. On another view, it is morpho-syntax (Déchaine, 2001) that privileges CV, (17)b. Third, the special status of the CV syllable could be the hallmark of prosodified categorization, (17)c. This third approach is the one advocated here: it has the virtue of capturing the insights of morpho-phonological and morpho-syntactic analyses, while resolving many of the stipulations that they invoke.

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

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

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

If there is prosodification of syntactic categories, then this information will be available in the signal (Kelly, 1992). This predicts that: (i) there exist robust phonological cues for syntactic categories; (ii) prosody-category correlations are widespread within the language; and (iii) the individual magnitudes of the correlations are significant. One thread that we can follow is word-size, which is strictly legislated in both Yorùbá and Shona. 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, F-categories are minimally and maximally one mora. As for the CV constraint, this holds of the prosaic lexicon in Yorùbá (with verbs), and of the expressive lexicon in Shona (with ideophones). 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). With these conceptual underpinnings in place, I now turn to the description and analysis of prosodification in Yorùbá and Shona.

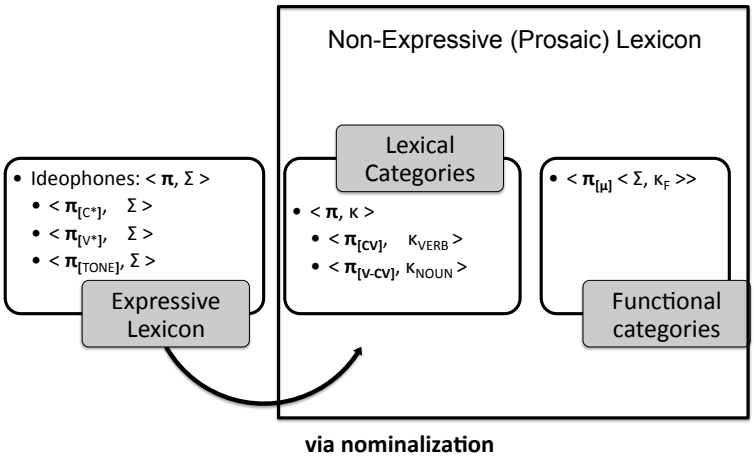
(18) WORD SIZE CONSTRAINTS IN YORÙBÁ AND SHONA

	MIN/MAX WORD = μ	MIN WORD = CV	MIN WORD = $[_{FT}\ \sigma\ \sigma]$
a. YORÙBÁ	F-categories	verb	ideophone
b. SHONA	F-categories	ideophone	L-categories

YORÙBÁ PROSODIFICATION

The Yorùbá lexicon has two strata: expressive and non-expressive, as in (19). 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 CV.V, and they enter the prosaic lexicon via nominalization. The prosaic lexicon prosodifies L- and F-categories differently. With L-categories there is phono-syntactic <π,κ> bundling: verbs are canonically CV; nouns are canonically V-CV. As for F-categories, they can be no bigger and no smaller than one mora. They display semantically driven categorization, with a direct association between a semantic atom and a category, and late prosodification. With this in place, I consider how prosodification plays out for Yorùbá L-categories, ideophones, and F-categories.

(19) LEXICAL STRATA IN YORÙBÁ



YORÙBÁ LEXICAL CATEGORIES

Yorùba verbs are CV; nouns are V-CV. The correspondence between word-class and segmental melody is so regular that it can be stated as an implicational relation, (20). This is expected if the categorization of Yorùbá verbs and nouns is prosodic: prosody (π) associates with category (κ), forming a phono-syntactic <π,κ> bundle. In what follows, I explore how such prosodic categorization affects the verb and noun lexicon, and its impact on VP syntax.

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

YORÙBÁ VERBS. For a given CV sequence, three verb-forms are possible, according to whether the tone is H, M, or L (Akinlabi, 1985; Courtenay, 1969). This is illustrated in (21), for *ro*.

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

Because Yorùbá verbs are minimally and maximally CV, they are a finite set. To see why, consider the segment and tone inventory in (22), which shows that Yorùbá has 3 tones, 10 vowels, and 18 consonants; this yields **540** logically possible CV tokens ($=3_{TONES}$ x 10_V x 18_C). Thus, Yorùbá verbs are a closed class: it is not possible to introduce a new verb form into the Yorùbá lexicon. This has consequences for lexical semantics. Here I focus on three properties: the Yorùbá verb lexicon has massive homophony, Yorùbá verbs have a broad semantic range, and the locus of predicative meaning is VP (rather than V) in Yorùbá.

(22) POSSIBLE CV TOKENS IN YORÙBÁ

	n =	
TONE	*3*	High, Mid, Low
V	*10*	i, e, ɛ, o, ɔ, u, a, ĩ, ũ, ã
C	*18*	t, k, b, d, g, kp, gb, f, s, ʃ, h, ʤ, m, n, l, r, y w
CV TOKENS	***540***	18_C x 10_V x 3_{TONES}

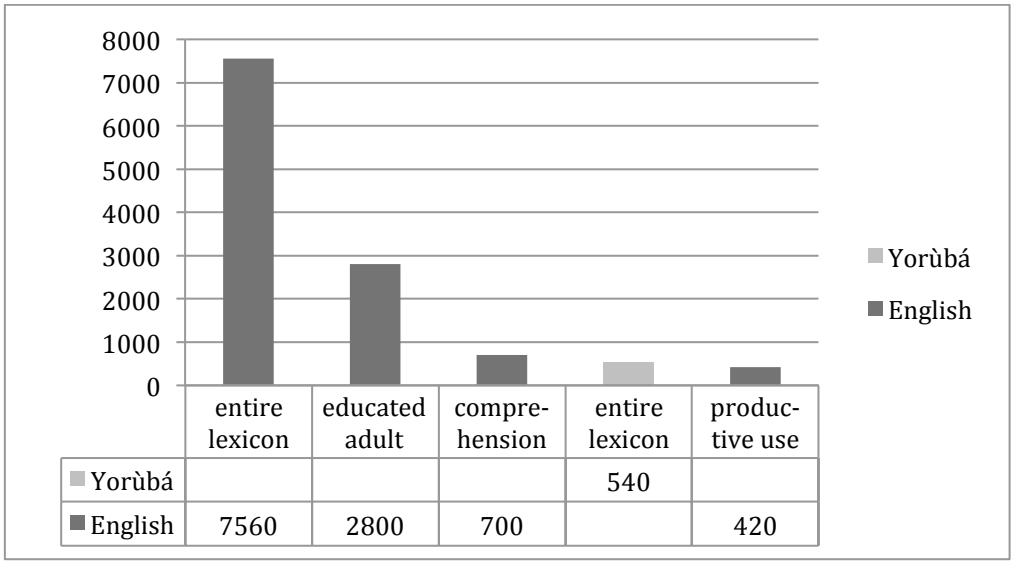
To see how the CV template gives rise to large-scale homophony, consider (23), which lists the *rV* Yorùbá verb forms. Of the 30 logically possible *rV* melodies (3_{TONES} x 10_V), all are attested. Many forms are homophonous, e.g. *ràn* is associated with four meanings: 'send', 'sew', 'recur', 'be.puny'. For the 30 logically possible *rV* roots, **61** lexemes are attested (24 for the 10 possible H-tone roots, 16 for the 10 M-tone roots, and 21 for the 10 L-tone roots). This exercise can be repeated with any CV melody and yields similar results. This means that, on average, there is as 1:2 ratio between form and meaning, with every CV root associated with two distinct meanings.

(23) YORÙBÁ *rV* 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

Suppose that homophony can increase the expressive capacity of the Yorùbá verb lexicon by a factor of two: the 540 CV tokens could be associated with about 1,000 distinct lexemes. But this still yields a radically constrained verb lexicon. To see this, consider (24), which compares the number of verb-forms in Yorùbá and English.[4] English verb-forms number about 7,500; a literate adult has a vocabulary of about 3,000; comprehension requires around 700 verb-forms, and productive use requires around 400 verb-forms. The upper bound of Yorùbá verb-forms is 540. While this is comparable to the 400 or so forms needed for productive use in English, it is much below the upper bound of English forms, which clocks in at over 7,000. So, English has about 14 times as many verb-forms as Yorùbá does.

(24) VERB-FORMS IN YORÙBÁ AND ENGLISH



	entire lexicon	educated adult	compre-hension	entire lexicon	produc-tive use
Yorùbá				540	
English	7560	2800	700		420

Yorùbá's small verb lexicon has semantic and syntactic consequences: verb-level meaning is vague, and every verb is a light verb (Déchaine, 2005). For example, *jẹ*, often glossed as 'eat', actually denotes ingestion or absorption, both physical and metaphorical. Literal physical digestion is exemplified in (25)a-b with 'eat mango' or 'eat grass; i.e., graze'. Metaphorical digestion is exemplified in (25)c-d with 'eat finger; i.e., feel regret' and 'eat whip; i.e., be whipped'. In each case, the complement restricts the denotation of the verb, making the phrasal VP the locus of predicative meaning.

(25) YORÙBÁ VERBS ARE ALL LIGHT VERBS

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

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

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

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

Light verbs are attested in all langauges, so a similar paradigm can be constructed in English (Cattell, 1984; Marantz, 1984) with the verb *hit*, as shown in (26). Again, the complement restricts the meaning of the verb, where *hit* denotes some general form of contact, and the '*hit*+Complement' collocation specifies the nature of the contact. In this wasy, a wide range of VP-level meanings are generated, ranging from departure (26)a, to studying (26)b, to going to bed (26)c, to confronting an obstacle (26)d. 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.

(26) ENGLISH LIGHT VERBS

a. *hit the road* 'contact road, i.e., depart'
b. *hit the books* 'contact book, i.e., study'
c. *hit the sack* 'contact bed, i.e., go to bed'
d. *hit a wall* 'contact wall, i.e. confront obstacle'

Besides accounting for the prevalence of light verbs in the Yorìubá verb lexicon, the present phono-syntactic analysis predicts that all verb-forms larger than CV will be multi-morphemic. Relevant is the fact that, in addition to simplex CV verb roots, Yorùbá has a large inventory of derived verb-forms (Ogunwale, 2005; Pulleyblank & Akinlabi, 1988), which surface as CVCV or CVCVCV; representative examples are given in (27).

(27) YORÙBÁ DERIVED CVCV AND CVCVCV VERBS (from Ogunwale 2005, (4, 13, 14, 16, 18))

a.	*tèlé*	'follow'	< Verb+Verb	*tè* 'bend' + *lé* 'after'
b.	*bínú*	'be furious'	< Verb+Noun	*bí* 'give birth' +*inú* 'inner mind'
c.	*dágunlá*	'ignore'	< Verb+Noun	*dá* + *agunla*
d.	*kọrísí*	'head towards'	< Verb +Noun+P	*kọ* + *orí* + *sí*
e.	*làkàkà*	'struggle'	< Verb + Ideophone	*là* + *kàkà*

Within Yorùbá linguistics, such verb-forms are the subject of extensive discussion and debate: using syntactic criteria, Déchaine (2001) argues at length that such forms have phrasal syntax; using phonological criteria, Orie & Pulleyblank (2002) present arguments that such forms are words lacking internal syntactic structure. My purpose is not to rehearse the debate here, but rather to point out that exactly this type of analytic indeterminacy is predicted to arise whenever we are in the presence of phono-syntactic <π,κ> bundling, i.e., prosodified syntax.

YORÙBÁ NOUNS. Yorùbá nouns are canonically V-CV; prosodic, syntactic, and semantic evidence indicates that they are stems consisting of a vowel prefix V- in combination with a bound √-CV noun root. Here I focus on the prosodic and semantic evidence; see Awobuluyi (2005) for discussion of the semantic evidence. In terms of prosody, while the √-CV noun root maintains a three-way tone contrast (H, M, L), the prefixal vowel has only a two-way tone contrast (M, L), as in (28). As we shall see below, in Yorùbá, impoverishment of tone melody is a diagnostic for F-categories.

(28) $[_{\text{STEM}}\ \underset{|}{\text{V-}}\ \underset{\{\text{L, M}\}}{}\ \ [_{\text{ROOT}}\ \underset{|}{\text{-CV}}]\ ]$ $\qquad\qquad \{\text{H, M, L}\}$

In addition to having an impoverished tone melody, the segmental melody of the prefixal vowel is also restricted (Stahlke, 1974): it cannot be nasal, it cannot be /u/, and it harmonizes in ATR value with the vowel of the noun root:

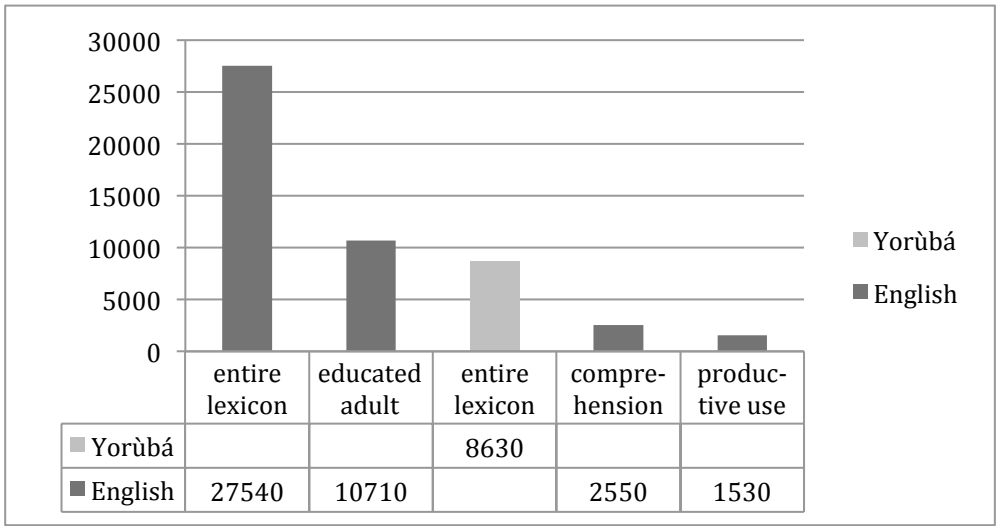
(29) YORÙBÁ PREFIXAL V-
- a. cannot be H-tone
- b. cannot be nasal
- c. cannot be /u/
- d. harmonizes in ATR value with vowel of noun root (adapted from Stalke 1976: 246-257)

These constraints, which indicate that V-CV nominals are inflected noun stems, generate **8,630** noun-forms, (30).[5] Now consider (31), which compares Yorùbá and English noun-forms. English has about 27,000 noun-forms, a literate adult has a vocabulary of about 10,000; comprehension requires around 2,500 noun-forms, and productive use requires around 1,500.[6] The upper bound of Yorùbá noun-forms is 8,630. 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 are around 27,000. Thus, English has over 3 times as many noun-forms as Yorùbá does.

(30) POSSIBLE V-CV NOUN STEMS IN YORÙBÁ

	n =	PROSODIC RESTRICTION
non-harmonic	*6,480*	$\{i,a\}_V$ x 540_{CV} x 6_{TONE}
[+ATR]	*1,296*	$\{e,o\}_V$ x 108_{CV} x 6_{TONE}
[–ATR]	*864*	$\{\varepsilon,ɔ\}_V$ x 72_{CV} x 6_{TONE}
	8,630	

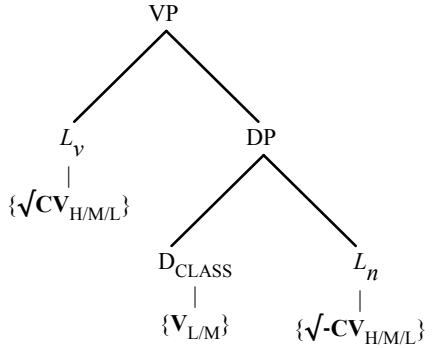
(31) NOUN-FORMS IN YORÙBÁ AND ENGLISH



YORÙBÁ VP SYNTAX. In Yorùbá, syntax can be read off of prosody; this is illustrated in (32) with a Verb-Complement structure. A bare √CV root can only be parsed as a verb; a bound √-CV root can only be parsed as a noun, and must appear with a V- prefix. In a Verb-Complement structure, combining a CV verb with a V-CV noun creates a [CV#V-CV]

string whose contiguous vowels are resolved by vowel deletion. As we shall see, the application of vowel deletion is intimately tied to syntactic structure.

(32) THE SYNTAX OF YORÙBÁ PROSODIC CATEGORIZATION



As discussed above, Yorùbá verb roots are semantically vague; a syntactic correlate of this is the pervasive transitivity of verbs (Awobuluyi 1978:51), which nearly always occur with 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 (33)a. In Yorùbá, the CV template is both an input constraint on roots and an output constraint on surface strings. Thus, a verb-noun sequence [CV#V-CV] (33)a is resolved into a surface CV.CV sequence, with elision of either the vowel of the verb (33)b, or of the noun (33)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. The two elision strategies are semantically distinct (Oyelaran 1970:181-185). Truncation of the verb root is associated with compositional meanings, (34). This contrasts with truncation of the noun-stem, where the meaning is sometimes compositional (35)a-c, and sometimes non-compositional (35)d- f.

(33)	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

(34) 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'ẹ́ja*	'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

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

	INPUT			OUTPUT			
	TONE	VERB	NOUN	TONE	VERB+NOUN	GLOSS	
a.	H + MH	*sọn*	*o-wó*	MH	*sọn'wó*	'pay up'	Oy181
b.	H + MM	*fọ*	*a-ṣọ*	MM	*fọ'ṣọ*	'wash clothes'	Oy181
c.	H + ML	*pa*	*a-sẹ̀*	ML	*pa'sẹ̀*	'beat rhythm w/feet'	Oy181
d.	M + MH	*rọ́n*	*e-tí*	HH	*rọ́n'tí*	'remember' (lit. sew ear)	Oy181
e.	M + 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 and CV'CV has syntactic consequences. If the verb root vowel is elided, this indicates a structure where a full DP complement combines with a verb, (36)a. Such structures have compositional meanings. Suppression of the prefixal vowel means the verb and noun root can combine directly. The syntactic account predicts such combinations will be structurally ambiguous. Some V_{ROOT}-N_{ROOT} combinations involve a nominal complement with a null D position, (36)b; such combinations have compositional meanings. But other V_{ROOT}-N_{ROOT} combinations are compounds, (36)c, and predictably the locus of non-compositional meanings.

(36) YORÙBÁ VERB#NOUN CONCATENATION

a.	C'VCV	←	[VP [V.ROOT √**C'**]	[DP [D.CLASS **V-**]	[N.ROOT √**CV**]]]
b.	CV'CV	←	[VP [V.ROOT √**CV**]	[DP [D.CLASS **∅**]	[N.ROOT √**CV**]]]
c.	CV'CV	←	[VP [V.ROOT √**CV**]		[N.ROOT √**CV**]]

A similar constrast is found when two nouns combine (Akinlabi & Oyebade, 1987; Orie & Pulleyblank, 2002). As shown in (37), concatenation of nouns gives two outputs: either the V- prefix of the second noun is deleted, or there is regressive vowel assimilation.

(37) 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 (deletion versus assimilation) correspond to distinct syntactic structures. Deletion of the vowel prefix arises with N-N root compounding, (38)a. Regressive vowel assimilation arises with a phrasal structure, (38)b. Followin g 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 below for discussion of K.)

(38) YORÙBÁ NOUN + NOUN CONCATENATION

a.	V-CV'CV	←	[DP [D.CLASS **V-**] [*np* [N.ROOT √**-CV$_1$**]	[N.ROOT √**-CV**]]
b.	[V-C']-V-[V-CV]	←	[DP [D.CLASS **V-**] [*np* [N.ROOT √**-CV**] [KP **V$_2$-** [DP [D.CLASS **V$_2$-**]	[N.ROOT √**-CV**]]]

YORÙBÁ IDEOPHONES

Other than verbs and nouns, the other major word-class in Yorùbá is the ideopho ne vocabulary (Awoyale, 1981, 1983, 1989, 2000; Courtenay, 1976; Fordyce, 1978, 1983). Representative examples are given in (39).

(39)

a.	CV.V	*róo*	'being a very small quantity of liquid' (Aw1989:D19c)
b.	CV.CV	*bìrì*	'being something heavy revolving quickly' (Aw1989:D16a)
c.	CV.CV.CV	*ròǵòdò*	'being very bulging and round'(Aw1989:D10a)
d.	CV.CV.CV.CV	*fárágádá*	'being repeatedly totally wiped out' (Aw1989:D7c)

Ideophones are templatic in that they are formed by a combination of C, V and tone melodies (Akinlabi, 1985). Consider (40), which illustrates how the ideophone √*rgd* 'round', is integrated into a tri-syllabic CV.CV.CV template, with vowel and tone melody modulating the basic meaning of the root. On independent grounds, the default vowel in Yorùbá is ***i*** and the default tone is **M** (Akinlabi, 1985; Pulleyblank, 1986). The basic meaning of the ideophone root emerges when it combines with a default vowel and tone melody, (40)a. Changing the vowel to ***o***, but maintaining **M**-tone, connotes smallness (40)b. An ***o*** vowel melody with **H**-tone connotes an even smaller size (40)c, and with **L**-tone connotes a larger size (40)d. Changing the vowel melody to ***ọi***, with L-tone, connotes an even larger size (40)e.

(40) √ *rgd* + CV.CV.CV

	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 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 content

is independent of descriptive content (41)a; they exhibit non-displaceability in that they predicate something of the utterance situation (41)b; they show perspective-dependence in that they are evaluated relative to a particular person's perspective (41)c; their meaning is ineffable in that it cannot be paraphrased with descriptive terms (41)d; and they are performative in that they achieve their intended act by virtue of being uttered (41)e.[7]

(41) 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 intended act by being uttered

Yorùbá ideophones are expressives. For example, the tone melody of ideophones involves a combination of lexical meaning together with emphasis, intensity, and speaker attitude (Awoyale 1989:30). Moreover, Yorùbá ideophones constitute a distinct expressive lexicon. We have seen above that, in the prosaic lexicon, verbs and nouns display phono-syntactic <π,κ> bundling. Severe prosodic constraints on categorization mean that both nouns and verbs are enumerable; thus, Yorùbá has 540 √CV verb roots, and 8,630 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 aggressive prosodification in the form of phono-semantic <π,Σ> bundling. Particular prosodic melodies (C, V, and tone) are associated with particular semantic atoms. For example, as illustrated in (42), while the C-melody ***r-g-d*** connotes roundness, the V-melody connotes size, with ***i*** being semantically neutral, ***o*** connoting smallness, and ***o-i*** connoting largeness. Tone melody connotes degree: M is neutral, H connotes a positive degree, and L connotes intensification.

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

C		V		TONE		
<π,	**Σ>**	**<π,**	**Σ>**	**<π,**	**Σ>**	
< *rgd*,	ROUND >	< *i*,	∅ >	M	∅	'round'
< *rgd*,	ROUND >	< *o*	SMALL >	M	∅	'small & round'
< *rgd*,	ROUND >	< *o*	SMALL >	H	DEGREE	'very small & round'
< *rgd*,	ROUND >	< *o*	SMALL >	L	INTENSIFICATION	'bulging & round'
< *rgd*,	ROUND >	< *o,i*>	BIG	L	INTENSIFICATION	'big & imposing'

The expressive and prosaic lexicons use the same building blocks (the same consonants, vowels, and tones) but deploy them differently. In particular, while phonological features are constrastive in the prosaic lexicon, in the expressive lexicon these same features are gradient (Waugh, 1994). For example, while tone is contrastive in the prosaic lexicon, tone connotes a scale in the expressive lexicon:

(43) YORÙBÁ EXPRESSIVE TONE IS GRADIENT

		$<\pi_L, \Sigma_{LARGE}>$			$<\pi_H, \Sigma_{small}>$	
a.	LL	*bìrì*	'being large'	HH	*bírí*	'being small'
b.	LL	*gbòrò*	'being wide'	HH	*gbóró*	'being narrow'
c.	LLL	*kìbìtì*	'being of big size'	HHH	*kíbíté*	'being of small size'

(Westermann, 1927, 1937)

Syntactically, Yorùbá expressive ideophones enter the prosaic lexicon via nominalization, (44). Awoyale (1989) takes nominalization to indicate that Yorùbá ideophones are inherently predicative. While I concur that ideophones are predicative, that they can be nominalized but not verbalized in Yorùbá is due to language-specific constraints on categorization. There is no mechanism in Yorùbá to integrate ideophones into verb structures: verbs are maximally CV, ideophones are minimally CV.V, so ideophones are too big to be verbs in Yorùbá. That this is a language-specific property is confirmed by the fact that Shona ideophones are freely verbalized or nominalized. (I return to this below.)

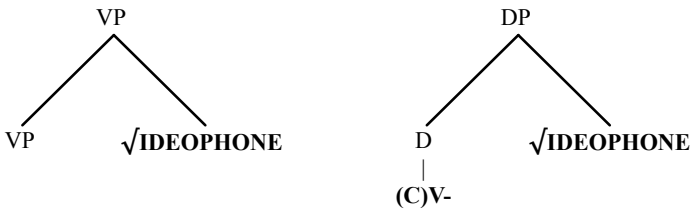
(44) a. *bò-gbirididi* < *gbirididi*
NOM-roll.over.many.times 'rolling over on the ground many times'
'the state of rolling over many times' (Awoyale 1989:30, (a))

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

Yorùbá ideophones are 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, (45)a. When nominalized, they are introduced into the N-spine, as in (45)b. (For concreteness, I represent Yorùbá's prefixal nominalizing morphology as a D head.)

(45) SYNTACTIC INTEGRATION OF YORÙBÁ IDEOPHONES

a. VP-adjunction b. nominalization



YORÙBÁ FUNCTIONAL CATEGORIES

Yorùbá F-categories are prosodically constrained in that they are 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 (46)a, or a specified vowel melody V (46)b. And the prosodic upper bound for Yorùbá F-categories is CV (46)c. I show how this plays out for the V-spine, and then the N-spine.

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

THE YORÙBÁ V- SPINE. The V-spine sub-divides into four domains, namely, C, Infl, Aspect, and *v*, as in (47)a. In addition, the Yorùbá Infl-domain is prolific (Barczak, 2007) and distinguishes Mood, Tense, and Modality, (47)b.

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

Yorùbá verbal F-categories are minimally and maximally mono-moraic (Barczak 2007:149*ff.*). The lower bound is a mora with no segmental specification, i.e., a tone-bearing unit. This includes the L-tone that spells out irrealis mood (48)a, as well as the H-Tone-Syllable that spells-out tense (48)b. It is also possible for the mora to have segmental content; this includes future ***á*** (48)c, habitual ***a*** (48)d, and progressive ***ń*** (48)e. The prosodic upper bound for Yorubá verbal F-categories is CV: all complementizers are CV, as well as some modal and aspectual particles (49).

(48) 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'

(49) YORÙBÁ VERBAL F-CATEGORIES: CV

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

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

c. ***bí*** *Akin ín bá sùn,…*
if Akin HTS MOD sleep
'if Akin sleeps,…; if (had) Akin 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 one mora, as in (50); 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.

(50) YORÙBÁ VERBAL F-CATEGORIES: > μ

a.	*Akin*	***y-ó-ò***	*ka*	*ìwé*	b.	*Akin*	*ín*	***má-a***	*ka*	*ìwé*
	A.	REAL-TNS-MOD	read	book		A.	HTS	MOD-HAB	read	book
	'Akin will read a 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 (51), which shows how L- and F-categories are prosodified in the Yorùbá V-spine. Three generalizations emerge. First, verb roots are minimally and maximally √CV. Second, F-categories are minimally and maximally one mora. Third, there is also a difference in tone melody: while √CV verb roots contrast H/M/L, F-category positions don't exploit the full range of tone contrasts. Motivation for the tone melodies for F-categories comes from considering the simplex and complex forms that spell out the Yorùbá V-spine (Barczak, 2007). Note in particular that, *yóò* spells out Mood-Tense-Modality (51)b, with [y] spelling out (unmarked) Mid-tone. And in (51)d, while futurate *máa* spells out Modality-Aspect, while *gbọ́dọ̀* is a compound modal.

(51) YORÙBÁ V-SPINE

	[COMP	μ_{CV}	[MOOD	μ	[TENSE	μ	[EPIST	$\mu_{(C)V}$	[DEONT	μ_{CV}	[ASP	$\mu_{(C)V}$	[*v*	√CV]]]]]]]
		H		L/M		H		H		L		H/M		H/M/L
a.	*tí*	***tí***												
	kí	***kí***												
	bí	***bí***												
b.	*y-ó-ò*			***y***		***-ó***		***-ò***						
	ì			***ì***										
c.	HTS					**H**								
d.	*bá*						***bá***							
	má-a							***má***				***-a***		
	gbọ́-dọ̀							***gbọ́***		***-dọ̀***				
	lè									***lè***				
e.	*a*											***a***		
	ń											***ń***		
	ti											***ti***		

THE YORÙBÁ N-SPINE. The N-spine has four domains (K, D, Class, *n*), as in (52)a, with further sub-classification possible in a given language. Consider (52)b, which shows the Yorùbá N-spine. While Yorùba K divides into two sub-classes (K.Possessor and K.Genitive), D divides into three sub-classes (D.Demonstrative, D.Specific, and D.Salient). As for the Class position, in Yorùbá this is instantiated by the vowel prefix that attaches to noun roots.[8]

(52) a. [Kase [Determiner [Class [*n*]]]]
b. [K_{POSS} [K_{GEN} [D_{DEM} [D_{SPEC} [$D_{SALIENT}$ [Class [*n*]]]]]]

Just as 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 M-tone copy vowel of possessor marking (53)a, and the V- prefix that occurs before noun roots (53)b. Yorùbá nominal F-categories that are CV and mono-morphemic are genitive ***ti*** (54)a and the specificity marker ***kan*** (54)b. All remaining nominal F-categories are multi-morphemic. This includes the specificity determiner ***ná-à*** (55)a, as well as the proximal and distal demonstratives ***yì-í*** (55)b and ***y-ẹn*** (55)c. (The bi-morphemic structure of these Ds is likely cognate with Bantu N-stems which consist of a CV- noun-class prefix in combination with a noun-root.)[9]

(53) YORÙBÁ NOMINAL F-CATEGORIES: μ

a.	*èrè*	***e***	*Kúnlé*	b.	[&]***o-bìnrin***		
	statue	K.POSS	Kunle		D.CL-woman		
	'a/the statue of Kunle				'a/the woman, some women'		

(54) YORÙBÁ NOMINAL F-CATEGORIES: CV

a.	*ère*	***ti***	*Kúnlé*		b.	*obìnrin*	***kan***
	statue	K.GEN	Kunle			woman	D.SPEC
	'a/the statue of Kunle					'a certain woman'	

(55) YORÙBÁ BI-MORPHEMIC NOMINAL F-CATEGORIES

a.	*o-bìnrin*	***ná-à***	b.	*o-bìnrin*	***yì-í***	c.	*obìnrin*	***y-ẹn***
	D-woman	D-SAL		D-woman	D-PROX		woman	D-DIST
	'the very woman'			'this woman'			'that woman'	

In sum, while Yorùbá noun roots are minimally √-CV, nominal F-categories are minimally and maximally one mora. Putting all this together yields the following picture of the Yorùbá N-spine, as in (56).[10] In terms of information detectable in the signal, there are three main findings. First, there is a size difference: the minimal noun root is √-CV, nominal F-categories are miminally and maximally one mora, and any nominal F-category larger than one μ is bi-morphemic. (This converges with Barczak's (2007) finding for Yorùbá verbal F-categories.) Second, relative to tone: noun roots contrast H/M/L, but nominal F-categories have impoverished tone contrasts.

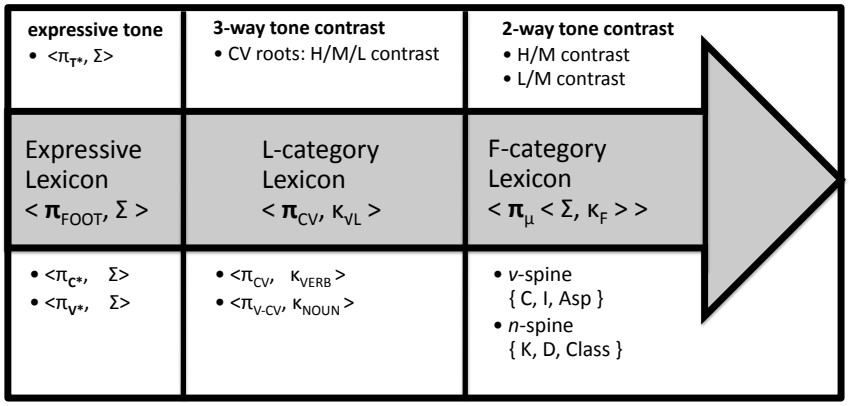
(56) YORÙBÁ N-SPINE

[K.POSS	**μ**	[K.GEN	**μ**CV	[D.DEM	**μ**(C)V	**μ**V	[D.SPEC	**μ**CV	[D.SAL	**μ**CV	**μ**V	[CLASS	**μ**V	[*n*	√-**CV**	]]]]]]]
	|		|		|	|		|		|	|		|		|		
	M		M		L	H/M		M		H	L		L/M		H/M/L	

SUMMARY: PROSODIFICATION IN YORÙBÁ

Yorùbá expressive and L-category lexicons have early prosodification in the form of phono-semantic <π,Σ> and phono-syntactic <π,κ> bundling. The F-category lexicon involves late prosodification: prosody (π) associates to a semantico-syntactic <Σ,κ> bundle. Minimality is enforced in different ways: ideophones are minimally one foot (√CV.V), L-categories are minimally and maximally √CV, and F-categories are minimally and maximally one mora. Tone deployment also differs: L-categories contrast H/M/L, but F-categories contrast H/M or L/M. And in the expressive lexicon, tone and segmental melodies, rather than being contrastive, connote gradient scales.

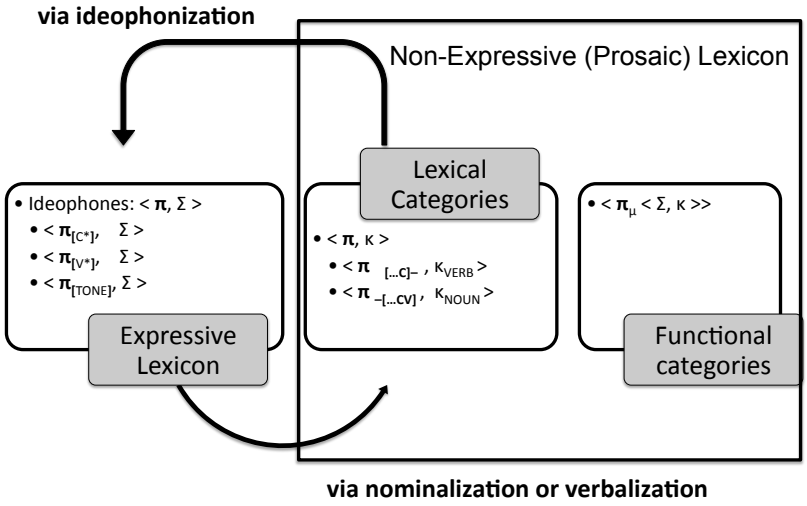
(57) PROSODIFICATION IN YORÙBÁ



SHONA PROSODIFICATION

As in Yorùbá, in Shona prosodic differentiation rules, (58). The expressive lexicon contains ideophones: these phono-semantic <π,Σ> bundles are minimally CV and enter the prosaic lexicon via verbalization or nominalization. The prosaic lexicon partitions L- and F- categories. L-categories are phono-syntactic <π,κ> bundles: verb roots are C-final, minimally C, and obligatorily suffixed; noun roots are V-final, minimally CV, and obligatorily prefixed. F-categories are almost all prefixal, and minimally and maximally one mora. I now consider how such prosodic differentiation shapes Shona L-categories, ideophones, and F-categories.

(58) LEXICAL STRATA IN SHONA



SHONA LEXICAL CATEGORIES: STEM CLASSES

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 category-neutral and have the distribution of predicates; they are minimally CV, V-final, and prosodically independent, (59)a. Verb roots are minimally C, are C-final, and must have something aligned to their right-edge, (59)b., are V-final, and must have something aligned to their left-edge, (59)c. Noun and adjective roots are minimally CV, V-final, minimally CV, and always appear with a noun-class prefix, (59)c. While the CV- noun-class prefix that occurs with N_{ROOTS} marks the inherent phi-feautures of the root; the sam prefix when it ataches to a noun

(59) SHONA STEM-CLASSES

a.	IDEOPHONE	→	MIN √CV		***fé***	'blowing'
b.	VERB	→	MIN √C	& Align (X, Right)	*kù-**p**-á*	'to give'
c.i	NOUN	→	MIN √CV	& Align (X, Left)	*mù$_3$-**tí***	'tree, noun class 3'
c.ii	ADJECTIVE	→	MIN √CV	& Align (X, Left)	*mù$_3$-**vé***	'bad, noun class 3''

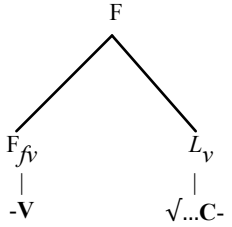
In the present analysis such prosodic regularities instantiate phono-syntactic <π,κ> bundling, as in (60). Ideophone roots are category-neutral and are freely integrated into the syntactic spine, (60)a. In contrast, C-final verb roots are prosodically dependent, and are always supplemented by a final vowel. Syntactically, this final vowel is introduced in a head-initial structure (60)b, with surface order determined by prosodically driven head-movement (see 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, (60)c. This establishes that Shona stem-classes show prosodic differentiation. With this as background, I examine in more detail the consequences this has for prosodification of verbs, nouns, and ideophones.

(60) THE SYNTAX OF SHONA PROSODIC CATEGORIZATION

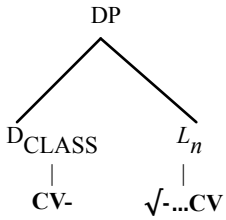
a. √IDEOPHONE

√...**V**#

b. √VERB



c. √NOUN



SHONA VERBS. All Shona verbal formatives end in C: this includes verb roots, suffixal verbalizers, and extensional suffixes. I consider each in turn.

Shona verb roots are C-final. For Bantu, Guthrie (1962) distinguishes three verb stem types: simplex, complex, and extended. Guthrie's "simplex stems" correspond to the mono-morphemic Shona verb roots discussed here. The latter have three segmental templates (√C √VC, √CVC) and two possible tone melodies (H, L). This defines six root shapes: H- versus L-tone √C roots, H- versus L-tone √VC roots, and H- versus L-tone √CVC roots. Examples are given in (61). In

Shona, The CV constraint regulates output forms, so all verb roots surface with a final vowel whose tone is contextually determined; in the simplest case the final vowel is H after H-tone roots, and L after L-tone roots.

(61) SHONA MONOMORPHEMIC VERB ROOTS: …C#

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

One question that comes up is whether all logically possible verb roots are equally attested in Shona. To calculate this, consider the tone and segment inventory of Shona, given in (62): there are 2 tones, 5 vowels, and 51 consonants.

(62) SHONA TONE AND SEGMENT INVENTORY (from Mudzingwa 2010, Mkanganwi 1995)

		n =	
TONE		*2*	H, L
V		*5*	i, e, o, u, a
C	SIMPLE	*27*	p, t, k, g, bh, dh, ɓ, ɗ, m, n, x, ɲ, ŋ, mh, nh, f, s, ʃ, z, ʒ, vh, ɦ, ʂ, ʐ, ʋ, j, w, r
	COMPLEX	*24*	pf, ts, tʃ, bv, dz, dʒ, tʂ, dʐ, ^{m}b, ^{n}d, ^{ŋ}g, m^{v}, n^{z}, ^{n}ʐ, p^{w}, b^{w}, t^{w}, k^{w}, g^{w}, m^{w}, n^{w}, ^{m}b^{w}, ^{n}z^{w}, ^{n}g^{w}

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 (63), this gives a total of 26,622 verb roots: 102 √C roots, 510 √CV roots, and 26,010 √CVC roots. Although Shona verbs are a large class, they are enumerable, and so 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.

(63) VERB ROOT MELODIES IN SHONA

		POSSIBLE	ATTESTED	
		n =	*n* =	*%*
√C	2_{TONES} x 51_{C}	*102*	*34*	*.333*
√VC	2_{TONES} x 5_{V} x 51_{C}	*510*	*49*	*.096*
√CVC	2_{TONES} x 5_{V} x 51^{2}_{C}	*26,010*	??	??
	TOTAL	***n* = 26,622**		

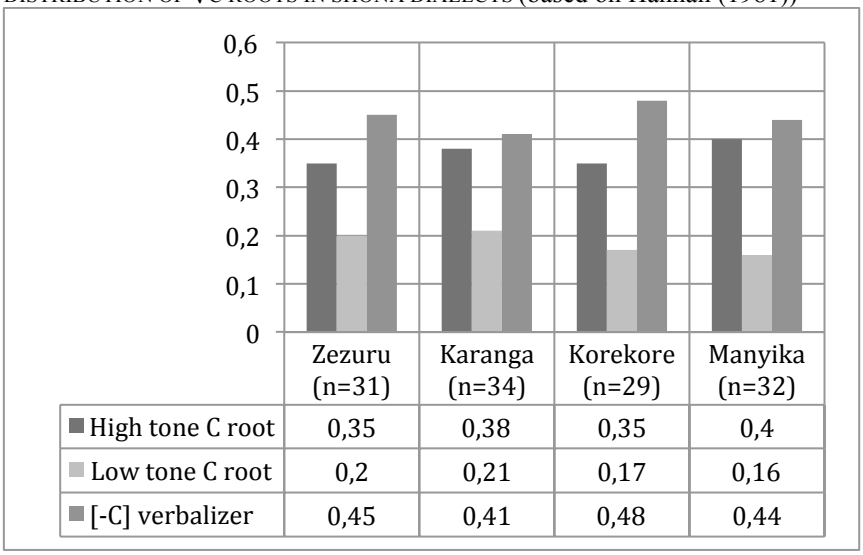
It is revealing to look at the distribution of √C roots: as shown by the shaded cells of (64), from a total inventory of 51 consonants, 31 are recruited as √C roots.

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

	n =		LABIAL	ALVEOLAR	PALATAL	VELAR	GLOTTAL
ORAL STOP	3	VOICELESS	**p**	**t**		**k** g	
	3	VOICELESS LABIALIZED	**p^{w}** b^{w}	**t^{w}**		k^{w} **g^{w}**	
	0	BREATHY VOICED	bh	dh			
	2	IMPLOSIVE	**ɓ**	**ɗ**			
	2	PRE-NASALIZED	**^{m}b**	^{n}d		**^{ŋ}g**	
NASAL STOP	4	NASAL	**m**	**n**	***ɲ**	**ŋ**	
	1	NASAL BREATHY VOICED	nh	**nh**			
	1	NASAL LABIALIZED	m^{w}	**n^{w}**			
FRICA -TIVE	3	PLAIN	**f**	**s** **z**	ʃ ʒ		
	0	BREATHY VOICED	vh				ɦ
	1	LABIALIZED "WHISTLING"		**ʂ** ʐ			
	0	PRE-NASALIZED	m^{v}	n^{z}			
	2	PRE-NASALIZED LABIALIZED	^{m}b^{w}	**^{n}z^{w}** **^{n}ʐ**		^{n}g^{w}	
AFFRI- CATE	4	PLAIN	**pf** **bv**	**ts** **dz**	tʃ dʒ		
	2	LABIALIZED		**tʂ,** **dʐ**			
APPROXI- MANT	2		**ʋ**		v	**w**	
TRILL	1			**r**			

Each √C root can associate with H or L tone, so there are 102 (= 51 Cs x 2) possible √C roots. An attested inventory of 31 √C roots means roughly 25% of the possible √C roots are attested. This count includes suffixal -C verbalizers (*n* = 14). As shown in (65), although the roots attested in any given dialect of Shona vary, the overall number is stable (at around 30), as is the overall distribution. Roughly 40% of √C roots are H-tone, 20% are L-tone, and 40% are suffixal -C verbalizers.

(65) DISTRIBUTION OF √C ROOTS IN SHONA DIALECTS (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 H- and L-tone. Surprisingly, they do not. This becomes apparent if one lists attested √C roots according to whether they are H-tone (66), L-tone (67), or variable tone (i.e., surface as H-tone in some dialects but L-tone in other dialects) (68). And although Shona √C roots don't contrast H versus L, √CVC roots do; examples are given in (69).

(66) SHONA H-TONE √C VERB ROOTS **n = 11**

a. ALL VARIETIES OF SHONA *n* = 6

*kù-**p**-á*	to give	*kù-**tsv**-á*	to be on fire, burn
*kù-**b**-á*	to steal, rob	*kù-**pw**-á*	KA MA Z to become dry
*kù-**f**-á*	to die, spoil, break		KA Z to be convinced
*kù-**nzw**-á*	to perceive, understand		KA to lose game

b. SOME SHONA DIALECTS *n* = 5

*kù-**mb**-á*	KA to exceed, surpass	*kù-**ts**-á*	KA Z to dig down
*kù-**mw**-á*	KA MA to drink	*kù-**nw**-á*	KO Z to drink, suck, absorb
*kù-**nzv**-á*	KO to see		KA MA to drink

(67) SHONA L-TONE √C VERB ROOTS **n = 10**

a. ALL VARIETIES OF SHONA *n* = 5

*kù-**v**-à*	to become	*kù-**dzv**-à*	to lose a game
*kù-**bv**-à*	to move from	*kù-**ny**-à*	to suffer
*kù-**d**-à*	to love		

b. SOME SHONA DIALECTS *n* = 5

*kù-**tw**-à á*	MA to stamp in	*kù-**gw**-à*	KO MA to fall (cf. *-**w**-a*)
*kù-**n**-à*	KA Z to rain	*kù-**ng**-à*	KO MA to seem
*kù-**sv**-à*	KA Z to let do		

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

H-TONE		L-TONE	
*kù-**w**-á*	KA to fall	*kù-**w**-à*	KO Z to fall
*kù-**z**-á*	KA to come	*kù-**z**-à*	MA Z to come
*kù-**pf**-á*	MA to die	*kù-**pf**-à*	KA to bear young
*kù-**dz**-á*	MA to dance	*kù-**dz**-à*	KA to become established

(69) H/L CONTRAST WITH SHONA √CVC ROOTS

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

The absence of an H/L contrast with √C roots is perplexing: why are tone melodies under-exploited with √C roots in Shona? As we shall see below, √VC roots likewise don't contrast H/L. Part of the answer to the question of why tone contrasts are under-exploited comes from looking at the inventory of verb suffixes, which fall into two classes: verbalizing -C suffixes and extensional -VC suffixes. I consider each in turn.

Shona verbalizing suffixes are -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-verb 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 to derive a verb would be to add a consonantal suffix, and this is exactly what Shona does. As shown in (70), Shona has 14 consonantal verbalizing suffixes: all attach to ideophone roots, and a subset attach to noun and adjective roots.

(70) 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	✓		

Representative examples of verb-forming -C suffixes are given below: (71)a illustrates verbs derived from noun roots, (71)b illustrates verbs derived from adjectival roots, and (71)c illustrates verbs derived from ideophone roots. Observe that the tone melody of derived verbs is determined by the initial tone of the root: roots with initial H-tone derive H-tone verbs, roots with initial L-tone derived L-tone verbs.

(71) SHONA VERBALIZING -C SUFFIXES

a.

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

b.

ADJECTIVE ROOT			VERBALIZED ADJECTIVE		
HH	*-nyóró*	'soft'	H	*nyóró-**v**-*	'be soft' (F21)
HL	*-pfúpì*	'short'	H	*pfúpí-**k**-*	'be short' (F7)
HL	*-dúkù*	'small'	H	*dúkú-**s**-*	'make smaller (F21)
LL	*-tètè*	'thin'	L	*tètè-**p**-*	'be thin' (F7)
LH	*-kòbvú*	'thick'	L	*kòbvù-**m**-àr*	'become thick, stout' (F21)

c.

IDEOPHONE ROOT			VERBALIZED IDEOPHONE		
HL	*párù*	'tearing'	H	*párú-**k**-*	'get torn, burst open'
LL	*kòchè*	'looping around'	L	*kòchè-**t**-*	'loop around'
L	*nzvè*	'dodging'	L	*nzvè-**ng**-*	'dodge'
L	*svì*	'dark'	L	*svì-**b**-*	'get dark'

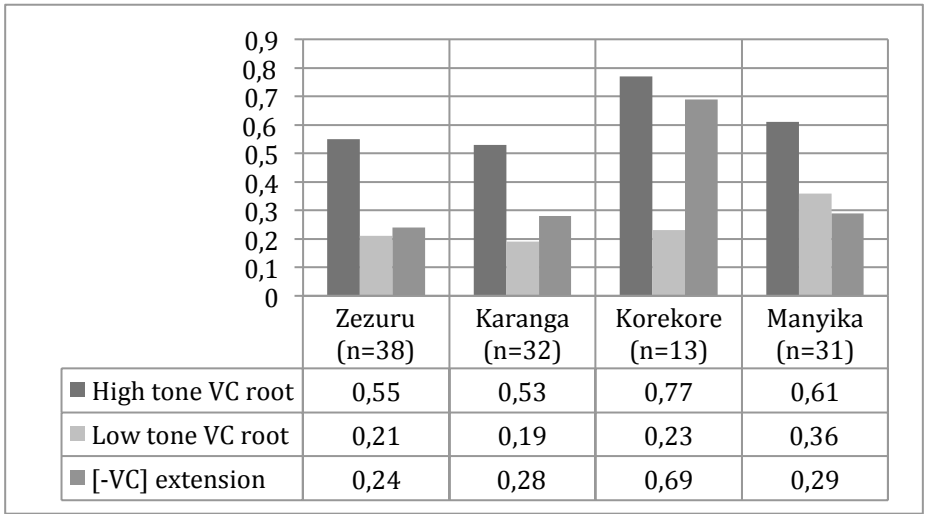
Given that the minimal verb root in Shona is C, it follows that verbalizing -C suffixes are verb roots. Accordingly, one can classify verb roots as independent or dependent, as in (72). Tonally, while √-C verbalizing suffixes are toneless, √C verb roots introduce an H- or L-tone melody (though they do not contrast the two tones). 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. This departs from traditional accounts of verbalizing suffixes, which treat them as a distinct morpho-syntactic class (Fortune, 1984).

(72) SHONA √C VERB ROOTS

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

Shona extensional suffixes are -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. Descriptively, the only difference between √VC roots and -VC suffixes is that the latter are segmentally and tonally more constrained. I take this to indicate that -VC extensional suffixes are defective verb roots. Again, attending closely to prosody challenges the traditional analysis, which treats extensional suffixes as a separate class. With this in mind, consider the overall distribution of √VC roots, given in (73).[11]

(73) DISTRIBUTION OF √VC ROOTS IN SHONA DIALECTS (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 generalizations emerge: (i) √VC roots don't contrast H/L tone; (ii) most √VC verb roots are H-tone; (iii) -VC extensional suffixes are toneless. (74) and (75) list H- and L-tone √VC roots respectively; and (76) lists -VC suffixes.

(74) SHONA H-TONE √VC VERB ROOTS ***n* = 24**

a. ALL VARIETIES OF SHONA *n* = 7

íp	be bad, unpleasant	*ót*	be soft (of leather)
ímb	sing	*údz*	tell, inform
óm$_1$/úm$_2$	KA$_1$ KO$_2$ MA$_2$ Z$_2$ become dry	*ón*	see
úng	be carried away (by flood water)		

b. SOME SHONA DIALECTS *n* = 17

íbv	KA KO Z become ripe/fully cooked	*únz*	KO MA Z bring
ísv	KA Z spoil, harm, contaminate	*ús*	MA bring
éng	MA see	*út*	Z collect, gather together
ír$_1$/ér$_2$	KA$_1$, MA$_2$ Z$_2$ be sacred	*óz*	MA gather (firewood)
ámw	MA suck	*úzh*	Z win over
úw	KA smear (wall/floor for first time)	*ózh*	MA Z make foolish statement
ónd$_1$/únd$_2$	KA$_{1/2}$ MA$_1$ Z$_1$ become thin	*úmb*	KA MA Z mould, shape, fashion, derive
óng$_1$/úng$_2$	KA$_1$ Z$_2$ extract alluvial gold	*únd*	KA KO Z plough new land
únz$_1$/únzv$_2$/úzv$_3$	KA$_{2/3}$ Z$_1$ give pottery required shape		

(75) SHONA L-TONE √VC VERB ROOTS ***n* = 16**

a. ALL VARIETIES OF SHONA *n* = 2

ìnd$_1$/ènd$_2$	KA$_1$ KO$_2$ MA$_2$ Z$_2$ go, go away, depart	*ìt*	do, act, bring about

b. SOME SHONA DIALECTS *n* = 14

ìk	MA copulate	*òdz*	MA plough virgin land
ìdz$_1$/èdz$_2$	KA$_1$, MA$_2$ Z$_2$ try, attempt, dare	*ùn*	KO MA Z wither, wilt, shrivel up
òr	KA MA Z rot, go bad, decompose	*ùny*	Z contract, shrivel up
òn'	KA Z growl (of a dog)	*ùn'*	Z hum
òmb	KA Z growl (of a dog)	*ùm*	MA fail to come/do/go
òp	MA appropriate to oneself	*ùw*	MA hid (bird or small animal)
òch	roast on open fire	*ànz*	MA give more to

(76) SHONA TONELESS EXTENSIONAL -VC 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'

Consider (77), which shows that Shona √VC and √C verb roots are specified for tone, but -VC and -C suffixes are not. (Both √VC and √C roots, though specified for H- or L-tone, do not contrast the two tones.) The tone distinction between roots and suffixes correlates with a distributional difference: √VC and √C roots can occur by themselves; they are independent roots. In contrast, -VC and -C suffixes must co-occur with roots; they are dependent roots. The proposed contrast between dependent and independent roots has consequences for the analysis of tone in Shona. Following Stevick's (1969) claim that, in all Bantu languages, H is marked, and L is unmarked, Myers (1990) analyzes the Shona H/L 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 here, then this calls for a re-evaluation of the underspecification analysis. There remains the question of whether there is a 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.

(77) SHONA √VC & √C VERB ROOTS

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

In sum, close inspection of the Shona verb root inventory reveals that √C and √VC roots are sparse. This contrasts with Yorùbá, where verb roots are only √CV, and all possible contrasts are exploited. What is the significance of this under-exploitation of root melodies in Shona? On independent grounds, Shona has an output constraint on word size: the minimal prosodic word is bi-syllabic; i.e., one foot (Mudzingwa, 2010).[12] Together with the CV constraint, which favors CV syllables, as shown in (78), this predicts that the most optimal verb stem melody will be CV.CV, i.e. a √CVC root in combination with a final vowel suffix.

(78) SHONA VERB STEM MELODIES

	ROOT + FINAL VOWEL SUFFIX	OUTPUT CONSTRAINTS	
		$[_{FT}\,\sigma\,\sigma]$	CV
a.	√C + V	✗	✓
b.	√VC + V	✓	✗✓
c.	√CVC + V	✓	✓✓

These ranking effects correctly predict that, in the Shona prosaic lexicon, most monomorphemic verb roots are √CVC, as the addition of the final vowel creates surface CV.C-V forms that satisfy both the CV constraint and the minimal word constraint. Although Shona verb roots don't obey the CV constraint as an input contraint, it is enforced elsewhere in the grammar, namely with ideophones, which I discuss below. This word size difference is one of many clues that indicate that the prosaic and expressive lexicons of Shona are structured in different ways. But before turning to Shona ideophones, let's take a look at nouns.

SHONA NOUNS. In Shona, mono-morphemic noun roots come in four shapes: mono-syllabic, √CV, bi-syllabic √CV.V and √CV.CV, and tri-syllabic √CV.CV.CV:

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

a.	√CV	*-gá*	*chì-**gá***	'mark, sign, brand, notch, CL7 (Ha65)'
b.	√CV.V	*-kòó*	*mà-**kòó***	'bloodstains, bloodclots, CL6 (Ha193)
b.	√CV.CV	*-pòfù*	*chì-**pòfù***	'groundnut, CL7 (Ha87)'
d.	√CV.CV.CV	*-kómáná*	*mù-**kómáná***	'boy, CL3'

The larger size of Shona nouns yields a correspondingly larger range of possible root melodies, and we see the emergence of an open class. The tabulation of logically possible noun roots establishes 510 possible √CV roots, 5,100 √CV.V roots, 260,100 √CV.CV roots, and 132,651,000 √CV.CV.CV roots. As a word-class, Shona nouns are instructive because they behave like Indo-European word-classes. The open-class effect emerges under precise conditions, namely when a language lets roots be bigger than one syllable. In Shona, V_{ROOTS} can be no larger than a syllable (√C, √VC, √CVC) and so predictably constitute a relatively closed class. On the other hand, N_{ROOTS} can be larger than a syllable (√CV, √CV.V, √CV.CV, √CV.CV.CV) and so predictably constitute an open class. Once again, prosodic constraints regulate the grammar in a precise fashion.

(80) POSSIBLE NOUN ROOT MELODIES IN SHONA

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

SHONA IDEOPHONES

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

(81) IDEOPHONE ROOTS: KARANGA SHONA

a.	√CV	*zó*	'going down a slope'
b.	√CVV	*zíí*	'buzzing of small insect'
b.	√CV.CV	*zhìmù*	'revving sluggish engine'
d.	√CV.CV.CV	*zhòkòtò*	'being weary'
e.	√CV.CV.CV.CV	*wíríwírí*	'descending swiftly'

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 (82) where the *p*/*b*/*bh* alternation indicates that the action takes place on an increasingly larger scale.

(82) SHONA EPXRESSIVE VOICING (Fortune 1984:150)

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	***bh**áru*	'tearing on a large scale'

Shona ideophones enter the prosaic lexicon via verbalization or nominalization; this is illustrated in (83) and (84) with data from Karanga Shona. One can see the effect of foot structure on output forms, in particular in (84)b, where the ideophone root is bi-syllabic (one foot), but the nominalized form is quadrisyllabic (two feet). The presence of the noun-class prefix (*mà-*, class 6) is necessary to derive a noun. The expansion of the ideophone base *dúdú* to *dúdúdú*, ensures that the output form (*mà-dúdúdú*) consists of two metrical feet.

(83)

	IDEOPHONE ROOT		VERBALIZED IDEOPHONE	
a.	*téù*	spilling	*téú-**k*-**	spill (liquid or grain); be poured as libation
			*téú-**r*-**	spill (liquid or grain); pour libation
b.	*tétsù*	rushing out (many)	*tétsú-**dz*-**	cause to emerge (large number, or quantity)
			*tétsú-**k*-**	burst out (many together)
			*tétsú-**r*-**	release (animals or things, that come out quickly and many, or much at a time)
c.	*tèkèshè*	extending over an area	*tèkèshè-**dz*-**	cause (living things) to spread out over area
			*tèkèshè-**r*-**	spread over the whole of an area

(84)

	IDEOPHONE ROOT		NOMINALIZED IDEOPHONE	
a.	*bhàbhàngú*	beating medium-sized and large drum	***chì**-bhàbhàngú*	n7 detonator
b.	*dúdú*	moving backwards (person or animal)	***mà**-dúdúdú*	n6 act of shirking backwards through fear

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 adverbials via adjunction to VP (85)a; as complements to copular or quotative verbs (85)b-c, as verbs via verbalization (85)d, or as nouns via nominalization (85)e.

(85) SYNTACTIC INTEGRATION OF SHONA IDEOPHONES

a.	adverbial	$[_{VP}\ [_{VP}\ \ldots\ ]$	$[\ \sqrt{}\text{IDEOPHONE}\ ]\ ]$
b.	copularized	$[_{VP}\ [_{V}\ \text{COPULA}]$	$[\ \sqrt{}\text{IDEOPHONE}\ ]\ ]$
c.	evidentialized	$[_{VP}\ [_{V}\ \text{'SAY'}]$	$[\ \sqrt{}\text{IDEOPHONE}\ ]\ ]$
d.	verbalized	$[_{VP}\ [_{V}\ \text{-C}\ ]$	$[\ \sqrt{}\text{IDEOPHONE}\ ]\ ]$
e.	nominalized	$[_{DP}\ [_{D.CLASS}\ \text{CV-}\ ]$	$[\ \sqrt{}\text{IDEOPHONE}\ ]\ ]$

In addition to ideophone roots, Shona also has ideophonized stems; these are formed by attaching a suffix (-V(V), -VCV) to a verb root. Representative examples are given in (86). Such derived ideophones may undergo verbalization by combining with a verbalizing -C suffix. Consequently, in Shona, just as ideophone roots can be verbalized and nominalized, prosaic roots can be ideophonized.

(86)

	DERIVED IDEOPHONE			VERB 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 something pointless'	< *zív-*	'know'
f.	*chènè-**rù***	'being white'	< chènà	'white'

(from Fortune 1984:152, §5.2.2)

SHONA FUNCTIONAL CATEGORIES

F-categories that constitute the V-spine are Comp, Infl, Aspect (87)a, while those that constitute the N-spine are Kase, Det, and Class (87)b. In Shona, formatives that lexicalize these positions are part of the inflectional system and they are almost exclusively prefixing (Mkanganwi, 2002). The Shona V-spine is discussed first, then the N-spine. Because it participates in the noun and verb system, the final vowel suffix is discussed separately.

(87)

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

THE SHONA V-SPINE. The Shona V-spine includes prefixal complementizers (88), prefixal subject marking (89), prefixal tense/aspect marking (90), and prefixal object marking (91).

(88)

a. $[_{C}$ ***há***]-*ndí-ón-è*
H.HORT-1SG-see-FV
'let me see'

b. $[_{C}$ ***hà***]-*ndí-ón-i*
NEG-1SG-see-FV
'I don't see'

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

d. ... $[_{C}$ ***pà***]-*ndí-òn-á*
P-1SG-see-FV
'when I saw'

(89)

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'

(90) 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)'

(91) 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]'

Like their Yorùbá counterparts, Shona verbal inflectional prefixes are no smaller or bigger than one mora, and so may be V- or CV-. Thus, as shown in (92), the Shona V-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.)

(92) SHONA V-SPINE
[CP [COMP **μ**(C)V] [IP [SM **μ**(C)V] [ASPP [ASP **μ**(C)V] [INNERASP [OM **μ**(C)V] [*v*P √…C -**μ** V]]]]]

THE SHONA N-SPINE. In the Shona N-spine we find prefixal locative inflection (93), prefixal D (94), and prefixal class markers which code gender and number (95).[13]

(93) a. [K ***pà***]*-mì-tí*
on-INANIM.PL-tree
'on the trees'

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

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

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

(95) a. [CLASS ***mù***]*-kómáná*
HUM.SG-boy
'boy, [CLASS 1: HUMAN, SG]'

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

Shona nominal inflectional prefixes are no smaller or bigger than one mora, and so may be V- or CV-. As shown in (96), just as the Shona V-spine is a succession of prefixal F-categories, so too is the Shona N-spine.

(96) SHONA N-SPINE
[KP [K **μ**CV] [DP [D **μ**V] [CLASSP [CLASS **μ**(C)V] [*n*P √…CV]]]]

THE SUFFIXAL FINAL VOWEL. 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 suffixed on all verb stems. Syntactically, the final vowel is found in two contexts: on inflected verbs (97), and on deverbal nouns (98).

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

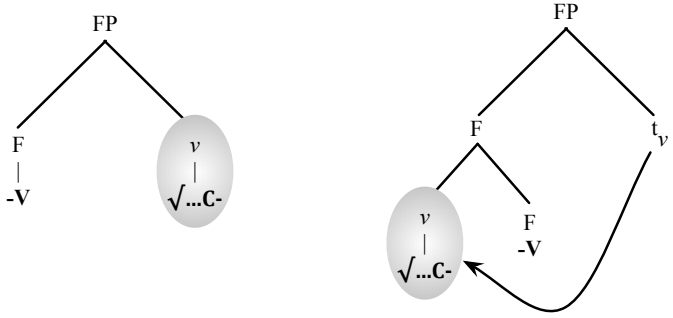
b. *kù-gàr-*[***á***]
INF-sit-FV
'to sit'

(98) a. *mù-tór-*[***í***]
C1-take-FV.AGENT
'one who takes'

b. *chì-gàr-*[***ò***]
C7-take-FV.INSTR
'chair; lit. thing one sits with'

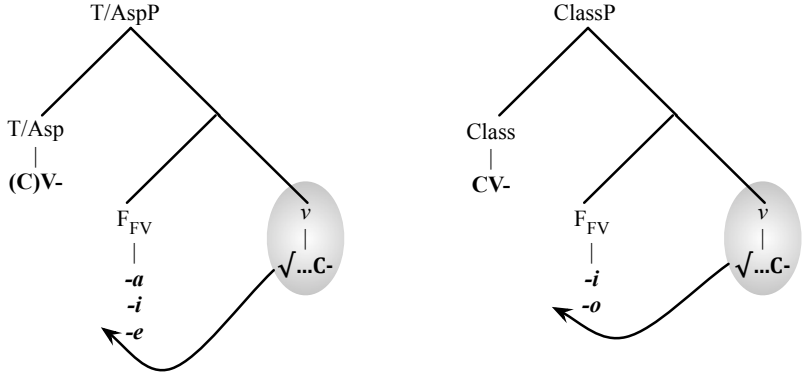
Co-occurrence restrictions show that the final vowel selects for the verb-stem (Fortune, 1984); this indicates a sisterhood relation. We know that Shona is otherwise head-initial. Combining these two generalizations — the final vowel is sister to the verb-stem, and the V-spine is head-initial — leads to the conclusion that the final vowel is introduced in a head-initial structure as in (99)a. I propose that the verb-stem undergoes prosodically driven head-movement (Wojdak, 2005), as in (99)b, and so surfaces to the left of the final vowel. Although introducing the final vowel in a head-initial structure requires a more abstract input representation, it yields a conceptually simpler analysis because it allows Shona to be analyzed as a consistently head-initial language.

(99) 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 verb and noun complex respectively (Fortune, 1984). For example, in verb 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 Lexical projection (L-projection) of which the final vowel is a head, as in (100). Subsequent movement of the verb stem to a position preceding the final vowel yields the surface order.

(100) a. T/ASP SELECTS FOR FV b. CM SELECTS FOR FV



Shona verb and noun inflection is summarized in (101) and (102). Shona F-categories are minimally and maximally a μ, and so surface as CV- or V-. Verb inflection may surface with H or L, but noun inflection is always L. (Recall that L is the unmarked tone in Shona.). The Shona N- and V-spine are head-initial: prefixes are proclitics, with prosodic movement determining the linearization of the single inflectional suffix (the final vowel suffix).

(101) SHONA VERB 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

(102) SHONA NOUN INFLECTION

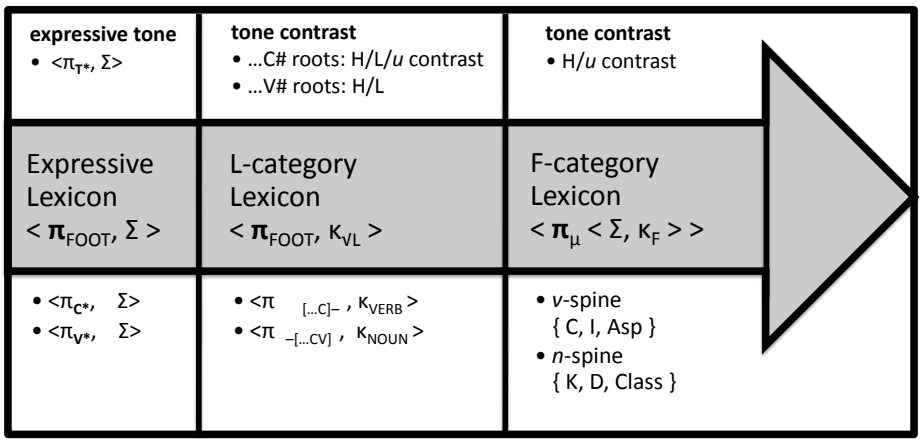
	HEAD-INITIAL	PREFIX	SEGMENTAL MELODY	TONE MELODY
locative marking	✓	✓	CV-	L
determiner	✓	✓	V-	L
gender-number	✓	✓	(C)V-	L
infinitive	✓	✓	CV-	L

One advantage of treating both Shona prefixation and suffixation as prosodically conditioned is that it is not necessary to posit syntactic head-movement to account for the linearization of affixes in a language like Shona, *pace* Baker (1985, 1988) and Baker, Aranovich, and Golloscio (2005).

SUMMARY: PROSODIFICATION IN SHONA

That Shona verb roots are C-final seems innocuous at first glance. Examining their phonotactics leads to the conclusion that monomorphemic √C, √VC and √CVC roots are sparse in Shona. Yet Shona does have an open class of derived stems, which arise by combining (vowel-final) ideophone roots with verbalizing -C suffixes or nominalizing class prefixes. Consequently, a primary source of lexical innovation in Shona is the expressive lexicon. In addition, Shona C-final roots — usually analyzed as contrasting H and L (Myers, 1990; Odden, 1981) — show a three-way partition between H, L, and unmarked. The latter correspond to -C and -VC suffixes respectively.[14] (For further discussion and analysis of how Shona expressive and prosaic lexicons differ relative to their phonological, morphological, syntactic, semantic, and pragmatic properties, see Déchaine & Mudzingwa (2014)).

(103) PROSODIFICATION IN SHONA



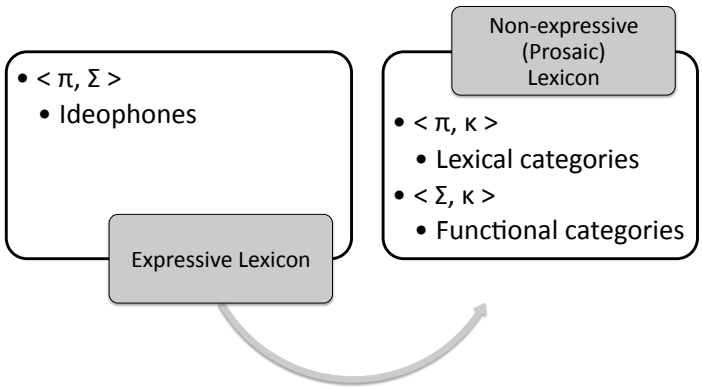
CONCLUSION: PROSODY SHAPES GRAMMAR

The present analysis has focused on two types of encapsulation that have been neglected in previous formal treatments of word-classes: phono-syntactic <π,κ> and phono-semantic <π,Σ> bundles. This closing section assesses the broader implications of the proposal, as it pertains to the typology of Niger-Congo languages, to theories of categorization, and to natural language typology.

PROSODIFICATON IN THE NIGER-CONGO LEXICON

The main claim that I have put forward is that the lexicon of Niger-Congo languages is structured as as in (104), with two lexical strata, one expressive, the other prosaic.

(104) ORGANIZATION OF THE LEXICON: NIGER-CONGO



The hallmark property of the expressive lexicon is semantic prosodification, namely a direct association of sound with meaning; this is analyzed as a phono-semantic <π,Σ> bundling. 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 the prosody. In other words, there is a direct relation between prosody and category; this is analyzed as phono-syntactic

<π,κ> bundling. Moreover, the expressive and prosaic lexicons are in complementary distribution: whatever constraints hold of the prosaic lexicon are lifted in the ideophonic lexicon. 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, connoting different degrees on a scale. The distinction between contrastive versus gradient features is one of the many ways in which the expressive lexicon differs from the non-expressive lexicon. And while the complementarity of the prosaic and expressive lexicon is dramatic in Niger-Congo languages, I conjecture that it is a property of all natural languages. Future research will reveal whether this is so.

The morphology of the two languages discussed here differs radically (Yorùbá is analytic, Shona agglutinative), but the organizing principles that determine surface form are characteristic of all Niger-Congo languages. In particular, the CV constraint is a driving force in the phonology, the phono-syntax and the 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 lexicon, 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 CV.V. In Shona, it emerges in the prosaic lexicon, where the smallest stem is CV.CV; a side-effect of this prosodic contraint is that monomorphemic C-final roots (√C, √VC, √CVC), though possible — are under-exploited in Shona. In both languages, the prosaic lexicon distinguishes L- 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, closer examination reveals several parallels. In the root-domain, both languages exploit a three-way tone contrast: Yorùbá has H/M/L (with M unmarked), and Shona has H/L/toneless (with suffixal √-C and √-VC being toneless). And in both languages, the tone contrasts available to the F-category lexicon is impoverished relative to the L-category lexicon.

PROSODIFIED SYNTACTIC CATEGORIES: THEORETICAL IMPLICATIONS

This analysis has implications 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 a noun; rather the root is inserted into a categorizing context, and then later assigned phonological content, as in (105)a. Similarly, English *read* is not a verb; it is inserted into a verb context and then assigned phonological content, as in (105)b. In the *Interface Syntax* model adopted here, the DM treatment of roots is equivalent to late prosodification of a syntactico-semantic <κ,Σ> bundle, as in (106).

(105) DISTRIBUTED MORPHOLOGY ANALYSIS OF ROOTS

a. [*n* [√CAT]] → [kæt]

b. [*v* [√READ]] → [ri:d]

(106) DISTRIBUTED MORPHOLOGY ANALYSIS = LATE PROSODIFICATION

	< κ,	Σ	>	π	> >
a.	< *n* ,	√CAT	>	[kæt]	> >
b.	< *v* ,	√READ	>	[ri:d]	> >

Late prosodification is not the only possibility. Languages such as Yorùbá and Shona, which have pervasive phono-syntactic <π,κ> bundling, indicate that phonological material can be inserted early. Consider (107), which highlights the phono-syntactic nature of Yorùbá and Shona L-categories. This contrasts with the semantico-syntactic logic of DM, which in *Interface Syntax* is a special case.

(107)

	< κ,	π	>	Σ	> >	YORÙBÁ PHONO-SYNTACTIC BUNDLING
a.	< *n* ,	√-CV	>	ENTITY	> >	
	< *v* ,	√CV	>	EVENTUALITY	> >	
b.	< *n* ,	√-…CV	>	ENTITY	> >	SHONA PHONO-SYNTACTIC BUNDLING
	< *v* ,	√ …C-	>	EVENTUALITY	> >	

The logic of the *Interface Syntax* model forces the analyst to attend to how prosody connects with syntax and semantics, and so shares many of the same concerns of *Emergent Morphology* (EM) (Archangeli & Pulleyblank, 2014), especially as regards the central question of how speakers learn "what the string of sounds is that constitutes any given word or part of word" (Archangeli & Pulleyblank 2014:1). While EM and *Interface Syntax* both privilege prosody/phonology as a source of evidence for how lexical formatives are structured, they make different claims

concerning how prosodic/phonological information enters into a correspondence relation with other types of information. Specifically, EM entertains only one type of encapsulation, namely where ***M-features***, defined as semantico-syntactic bundles, enter into a correspondence relation with phonological features (Archangeli & Pulleyblank 2014, (4)). Accordingly, EM defines a ***morpheme*** as an association between M-features and a phonological string.[15] Of particular interest for EM is the fact that the same M-features can associate with distinct phonological strings; such a one-to-many association creates the surface effect of allomorphy, (108)a. Restated in terms of the vocabulary of *Interface Syntax*, this involves associating a semantico-syntactic <Σ,κ> bundle with distinct prosodic melodies, e.g π1, π2, as in (108)b.

(108) a. Emergent Morphology (Archangeli & Pulleyblank 2014) $\{ X, Y, \ldots \}_{\text{M-FEATURE}}$

b. Interface Syntax (herein) $< < \Sigma, \kappa >, \pi 1 >$
$< < \Sigma, \kappa >, \pi 2 >$

So, both *Interface Syntax* and EM predict one-to-many mappings of the type that give rise to allomorphy. However, in *Interface Syntax* this type of encapsulation is only one of many logical possibilities. In particular, the type of phono-syntactic <π,κ> and phono-semantic <π,Σ> encapsulation characteristic of Niger-Congo languages is not countenanced in EM. This leads to questions relating to the broader implications of the analysis, to which I now turn.

PROSODIFICATION IN NATURAL LANGUAGE

If phono-syntactic <π,κ> bundling is the engine of the prosaic lexicon, this 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): (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): in languages such as Yorùbá and Shona — and more generally Niger-Congo languages — prosodic information relating to meaning (in the expressive lexicon) and structure (in the prosaic 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. 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 the emergence of the unmarked, and we expect to find similar effects in all languages. This is precisely the case in English, where we observe syntactic prosodification in a constrained domain, namely with bi-syllabic words. So it may be that the phono-syntactic and phono-semantic effects prevalent in Yorùbá and Shona, rather than being language-specific strategies, reflect a default strategy for natural language categorization.

The existence of transparent prosodification in the root lexicon converges with theorizing on the syntax-phonology interface at the word-level and above. In particular, Selkirk's (2011) *Match Theory* advances the claim that syntactic and prosodic structure are isomorphic relative to three syntactic constituents, namely X (which maps onto prosodic words ω), XP (which maps onto prosodic phrases φ), and CP (which maps onto intonational phrases ι). The present discussion has focused on the word-level and below, and has shown that significant traction is gained from attending to phono-syntactic and phono-semantic mapping relations. In this respect, it both confirms and challenges the broad claims of *Match Theory*. The confirmatory aspect resides in the finding that, at least in some languages, both L- and F-categories are prosodically defined. This could be seen as a friendly amendment to *Match Theory*, and would entail that the inventory of syntactic and prosodic constituents be expanded to include sub-word constituents, in particular L-category Roots (which map onto a syllable) and F-category Roots (which map onto a mora), as in (109). Languages such as Yorùbá and Shona provide strong evidence for integrating sub-word prosody within a larger theory of phonology-syntax mapping. However, taking this step also poses a challenge to *Match Theory*, as the latter predicts that phonological domains will tend to mirror syntactic domains, and that non-isomorphism will arise only if highly ranked phonological constraints on prosodic structure over-rule the syntax. Viewed in this way, the vigorous phono-syntactic bundling found in the lexicon of Yorùbá and Shona is the norm. This leads one to expect that languages that have opaque lexicons, i.e. where phono-syntactic and phono-semantic generalizations are not easily detectable, are likely subject to additional prosodic constraints that obfuscate (but don't obliterate) an optimal match between syntax, semantics, and phonology. This is clearly a promising area for future research.

(109)

SYNTACTIC CONSTITUENT		PROSODIC CONSTITUENT
F-Root	μ	Mora
L-Root	σ	Syllable
X	ω	Prosodic Word
XP	φ	Prosodic Phrase
CP	ι	Intonational Phrase

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[1] Abbreviations and conventions: 1 = 1st person; 3 = 3rd person; . = syllable boundary; % = dialect variation; √ = root; μ = mora; AGR = agreement; ι = information-structural, κ = category, μ = mora; π=prosody, σ = syllable; Σ = semantic; Ab = Abraham; AGR = agreement; ASP = aspect; ATR = advanced tongue root; Aw= Awoyale; C = consonant; C.FORCE = force complementize; C.FINITE = finiteness compementizer; CL = noun class; COMP = complementizer; CV = CV syllable (i.e. open syllable, conisting of a consonant and vowel); De = Delano; D = determiner; DEM = demonstrative; DEONT = deontic modality; DIST = distal; EPIST = epistemic modality; F-category = functional category; FT = foot; FV = final vowel; FUT = future; GEN = genitive; Ha = Hannan; H = high-tone, HAB = habitual; HORT = hortative; HTS = high tone syllable; HORT = hortative; HUM = human; IMP = imperfective; INANIM = inanimate; INF = infinitive; INFL = inflection; INSTR = instrument; IRR = irrealis; K = kase; KA = Karanga Shona; K.GEN = genitive kase; KO = Korekore Shona; K.POSS = possessive case; L = low-tone; L-category = lexical category; L_n = roots categorized as a noun; L_v = root categorized as a verb; M = mid-tone, MA = Manyika Shona; MIN = minamal(ity); MOD = modal; NEG = negative; *n* = number of forms; N-spine = nominal spine; OM = object marker; P = preposition; PERF = perfective; PL = plural; POSS = possessor; PROG = progressive; PROX = proximal; REAL = realis; SAL = salient; SG = singular; SM = sujbect marker; SPEC = specific; TNS = tense; V = vowel; V-spine = verbal spine; Z = Zezuru Shona.

[2] 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. (Déchaine, Girard, Mudzingwa, & Wiltschko, 2014) 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*]]]]

[3] 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

[4] The calculation of English verb-forms is made as follows. 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%, so that yields a count of 7,500 verb-forms. 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.

[5] The calculation of the total number of Yorùbá noun stems is arrived at as follows. Since the V- prefix never bears H-tone, v-CV nouns stems have 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 roots (3_{TONES} x 10_V x 18_C); in combination with the non-harmonic prefixes (*i-*/*a*), and six tone melodies (LH, LM, LL, MH, MM, ML), these 540 roots define 6,480 non-harmonic noun stems. In addition, 108 -CV roots are compatible with [+ATR] harmony (18C x 6V; V= { *i-*, *e-*, *o-*, *u-*, *ĩ-*, *ũ-*}; this yields a total of 1,296 [+ATR] noun stems. Finally, 72 -CV roots are compatible with [-ATR] harmony (18C x 4V; V= {ɛ-, ɔ-, a-, ã-}; this yields a total of 864 [-ATR] noun stems.

[6] The calculation of English noun-forms takes as its baseline the English word-form count given in footnote 4 (54,000), as well as the fact that, according to the OED, slightly more than half of English word-forms are nouns, roughly 51% (27,540). Given that the active vocabulary of an English-speaking literate adult is 20,000 word-forms, this means that the number of active noun-forms is 10,710. The total number of word-forms needed for comprehension is 5,000, so the noun-forms needed for comprehension clock in at 2,550. And the number of word-forms needed for productive use is 3,000, so noun-forms needed for production number 1,530.

[7] 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)
(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) [*ró**g**ó**d**ó-dó*]-[*ró**g**ó**d**ó-dó*] ‘several things very small & round’ (Aw89:D7.a)

[8] 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’

[9] In Yorùbá, the four D-positions co-occur, creating underlying sequences [D.PROX D.SPEC D.SAL D.CLASS], as in (i). Observe that the noun head (inflected with prefixal D.CLASS) surfaces to the left of all other Ds; this reflects the application of leftward DP-movement (Ajiboye, 2005, 2007).

(i) *Mo ri* [*a-já*]$_{\mathbf{i}}$ *yì-í kan ná-à* $\mathbf{t_i}$
1SG see D.CLASS-dog D-PROX D.SPEC D-SAL
‘I saw this very same dog’ (Ajiboye 2005:216, (74))

[10] 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) ’

[11] Not included in this tabulation of Shona √VC roots are the following 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

[12] Shona dialects differ according to how highly they rank the minimal word size constraint (Mudzingwa, 2010): while Zezuru require all surface outputs to obey minimality, Karanga does not:

(i)			Zezuru	Karanga
a.	/gò/	‘wasp, cl5	[ì.gò]	[gò]
b.	/^{m}bá/	‘house, cl9	[ì .^{m}bá]	[^{m}bá]
c.	/p-á/	‘give!’	[ì.pá]	[pá]
d.	/g^{w}-à/	‘fight’	[ì.g^{w}à]	[g^{w}à]

(Mudzingwa 2010:13, (18))

[13] The Shona 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-. For discusssion, see xxx.

[14] As discussed in 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. 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*
1SG-PAST-arrive-cook-FV
‘I arrived and cooked’

*nd-à-**nyátsò**-bìk-à*
1SG-PAST-neatly-cook-FV
‘I arrived and cooked neatly’

(cf. Odden 1981:15 (18))

[15] In Emergent Morphology, the correspondence relation between semantico-syntactic M-features and the phonoloigcal string is formalized in terms of the *Morpheme condition* in (i):

(i) *Morpheme condition*
Two morphs { X }, { Y } are members of a single morpheme {…}α,
iff ∃ M-feature α, where α is a property of both { X } and { Y }.
(Archangeli & Pulleyblank 2014, (6))