Language Internal Factors Explain Syllable Structure Complexity (feat. Ecological Adaptation): Stress, tone and consonant clusters

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Aim:

To demonstrate that language internal factors are sufficient to explain the typological distribution of syllable structure complexity in terms of consonant clusters, undercutting linguistic ecological adaptation.

1. Language Ecology and Phonological Complexity

A recent trend in the typology of phonology (Everett 2013; Everett et al. 2015, 2016; Maddieson and Coupé 2015) is to claim that the sound structure of a language reflects its local ecological conditions.

This is thought to occur by a process of linguistic 'adaptation' to the acoustic properties of the physical environment. This ostensibly parallels the ecological feedback mechanisms which contribute to the shape of the acoustic signals of various species, including birds.

In Maddieson and Coupé (2015) it is argued that syllable complexity (measured in terms of consonant clusters) is ecologically dispreferred in areas of dense foliage.

The mechanism behind the correlation is argued to be that high frequency sounds (consonants) are muffled in these environments and therefore more sonorous sound patters (CVCV, CV.V) are preferred.

In this presentation we will argue that the distribution of consonant clusters in sound systems could have a previously unknown language-internal motivation, thereby undercutting the ecological correlation. We will show that (in mono-morphemic forms, excluding the phrasal level or compounding), overwhelmingly, tonal languages have CV syllabification (no consonant clusters). Consonant clusters tend to occur in stress-prominence languages.

(1) Extract from table of stress, tone and consonant clusters

Projected

2. Case studies of the relationship between stress, tone and consonant clusters

The correlation between stress-prominent languages and consonant clusters on the one hand, and tone languages and CV syllabification on the other, produces some compelling brief case studies.

- West Atlantic

  While consonant clusters are largely absent from Niger-Congo languages, medium level consonant clusters (NC[-voice]) are found in West Atlantic languages such as Wolof (Ka 1988) and Pulaar (Niang 1998).

- Austroasiatic

  Austroasiatic is a family of languages that is slowly transitioning from systems with stress-prominent polysyllabic words to tone (a process seemingly part driven by contact with Middle Chinese (cf. Vietnamese)). In this family, the complex consonant clusters are predictably found in the stress systems of (Khmer) and where tonogenesis is less advanced (cf. Sidwell 2014).

- Mazatecan

  What might appear to be consonant clusters in the tonal Mazatecan languages (Gudschinsky 1953) are, in fact, prosodic features that apply at the word-level and born equally on the vowels (reducing the syllable structure to CV (Léonard 2005)).

Crucially, many apparent counterexamples to this generalization appear to confirm the generalization; those languages with established tonal systems and consonantal complexity are usually of a certain 'type' that I call: **BIG CV - small cv**[1].

[1] This would include, in GP terms, the Han template (Goh 1997) later reanalyzed as Charette (2008) and redefined as incorporation in Ulfsbjorninn (2014); Faust and Ulfsbjorninn (in prep.).

3. Exceptions that prove the rule

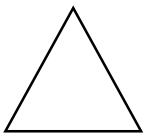
3.1 Background on consonant clusters

The classification of consonant complexity has been a particular focus of Government Phonology (Charette 1990; Harris 1994; Scheer 2004; Ulfsbjorninn 2015; Brandão de Carvalho 2002, forth.), but it also represents a strand of generative work on representations (Sagey 1986; Clements and Rielland 2006). In these works, the common thread is the crucial representational difference between *complex onset* and *branching onset*, the former are complex and *monopositional*: (affricates, labio-velar stops, prenasalised stops), while the latter are *bipositional*: 'true': [pr, kl, rt, lp] or 'bogus': [tl, ps, tm].

3.2 Consonantal complexity in tone languages

The languages with consonantal complexity and an established tone system are all of the same basic shape, shown in (2). The word-shape is as follows, a strong CV pair followed by one recessive CV position (rarely more than one). We show (2) populated by data from !Xóõ as described by Harris and Gussmann (2002, cf. Traill 1985).

(3) **Big CV – small cv** Consonantal complexity in tonal languages

C1  strong		V1 | V strong	C2 | recessive	V2 | V weak
Click onsets:	80		0	
Non-click stops:	27		0	
Other:	6		6 or 2 (if V2 is empty)	
Tot.	113		6 or 2	

What can be demonstrated to be the first consonantal position is a monopositional complex onset – these tonal languages never allow (bipositional) consonant clusters. This is the pattern for the following tonal languages: **Kru** and **Gbe** in humid tropical West Africa, it is widely attested in '**Khoisan**' languages in the arid regions of Southern Africa (Traill 1985), and it is typical of the unrelated **Hmongic** and **Tai-Kadai** languages of humid South East Asia[2].

[2] Perhaps even **Nilotic** with its CVC (devoicing) and CwVCV *CVCwV *CVCw

4. Language internal factors of consonant cluster complexity

4.1 The pattern

- Stress-prominent languages tend to have consonant clusters
- Tonal languages tend not to have bipositional consonant clusters

4.2 Explanation for the pattern

The reason why this pattern exists is due to the very different nature of tone, and the formal structural description of bipositional consonant clusters.

4.2.1 Consonant cluster structural description

In Strict CV terms (Lowenstamm 1996; Scheer 2004) a (bipositional) consonant cluster always results from the silence or emptiness of an intervening V position.

In (3) we demonstrate how this works. The layers in the structure are as shown: (a) is the syllable structure position, (b) the melody that fills the position – or does not, (c) the phonetic form that ensues, and in (d) I have abstracted the consonant clusters.

(3) (Bipositional) consonant clusters in Strict CV

(a)	C	v	C	V	C	v	C	V	C	v	C	v]
	|		|	|	|		|	|	|		|	
(b)	T		R	V	R		T	V	T			
(c)	[t		r	a	m		p	e	k		t]	
(d)		[tr]				[mp]				[kt]		

In this model of syllable structure, consonant clusters are always a product of silencing a vowel position.

4.2.2 The difference between stress and tone

Stress and tone are built on stress and tone bearing units: vowels/nuclei. However, the inherent nature of stress and tone produce very different systemic preferences with regard to consonant complexity and clusters.

- Stress is a relational property that acts through establishing syntagmatic contrasts based on strength and weakness.
- Tone is a feature that attaches to nuclei.

4.2.3 Tone and consonant clusters

Tone is wholly expressed as a feature on a tone-bearing unit, therefore, in tonal languages there is no incentive to silence these tone bearing units (vowels). This accounts for a dispreference

for the creation of bipositional consonant clusters in these languages. Therefore, when consonantal complexity is found in tonal languages, it tends to be of a monopositional nature (complex onsets in the strong position of the word) thereby increasing the systemic complexity without silencing any potential V positions (the kind of consonant complexity shown in (3)).

4.2.4 Stress and consonant clusters

Concomitantly, in stress languages, the strength of the head nucleus is *enhanced* by the silence of other nuclei. In Strict CV terms (cf. Scheer and Szigetvari 2005), the nuclear head shows its positional strength by silencing the nuclei around it (Ulfsbjorninn 2014). This creates bipositional consonant clusters all around the head. This is what drives syncope in the stress-prominent languages of Latin (Sen 2012), Etruscan (Bonfante and Bonfante 2002), English (Harris 1994), and the Mayan languages (penultimate syncope) (Campbell 1977; Bennett 2015). Stress tends to produce loci of complexity within words from which its presence can be established.

5. Conclusion

The conclusion we reach is that the typological distribution of syllable structure complexity is already accounted for by language internal factors relating to the nature of stress and tone. We would argue this seems to undercut the ecological distribution and its motivation, which, if it does have an effect, would surely be a distant second to language internal factors.

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