The stress-encapsulation universal and phonological modularity

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Background: Cross-linguistically, the distribution of segmental features is often conditioned on the position of stress. In American English, for example (and simplifying), voiceless stops are aspirated at the onset of a stressed syllable (opp^{h}óse vs. oppositíon) and stressless vowels undergo reduction (átəm vs. ətómic). de Lacy (2006) and Blumenfeld (2006) note that stress-segmental interactions in the other direction are almost non-existent: stress is sensitive to suprasegmental features such as syllable structure and tone, but – with the exception of sonority – it is never sensitive to any segmental features (such as voicing, continuancy, and so on). Blumenfeld (2006) treats the asymmetry as a list of specific universals of the form 'the distribution of stress is never conditioned on X', where X ranges over every segmental feature but sonority.

Proposal: Continuing a line of work by Hargus (2001), Blumenfeld (2006), de Lacy (2013 et seq.), Iacoponi (2013), and Shih (2015), I re-evaluate reported cases of sonority-driven stress and propose that the distribution of stress is never directly conditioned on sonority. The result is that Blumenfeld's list of universal asymmetries becomes a generalization: the distribution of stress is never directly conditioned on segmental features. I refer to this result as the **Stress-encapsulation Universal**. Information encapsulation of this kind is the hallmark of modular cognitive architectures, and it motivates a decomposition of phonology into modules that can capture the universal. According to the **Modularity Hypothesis** that I will defend, phonology contains an informationally-encapsulated stress module with the following properties: 1) The input to the stress module excludes representations of segmental features; 2) Outside of the stress module, stress representations cannot be changed. Since stress minimally needs to see syllable structure (e.g., Latin [volúp.tas] vs. [vólu.kris]), I assume, as a preliminary theory of the interface, that syllable structure is all stress can see: indirect effects of segmental features on stress are mediated by syllable structure.

Sonority-driven stress in the literature: Notable works reporting sonority-driven stress include Hayes (1995), Kenstowicz (1997), de Lacy (2002), Crowhurst and Michael (2005), and Gordon (2006). Some patterns have been re-evaluated by Hargus (2001), Blumenfeld (2006), de Lacy (2013 et seq.), Iacoponi (2013), and Shih (2015), and some of these works have questioned the existence of sonority-driven stress altogether. Based on Gordon's 2006 stress survey of 388 languages, we can roughly classify the reported 28 sonority-driven stress patterns into three types: **Type I**: Distinction between full and reduced vowels; stress skips reduced vowels (20/28); **Type II**: Low vowel attracts stress (5/28); **Type III**: Fine-grained sonority hierarchy based on vowel height or peripherality; stress falls on the most sonorous vowel within some domain (3/28). Regarding Type II patterns, Blumenfeld (2006) claims that the low vowel attracting stress in Kara should be analyzed as phonologically long, and Shih (2015) claims that in Gujarati there is no correlation between the low vowel and stress-related phonetics, suggesting that properties like length may have been misinterpreted as stress. I will focus on Type I and Type III patterns, providing a general recipe for reanalyzing Type I patterns and arguing that there is no good evidence for Type III patterns.

Type I patterns: Late projection. In Type I patterns, stress skips particular vowels like schwa. Kager (1990) proposes that non-epenthetic empty vowels like schwa may project late in the derivation: until they project, they are invisible to the stress component. Late projection allows for analyzing stress-skipping without reference to segment quality. I demonstrate using the complex pattern in **Eastern Mari** (Kenstowicz, 1997; data here taken from Vaysman, 2008). In mono-morphemic words, stress generally falls on the rightmost full vowel – the rightmost vowel that is not a schwa (ə) (korgá, sérəʃ, jóŋələs); stress also skips vowels that alternate with schwa and are the result of vowel harmony (pő̈rʃö∼pő̈rʃə-lə, ʃóʃo∼ʃóʃə-lə); when every vowel in a word is a schwa, stress is initial (βə́nər). In multi-morphemic words, when the root only contains full vowels, stress in the suffixed form is root-final (paʃá∼paʃá-lan, paʃá∼paʃá-ge); when the root has only schwas, stress falls on the suffix (rə́wəz∼rəwəz-lán, rə́wəz∼rəwəz-gé); when the root has non-final stress, suffixes like -lan and -ge behave differently: -lan attracts stress from the root, but -ge does not, keeping stress on its pre-suffix position (sérəʃ∼serəʃ-lán, sérəʃ∼sérəʃ-ge). The assumption that suffixes like -lan (a total of 4 suffixes) are lexically stressed whereas suffixes like -ge (a total of 3 suffixes) are not is enough to derive the distribution of stress in suffixed words. The following table shows sample derivations in a cyclic analysis, where schwa initially does not project a skeletal slot (indicated as [ə]), stress assignment rules only apply to stressless words, and post-stress destressing requires two adjacent stressed vowels whereas pre-stress destressing does not. The conclusion is that stress assignment in Eastern Mari does not require reference to segment quality.

Word	[paʃá-lan]	[rə́wəz]	[rəwəz-lán]	[rəwəz-gé]	[serəʃ-lán]	[sérəʃ-ge]
Cycle I	paʃa	r[ə]w[ə]z	r[ə]w[ə]z	r[ə]w[ə]z	ser[ə]ʃ	ser[ə]ʃ
Final stress	paʃá	-	-	-	sér[ə]ʃ	sér[ə]ʃ
Cycle II	paʃá-lán	-	r[ə]w[ə]z-lán	r[ə]w[ə]z-ge	sér[ə]ʃ-lán	sér[ə]ʃ-ge
Final stress	-	-	-	r[ə]w[ə]z-gé	-	-
Post-cycle	paʃá-lán	r[ə]w[ə]z	r[ə]w[ə]z-lán	r[ə]w[ə]z-gé	sér[ə]ʃ-lán	sér[ə]ʃ-ge
Projection, VH	-	rəwəz	rəwəz-lán	rəwəz-gé	sérəʃ-lán	sérəʃ-ge
Post-stress destressing	paʃá-lan	-	-	-	-	-
Pre-stress destressing	-	-	-	-	serəʃ-lán	-
Initial stress	-	rə́wəz	-	-	-	-
Output	[paʃá-lan]	[rə́wəz]	[rəwəz-lán]	[rəwəz-gé]	[serəʃ-lán]	[sérəʃ-ge]

Type III: No conclusive evidence. Stress patterns in a few languages have been claimed to show sensitivity to a fine-grained sonority hierarchy. I re-evaluate the patterns in Asheninca (Hayes, 1995; data from Payne, 1990), Kobon (Kenstowicz, 1997; data from Davies, 1981), and Nanti (Crowhurst and Michael, 2005). Example: Davies (1981) reports that stress in **Kobon** is almost always placed on the syllable which is strongest according to the following hierarchy: (a/au/ai > o/e/u/i > ə/ɨ). Based on this generalization, Kenstowicz (1997) hypothesizes that stress falls on the more sonorous vowel among the final two vowels. Davies (1980), a book on Kobon phonology (around 500 examples marked for stress), disagrees with the stress generalization in Davies 1981 (around 50 examples), and reports that stress normally falls on the penultimate syllable. To compare the two generalizations, I have re-organized the data from both sources according to lexical category, morphosyntactic environment, and syllable structure. Result: the two hypotheses are nearly equally successful, with 7 examples supporting the sonority hierarchy (e.g., kɨdolmán, uréf) and 6 examples supporting penultimate stress (e.g., gí̯an, múmon, rə́mni). I conclude that there is no convincing evidence for sonority-driven stress in Kobon.

Implications and open questions: The stress-encapsulation universal has significant architectural implications. A modular architecture with encapsulation provides an explanation for why stress assignment never makes reference to segmental features. Within a modular architecture, open questions are how the stress module and the rest of phonology interact and how concrete theories of the interface translate into predictions regarding possible stress-segmental interactions.