

Stress and Morphological Complexity in Brazilian Portuguese

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Introduction: Stress in Brazilian Portuguese is sensitive to morphology. While morphologically simple words and words with **normal suffixes** (those that integrate prosodically with the base) have regular secondary stress (binary or initial), words with **special suffixes**—diminutive -(z)inho, superlative -issimo ('very X'), and adverbial -mente—maintain a secondary stress in the same location as in the independent base, while primary stress shifts to the suffix. Maintenance of stress on the base blocks regular secondary stress (1).

1.	Base	Suffixed	Orthographic
	siste'matſika 'systematic'	sis'tema, tſisi-'dadži (*siste'_matſisi'dadži)	(normal) sistematicidade
	e'zexſitu 'army'	e'zexſitu-'z̄nu (*ezex_situ'z̄nu)	(special) exércitozinho

I present an acoustic production study looking for secondary stress in bases with special and normal suffixes. The correlates of stress (duration, intensity, F1) show that special suffixes maintain a secondary stress in the same location as in the independent base (as suggested by Ulrich (2016) and Ulrich & Schwindt (2017)), but they differ in the extent of maintenance. I propose that the class of special suffixes is unique phonologically because the suffixes share one morphological property: they attach to categorized roots (while normal suffixes are categorizing heads). Most scholars believe these suffixes to be independent prosodic words (Bachrach & Wagner 2007; Lee 2013; Schwindt 2013; Ulrich 2016) and treat the special suffixes as a unified class phonologically. However, the phonetic differences between special suffixes observed in the current production study may stem from different types of attachment.

Experiment: 14 native speakers of Brazilian Portuguese read 90 morphologically complex target words embedded in naturalistic sentences of two types: preceded by a verb with either penultimate stress ('σσ + target) or final stress (σ'σ + target) (90 words x 2 sentences = 180 sentences). Target words were built from the same root, in sets, to facilitate comparison of the pretonic vowels. Each set contains words with special suffixes and a normal suffix (2).

2.	Root	Special Suffixes	Normal Suffix
	eduk-	eduka'dž- ĩna 'well behaved-DIM-FEM' (adj)	eduka-'tſiva 'educational'
		edukada-'mětſi 'well behaved' (adv)	
		eduka'dž-isima 'very well behaved' (adj)	

To avoid confounds of vowel quality, the analysis compares each vowel in a special suffix word to its counterpart in a normal suffix word. For example, the “a” in the special suffix word [eduka'džiŋa] is compared to the “a” in the normal suffix word [eduka'tſiva] using a ratio for duration/intensity and a difference for F1 (e.g. duration ratio of /a/: 55ms:34ms = 1.61). Ratios above 1 indicate a longer vowel (stress maintenance) in the special suffix word. The difference in F1 captures phonological reduction: unstressed mid vowels raise, neutralizing height distinctions. A stressed base vowel should stay lower in special suffix words if it maintains stress, and raise in normal suffix words where it receives none. Large difference measures reflect the extent of reduction and stress maintenance. For each special suffix, the ratios/differences for each correlate were assessed in mixed-effects linear regressions using the *lme4* package in R (Bates et al. 2015). **Results:** The special suffixes maintain stress on the base compared to normal suffixes, but the patterns vary by suffix. DIMINUTIVES show stress maintenance on the base through duration, intensity, and F1: vowels that are stressed in the independent base ([ka'fɛ]) are longer, louder, and have higher F1 in words with special suffixes ([kafɛ'z̄nu]) than in words with normal suffixes

([*kafə'teira*]). Some suffixes attach only to bases of certain shapes: bases with PENULTIMATE and ANTEPENULTIMATE stress accept all special suffixes (PENULTIMATE bases take the *-inho* diminutive), bases with FINAL stress accept only diminutives (the *-zinho* form). Figure 1 shows duration ratios. Vowels that are unstressed in the independent base have the same duration in special and normal suffix words ([*edu'kada*]: [*eduka'dʒiŋa*]-[*eduka'tʃiva*]). Vowels that are stressed in the base are longer in diminutives than in normal suffix words ([*eduka'dʒiŋa*]-[*eduka'tʃiva*]), and the effect is strongest for bases with ANTEPENULTIMATE/FINAL stress. Stressed base vowels are also louder in diminutives than in words with normal suffixes. Finally, stressed base vowels stay lower (higher F1) in diminutives, where they retain stress, than in normal suffix words, where they are unstressed and raise (lower F1) ([*ka'fɛ*]: [*kafɛ'zjnu*]-[*kafɛ'teira*]).

SUPERLATIVES show stress maintenance only with F1: vowels that are stressed in the base stay lower (higher F1) in superlatives, where base stress is maintained ([*zene'rɔza*]: [*zenerɔ'zisima*]), and raise (lower F1) in normal suffix words ([*zenerozi'dadʒi*]) where base stress is lost. ADVERBIAL *-mente* words maintain base stress through duration, intensity and F1 ([*siste'matʃika*]: [*sistematʃika'meñti*]-[*sistematʃika'dadʒi*]), but the effects are smaller than for diminutives.

Discussion & Analysis: The results provide acoustic evidence for stress maintenance on the base of words with DIMINUTIVE, SUPERLATIVE, and ADVERBIAL suffixes, supporting the claim that the suffixes and bases are independent prosodic words. The analysis assumes that special suffixes differ morphosyntactically from normal suffixes in that they attach as modifiers or adjuncts to already categorized heads (*-inha* in Figure 2) while normal suffixes are categorizing heads (*-ad-* in Figure 2).

Assuming that the first categorizing head defines a spell-out domain in a Distributed Morphology framework (Marantz 2001), the special suffixes are spelled out and receive stress separately from their bases. For Spanish, Oltra-Massuet & Arregi (2005) argue that stress assignment refers to internal word structure and propose that certain functional heads project foot boundaries. Combined with a serial phonology that assigns stress to each chunk delivered by the morphology, this correctly predicts that the special suffixes all maintain stress on the base. Although the special suffixes all attach to categorized roots, they differ in type of attachment (DIMINUTIVES and SUPERLATIVES are modifiers; ADVERBIAL *-mente* assigns category), and this may shed light on the relationship between prosodic word formation, gradient stress maintenance, and morphological structure. The analysis correctly predicts the acoustic results: a bare root--or a root with a normal suffix—and an exceptional suffix maintains stress on the base.

Alternatives: Deriving stress maintenance on the base relies on cyclic spell-out and serial foot building (Pruitt 2010). This differs from an OO faithfulness account, which requires existing free-standing bases as reference points for morphologically complex words (Benua 1997). OO faithfulness does not distinguish different suffix types; in the morphological account proposed here, the morphological differences are key to explaining why certain suffixes maintain base stress.

References: Bachrach, Asaf & Michael Wagner. 2007. Syntactically Driven Cyclicity vs. Output-Output Correspondence: The Case of Adjunction in Diminutive Morphology. *University of Pennsylvania Working Papers in Linguistics* 10(1). • Marantz, Alec. 2001. Words and Things. Manuscript. MIT, ms. • Oltra-Massuet, Maria Isabel & Karlos Arregi. 2005. Stress-by-Structure in Spanish. *Linguistic Inquiry* 36(1). 43–84. • Ulrich, Camila. 2016. A neutralização de vogais pretônicas e a formação de palavras complexas em PB: o caso dos sufixos *-inho/-zinho*, *-mente* e *-íssimo*. Porto Alegre: Universidade Federal do Rio Grande do Sul MA Thesis.

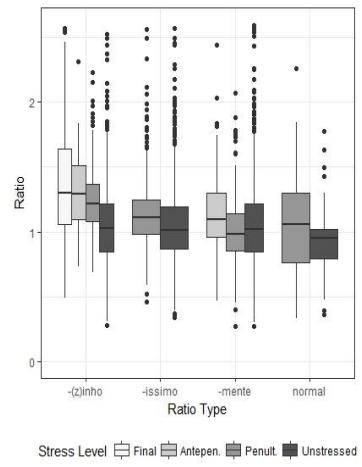


Figure 1 Duration ratios by suffix and type of stress a vowel receives in the independent base

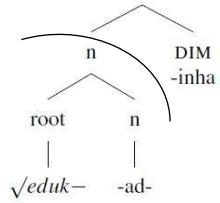


Figure 2 Diminutives attach to already categorized roots