

Articles

The prosodization of derived words in Brazilian Portuguese: Joining perspectives

A prosodização de palavras derivadas em português brasileiro: Reunindo perspectivas

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ABSTRACT

This paper revisits and extends the debate on the prosodic status of affixed words in Brazilian Portuguese within the Optimality Theory framework, especially based on Selkirk (1996) and Itô & Mester (2008)'s proposals, according to which violable universal constraints are responsible for mapping grammatical and prosodic structures at the expense of a possible disobedience to certain principles of the prosodic hierarchy. Starting from a review of the literature on the topic, we bring together ideas from our previous studies (Bisol, 2000, 2004, 2007; Schwindt, 2001, 2008, 2013) to argue that affixed words in Brazilian Portuguese are subject to three types of prosodization — composition, adjunction and incorporation —

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prefixes being subject to all three, while suffixes only to incorporation and composition, not to adjunction. In contrast, clitics are characterized as structures labeled as attached to their hosts. The evidence comes especially from the diagnostics of stress assignment, but also from other word domain processes. Based on this description, we problematize some consequences of this typology for the organization of the prosodic hierarchy and its effects on morphological transparency by defending a continuum that goes from composite to incorporated structures.

Keywords: *prosodic word; morphological derivation; morphophonology.*

RESUMO

Neste artigo revisitamos e estendemos o debate sobre o estatuto prosódico de palavras derivadas por afixação em português brasileiro no escopo da Teoria da Otimidade, de modo especial nas propostas de Selkirk (1996) e Itô & Mester (2008), em que se assume que restrições universais violáveis dão conta do mapeamento entre estruturas prosódicas e gramaticais com o custo de eventual desobediência a certos princípios da hierarquia prosódica. Partindo da literatura sobre o tema, reunimos as ideias de nossas análises anteriores (Bisol, 2000, 2004, 2007; Schwindt, 2001, 2008, 2013) para sustentar que vocábulos afixados da língua estão submetidos a três tipos de prosodização — composição, adjunção e incorporação —, estando prefixos sujeitos aos três, enquanto sufixos somente à incorporação e composição, não à adjunção. Em contraste, clíticos se caracterizam como estruturas a que rotulamos como anexadas. As evidências provêm, sobretudo, do diagnóstico de atribuição do acento, mas também de outros processos do domínio da palavra. Baseados nessa descrição, problematizamos algumas consequências dessa tipologia para a organização da hierarquia prosódica e seus efeitos sobre a transparência morfológica, defendendo um contínuo que vai de estruturas compostas até incorporadas.

Palavras-chave: *palavra prosódica; derivação morfológica; morfofonologia.*

1. Introduction

Despite aiming for isomorphism — the most basic idea in Match Theory (Selkirk, 2011), which deals with the pairing of syntactic and prosodic structures — morphosyntactic words (X^0) and prosodic

words (ω) are not completely identical in many world languages. Word formation processes, especially composition and derivation, can be responsible for the misalignment between these two types of words. This occurs in systems that preserve primary stress after composition or derivation, that is, in systems in which each part of a compound, and even affixes, can be considered independent ω 's, in contrast to languages that redistribute it (e.g. English, [whíte]_A [hóuse]_N vs. [Whítehouse]_N or [éngine]_N vs. [enginээр]_N).³

Portuguese, among other Romance languages such as Spanish and Italian, is an example of this type of system: composition, in most cases, preserves the original stress, but affixes behave in a peculiar way. The consequence is a non-isomorphic relationship between the extension of ω and X^0 , as shown in (1), in which ω 's are interpreted as equal, smaller and larger than their morphosyntactic counterpart.

(1) Possible extensions of ω 's in BP

- | | | | |
|----|----------------|------------------------------------------------------------------------------------------------------|--------------------|
| a. | $\omega = X^0$ | casa] _{ω, X^0} 'house' | simple word |
| b. | $\omega < X^0$ | pre] _{ω} escola] _{ω, X^0} 'pre school' | prefixed word |
| | | café] _{ω} zinho] _{ω, X^0} 'small black coffee' | suffixed word |
| | | cachorro] _{ω} quente] _{ω, X^0} 'hot dog' | compound word |
| c. | $\omega > X^0$ | me] _{X^0} espere] _{X^0, ω} 'wait for me' | cliticized phrase* |

* The prosodization of cliticized structures such as an ω 's will be discussed later in this text. We initially assume (1c) as an example of a restructured word, therefore, post-syntactic.

Based on ideas developed in previous works, especially in Bisol (2000, 2004, 2007) and Schwindt (2001, 2008, 2013), we revisit the debate on the prosodic status of morphologically derived words in Brazilian Portuguese (BP) in order to argue that prefixes are subject to the three types of prosodization involving ω 's — incorporation, adjunction and composition — whereas suffixes are subject only to incorporation and composition. Clitics, in contrast, are characterized as structures attached to the category that hosts them. Alongside this descriptive objective, we problematize some consequences of this typology for the organization of the prosodic hierarchy and its effects on morphological transparency.

3. In this paper, in non-phonetically transcribed examples, we use, whenever necessary, the acute diacritical mark (´) to indicate stressed syllables, regardless of Portuguese writing rules.

The text is organized as follows. In section 2, we propose a non-exhaustive debate about the concept of word in the prosodic and grammatical domain, with examples from BP whenever possible. In section 3, we discuss phonological processes that apply in the domain of ω 's, including primary stress, in order to support our hypothesis about the prosodic structure of derived words in the language. In section 4, our proposal for the prosodization of affixed words is followed by a discussion of the constraints we believe account for it, under the hypothesis that the prosodization of ω 's may reflect aspects of productivity/transparency of the morphological forms involved.

2. On the definition of word

Although it is relatively consensual that the word is a pertinent unit of language description, its conceptualization consists in a challenging task in linguistics. Some authors, including Veloso (2016) and Villalva (2012), strive to propose a minimal set of requirements for defining word, which includes (i) having meaning and class, (ii) being a locus of affixation, (iii) being the domain of specific stress rules, and (iii) being a terminal node of a syntactic structure with autonomy and mobility. However, these properties are always falsifiable, either because not all of them are considered universal, or because they are often conceived in opposition to other structures larger or smaller than what is frequently labeled as a word. Therefore, it is common understanding that the best approach is the one that conceives not one, but several types of words, such as lexical word (or lexeme), morphosyntactic word, phonological word and even graphic word.⁴ For the purpose of this paper, we will initially focus on what we define here as a morphosyntactic word, with the broad definition of the terminal node of a sentence, as opposed to the phonological word, whose definition we will examine more in depth below.

4. Native speakers of any language are in principle able to identify and isolate words, a property known as *wordhood*. Ulrich and Schwindt (2016), through experimental analysis, found that such intuition is achieved by criteria of different natures, namely, phonological/orthographic, morphological, semantic, and syntactic.

Word as prosodic constituent in BP

It seems uncontroversial that native speakers identify sound units larger than syllables and smaller than sentences in the continuum of speech. However, there is no consensus about the criteria which allow this segmentation from a purely phonological point of view. Azuaga (1996) suggests that phonological or prosodic words are entities that can be preceded and followed by pauses, which do not occur within such units (e.g. #fantastic#person#, but not #fan#tas#tic#per#son#). Such criterion, however, seems fragile, since morphologically compound words can consist of two phonological words that do not allow for a similar pause between their parts in many languages (*#guarda#roupa# ‘closet’).⁵ The most consensual criterion in the literature, on the other hand, is that ω 's are the domain of primary stress. Although more objective than the pause, stress is far from being a simple criterion for a number of reasons: (i) it is not uncommon for functional words to be stressless in the world's languages (e.g. articles and oblique pronouns in BP), (ii) words may show more than one stress placement (primary and secondary stress), (iii) units larger than a word can also be given some sort of stress (phrasal stress).

With regard to Portuguese, even before the dissemination of theories about prosodic hierarchies, Camara Jr. (1975) assumed the notion of phonological word according to a criterion of relative prominence, distinguishing it from the grammatical word:

The phonological word is a prosodic entity, characterized by one stress and two possible degrees of atonicity before and after the stress. It corresponds in the morphic plane to Bloomfield's free form. (Camara Jr., 1975, p. 38, free translation)⁶

5. Azuaga (1996) suggests that pauses can be interpreted as hesitations in speech (e.g. *fantastic...um...person*, but not *fan...um...tas...um...tic...um...per...um...son*). It is even more evident, however, the ineffectiveness of this criterion when applied to compounds (e.g. **hot...um...dog*).

6. “O vocábulo fonológico é uma entidade prosódica, caracterizada por um acento e dois graus de atonicidade possíveis antes e depois do acento. Corresponde no plano mórfico à forma livre de Bloomfield.” (Camara Jr., 1975, p. 38).

The author exemplifies stress distribution with a numerical scale, from 3 to 0, in which 3 indicates the stressed syllable, whereas 2, 1, 0 indicate unstressed syllables, with 0 being the weakest among them. In (2) these force groups are exemplified, contrasting prosodic words that correspond to one or two grammatical words, respectively (2a) and (2b).

(2) BP word prominence scale (adapted from Camara Jr., 1969, p. 36)

	/a.bi.li.da.de/					/se.le.bri.da.de/								
a.	1	1	1	3	0	habilidade	'ability'	1	1	1	3	0	celebridade	'celebrity'
b.	2	0	1	3	0	hábil idade	'able age'	2	0	0	3	0	célebre idade	'remarkable age'

Although not committed to a specific grammatical architecture, it is interesting to note that Camara Jr. is considering the word at two different levels of analysis, pre- and post-syntactic, in the examples above. In other words, it is a lexical word that is parsed in (2a), whereas it is a restructured word that is parsed in (2b) (after its association with another word).

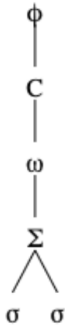
Hierarchies of prosodic categories, such as those proposed by Hayes (1989), Nespor and Vogel (1986) and Selkirk (1980), arise from the observation that grammatical categories are insufficient to fully account for the analysis of linguistic phenomena. This is attested, for example, both in regard to the limits between a syntactic phrase and a phonological phrase and between X^0 and ω , as shown in (2).

In this study, following Nespor and Vogel (1986, p. 141), we approach ω as an intermediate constituent of the prosodic hierarchy, which corresponds to the output of morphology and the input of syntax in a modular perspective of grammar.

...the phonological word is the level of prosodic hierarchy that represents the mapping between the morphological and the phonological components of the grammar.

From a hierarchical point of view, ω is, by consensus, the constituent that is below the phonological phrase (ϕ) and above the syllable (σ) — or below the clitic group (C) and above the foot (Σ), in Nespor and Vogel's proposal.

(3) Prosodic word in the Prosodic Hierarchy



Although it is not the focus of this paper, it is worth making some comments about C, the most controversial category of the prosodic hierarchy and whose definition directly interferes in the definition of ω . The clitic group has been subject to criticism by several authors. Many of the objections refer directly or indirectly to the requirements of the Strict Layer Hypothesis (SLH), defined below.⁷

Principle 1. A given nonterminal unit of the prosodic hierarchy, X^p , is composed of one or more units of the immediately lower category, X^{p-1} .

Principle 2. A unit of a given level of the hierarchy is exhaustively contained in the superordinate unit of which it is part.

Principle 3. The hierarchical structures of prosodic phonology are n-ary branching.

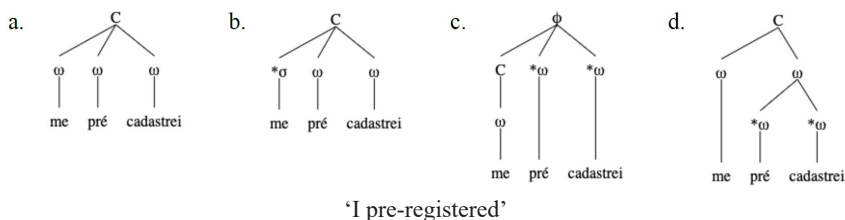
Principle 4. The relative prominence relation defined for sister nodes is such that one is assigned the value strong (s) and all the other nodes are assigned the value weak (w). (Nespor & Vogel, 1986, p. 7)

The main controversy involving C concerns the principles 1 and 2 of SLH, which determine, according to the interpretation of most authors, that prosodic structures are not recursive and must be parsed

7. Vigário (2001, p. 18) highlights the difficulty of treating clitics as independent ω 's (a category subordinated to the C, according to SLH, principle 1), due to their lack of properties characteristic of this domain, including its typical atonicity, and suggests abandoning C as a constituent of the prosodic hierarchy: "By abandoning the clitic group and the need for clitics to be independent prosodic words, it is possible to establish a one-to-one correspondence between the prosodic word and primary word stress (...)".

exhaustively in the category to which they are subordinate (no skipping levels)⁸. We exemplify the violation of these principles in BP, starting with the second one. Exhaustivity, in the case in question, imposes that C necessarily dominates ω , not distinguishing, for instance, between pronominal clitics and prosodically autonomous affixes, as exemplified in (4a). Linking σ directly to C, as in (4b), violates this principle. Reserving C, on the other hand, only for clitics, linking the other words directly to ϕ , as in (4c), represents a similar violation, with the inconvenience of not distinguishing the prosody of affixes and clitics in relation to ω . Finally, the proposal of sub-hierarchies to distinguish these structures, as exemplified in (4d), assuming recursion of ω , violates principle 1 of SLH.

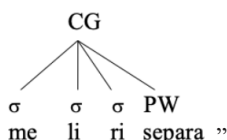
(4) Alternatives for prosodization of BP pronominal clitics and autonomous prefixes



Among other studies, Peperkamp (1997), Vigário (2001) and, for BP, Brisolara (2008) and Schwindt (2008, 2013) admit the recursion of ω . The main problem with this approach, however, as Vogel (2012) points out, is the expectation that the different projections of ω are domain for the same processes (under penalty of concluding, on the contrary, that, for example, ω -max and ω -min are distinct categories).

8. In the foreword of the revised edition of their book, Nespor and Vogel (2007, p. xviii) acknowledge the limitation of the SLH in dealing with the problem we mentioned here: “... we propose that the only change needed is for the SLH to permit a constituent to dominate material more than one level lower in the prosodic hierarchy. This is illustrated in (3), where the CG dominates items that are not PWs, but simply syllables.

(3)



‘(he) re-separates them for me’ (Nespor & Vogel, 2007, p. xvi)

The most characteristic example is the intervocalic voicing process in Northern Italian, which targets the inner ω (e.g. [dizonesto] _{ω} ‘dishonest’), but not the outer ω (e.g. [a[sociale] _{ω}] _{ω} ‘asocial’) — assuming, here, that *dis-* is a prefix that is incorporated into the ω -base, unlike *a-*.⁹

To deal with this problem, Vigário (2010) and Vogel (2008) propose a category to replace C what they call *composite group* (CG) and *prosodic word group* (PWG), respectively. Both proposals account for composite prosodic structures, without resorting to recursion; the crucial difference is that CG includes clitics, unlike PWG, which implies that exhaustivity is violated in order to ensure that syllables corresponding to pronominal clitics are directly linked to higher constituents (such as the phonological or intonational phrase). These constituents are present in BP analyzes, such as those by Guzzo (2015), Toneli (2014) and Ulrich (2021) — in some specific cases in conjunction with ω recursion. From a representational point of view, we recognize the need for an intermediate category between φ and ω , but we consider the debate about its labeling to be less relevant for the purposes of this study. We understand, however, that recursion, as it creates distinct projections, also creates its own domains. This could explain the fact that a process occasionally applies to ω -min and does not apply to ω -max and vice versa, perhaps with the benefit of not complexifying the hierarchy with an additional level, with specific base properties.

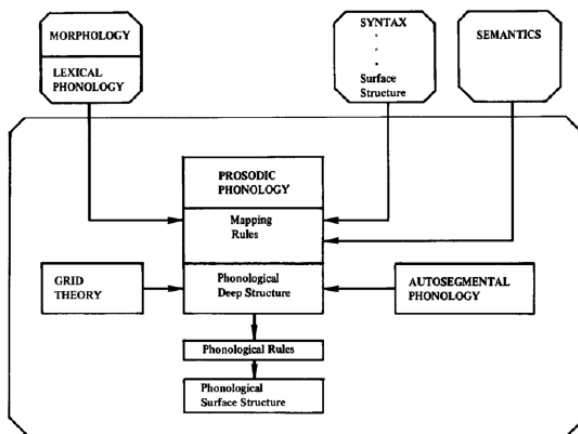
Word prosodization and grammatical modeling

Within the scope of the Standard Generative Phonology, Selkirk (1980) proposes that prosodic categories are established from the output of syntax. Categories smaller than ω , such as σ and Σ , in their relationship to morphological processes, are naturally not covered by this perspective of analysis. Likewise, units equal to or greater than ω , which, perhaps, interact with affixal derivation, are not satisfactorily

9. The prefixes *des-* and *a-* behave similarly in Portuguese and Italian in relation to /s/-voicing. However, Portuguese does not have an active intervocalic voicing process within words (since /s/ and /z/ form minimal pairs, as *ca/z/a* ‘house’ vs. *ca/s/a* ‘hunting’, *ro/z/a* ‘rose’ vs. *ro/s/a* ‘farm’ etc). Therefore, the analysis of this phenomenon in Portuguese requires referring to the morphological edge in addition to the prosodic one, as suggested in Schwindt (2008).

described by this approach. Nespor and Vogel (1986) identify this problem and propose, instead of a T grammar architecture, a model in which each of the three components — syntax, morphology and semantics — provide direct input to the mapping rules of the phonological component.¹⁰

(5) Nespor and Vogel's model (1986, p. 302)



The model in (5) can be criticized for being too complex and not restrictive enough, since it proposes several simultaneous linear grammars that are not linearly articulated with each other. Therefore, we believe that discussing the violation of SLH principles in a model that addresses the different components from the same perspective is a more adequate alternative.

Disobedience to both exhaustivity and prohibition of recursion of ω 's seems defensible if observed from the perspective of grammar modeling: for example, in Lexical Phonology and Morphology (LPM), considering levels or components; in Optimality Theory (OT), considering violable constraints (rather than inviolable principles).

10. In a T (or Y) grammar model, a deep structure is mapped to a surface structure and interpreted into a logical and phonetic form. The justification of classical T models to propose prosodic phonology from the surface structure is based on the difficulty of prosodizing occasional empty categories. However, considering that in Nespor and Vogel's proposal the part of the syntax that interacts with the phonology corresponds to the surface structure, in principle, this problem does not exist.

From the LPM perspective, the isolated ω (or lexical ω) is characterized as the locus of the primary stress and domain of processes that occur within it or at its edges. Then, by going through the syntax, the word is subject to cliticization and juncture processes in general. In this approach, stressed affixes, for example, are independent ω 's up to the end of the lexical derivation, being prosodically anchored into higher units (which does not exclude recursive ω 's) only at the post-lexical level. Post-lexically, there is grammatical context for units as C, ϕ , I and U (from utterance).

This analysis results in a mismatch between morphology and prosody at the lexical level, allowing outputs at the lexical level such as $[[\text{néo}]\omega[\text{natál}]\omega]_{X_0}$. In this case, the grammatical bracketing ensures that the affixation has already taken place and that we are dealing with only one syntactic atom, despite corresponding to two units in the prosody. Post-lexically, these ω 's can be restructured in order to guarantee their parsing as a single ω , $[[\text{neonatal}]\omega]_{X_0}$, redistributing the stress (with consequences, in Portuguese, for the process of pretonic vowel neutralization, a topic which we will discuss in more detail later).

Clitics, however, according to the LPM analysis proposed by Bisol (2000), must be prosodized as unstressed syllables at the lexical level. They will only be associated to a higher constituent post-lexically, when linked to the clitic group (or to the post-lexical ω , in terms of this work). Such an analysis, if, on the one hand, does not conflict with the requirement that ω be stressed, on the other hand, it disobeys the requirement of parsing σ 's into ω 's with regard to the clitic. The topic is controversial, as processes such as final raising, a very common phenomenon in BP, reveal that clitics, even if stressless, can provide context for processes that target the right edge of ω (e.g. *s[ɪ] acha* 'to find she/he/itself').¹¹ The chance, however, of diphthongizing with the next word is evidence of the potential for ω restructuring (e.g. *s[ja]cha*) post-lexically. Furthermore, clitics undergo elision, a process which, on the other hand, does not occur within ω (ex. *para o lado* \rightarrow *par[o] lado* 'to the side', but *maometano* \rightarrow **m[o]metano* 'Mohammedan').

11. An alternative analysis, given the generality of final raising in PB, is to consider it not limited to final ω 's, but having as domain any final syllable, regardless of its superordinate unit.

In the scope of OT, as Peperkamp (1997) and Selkirk (1996) defend, the exhaustivity and recursion properties can be interpreted as violable constraints. To some extent, this perspective relativizes Vogel's and Vigário's criticisms of ω 's recursion, since it can be argued that the difference between the higher and lower ω is not due to the processes that they are subject to, but rather to the nature and ranking of the constraints responsible for the emergence of these domains.

Thus, considering Peperkamp's (1997) analysis, in the case of Italian intervocalic voicing, the *V[s]V constraint is limited in *a[s]ociale* 'antisocial' not by its intrinsic definition, but by a higher constraint, IDENT(F)OO, which requires identity between the shape of the base of the primitive and derived forms. This does not apply to *di[z]onesto* 'dishonest' because /s/ is not part of the base. Furthermore, because OT evaluates full outputs in parallel, the distinction between higher and lower prosodic or grammatical units (defined by leveling in the LPM framework as shown above) must be defined by the design of the constraints and ranking.

Stress assignment constraints competing with constraints on the ω 's prosodization may also account for the clitic prosodization. For Itô and Mester (2008), clitics can be prosodized as isolated ω 's, even though they violate a constraint that requires that feet have at least two syllables or two moras, FT-BIN. However, although it is not generally violated in most Portuguese words — not even in most of the languages of the world, including English —, this constraint needs to be active in the Portuguese grammar, since both functional and lexical words can emerge as light monosyllables (e.g. *se* 'if', *me* 'me', *pá* 'shovel', *fé* 'faith', *nó* 'knot').

The idea that Portuguese is not subject to the minimal word requirement, proposed by Bisol (2000) and Vigário (2003), among others, contradicts the hypothesis defended by McCarthy and Prince (1995), according to which feet are binary under moraic or syllabic analysis in the world's languages (in other terms, words must contain at least one heavy syllable or two syllables). Given the scarcity of ω 's with the CV structure, Iosad and Wetzels (2021), in their turn, suggest that the word in BP is at least bimoraic or has the structure $C_0V.C_0V$ or C_0VC . Treating monosyllables consisting of light syllables in BP as

exceptional, however, is far from being consensual, especially because they are items, including nouns, inflected verbs and functional words, which are highly frequent in the language.

On the other hand, considering that monosyllabic clitics and monosyllabic lexical words are equally instantiated as ω 's in the language by simply violating FT-BIN implies losing the distinction between these structures. In this sense, we maintain that clitics are strictly attached as syllables directly to a structure greater than ω , violating exhaustiveness, not being parsed in ω or Σ (violations, respectively, of PARSE-INTO- ω and PARSE-INTO- Σ , in terms of Itô & Mester, 2008, constraints defined later).

In summary, in this section, we revisit the arguments in favor of the thesis that ω 's are necessary entities for linguistic description due to their imperfect pairing with grammatical words. The definition of ω includes being the locus of primary stress. In BP, the existence of highly frequent stressed monosyllables consisting of light syllables in the lexicon challenges the hypothesis of a bimoraic or disyllabic minimal universal word. As for stressless words, such as pronominal clitics, there are reasons to believe that they are parsed as syllables directly linked to a hierarchical structure greater than ω , thus violating the exhaustiveness principle advocated by SLH. So far, this category has been mainly analyzed as C, although defining this constituent — whether a recursive word, a specific new category, or ϕ — is not crucial for the purposes of this analysis. Finally, we argue that violations of SLH principles, such as exhaustiveness and recursion, are better handled when designing prosodic representations from a grammatical modeling perspective. In this analysis, we chose to address this problem in OT, as we understand that this model accounts for both the preservation of the important generalizations expressed by these principles and their violability when articulated with other constraints in the languages of the world.

3. ω -level processes and affixal derivation in BP

Vigário (2001) states, among the common diagnostics for ω in different languages, that this constituent should be (i) a locus of primary stress assignment, (ii) a domain of other phonological processes inherent

to this domain, and (iii) subject to the minimal word requirements. In this section we examine derived words that we hypothesize to consist of two independent ω 's in contrast to words prosodized as a single ω , considering the first two diagnostics, as we assume that ω 's in BP are not subject to the third, the minimality condition.

Primary stress

Although there are those who argue that there can be ω 's without any stress, as suggested by the approach of C by Nespor and Vogel (1986), there seems to be a consensus that there is no ω with more than one primary stress. We maintain in this approach that clitics are stressless entities, in contrast to affixes, which can be stressed. Therefore, as with compounds, derived words can consist of more than one ω . This leads to the conclusion that a ω , with regard to primary stress, can be equal to or less than X^0 , never greater. Such conclusion refutes the representation presented in (1c) in the introduction.

A relatively complex issue, however, is defining a stressed structure. There are phonologically based criteria, abstract in nature, that can be ratified by phonetic correlates, as proposed by Ulrich and Schwindt (2018, 2020). In this paper, we only deal with the first ones, and take the pretonic vowel neutralization process as the main evidence. As described by Camara Jr. (1970), in pretonic position, close and open mid vowels lose the oppositional character they present in a stressed position. Thus, despite the sociolinguistic relevance, the vowel alternance in *c[o]ração* or *c[ɔ]ração* 'heart' in BP is not relevant for the phonological distinctive system. In some dialects, however, particularly in southern and southeastern Brazil, this neutralization results in a reduction in the phonetic inventory, that is, the vowels / ε / and / ɔ / in principle do not appear in an unstressed position. This fact allows testing whether affixes are stressed or not in these dialects, since each open-mid vowel should be associated with a primary prominence, as exemplified in (6).

(7) Phonological processes and affix derivation in BP

	Compositional affixes	True affixes
a.	vowel harmony	
	pr[e]tônico ~ *pr[i]tônico ‘pretonic’	r[e]tiro ~ r[i]tiro ‘retreat’
	m[e]dinho ~ *midinho ‘little fear’	p[e]dinte ~ p[i]dinte ‘beggar’
b.	final vowel reduction	
	ant[e]datado ~ ant[i]datado ‘backdated’	r[e]fazer ~ *r[i]fazer ‘redo’
	can[o]zinho ~ can[ɔ]zinho ‘short pipe’	canal ~ *can[ɔ]al ‘channel’
c.	nasalization	
	p[ẽ]-islamismo ~ *pa[n]islamismo ‘pan-islam’	i[n]odoro ~ *[ĩ]odoro ‘odorless’
	f[ẽ]mazinha ~ *f[a]mazinha ‘little fame’	f[a]moso ~ f[ẽ]moso ‘famous’
d.	assibilation	
	n.a.*	n.a.
	elegan[t]emente ~ *elegan[s]emente ‘elegantly’	elegân[s]ia ~ *elegân[t]ia ‘elegance’
e.	velar softening	
	n.a.	n.a.
	analo[g]amente ~ *analo[ʒ]amente ‘similarly’	analo[ʒ]ismo ~ *analo[g]ismo ‘analogueism’

*Not applicable.

In (7a) there is context for vowel harmony among the forms derived by true affixes, such as *re-* or *-nte*, since the target of the process, the close-mid vowel, is in pretonic position. Words formed by compositional affixes, such as *pre-* or *-inho*, are not a context for the process, because vowel harmony does not cross ω 's, according to Bisol (1981). In (7b), the fact that the compositional prefix *ante-* and the base preceding the compositional suffix *-zinho*, *cano*, are subject to final vowel reduction, suggests they are both prosodically independent contexts. This phenomenon is not observed in words formed by true affixes, such as *re-* and *-al*.¹² The examples in (7c) address the phenomenon of nasalization from different perspectives for prefixes and suffixes. In the case of prefixes, it is observed that compositional ones closed by a nasal segment resist resyllabification with the vowel

12. In words like *canal* ‘channel’, for instance, we can explore the additional argument that suffixation by true affixes, unlike compositional ones, is based on the root rather than the word or theme, an aspect that we will return to at the end of this analysis. For divergent approaches on the topic, see Matzenauer and Bisol (2016), Schwindt (2013), Ulrich and Schwindt (2020).

starting the next word, as seen in ordinary words of the language (ex. *batom azul* ~ **bato.[n]azul* / **bato.[m]azul* ‘blue lipstick’); with true prefixes, resyllabification is expected, as they are syllables internal to ω . In the case of the suffixes, the example addresses the variability in the realization of nasal vowels in unstressed syllables, which contrasts with its mandatory character in stressed syllables (ex. *ff[ẽ]ma* ~ **ff[a]ma* ‘fame’), proving that *-zinha* is an independent ω , unlike *-oso*.¹³ Finally, the processes exemplified in (7d) and (7e) only apply to suffixes, because assibilation and velar softening are phenomena that affect the last consonant of the root in contact with a vowel-initial suffix. The fact that they reach only words formed by true suffixes is evidence of the prosodic distinction between the two types of suffixes we postulate.

Two other extra phonological criteria can also contribute to the recognition of independent affixes, namely the affix ordering and the possible isolated instantiation of these morphemes in an utterance. Compositional affixes are necessarily more peripheral when they co-occur with true affixes (eg *ex-desocupado* ‘former idle’ ~ **desex-ocupado* ‘not former idle’; *confortavelmente* ‘comfortably’ ~ **confortamentavel*) ~ *unoccupied; *alegravemente* ‘joyfully’ ~ **alegrementavel* ‘able to be done happily’). This type of affixes are also freer, and may occasionally be instantiated in isolation in an utterance (e.g. *cuidados pré e pós-covid* ‘pre- and post-covid care’ / *saí com meu ex* ‘I went out with my ex’; *fale suave e lentamente* ‘speak softly and slowly’ / *me tratou como um zinho qualquer* ‘treated me like an unimportant person’).

In short, in this section, we defend that affixes in BP can be prosodized as independent ω ’s. The main evidence comes from stress, a thesis confirmed by several authors in the literature on the topic. The non-neutralization of the pretonic vowel, which is observed in words formed by prefixes with open-mid vowels or even in bases related to certain suffixes in some dialects of BP, is the ideal evidence that we are facing two ω ’s in this case. Other phonological processes — such as vowel harmony, final vowel reduction, nasalization, assibilation,

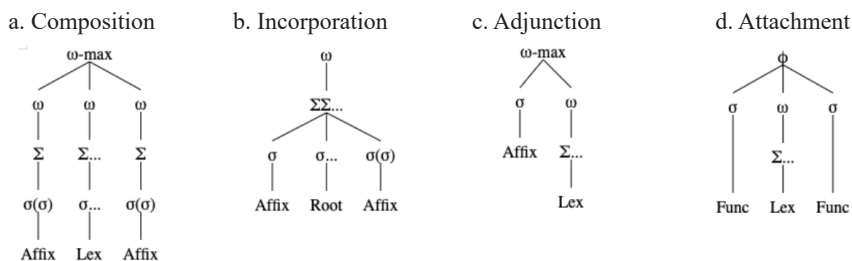
13. The word *panamericano* ‘Panamerican’ — a form we suspect is lexicalized — can be pointed out as a counterexample in this case. It is worth noting, however, that even in this case, *p[ẽ]-Americano* is an attestable word, whereas *pa[n]islamismo* ‘pa[n]Islam’ and, in particular, *[ĩ]odoro* ‘odorless’ remain avoided forms in BP.

and velar softening — which apply or fail to apply depending on whether we are in the domain of one or two ω 's provide additional evidence. Finally, as an extra-phonological argument, we propose that compositional affixes are more peripheral than true affixes, in addition to enjoying greater autonomy, and may occasionally be instantiated in isolation in the utterance.

4. Prosodization of derived words in BP

Once defined that derived words can be paired with more than one ω in BP, we must discuss how these structures are mapped into the prosodic hierarchy.¹⁴ In this paper, based on Booij (1996) and Itô and Mester (2008), we assume that prosodic structures can be composite, incorporated, adjoined or attached to another prosodic structure. In an expanded version of Bisol (2000) and Schwindt (2008, 2013) approaches, we argue that whereas prefixes can fall into the first three types of prosodization, suffixes can only fall into the first two and monosyllabic clitics in the last one, as illustrated in (8).

(8) Prosodization of affixes and monosyllabic clitics in BP



The trees (8a-c) present the possibilities of prosodic parsing of affixes and (8d) of monosyllabic clitics in BP. What we call ω -max in (8a) and (8c) is defined as a recursive category, interpreted in this analysis as a particular domain for phonological processes due to its position in the hierarchy (in this sense, by replacing C or analogous

14. In this text, we do not aim to list the affixes that fit into each type of prosodization. The examples we bring here are based on the most typical cases and may present counter-examples. For a proposal to characterize BP affixes, we suggest reading Schwindt (2001, 2008), Ulrich (2021) and Ulrich and Schwindt (2020).

categories). The diagrams presented in (8a-c) represent maximum structural possibilities in BP, that is, (8a) and (8b) support only prefixes, only suffixes or both prefixes and suffixes, but (8c) supports only prefixes. The structure in (8d) accounts for monosyllabic functional words, which can be located before or after their host.¹⁵ The last line of each diagram brings the grammatical or morphological categories corresponding to these structures, disregarding possible restructurings to which these forms may be subjected. We use Lex and Func, following Selkirk (1996), to differentiate, among morphosyntactic words, lexical and functional items. In addition, in the case of prosodically incorporated affixes, we argue that Root is the morphological base of the derivation.

The structures proposed in (8) involve, in OT terms, violation of constraints on the prosodic structure concerning (i) the tree form restrictions, (ii) interface conditions, (iii) parsing principles and (iv) size and shape requirements. The constraints defined below, based on Itô and Mester (2008), reflect, in order, each of these types of violations.

(9) NO-RECURSION

An element is parsed only once into a given category. Assign one violation mark for each additional parse of an element into the same category.

(10) ROOT-TO- ω (adapted from LEX-TO- ω)

ALIGN(ROOT, Left/Right, ω , Left/Right)

Every root is left/right aligned with a prosodic word.

(11) PARSE-INTO-X

Every element of the terminal string is parsed at the X-level.

(12) FT-BIN

Feet are binary under syllabic or moraic analysis.

In (13) below, we present the violations of these constraints, not ranked in this case, for each of the prosodization patterns presented in (8).

15. The treatment of non-monosyllabic clitics is controversial (e.g. regarding the establishment of relative prominence of the preposition *para* 'for' as opposed to the inflected verbal form *para* 'stop'). If we consider them to be without prominence, they will never emerge as ω 's. There are reasons, however, to suspect that such clitics are also ω 's, as they allow foot parsing. Unlike prefixes, these ω 's would not be associated with their host in a recursive word, but would be attached to a structure higher than ω in the hierarchy (C, ϕ or equivalent), as proposed in (8d).

(13) Violated constraints in affix derivation and cliticization in BP

	NO- RECURSION	ROOT- TO- ω	PARSE- INTO- Σ^*	PARSE- INTO- ω	FT-BIN
Composition $\text{pr}\acute{\text{e}}]_{\text{Affix},\omega}[\text{fixo}]_{\text{Lex},\omega}]_{\omega\text{-max}}$ ‘prefix’ $\text{certa}]_{\text{Lex},\omega}[\text{mente}]_{\text{Affix},\omega}]_{\omega\text{-max}}$ ‘certainly’	pré fixo certa mente				pré
Incorporation $\text{in}]_{\text{Affix},\sigma}[\text{scrito}]_{\text{Root},\sigma\text{...}}]_{\omega}$ ‘registered’ $\text{can}]_{\text{Root},\sigma\text{...}}[\text{al}]_{\text{Affix},\sigma\sigma}]_{\omega}$ ‘channel’		scrito can			
Adjunction $\text{re}]_{\text{Affix},\sigma}[\text{uso}]_{\omega}]_{\omega\text{-max}}$ ‘reuse’	uso		re		
Attachment $\text{se}]_{\text{Func},\sigma}[\text{move}]_{\text{Lex},\omega}]_{\phi}$ $\text{move}]_{\text{Lex},\omega}[\text{se}]_{\text{Func},\sigma}]_{\phi}$ ‘move s/he/itself’			se se	se se	

*There are no labels for feet in candidates in (13), as they do not dominate other categories relevant to this analysis. Regardless, a violation of Parse-Into- Σ is computed whenever a syllable is directly linked to a Pwd.

Prosodic composition naturally violates NO-RECURSION, since two prosodic ω ’s are dominated by a maximal word. In this case, the prefix parsed as a ω also violates FT-BIN, considering it is a light monosyllable. Many BP prefixes and all suffixes, however, are generally well formed from the perspective of this constraint.

Incorporated structures are prosodically similar to simple words in the language and seem to join the base at the root level rather than the word level. Such leveling allows to distinguish, for example, a prefix such as in-, indicating inward movement, from the homophonous negative prefix in- (e.g. *inscrito* ‘registered’ vs. *inescrito* ‘unwritten’). Epenthesis, in this case, which does not apply to the first, but applies to the second prefix, is the main evidence.¹⁶ All suffixes other than

16. For a discussion on the representation of sC-initial bases in Portuguese, see Collischonn and Schwindt (2005).

compositional ones are also incorporated, since they are not preceded by a ω -boundary, thus being subject to resyllabification and stress redistribution.¹⁷ We argue that an interface constraint, ROOT-TO- ω , which militates for isomorphism between the root (which is among the bases understood as notional) and the ω , is violated in this case.

Adjunction is a structure only observed in prefixal derivation in BP, in which there is evidence that the base following the affix is a well-formed ω , constituting a ω -max with the syllables of the affix. This implies, of course, violation of NON-RECURSION and PARSE-INTO- Σ , the latter a constraint of the PARSE-INTO-X family, which particularly militates in favor of exhaustive parsing of syllables into feet. As we have mentioned in our proposal, every suffix in BP is either autonomous or incorporated into the base at the root level, which excludes the possibility of prosodically ω -adjoined suffixes.¹⁸

Finally, attachment structures appear here only to delimit the distinction between affixal and cliticized structures. As Bisol (2000) suggests, clitics are unstressed syllables that associate with their hosts at the syntactic level, thus violating PARSE-INTO- Σ . In this work, since exhaustivity is taken as a violable constraint, we do not see reasons to reject the hypothesis that monosyllabic clitics link directly to ϕ , skipping ω , resulting in a violation of PARSE-INTO- ω .

Affix prosodization and morphological productivity

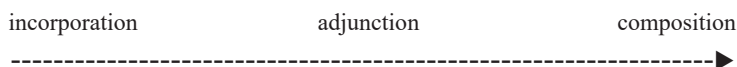
Morphological productivity is a complex concept, which concerns the potential for forming new words and their frequency of use in the language. From the perspective of the parallel between word formation rules and structural analysis rules suggested by Basilio (1980), we know

17. Many of the incorporated forms, such as *sol* ‘sun’ in *solaço* ‘strong sunlight’, show properties of complete words. However, as Portuguese distinguishes roots from themes or stems (e.g. *cas*_{Root} ≠ *casa*_{Word} ‘house’), it seems appropriate to extend the two-level structural analysis even to athematic words, despite the fact that root and word coincide in this case.

18. Admitting prosodic adjunction in the case of suffixes would involve assuming that the process of final vowel syncope affects most of the derivations. However, we demonstrate in Schwindt (2013) that most Portuguese words formed by suffixation, except those in which the suffixes are autonomous ω 's, have evidence of the root+suffix structure.

that productive forms are also transparent, perceptible by speakers, but not all transparent forms compete with equal force to form new words. In this sense, although we do not approach affix frequency in this article, we argue that the calculation of productivity/transparency of derived structures must take their prosodic structure into account. In this sense, we suggest the continuum in (14), which extends from incorporation (the less transparent process) and adjunction (intermediate in terms of transparency) to composition (the most transparent process). This fact may seem trivial in derivational grammars (where structures are more transparent, the closer they are to the surface), but it is not so in parallel models like OT.

(14) Morphological transparency continuum of prosodized affixal structures



The advantage of proposing a continuum is that we do not need to decide categorically which affixes fit into each of these structures, as many of these morphemes can be in transition between two types of formation. Prefixes like *pr[ɛ]-* versus *pr[e]-*, *n[ɛ]o-* versus *n[e]o-* and suffixes like *-zinho* versus *-inho* can illustrate the transition we are referring to, from composition to adjunction. The same can be said of adjoined forms migrating to incorporated ones or even incorporated to lexicalized (morphologically opaque forms). Attachment structures, which particularly affect clitics, were not included in the continuum above. However, data suggest that clitics are, on the one hand, transparent, as they relate to bases that are syntactic atoms. On the other hand, they lack transparency for being unstressed syllables that easily restructure with their hosts (which is evidenced in hyper- and hypo-segmentation processes commonly observed in writing).

In summary, we present a proposal for prosodization of affixes in BP in this section, according to which prefixed structures can be characterized as composite, incorporated or adjoined, whereas suffixed structures are either composite or incorporated, but never adjoined. Conversely, constructions involving monosyllabic clitics are prosodized as structures attached to a category higher than ω , which we suggest is ϕ . Violable constraints referring to tree form restrictions, interface

conditions, parsing principles and size and shape requirements, in line with what Itô and Mester (2008) suggest, support this proposal. Finally, we argue that the level of prosodization of a derived structure is related in a continuum to the degree of morphological transparency/productivity of this form. This allows us to better understand occasional oscillation in the perception of certain affixes.

5. Conclusion

In this paper, we revisit the debate on the prosodization of affixes in BP in a constraint-based approach. Departing from our previous studies (Bisol, 2000, 2004, 2007; Schwindt, 2001, 2008, 2013), we argue that prefixed words are prosodized as composite, adjoined or incorporated to their bases, while suffixed words are prosodized as composite or incorporated, not as adjoined. In contrast, clitics are attached to a host that is a structure higher than ω , for now defined as ϕ . The evidence for this proposal is found particularly in the stress assignment, which assures some affixes the status of ω . Furthermore, phonological processes in the domain of ω , or related to it, and extra phonological characteristics, such as affix ordering and autonomy in the utterance, are additional evidence. Inspired by Itô and Mester (2008) and Selkirk (1996), we propose that violable constraints related to tree form restrictions, interface conditions, parsing principles and size and shape requirements ensure the emergence of the described prosodic structures. Finally, we maintain that these structures are related in a continuum to the degree of transparency/productivity of forms derived by affixes in the language, a fact that can explain possible overlaps or fluctuations in their perception.

Acknowledgements

This research was carried out with the support of the National Council for Scientific and Technological Development (CNPq), through grant PQ310921/2018-0.

Conflict of interests

The authors declare they have no conflict of interest.

Credit Author Statement

We, Luiz Carlos Schwindt and Leda Bisol, hereby declare that we do not have any potential conflict of interest in this study. We both participated in the discussion of the ideas presented in the article. The text was written by the first author and revised by the second author.

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Recebido em: 29/11/2021

Aprovado em: 07/03/2022