The prosodic representation of composite structures in Brazilian Portuguese[1]

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In previous research, word-word compounds and stressed affix + word structures have been assigned to the same prosodic domain in Brazilian Portuguese (BP), on account of certain similarities in morphosyntactic and phonological behaviour (Silva 2010, Toneli 2014). With respect to phonological behaviour, both types of composite structures undergo vowel raising at the right edge of each element in the construction and vowel sandhi processes between their elements. In this paper, I show that word-word compounds and stressed affix + word structures exhibit significant differences in stress assignment in BP, which supports their prosodization in two separate domains. While stressed affix + word structures are assigned primary and secondary stress as simple phonological words (PWds), each element in word-word compounds behaves as an independent PWd with regard to stress assignment. I thus propose that while stressed affix + word structures are recursively prosodized in the PWd domain, word-word compounds are prosodized in the composite group, the domain proposed by Vogel (2008, 2009) that immediately dominates the PWd and accounts for the prosodization of structures with compositional characteristics. My analysis reconciles two views on prosodic structure that are traditionally assumed to be mutually exclusive: the view that prosodic domains can be recursive (e.g. Inkelas (1990), Selkirk (1996)) and the view that the prosodic hierarchy includes an additional domain specific to composite structures above the PWd (e.g Vogel (2009)).

1. Introduction

The representation of composite structures (such as word-word compounds and stressed affix + word structures) is an issue that has received considerable attention within the framework of Prosodic Phonology (since Selkirk (1984), Nespor & Vogel (1986)). One of the fundamental premises in Prosodic Phonology is that the application of phonological processes is circumscribed to prosodic domains, which are formed via indirect mapping from the morphosyntactic component. In other words, Prosodic Phonology assumes that phonological processes apply not in reference to morphosyntactic structures, but to the interpretation of such structures within the phonological component of the grammar. Each prosodic constituent, then, is the domain of application for particular phonological processes.

In Prosodic Phonology, it is standardly assumed that if two structures are mapped onto the prosodic hierarchy in the same way, they will undergo identical

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phonological processes (if their structural descriptions are met). Since multiple morphosyntactic structures may be assigned to a single prosodic domain, researchers often resort to the examination of phonological processes exhibited by a set of linguistic structures in order to access the form through which their syntax-phonology mapping occurs. Although morphosyntactic structures and prosodic domains do not match exactly, these two types of structures have a certain degree of correspondence. For example, lexical items are in general assumed to correspond to phonological words (PWds), whereas syntactic phrases are expected to be equivalent to phonological phrases (PPhs) (since Selkirk (1984), Nespor & Vogel (1986); see also Selkirk (2011)).

Compounds (and composite structures in general) are often the object of prosodic analysis because their place in the hierarchy of prosodic domains is unclear. It is generally assumed that the combination of stems or independent lexical words corresponding to a single lexical item and a single conceptual unit (Lieber & Stekauer 2009, Bauer 1998, Partee 1994) will be mapped onto the prosodic hierarchy as compounds. However, the prosodic representation of such structures depends on specific assumptions regarding the configuration of the prosodic hierarchy.

In approaches in which domain recursion and domain skipping are ruled out (Nespor & Vogel 1986), compounds are considered to form simple PWds. This prosodization, however, is not consistent with the fact that compounds are formed from the combination of stems (or independent words) and thus exhibit phonological behaviour that is not identical to that of 'regular' words (i.e. morphologically simplex words).

On the other hand, the fact that compounds are morphosyntactically cohesive structures is an argument against their classification as PPhs.[1] PPhs, but not compounds, show a freer morphosyntactic structure, in the sense that they can be restructured through the insertion of new elements. This means that while compound edges are well-defined, PPh edges can vary due to syntactic and rhythmic constraints (Nespor & Vogel 1986). For example, while no element can be inserted between the members of the English compound *lighthouse*, insertions or modifications to the phrase *a light house* are possible: *a light dollhouse*, *a light, navy blue dollhouse*, and so on. In a structure such as *a light, navy blue dollhouse*, a phrase boundary can be inserted between *light* and *navy blue*.

One solution to this problem, adopted in approaches in which domain recursion and domain skipping are sanctioned (e.g. Peperkamp (1997a), Vigário (2003), Ito & Mester (2007)), is to represent compounds as recursive PWds (e.g. $[[\text{light}]_{\text{PWd}}[\text{house}]_{\text{PWd}}]_{\text{PWd}}$). Although such approaches capture the fact that compounds correspond to discrete lexical items resulting from the combination of independent elements, they obscure the notion of prosodic domain as the domain

[1] But see Ito & Mester (2007), who consider that certain compounds in Japanese are equivalent to PPhs.

of application for specific phonological processes (Vogel 2009). In other words, since compounds (recursive PWds) may undergo processes that their members (non-recursive PWds) fail to observe, it must be assumed that both recursive levels and prosodic domains can be domains of application for independent phenomena.

Another issue with the prosodic representation of compounds is rooted in the fact that, in both approaches to compound prosodization (i.e. in approaches that either adopt or prohibit prosodic recursion), different types of composite structures are assigned to the same prosodic domain, despite differences in their phonological behaviour. In Brazilian Portuguese (BP), it is generally assumed that two types of composite structures, namely word-word compounds (e.g. *guarda-chuva* 'umbrella', lit. keep-rain) and stressed affix + word constructions (with either a stressed prefix, e.g. *pre-guerra* 'pre-war', or a stressed suffix, e.g. *cafe-zinho* 'coffee.DIM') have the same prosodic representation (Silva 2010, Toneli 2014). Both structures have been represented as projections of the PWd domain formed by two independent PWds ([[guarda]$_{PWd}$[chuva]$_{PWd}$]$_{PWd}$, [[pre]$_{PWd}$[guerra]$_{PWd}$]$_{PWd}$, [[cafe]$_{PWd}$[zinho]$_{PWd}$]$_{PWd}$) (Silva 2010, Toneli 2014).[2] These analyses are based on the fact that these structures exhibit the same phonological processes (such as vowel raising at the right edge of both elements) and also on the fact that each element in these constructions bears stress. However, what such analyses fail to consider is that these different types of composite structures present differences in both phonological and morphosyntactic behaviour, which in fact suggests their representation in separate domains.

In this paper, I argue that word-word compounds and stressed affix + word structures in BP are *not* prosodized in same domain. In section 2, I review different approaches to compound prosodization in order to motivate the introduction of an additional domain into the prosodic hierarchy, namely the composite group (CG) (following Vogel (2008, 2009)). In section 3, I discuss the morphosyntactic and phonological behaviour of these two types of composite structures in BP, focusing on the manners in which they differ. Specifically, word-word compounds and stressed affix + word structures differ with regard to stress assignment and whether they can undergo ellipsis in coordinate constructions. I argue that while stress assignment is direct evidence for the assignment of such structures to distinct domains, their behaviour with regard to ellipsis in coordination reveals how the elements in composite constructions should be prosodically mapped. In section 4, I argue that word-word compounds are prosodized in the CG, while stressed affix + word structures correspond to recursive PWds. In section 4, I also discuss the role of recursive nodes in prosodic representation and point to how an approach that considers recursion can be reconciled with an approach that assumes the

[2] In fact, Toneli (2014) represents such structures as *prosodic word groups*, following Vigário (2010). Although the prosodic word group has been defined as an independent prosodic domain, it is unclear whether it corresponds to a higher projection of the PWd and whether it also accounts for the prosodization of other structures that are formed between the PWd and the PPh domains (such as clitic structures).

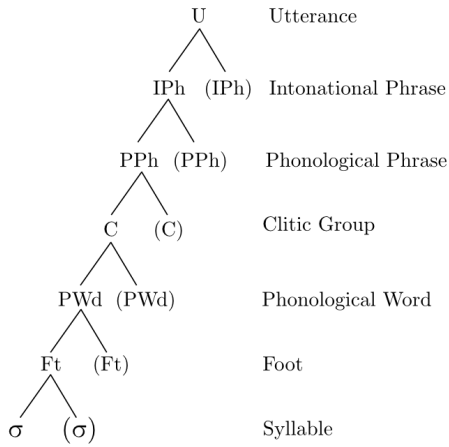

Figure 1
The prosodic hierarchy (adapted from Nespor and Vogel (1986)).

existence of an additional domain in the prosodic hierarchy.

2. Composite structures in Prosodic Phonology

When morphosyntactic structures are mapped onto phonological domains, they are arranged into a limited number of prosodic domains, or constituents. Such constituents range from the syllable (σ) to the utterance (U) (Fig. 1) and correspond to domains of application for phonological processes. In early approaches to Prosodic Phonology (Selkirk 1984, Nespor & Vogel 1986), each domain must contain at least one instance of the immediately lower domain (i.e. the *Exhaustivity* principle) and no domain can be contained within a constituent with the same label (i.e. the *Non-Recursivity* principle). In other words, in such approaches the prosodic hierarchy was regulated by a set of principles that prohibited both the skipping and the repetition of prosodic domains. *Exhaustivity* and *Non-Recursivity* were part of the set of principles regulating the prosodic hierarchy known as the Strict Layer Hypothesis (SLH).[3]

Since the first works in Prosodic Phonology, it has been assumed that prosodic domains are domains in which segmental and prominence phenomena apply. Although certain phonological processes may apply in more than one domain, phonological domains should be identified on the basis of particular processes that they exhibit. In general, then, morphosyntactic structures that are mapped onto a given domain (e.g. domain *X*) are not expected to undergo the processes that are

[3] The two other principles in the Strict Layer Hypothesis are *Headedness* (one of the elements contained within a given domain must be its head) and *Layeredness* (the hierarchical order of domains is fixed) (Selkirk 1984, Nespor & Vogel 1986).

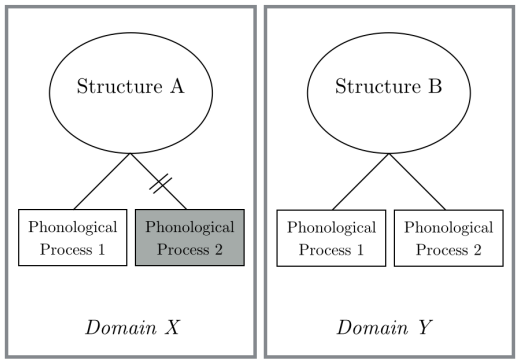

Figure 2
Identification of prosodic domains based on the application of phonological processes.

specific to another domain (e.g. domain *Y*). Consider Structure A and Structure B in Fig. 2. Both undergo Phonological Process 1. However, the application of Phonological Process 2 is only attested in Structure B. This discrepancy in process application between Structure A and Structure B supports the assumption that they are prosodized in separate domains.

Approaches to compound prosodization in general assume that prosodic domains differ with regard to the application of phonological processes (Fig. 2). These approaches, however, may differ in (a) how they interpret the place of compounds in the prosodic hierarchy and in (b) the status that they assign to recursion in prosodic representation. The next subsections describe the main views on the representation of compounds in prosodic theory.

2.1. Early approaches

Early approaches to compound prosodization, such as Nespor & Vogel's (1986), were constrained by the Strict Layered Hypothesis, in which domain repetition and domain skipping were not allowed. One possible way to analyse compound prosodization under the SLH is to assume that these structures are prosodized in the domain that immediately dominates the PWd, namely, the clitic group (C) (Fig 1).

This analysis seems somewhat intuitive, since compounds are typically the result of combining two lexical words. In this case, compounds would be assigned to the same domain as clitic structures (i.e. clitic + host sequences), and both structures would be formed from independent PWds. This means that for a language such as English, the clitic structure *help him* and the compound *lighthouse* would have the same prosodic structure ([[help]$_{\text{PWd}}$[him]$_{\text{PWd}}$]$_{\text{C}}$, [light]$_{\text{PWd}}$[house]$_{\text{PWd}}$]$_{\text{C}}$).

However, clitic structures and compounds often display distinct behaviour within the same language. Nespor & Vogel (1986) note that, for a language such as Greek, compounds display only primary stress (1), but clitic structures contain

primary and secondary stresses (2) (examples from Nespor & Vogel (1986)). In clitic structures, the head PWd (the host) is assigned primary stress, and secondary stresses may be on both the host and the clitics. On the other hand, the primary stress position in compounds does not necessarily correspond to the primary stress position in any of their elements. In addition, Greek compounds, but not clitic structures, exhibit a linking vowel (*-o-*) between their elements.

(1) (a) kúkla spíti → kuklóspito
doll house

(b) níxta pulí → nixtopúli
night bird

(c) níxta filakí → nixtofilakí
night guard

(2) (a) ðyávase – ðyávasè to – ðyávasè mu to
read.IMP read.IMP it read.IMP to-me it

(b) ɣrápse – ɣrápse to – ɣrápse mù to
write.IMP write.IMP it write.IMP to-me it

The divergent behaviour between clitic structures and compounds in Greek indicates that these constructions are not prosodized in the same way. Based primarily on stress assignment patterns, Nespor & Vogel (1986) propose that Greek compounds correspond to PWds ([kuklóspito]$_{PWd}$), while clitic structures form clitic groups ([[ðyávasè]$_{PWd}$[to]$_{PWd}$]$_{C}$). The fact that compound structures present only one stress justifies their representation as a single PWd, since the PWd is traditionally considered to be the domain where stress is computed crosslinguistically (e.g. Nespor & Vogel (1986), Selkirk (1996), Peperkamp (1997b)).

Later developments in Prosodic Theory, however, challenged the existence of the clitic group and, as a result, led to a re-examination of the principles contained within the Strict Layer Hypothesis. The clitic group was criticized for two main reasons: (a) both crosslinguistically and within the same language, clitics may show differences in phonological and morphosyntactic behaviour, which suggests that more than one form of prosodization is available to them (Inkelas 1990, Selkirk 1996); and (b) clitics are phonologically weak elements, in the sense that their instantiation depends on the existence of a prominent host, which is inconsistent with their representation as independent PWds. Although the re-examination of the SLH principles was motivated by issues concerning the prosodization of clitics, it also had a significant effect on the representation of compounds, as will be discussed in the next subsection.

2.2. Approaches with Non-Recursivity *as a violable principle*

The weakening of the Strict Layer Hypothesis was most easily accommodated within Optimality Theory (OT) (Prince & Smolensky 1993/2004). In the OT

framework, the problematic principles in the Strict Layer Hypothesis (namely, *Exhaustivity* and *Non-Recursivity*) are regarded as violable constraints, which means that recursive and non-exhaustive structures in a given language may emerge depending on how such a language ranks these constraints. Regarding clitic prosodization, it is generally assumed that clitics that behave more closely to their hosts (by influencing primary or secondary stress assignment in the structure, for example) are assigned to the PWd domain (in the lowest level or recursively), whereas clitics that display a freer behaviour are assigned to the PPh (Selkirk 1996, Peperkamp 1997b).

With *Non-Recursivity* as a violable constraint, the prosodization of compounds was also reconsidered. Evidence from different languages revealed that compound members often preserve their primary stress (Peperkamp 1997a, Vigário 2003) or undergo compound-specific phonological phenomena (Ito & Mester 1986). These are indicators that compounds in certain languages are not prosodized as simple PWds (*contra* Nespor & Vogel (1986)). Based on the fact that compound words correspond to single lexical items and terminal syntactic nodes and that compound members behave as independent words (particularly with regard to stress assignment), approaches to compounding in OT generally assume that such structures form recursive PWds (e.g. $[[\text{light}]_{\text{PWd}}[\text{house}]_{\text{PWd}}]_{\text{PWd}}$).

In OT approaches to compound prosodization, then, recursive nodes in the PWd are the domains of application for compound-specific phonological processes. In Japanese, for example, compounds display *rendaku* (Ito & Mester 1986, 2007, Kubozono 1995), the process whereby the first voiceless obstruent of the second compound element becomes voiced (3a and 3b). Rendaku is blocked when there is already a voiced obstruent in the second compound element (3c). The examples in (3) are from Ito & Mester (1986).

(3) (a) ori + kami → origami
fold paper paper-folding

(b) yama + tera → yamadera
mountain temple mountain temple

(c) kami + kaze → kamikaze (*kamigaze)
god wind divine wind

The fact that rendaku is not observed word-internally has led to the assumption that Japanese compounds do not correspond to simple PWds, but to recursive PWds (Ito & Mester 2007). Japanese compounds, then, are formed by independent PWds which, when combined, constitute a recursive PWd ($[[\text{ori}]_{\text{PWd}}[\text{gami}]_{\text{PWd}}]_{\text{PWd}}$).[4]

[4] Rendaku respects Lyman's Law, which states that only one voiced obstruent can be found within a morpheme. The examples in (3) may suggest that Japanese compounds correspond to a single PWd, since only one voiced obstruent is found in all of them. However, rendaku is allowed in compounds such as *eda-ge* 'split hair' (from *eda* + *ke*) and *mizu-zeme* 'water torture' (from *mizu*

In other languages, compounds may display variation in phonological behaviour, a property which has been interpreted by some as an indicator of variability in prosodization (Peperkamp 1997a). In Italian, for example, the stressed vowel in the first element of compounds (such as *euro socialista* 'Eurosocialist') can be produced with either a lower mid vowel ([ɛ]uro) or an upper mid vowel ([e]uro) (Peperkamp 1997a).

Peperkamp (1997a) interprets the preservation of lower mid vowels in the first element of Italian compounds as evidence for their prosodization as independent PWds, since such vowels normally occupy stressed positions in the language ([[ɛ]uro]$_{\text{PWd}}$[socialista]$_{\text{PWd}}$). On the other hand, the production of such vowels as upper mid indicates that the element in which they are located lost its PWd stress and thus attaches to the following PWd as a prefix (without a prosodic label). The resulting prosodic configuration of a compound structure whose first element is realized as upper mid is, then, a recursive PWd: [euro [socialista]$_{\text{PWd}}$]$_{\text{PWd}}$ (Peperkamp 1997a). The fact that *s-voicing*, the process whereby /s/ becomes /z/ word-internally in Italian, is blocked in the second part of the compound (*euro[z]ocialista) suggests that, in both forms of representation, there is a word boundary between the first and the second elements of such structures.

Without a specific domain for compound prosodization, compound-specific phenomena (such as rendaku in Japanese) are regarded as processes whose domain of application is a higher PWd (i.e. a recursive level in the PWd domain). Furthermore, the lack of an independent domain to accommodate certain composite structures has led some scholars to assume that structures displaying distinct phonological behaviour actually have identical prosodic representations. For Brazilian Portuguese, for example, it has been proposed that word-word compounds (e.g. *guarda-chuva* 'umbrella', lit. keep-rain) and composite structures with a stressed affix (e.g. *pre-guerra* 'pre-war', *cidade-zinha* 'city.DIM') are both prosodized in the same way (Silva 2010, Toneli 2014),[5] even though they present considerable differences in phonological behaviour.

In addition to the assignment of multiple structures to a single prosodic constituent, the assumption that recursive levels are domains for segmental process application poses a problem for prosodic analysis. Although a particular prosodic domain may require multiple recursive levels,[6] it is not clear whether all recursive levels can be domains of application for specific phonological

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+ *seme*). These examples support the idea that there is in fact a boundary between compound elements. Ito & Mester (1986) suggest that there is a [+voice] linking morpheme at the juncture of PWds that form compounds. Such a morpheme is linked to the phonological tier, but not to any particular segment. In the context of compounding, the voicing of the linking morpheme spreads to the first unvoiced obstruent in the second element. Spreading is blocked if there is already a voiced obstruent in the second element of the compound.

[5] See also Vigário (2003), who assumes that stressed affix + word structures and word-word compounds have the same prosodic representation in European Portuguese.

[6] For an analysis of clitic prosodization involving multiple recursive levels, see Peperkamp (1997b). For an analysis of recursive phonological phrasing, see Elfner (2015).

processes.[7] Also, the fact that both recursive nodes and prosodic constituents can be domains of application for specific phonological processes undermines the definition of prosodic domains as units that result from specific syntax-phonology mapping constraints and in which specific phonological phenomena occur. Such a problem with recursive representations, as well as the fact that composite structures undergo particular phonological processes crosslinguistically, has led to the reintroduction of a prosodic domain between the PWd and the PPh.

2.3. The composite group

The fact that composite structures display crosslinguistic similarities has led Vogel (2008, 2009) to propose a particular domain for their prosodization, namely the *composite group* (CG). In Vogel's (2008, 2009) approach, the CG comprises cohesive structures that are formed above the PWd, but below the PPh. Thus, CGs encompass constructions that present compositional features, such as compounds formed by two independent lexical words and certain clitic + host structures.

Since the phonological behaviour of composite constructions is often not identical to that of PWds or PPhs across languages, the existence of a particular domain for their prosodization is justifiable. For example, compounds usually differ from PWds and PPhs with regard to prominence assignment. Prominence assignment is regulated by domain-specific algorithms (see e.g. Nespor & Vogel (1986)), which means that every domain has a particular algorithm for assigning prominence to the elements that it contains. In English, compounds and phrases differ with regard to where the primary prominence falls. English compounds usually have primary prominence on their first element (e.g. *hót dog*), while phrases have primary prominence on the second element (e.g. *hot dóg*). This difference in prominence between compounds and phrases is indicative, according to Vogel (2009), of the prosodization of such structures in distinct domains. Additionally, the compound *hot dog* differs from regular PWds in two main ways: (a) it has stress on both of its elements, and (b) no type of vowel reduction is attested on the vowel that is not primarily stressed ([hɔ́tdɔ̀g], but not *[hɔ́tdəg] 'hotdog'; compare with *origin* [ɔ́rədʒən] → *original* [ərídʒənəl]).

The CG approach is contained within a prosodic theory in which violations of *Exhaustivity* are allowed. Thus, independent syllables (corresponding to clitics) can attach to a PWd directly in the CG, without having to be prosodized as feet and PWds (*contra* Nespor & Vogel (1986)). However, Vogel's (2008, 2009) approach still regards *Non-Recursivity* as an inviolable principle. Thus, structures

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[7] Ito & Mester (2007, 2009, 2013), and Martinez-Paricio (2012) argue that certain phonological processes can be associated to minimal (non-recursive) and maximal (highest recursive) prosodic levels. Elfner (2015) also points out that non-minimal levels can be domains for specific processes. However, most of the phenomena circumscribed to maximal or non-minimal levels are prominence phenomena, which indicates that recursive levels may be subject to boundary effects (such as specific pitch movements and prominence effects), but not domain of application for particular segmental processes.

with multiple clitics or a compound with three or more parts are prosodized as non-recursive prosodic constituents (*contra* e.g. Peperkamp (1997b)).

An approach with some similarities to Vogel's (2008, 2009) composite group has been proposed by Vigário (2010). Vigário (2010) argues for the need for a domain between the PWd and the PPh, which she labels as the *prosodic word group* (PWG). According to Vigário (2010), the PWG accounts only for the prosodization of compounds crosslinguistically, but not for the representation of clitic structures. However, evidence from certain clitic structures in Brazilian Portuguese favours the view that the additional domain also accounts for clitic prosodization (Author 2015). Furthermore, the label *prosodic word group* is unclear as to whether the additional domain is a discrete domain or a higher projection of the PWd.

Based on the assumption that prosodic domains are primarily defined with respect to the particular phonological processes they exhibit, composite structures whose phonological behaviour does not match that of regular PWds or PPhs in a given language should be assigned to a separate domain. In the present analysis, I demonstrate that the additional domain that accounts for the prosodization of certain composite structures is Vogel's (2008, 2009) composite group. More specifically, I show that the composite group accounts for the prosodization of word-word compounds in BP.

In BP, word-word compounds and stressed affix + word structures exhibit distinct phonological and morphosyntactic processes, which contradicts the assumption that such constructions have the same prosodic representation (*contra* Silva (2010), Toneli (2014)). In the next section, I discuss the phonological and morphosyntactic behaviour of composite structures in BP in order to show, in section 4, that while stressed affix + word structures are formed recursively within the PWd domain, the prosodization of word-word compounds requires an additional domain in the prosodic hierarchy. Thus, the analysis of BP composite structures not only supports the need for multiple prosodic representations for a single class of elements, but also provides evidence for the inclusion of both recursion and an additional domain in the prosodic hierarchy.

3. Composite structures in Brazilian Portuguese

Word-word compounds and stressed affix + word structures in BP are under focus in the present analysis, given their presumed equivalence in phonological behaviour and thus in prosodic representation (Silva 2010, Toneli 2014). In this section, I compare the phonological and morphosyntactic behaviour of these two types of structures in Brazilian Portuguese (BP), in order to show that, even though they do have similarities, they also display important differences.

With regard to their morphosyntactic behaviour (section 3.2), stressed affix + word structures display ellipsis in coordination (*pre-guerra e pos-guerra* → *pre e pos-guerra* 'pre-war and post-war'), a process which is not attested in word-word compounds. When ellipsis applies in structures with a stressed prefix, the prefix

has no immediate host, which supports the idea that such elements bear prosodic independence.

With regard to their phonological behaviour (section 3.3), both word-word compounds and stressed affix + word compounds display vowel raising at the right edge of each of their elements and vowel sandhi processes between their elements. However, while word-word compounds may present stress retraction in the context of clash, stressed affix + word structures are assigned stress according to BP's algorithm of word-level primary and secondary stresses.

These differences in morphosyntactic and phonological behaviour are relevant for the discussion of their prosodic representation (section 4) and to support the idea that word-word compounds and stressed affix + word structures are prosodized in separate domains. Before I examine such differences in greater detail, however, I briefly describe the types of composite structures that are relevant for the present study (section 3.1).

3.1. Types of composite structures in BP

Word-word compounds in (Brazilian) Portuguese can be formed from several distinct combinations of lexical categories (Moreno 1997, Lee 1997, Rio-Torto & Ribeiro 2012). Table 1 shows examples of word-word compounds in BP.[8] Since factors such as position of the head and word class of elements do not seem to influence the application of phonological processes in word-word compounds, I assume that the structures in Table 1 all form a single prosodic category.

Stressed affix + word structures can emerge from the attachment of either a prominent prefix or a prominent suffix to a fully-formed word. As we will see in section 3.2, their morphosyntactic behaviour is consistent with their classification into two distinct groups. Table 2 provides examples of composite structures with stressed affixes. In both Table 1 and Table 2, prominence on both elements is indicated with an acute accent.

While BP has many stressed prefixes (other examples are *ex-*, such as in *ex-presidente* 'ex-president', *vice-*, such as in *vice-reitor* 'vice-dean', and *anti-*, such as in *anti-capitalismo* 'anti-capitalism'), the number of inherently stressed suffixes is very limited. It is generally assumed that suffixes fall within the regular stress domain in Brazilian Portuguese. Primary stress in BP is assigned within a three-syllable window, and the language shows a tendency toward trochaic rhythm (e.g. *ativ-idáde* 'activity', *marmel-áda* 'marmalade', *jornal-ísmo* 'journalism') (Bisol 1992, Hermans & Wetzels 2012). It may seem, thus, that the suffixes *-zinho* and *-mente* receive stress according to the BP's regular stress algorithm. However, evidence from vowel quality suggests otherwise. While mid low vowels

[8] Portuguese also has a number of noun-preposition-noun compounds (e.g. *dona de casa* 'housewife', lit. owner of house; *lua de mel* 'honeymoon', lit. moon of honey). Given certain particularities in morphosyntactic behaviour, such compounds are not considered in the present study.

Word class of parts	Class of compound	Examples
[N-N]	N	cidáde-satélite 'satellite city', lit. city satellite
[N-Adj]	(usually) N	amór-perféito 'pansy', lit. love perfect
[Adj-Adj]	(usually) Adj	súrdo-múdo 'deaf mute'
[Adj-N]	(usually) Adj	bóa-práça 'pleasant person', lit. good square
[V-N]	N	gúarda-róupa 'wardrobe', lit. keep clothing
[V-V]	N	córre-córre 'haste', lit. run run
[Adv-Adj]	N	sémpre-víva 'evergreen (plant)', lit. always alive
[Prep-N]	N	sém-této 'homeless', lit. without roof

Table 1
Word-word compounds in Brazilian Portuguese.

Stressed affix + word		Word + stressed suffix	
pré-guérra	'pre-war'	cidáde-zínha	'city.DIM'
pós-modérno	'post-modern'	suáve-ménte	'smoothly'

Table 2
Stressed affix + word structures in Brazilian Portuguese.

in the stem are neutralized with the attachment of regular suffixes (e.g. g[ɔ]lpe → g[o]lpe-ádo 'strike *n*, struck') (Wetzels 1992), the attachment of inherently stressed suffixes (e.g. *-zinho* and *-mente*) does not affect the quality of the stem vowel (e.g. caf[ɛ́] → caf[ɛ́]-zínho 'coffee, coffee.DIM', compl[ɛ́]ta → compl[ɛ́]ta-ménte 'complete, completely'). Therefore, it seems appropriate to consider that there is a prosodic boundary between suffixes such as *-zinho* and *-mente* and the adjacent stem. Since stress is realized in both the stem and the suffix in such structures, these suffixes are usually regarded as inherently stressed (Schwindt 2013).

When morphosyntactic structures are mapped onto the prosodic hierarchy, they undergo domain-specific phonological processes (Nespor & Vogel 1986, Vogel 2009). This means that each prosodic domain (especially in and above the phonological word domain) shows morphosyntax-phonology mapping specifications and particular phonological phenomena. When comparing two (or more) types of linguistic structures, then, both their phonological behaviour and their morphosyntactic behaviour provide evidence as to the prosodic domain to which they are assigned. In the next subsections, I revise aspects of the morphosyntactic

and phonological behaviour of word-word compounds and stressed affix + word structures that are indicative of their prosodic representation.

3.2. Morphosyntactic behaviour of composite structures

Word-word compounds and stressed affix + word structures display considerable variability in morphosyntactic processes. Pluralization is an example of a process whose application varies among composite structures. In word-word compounds, plural suffixes in general attach to the head of the structure (e.g. *sofá-s cama* 'sofa bed.PL'). However, in certain word-word compounds both elements are assigned plural markers (e.g. *amor-es perfeito-s* 'pansy.PL'). With regard to stressed affix + word constructions, whereas the full word is assigned a plural marker in stressed prefix + word structures, (e.g. *vice presidente-s* 'vice-president.PL'), in word + stressed suffix structures, both elements are pluralized (e.g. *animai(s) zinho-s*[9] 'animal.DIM.PL').

Although differences in the application of a particular morphosyntactic process may be indicative of differences in prosodization, pluralization cannot be used to prosodically distinguish between word-word compounds and stressed affix + word structures, or even between stressed prefix + word structures and word + stressed suffix structures. Plural suffix attachment is conditioned by factors such as position of the head in the construction and word class of its elements, and thus does not seem to be influenced by (or to influence) prosodic representation. Thus, in order to investigate the role of morphosyntactic behaviour in the prosodization of composite structures, we must focus on phenomena which have been argued to provide evidence for prosodic representation. One such phenomenon is ellipsis in coordination, a process whose application (in structures with stressed affixes only) evidences the independent prosodic status of stressed affixes. I discuss ellipsis in coordination in the next subsection.

3.2.1. Ellipsis in coordination and the prosodic status of stressed affixes

The application of ellipsis in coordination in stressed affix + word constructions has been considered to be indicative of the status of stressed affixes as independent PWds in Brazilian Portuguese (Schwindt 2001). In coordinate structures with two

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[9] The plural marker -s is not overt in the first element of pluralized constructions with the suffix *-zinho*. In Portuguese, final lateral consonants are semivocalized (to [j]) when a plural suffix attaches to the word (e.g. *animal*, *anima[j]s* 'animal.PL'). The fact that words in pluralized word + stressed suffix constructions exhibit lateral semivocalization is evidence that they are pluralized. In other constructions with *-zinho*, phonological alterations in the word form also indicate that the word is pluralized (e.g. *coração-zinho*, *coraçõe-zinhos* 'heart.DIM.PL'; compare with *coração*, *corações* 'heart.PL'). Although there is number agreement between the elements of such constructions, word + *-zinho* structures are not equivalent to phrases. The suffix *-zinho* can be inserted into certain word-word compounds (e.g. *cidade-satelite* → *cidadezinha-satelite* 'satellite city'), whereas other modifiers cannot (e.g. *cidade-satelite bonita*, but not **cidade-bonita-satelite* 'beautiful satellite city'. This is an indication that *-zinho* is indeed a suffix, not a modifier.

stressed suffixes, the first suffix can be omitted (4a).[10] In coordinate structures with two stressed prefixes, the first full word can be omitted (4b).

(4) (a) linda-mente e suave-mente → linda e suave-mente
beautifully and softly

(b) pre-cirurgia e pos-cirurgia → pre e pos-cirurgia
pre-surgery and post-surgery

Although in coordinate phrases ellipsis is also a possibility (e.g. *menino inteligente e menina inteligente → menino e menina inteligentes* 'intelligent boy and intelligent girl'), in word-word compounds such a process seems to be blocked. Structures such as *guarda-roupa ou guarda-chuva* 'wardrobe or umbrella' or *sempre-viva e agua-viva* 'evergreen and jellyfish' do not undergo ellipsis in coordination (e.g. *Ela disse 'guarda-roupa' ou 'guarda-chuva'?* 'Did she say *wardrobe* or *umbrella*?', and *Você viu uma sempre-viva ou agua-viva?* 'Did you see an evergreen or (a) jellyfish?', but not **Ela disse 'guarda-roupa' ou 'chuva'?* or **Você viu uma sempre ou agua-viva?*).

It could be argued, however, that in contexts in which the two word-word compounds are more semantically related, ellipsis may occur. This is in fact reported by Bisetto (2010) for the combination of certain Italian compounds, such as *lava-biancheria, asciuga-biancheria* 'washer, drier' (lit. wash-clothing, dry-clothing), which can be produced as *lava-asciuga biancheria*. In BP, it also seems possible for a construction such as *tira-manchas e tira-odores* 'remove-stains.N and remove-odours.N', with a coordinate conjunction (*e*), to be produced as *tira-manchas e odores*. However, it could be argued that the resulting constructions in both Italian and BP (*lava-asciuga biancheria* and *tira-manchas e odores*, respectively) are new compound forms corresponding to independent morphological and semantic units (i.e. *tira-manchas e odores* corresponds to a single lexical item and conceptual unit).

In the case of structures with stressed affixes, the application of ellipsis does not result in a new compound. This conclusion is based on the fact that elements can be inserted within the coordinate structure. For example, (4b) may be produced as *na pre e* ***na*** *pos-cirurgia* 'in-the pre and in-the post-surgery' (e.g. *Você precisa de cuidados na pre e na pos-cirurgia* 'You need care in-the pre and in-the post-surgery'), with both composite structures included in prepositional phrases.

In addition to displaying ellipsis in coordinate structures, stressed affixes in BP show rather independent morphosyntactic behaviour. Stressed prefixes can appear independently in sentences (5),[11] which means that they may correspond

[10] Ellipsis does not occur with the stressed suffix *-zinho* (e.g. *cafe-zinho e cha-zinho → *café e cha-zinho* 'coffee.DIM and tea.DIM'). This may be due to the fact that such a suffix does not take scope over the entire structure, or to the fact that its omission has semantic consequences. In any case, the blocking of ellipsis with *-zinho* does not seem to be influenced by prosodic factors.

[11] In BP, suffix *-zinho/a* may also appear independently in sentences, with a deprecatory

to terminal syntactic nodes.

(5) (a) Ela ainda pensa no **ex**.
'She still thinks about-the ex' (e.g. ex-boyfriend, not ex-boss)

(b) Falei com o presidente e o **vice**.
'(I) spoke with the president and the vice' (e.g. ex-president, not ex-dean)

This property of stressed prefixes has been proposed to be additional evidence for their status as PWds (Schwindt 2001), even though their syntactic independence is very limited. In (5a), *ex* can only be interpreted as *ex-boyfriend* (or any kind of romantic partner), but not as *ex-boss* or *ex-colleague*, for example, even if there is no reference to *boyfriend* in the context. This is an indication that the meaning of this prefix has been lexicalized. In (5b), *vice* can only be interpreted as *vice-president*, since *presidente* 'president' functions as a referent in this case.

Stressed prefixes in fact show rather independent behaviour with regard to stem attachment. Apart from being able to attach to simple words (e.g. *pre-guerra* 'pre-war'), such prefixes may attach to word-word compounds (e.g. *vice-primeiro-ministro* 'vice-prime minister') and phrases (e.g. *pre-vida no exterior* 'pre-life abroad'). In a more restricted way, the suffix *-zinho* can also attach to complex structures, such as word-word compounds (e.g. *amor-zinho perfeito* 'pansy.DIM'). The fact that stressed affixes are able to attach to multiple types of structures suggests that they can be prosodized in distinct domains. Since the present study focuses on distinctions in prosodization between word-word compounds and stressed affix + word compounds, the representation of stressed affixes in constructions with compounds or phrases will not be examined.

The fact that stressed affixes display a certain degree of morphosyntactic freedom and participate in ellipsis in coordination suggests that they are prosodized as independent PWds. In fact, their morphosyntactic freedom has an effect on their phonological behaviour, which, as discussed in the next section, is similar to that of independent PWds. However, although the application of ellipsis in coordination and morphosyntactic freedom are indicative of the status of stressed affixes as independent PWds, these properties do not suggest that structures with stressed affixes and word-word compounds are mapped onto the prosodic hierarchy in the same way. In previous analyses (Silva 2010, Toneli 2014), morphosyntactic evidence for the PWd status of stressed affixes was interpreted as evidence for the prosodization of stressed affix + word structures and word-word compounds in the same domain. In the next section, I show that although these two composite constructions have similarities in phonological behaviour,

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interpretation, especially of a person (e.g. *Ainda preciso falar com aquele zinho* '(I) still need to talk to that one'). Like the prefix in (5a), the use of *-zinho/a* as an independent lexical item seems to have been lexicalized.

they differ with regard to stress assignment, which accounts for their prosodization in separate domains.

3.3. Phonological behaviour of composite structures

3.3.1. Phonological similarities between composite structures: vowel raising and vowel sandhi

Word-word compounds and stressed affix + word structures overlap in the application of phonological processes in BP. Both undergo vowel raising at the right edge of their elements and vowel sandhi processes at the juncture of the two elements.

Vowel raising, the process whereby unstressed mid high vowels /e, o/ become [i, u], applies categorically in word-final position in standard BP dialects (Leite & Callou 2002). In addition to being observed between word-word compound members (6) and between the elements of structures with a stressed affix (7), vowel raising also occurs word-finally in PWds forming a phonological phrase (e.g. [menin[u] bonit[u]]$_{PPh}$ 'beautiful boy', [gent[i] inteligent[i]]$_{PPh}$ 'intelligent people').

(6) (a) surdo mudo → surd[u] mud[u]
deaf mute

(b) cidade satelite → cidad[i] satelit[i]
city satellite satellite city

(7) (a) vice presidente → vic[i] president[i]
vice president

(b) suave mente → suav[i] ment[i]
soft adv. suf. softly

Word-internally, vowel raising is highly constrained. Pretonic vowels may raise if there is a high vowel in the following syllable (e.g. *comída* → *c[u]mída* 'food') or in specific word families (e.g. *g[u]verno, g[u]vernar, g[u]vernador* 'government, to govern, governor') (Bisol 1981, 2009). However, at the right edge of stems that combine with non-inherently stressed suffixes beginning with a consonant, vowel raising does not apply (e.g. *promete-dor* → *promet[e]dor* 'person who makes a promise').

Vowel sandhi processes also occur between the elements in both word-word compounds and stressed affix + word structures in BP. The sandhi processes that can apply in these constructions are, according to the labels found in the literature about Portuguese phonology, degemination (in the case of identical vowels, (8a) and (9a)) and elision (in the case of distinct vowels (8b) and (9b)) (Abaurre 1996, Bisol 2003).[12] Note that elision in BP applies more frequently when there is a low

[12] Diphthongization is another vowel sandhi process found in BP. However, this phenomenon will

vowel (/a/) in the first position of the vowel sequence.[13]

(8) (a) peixe espada → peix[i]spada
fish sword sword fish

(b) porta espada → port[i]spada
holder sword sword holder

(9) (a) vice inspetor → vic[i]nspetor
vice inspector

(b) contra evidência → contr[e]vidência
counter evidence

Degemination and elision are also phrasal phenomena in BP. In phrasal contexts, both processes are constrained by position of word stress and position of phrasal stress (Abaurre 1996, Bisol 2003). For example, while two stressed vowels cannot merge (e.g. *sofá útil* → **sofútil* 'useful sofa'), a stressed vowel in the first element can merge with an identical unstressed vowel (e.g. *sofá agradável* → *sofàgradável* 'nice sofa', in which the diacritics mark secondary and primary phrasal prominences respectively). Additionally, an unstressed vowel in the first element can merge with an identical stressed vowel, as long as the latter is not the primarily stressed vowel in the phrase (e.g. *cóisa ágil* → **còiságil* 'agile thing', but *cóisa ágil assím* → *coisàgil assím* 'agile thing like-this').

Such sandhi processes do not occur word-internally. Although words with a word-internal sequence of two identical vowels are rare in Portuguese, contexts of hiatus involving two distinct vowels are relatively more frequent. In this case, words such as *baobá* 'Adansonia tree' and *maestría* 'mastership' are not produced as **bobá* or **mestría*. Although elision does not apply word-internally, it is possible for some contexts of hiatus to be resolved through diphthongization (e.g. *maestría* → *ma[j]stría*).

Based on vowel raising and vowel sandhi processes alone, word-word compounds and stressed affix + word structures do not seem to differ with regard to phonological behaviour. We may thus be tempted to conclude that such constructions have a single form of prosodization. However, in the next subsection, I show that word-word compounds and stressed affix + word structures exhibit distinct stress patterns. Since prosodic domains are often associated with specific prominence patterns, such a distinction is important for the discussion of the prosodic representation of these composite structures in BP.

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not be discussed in the present study, as it may occur both word-internally and phrase-internally, and thus does not help to differentiate among prosodic structures in the language.

[13] In contexts in which there is a mid vowel (/e, o/) or a high vowel (/i, u/) in the first position of the vowel sequence, diphthongization applies.

3.3.2. Phonological differences between composite structures: stress assignment
Each element in word-word compounds and stressed affix + word structures in BP has primary stress. Fully-formed words in these constructions maintain the stress pattern that they exhibit when in isolation (e.g. *guárda* + *chúva* = *guárda-chúva*). The prefixes and suffixes involved in composite structures, on the other hand, are inherently prominent and thus also exhibit stress on one of their syllables. As discussed in the beginning of section 3, some of the stressed prefixes in BP present mid low vowels (e.g. pr*é* 'pre', p*ɔ́*s 'post', pr*ɔ́* 'pro'),[14] which are traditionally identified with primarily stressed syllables in the language. The fact that some prefixes exhibit vowels that are found only in primarily stressed syllables has been considered indicative of the status of stressed affixes as indepedent PWds (Schwindt 2001).

Thus, both word-word compounds and stressed affix + word structures seem to correspond to combinations of PWds. However, word-word compounds differ from stressed affix + word structures (in particular to structures with stressed suffixes) with regard to prominence realization on the first element, which suggests that the domains in which such PWd combinations occur are different.

In word-word compounds in which a stress clash is observed, stress on the first element may retract (10).

(10) (a) amór próprio → ámor próprio
love self self-love

(b) sofá cáma → sófa cáma
sofa bed

Such a process is not observed in stressed prefix + word structures, since no prefix in BP has final stress. It could be argued, though, that word + stressed suffix structures exhibit the exact same process (11).

(11) (a) calór zínho → cálor zínho
heat dim. suf. heat.DIM

(b) reál ménte → réal ménte
real adv. suf. really

However, stress in word + suffix compounds may retract even if there is no stress clash in the structure (12). Additionally, stress on the first element may not only *retract*, but also *advance* one syllable (13). This is also possible in stressed prefix + word constructions (14). The behaviour of stressed affix + word constructions regarding stress assignment is identical to the behaviour of simple PWds (stem + non-inherently stressed suffixes). In simple PWds, primary stress

[14] These same prefixes also have unstressed counterparts, in which a mid high vowel is present (e.g. pr[e]ámbulo 'preamble', p[o]stergár 'to postpone'). Such forms with unstressed prefixes have been regarded as lexicalized items and thus correspond to simple PWds (see e.g. Schwindt (2001)).

is constrained to one of the last three syllables, and, in words with an odd numbers of syllables to the left of the stressed one, two distinct patterns of secondary stress assignment are observed (Collischonn 1994, Lee 2002, Abaurre et al. 2006). For example, secondary stress assignment can either follow a binary pattern (e.g. *deslìzaménto* landslide) or be assigned to the leftmost syllable in the word, which thus exhibits a stress lapse (e.g. *dèslizaménto*).

(12) (a) medída zínha → médida zínha
measure dim. suf. measure.DIM

(b) compléta ménte → cómpleta ménte
complete adv. suf. completely

(13) (a) ácido zínho → acído zínho
acid dim. suf. acid.DIM

(b) prática ménte → pratíca ménte
practical adv. suf. practically

(14) (a) súper mercádo → supér mercádo
super market

(b) více reitór → vicé reitór
vice dean

In word-word compounds, on the other hand, stress on the first element cannot move to the right (15).

(15) (a) prónto socórro → *prontó socórro
ready help emergency room

(b) cidáde satélite → *cidadé satélite
city satellite satellite city

Therefore, the stress patterns observed in structures with a stressed affix and word-word compounds are different. While word-word compounds present stress retraction in clash environments, structures with a stressed affix are assigned prominence in the same fashion as simple PWds (i.e. according to BP's algorithm of PWd stress).

Neither stress retraction (in word-word compounds) nor stress movement due to secondary stress assignment (constructions with a stressed affix) cause lower mid vowels to raise (e.g. chapɛ́u-cóco → cháp**ɛ**u-cóco 'bowler hat', complɛ́ta-ménte → cómpl**ɛ**ta-ménte 'completely'). As noted above, lower mid vowels are associated with primarily stressed syllables in Portuguese (since Câmara (1970); see also Wetzels (1992)), and, in derivation contexts in which the added suffix is stressed, lower mid vowels become upper mid vowels. The fact that elements in word-word compounds and stressed affix + word structures preserve their lower mid vowels even after stress moves is indicative that such elements correspond to independent PWds.

Phenomena	**Word-word compounds**	**Stressed prefix + word**	**Word + stressed suffix**
Ellipsis	**does not apply**	**applies**	**applies (with *-mente*)**
Vowel raising	in both members: surd[u]-mud[u]	in both members: vic[i]-president[i]	in both members: suav[i]-ment[i]
Vowel sandhi	applies: peix[i]spada	applies: vic[i]nspetor	NA
Stress	**fixed in both members; retraction possible in the context of clash**	**retraction and advacement to parallel patterns in individual PWds**	**retraction and advacement to parallel patterns in individual PWds**

Table 3
Behaviour of composite structures in BP.

In this section, I examined the morphosyntactic and phonological behaviour of word-word compounds and composite structures with a stressed affix in order to demonstrate that such constructions are fundamentally different with regard to ellipsis in coordination and stress assignment. I argued that the behaviour of stressed prefixes and suffixes with respect to ellipsis in coordination, as well as the fact that they have primary stress (reflected as well in vowel quality, for example), suggests that these affixes are prosodized as independent PWds. However, the fact that word-word compounds and stressed affix + word structures present distinct prominence patterns is an indication that their prosodization occurs in separate domains. In the next section, I discuss the prosodic representation of these composite constructions.

4. The prosodic representation of BP composite structures

Word-word compounds and stressed affix + word structures in Brazilian Portuguese have several morphosyntactic and phonological similarities and thus have been assigned the same prosodic representation (Silva 2010, Toneli 2014). However, as seen in the previous section, such structures also exhibit important differences. In morphosyntactic terms, these two structures differ with respect to the application of ellipsis in coordination and to the syntactic freedom of their elements. In phonological terms, word-word compounds and stressed affix + word constructions differ with regard to stress assignment.

Table 3 summarizes the similarities and differences between word-word compounds and stressed affix + word structures. Stressed affix + word structures are divided into two categories: stressed prefix + word constructions and word + stressed suffix constructions. The cells in bold show the phenomena that are important for differentiating among these constructions, as detailed in section 3.

All types of composite structures in Table 3 exhibit vowel raising in final position in each of their elements, and both word-word compounds and stressed prefix + word constructions display vowel sandhi processes between their elements. Based on the premise that prosodic domains show consistency in the application

of phonological phenomena, an analysis that considers only vowel raising and vowel sandhi will assign both word-word compounds and stressed affix + word structures to the same prosodic domain.

The examination of additional phonological and morphosyntactic phenomena, however, indicates important distinctions in prosodic behaviour between word-word compounds and stressed affix + word structures. As I have shown in the previous section, stress in stressed affix + word structures is repaired to reflect the patterns in single PWds. Word-word compounds, on the other hand, exhibit primary stress on each of their members and may show stress retraction in the context of clash. If these two types of structures had exactly the same prosodic configuration, they would not differ with regard to prominence assignment.

I propose that word-word compounds and stressed affix + word structures are prosodized in separate domains. Specifically, I propose that while stressed affix + word structures are prosodized recursively in the PWd domain, word-word compounds are prosodized in a higher domain, namely, the composite group (CG). Thus, the present analysis considers that the prosodic hierarchy both supports recursive domains (following e.g. Inkelas (1990), Selkirk (1996)) and contains an additional domain for the representation of certain composite structures (following Vogel (2008, 2009)).

A prosodic hierarchy in which domain recursion is allowed is not incompatible with a prosodic hierarchy that contains a domain specific to the representation of composite structures. Domain recursion and the additional domain (the CG) serve different purposes, and thus the existence of the former does not preclude the existence of the latter. While the CG accommodates certain composite structures and thus is the domain of application for specific phonological processes, the possibility of domain recursion constrains prosodic adjunction.

Structures that arise through adjunction do not exhibit particular processes, but undergo processes that are associated with the domain in which they are prosodized. In that sense, prosodic adjunction refers to the attachment of a given element to a fully-formed structure (e.g. a prefix that attaches to a fully-formed PWd). In the remainder of this section, we will see that while stressed affix + word structures arise through adjunction and thus have a recursive representation, word-word compounds display phonological behaviour that is consistent with their prosodization in a higher, independent domain. Before I discuss this, however, it is appropriate to examine the prosodic status of each element in both types of composite structures in BP.

With regard to the internal constituency of the domains in which word-word compounds and stressed affix + word structures are prosodized, I propose, following Silva (2010) and Toneli (2014), that each element in both types of constructions corresponds to a PWd. The reason why members of word-word compounds are independent PWds is straigthforward: each compound member (a) exhibits primary stress (which only shifts in case of clash) and (b) behaves as an independent word with regard to vowel raising in final position and vowel sandhi processes (See Fig. 5 below).

Members of stressed affix + word constructions also behave as independent words with regard to vowel raising (and with regard to sandhi processes, in the case of stressed prefix + word structures). However, these constructions are assigned prominence according to the language's primary and secondary stress algorithm, which could indicate that the combination between a word and a stressed affix forms a constituent with no internal boundaries.

The fact that stressed prefixes display rather independent syntactic freedom is indicative of their status as independent PWds. Stressed prefixes may attach to different types of constructions (such as independent words, word-word compounds and phrases), which points to the possibility of their incorporation into distinct prosodic domains.

In the case of word + stressed suffix constructions, the fact that mid low vowels are preserved in the first element even if prominence moves to other positions suggests that this element is also assigned PWd status (e.g. còmplɛta-ménte). In word + stressed suffix structures, the head of the construction is the suffix, which is assigned the primary prominence. Within a given prosodic domain, the prosodic status of the head must be identical or higher than the prosodic status of the non-heads (the *Headedness* principle, see e.g. Zec (2005)). In other words, if the head element in a given domain is a PWd, the non-heads can be PWds, feet or syllables, but not PPhs. Conversely, if the host word (the non-head) corresponds to a PWd, the stressed suffix (the head) must also correspond to a PWd, but not to a lower domain.[15]

The critical difference between word-word compounds and stressed affix + word structures is, then, stress assignment. The fact that stressed affix + word structures are assigned prominence according to the PWd algorithm indicates that these structures are prosodized as PWds. Fig. 3 and Fig. 4 show that when both stressed prefixes and stressed suffixes attach to independent words, they are recursively prosodized in the same domain as their host PWds.

Note that in Figs. 3 and 4, the recursive PWd is connected to the lower PWds through a straight line and a diagonal line. Such a representation indicates that the stressed affix adjoins a fully-formed PWd, and then recursion arises. In other words, the element connected through a straight line is the host, while the element connected through a diagonal line is its prosodic adjunct.

Both elements in word-word compounds are primarily stressed, and the structure does not behave as a PWd with regard to stress assignment. This

[15] Another option for the prosodization of stressed affixes would be to assume that they correspond to feet (following Vogel (2010)). However, the fact that stressed affixes undergo PWd-specific processes (such as vowel raising and vowel sandhi phenomena) indicates that such structures are indeed PWds. It might be the case, however, that neoclassical stems correspond to feet when they adjoin fully formed words (e.g. *psico* in *psico-linguistica* 'psycholinguistics' and *agro* in *agro-negocio* 'agrobusiness'). Although constructions with neoclassical stems are assigned stress in the same manner as constructions with stressed affixes, neoclassical stems do not exhibit vowel raising in final position. Vowel raising is also not expected at the right edge of word-internal feet.

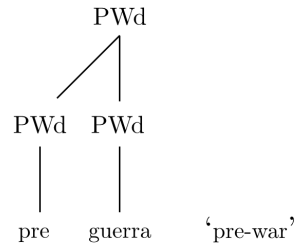

Figure 3
Prosodic representation of stressed prefix + word structures.

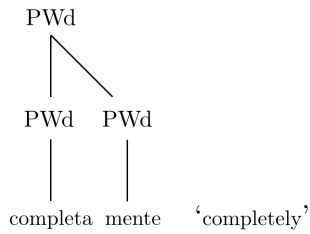

Figure 4
Prosodic representation of word + stressed suffix structures.

indicates that such compounds are not prosodized in the PWd, but in the immediately higher domain, namely, the CG (Fig. 5).

In sum, word-word compounds and stressed affix + word structures have important phonological and morphosyntactic differences, which account for their distinct prosodic representations. Stressed affix + word structures receive stress as regular PWds, although they are formed by independent PWds. On the other hand, primary stress in both elements of word-word compounds is fixed, and stress in

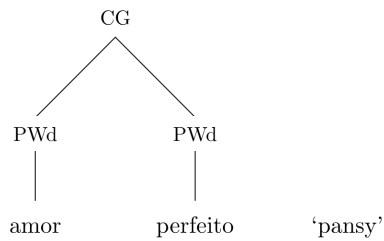

Figure 5
Prosodic representation of word-word compounds.

the first element can only retract in the context of clash. If we assume that prosodic domains display specific segmental and prominence processes, it is not possible to have two structures with different stress assignment patterns prosodized in the same way. That is precisely why word-word compounds in BP cannot correspond to recursive PWds and thus have the same prosodic representation as stressed affix + word constructions (*contra* e.g. Silva (2010)).

As mentioned above, I assume here that recursive PWds arise through prosodic adjunction (following e.g. Ito & Mester (2013)). A prosodic adjunct attaches to a fully-formed structure in the same domain in which such a structure is prosodized. In the case of stressed affix + word structures, stressed affixes correspond to independent PWds that attach to fully-formed PWds. The resulting structure also displays characteristics of PWds (in this case, those related to stress assignment) and can thus be assumed to be prosodized as a higher (or recursive) PWd. Word-word compounds, on the other hand, are not formed through adjunction, but from the combination of elements. The combination of compound elements yields a structure with characteristics that do not match those of the PWd domain. Thus, word-word compounds are prosodized in a higher domain (the CG).

The representation in Fig. 5 differs from the representations in Figs. 3 and 4 with respect to the directionality of the lines that link the PWds to the higher domain or level. In Fig. 5, both compound elements are connected to the CG through diagonal lines. This represents the fact that even though such compounds may have a *semantic* head, their elements have the same prosodic status within their domain of prosodization. In other words, no element in such a construction functions as a prosodic adjunct to the other. In addition, the representations in Figs. 3 and 4 capture the fact that the dominating domain (the recursive PWd) is a copy of the domain that corresponds to the host of the structure.

One issue regarding the configuration of the prosodic hierarchy should be addressed at this point. This issue concerns the application of phonological processes in recursive levels. One criticism directed at the use of recursion in prosodic representation concerns the fact that recursive levels are often the domain of application for specific phonological processes (Vogel 2009), which contradicts the fundamental premise in prosodic theory that phonological processes are constrained to prosodic domains (not to recursive levels).

If both prosodic domains (such as the PWd) and recursive levels (such as the recursive PWd) can be domains of application for distinct processes, it is not clear in which aspects prosodic domains differ from recursive levels. It is often the case that structures whose prosodization is assigned to a recursive level differ substantially from structures whose prosodization is assigned to a non-recursive level in the same domain. In this case, it is not clear why such structures are assigned to a recursive level instead of to a novel domain in the prosodic hierarchy.

Another problem for recursive representations is the fact that recursive levels often show an overlap in process application with higher domains in the prosodic hierarchy. This is particularly the challenge for the representation of BP stressed affixes in recursive levels. At this point, then, a note on the configuration of the

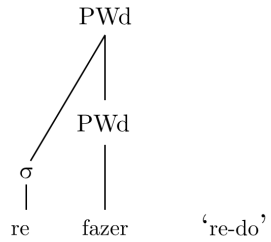

Figure 6
Prosodic representation of unstressed prefix + word constructions.

recursive PWd in BP is appropriate.

In BP, certain unstressed monosyllabic prefixes have also been assumed to attach to fully-formed words (e.g. *re-fazer* 're-do', *co-produzir* 'co-produce') and thus to prosodize recursively in the PWd domain (e.g. Schwindt (2001)).[16] Such unstressed prefixes do not exhibit vowel raising nor undergo vowel sandhi processes (if the adjacent word starts with a vowel). In other words, unstressed prefixes seem to behave as pretonic syllables in the language.

It is assumed, then, that both unstressed prefix + word structures and stressed prefix + word structures are prosodized as recursive PWds, although the status of the prefix differs in the two constructions (see e.g. Schwindt (2001)). One question, then, arises: How can structures prosodized in the same node (i.e., as recursive PWds) display such differences in phonological behaviour?

One possible explanation refers to the prosodic category of the elements within the recursive structure. In stressed prefix + word structures, the prefix is equivalent to a PWd, and thus displays PWd processes, such as vowel raising in final position and sandhi with the initial vowel of the host word. In unstressed prefix + word structures (Fig. 6), the prefix corresponds to an independent syllable, which, within the PWd domain, cannot exhibit vowel raising nor sandhi processes.

In the case of stressed prefix + word structures, it is not the status of the combination between the elements, but rather the status of each of the elements that conditions the application of phonological processes in the construction. A recursive representation, in this context, captures the fact that a prefix whose phonological behaviour is equivalent to that of a PWd attaches to another PWd. It also captures a fundamental difference between constructions with stressed affixes and word-word compounds: while stressed affix + word structures arise through adjunction, word-word compounds are formed from the combination (or sum) of elements.

Therefore, the view that prosodic domains can be recursive is not incompatible

[16] It is assumed that such prefixes can also be incorporated into the stem, in cases in which the stem does not function as a full word in the language (e.g. *pro-gresso* 'progress', *re-gresso* 'return' Schwindt (2001)).

with the view that considers the existence of an additional domain between the PWd and the PPh in the prosodic hierarchy. Whereas recursive domains emerge through prosodic adjunction and account for the prosodization of structures with stressed affixes in BP, the additional domain (the CG) functions as the domain of prosodization of word-word compounds.

5. Final remarks

In this paper, I showed that word-word compounds and stressed affix + word compounds in Brazilian Portuguese are prosodized in distinct domains. While stressed affix + word structures are prosodized in the phonological word (PWd), word-word compounds are prosodized in the composite group (CG), the constituent located between the PWd and the phonological phrase proposed by Vogel (2008, 2009).

The main phonological difference between word-word compounds and constructions with a stressed affix is related to stress assignment: each element of word-word compounds behaves as an independent word with regard to stress assignment, whereas stressed affix + word structures are assigned primary and secondary stresses as simple PWds. Additionally, the fact that stressed prefixes can attach to multiple structures (independent PWds, word-word compounds and phrases) suggests that, when they attach to an independent PWd, they are integrated into such a domain.

Given their inherent prominence and the phonological processes that they undergo (namely, vowel raising and vowel sandhi), each element in word-word compounds and stressed affix + word constructions corresponds to a PWd. Thus, the present analysis assumes that the prosodic hierarchy admits recursive levels (to account for the prosodization of stressed affixes) *and* contains an additional domain between the PWd and the PPh. While prosodic domains are still assumed to serve as environments for phonological process application, recursion accounts for the adjunction of elements to fully-formed structures.

REFERENCES

Abaurre, Maria Bernadete. 1996. Acento frasal e processos fonológicos segmentais. *Letras de Hoje* 31(2).

Abaurre, Maria Bernadete, Charlotte Galves, Arnaldo Mandel & Filomena Sandalo. 2006. Secondary stress in two varieties of Portuguese and the Sotaq optimality based computer program. *Probus* 18. 97–125.

Author. 2015. *Phd dissertation*: dissertation.

Bauer, Laurie. 1998. When is a sequence of two nouns a compound in English? *English Language and Linguistics* 2. 65–86.

Bisetto, Antonietta. 2010. Recursiveness and Italian compounds. *SKASE Journal of Theoretical Linguistics* 7. 14–35.

Bisol, Leda. 1981. *Harmonia vocálica: uma regra variável*: Universidade Federal do Rio de Janeiro dissertation.

Bisol, Leda. 1992. O Acento: Duas Alternativas de Análise. Unpublished manuscript.

Bisol, Leda. 2003. Sandhi in Brazilian Portuguese. *Probus* 15. 177–200.

Bisol, Leda. 2009. O alçamento da pretônica sem motivação aparente. In Leda Bisol & Gisela Collischonn (eds.), *Português do sul do Brasil: variação fonológica*, Porto Alegre: EDIPUCRS.

Câmara, Joaquim Mattoso. 1970. *Estrutura da língua portuguesa*. Petrópolis: Editora Vozes.
Collischonn, Gisela. 1994. Acento secundário em português. *Letras de Hoje* 29(4). 43–55.
Elfner, Emily. 2015. Recursion in prosodic phrasing: evidence from Connemara Irish. *Natural Language & Linguistic Theory* 33(4). 1169–1208.
Hermans, Ben & Leo Wetzels. 2012. Productive and unproductive stress patterns in Brazilian Portuguese. *Revista Letras & Letras* 28. 77–114.
Inkelas, Sharon. 1990. *Prosodic constituency in the lexicon.* Outstanding Dissertations in Linguistics. New York: Garland Press.
Ito, Junko & Armin Mester. 1986. The phonology of voicing in Japanese: Theoretical consequences for morphological accessibility. *Linguistic Inquiry* 17. 49–73.
Ito, Junko & Armin Mester. 2007. Prosodic adjunction in Japanese compounds. In Yoichi Miyamoto & Masao Ochi (eds.), *The proceedings of Formal Approaches to Japanese Linguistics 4*, 97–112. Cambridge, MA: MITWPL 55.
Ito, Junko & Armin Mester. 2009. The extended prosodic word. In Janet Grijzenhout & Baris Kabak (eds.), *Phonological domains: Universals and deviations*, Berlin: Mouton de Gruyter.
Ito, Junko & Armin Mester. 2013. Prosodic subcategories in Japanese. *Lingua* 124. 20–40.
Kubozono, Haruo. 1995. Constraint interaction in Japanese phonology: Evidence from compound accent. In Rachel Walker, Ove Lorentz & Haruo Kubozono (eds.), *Phonology at Santa Cruz*, vol. 4, 21–38. Linguistics Research Center, UC Santa Cruz.
Lee, Seung Hwa. 1997. Sobre os compostos do PB. *DELTA* 13. 17–33.
Lee, Seung Hwa. 2002. Acento secundário do PB. *Letras de Hoje* 37. 149–162.
Leite, Yonne & Dinah Callou. 2002. *Como falam os brasileiros*. Rio de Janeiro: Zahar.
Lieber, Rochelle & Pavol Stekauer. 2009. Introduction: status and definition of compounding. In Rochelle Lieber & Pavol Stekauer (eds.), *The Oxford handbook of compounding*, Oxford: Oxford University Press.
Martinez-Paricio, Violeta. 2012. Superfeet as recursion. In Nathan Arnett & Ryan Bennett (eds.), *30th West Coast Conference on Formal Linguistics*, 259–269. University of California Santa Cruz.
Moreno, Cláudio. 1997. *Morfologia nominal do posrtuguês: um estudo de fonologia lexical*: Pontifícia Universidade Católica do Rio Grande do Sul dissertation.
Nespor, Marina & Irene Vogel. 1986. *Prosodic phonology*. Dordrecht: Foris.
Partee, Barbara. 1994. Lexical semantics and compositionality. In Lila Gleitman & Mark Liberman (eds.), *Invitation to cognitive science - Part I: Language*, Cambridge: MIT Press.
Peperkamp, Sharon. 1997a. The prosodic structure of compounds. In Gabriela Matos, Matilde Miguel, Inês Duarte & Isabel Hub Faria (eds.), *Interfaces in linguistic theory*, 259–279. APL/Colibri.
Peperkamp, Sharon. 1997b. *Prosodic words*. The Hague: Holland Academic Graphics. University of Amsterdam dissertation.
Prince, Alan & Paul Smolensky. 1993/2004. Optimality theory: Constraint interaction in generative grammar .
Rio-Torto, Graça & Sílvia Ribeiro. 2012. Portuguese compounds. *Probus* 24. 119–145.
Schwindt, Luiz Carlos. 2001. O prefixo no português brasileiro: análise prosódica e lexical. *DELTA* 17(2). 175–207.
Schwindt, Luiz Carlos. 2013. Neutralização da vogal pretônica e formação de palavras em português brasileiro. *Organon* 28(54). 137–154.
Selkirk, Elisabeth. 1984. *Phonology and Syntax: The Relation between Sound and Structure*. Cambridge, MA: MIT Press.
Selkirk, Elisabeth. 1996. The prosodic structure of function words. In James L. Morgan & Katherine Demuth (eds.), *Signal to syntax: Bootstrapping from speech to grammar in early acquisition*, 187–214. Lawrence Erlbaum Associates.
Selkirk, Elisabeth. 2011. The syntax-phonology interface. In John Goldsmith, Jason Riggle & Alan Yu (eds.), *The handbook of phonological theory*, 435–483. Oxford: Blackwell.
Silva, Taís Bopp da. 2010. *Formação de palavras compostas em Português Brasileiro: uma análise de interfaces*: Universidade Federal do Rio Grande do Sul dissertation.
Toneli, Priscila Marques. 2014. *A palavra prosódica no português brasileiro*: Universidade Estadual de Campinas dissertation.
Vigário, Marina. 2003. *The prosodic word in European Portuguese*, vol. 6. Berlin: Walter de Gruyter.
Vigário, Marina. 2010. Prosodic structure between the prosodic word and the phonological phrase: recursive nodes or an independent domain? *Linguistic Review* 27. 485–530.
Vogel, Irene. 2008. The morphology-phonology interface: Isolating to polysynthetic languages. *Acta Linguistica Hungarica* 55(1). 205–226.

Vogel, Irene. 2009. The status of the clitic group. In Janet Grijzenhout & Baris Kabak (eds.), *Phonological domains: Universals and deviations*, 15–46. Berlin: Mouton de Gruyter.
Vogel, Irene. 2010. The phonology of compounds. In Sergio Scalise & Irene Vogel (eds.), *Crossdisciplinary issues in compounding*, 145–163. Amsterdam: John Benjamins Publishing.
Wetzels, Leo. 1992. Mid vowel neutralization in Brazilian Portuguese. *Cadernos de Estudos Linguísticos* 23.
Zec, Draga. 2005. Prosodic differences among function words. *Phonology* 22(01).

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