

UNIFYING NEOCLASSICAL AND STEM-BASED COMPOUNDS: A NON-LEXICALIST APPROACH

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ABSTRACT

In this paper, we discuss the structural parallelism present in neoclassical and stem-based compounds to suggest that they are both formed in a uniform fashion, from a single underlying structure. Assuming a non-lexicalist approach to grammar – viz., the Distributed Morphology framework – we propose that these compounds' stems are concatenated via a functional projection, in the sense of Di Sciullo (2005, 2009), which receives a one-time categorization. As for the insertion of linking elements, it is the emerged structural configuration that triggers it in the compound structure at the morphological component.

KEYWORDS: neoclassical compounds; stem-based compounds; Distributed Morphology.

COMPOSTOS NEOCLÁSSICOS E COMPOSTOS FORMADOS POR RADICAIS: UM TRATAMENTO UNIFICADO DENTRO DE UMA ABORDAGEM NÃO LEXICALISTA

RESUMO

O presente artigo discute o paralelismo estrutural presente em compostos neoclássicos e compostos formados por radicais, sugerindo que ambos são derivados de modo uniforme na gramática, a partir de uma mesma estrutura subjacente. Dentro de uma abordagem não-lexicalista – a Morfologia Distribuída – propomos que os radicais desses compostos são concatenados via uma projeção funcional, de acordo com Di Sciullo (2005, 2009), e são categorizados de uma só vez por um único núcleo categorizador. Por sua vez, a configuração estrutural que emerge é a responsável por desencadear a inserção de elementos de ligação no componente morfológico da gramática.

PALAVRAS-CHAVE: compostos neoclássicos; compostos formados por radicais, morfologia distribuída.

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1. INTRODUCTION

Bound stems are characterized by posing some theoretical problems for morphological theories that defend a clear-cut distinction between derivation and compounding. The formations in which they appear suggest a compound-like structure in which the constituents exhibit an intermediate status between an affix and a stem, since they are bound as affixes and contentful as stems. In this context, an expressive set of elements whose subparts exhibit these characteristics are the so-called neoclassical compounds (i.e., compounds based in at least two or more bound stems of classical origin, connected via a linking element; henceforth, LE). Examples of this kind of compound in Brazilian Portuguese (BP) are forms such as *oftalm-o-logista* ‘ophthalmologist’, *neur-o-psic-ó-logo* ‘neuropsychologist’ and *hidr-o-massagem* ‘whirlpool bath’.

To explore the morphosyntax of neoclassical compounds in BP and to put forward a syntactic explanation for these formations, we will associate them with stem-based compounds (henceforth, SBC) from Modern Greek (e.g., *mavr-o-aspros* ‘black and white’, *sider-o-porta* ‘iron door’) and Russian (e.g., *nov-o-strojka* ‘new building’, *kof-e-varka* ‘coffee machine’), to propose that it is this sort of compounds’ formal structure that triggers the insertion of LEs between the stems. Furthermore, we will investigate the impossibility of attaching inflectional or derivational morphemes in their first constituents, and the influence of this fact on the compounds’ stems categorization.

Our proposal is based on the initial hypothesis that neoclassical word-formation process is integrated into BP morphological system, despite the fact that its formants are loanwords from classical languages. This assumption can find evidence in the great amount of new coined words attested in neologism-mapping databases, reflecting the fact that they are productive and active for new formations (e.g., *fotodepilação* ‘photoepilation’, *agroecologia* ‘agroecology’, *eletroacupuntura* ‘electroacupuncture’, *ecosocialismo* ‘ecosocialism’).

We will approach these data from a non-lexicalist view of grammar, the Distributed Morphology framework (henceforth, DM; see Halle and Marantz, 1993), in which the interface between syntax and morphology is as transparent as possible, since it hypothesizes that the same computational system (i.e., syntax) generates both sentences and words. We argue that neoclassical and SBCs can be generated straightforwardly in a syntactic approach to morphology, and that these compounds share a basic underlying structure. For this reason, our questions are twofold: (i) how can a SBC be structured in a syntactic approach to morphology?; and (ii) what is the syntactic relevance (if any) of the LE displayed in their internal structure?

The development of the above-mentioned questions is schematized as follows: in section 2, we describe the morphological properties of neoclassical compounds in BP; in section 3, we discuss the distribution of LEs in BP neoclassical, Modern Greek and Russian compounds, questioning their grammatical function, as suggested by Di Sciullo (2005, 2009), to defend they are inserted only for phonological requirements. In section 4, we present the tenets of DM, showing how the internal structure of these compounds is similar, arguing that the compounds’ roots – in DM sense – have a one-time categorization and that the LEs are inserted post-syntactically at the morphological component.

2. NEOCLASSICAL COMPOUNDS IN BP

Neoclassical compounds are distinguished from the other types of compounds by the fact they are based on Greek or Latin classical bound stems, which do not possess the same syntactic licensing conditions present in the autonomous stems of a particular language. Their general characteristics were pointed out by Amiot and Dal (2007:323), and are listed in (1):

(1) a. *Absence of syntactic realization in the target language:*

Neoclassical stems can only appear as bound constituents, without receiving associated grammatical words in the target language (e.g., *I saw an *anthrop* with a hat; *Children love *lud(e)s*);

b. *The kind of vocabulary they serve to form:*

The complexes in which they appear belong to the learned vocabulary of scientific or technical fields;

c. *The presence of a linking vowel (o or i) between the constituents:*

The presence of a linking vowel (*o* or *i*) between the constituents in the phonological context /... C_fC_i.../ where C_f and C_i are consonants in, respectively, final position of the first constituent and initial position of the second constituent (e.g., anglo*ph*ile, carn*i*vore)

These characteristics conjugate the most salient traits of neoclassical stems and of the formations they appear in, mainly the characteristics (1a) and (1c), which highlights specific morphosyntactic aspects related to their licensing conditions and concatenation, respectively. However, the characteristic (1b) is restrictive, since it disregards two important aspects: (i) the presence of many of these stems in the current use of the language; and (ii) the fact that the speaker, besides hypothetically acquiring them in a later stage, does have knowledge of what they are and how they can be combined.

From the morphological perspective, these neoclassical bound stems display the following properties, listed in Table 1 below, which demonstrate they behave differently in a variety of possible combinations. By way of illustration, we bring examples from *morf-*, *hidr-* and *neur-*:

(2) **Table 1:** Morphological properties of neoclassical bound stems

PROPERTIES	EXAMPLES
I: Ability to be attached to other neoclassical stem	(a) With two stems: morfologia ‘morphology’, hidroelétrica ‘hydroelectric’, neurometria ‘neurometrics’ (b) With three stems: morfofonia ‘morphology’, neuroendoscopia ‘neuroendoscopy’ ³
II: Ability to be attached to non-neoclassical stems	hidroginástica ‘gym in water’, neurociência ‘neuroscience’ *morf- Ø ⁴
III: Ability to derive new words	(a) By suffixation: morfema ‘morpheme’, hidrante ‘hydrant’, neuronal. (b) By prefixation: monomorfêmico ‘monomorphemic’, desidrar ‘dehydrate’, polineuropatia ‘polyneuropathy’
IV: Ability to transit in the compound	antropomorfia ‘antropomorphy’, morfologia ‘morphology’ *Ø -hidro, *Ø -neuro.
V: Ability of being truncated⁵	morfo ‘morphology’, hidro ‘gym in water’, neuro ‘patient in neurology’

We can see in Table 1 that despite being bound, those neoclassical forms have a stem morphological status endorsed by the properties I, III, IV and V, contrary to the claim that they should be analyzed as affixes or semi-affixes (see Marchand, 1969; Schmidt, 1987; Katamba, 1990; Martinet, 1979). In this sense, we believe that property III (viz., the ability of deriving new words) is the most striking evidence to assume neoclassical forms are stems, as we have been emphasizing.

In compounding contexts, neoclassical stems give rise to compounds whose head is always on the right-hand edge of the structure (e.g., *hidroelétrica*, *neuroimagem*), while in BP, as well as in Romance languages in general, the head of word-based compounds varies in position (e.g., *vaso*

3. The quantity of stems that one can concatenate in compound formations, i.e. its recursion, may be linked to the combination of any compound with a neoclassical stem. There are several formations that make this recursion explicit, which is peculiar to these stems (e.g. aero-foto-geo-graf-ia; oftalmo-otorrino-laringo-log-ista).

4. We use “Ø” to point the absence of some property to a particular neoclassical stem.

5. Within property V, we can also consider the recomposing data, that is, compounds formed with a truncated form from a neoclassical compound, such as tele (televisão → tele → telecurso) and foto (fotografia → foto → fotonovela).

constricção ‘vasoconstriction’; *sangue frio* ‘in cold blood’, see Moreno, 1997). Amiot and Dal (2008) assume that the head position situated on the right-hand edge is a cross-linguistic characteristic of neoclassical compounds, since it is uniform in the languages they are used:

- (3) a. (FR) **phytothérapie** vs **homme-grenouille**
‘phytotherapy’ ‘frogman’
- b. (BP) **hidroginástica** vs. **banana-maçã**
‘gym in water’ ‘latundan banana’
- c. (IT) **idromassaggio** vs **capostazione**
‘whirlpool bath’ ‘stationmaster’
- d. (GE) **Hidrogeologie** vs **Kranhenhaus**
‘hydrogeology’ ‘hospital’
- e. (EN) **biochemistry** vs **boathouse**

Exploring the syntactic licensing conditions of neoclassical bound stems, we verify they can be licensed in two basic situations in BP:

(4) *Syntactic licensing conditions for neoclassical bound stems in BP*

- (i) When categorized by a restricted set of suffixes: *-ico, -ema, -ose, -ante, -onal, -ite*⁶;
(ii) When in a compounding context: *hidr-o-log-ia, antrop-o-morf-ico, neur-o-metr-ia*.

However, these bound stems do not obey any licensing condition concerning the insertion of a theme vowel (henceforth, TV), which is argued to be forced to occur with common nominal free stems (see Harris, 1999; Alcântara, 2003, 2010). This fact suggests that neoclassical bound stems belong to none of the four nominal thematic classes in BP, according to the distribution proposed by Alcântara (2003, 2010)⁷.

The fact that they do not exhibit a TV does not include them in Class IV, of the non-thematic words, since even these words are licensed syntactically. Thus, neoclassical bound stems do not have any thematic class information, resulting, consequently, in their bound character, something we will argue to be related to the absence of categorial information in bound stems, what is responsible for precluding the insertion of a TV post-syntactically (see section 4).

At the same time, we cannot assume that the linking vowel⁸ *-o-*, present in these compounds and in their truncated forms (e.g., *hidroginástica*; *hidro* ‘gym in water’), is a Class I TV, since in compounds as *paulist-ó-logo* ‘someone who studies people from São Paulo’, *epistol-o-graf-ia* ‘study of epistle’

6. It is important to notice that the combination of the suffixes to the stems does not occur uniformly (e.g., *morf-ante; *hidr-onal; *neur-ema).

7. Viz., Class I – ending in /o/; Class II – ending in /a/; Class III – ending in /e/ and Class IV – ending in ∅.

8. In Brazilian Portuguese, the LE is always a vowel. We will, therefore, from now on, refer to this vowel as LE.

and *cam-o-terapia* ‘therapy in bed’, it is not the TV of the first member that is satisfying this position, but the LE *-o-*, which evidences its linking function with no class marker information.

If this vowel were indeed a class marker, it should be *-a*, the Class II TV, which is present in the independent forms *paulista* (‘person from São Paulo’), *epístola* (‘epistle’) and *cama* (‘bed’). However, that is not what happens in SBCs, as can be seen by the ungrammaticality of the following forms: **paulist-a-log-o*, **epistol-a-graf-ia*, **cam-a-terapia*, respectively.

Still, the LE *-o-* cannot be assumed to be the phonetic realization of a category-defining head, since *hidro* exists as a truncated form of a compound (e.g., from *hidrologia* ‘hydrology’, *hidroterapia* ‘therapy in water’, *hidroginástica* ‘gym in water’), but not as an isolated stem which, hypothetically, could be categorized by *-o*, giving rise to a word with a water-like meaning.

(5)

a. **hidr-o*

b. *

$$\begin{array}{c} n \\ \diagup \quad \diagdown \\ n \quad \sqrt{\text{HIDR}} \end{array}$$

Nevertheless, it is not consensual whether neoclassical bound stems have categorial information or not. As Petropoulou (2009) has pointed out, Cannon (1992) and ten Hacken (1994) argue that neoclassical bound stems lack categorial properties, with the latter defending that these elements will only acquire categorial features when they combine with suffixes (e.g., when *antropomorph*, which consists of the bound stems *antropo* and *morph*, is attached to the suffix *-ic*, providing its adjectival category).

Baeskow (2004), on the other hand, assumes the opposite position, defending that all bound stems of classical origin belong to the nominal category without containing any nominalizing suffix. An example of such claim is the word *telephone* consisting only of the bound stems *tele* and *phone*, or the word *microscope*, containing the elements *micro* and *scope*. We will get back to these questions of licensing and categorization in section 4, when we explore how this information gathered until here could be explained in the DM framework, which assumes that roots are category-less by definition.

Examining their inflectional properties, we find evidence that bound stems do not carry any categorial information, something that can be noticed by the fact that inflectional morphemes are attached exclusively to their right-hand edge, as in (6a) and (6b) unlike word-based compounds, as in (6c) and (6d), which have inflectional morphemes also on their left-hand edge member:

- | | |
|---|---|
| (6) a. neur-o-metria-s/*neur-o-s-metria;
neur-LE-metrics-pl./*neur-LE-pl.-metrics;
'neurometrics' | psic-o-terapia-s/*psic-o-s-terapia
psych-LE-therapy-pl./*psych-LE-pl.therapy
'psychotherapy' |
| b. neur-o-metria- zinha /*neur- inh -o-metria;
neur-LE-metria-dim/*neur-dim-LE-metria; | psicoterapia- zinha /*psiqu- inh -o-terapia
psych-LE-therapy-dim/*psyc-dim-LE-therapy. |
| c. sofá- s -cama/ *sofá-cama-s
sofa-pl.-bed/*sofa-bed-pl.;
'sofa-bed' | tren-s bala, *trem bala-s
trains-pl.bullet, *train-bullet-pl.
'bullet train' |
| d. sofá- zinho -cama/ *sofá-cam- inha ;
sofa-small-bed/*sofa-bed-small; | trenz- inho bala/ *trem bal- inha
train-small bullet/*train bullet-small |

Likewise, neoclassical compounds cannot have any derivational morpheme attached to their first member, as in (7a), contrary to word-based morphemes, as in (7b):

- (7) a. #morf-em-o-log-ia; *neur-os-o-log-ia
-em-: nominal derivational affix; -os-: adjective derivational affix
- b. econom-ico-soci-al
-ico-: adjective derivational affix

In sum, neoclassical bound stems in BP display a peculiar morphological behavior when compared to vernacular stems of the language: their bound character. As will be seen in the remainder of the paper, we propose that it is due to the fact that bound stems can only receive categorial information from a strict set of morphemes or by means of a functional projection in compounding contexts, otherwise their use is precluded in grammar (an assumption that is in line with Cannon 1992; ten Hacken 1994, mentioned above).

3. STEM-BASED COMPOUNDS: LINKING ELEMENTS

Linking element, interfix, connective, semantically empty suffix, non-case suffix or linking morphemes are all terms used to describe the same phenomenon: an element occurring in the gap between the two constituents of compounds in a certain group of languages. These LEs appear in different languages as well as in different family of languages (8), and in neoclassical compounds, being very productive in some of them (e.g., German, see Seipel 2005; Russian, see Perkles 2008), and markers of the compounding process in others (Modern Greek, see Ralli 2008; neoclassical compounds, see Amiot and Dal 2007).

(8) (GE) ⁹	hund- e -futter	dog-LE-food	‘dogfood’
(DU)	boek- em -kast	book-LE-case	‘bookcase’
(NO)	arbeid- s -dag	work-LE-day	‘working-day’
(SW)	jord- a -färd	earth-LE-voyage	‘burial’
(LA)	verb- i -velitatio	word-LE-dispute	‘verbal dispute’
(PO)	gwiazd- o -zbiór	star-LE-collection	‘constellation’

(Delfitto, Fábregas, Melloni 2011)

Its occurrence is predominant in compounds that are formed with a stem in the first position, not a word. Thereafter we will focus on explaining some properties of these LEs in neoclassical compounds (section 3.1), and in Modern Greek and Russian compounds (section 3.2).

3.1. Linking elements in neoclassical compounds

We already know, from the characteristics listed by Amiot and Dal (2007:323) presented in (1c), that neoclassical compounds are marked by the presence of a vowel connecting the stems. Their selection is governed by historical rules, related to the etymology of the second member of the compound, following the distribution in (9):

(9) *Linking element (LE) selection in neoclassical compounds*

- a. If the second member of a compound is an Ancient Greek stem, insert the LE *-o-*
- b. If the second member of a compound is an Latinate stem, insert the LE *-i-*

(10) a.	turism-ó- <u>l</u> ogo	term-ô- <u>m</u> etro,	hom-o- <u>f</u> obia	[+Greek]
	‘tourismologist’	‘thermometer’	‘homophobia’	
b.	pragu-i- <u>c</u> ida	ap-i- <u>c</u> ultura	vin-í- <u>c</u> ola	[+Latinate]
	‘pesticide’	‘apiculture’	‘winery’	

Synchronically, there are empirical arguments that make it possible to suggest that the LE *-o-* is the non-marked vowel to be inserted in this linking position, since (i) it is widely found in non-verbal words in BP; and (ii) it is widely found in compounds with the structure [stem word] in that same language, as exemplified in (11):

(11) a.	hidr-o-avião,	psic-o-terapia,	neur-o-transmissor,	eletr-o-choque,	heter-o-normativo
	‘seaplane’	‘psychotherapy’	‘neurotransmitter’	‘electroshock’	‘heteronormative’

9. (GE) = German; (DU) = Dutch; (NO) = Norwegian; (SW) = Swedish; (LA) = Latin; (PO) = Polish.

Moreover, the vowel *-o-* seems to be related to a general LE of stems into compounds in BP, insofar as they are used in compounds where the TV *-o-* would not find a context for insertion, as can be seen with the forms *Kassab-LE-Serr-ist-TV* and *dent-o-bucal*, in (12a) and (12b):

(12) a. *Kassab-o-Serrista*¹⁰ é assim: se for pra ganhar voto vira amigo de Lula e Dilma na hora.¹¹
Kassaboserrista is like this: if it's to win votes they get friends of Lula and Dilma easily.

b. Escovas muco-dental¹² e *dent-o-bucal* específicas para bebês.¹³
 Mucodental and dentibuccal toothbrushes designed for babies.

Nevertheless, the distribution established in (9) does not seem to occur quite regularly, since stems such as *-ducto* [+Latinate] have begun to select the vowel *-o-* as a LE (see Rio-Torto and Ribeiro 2012), and *-metro* [+Greek] seems to have lost the requirement selection provided for Greek-origin stems:

(13) a. *óle-o-duto*, *gas-o-duto*
 ‘oil pipeline’ ‘gas pipeline’

b. *term-ô-metro*, *parqu-í-metro*
 ‘thermometer’ ‘parkmeter’

Contrary to the distribution presented in (9), some scholars discuss the possibility that these LEs be part of one of the compound constituents. In this paper, we assume that neoclassical elements are stems (as already mentioned extensively) – mainly to capture property III, in Table 1, in the same analysis (viz., the ability to derive new words), which brings about the fact that in our view these LEs are dissociated elements. Once dissociated, two hypothesis can be released about the presence of these vowels: (i) a phonological requirement; or (ii) a syntactic requirement (e.g., in Di Sciullo's (2005) functional projection, to be presented beneath).

Considering the already proposed analysis for these vowels in BP neoclassical compounds, we find most scholars assuming they are LEs (see Sandmann, 1989; Laroca, 1994; Kehdi, 2002). The same is assumed by Villalva (2000) and Rio-Torto and Ribeiro (2012) for European Portuguese. Gonçalves (2011), on the other hand, claims that these vowels are part of the first constituent, since they are kept in truncated forms, such as *foto* (from *foto-grafia* ‘photography’), *hetero* (from *hetero-ssexual* ‘heterosexual’), *quilo* (from *quilo-grama* ‘kilogram’), etc. However, such an analysis is a non-economic solution because not only can it not cover the above-mentioned properties, but it also

10. Kassab and Serra are two Brazilian politicians.

11. Data from Facebook

12. Compounds such as muco-dental ‘mucodental’ and vaso-constricção have a dubious interpretation in what relates their internal vowel *-o-*, which can either be considered a Class I TV, since both first stems displays the TV *-o-*, or be interpreted as an LE.

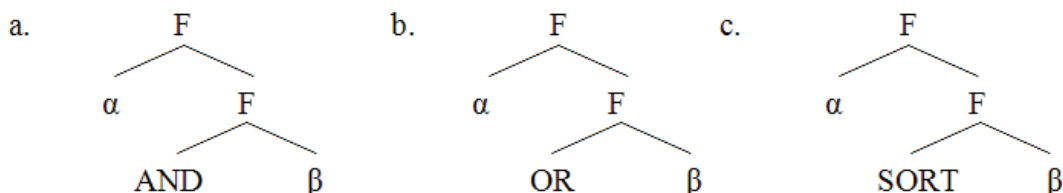
13. <http://www.patentesonline.com.br/escovas-muco-dental-e-dento-bucal-espec-ficas-para-beb-s-e-crian-as-de-baixa-idade-133502.html>, collected in 15/12/2012.

forces the grammar to have two distinct forms available, *hidr-* and *hidro*, in order to account for their derivational properties (e.g. *hidr-ico* ‘hydric’, *hidr-ante* ‘hydrant’).

For the different languages in which these LEs appear, they were assigned various analyses with respect to their status, as listed by Ralli (2008:2): TVs (Scalise, 1992); parts of an allomorphic variant of the first compound constituent (Vogel and Napoli, 1995; Booij, 2005); interradical derivational affixes (Malkiel, 1958; Mel’čuk, 1982); compound markers (Ralli, 2008) and structural functional elements linking the compound parts to each other (Di Sciullo, 2005, 2009).

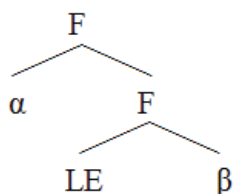
Focusing on Di Sciullo’s (*op. cit.*) proposal, which suggests a lexicalist explanation for compounds, we have that all compounds are built on a functional projection, necessarily legible at the semantic interface (LF), whereas it may also be legible at the phonological interface (PF) (e.g., *hit-and-run*, *win-Ø-win relation*). These functional projections have as their heads operators whose function is to provide the kind of relation existing between the compound constituents (e.g., AND, OR, SORT, IN and WITH), as represented in (14):

(14)



Based on the universality of the functional projections, Di Sciullo (2005, 2009) defends that such projections are required for phonological interpretation in compounds that have LEs¹⁴, such as those from Balkan languages, Modern Greek, Slovenian and others:

(15)



(Adapted from Di Sciullo, 2005:18)

(16) a. pag-o-vun-o
ice-LE-mountain:NEU-NOM:SG
‘ice-berg’

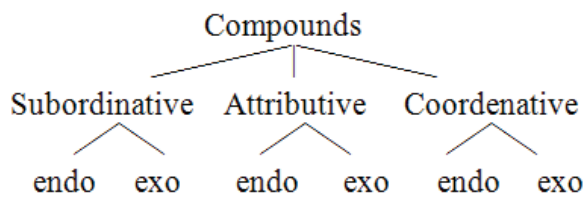
(Modern Greek)

(Adapted from Di Sciullo, 2005:18)

14. LV, in her terms, stands for linking vowel.

For the author, the parts of compounds with a LE in Romance languages and English are linked through a coordination relation (Di Sciullo, 2005:18). However, assuming Bisetto and Scalise (2005), who classify compounds into three macro-levels established according to the different internal grammatical relations present inside the compounds (viz., subordination – predicate-argument relation, attribution – modification relation, and coordination), we can admit that subordination and attribution correspond to a head such as SORT, while coordination corresponds to either AND or OR. Thereby, applying this classification to a set of BP neoclassical compounds, we notice they can belong to all the types provided:

(17) *The classification of compounds (Bisetto and Scalise 2005)*



SUBORDINATIVES

endo	exo
<i>aracnofobia</i>	
arachnophobia	

ATTRIBUTIVES

endo	exo
<i>equoterapia</i>	<i>biodegradável</i>
hippotherapy	biodegradable

COORDINATIVES

endo	exo
	<i>sociocultural</i>
	sociocultural

This indicates that the LE cannot be strictly specified as a head for AND, OR, SORT, or any other operator, since it is a single LE which denotes all the different operators, suggesting it has no morphosemantic relevance, and it is only there to verify a phonological requirement¹⁵. To corroborate this conclusion, we bring some Modern Greek compounds presented in Ralli (2009), which also have a single LE to denote all the semantic relational flavors, impoverishing the conclusion that these vowels carry any semantic or grammatical function:

- (18) a. xaz-o-koritso (Attributive) (Modern Greek)
 silly girl
 ‘silly girl’
- b. mavr-o-aspros (Coordinative)
 black white
 ‘black and white’
- c. nixt-o-puli (Subordinative)
 night bird
 ‘night bird’ (Ralli 2009:458)

15. The distribution in (17) also shows, contrary to what is assumed by Bisetto and Scalise (2005), that neoclassical compounds are not circumscribed to subordinative relations, since some data was also found, in which they have attributive and coordinative readings.

Another striking piece of evidence against any morphosemantic flavor related to LEs was brought to light by Ralli (1992:154) who shows that the presence of the LE in Modern Greek compounds is the result of a phonological requirement responsible for eliminating a sequence of consonants in stem boundaries: in the examples in (19), the LE *-o-* is not inserted before stems beginning with a vowel, since this sequence is phonologically admitted in this context, in Modern Greek, contrary to a sequence of consonants:

- (19) a. *ayriaántropos* < *ayri-* *ántropos*
 ‘savage man’ ‘savage’ ‘man’
- b. *aksiayápitos* < *aksi-* *ayapítos*
 ‘lovable’ ‘worth’ ‘loved’

Such information weakens the argument that LE should be part of a functional projection, relegating them for phonological readjustment rules.

3.2. Compounding in Modern Greek and Russian

In this section, we will briefly present a description of compounding in Modern Greek and in Russian, showing the structural similarities they share with neoclassical compounds.

3.2.1. Modern Greek

Compounding is a widespread process in Modern Greek, a language that generally creates SBCs connected exclusively by a LE *-o-* (e.g. *psar-o-kaiko* ‘fishing boat’ < *psar-(i)* ‘fish’ *kaik-(i)*¹⁶ ‘boat’). As pointed out by Ralli (2009), stems represent an important role in the formation of compounds in Modern Greek. The structures attributed to those elements can be distributed in: (i) [stem stem] (e.g., *ambel-o-xórafo* ‘campo de vinha’ < *ambel-(i)* ‘vine’, *xoraf-(i)* ‘field’); and (ii) [stem word] (e.g. *domat-o-saláta* ‘tomato salad’ < *domát-(a)* ‘tomato’, *salata* ‘salad’) formations. This is similar to what happens in BP neoclassical compounds (e.g., (i) [stem stem] *hidr-o-log-ia* ‘hydrology’; (ii) [stem word] *hidr-o-massagem* ‘massage in water’).

The presence of stems in these compounds, corroborated by the absence of inflectional and derivational morpheme on the first constituent, as in (20), has motivated Ralli and Karasimos (2009) to propose the restriction in (21), for Modern Greek compounds, as well as for any language that has SBCs, namely the *Bare-Stem Constraint*:

- (20) [stem-LE/CM¹⁷-stem-INFL]_{verb} < [stem-LE/CM-stem-INFL]_{noun} [stem-INFL]_v
 a. *anth-o-for-ó* < *anth-o-fór-os* *fer-o*
 ‘carry flowers’ ‘flower-carrier’ ‘carry’

16. Nominative case marking, in order to illustrate the inflected form is not possible when the stem is in a compound environment.

17. Compound Marker.

b. vivli-o-det-ó 'bind books'	<	vivli-o-déti-s 'book binder'	den-o 'bind'
c. dani-o-dot-ó 'give a loan'	<	dani-o-dóti-s 'loan giver'	din-o 'give'

(Ralli 2010)

(21) *Bare-Stem Constraint* (Ralli and Karasimos 2009)

The cohesion of a compound is better guaranteed if the first stem is as bare as possible.

This restriction precludes the overt realization of phonological material, but for those of the first stem. Furthermore, this constraint requires a strong structural bond between their two basic constituents, namely the LE, to ensure a better cohesion of its internal structure.

As for their similarities with BP neoclassical compounds, one can say that: (i) the Greek LE is semantically empty (see Ralli, 2008, 2009, 2010), what can be endorsed by the data in (18); (ii) the compounds are inflected only at the right-hand edge, as presented in (20); and (iii) they have their category assigned by derivational morphemes also present solely at the right-side edge of the compound.

3.2.2. Russian

Many compounds in Russian are stem-based, and consequently, require the presence of LEs, namely *-o-* or *-e-* connecting them. These LEs do not carry any semantic information, functioning only as a connector (see Perkles, 2008:60):

(22) a. sam-o-pis-ec auto-EL-white-noun mark 'fountain pen'	<	sam auto/self	pis-at write-verb mark	(Russian)
b. mor-e-plava-tel sea-EL-sail-noun mark 'sea sailor'	<	more sea	plava-t sail-verb mark	
c. perv-o-klass-nik first-EL-class-agentive noun 'first-class boy'	<	perv-yj first-m.sg	klass class	
d. vol'n-o-dum-stvo free-EL-think-noun mark 'free thinking'	<	vol'n-yj free-m.sg	dum-at think-verb mark	

The distribution of these LEs is related to the final consonant of the first constituent. While vowel *-o-* (pronounced /a/ in unstressed sequences) is the non-marked form to occupy this linking position

(e.g., *beton-o-meshalka* ‘concrete mixer’, *hleb-o-zavod* ‘bread factory’, *glubok-o-myslie* ‘profundity of thought’), the vowel *-e-* (pronounced /je/) occurs when the final segment of the first constituent is a coronal or a strident consonant (e.g., *neft’-e-pravod* ‘pipeline’, *furazh-e-meshalka* ‘forage mixer’, *pesh-e-hod* ‘pedestrian’) (see Koutsantoni, 2005 *apud* Ralli, 2008).

Beyond that, it is noteworthy that there are also word-based compounds in Russian, as pointed out by Gouskova & Roon (2009), in which each constituent has inflectional information, such as *gús-i-lébed-i* ‘geese (nom.pl) and swans (nom.pl)’, and that their head position is mostly at the right-hand side (see Gouskova, 2012).

4. THE FORMAL STRUCTURE OF NEOCLASSICAL AND STEM-BASED COMPOUNDS

In the following sub-sections, we will come up with a hypothesis about neoclassical and SBC. From now on, we will refer to both of them using a single term, namely SBC, since they share the same morphological properties as presented above. We first briefly present the essentials of the DM framework, which grounds our hypothesis; subsequently, we discuss the idea of a single category-defining head for two roots¹⁸ and its consequences for the claims assumed in this theory. Lastly, we outline the syntactic derivation and the structure linearization processes, as well as the way this configuration leads to the insertion of the LE.

4.1. Distributed Morphology

DM is a non-lexicalist theory of grammar, first presented by Halle and Marantz (1993), which proposes that grammar contains no generative Lexicon. This means that the derivation of words takes place in the same generative component where sentences are generated. Such assumption leads to a syntactocentric architecture of grammar, in which the syntactic component is the only one responsible for combining the grammar primitives in order to generate complex structures – whether words or sentences.

In this approach, what was typically assumed to be lexical information is distributed through the architecture of grammar (hence the name of the framework) in the form of lists. *List 1* contains the primitives that enter the syntactic computation (viz., roots and grammatical features, such as [past], [pl]). *List 2* contains the Vocabulary Items (henceforth, VI), that is, connections between sets of grammatical features and their phonological relevant features, and *List 3* contains the encyclopedic entries that relate VIs to meanings.

As a result, the architecture of grammar suffers some reformulations, being represented in Figure 1 below:

18. DM primitive.

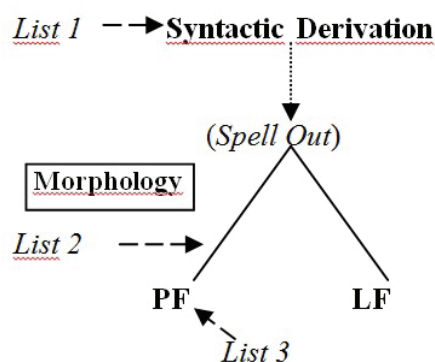


Figure 1: Architecture of Grammar

In this framework, roots are assumed to be category-less. It is their attachment to a category-defining head (*v*, *n*, *a*; e.g., [root + *n*]) that determines whether they are verbs, nouns and adjectives. Such category-defining heads are considered to be universal (see Chung 2012:46), and the categorization of a root serves as an immediate environment to provide the root interpretation (Marantz 2001; Arad 2003).

As could be noticed, DM does not have a primitive that stands for a “word”. However, the theory relies on a set of primitives – roots and abstract morphemes – and on a set of procedures for combining them, generating thereby *complex heads*. Given these assumptions, it is worth asking: what comes to be a compound for DM? We will try to answer this question after discussing the consequences of the acategorical root hypothesis for SBCs data.

4.2. Acategorical root and its implications

The assumption that roots are category-less in DM and that the categorial information is inserted only after the concatenation of a category-defining head is consensual among many theoreticians (see Marantz 1997, 2001; Arad, 2003, 2005; Embick and Marantz 2007). Other non-lexicalist approaches, such as the exoskeletal approach (see Borer 2003, 2005), also share this assumption.

As it has been argued so far, SBCs seem to carry just a single category-defining head, situated at the compound right-hand edge, which is responsible for assigning the category to the compound constituents as a whole. Under DM assumptions, the proposal can be rewritten as follows: (i) first position root is not categorized; and (ii) the two roots forming a compound are categorized by a single category-defining head.

Evidence for this proposal is given by the impossibility of concatenating inflectional or derivational morphemes in the first position root, as described in section 2¹⁹, and repeated with the data in (23). The addition of categorial information to a root must be prior to the addition of inflectional information. Thus, it is the absence of a category-defining head attached to the first compound root that causes the

19. This also reflects Ralli and Karasimos' Bare-Stem Constraint, presented in 0

absence of inflectional or derivational morphemes inside the compound structure, differently from word-based compounds in (24), which are capable of receiving inflectional information in both roots, since each of them is categorized independently:

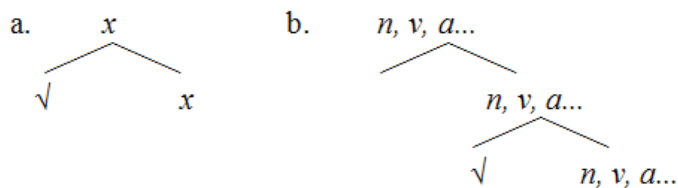
(23) a. (BP)	*neur-o-s-transmissor; neur-LE-pl-transmitter	*psic-o-s-terapia psyc-LE-pl-therapy
b. (GR)	*ambel-i-o-xórafo; vineyard-nom.sg-LE-field 'vineyard field'	*ríz-i-o-γalo rice-nom.sg-LE-milk 'rice pudding'
c. (RU)	* vol'n-yj-o-dum-stvo; free-adj.nom.sg.masc-LE-think-n 'free thinking'	*perv-yj-o-klass-nik first-adj.nom.sg.masc-class-n 'first-class boy'
(24) a. (BP)	sofá-s-cama sofá-pl-bed 'sofa-bed'	tren-s bala train-pl-bullet 'bullet train'
b. (GR)	ksana-γράφο again-write 'write again'	eksó-porta ²⁰ out-door 'outdoor'
c. (RU)	gús-i-lébed-i goose-nom.pl.masc-swan-nom.pl.masc 'goose and swan'	

However, the so-called Marantz-Arad approach argues that roots are assigned an interpretation in the environment of the first category-defining head to which they are merged, and once this interpretation is assigned, it is carried along throughout the derivation. If this assumption is right, a one-time categorization for two roots, as suggested in this paper, will find problems explaining how the compound roots have their meanings established, since they receive a late category-defining head insertion during the derivation.

In such an approach, Arad (2003) shows that there is a difference between: (i) creating words from roots (i.e., merging a category-defining head directly to a root), as in (25a); and (ii) creating words from existing words (i.e., from roots already merged with some category-defining head), as in (25b). The main difference is that in (i) roots may have idiosyncratic meanings, whereas in (ii), the second category-defining head has no direct access to the root, but only to the already established meaning of its first categorization, which causes the resulting meaning to be predictable.

20. Ralli (2009) comments there are few compounds in Modern Greek in which the first constituent is a word. Data as these are found when the first constituent is an adverb or a numeral.

(25)



(Arad 2003:738)

One example to illustrate these locality constraints on the interpretation of roots is in (26), with the Hebrew root $\checkmark xšb$:

(26) $\checkmark xšb$

a. CaCaC	<i>xašav</i>	‘think’	(Hebrew)
b. CiCCeC	<i>xišev</i>	‘calculate’	
c. hiCCiC	<i>hexšiv</i>	‘consider’	
d. hitCaCCeC	<i>hitxašev</i>	‘be considered’	
e. taCCiC	<i>taxšiv</i>	‘calculus’	
f. maCCaCa	<i>maxšava</i>	‘thought’	
g. maCCeC	<i>maxšev</i>	‘computer’	
h. CiCCeC	<i>mixšev</i>	‘computerize’, from <i>maxšev</i> ‘computer’	
i. CiCCon	<i>xešbon</i>	‘account, arithmetic, calculus, bill’	
j. hitCaCCeC	<i>hitxašben</i>	‘settle accounts with someone’, from <i>xešbon</i> ‘account’	

(Arad 2003:750)

In Hebrew, categorial heads are vocalic patterns (e.g., CaCaC), which fill unpronounceable tri-consonantal roots (e.g., $\checkmark xšb$), providing them categorial and grammatical information (e.g., voice alternation) as well as pronunciation. As we can see in (26), the formation of (26a) until (26g) occurs with the insertion of a specific vocalic pattern – categorial head – directly in the root, enabling it to acquire multiple meanings in Arad’s vision. On the other hand, the formation of (26h) and (26j) is derived from (26g) and (26i), respectively, which causes the meaning of those words to be based on the already negotiated meaning of their first categorization (i.e., in (26g) and (26i)). For these reasons, locality becomes essential in the DM framework, since the root meaning is negotiated from the point of the derivation in which the categorizer is merged.

On the other hand, Borer (2009a, 2009b) presents a different analysis, pointing out that it is not entirely verifiable the first categorizer plays a key role in the interpretation of the root, since Hebrew also have words with idiosyncratic meanings, even after the second categorizer is merged, which would not be expected according to Arad’s claims (2003, 2005).

(27) a. Underived noun: [_N*bayit*] à [_V*biyet*]
 ‘house’ ‘domesticate’

But also: [_V*hitbayet*]
 ‘focus on something’ (e.g., a missile)

Borer (*op. cit.*) argues that [_N*xešbon*] ‘account’ does not have the ‘settle account/retaliate’ meaning that appears in its derivative [_V*hitxašben*], in the example (26j), being a problem of literally translation from the English idiom, rather than derived from the Hebrew noun. More examples of idiosyncrasies outside the root domain are found in other Hebrew verbs, such as √*xrb* ‘having to do with destruction, desolation’, in which the derived noun *xerbon* ‘a disaster, a failure, a mess’ has subsequent verbal derivations containing idiosyncratic meanings, as : (i) *xirben* a. caused a disaster, a failure, a mess / b. defecated; and (ii) *hitxarben* a. endured a disaster, a failure, a mess / b. started to menstruate.

Given that locality constraints on root categorization is not strictly necessary, as advocated in the Marantz-Arad approach, we see no empirical problems in assuming that two roots can be categorized by a single category-defining head, since empirically, there is evidence that the first compound constituent is deprived of the possibility to have any grammatical or derivational information attached to it, what, in our view, triggers the presence of a LE (as we will show in sub-section 4.3)²¹.

Hence, removing the categorization requirement for negotiating the root meaning, we assume the categorization only constitutes a domain capable of sending part of the syntactic derivation to the interface levels (i.e., category-defining heads are phase heads that trigger the Spell-Out of the syntactic structure), but the meaning negotiation seems to be dissociated from the first categorization, and must be accounted for by List 3 (i.e., Encyclopedia) post-syntactically.

4.3. The linking element hypothesis

Having described the theoretical model under which our hypothesis is grounded and the syntactic contexts in which categorization is needed, we will now describe how a SBC is structured, focusing on the grammatical relations that emerge from the combination of two roots in a compound and from the presence of a LE.

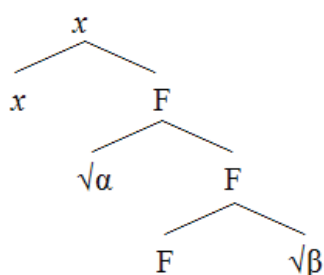
In formal analysis, the heterogeneity of the internal grammatical relations present in compounds can be captured by functional projections that carry semantic operators (e.g. SORT, AND, IN), as proposed by Di Sciullo (2005, 2009). The author suggests that LEs provide evidence for the presence of a functional projection in compounds. Her generalization, however, cannot account for neoclassical compounds if we assume that *-o-* is the exponent of AND exclusively, since three different vowels *-o-* would be necessary (o₁ -SORT-, as in *equ-o-terapia*, o₂ -AND-, *agr-o-silv-o-pastoril*, and o₃ -IN-, *hidr-o-ginástica*). Likewise, assuming that the LE is what fills these functional projection heads also cannot explain data from Modern Greek and Russian.

21. Zhang (2007) and Zwitserlood (2008) also argue that compounds may be formed by two roots directly merged, receiving lately their categorial information, based on an amount of other grammatical facts presented by Chinese and Sign Language of the Netherlands’ data.

Nevertheless, Di Sciullo's proposal has some interesting points, since the absence of semantic information in LEs only prevents their appearance as a head of these functional projections. Therefore, we defend that LEs in SBCs are not relevant for syntax, because they do not carry any grammatical or semantic information, in the sense employed by the author, but they are the result of phonological requirements made to the compound structure at the morphological component.

Therefore, we maintain the assumption that these functional projections are present in the compounds structure, but their heads are phonologically empty. Thus, we assume that a SBC has the generic structured depicted in (28). As a result, the compounds explored in this paper are structured as in (29), (30) and (31):

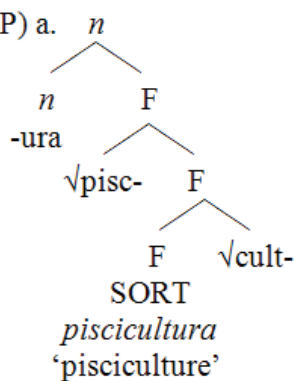
(28)



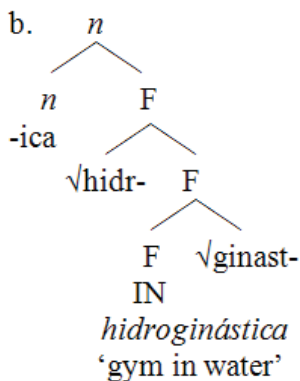
In which x : v , n , a ; and
 F: SORT, AND, OR, IN, WITH.

(29)

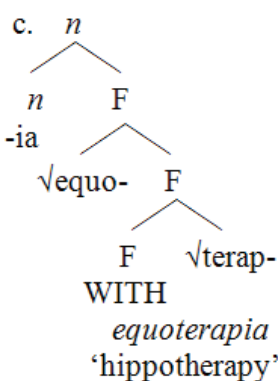
(BP) a.



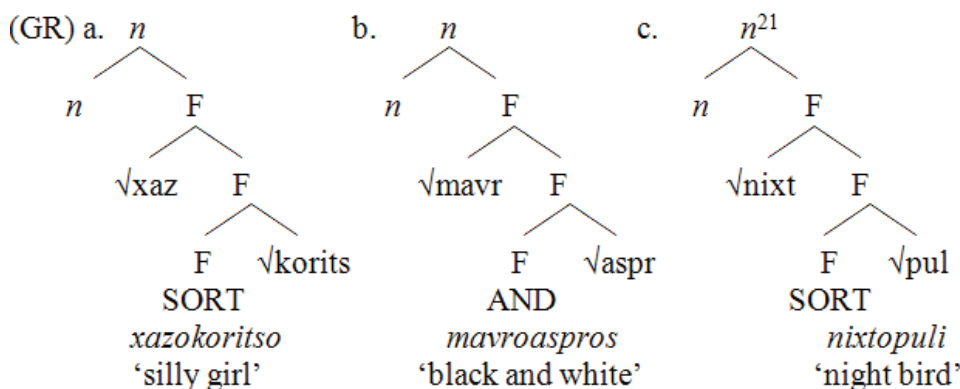
b.



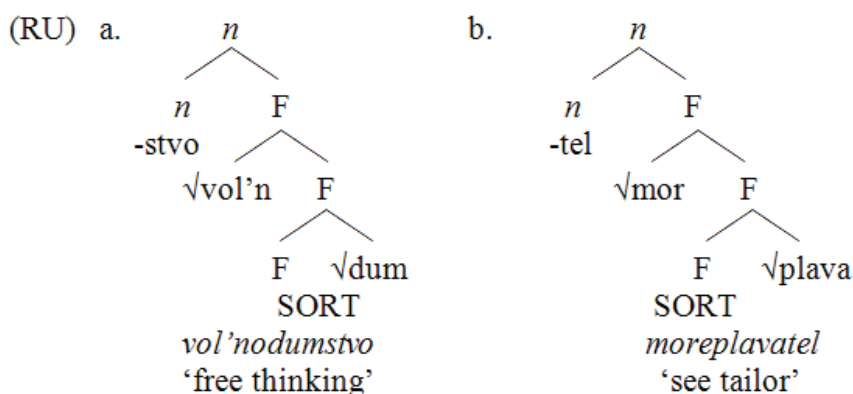
c.



(30)



(31)



The structures in (29), (30) and (31) describe the way a SBC is structured: two roots are joined by a functional head, in which the modifier root c-commands the modified one, and the internal relation between them is provided by an operator serving as head. The categorial information is added by a category-defining head that takes the functional projection containing the roots as a complement. The LEs will be inserted in the path to PF, when linearization takes place, and their selection – in cases where there is more than one LE available – is governed by language-specific rules.

Given that the linearization process occurs before Vocabulary Insertion, according to Embick and Noyer (2001), it is the linear adjacency of two roots (i.e., $\sqrt{\beta} \oplus \sqrt{\alpha}$, where the first ends in a consonant and the second begins with a consonant) that will trigger the LE insertion. As we have already said, its distribution is language-specific, motivated according to this phonological environment.

Modern Greek, for example, requires only the vowel /o/ to be inserted between two linearized bare roots. In Russian, the first root phonological constituency will indicate whether the LE is /o/ or /je/, and finally, for BP neoclassical compounds, we admit there is a diacritic 'ʹ' in the marked contexts, namely, Latinate second root position (e.g., *cid-*, *cultur-*, *-voro-*, *-fug*), which requires the insertion of the marked vowel /i/, while the vowel /o/ is inserted elsewhere.

(32) *Rules for linking element insertion*

(GR) When $\sqrt{\beta}$ ends in a consonant and $\sqrt{\alpha}$ begins with a consonant, insert the vowel /o/ right after $\sqrt{\beta}$.

(RU) When $\sqrt{\beta}$ ends in coronal or strident consonants, insert the vowel /je/ right after $\sqrt{\beta}$. In other contexts, insert /a/.

(BP) When $\sqrt{\beta}$ ends in a consonant and $\sqrt{\alpha}$ begins with a consonant, insert the vowel /i/ right after $\sqrt{\beta}$, just if $\sqrt{\alpha}$ contains the diacritic $\acute{}$. In other contexts, insert /o/.

Thus, the resulting sequence from linearization requires the insertion of LEs, which are regulated by phonological rules according to the quality of the roots in the phonological context, or for a diacritic when its insertion is a historical residue. With this proposal, we explain how SBCs have their semantic relations between the compound constituents, following Di Sciullo's proposal of functional projections, and how their LEs are inserted in the product generated by the computational device.

5. FINAL REMARKS

Neoclassical compounds and SBCs can be seen as closely linked, due to their various structural similarities. The data presented in this paper show that it is not obvious there is a category-defining head in the compound first constituent, causing the whole structure to be categorized by a single categorial head. The LE present in this type of compounding does not have any semantic information in the languages under study (see Ralli 2009, for Modern Greek; Perkles 2008, for Russian), being strictly inserted in order to satisfy a phonological requirement.

Formally, our analysis shows that, in DM, roots are combined by means of a functional projection to give rise to a compound, that besides connecting the roots also carries semantic information, such as SORT, AND, OR, IN or WITH, following Di Sciullo's (2005, 2009) proposal. For SBCs, this functional projection head is phonologically empty, and when the structure is linearized at PF, the pruning of this head triggers the LE insertion between the roots, since they will be linear adjacent, receiving then a LE inserted by language-specific rules.

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