

# Morphology–phonology interface: Phonological domains in Greek compounds<sup>1</sup>

MARINA NESPOR and ANGELA RALLI

## Abstract

*This paper deals with a case of morphology — phonology interaction, specifically, stress in Greek compounding. It is claimed that two types of compounds are distinguished with respect to the stressing procedure: a) [stem + stem] compounds, submitted to the application of the antepenultimate stress rule, and b) [stem + word] and [word + word] compounds, governed by stress preservation. On the basis of this analysis, a principle is proposed that, given the morphological structure of a certain compound type, predicts its mapping onto either one or two phonological words. Additional evidence from Italian is offered to support the analysis.*

## 1. Introduction

Greek compounds are not characterized by having a uniform stress pattern. Rather, in some cases, there is just one primary stress located on either the penultimate or the antepenultimate syllable, independently of the location of stress on the compound's members in isolation:<sup>2</sup>

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1. A preliminary version of this paper has been presented at the First International Conference on Greek Linguistics held in Reading, England in September 1993. A shortened version of that presentation has appeared in the proceedings of the conference. A talk based on this paper was given also at the University of Thessaloniki in April 1994. We would like to thank the audience of Thessaloniki, Amalia Arvaniti and Sharon Peperkamp for useful comments.
  2. Throughout this paper, Greek examples are given phonologically, according to the characters of the International Phonetic Alphabet. Word secondary and word primary stresses are marked according to standard notation: a grave accent (˘) stands for word secondary stress, an acute accent (ˊ) for word primary stress. When relevant to the discussion, a stress that is stronger

- (1) a. *kuklóspito* < *kúkla* *spíti*  
 'doll's house' 'doll' 'house'  
 b. *spirtokúti* < *spírto* *kutí*  
 'match box' 'match' 'box'

In other cases, the only primary stress is situated on the syllable that bears primary stress on the compound's second member:

- (2) a. *pefkoðásos* < *péfkō* *ðásos*  
 'pine forest' 'pine' 'forest'  
 b. *xartopetséta* < *xartí* *petséta*  
 'paper napkin' 'paper' 'napkin'

Yet in other cases, the compound bears two stresses, one on each syllable that bears primary stress when the two members are pronounced in isolation:

- (3) a. *zóni asfalías* < *zóni* *asfalías* (GEN.SG)  
 'security belt' 'belt' 'security'  
 b. *nómos plésio* < *nómos* *plésio*  
 'law frame' 'law' 'frame'

No satisfactory analysis of the stress pattern of compounds is available, to our knowledge, in the literature.<sup>3</sup> In this paper, we will offer an analysis of the facts introduced above based on both the morphological and the phonological analysis of the different compound types. In particular, we will propose that while the difference in stress between (1) and (2) is partly due to a different order in the application of the word formation rules, and partly to specific inherent stress properties of the word's morphological constituents, the difference between (1) and (2) on the one hand, and (3) on the other hand, is due to the fact that while the first two are the result of lexical processes, the third is the result of a postlexical composition and thus of a different analysis into phonological constituents. In addition, we will make a proposal concerning the location of stress in the compounds illustrated in (1), the only ones, we will

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than the word primary stress is marked with "'". Greek compounds, as well as compounds in many other languages, may contain more than two members. Exclusively, examples of two-member compounds will be used in this paper, since, as far as stress is concerned, all nonfinal members behave in a similar way.

3. For the stress of the compounds illustrated in (1) the proposal is advanced in Nesper and Vogel (1986) that its location depends on the quality of the last vowel: if it is a back vowel the stress falls on the antepenultimate syllable, if it is a front vowel, the stress falls on the penultimate syllable. A different analysis of these facts will be advanced in the present paper. For a different perspective on the ways in which morphosyntax influences the stress pattern of compounds, see Malikouti-Drachman and Drachman (1989); Drachman and Malikouti-Drachman (1992). We will not discuss here the various claims about compounds made in the above mentioned papers, but exclusively those relevant to our discussion of stress.

argue, to which a compound's stress rule applies. For the others, in fact, the location of stress follows from the principle of stress preservation (cf. Burzio 1994).

This paper consists of six sections: Sections 1 and 2 contain a brief sketch of the morphological structure of Greek compounds and an analysis of Greek compounds into prosodic constituents, respectively; this analysis is followed, in section 3, by an account of the word internal stress properties of Greek. In section 4, the main proposal of this paper is advanced. Section 5 offers some evidence that an analysis similar to that proposed for Greek can also account for the stress of compounds in other languages, specifically Italian. Section 6 contains some concluding remarks together with a few observations about the way in which the components of the grammar interact in the specification of the different processes of composition.

## 2. A brief sketch of the morphology of Greek compounds

It is proposed in Malikouti-Drachman and Drachman (1989) and in Ralli (1989, 1991, 1992), that the morphology of Greek compounds exhibits one of three structural patterns: They are formed by joining together (a) two stems ([stem+stem]), (b) a stem and a word ([stem+word]) or (c) two words ([word+word]), as illustrated in (4), (5) and (6), respectively.<sup>4</sup>

### (4) [stem + stem] (type 1)

- |    |                  |   |             |             |
|----|------------------|---|-------------|-------------|
| a. | <i>anθókipos</i> | < | <i>anθ-</i> | <i>kip-</i> |
|    | 'flower garden'  |   | 'flower'    | 'garden'    |
| b. | <i>tirópita</i>  | < | <i>tir-</i> | <i>pit-</i> |
|    | 'cheese pie'     |   | 'cheese'    | 'pie'       |

4. It should be noticed that both [stem + stem] and [stem + word] compounds contain the vowel [o] between their first and second member. This vowel is not an inflectional ending, but should rather be considered a linking vowel making the transition between the first and the second constituent of a compound structure (cf. among others, Ralli 1988, 1992). Notice that the vowel does not generally occur before items beginning with a vowel, as in (5a) and (5d), unless the compound consists of a coordination, as may be seen in (i). The inflectional ending of the first member is put within brackets to indicate that it does not take part in composition.

- |        |                        |   |                   |                   |
|--------|------------------------|---|-------------------|-------------------|
| (i) a. | <i>elinoamerikános</i> | < | <i>élin(as)</i> + | <i>amerikános</i> |
|        | 'Greek-american'       |   | 'Greek'           | 'American'        |
| b.     | <i>pijenoérxete</i>    | < | <i>pijén(i)</i> + | <i>érxete</i>     |
|        | '(he) comes and goes'  |   | '(he) goes'       | '(he) comes'      |

As is clear from the examples, the vowel preceding the second compound's member is different from the inflectional ending its first member would have in isolation.

- |    |                   |   |               |              |
|----|-------------------|---|---------------|--------------|
| c. | <i>xrisóskoni</i> | < | <i>xris-</i>  | <i>skon-</i> |
|    | 'golden powder'   |   | 'golden'      | 'powder'     |
| d. | <i>karavópano</i> | < | <i>karav-</i> | <i>pan-</i>  |
|    | 'sail cloth'      |   | 'ship'        | 'cloth'      |
- (5) [stem + word] (type 2)
- |    |                     |   |               |                |
|----|---------------------|---|---------------|----------------|
| a. | <i>kreatayorá</i>   | < | <i>kreat-</i> | <i>ayorá</i>   |
|    | 'meat market'       |   | 'meat'        | 'market'       |
| b. | <i>tamosaláta</i>   | < | <i>taram-</i> | <i>saláta</i>  |
|    | 'caviar salad'      |   | 'caviar'      | 'salad'        |
| c. | <i>elafokiniyós</i> | < | <i>elaf-</i>  | <i>kiniyós</i> |
|    | 'deer hunter'       |   | 'deer'        | 'hunter'       |
| d. | <i>xrisavjí</i>     | < | <i>xris-</i>  | <i>avjí</i>    |
|    | 'golden dawn'       |   | 'golden'      | 'dawn'         |
- (6) [word + word] (type 3)
- |    |                       |   |                |                |
|----|-----------------------|---|----------------|----------------|
| a. | <i>nómos plésio</i>   | < | <i>nómos</i>   | <i>plésio</i>  |
|    | 'law-frame'           |   | 'law'          | 'frame'        |
| b. | <i>atomikí vómva</i>  | < | <i>atomikí</i> | <i>vómva</i>   |
|    | 'atomic bomb'         |   | 'atomic'       | 'bomb'         |
| c. | <i>omáda eryasías</i> | < | <i>omáda</i>   | <i>eryasía</i> |
|    | 'working group'       |   | 'group'        | 'work'         |
| d. | <i>pedí thávma</i>    | < | <i>pedí</i>    | <i>thávma</i>  |
|    | 'wonder boy'          |   | 'boy'          | 'wonder'       |

The main motivation to distinguish [stem + stem] from [stem + word] compounds comes from inflection: The inflectional endings of items belonging to the [stem + stem] compounds are, in general, not the same as the endings of the compound's second member when used as an autonomous word, as shown in (7).

- |     |    |                    |        |               |
|-----|----|--------------------|--------|---------------|
| (7) | a. | <i>nixtolúludo</i> | versus | <i>lulúdi</i> |
|     |    | 'night flower'     |        | 'flower'      |
|     | b. | <i>omorfópedo</i>  | versus | <i>pedí</i>   |
|     |    | 'pretty child'     |        | 'child'       |
|     | c. | <i>sklirókarðo</i> | versus | <i>karðjá</i> |
|     |    | 'hard hearted'     |        | 'heart'       |
|     | d. | <i>merónixto</i>   | versus | <i>níxta</i>  |
|     |    | 'day and night'    |        | 'night'       |

The inflectional endings of [stem + word] compounds, instead, always correspond exactly to the ending their second member has when used as an autonomous word, as seen in (8).

- (8) a. *eθnofrurós* cf. *frurós*  
 country-guard 'guard'  
 'militiaman'
- b. *psixokóri* cf. *kóri*  
 soul-daughter 'daughter'  
 'adopted daughter'

As to the motivation to attribute the structure [word + word] to the compounds illustrated in (3), this is based on the fact that both members are regularly inflected, exactly as two words belonging to a syntactic phrase. That is, the compound's inflection is on the head, while the nonhead member is inflected either independently or according to agreement requirements. In *zónes asfaltas* 'safety belts' (literally 'belts of security') for example, the plural inflection is at the end of the first member, while the second member maintains its genitive Case. In *dimósii ipálili* 'public servants', instead, the plural inflection appears at the end of both members: The second member because it is the nominal head and the first because it is an adjective that agrees with it. This is why these compounds have been defined in Ralli (1992) "phrasal compounds". Their compound's like behavior consists in the impossibility of affecting them with a syntactic operation, for example, movement or insertion, as well as, in some cases, semantic opacity. That is, type-3 compounds are not identified as compounds on the basis of their phonological characteristics.<sup>5</sup>

The fact that of the four logical possibilities of binary composition of stems and words one is missing, that is [word + stem], is due to the impossibility that characterizes Greek morphology of generating a word (in this case a compound) with internal inflectional suffixes. Since a stem becomes a word after inflection, this would be the case in the structure [word + stem]. Compounds with the structure [word + word] are the result of a postlexical phrasal formation rather than a morphological one; the same restriction, therefore, does not hold for them.

### 3. The phonological structure of Greek compounds

In this section, we will consider the effect that these structures have on the phonological analysis of the different compound types. We will assume a phonological component divided into lexical and postlexical phonology (cf. among others, Kiparsky 1985; Kaisse 1985; Mohanan 1986). Lexical phonology is responsible for the phonological shape of words in isolation, and, in addition, only for those phonological properties that are the result of structure preserving rules; these rules are often triggered by certain morphemes and not by others

5. But see Ralli (1992) for further justification of the three different analyses.

and are independent from speech rate and style.<sup>6</sup> The phonological structure available in the lexicon includes the analysis of a string into syllables, feet and phonological words. That is, the prosodic structure up to the level of the word is built in the lexicon (cf. Booij and Lieber 1992).

Postlexical phonology, instead, is responsible for all the regular phonological processes, that is, those processes that do not refer to specific morphosyntactic categories, but rather apply throughout a string independently of the specific morphosyntactic items that the string includes. Postlexical phonology includes prosodic phonology, the phonology of rhythm and the phonology of intonation. For the purposes of this paper, only the first of the three is relevant.

Prosodic phonology is a theory of the organization of a string into phonological constituents; among the different functions of prosodic constituents there is that of serving as domains of application of phonological rules. That is, for each category, there is a set of rules which apply within it, thus determining different degrees of cohesion among the elements that compose a string. The lowest the constituent, the highest the cohesion (cf. among others, Selkirk 1981; Nespov and Vogel 1986; Hayes 1989). In postlexical phonology, the prosodic categories up to the word level are already present, since, as has been said above, they are built in the lexicon. The prosodic categories above the word level, which, we will assume, include the clitic group, the phonological phrase, the intonational phrase and the phonological utterance, are built postlexically through rules that map syntactic structure, as well as specific aspects of semantic structure onto phonology. Among the most cogent arguments to have a phonological organization into constituents next to the morphosyntactic one is the fact that the two are not necessarily isomorphic to each other.

The two phonological categories most relevant for the present discussion are the phonological word and the phonological phrase.<sup>7</sup> We would like to propose

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6. It must be noticed that Lexical Phonology does not contain exclusively word level rules: A language may have a few allomorphic alternations phonologically determined at the level of the phrase, such as the alternation of the English indefinite article *a/an* or of the Italian definite article *il/lo*. These phrasal allomorphs together with the frames that determine the environment in which each is selected, belong to the domain of lexical phonology as well (cf. Hayes 1990; Nespov 1990).

7. The domain of the phonological word as well as the relative prominence within it varies to a certain extent from language to language; for Greek, the domain includes a stem (and more than one, as we will see, in the case of type-1 and type-2 compounds) plus all adjacent affixes. The strongest element is the rightmost foot. That is, main stress in Greek falls on one of the last three syllables of a word.

As to the domain and the relative prominence of the phonological phrase, we assume here the definition given in Nespov and Vogel (1986), which we report under (i) and (ii). (Recall that the constituent of the prosodic hierarchy immediately below the phonological phrase is the clitic group).

(i) The domain of a phonological phrase consists of a clitic group which contains a lexical head (X) and all the clitic groups on its nonrecursive side up to the clitic group that contains another head outside of the maximal projection of X.

that, in spite of their different stress pattern, both the [stem+stem] and the [stem+word] type of compounds constitute one single phonological word and are thus nondistinct, in their surface phonological structure from noncompound words, while the [word+word] compounds constitute a phonological phrase and are thus phonologically nondistinct from adjacent words in specific syntactic relations (cf. Nespor and Vogel 1986). In the present section, we will motivate this proposal, independently of the specific stress pattern of the various compounds, to which is devoted the following section.

The first motivation to assign to the first two types of compounds the status of phonological word is that, independently of its specific location, they have just one word primary stress. There may be another stress to the left of it, but this is a secondary stress, similar to the secondary stress that may appear, for rhythmic reasons, in noncompound words, as shown in (9) and (10) below for the compounds of the first and second type respectively.

- (9) a. Compound: *màvrovúni* 'black mountain'  
 b. Derivative: *sòfrosíni* 'wisdom'
- (10) a. Compound: *pàtatokeftés* 'potato ball'  
 b. Derivative: *kàlierjitts* 'cultivator'

In spite of the fact that, in both (9) and (10), the first example is a compound and the second a noncompound word, their stress pattern is the same: Main stress on the penultimate syllable for (9) and on the last syllable for (10), and, in the appropriate rhythmical context, a secondary rhythmic stress on the first syllable.<sup>8</sup>

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Since Greek is a right recursive language, the phonological phrase contains a head plus everything on its left until another maximal projection is reached. The relative prominence within a phonological phrase is such that the strongest element is to the right in right recursive languages and to the left in left recursive languages:

- (ii) In languages whose syntactic trees are right branching, the rightmost node of the phonological phrase is labeled strong; in languages whose syntactic trees are left branching, the leftmost node of the phonological phrase is labeled strong. All sister nodes are labeled weak.
8. The surface location of secondary rhythmic stress is generally considered to be determined by the rhythmical contour of the utterance, in that it must respect the principle of rhythmic alternation, which forbids both clashes and lapses (cf. Selkirk 1984; Nespor and Vogel 1989 and specifically for Greek, Nespor 1989). The location of secondary stress is thus characterized by a certain degree of optionality. We believe the stress patterns indicated in (9) and (10) to be the most common. In Arvaniti (1992), it is shown on the basis of experimental data based on the speech of four subjects, that no acoustical evidence for rhythmic stress is found in Greek. Whether or not rhythmic stress belongs to the competence of native speakers of Greek, is not relevant to the observation that the a- and b-members of (9) and (10) are perceived as having a similar rhythmic pattern. It is, however, important to observe that a certain amount of variability is present in the stress pattern of Greek and it could be in this case, too. One of the disputes about Greek stress, for example, concerns clitic groups that require the addition of a

The second motivation to consider these types of compounds just one phonological word is that two span rules bound to the domain of the clitic group, that is rules that apply within a clitic group no matter what is its internal analysis into constituents, but never across two clitic groups, apply within these compounds as well.<sup>9</sup> Were the two members of these compounds two separate phonological words, they would belong to different clitic groups and these rules should be blocked from applying. These are the two assimilation rules of progressive nasal homorganic assimilation and of regressive stop voicing assimilation (cf. Nespó and Vogel 1986).<sup>10</sup> In (11), it is shown that these rules apply across the two members of [stem + stem] compounds (type 1).

- |      |    |                   |   |                   |                |
|------|----|-------------------|---|-------------------|----------------|
| (11) | a. | <i>panpóniros</i> | → | <i>pambóniros</i> | ‘very cunning’ |
|      | b. | <i>pánplutos</i>  | → | <i>pámblutos</i>  | ‘very rich’    |
|      | c. | <i>pankózmios</i> | → | <i>pangózmios</i> | ‘universal’    |

As far as [stem + word] compounds (type 2) are concerned, to our knowledge, there is no example in which the first member ends in a nasal consonant. In nonexistent neologisms of type-2 compounds such as *pankolitíko* ‘universal glue’ or *pantixerós* ‘very lucky’, however, the assimilation rules apply to yield *pangolitíko* and *pandixerós*, respectively, according to the native speakers we consulted.

There is yet a third argument in favor of considering both [stem + stem] and [stem + word] type of compounds phonologically similar: The deletion of the [o] appearing between the first and the second member when the second starts in a vowel may apply in both cases, as seen in (12) and (13), respectively, while this particular vowel deletion is not a phenomenon that applies normally across (nonclitic) words.<sup>11</sup>

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stress to the right of the lexical stress of the host. Setatos (1974) (followed in Nespó and Vogel 1986, 1989) claims that the stress of the host is the strongest; according to Dauer (1980), Malikouti-Drachman and Drachman (1980), Joseph-Warburton (1987) and Arvaniti (1992), instead, the newly added stress is the strongest. According to our own investigations, whether the first or the second stress is the strongest of the two is largely dependent on the speaker’s generation, older generations showing the tendency to produce a strong–weak pattern and younger generations a weak–strong one.

9. The first constituent built postlexically is, in fact, the clitic group, which joins together one nonclitic word plus all clitics that this word hosts (cf. Hayes 1990; Nespó and Vogel 1986). Since compounds involve two (or more) nonclitic elements, they could not form a clitic group, according to this definition.
10. The fact that specific clitics do not assimilate is not relevant to the present discussion.
11. According to Drachman and Malikouti-Drachman (1992), the deletion of [o] applies exclusively to compounds of the type [stem + stem] and thus they use this phenomenon as an argument to consider compounds of the type [stem + word] as consisting of two phonological domains. The examples in (13), however, show that the phenomenon applies also to (at least some) compounds of the second type. It must be observed that this vowel deletion does not apply regularly within words, as may be seen from the presence of adjacent vowels in words such as *oárto*



- (12) a. *mon-o-akriv* → *monákrivos* 'one and only'  
 b. *ksil-o-angur* → *ksilánguro* 'hard cucumber'
- (13) a. *laxan-o-ayorá* → *laxanayorá* 'vegetable open market'  
 b. *ayri-o-ánthropos* → *ayriánthropos* 'savage man'

We now turn to [word + word] compounds (type 3), exemplified in (3) and proposed above to consist of two separate phonological words which form together a phonological phrase. We can observe, first of all, that the word-internal rule of vowel deletion at the end of the first member when the second starts with a vowel does not apply across the two members of compounds of type 3, as illustrated in (14).

- (14) a. *omáda eryasías* → \**omádeyasías* 'working team'  
 b. *zóni asfalías* → \**zónasfalías* 'safety belt'

The nonapplication of this rule suggests that these compounds are appropriately analyzed into two phonological words.

The analysis presented above predicts, in addition, that neither nasal assimilation to the following stop, nor stop voicing assimilation to the preceding nasal take place in the case of a [word + word] compound with the first member ending in a nasal. This prediction is borne out, as may be seen from the examples in (15).<sup>12</sup>

- (15) a. *ton nómon plésion* → \**ton nómom blésion* 'of the law frames'  
 b. *ton psixrón polémon* → \**tom bsixróm bolémon* 'of the cold wars'

The presence of two word-primary stresses in this type of compounds confirms the analysis presented above. Their stress pattern is, in fact, identical to that of independent words that form together one phonological phrase, as illustrated in (16) where (16a) contains a compound and (16b) individual words that belong to the same syntactic phrase:

- (16) a. *tis zónis asfalías* 'of the safety belt'  
 b. *tis ális eryasías* 'of the other work'

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'ovum'. A precise description of the conditions of application of [o] deletion is not available in the literature and is outside the scope of the present paper. Notice, however, that contrary to the description given in Drachman and Malikouti-Drachman (1992), the phenomenon is not restricted to applying before non high vowels, as type 1 compounds like the following show:

(i) *mes-o- [u]ran* → *mes[ú]rana* 'in the middle of the sky'

For a discussion of several phenomena of vowel deletion in Greek, none of which could be responsible for the data in (12) or (13), cf. Kaisse (1982, 1985).

12. The domain of homorganic progressive nasal assimilation is larger than the clitic group for some speakers (cf. Marianna Margariti-Roga, personal communication). For these speakers this rule consequently applies also at the end of the first member of the compounds in (15).

The question we should pose now is why some compounds are phonological words while others are phonological phrases. The answer is, we believe, that some compounds are formed in the lexicon, while others are formed in the syntactic component and enter then the lexicon in the way Di Sciullo and Williams (1987) have proposed for English and French. That is, type-3 compounds are generated as phrases in the syntactic component and are subsequently reanalyzed as  $X^0$  when they enter the lexicon.<sup>13</sup> Since the phonological constituents up to the word level are built in the lexicon (cf. Booij and Lieber 1992; Inkelas 1989), while the phonological phrase is built postlexically, the phonological status of the different compounds is determined by the level of the derivation in which they are formed. The presence of compounds with different phonological behaviors within one language has been observed earlier. In Mohanan (1986), for example, it is shown that compounds in Malayalam may be of two types, depending on the syntactic relation between the two compound's members (specifically, coordinate versus subordinate compounds). Sproat (1986) proposes the different phonology of these two compound types to depend on their prosodic structure and Inkelas (1989) assigns them a different prosodic constituency: Subordinate compounds are one domain and coordinate compounds are two domains. As will be clear from the examples in the text, the phonological behavior of Greek compounds is not predictable on the basis of the nature of the syntactic dependency relation between its members: Although most nominal and adjectival compounds belong to the first type, in each type of compound both coordinate and subordinate structures may be found. Examples of coordinate compounds for each of the three groups are: 1. *ladóksido* 'oil and vinegar', 2. *anevokatevéno* '(I) go up and down', 3. *metafrastís diierminéas* 'translator interpreter'. Examples of subordinate compounds for each of the three groups are given in (1)–(3) above.

#### 4. General stress properties of Greek

Before proceeding to a more detailed analysis of the stress of compounds, it is necessary to briefly consider certain stress properties of Greek. In particular, we assume that most morphemes participating as constituents in morphological structures have inherent stress properties (cf. Ralli 1988). More specifically, with respect to derivational suffixes, we assume that most of them are either stressed, as shown in (17), or determine the stress location on some preceding or following syllable, as shown in (18a) and (18b), respectively.

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13. Cf. Drachman and Malikouti-Drachman (1992) about a distinction into lexical and morpho-syntactic compounds which, however, only partly maps our distinction.

- (17) a. *zoyrafizo* 'I paint'  
 b. *spitáki* 'little house'
- (18) a. *kínima* 'movement, stream'  
 b. *tonizmós* 'stressing'

Specific stress properties also characterize some inflectional suffixes although most of them are stress neutral. In the examples given below, the inflectional suffixes in (19) show inherent stress while those in (20) exemplify their influence on the stress of the stem.<sup>14</sup>

- (19) a. *evjenís* 'polite' (-is = NOM, SG)  
 b. *tha ayapiθó* 'I shall be loved' (-θo = PER, PASS, 1SG)
- (20) a. *anθrópu* 'man' (-u = GEN, SG, NOM *ánθropos*)  
 b. *ayápiša* '(I) loved' (-sa and antepenultimate stress = PAS, PERF, 1 SG; stem: *ayapi*)

Contrary to Malikouti-Drachman and Drachman (1989) who, with some exceptions, consider stems to be deprived of any stress properties, we propose stems to be inherently marked for certain stress properties. In the absence of inflectional suffixes inherently marked for stress, these properties may determine the surface stress of simple words, once the morphological and the phonological words are built, as the examples in (21) and (22) show:

- (21) a. *nómos* 'law'  
 b. *nomós* 'province'
- (22) a. *pérno* 'I take'  
 b. *pernó* 'I pass'

The minimal pairs above indicate that the stress of the stem is not predictable by rule (cf. Petrunias 1986): In fact, the phonological make-up of the two words is, apart from the location of the stress, identical and, in many cases (like in [21] and [22]), the lexical category is the same in the two members of the minimal pair, so that no morphological criterion may be invoked to predict the different stress location. So far, we have not mentioned prefixes. They will be considered below, in the section devoted to compounds, because they appear to behave like stems in type-1 compounds, as will be shown.

14. For a justification of the analyses of inflection exemplified in (19) and (20), cf. Ralli (1988; 1994).

## 5. The stress pattern of Greek compounds

The issue we address in this section is why compounds have different stress patterns, in particular, why certain compounds retain some of the stresses of their members (type 2 and 3), while others do not (type 1).

Let us start with the compounds formed by two words (type 3). The facts that the syllables that bear word primary stress on the two words in isolation are both stressed in the compound and that the second stress is the strongest of the two are consequences of their constituting a phonological phrase. Both stresses are, in fact, primary at the word level, while the fact that the second is stronger than the first is determined at the phrase level. The relative prominence within a phonological phrase, in fact, in Greek, as in any other language characterized by a right recursive syntactic component, is such that every phonological word bears word stress and the rightmost one within the phonological phrase bears phrasal stress as well (cf. note 7 above). We can thus draw the conclusion, for this type of compounds, that they preserve the stresses the composing words have in isolation and follow in a regular way the stress rule of the level of the grammar in which they are composed, that is, of the phonological phrase, the first constituent built postlexically that may join together more than one nonclitic word. This amounts to saying that compounds of type 3 are not recognizable as such because of their phonology, as mentioned above. It is, instead, their morphosyntactic behavior and often their specific meaning that are responsible for the definition of these elements as compounds.

The problem is now to determine why type-1 and type-2 compounds behave differently, as far as stress is concerned, while they both constitute single phonological words. In particular, it appears that while compounds of type 2 (that is, [stem + word]) are characterized by stress stability, compounds of type 1 ([stem + stem]) are not. As we have already mentioned, we believe that the reason for this difference is partly related, though indirectly, to the different morphological structure of the two types of compounds, as well as to inherent lexical properties, both morphological and phonological in nature, of the compound's constituent parts. As far as the second type of compounds is concerned ([stem + word]), the stress of the compound's second member is preserved. Morphologically, this member constitutes a word (cf. Ralli 1992) and, at the level at which composition takes place, it already has the status of a phonological word, bearing a primary stress. Thus, an account of this type of compounds only requires stating that there is a principle of stress preservation according to which stress is preserved, to the greatest possible extent, during a word formation process involving an already stressed constituent (cf. Burzio 1994). Notice that, independently of whether the compound's first member bears stress or not, its stress would not be a candidate to become the compound's stress, since word primary stress must fall, in Greek, on one of the word's last three syllables (cf. note 7 above). It has been said, in section 3, that derivational

suffixes are characterized by having specific stress properties, which determine the location of the word primary stress. Stress preservation appears to be responsible for the surface stress location also in the case of compounds that end in a derivational suffix. That is, the stress determined by the inherent stress properties of derivational suffixes (underlined in the examples), generally appears on the surface in compounds whose rightmost member (most often the head) is a derived constituent:

- (23) a. *vorioanatolikós* 'north eastern'  
 b. *iljokaménos* 'sun burnt'  
 c. *oðostrotíras* 'steam-roller'

Whether these compounds belong to the first or to the second type is not relevant here given the fact that the stress properties of the suffixes generally overrule any other stressing procedure.<sup>15</sup> That is, in type-1 compounds, if the second member is an item derived by suffixation, the inherent stress of the suffix prevails and the compound stress rule does not apply. The same is true for type-2 compounds: When their second member contains a suffix, that is, when the second member is a word derived by suffixation, the stress of the suffix surfaces as the stress of the compound. In this case, in fact, as more generally in Greek, where the stress prominence within a word is weak or strong, the rightmost of the two stresses surfaces as the strongest.

It has been shown in (19) and (20) above that also in the case of inflectional suffixes with inherent stress properties these determine the word's stress. This is true also for compound structures. That is, inflectional suffixes behave exactly like derivational ones, as far as stress is concerned. An example of an inherently stressed inflectional suffix is *-ís* and, as shown in (24), it determines the surface stress.

- (24) a. *olijomelís* 'few membered' (*-is* = NOM, SG)  
 b. *aksioprepís* 'decent' (*-is* = NOM, SG)

It has been proposed above that sometimes the stress properties of stems may determine the surface location of the word's stress (cf. [21] and [22]). This is the case also for certain compounds, specifically those whose second member

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15. An apparent counterexample is constituted by words such as *ksekárfotos* 'unnailed', given the existence of words such as *karfotós* 'nailed'. That is, if the first is derived from the second, it is unclear why the stress in *ksekárfotos* falls on the antepenultimate syllable, given that the suffix stress should have priority, according to our proposal. The reason for this behavior of the suffix *-tos* is probably to be searched in the structure of *ksekárfotos* which is parasynthetic, that is, ternary and not binary. That this is the case is shown by the existence of words such as *axaraktiristos* 'uncharacterizable' or *amílitos* 'unspeakable', while *xaraktiristós* and *militós* are not existing words. The same holds for compounds, where forms such as *mixanokínitos* 'engine actioned' is an apparent problem, given the existence of *kinitós* 'movable'. Also for compounds, however, we are dealing with parasynthetic formation, as shown by the existence of *glikomílitos* 'sweetly speaking', while *militós* does not exist.

is a morphologically underived word, that is, a word without any affixes inherently marked for stress, as the examples in (25) below illustrate.

- |      |    |                      |   |              |   |                |
|------|----|----------------------|---|--------------|---|----------------|
| (25) | a. | <i>xrisavjí</i>      | < | <i>xris</i>  | - | <i>avjí</i>    |
|      |    | 'golden dawn'        |   | 'golden'     |   | 'dawn'         |
|      | b. | <i>xasapotavérna</i> | < | <i>xasap</i> | - | <i>tavérna</i> |
|      |    | 'meat tavern'        |   | 'butcher'    |   | 'tavern'       |
|      | c. | <i>xartopetséta</i>  | < | <i>xart</i>  | - | <i>petséta</i> |
|      |    | 'paper napkin'       |   | 'paper'      |   | 'napkin'       |

That is, as has been said above, in compounds like the ones in (25), containing a morphologically underived word as their second member, rather than a stem, the location of stress remains unvaried after composition. The stress of the second underived constituent thus corresponds to the stress of the compound as a whole. Notice that this is not something we must stipulate for these specific words if we appeal to the principle of stress preservation. As assumed above, the reason for the surfacing of the stress of the compound's second member is that, if primary stress is already present at the time of composition, it is preserved, as expected, since lexical structure in general is preserved.<sup>16</sup>

Let us now turn to a more detailed analysis of the stress pattern of compounds of type 1, that is, compounds created by joining together two stems, thus creating a complex stem. When an inflectional suffix is added to a compound stem by application of the rule *word* → *stem infl*, the inflected compound becomes a morphological word (cf. Ralli 1988, 1989, 1992). Through a morphology-phonology mapping rule, the compound is then mapped into a phonological word. Until this point of the derivation no stress has been assigned. We would like to propose that in this case a stress rule applies to assign stress on the antepenultimate syllable, as shown in (26).<sup>17</sup>

- |      |    |                                       |                      |
|------|----|---------------------------------------|----------------------|
| (26) | a. | [[[ <i>paɣ</i> ]ó[ <i>vun</i> ]]o]    | 'iceberg'            |
|      | b. | [[[ <i>kuʔ</i> ]o[ <i>pónir</i> ]]os] | 'silly and sly' MASC |
|      | c. | [[[ <i>spanak</i> ]ó[ <i>pit</i> ]]a] | 'spinach pie'        |

16. We do not have at this point an explanation of why certain elements appear to avoid entering composition as stems. We may observe, however, that the large majority of these elements is formed by words of foreign origin, like *tavérna* (from Italian *taverna*) *saláta* 'salad' (from Italian *salata*) and *petséta* 'napkin' (from Italian *pezzetta* 'small piece of material') and preserve their original stress.

17. In Malikouti-Drachman and Drachman (1989), the final syllable of these compounds is considered extrametrical, while the antepenultimate and penultimate syllables form together a trochee. Since the only rule that assigns stress to compounds places it on the antepenultimate syllable (the rest of the stress location being due to stress preservation) it seems unmotivated to consider extrametrical the final syllable of every Greek compound of the [stem + stem] type. It should be noticed, however, that even if extrametricality is adopted for these cases as a consequence of principles of universal grammar, this does not influence our basic analysis.

As already noted, the location of stress in this type of compounds does not coincide with any of the syllables that receive stress when each of the compound's members becomes a word on its own, as shown in (27) which contains all the words derived from the stems in (26).<sup>18</sup>

- (27)
- |    |                |              |
|----|----------------|--------------|
| a. | <i>páγos</i>   | 'ice'        |
| b. | <i>vunó</i>    | 'mountain'   |
| c. | <i>kuṓs</i>    | 'silly' MASC |
| d. | <i>ponirós</i> | 'sly' MASC   |
| e. | <i>spanáki</i> | 'spinach'    |
| f. | <i>píta</i>    | 'pie'        |

It must be observed that also in this case ([stem+stem] compounds), the compound's stress pattern does not constitute a violation of stress preservation. In fact, since the two stems undergo composition before the morphological and phonological words are formed, there is no stress to be violated.

The question remains, however, why contrary to the stress preservation principle, the stress properties of neither stem and in particular of the rightmost one surface as the word's primary stress. Given that the remaining lexical structure is preserved, there is no reason why stress should not be. We believe that the answer to this question may be found in the distinction between close class and open class elements, the first being rich in morphophonological specifications and poor in semantic content and the second, *vice versa*, poor in morphosyntactic specifications and rich in semantic content (cf. Emonds 1985). Stems constitute an open class of semantically rich items and are thus weak in their phonological specifications. Their stress properties are thus generally overridden either by the stress properties of other morphemes, for example, suffixes, which constitute a close class of grammatically rich items, or by the rule that assigns stress on the antepenultimate syllable of a compound. The only case in which a stem's stress may surface as the word's primary stress is when no stress rule may apply and no other constituent (suffix) bears any stress properties to be preserved under word formation (cf. [21] and [22] above).

As opposed to stems, suffixes constitute a closed set of items. They are not rich in semantic information and thus, as proposed in Emonds, tolerate a qualitatively richer phonological specification. This is the reason why, as we

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18. There are cases of exocentric compounds such as *anixtoxéris* 'open handed' and *grizomális* 'grey haired' which are of type 1, that is [stem+stem], whose stress falls on the penultimate syllable; these, however, do not constitute counterexamples to the application of the antepenultimate syllable rule since this particular inflectional ending requires the stress on the immediately preceding syllable. It must be observed, in fact, that this *-is* is not the more common masculine singular ending *-is* which paradigm has *-es* in the plural. In all the cases exemplified above, in fact, the nominative/accusative/vocative plural are formed in *-ídes* and the genitive plural in *-ídon*.

have seen above, the stress properties of suffixes resist during word formation and surface at the word level.

In our account of stress in derived and inflected words given in section 3, only suffixation has been mentioned. Greek words, however, may be derived also by prefixation. In the case of prefixed structures, stress appears to behave in a way parallel to that of compound structures. As illustrated in (28) and (29) respectively, when a prefix is added to a stem, the stress is located on the antepenultimate syllable, while when the prefix is added to a word the stress follows the stress preservation principle:

- |      |    |                    |                 |                 |               |
|------|----|--------------------|-----------------|-----------------|---------------|
| (28) | a. | <i>ipóloyos</i>    | (< <i>ipo-</i>  | <i>loy-</i> )   | 'responsible' |
|      | b. | <i>ipérlambros</i> | (< <i>iper-</i> | <i>lambr-</i> ) | 'supershiny'  |
|      | c. | <i>éndromos</i>    | (< <i>en-</i>   | <i>trom-</i> )  | 'very scared' |
| (29) | a. | <i>ipokómis</i>    | (< <i>ipo-</i>  | <i>kómis</i> )  | 'viscount'    |
|      | b. | <i>iperayorá</i>   | (< <i>iper-</i> | <i>ayorá</i> )  | 'supermarket' |
|      | c. | <i>ektafí</i>      | (< <i>ek-</i>   | <i>tafí</i> )   | 'exhumation'  |

The fact that prefixes behave phonologically much more like stems than like suffixes should not be surprising because unlike suffixes, prefixes generally have a lexical content and, in addition, most of them may appear as independent words as is the case for *andí* 'instead', *ipó* 'under', etc. The stress properties of prefixes, like those of stems can thus be characterized as too weak to surface at the word level. The rule responsible for the stress of [stem + stem] compounds, therefore applies also in the case of prefixed structures to assign stress on the antepenultimate syllable.

To sum up so far, we postulate the stress rule of the antepenultimate syllable to be responsible for the location of stress in compounds of the first type whose rightmost member is not derived and whose inflectional suffix is not inherently stressed (as in [24] above). The same rule is also responsible for the stress of prefixed words, if the prefix is added to a stem which does not contain any suffix. There are compounds, however, that constitute apparent exceptions. This is the case of neuters in *-i*, illustrated in (30). It is exactly this type of examples that motivates the relevance of the quality of the last vowel for the location of stress in nominal compounds in Nespør and Vogel (1986).

- |      |    |                    |                    |
|------|----|--------------------|--------------------|
| (30) | a. | <i>spirtokúti</i>  | 'match box'        |
|      | b. | <i>psomotíri</i>   | 'bread and cheese' |
|      | c. | <i>thalasopúli</i> | 'sea bird'         |

It should be noticed that the final *-i* of the examples in (30) is not an inflectional ending, but rather belongs to the stem of the compound's second member as may be seen from the other forms of the inflectional paradigm, which exhibit



the [i] (or [j] after the application of a phonological rule of glide formation) before the inflectional suffixes, as shown in (31).<sup>19</sup>

- (31)
- |    |                |                 |
|----|----------------|-----------------|
| a. | <i>spíti</i>   | NOM/ACC/VOC, SG |
| b. | <i>spitjú</i>  | GEN.SG          |
| c. | <i>spítja</i>  | NOM/ACC/VOC, SG |
| d. | <i>spitjón</i> | GEN, PL         |

Given the fact that the different forms above are members of the same paradigm, and since the process of inflection supplies an additional syllable to all forms of the stem, except for (31a), also the location of stress in the examples in (30) is accounted for by the stress rule of the antepenultimate syllable, if we postulate the presence of a syllabic slot occupied by an inflectional zero suffix whose function is to provide the unmarked case and number specifications to the stem. An argument in favor of this proposal is provided by the nonexistence, in Greek, of neuters ending in *-i* with stress on the antepenultimate syllable. Without the postulation of an extra syllabic slot at the end of these words, the non existence of words of this type would just be a fortuitous coincidence.<sup>20</sup>

Finally, there is a last group of compounds whose stress pattern appears to be that of the second type [stem + word] but whose morphological structure is that of the first type [stem + stem]. This is the group of nominal compounds formed by a stem plus a pseudostem exemplified in (32) below. Pseudostems are similar to stems as far as their lexical content is concerned; they are, however, similar to affixes in that even if inflected, they cannot be inserted in a sentence.<sup>21</sup>

- (32)
- |    |                    |               |
|----|--------------------|---------------|
| a. | <i>melisokómos</i> | 'apiarist'    |
| b. | <i>astronómos</i>  | 'astronomer'  |
| c. | <i>tavromáxos</i>  | 'bullfighter' |
| d. | <i>aeropóros</i>   | 'aviator'     |

Contrary to the proposal in Drachman and Malikouti-Drachman (1992) that they belong to different prosodic structures from common [stem + stem] compounds, we believe that, compounds like those in (32) belong to the first type of compounds not only morphologically but also phonologically. Morphologically, they are [stem + stem] compounds. Their second member, however, belongs to a closed class and is thus, in a way, intermediate between a stem and a suffix. Phonologically, these compounds constitute a phonological word. Their different stress behavior, that is, their not being submitted to the antepenultimate stress rule is due to the fact that their second member, that is the pseudostem, belongs

19. Compare Ralli (1994) for details about Greek inflectional affixes and the creation of paradigms.

20. Compare Revithiadou (in preparation) for an alternative proposal.

21. This definition of pseudostems is similar to that given in Scalise (1983) for semiwords. The reason we prefer the former term to the latter is that these elements are intermediate between stems and affixes, rather than between stems and words as the latter term suggests.

to a close class. More specifically, we propose that the phonological behavior of pseudostems parallels their morphological one, in that they also behave similarly to suffixes with respect to stress: They have inherent stress which surfaces as the compound's stress as well.<sup>22</sup>

Up to this point, we have distinguished three types of compounds with respect to stress.

1. [stem + stem] compounds, constituting one phonological word, submitted to the application of the antepenultimate stress rule.
2. [stem + word] compounds, constituting one phonological word, governed by the stress preservation principle.
3. [word + word] compounds, constituting one phonological phrase, governed by the stress preservation principle; their main stress is accounted for by phrasal phonology.

As we have seen above, the construction of both type-1 and type-2 compounds is lexical. But while the first constitutes a clear morphological case of a word-formation rule preceding inflection, the second is closer to syntax, in that composition operates after inflection has applied to its second member, as shown in (33).

- (33)
- |    |                         |   |             |  |                      |
|----|-------------------------|---|-------------|--|----------------------|
| a. | <i>xartopéktes</i>      | < | <i>xart</i> |  | <i>péktes</i>        |
|    | 'card players'          |   | 'card'      |  | 'players'            |
| b. | <i>γantoforeméni</i>    | < | <i>γant</i> |  | <i>foreméni</i>      |
|    | 'those who wear gloves' |   | 'glove'     |  | 'worn'               |
| c. | <i>anevokatévike</i>    | < | <i>anev</i> |  | <i>katévike</i>      |
|    | '(he) went up and down' |   | 'go up'     |  | '(he/she) went down' |

The *-o-* at the end of the compound's first member shows that this is a stem, rather than a word, while plural inflection in (33a) and (33b) and the aorist third person singular ending in (33c) show that the second member is a fully inflected

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22. It must be observed that in a few isolated cases, pseudostems characterized by having one of two different meanings, in one of these appear to enter composition without stress properties and thus undergo the rule that assigns stress to the compound's antepenultimate syllable (cf. Anna Anastasiadi-Simeonidi, personal communication). Examples are:

- |      |    |                              |   |              |  |               |
|------|----|------------------------------|---|--------------|--|---------------|
| (i)  | a. | <i>protótokos</i>            | < | <i>prot-</i> |  | <i>tokos</i>  |
|      |    | 'first born'                 |   | 'first'      |  | 'born'        |
|      | b. | <i>θεotókos</i>              | < | <i>θε-</i>   |  | <i>tókos</i>  |
|      |    | 'that who gave birth to God' |   | 'God'        |  | 'bearer'      |
| (ii) | a. | <i>ikótrofos</i>             | < | <i>ik-</i>   |  | <i>trofos</i> |
|      |    | 'resident'                   |   | 'house'      |  | 'nourished'   |
|      | b. | <i>ktinotrófos</i>           | < | <i>ktin-</i> |  | <i>trófos</i> |
|      |    | 'cattle breeder'             |   | 'beast'      |  | 'nourisher'   |

As may be seen, *-tokos* and *-trofos* have a passive meaning in the examples in a. and an active meaning in the examples in b.

word. The different point in the derivation in which the two compound types are formed determines also that the stress of type 1 is assigned by the compound stress rule of Greek, while the stress of type 2 is determined by the location of the stress in the compound's second member.

The interaction with syntax of compounds of type 2 is also proved by the fact that some of these may be the result of the syntactic operation of incorporation (cf. Baker 1988). This is the case with compounds in which the first member is a complement of the second, while the syntactic component would generate the opposite order. These include compounds with adverbs internal to the verb phrase, as in (34) or anaphors functioning as arguments as in (35) (cf. Rivero 1992) and, possibly a group of other nominal complements.<sup>23</sup>

- (34) a. *siyovrázo* 'I boil slowly'  
 b. *sixnorotó* 'I ask often'
- (35) a. *aftoθavmázonde* 'they admire themselves'  
 b. *aliloskotónonde* 'they kill each other'

Still, also type-2 compounds are lexical in nature as may be seen from the presence of the linking vowel *-o-* which is placed after a nonfinal stem of a compound and whose presence is only motivated as a marker of a lexical compound formation (cf. Ralli 1992).<sup>24</sup>

If we assume that the domain of word primary stress is the phonological word and if the phonological word is built through a rule that maps morphological structure onto phonological structure, then, in type-2 compounds, the second member, being already a word, comes into composition with a stress. The stress preservation principle is then responsible for the fact that this stress is maintained in the phonological word that includes the whole compound. The two members of type-1 compounds, instead, do not constitute phonological words. Rather, they become one phonological word after composition and inflection have taken place. Stress is assigned to such a compound structure at this point for the first time. This analysis, therefore, does not violate the stress preservation principle because no stress is there to be preserved.

The conclusion may thus be drawn that the different point in the derivation in which these two compound types are formed determines also that the stress of type 1 is assigned by the stress rule of the antepenultimate syllable, while the stress of type 2 is not different from the stress of the compound's second member.

23. Smirniotopoulos and Joseph (1993) have argued that these cases do not follow from a syntactic operation of incorporation but rather constitute lexical compound formations. We will not enter this issue here, since it is outside the scope of this paper.

24. There is no linking [o] in compounds with *ksana* as first member, as in *ksanayráfō* '(I) write again' (\**ksanoyráfō*). This is due to the fact that unlike in other adverbs ending in *-a*, in this case *-a* belongs to the stem.

If we also take into consideration the fact that the inherent stress properties of suffixes surface against the compound's stress rule, as the examples given above indicate, we may conclude with the following remarks. First, since the stress properties of suffixes prevail over the stress properties of stems and thus surface at the level of the phonological word, we may assume that suffixes are listed in the lexicon as stress consistent. Second, the stress consistency of suffixes is the strongest stipulation overruling the need for a stress assignment by rule of the type that applies in [stem + stem] compounds. Third, this stress rule prevails over the stem's stress because in the process of putting two simple stems together (compounds of the type [stem + stem]), a new stem is created and the inherent stress properties of the individual stems, weak to begin with, are lost.

## 6. The stress patterns of compounds in other languages

According to the proposal in Nespør and Vogel (1986), in some languages, among which Greek, there are compounds, as we said above, that constitute one single phonological word, thus matching the morphological structure that assigns to them the label "word". In other languages, among which Italian, compounds contain two phonological words and are thus an example of nonisomorphism with the morphological word.<sup>25</sup> It has been shown above, instead, that while the majority of Greek compounds consists indeed of just one phonological word, a group of them contain two phonological words. In addition, matching compounds have one of two different morphological structures which yield two different stress patterns, one characterized by antepenultimate stress and the other by stress preservation of the compound's second member.

An exhaustive analysis of Italian compounds is outside the scope of the present paper. It will be proposed here, however, that, while the majority of Italian compounds and, in addition, the only productive ones in all styles of the language consist of two phonological words, in agreement with Nespør and Vogel's proposal, there are also compounds whose phonological structure is isomorphic with the morphological one, in that they constitute just one phonological word.<sup>26</sup>

In addition, it will be proposed that the matching compounds must, in fact, be classified into two different compound types, which parallel in most respects the type 1 and type-2 compounds proposed above for Greek.

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25. For the stress of compounds in Italian, cf., among others, Vogel and Scalise (1982). For a phonological analysis of Italian compounds within the framework of Prosodic Lexical Phonology, cf. Peperkamp (1993), where it is proposed that three different phonological constituents are necessary to account for the compounds' phonological behavior.

26. Compare also Peperkamp (1993), in which it is proposed that lexicalized compounds form a phonological constituent identical to that of noncompound words.

First of all, compounds of the type [stem+stem] exist also in Italian, as shown in (36) and they appear to have exactly the same stress pattern that [stem+stem] compounds have in Greek.

- (36)
- |    |                   |                  |
|----|-------------------|------------------|
| a. | <i>stenóyrafo</i> | 'stenographer'   |
| b. | <i>barómetro</i>  | 'barometer'      |
| c. | <i>sociólogo</i>  | 'sociologist'    |
| d. | <i>onnívoro</i>   | 'omnivorous'     |
| e. | <i>monólogo</i>   | 'monologue'      |
| f. | <i>filántropo</i> | 'philanthropist' |
| g. | <i>eurócrata</i>  | 'eurocrat'       |

The fact that this type of compounds has limited distribution in Italian is due to the fact that it does not usually contain Italian stems. It is important to notice, however, that in certain (technical or scientific) styles of Italian, this stress pattern is productive for [stem+stem] compounds, as is shown by the fact that it characterizes compounds whose second member, of Greek or Latin origin, is used in composition in recent times.<sup>27</sup>

That [stem+word] compounds contain just one primary stress, is proposed in Peperkamp (1993). Among the arguments used to show this, is that the rule that raises a vowel that loses word primary stress (cf. Nespor and Vogel 1986) applies in the first member of these compounds, as may be seen in (37).<sup>28</sup>

- (37)
- |    |                    |                    |                      |
|----|--------------------|--------------------|----------------------|
| a. | <i>monolocále</i>  | (< <i>m[ɔ]no</i> ) | 'one room apartment' |
| b. | <i>euromíssile</i> | (<[ <i>ε</i> ]uro) | 'euromissile'        |

These examples show that the compound's stress corresponds to the stress of its second member, as in Greek. This compounding is also productive in Italian in a certain technical style, including geographical terms, such as *afro-asiático* 'afroasiatic', *italo-americano* 'italoamerican'.<sup>29</sup>

Compounds containing two words are the majority in Italian; they are the most productive, they are productive in all styles of the language, they are the

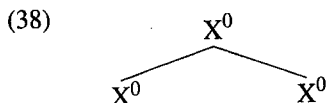
27. Penultimate stress is occasionally found in [stem+stem] compounds either for historical or for independent phonological reasons. An example of the first is *biblioteca* 'library', which is not the effect of composition in Italian, since the same word exists in Latin. An example of the second is *monocórde* 'monotonous', whose second stem has a heavy penultimate syllable, which, as is well known, attracts stress in Italian, the only counterexample, excluding a few proper names, being *mándorla* 'almond'.

28. A certain amount of variation is present in type-2 compounds in that, at least in certain varieties, as neologisms, they behave phonologically as two separate words. For example, *pseudo* 'pseudo' as the first member of newly created compounds is more likely to be pronounced as *ps[ε]judo*, while in older compounds it is more likely to appear as *ps[e]judo*.

29. Greek compounds corresponding to coordinations of national and geographic terms are generally of the [stem+word] type in Greek as well.

unmarked case. That these compounds contain two phonological words joined together into a phonological phrase and thus with main prominence on the second member, has been shown in Nespor and Vogel (1986) on the basis of a variety of phonological rules.<sup>30</sup>

A question that comes to mind now is why such a variety of compounds should exist. Following the general idea presented in Nespor and Vogel (1986) that different types of compounds are found in different languages, it has been proposed in Vogel (1990), that languages differ as to whether the upper or the lower  $X^0$  nodes of a compound structure (cf. [38] below) are chosen to construct a phonological constituent.<sup>31</sup> Languages such as Hungarian and Swedish would choose the upper node, while Taiwanese (cf. Chiang 1988) would choose the lower nodes.



From the observations on Greek and Italian presented above, the conclusion has been drawn that, while different types of compound formation are most productive in the two languages, Greek and Italian, generating by and large compounds constituted by one phonological word in Greek and by two in Italian, the same three types of compounds are present in both languages.

We would like to propose, in addition, that whether the compound is mapped into one or two phonological words is predictable in most cases. That is, the mapping of compounds onto phonological words is governed by the following principle.<sup>32</sup>

- (39) Minimal word principle (Greek, Italian)  
Choose the lowest  $X^0$  in the mapping of compounds onto phonological words.

30. On the basis of English, German and Italian, it is proposed in Cinque (1993) that the stress of compounds depends on their internal structure. In particular, when the two members of a compound are in the relation head complement, the latter is stressed; when they are in the relation Head Specifier, instead, the former is stressed. This generalization appears not to be adequate for Italian, as may be seen from examples such as *capogiro* 'dizziness' (literally: *Of the head - the turn*) and *capotreno* 'conductor' (literally: *Of the train - the head*) where, in spite of the fact that the compound's members are in an identical syntactic relation to each other in the two cases, but in a different linear order, the same stress pattern obtains.

31. On the basis of Hungarian, this constituent is argued in Vogel (1990) to be the clitic group. The clitic group is not a relevant constituent in the analysis of compounds in either Greek or Italian. A discussion of Vogel's account of Hungarian compounds is outside the scope of the present paper; we will thus not discuss it further.

32. Compare Nespor (to appear) for the phonological analysis of compounds in a variety of (European) Languages.

If the terminal nodes are stems rather than words, they are not individually dominated by a  $X^0$  and the terminal  $X^0$  node is thus the one dominating the whole compound. It is thus predicted that [stem + stem] compounds form just one phonological word, while [word + word] compounds form two. As to [stem + word] compounds, in Greek the upper node is selected, mapping the whole compound into one phonological word, while in certain varieties of Italian the lower node is selected. In the latter case the  $X^0$  dominating the second member, a word, is mapped onto a phonological word and the mapping of the first member into a separate phonological word is a consequence of the Strict Layer Hypothesis, according to which a constituent of level  $x^n$  dominates only constituents of level  $x^{n-1}$ . (cf. Selkirk 1984; Nespor and Vogel 1986).<sup>33</sup> In other varieties of Italian, the upper node is selected and, just as in Greek, [stem + word] compounds are mapped onto just one phonological word. This variability between one and two phonological words for these compounds is even present within the same idiolect in yet other varieties of Italian, so that two pronunciations are accepted. We would like to propose that this variability must be attributed to the asymmetric structure of [stem + word] compounds, which makes the definition of what is the lower  $X^0$  ambiguous: By looking at the first member, in fact, the lowest  $X^0$  turns out to be the node that dominates both compound's members, while by looking at the second member the lowest  $X^0$  turns out to correspond just to the second compound's member.

The question that should be answered now is why a very productive composition process in Greek takes stems as its basis, while in Italian the unmarked basis for composition is the word. The answer to this question is outside the scope of this paper, but we would like to suggest that it might be connected to the facts, proposed respectively in Ralli (1988) and Scalise (1983), that Greek has a morphology based on stems and Italian has a morphology based on words.<sup>34</sup>

## 7. Conclusions

In this paper, we have offered an analysis of the different stress patterns of Greek compounds based on their morphological and phonological characteristics. Specifically, we have proposed that of the three structures that normally go under the heading of "compounds", two are derived in the lexicon and one is built postlexically.

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33. The validity of the Strict Layer Hypothesis as a principle governing the geometry of prosodic trees has been put into question for the level below the word (cf., among others, Ito and Mester 1992). A discussion as to whether a theory with or without this principle makes stronger predictions is outside the scope of the present paper.

34. But cf. Peperkamp (1995) where it is proposed that Italian morphology is based on stems.

In particular, the first lexical process of composition involves stems, that is, noninflected elements. The second type of lexical compounds is formed by a sequence of [stem + word], that is, the second element has undergone inflection before entering composition, while the first has not. The third compound type is formed syntactically, that is postlexically, by two fully inflected words.

We have argued that during the morphology-phonology mapping, both lexical compounds are mapped into single phonological words. In the case of post-lexical compounds, instead, each member of the compound is mapped onto one phonological word. These two phonological words are then joined into a phonological phrase.

The two assumptions that primary word stress is assigned to phonological words and that stress is preserved account for the stress pattern of type-2 and type-3 compounds. In contrast to these, [stem + stem] compounds do not have any stress to be preserved, since their members do not constitute phonological words; a phonological rule is thus responsible for the assignment of stress on the antepenultimate syllable.

These results are in contrast with previous proposals according to which, as far as compounds are concerned, languages differ in that some map each compound's member onto one phonological word, while in others the whole compound forms just one phonological word. In particular, it is proposed in Nespør and Vogel (1986) that while Italian chooses the first option, Greek chooses the second. Italian compounds have thus briefly been taken into consideration above, in order to verify whether different types of compounds exist in this language as well. The conclusion has been drawn that compounds are the result of different processes also in Italian and that they can be mapped either onto one or onto two phonological words. The two languages are thus much more similar to each other than previously proposed, as far as the phonological behavior of compound words is concerned. They do show, however, different tendencies as to the preferred composition process.

One of the basic results we have reached about the morphology-phonology mapping for the languages we have examined is that a unitary principle may be posited that governs the mapping of compound words onto phonological domains, specifically the phonological word and the phonological phrase.

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*(Nespør)*

*University of Amsterdam and HIL*

*(Ralli)*

*University of Athens*



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